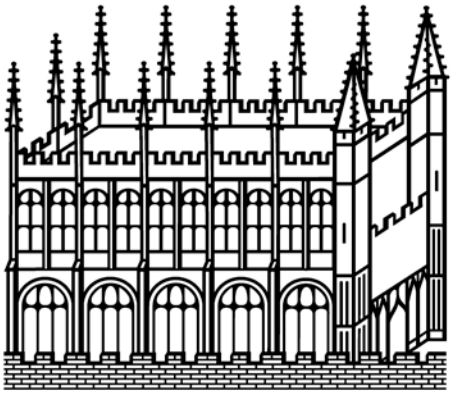

Bodleian Libraries

UNIVERSITY OF OXFORD

This book is part of the collection held by the Bodleian Libraries and scanned by Google, Inc. for the Google Books Library Project.

For more information see:

http://www.bodleian.ox.ac.uk/dbooks

This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 2.0 UK: England & Wales (CC BY-NC-SA 2.0) licence.

41/

Pr. from Bassendean
Edinb.t

600048492X

HASSENDEANBURN.

1802 e. 542

W. & J. KENNEDY,
Booksellers & Stationers,
HAWICK

Miss Hannah Stavert

# The ACCOMPTANT'S Gude,

## A NEW SYSTEM of Arithmetic for

*Men of Buſineſs, Academies and Schools.*

By James Morrison,
*Maſter of the Commercial department Hall's Academy, Glaſgow.*

Glaſgow,
*Printed for the Author, by Niven, Napier & Khull.*
*Sold by D. Niven, Glas.w J. Scrimgeour, Edin.r*
*and R. Ogle, London.*
1801.

*Haldane ſcr.* *et ſculpſit.*

BODLEIAN
28 MAY 1931
LIBRARY

To

*The Honourable*

# The Lord Provoſt,

# MAGISTRATES,

AND

# *TOWN COUNCIL*

# of Glasgow.

JOHN HAMILTON, Esq. *Lord Provost.*

*William Wardlaw, Esq.*
*Peter Bald, Esq.*
*Robert Tennent, Esq.*
} Baillies.

*John Laurie, Esq. Dean of Guild.*
*Arch. Newbigging, Esq. Deacon Convenor.*
*Robert Austin, Esq. Treasurer.*
*James Spreull, Esq. City Chamberlain.*
*Arch. Falconer, Baillie of Port-Glaſgow.*
*John Orr, Esq. Sen. Town Clerk.*
*Richd. Henderson, Esq. Jun. Town Clerk.*
*John Bennet, Esq. Proc. Fisc. &c.*

## COUNSELLORS.

*Laurence Craigie, Esq.*
*George Buchanan, Esq.*
*Thomas Hopkirk, Esq.*
*Robert Finlay, Esq.*
*James Black, Esq.*
*Archibald Smith, Esq.*
*James M'Dowall, Esq.*
*Robert Bogle, Esq.*

*David Connell, Esq.*
*Robert Dunlop, Esq.*
*James M'Kenzie, Esq.*
*Robert Muirheid, Esq.*
*William Craig, Esq.*
*Robert Robertson, Esq.*
*John Ballantine, Esq.*
*John Morison, Esq.*

*Richard Smellie, Esq.*
*Robert Waddell, Esq.*
*Andrew Patton, Esq.*
*Thomas Alston, Esq.*
*John Tennent, Esq.*
*Thomas Smith, Esq.*
*Basil Ronald, Esq.*
*William Aird, Esq.*

The
*Following*
Little Treatiſe,
HONOURED WITH
Your Generous Patronage,
*Is with* GRATITUDE *&* *Humility*
*MOST RESPECTFULLY*
Inscribed
By

Hall's *Academy*,
*20th Auguſt*, 1801.

*The Author.*

*Entered in Stationer's Hall.*

# TO THE PUBLIC.

In a country which depends upon commerce, whatever profeſſes to facilitate any of its tranſactions, if it be not regarded with an eye of partiality, will at leaſt be entitled to the indulgence of the public. The author truſts, that in the following treatiſe there will be found a degree of utility ſuperior to what has been hitherto derived from works of this nature. A few, indeed, of theſe publications, merit attention, and do honour to their authors, to whom the compiler of this ſyſtem acknowledges himſelf very much indebted. But being for the moſt part the productions of gentlemen, who have had little experience in commercial affairs, they are often remarkably deficient in the moſt eligible forms of mercantile practice. Whereas the author of this publication, having been for a number of years employed in ſituations, where he had the advantage of becoming acquainted with calculations in every commercial point of view, has acquired the knowledge of ſeveral conciſe methods, which men of buſineſs have found neceſſary to adopt for the ſake of diſpatch, and whoſe claim to ſuperior utility has been determined by experience. A number of theſe will be found interſperſed throughout the following work, and in this, he humbly hopes, its ſuperiority will appear.

*Hall's Academy, Ingram-Street,*
*20th Auguſt,* 1801.

## ADVERTISEMENT.

Owing to the advanced price of Paper, and the Author's time being chiefly taken up in teaching, he makes this apology for delaying the Treatiſe on Book-keeping, which will be preſented to the public as ſoon as convenient.

# CONTENTS.


| | |
|---|---|
| INTRODUCTION—Weights and Meaſures | Page 1 |
| CHAPTER I. Notation and Numeration | 15 |
| SECT. I. Notation | 16 |
| II. Numeration | *ib.* |
| II. Addition | 18 |
| SECT. I. Simple Addition | *ib.* |
| II. Compound Addition | 19 |
| III. Subtraction | 25 |
| SECT. I. Simple Subtraction | *ib.* |
| II. Compound Subtraction | 26 |
| IV. Multiplication | 32 |
| SECT. I. Simple Multiplication | 33 |
| II. Compound Multiplication | 36 |
| III. Croſs Multiplication | 41 |
| V. Diviſion | 43 |
| SECT. I. Simple Diviſion | *ib.* |
| II. Compound Diviſion | 49 |
| III. Mixt Reduction | 54 |
| VI. Rule of Proportion | 57 |
| SECT. I. Simple Proportion | *ib.* |
| II. Compound Proportion | 62 |
| III. Diſtributive Proportion | 64 |
| VII. Rules for Practice | 66 |
| SECT. I. Computation of Prices | *ib.* |
| II. Deduction on Weights | 75 |
| III. Commiſſion | 76 |
| IV. Intereſt | 78 |
| V. Merchants' Accompts | 84 |

Bills of Parcels Page 84
Invoices 88
Accompt Sales 91

CHAPTER. VIII. Vulgar Fractions 93
SECT. I. Reduction of Fractions 94
II. Addition of Fractions 98
III. Subtraction of Fractions 99
IV. Multiplication of Fractions 100
V. Diviſion of Fractions 101

IX. Decimal Fractions 103
SECT. I. Reduction of Decimals *ib.*
II. Addition of Decimals 107
III. Subtraction of Decimals 108
IV. Multiplication of Decimals 109
V. Diviſion of Decimals 110

X. Varieties in Proportion
SECT. I. Inſurance 114
II. Gain and Loſs 116
III. Exchange 119
With London *ib.*
—— Ireland 120
—— America 121
—— Holland 123
—— Germany 126
—— France 129
—— Portugal 131
—— Spain 132
—— Italy 133
—— Denmark and Norway 135
—— Sweden 137
—— Polland and Pruſſia 138
—— Ruſſia 139
SECT. IV. Arbitration of Exchange *ib.*
Simple Arbitration 140
Compound Arbitration 143

CHAPTER. XI. Intereſt 145
SECT. I. Simple Intereſt *ib.*
Diſcount or Rebate 148
Equation of Payments 149
Practical Diſcount 150
A Perpetual Calendar 151
II. Compound Intereſt 152
Tables of Compound Intereſt and Annuities 153
XII. Annuities 156
SECT. I. Annuities for a certain time 157
II. Annuities for ever 158
III. Annuities in Reverſion 160
IV. Annuities on Lives 161
Tables of Probabilities of Life 165
Miſcellaneous Exerciſes 168
Appendix
I. Involution 179
II. Evolution *ib.*
Extraction of the Square Root 180
——— of the Cube Root 182
Supplement.
Anſwers to the Queſtions 185
Solutions of the Miſcellaneous Exerciſes 194
Anſwers to the Queſtions in the Appendix 215

# ERRATA.

| | | | | | | |
|---|---|---|---|---|---|---|
| Page | 86 | Qu. | 30 | | after 3 qrs. 7 lb. | *add* at 81s per cwt. |
| | 110 | | 2 | *for* | per lb. | *read* per cwt. |
| | 113 | | 14 | | A paid | A had |
| | 116 | | 11 | | 9 gs. diſcount | 9 gs. per cent. |
| | 128 | | 4 | | Hamburgh $3\frac{1}{3}$ | Holland $3\frac{1}{3}$ |
| | 135 | | 4 | | piaſtre | ducat |
| | 145 | | 3 | | per piaſtre | per piſtole |
| | 177 | | LIV. | | guinea | quintal |

A

# SYSTEM

OF

# ARITHMETIC.

## INTRODUCTION.

ARITHMETIC is the ſcience of numbers, and the art of computing by them.

### DEFINITIONS.

1. A *Unit*, or unity, ſignifies one univerſally, and denotes the beginning of numbers.

2. An *Integer* ſignifies any whole number, as 1 or 2.

3. A *Mixed Number* is an integer with a fraction annexed, as $4\frac{1}{2}$.

4. A *Prime Number* is that which can only be meaſured by unity, as 7.

5. A *Compoſite Number* is that which can be meaſured by another, as 4 by 2.

6. A *Common Meaſure* will divide two or more numbers without a remainder, as 4 divides 12 and 16.

*Explanation of the Characters or Signs.*

1ſt, The character = ſignifies *Equality*, and when placed between two numbers, denotes them to be equal, thus 12 pence = 1 ſhilling.

2d, The character + ſignifies *Plus*, or *Addition*, and, placed between two numbers, it denotes that they are to be added, as 5+7 = 12.

3d, The ſign — ſignifies *Minus*, or *Subtraction*, and, put between two numbers, ſhews that the latter is to be taken from the former, as 12—7=5.

4th, The character × denotes *Multiplication*, and when put between two numbers, it ſignifies that they are to be multiplied together, as 5×7=35.

5th, The character ÷ denotes *Diviſion*, and, being put between two numbers, ſhews that the former is to be divided by the latter, as 35÷7=5. Alſo, if two numbers be placed one above another, with a line between them, it ſignifies that the upper number is to be divided by the under one.

6th, When two points ( : ) are placed between two numbers, and four points ( : : ) between the ſecond number and a third one, they indicate that theſe numbers are proportional: thus, 2 : 3 : : 4 : 6, muſt be read thus: as 2 is to 3, ſo is 4 to 6.

Before we proceed to explain the operations in Arithmetic, it will be proper to give ſome account of the monies, weights and meaſures uſed in Great Britain.

## *Britiſh Money, Weights and Meaſures.*

In Britain, as in all other trading places, the current money or ſpecie, is either gold, ſilver or copper. Pure gold is too ſoft to be uſed for coin. The ſtandard of gold coin in this kingdom, is 22 carrats * fine, and the ſtandard of ſilver coin contains 11 ounces 2 dwts of pure ſilver, and 18 dwts. of alloy or copper.

The value of a pound of gold, when coined, at the mint price, is L. 46 : 14 : 6, and the value of pound of ſilver, is L. 3 : 2 : 0.

Accompts are kept in Britain in pounds, ſhillings, pence and farthings, and divided as in the following table.

* A carrat is a weight of 4 grains; but when that term is applied to gold, it denotes the degree of fineneſs. Any quantity of gold is ſuppoſed to be divided into 24 parts. If the maſs be pure gold, it is ſaid to be 24 carrats fine; if there be 23 parts of pure gold, and one part of baſe metal or alloy, it is ſaid to be 23 carrats fine, and ſo on.

## I. *Sterling Money.*

TABLES.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2 farthings | = | 1 halfpenny, | Farthings, | | | | |
| 4 farthings | = | 1 penny, | 4 | = | 1 penny, | | |
| 12 pence | = | 1 ſhilling, | 48 | = | 12 | = | 1 ſhil. |
| 20 ſhillings | = | 1 pound, | 960 | = | 240 | = | 20 = 1 pound. |

*Note.* Scots money is divided in the ſame manner as ſterling, and is one twelfth of its value. A pound Scots is equal to 1s. 8d. ſterling, a ſhilling Scots to a penny ſterling, and a penny Scots to a twelfth part of a penny, a merk Scots is two thirds of a pound Scots or 13⅓d ſterling; hence there are 12 pounds Scots, or 18 merks Scots, in a pound ſterling.

TABLE OF COINS.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| A double Joannes, | = | L. 3 | 12 | 0 | An Angel, | = | L.0 | 10 | 0 |
| A Joannes, | = | 1 | 16 | 0 | A Noble, | = | 0 | 6 | 8 |
| A Moidore, | = | 1 | 7 | 0 | A Quar. Guin. | = | 0 | 5 | 3 |
| A Jacobus, | = | 1 | 5 | 0 | A Crown, | = | 0 | 5 | 0 |
| A Guinea, | = | 1 | 1 | 0 | A Dollar, | = | 0 | 4 | 6 |
| A Piſtole, | = | 0 | 17 | 6 | A Half Crown, | = | 0 | 2 | 6 |
| A Merk, | = | 0 | 13 | 4 | A Guilder, | = | 0 | 1 | 10 |
| A Half Guinea, | = | 0 | 10 | 6 | A Livre, | = | 0 | 0 | 10 |

*Note.* The coins uſed in Britain are, the Guinea, Half-guinea, Seven-ſhilling-piece, and Quarter-guinea, of gold. The Crown, Half-crown, Shilling and Sixpence, of ſilver. The Penny-piece, Halfpenny, and Farthing, of copper.

## II. *Troy Weight.*

TABLES.

| | | |
|---|---|---|
| 24 grains | = | 1 penny-weight, |
| 20 penny-weights | = | 1 ounce, |
| 12 ounces | = | 1 pound. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 24 grains | = | 1 dwt. | | | | |
| 480 —— | = | 20 | = | 1 oz. | | |
| 5760 —— | = | 240 | = | 12 | = | 1 lb. |

*Note.* The firſt of all the weights uſed in Britain, was a grain of wheat picked out of the middle of the ear, which being well dried, became the leaſt denomination of Troy weight. This weight is now uſed for gold, ſilver, and jewels; for experiments in natural philoſophy, and for comparing different weights with each other.

Goldſmiths in Scotland divide the ounce into 16 drops, and the drop into 30 grains; but in all theſe ways, the ounce and grain are the ſame.

## III. *Apothecaries Weight.*

TABLES.

| | | |
|---|---|---|
| 20 grains | = | 1 ſcruple, |
| 3 ſcruples | = | 1 dram, |
| 8 drams | = | 1 ounce, |
| 12 ounces | = | 1 pound. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 20 grains | = | 1 ſcruple. | | | | |
| 60 —— | = | 3 | = | 1 dram. | | |
| 480 —— | = | 24 | = | 8 | = | 1 oz. |
| 5760 —— | = | 288 | = | 96 | = | 12 = 1 lb. |

*Note.* This weight is the ſame as Troy, the ſubdiviſions are only different. Apothecaries uſe it in compounding their medicines, but buy and ſell their drugs by Avoirdupois.

## IV. *Avoirdupois Weight.*

TABLES.

| | | |
|---|---|---|
| 16 drams or drops | = | 1 ounce, |
| 16 ounces | = | 1 pound, |
| 28 pounds | = | 1 quarter, |
| 4 quarters | = | 1 hundred weight, |
| 20 hundred weight | = | 1 ton. |

| *The greater weight.* | | | | | *The leſſer weight.* | | | |
|---|---|---|---|---|---|---|---|---|
| lb. | | | | | drs. | | | |
| 28 | = | 1 qr. | | | 16 | = | 1 oz. | |
| 112 | = | 4 | = | 1 cwt. | 256 | = | 16 = | 1 lb. |
| 2240 | = | 80 | = | 20 = 1 ton. | 3584 | = | 224 = | 14 = 1 ſtone. |

*Note.* This weight is uſed in England for all purpoſes, except thoſe mentioned in Troy and Apothecaries weights; and in Scotland for collecting the revenue; in ſelling leather, tallow, ſoap, flour, bread, candle, groceries, roſin, wax, pitch, wrought metals, ſome Baltic goods, and all goods brought from England. It is appointed by the Articles of Union, as the general weight through Great Britain; but has not been adopted in Scotland, except for the above mentioned commodities.

The pound is reckoned to contain 7000 grains Troy, and as the pound Troy contains 5760 grains, the proportion between the pound Troy and Avoirdupois will be as 175 to 144; for 175 pounds of the former are equal to 144 of the latter. Hence the pound Avoirdupois weighs 14 oz. 11 dwt. 16 grains Troy, and the pound Troy is equal to 13 oz. 2½ drops Avoirdupois. In weighing lead 19½ cwt. are only given to the ton, or fodder.

## V. *Wool Weight.*

TABLES.

| | | | |
|---|---|---|---|
| 7 | pounds | = | 1 clove, |
| 2 | cloves | = | 1 ſtone, |
| 2 | ſtones | = | 1 todd, |
| 6½ | todds | = | 1 wey, |
| 2 | weys | = | 1 ſack, |
| 12 | ſacks | = | 1 laſt. |

| lb. | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | = | 1 clove, | | | | | |
| 14 | = | 2 | = | 1 ſtone, | | | |
| 28 | = | 4 | = | 2 | = | 1 todd, | |
| 182 | = | 26 | = | 13 | = | 6½ | = 1 wey, |
| 364 | = | 52 | = | 26 | = | 13 | = 2 = 1 ſack, |
| 4368 | = | 624 | = | 312 | = | 156 | = 24 = 12 = 1 laſt. |

*Note.* This weight is founded on, and derived from, Avoirdupois, the pound in both being the ſame, but the greater weights different.—Wool-ſtaplers generally purchaſe their wool by the *Todd*, but ſell it again, when ſorted and ſtapled, by the pack, containing 12 ſcore or 240. lb.

## VI. *Trone Weight* *

Is the moſt ancient of the different kinds uſed in Scotland, and, though now forbidden by ſeveral ſtatutes, is ſtill uſed for many home commodities. It is divided as in the following Table of Dutch weight; but the pound varies in different places, and for different purpoſes, from 20 to 28 Dutch ounces.

## VII. *Dutch Weight.*

TABLES.

| | | | |
|---|---|---|---|
| 29 11/16 | Engliſh Troy grains | = | 1 drop, |
| 16 | drops | = | 1 ounce, |
| 16 | ounces | = | 1 pound, |
| 16 | pounds | = | 1 ſtone. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 29 11/16 | grains | = | 1 drop, | | | | |
| 475 | —— | = | 16 | = | 1 oz. | | |
| 7600 | —— | = | 256 | = | 16 | = | 1 lb. |
| 121600 | —— | = | 4096 | = | 256 | = | 16 = 1 ſtone. |

* The ancient ſtandard of Trone weight was to the Dutch as 55 to 41, and therefore the pound Trone, muſt have contained 21½ ounces Dutch weight, or 23 oz. 5½ drs. Avoirdupois.

*Note.* This weight is nearly, if not exactly, the ſame as that of Paris and Amſterdam. The pound contains 7600 grains as above, hence the Paris or Amſterdam pound will be to the pound Avoirdupois as 38 to 35. The cwt. Avoirdupois contains 103 lb 2½ oz Dutch. A lb. of this is equal to about 17 oz. 5¼ drs. Avoirdupois, and 15 oz. 16 dwt. 16 grs. Troy weight; or 95 lb. Dutch=72 lb. Troy. Although this weight be prohibited by the articles of Union, it is ſtill generally uſed in Scotland, for weighing iron, hemp, flax, moſt Dutch and Baltic goods, meal, butcher-meat, unwrought pewter and lead, and ſome other articles.

## VIII. *Cloth Meaſure.*

TABLES.

| | | Inches, | | | |
|---|---|---|---|---|---|
| 2¼ inches | = 1 nail, | 2¼ | = 1 nail, | | |
| 4 nails | = 1 quarter, | 9 | = 4 | = 1 quarter, | |
| 3 quarters | = 1 ell Flemiſh, | 36 | = 16 | = 4 | = 1 yard, |
| 4 quarters | = 1 yard, | 27 | = 12 | = 3 | = 1 Flemiſh ell, |
| 5 quarters | = 1 ell Engliſh, | 45 | = 20 | = 5 | = 1 Engliſh ell, |
| 6 quarters | = 1 ell French. | 54 | = 24 | = 6 | = 1 French ell. |

*Note.* The uſe of the *yard* was eſtabliſhed by Henry I. of England, and the ſtandard taken from the length of his own arm. It is uſed in meaſuring all kinds of Engliſh woollen cloths, linen, wrought ſilks, tape, &c.

The Engliſh ell is uſed in meaſuring chiefly a ſpecies of fine linen called *Holland.* The Flemiſh ell is chiefly applied to tapeſtry.

The Scotch ell * was eſtabliſhed by King David I. and divided into 37 inches, and though now forbidden by law, is ſtill uſed for green linen, and ſome other coarſe commodities of private or houſe manufacture.

## IX. *Wine Meaſure.*

TABLES.

| | | | |
|---|---|---|---|
| 2 pints | = 1 quart, | 42 gallons | = 1 tierce, |
| 2 quarts | = 1 pottle, | 2 bar. or 63 gallons | = 1 hhd. |
| 2 pottles | = 1 gallon, | | |
| 10 gallons | = 1 anker, | 84 gallons | = 1 puncheon, |
| 18 gallons | = 1 runlet, | 2 hhds. | = 1 pipe or butt, |
| 31½ gallons | = 1 barrel, | 2 pipes | = 1 tun. |

* The ſtandard of this meaſure is kept in the council-chamber of Edinburgh, and being compared with the Engliſh yard, is found to meaſure 37-1-fifth inches; and therefore the Scotch inch and foot are larger than the Engliſh, in the proportion of 186 to 185; but this difference being inconſiderable, is ſeldom attended to in practice.

Solid inches,

$28\frac{7}{8}$ = 1 pint,
$57\frac{3}{4}$ = 2 = 1 quart,
231 = 8 = 4 = 1 gallon,
4158 = 144 = 72 = 18 = 1 runlet,
$7276\frac{1}{2}$ = 252 = 126 = $31\frac{1}{2}$ = $1\frac{3}{4}$ = 1 barrel,
9702 = 336 = 168 = 42 = $2\frac{1}{3}$ = $1\frac{1}{3}$ = 1 tierce,
14553 = 504 = 252 = 63 = $3\frac{1}{2}$ = 2 = $1\frac{1}{2}$ = 1 hhd.
19404 = 672 = 336 = 84 = $4\frac{2}{3}$ = $2\frac{2}{3}$ = 2 = $1\frac{1}{3}$ = 1 puncheon,
29106 = 1008 = 504 = 126 = 7 = 4 = 3 = 2 = $1\frac{1}{2}$ = 1 pipe,
58212 = 2016 = 1008 = 252 = 14 = 8 = 6 = 4 = 3 = 2 = 1 tun.

*Note.* Liquid Meaſure was originally raiſed from Troy weight. It was appointed that 8 lb. Troy of wheat, gathered from the middle of the ear, and well dried, ſhould make one gallon of wine meaſure. The ſtandard wine gallon kept at Guild-hall, was ſuppoſed to contain 231 cubic inches; and though by actual experiment made in 1688, this gallon was found to contain only about 224, yet it was agreed, that the wine gallon ſhould ſtill be regulated to contain 231 inches; and a cylindrical veſſel 7 inches diameter, and 6 inches deep, which anſwers almoſt exactly to that capacity, is alſo appointed to be a legal wine gallon. This meaſure is uſed for all ſpirits, vinegar, oil, mead, perry, cyder and honey.

## X. *Engliſh Ale Meaſure.*

TABLES.

| | | | | | |
|---|---|---|---|---|---|
| 2 pints | = | 1 quart, | 4 firkins | = | 1 barrel, |
| 4 quarts | = | 1 gallon, | $1\frac{1}{2}$ barrels | = | 1 hhd. |
| $8\frac{1}{2}$ gallons | = | 1 firkin, | 2 hhds. | = | 1 butt, |
| 2 firkins | = | 1 kilderkin, | 2 butts | = | 1 tun. |

Solid inches,

$35\frac{1}{4}$ = 1 pint,
$70\frac{1}{2}$ = 2 = 1 quart,
282 = 8 = 4 = 1 gallon,
2397 = 68 = 34 = $8\frac{1}{2}$ = 1 firkin,
4794 = 136 = 68 = 17 = 2 = 1 kilderkin,
9588 = 272 = 136 = 34 = 4 = 2 = 1 barrel,
14382 = 408 = 204 = 51 = 6 = 3 = $1\frac{1}{2}$ = hhd.

*Note.* When Avoirdupois weight came into uſe, another gallon for ale or beer meaſure was formed from it, in the ſame manner as the wine gallon was raiſed from Troy weight, and therefore is larger than the gallon in wine meaſure, in the ſame proportion as the lb. Avoirdupois exceeds the lb. Troy. The ſtandard ale quart, kept in the

Exchequer has been found by experiment, to contain juſt 70½ cubic inches, conſequently the ale gallon muſt contain 282 cubic inches.

In London *only* they compute 8 gallons to the firkin of ale; 32 to the barrel, and 36 gallons to the barrel of beer. But in all other places in England, the above Table of beer or ale meaſure is to be obſerved, according to a ſtatute of Exciſe made in the year 1689.

## XI. *Scotch Ale Meaſure.*

TABLES.

| | | | | | |
|---|---|---|---|---|---|
| 4 gills | = | 1 mutchkin, | 2 pints | = | 1 quart, |
| 2 mutchkins | = | 1 choppin, | 4 quarts | = | 1 gallon, |
| 2 choppins | = | 1 pint, | 16 gallons | = | 1 butt. |

Solid inches,

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $6\frac{9}{10}$ | = | 1 gill, | | | | | |
| $26\frac{1}{4}$ | = | 4 | = | 1 mutchkin, | | | |
| 105 | = | 16 | = | 4 | = | 1 pint, | |
| 840 | = | 128 | = | 32 | = | 8 | = 1 gallon, |
| 13440 | = | 2048 | = | 512 | = | 128 | = 16 = 1 hhd. or butt. |

*Note.* The Stirling *jug* (made of caſt metal) was formerly the ſtandard for the Scotch pint, which was ſuppoſed to contain 105 cubic inches, and though after ſeveral careful trials, it has been found to contain only about 103½ inches; it was however agreed that the pint *ſtoups* ſhould ſtill be regulated to contain 105 cubic inches.

The Scotch quart contains 210 inches, and is therefore to the Engliſh wine gallon as 10 to 11, and to the Engliſh ale gallon nearly as 4 to 5.

In Scotland, the Exciſe and Breweries uſe the Engliſh meaſure; but retailers and victuallers in the country, generally uſe the Scotch pint. An Engliſh wine pint is commonly reckoned the ſame as the Scotch mutchkin; but it is in fact larger, in the proportion of 28 to 25; or rather above a ninth part.

## XII. *Engliſh Dry Meaſure.*

TABLES.

| | | | | | |
|---|---|---|---|---|---|
| 2 pints | = | 1 quart, | 4 buſhels | = | 1 coomb, |
| 2 quarts | = | 1 pottle, | 2 coombs | = | 1 quarter, |
| 2 pottles | = | 1 gallon, | 4 quarters | = | 1 chaldron, |
| 2 gallons | = | 1 peck, | 5 quarters | = | 1 wey or load, |
| 4 pecks | = | 1 buſhel, | 2 weys | = | 1 laſt. |

Pints,
2= 1 quart,
4= 2= 1 pottle,
8= 4= 2= 1 gallon,
16= 8= 4= 2= 1 peck,
64= 32= 16= 8= 4= 1 buſhel,
256= 128= 64= 32= 16= 4= 1 coomb,
512= 256= 128= 64= 32= 8= 2= 1 quarter,
2048=1024= 512=256=128=32= 8= 4=1 chaldron,
2560=1280= 640=320=160=40=10= 5=1¼=1 tun or wey,
5120=2560=1280=640=320=80=20=10=2½=2=1 laſt.

*Note.* The ſtandard for meaſuring corn, ſalt, coals, and other dry goods, in England, is the Wincheſter buſhel, which contains 2150 cubic inches. It is a cylindrical veſſel, 18½ inches diameter, and 8 inches deep. The buſhel for coals, is about a fourth part greater than the corn buſhel: 3 buſhels make a ſack, 9 buſhels, a quarter or vatt, 4 quarters, a London chaldron, and 21 chaldrons, a ſcore; 15 chaldrons London meaſure, are equal to 9 chaldrons Newcaſtle meaſure.

## XIII. *Scotch Dry Meaſure.*

TABLES.

| | | | |
|---|---|---|---|
| 4 forpats | = 1 peck, | Lippies, | |
| 4 pecks | = 1 firlot, | 4= | 1 peck, |
| 4 firlots | = 1 boll, | 16= | 4 = 1 firlot, |
| 16 bolls | = 1 chalder. | 64= | 16 = 4 = 1 boll, |
| | | 1024= | 256 =64 =16 = 1 chald. |

*Note.* The dry meaſure in moſt parts of Scotland, differs from that uſed in England. The wheat firlot uſed alſo for rye, peaſe, beans, ſalt and graſs ſeeds, contains 21¼ pints when meaſured by the Stirling jug. The bear or barley firlot, uſed alſo for oats, malt, fruit and potatoes, contains 31 pints. If the Stirling jug contain 103½ inches, the wheat firlot will contain 2199 cubic inches, which is more than a fiftieth part larger than the Wincheſter buſhel; and the barley firlot will contain 3208 inches. The boll of barley is nearly equal to 6 buſhels.

## XIV. *Engliſh Long Meaſure.*

TABLES.

| | | | |
|---|---|---|---|
| 3 barley-corns | = 1 inch, | 4 poles | = 1 chain, |
| 12 inches | = 1 foot, | 10 chains | = 1 furlong, |
| 3 feet | = 1 yard, | 8 furlongs | = 1 mile, |
| 2 yards | = 1 fathom, | 3 miles | = 1 league, |
| 5½ yards | = 1 pole or perch, | 60 miles or 69½ | = 1 degree. |

Barley-corns,

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 = | 1 inch, | | | | | |
| 36 = | 12 = | 1 foot, | | | | |
| 108 = | 36 = | 3 = | 1 yard, | | | |
| 594 = | 198 = | 16½ = | 5½ = | 1 pole, | | |
| 23760 = | 7920 = | 660 = | 220 = | 40 = | 1 furlong, | |
| 190080 = | 63360 = | 5280 = | 1760 = | 320 = | 8 = | 1 mile, |
| 570240 = | 190080 = | 15840 = | 5280 = | 960 = | 24 = 3 = | 1 league. |

*Note.* Long meaſure took its riſe from wheat, 3 grains of which properly prepared, and joined length-wiſe, were made the meaſure of an inch. A hand-breadth, in horſe-meaſure, is 4 inches; a ſpan, 9 inches; a common pace, 2 feet 6 inches; and a geometrical pace, 5 feet; 360 degrees, or 25000 miles is nearly the circumference of the earth.

## XV. *Scotch Long Meaſure.*

TABLES.

| | | | |
|---|---|---|---|
| 3 barley-corns | = 1 inch, | 4 falls, or 74 feet | = 1 chain, |
| 12 inches | = 1 foot, | 10 chains, or 40 falls | = 1 furlong, |
| 37 inches | = 1 ell, | 8 fur. or 80 chains | = 1 mile, |
| 6 ells, or 18½ feet | = 1 fall, | 56 Scotch miles | = 1 degree. |

Inches,

| | | | | | |
|---|---|---|---|---|---|
| 12 = | 1 foot, | | | | |
| 37 = | 3 1/12 = | 1 ell, | | | |
| 222 = | 18½ = | 6 = | 1 fall, | | |
| 8880 = | 740 = | 240 = | 40 = | 1 furlong, | |
| 71040 = | 5920 = | 1920 = | 320 = | 8 = | 1 mile. |

*Note.* The old Scotch computed mile, is about a mile and a half Engliſh.

## XVI. *Engliſh Land Meaſure.*

TABLES.

| | | | |
|---|---|---|---|
| 144 ſq. inches | = 1 ſq. foot, | 40 ſq. poles | = 1 rood, |
| 9 ſq. feet | = 1 ſq. yard, | 4 roods | = 1 acre, |
| 30¼ ſq. yards | = 1 ſq. pole, | 640 acres | = 1 mile. |

Square inches,

144 = 1 ſq. foot,
1296 = 9 = 1 ſq. yard,
39204 = 272¼ = 30¼ = 1 ſq. pole,
1568160 = 10890 = 1210 = 40 = 1 rood,
6272640 = 43560 = 4840 = 160 = 4 = 1 acre,
40144896oo = 27878400 = 3097600 = 102400 = 2560 = 640 = 1 mile.

*Note.* The length of the chain for meaſuring land in England, is 4 poles, or 66 feet, divided into 100 equal parts or links, each link being $7\frac{92}{100}$ inches; 40 poles in length and 4 in breadth make a ſtatute acre. A hide of land, frequently mentioned in the earlier part of the Engliſh hiſtory, contained about 100 arable acres; and 5 hides were eſteemed a Knight's fee. At the time of the Norman conqueſt, there were 243600 hides in England.

## XVII. *Scotch Land Meaſure.*

### TABLES.

36 ſquare ells = 1 ſq. fall, 40 falls = 1 rood, 4 roods = 1 acre.

Links,

$17\frac{136}{360}$ = 1 ell,
625 = 36 = 1 fall,
25000 = 1440 = 40 = 1 rood,
100000 = 5760 = 160 = 4 = 1 acre,
64000000 = 3686400 = 102400 = 2560 = 640 = 1 mile.

*Note.* This meaſure is founded on the Scotch ell. The proportion between the Scotch and Engliſh acre *, is, as 1369 to 1089, or nearly as 5 to 4. The length of the Scotch chain is 24 ells, or 74 feet, divided into 100 links, each link being $8\frac{88}{100}$ inches.

## XVIII. *Hay.*

56 lbs. old hay } = 1 truſs,
60 lbs. new hay }
36 lbs. ſtraw = 1 truſs,
36 truſſes = 1 load.

* If the difference between the Scotch and Engliſh foot (ſee note, page 6th) be regarded, the length of the Scotch chain ſhould be 74 feet 4 inches and 4-fifths Engliſh meaſure, and therefore 100000 Engliſh acres will be equal to 78694 Scotch acres. But on account of the very great difficulty of adjuſting the chain to this ſtandard, it has been enacted by a late deciſion of the Court of Seſſion, that the chain of 74 Engliſh feet be uſed through all Scotland.

## XIX. *Solid Meaſure.*

1728 ſolid inches = 1 ſolid foot,
27 ſolid feet = 1 ſolid yard,
40 ſolid feet = 1 ton.

*Note.* This meaſure comprehends length, breadth, and thickneſs or depth.

There are ſome commodities ſold by the dozen, of which we reckon 12=1 dozen, 12 dozen=1 ſmall groſs, 12 ſmall groſs =1 great groſs.

Paper is ſold by the following denominations, 24 ſheets=1 quire, 20 quires = 1 ream, 2 reams = 1 bundle, 10 reams = 1 bale.

Parchment is ſold thus, 12 ſkins =1 dozen, 5 dozen = 1 roll.

Of Glaſs, 5 pounds =1 ſtone, 24 ſtones, = 1 ſeam.

The reel for Lint-yarn, is $2\frac{1}{2}$ yards, or 10 quarters in circuit, 120 threads = 1 cut, 2 cuts = 1 heer, 6 heers = 1 haſp, hank, or ſlip, 4 haſps = 1 ſpindle. And the reel for Cotton-yarn is 54 inches in circuit, 80 threads = 1 ſkene or rap, 7 ſkenes = 1 hank, 18 hanks = 1 ſpindle.

## XX. *Time.*

TABLES.

| | |
|---|---|
| 60 ſeconds = 1 minute, | 7 days = 1 week, |
| 60 minutes = 1 hour, | 4 weeks = 1 mo. of 28 days, |
| 24 hours = 1 day, | 13 mo. or 52 w. = 1 year of 364 days. |

Seconds,

| | | | | | | |
|---|---|---|---|---|---|---|
| 60 | = | 1 minute, | | | | |
| 3600 | = | 60 | = | 1 hour, | | |
| 86400 | = | 1440 | = | 24 | = | 1 day, |
| 604800 | = | 10080 | = | 168 | = | 7 = 1 week, |
| 2419200 | = | 40320 | = | 672 | = | 28 = 4 = 1 month, |
| 31557600 | = | 525960 | = | 8766 | = | $365\frac{1}{4}$ = 1 year. |

*Note.* The Calendar for the computation of years and months, which is now called the Old Style, was enacted by Julius Cæſar, and was obſerved in Europe for about 16 centuries. After ſo long a trial, it was found not to correſpond exactly with the courſe of the ſun, and therefore was corrected by order of Pope Gregory XIII. in the year 1582.

The length of the year according to the Julian, or Old Style, is 365 days 6 hours. Theſe 6 hours in the ſpace of four years make a day, which is added to February; this year is called *Biſſextile*, or leap year. But the preciſe time the ſun takes to go round, from one tropic to the ſame again, is 365 days, 5 hours, 48 minutes, 49 ſeconds, which is the exact

length of the year, as marked out by the ſeaſons. As that computation therefore exceeds the true year by 11 minutes, 11 ſeconds, theſe in 400 years will amount to 3 days, 2 hours, 33 minutes, 23 ſeconds, and the firſt of January by the Calendar, ſhould be the 4th by the ſeaſons. To correct this the Gregorian, or New Style enacts, that of every 400 years the 100th, 200th and 300th ſhould not be made leap, but common years, by which means the ſeaſons and calendar are made nearly to agree. The years made common are 1700, 1800, 1900; 2100, 2200, 2300; 2500, and ſo on. By this method the Calendar and true year will differ only one day in about 3668 years.

The number of Days in each Calendar Month is as follows, viz.

| | | | |
|---|---|---|---|
| January 31, | April 30, | July 31, | October 31, |
| February 28, | May 31, | Auguſt 31, | November 30, |
| March 31, | June 30, | September 30, | December 31. |

*Expreſſed in the following rhyme.*

Thirty days hath September,
April, June, and November,
All the reſt have thirty-one,
But Feb'ry twenty-eight alone;
Which hath in the biſſextile year
Days twenty-nine; I tell you here,
The *Note* above will make appear.

a Julius si a mahen
mulieres.

# CHAP. I.

## NOTATION AND NUMERATION.

ALL numbers are repreſented by the ten following characters.

1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

One, two, three, four, five, ſix, ſeven, eight, nine, cypher.

The nine digits are called ſignificant figures to diſtinguiſh them from the cypher, which of itſelf has no value. The nine figures repreſent units, tens, hundreds, thouſands, &c. as they ſtand in the following

TABLE.

| TRILLIONS. | | | BILLIONS | | | MILLIONS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hundred thouſands of billions | Ten thouſands of billions | Thouſands of billions | Hundreds of billions | Tens of billions | Hundred thouſands of millions | Ten thouſands of millions | Thouſands of millions | Hundreds of millions | Tens of millions | Hundreds of thouſands | Tens of thouſands | Thouſands | Hundreds | Tens | Units |
| 9. | 8 | 7 | 6, | 5 | 4 | 3. | 2 | 1 | 0, | 9 | 8 | 7. | 6 | 5 | 4, | 3 | 2 | 1 |

If a larger line than the table be required, the periods which follow in order, are quadrillions, quintillions, ſextillions, ſeptillions, octillions, nonillions, decillions, &c.

*Explanation of the Table.*

The firſt figure on the right hand denotes one; two figures, twenty-one; three figures, three hundred and twenty-one; four figures, four thouſand, three hundred and twenty-one; five figures, fifty-four thouſand, three hundred and twenty-one; ſix figures, ſix hundred and fifty-four thouſand, three hundred and twenty-one; ſeven figures, ſeven millions, ſix hundred and fifty-four thouſand, three hundred and twenty one; eight figures, eighty-ſeven million, ſix hundred and fifty-four thouſand, three hundred and twenty-one; nine figures, nine hundred and eighty-ſeven millions, ſix hundred and fifty-four thouſand, three hundred and twenty-one, and ſo on.

From the above, all numbers evidently increaſe in value in ten-fold proportion from right to left. And though the cypher of itſelf, or on the left of any number be inſignificant, yet, on its right, it increaſes the value ten times; thus, 7 ſignifies ſeven, but 70 ſignifies ſeven tens, or ſeventy, and 700 ſignifies, ſeventy tens, or ſeven hundred, &c.

## Sect. 1. Notation.

Notation teaches to write numbers by figures.

*Rule. Put the figures of the given number in their proper places, and ſupply vacancies with cyphers.*

### EXAMPLES.

1. Write in figures, one million three hundred thouſand.
2. ——— nineteen thouſand, nineteen hundred and nineteen.
3. ——— ſeventy millions, ſeven hundred and ſeven.
4. ——— five hundred trillions, three hundred and ſeven thouſand, eight hundred and fifty billions, forty-five thouſand and nine millions, and eighty one thouſand.

## Sect. II. Numeration.

Numeration teaches to read any number expreſſed by figures.

*Rule. Divide the given number into periods of ſix figures each (as in the table) then the* places *of the ſeveral figures will readily appear, and read them accordingly.*

### EXAMPLES.

1. Expreſs in words 1300000? (2) 20919? (3) 70000707?
4. ——————— 5003078500450090810 00?
5. ——————— 1000000000000000000000000?

Anſwer, One quadrillion. If we ſuppoſe this ſum guineas, and a perſon to count ſixty thouſand each day, though the whole earth from the creation had been as populous as Britain is now, and the whole human race had been conſtantly counting, they would not, at the preſent time, have numbered the thouſandth part of that ſum.

*A Synopſis of the Roman Notation.*

| | | | | | |
|---|---|---|---|---|---|
| I. | —— | 1 | XX. | —— | 20 |
| II. | —— | 2 | XXX. | —— | 30 |
| III. | —— | 3 | XL. | —— | 40 |
| IV. | —— | 4 | L. | —— | 50 |
| V. | —— | 5 | LX. | —— | 60 |
| VI. | —— | 6 | LXX. | —— | 70 |
| VII. | —— | 7 | LXXX. | —— | 80 |
| VIII. | —— | 8 | XC. | —— | 90 |
| IX. | —— | 9 | C. | —— | 100 |
| X. | —— | 10 | D, or Iↀ. | —— | 500 |
| XI. | —— | 11 | M, or CIↀ. or ∞ | —— | 1,000 |
| XII. | —— | 12 | Iↀↀ, or $\overline{V}$. | —— | 5,000 |
| XIII. | —— | 13 | CCIↀↀ, or $\overline{X}$. | —— | 10,000 |
| XIV. | —— | 14 | Iↀↀↀ, or $\overline{L}$. | —— | 50,000 |
| XV. | —— | 15 | CCCIↀↀↀ, or $\overline{C}$. | —— | 100,000 |
| XVI. | —— | 16 | CCCCIↀↀↀↀ, or $\overline{M}$. | —— | 1,000,000 |
| XVII. | —— | 17 | M,DCCC. | —— | 1800 |
| XVIII. | —— | 18 | | | |
| XIX. | —— | 19 | | | |

*Explanation.*

As often as any character is repeated, ſo many times its value is repeated; thus, XXIII. ſignifies twenty-three.

A leſs character before a greater, diminiſhes the greater by the value of the leſs; thus, IV. ſignifies four, and XC. ninety *.

A leſs character after a greater increaſes the greater by the value of the leſs; thus, VI. ſignifies ſix, and CL. one hundred and fifty.

Every ↀ. affixed to Iↀ increaſes the number ten times; thus, Iↀↀ. ſignifies five thouſand.

Every C. and ↀ. to the right and left of CIↀ. increaſes the value ten times; thus, CCIↀↀ. ſignifies ten thouſand.

A line over any number, increaſes it a thouſand fold; thus, $\overline{V}$. ſignifies, five thouſand.

* This method was ſometimes adopted by the Romans, when they could expreſs a number by fewer letters than in the other way. For example, IIX=VIII; XIIX =XVIII; XXIIX=XXVIII; for II taken from X equal eight; CD=CCCC, for C taken from D equal, four hundred; DXXCI=DLXXXI, for XX taken from CI equal eighty-one; and DXXCIIX=DLXXXVIII, or 588.

# CHAP. II.

## ADDITION.

ADDITION teaches to collect two or more numbers into one ſum.

### Sect. I. SIMPLE ADDITION.

*RULE.* 1ſt. *Write the numbers under each other, units under units, tens under tens, &c. and draw a line below them.*

2d. *Add the column of units, find the tens in it, ſet down the remainder below the column, if nothing remain put down a cypher, and for every ten carry one to the next column.*

3d. *Proceed thus, adding what you carry to every column, till the laſt, under which write the whole ſum.*

EXAMPLES.

| *£.* | *Yards.* | *Feet.* |
|---|---|---|
| 6467545 | 8473543 | 63514371 |
| 9131434 | 7542054 | 73217851 |
| 1245615 | 9871345 | 63754321 |
| 7321890 | 5432032 | 75970235 |
| ———24166484 | 7567545 | 89543107 |
| 9190654 | 7815432 | 57859759 |
| 5143241 | 4536098 | 43215487 |
| 3210532 | 5431542 | 59723545 |
| 6732143 | 4217879 | 43215435 |
| ———24276570 | 9572345 | 59532014 |
| 1828904 | 5147532 | 87054307 |
| 5131031 | 9239871 | 78598715 |
| 3179854 | 4563543 | 57940430 |
| 4513209 | | |
| ———14652998 | 89410761 | 853139577 |
| 63096052——— | | |
| 63096052 | | |

We carry 1 for every 10, becauſe numbers increaſe in a ten-fold proportion from right to left, and therefore ten in any column is equal to one in the next.

As Addition occurs moſt frequently in buſineſs, the learner ought to conſider that accuracy and diſpatch are abſolutely requiſite, and can only be acquired by much practice, and taking in two or three figures at a glance.

*Methods of Proof.*

1ſt, Cut the columns by croſs lines at ſeveral places. Add them ſeparately, and then collect their ſums together for the ſum total. This is done in example firſt.

2d, After adding the columns upward, for proof, men of buſineſs add them downward, and if the ſums be the ſame, they conclude the work to be right.

## Sect. II. Compound Addition.

*Rule 1ſt. Write the numbers of the ſame name under each other, add the figures of the loweſt denomination, and find how many of the next higher their ſum contains.*

*2d. Set down the remainder, and carry one for each of the higher denomination to the next column.*

*3d. Proceed in this manner to carry one for each of the next higher denomination till the laſt, at which carry by ten, as in Simple Addition.*

*Note.* In adding ſterling money, at the ſhillings, carry by 10 from the units to the tens, and by 2 from the tens to the pounds.

The method of proof is the ſame as in Simple Addition.

### EXAMPLES.

### *Sterling Money.*

| Lent to Sundries. | | | Paid to Sundries. | | | Received from Sundries. | | |
|---|---|---|---|---|---|---|---|---|
| £.56 | 18 | 9¼ | £.3186 | 14 | 3½ | £.178 | 13 | 10½ |
| 47 | 13 | 4 | 2675 | 16 | 5¼ | 114 | 15 | 11½ |
| 76 | 10 | 6½ | 1347 | 10 | 10¼ | 136 | 18 | 6¼ |
| 35 | 16 | 8 | 5850 | 18 | 6¾ | 253 | 16 | 8 |
| 24 | 17 | 3¼ | 4528 | 16 | 8½ | 198 | 18 | 4½ |
| 98 | 15 | 5 | 5984 | 13 | 9¼ | 168 | 10 | 8 |
| 39 | 12 | 6½ | 7489 | 19 | 11¾ | 365 | 13 | 6¾ |
| 64 | 17 | 9 | 1684 | 17 | 6½ | 176 | 15 | 10 |
| 57 | 19 | 10 | 5968 | 15 | 8½ | 258 | 17 | 3 |
| 75 | 16 | 8¾ | 6835 | 12 | 6¼ | 245 | 15 | 4½ |
| £.578 | 18 | 10¼ | £.45553 | 16 | 4½ | £.2098 | 16 | 1 |

*Note.* In adding the 1ſt example the ſum of the farthings is 9 or 2¼d, the odd ¼ is ſet down, and the 2 carried to the column of pence, the amount of which is 70, or 5s. 10d. the 10d. is put down, and the 5 carried to the units' place of the column of ſhillings, the ſum whereof is 58, the 8 is put down, and the 5 carried to the tens' place, in which there are 15 tens, the half of which is 7 and 1 over, or (7l. 10s.) we ſet down the odd 1 before the 8, and carry the 7 to the pounds, &c.

*Troy Weight.*

| lb. | oz. | dwt. | gr. |
|---|---|---|---|
| 47 | 11 | 18 | 20 |
| 75 | 10 | 16 | 14 |
| 68 | 9 | 10 | 10 |
| 71 | 8 | 15 | 18 |
| 56 | 11 | 13 | 15 |
| 61 | 10 | 15 | 18 |
| 14 | 8 | 14 | 17 |
| 94 | 11 | 16 | 21 |
| 45 | 10 | 14 | 11 |
| 38 | 9 | 13 | 12 |
| 577 | 8 | 10 | 12 |

*Apothecaries Weight.*

| lb. | oz. | dr. | ſcr. | gr. |
|---|---|---|---|---|
| 149 | 10 | 7 | 1 | 15 |
| 356 | 11 | 6 | 1 | 19 |
| 75 | 10 | 5 | 2 | 17 |
| 615 | 9 | 3 | 0 | 15 |
| 14 | 7 | 4 | 1 | 12 |
| 69 | 8 | 2 | 2 | 8 |
| 573 | 2 | 5 | 1 | 7 |
| 94 | 6 | 6 | 0 | 9 |
| 287 | 7 | 5 | 2 | 5 |
| 64 | 5 | 7 | 1 | 8 |
| 2302 | 9 | 7 | 1 | 15 |

## *Avoirdupois Weight.*

*Leſſer Weight.*

| Stones. | lb. | oz. | dr. |
|---|---|---|---|
| 74 | 13 | 14 | 13 |
| 14 | 11 | 10 | 11 |
| 15 | 9 | 4 | 15 |
| 90 | 13 | 13 | 14 |
| 56 | 11 | 11 | 10 |
| 48 | 13 | 9 | 7 |
| 59 | 11 | 14 | 12 |
| 66 | 11 | 9 | 4 |
| 84 | 12 | 12 | 0 |
| 36 | 10 | 8 | 14 |
| 550 | 2 | 14 | 4 |

*Greater Weight.*

| Tons | cwt. | qr. | lb. |
|---|---|---|---|
| 597 | 19 | 3 | 27 |
| 364 | 17 | 2 | 14 |
| 636 | 14 | 1 | 10 |
| 71 | 8 | 3 | 9 |
| 168 | 15 | 2 | 8 |
| 46 | 10 | 2 | 10 |
| 754 | 13 | 1 | 26 |
| 43 | 4 | 0 | 21 |
| 39 | 18 | 3 | 25 |
| 514 | 13 | 2 | 17 |
| 3238 | 17 | 0 | 27 |

*Wool Weight.*

| Laſts | S. | W. | Tod. | St. | Cl. | lb. |
|---|---|---|---|---|---|---|
| 141 | 11 | 1 | 6 | 0 | 1 | 6 |
| 144 | 10 | 1 | 5 | 1 | 0 | 5 |
| 168 | 9 | 1 | 5 | 0 | 1 | 4 |
| 74 | 8 | 0 | 6 | 1 | 0 | 4 |
| 96 | 7 | 1 | 5 | 1 | 1 | 3 |
| 164 | 9 | 1 | 4 | 0 | 1 | 5 |
| 84 | 11 | 0 | 3 | 1 | 1 | 4 |
| 94 | 8 | 1 | 2 | 0 | 6 | 6 |
| 347 | 5 | 1 | 3 | 1 | 1 | 5 |
| 10 | 4 | 0 | 5 | 0 | 1 | 5 |
| 1329 | 5 | 0 | 4½ | 0 | 0 | 5 |

*Dutch Weight.*

| St. | lb. | oz. | dr. |
|---|---|---|---|
| 375 | 15 | 14 | 13 |
| 97 | 8 | 13 | 14 |
| 100 | 12 | 11 | 10 |
| 69 | 14 | 13 | 9 |
| 8 | 12 | 10 | 8 |
| 114 | 9 | 8 | 7 |
| 65 | 8 | 4 | 5 |
| 84 | 7 | 5 | 6 |
| 76 | 5 | 3 | 4 |
| 14 | 9 | 14 | 5 |
| 1008 | 9 | 4 | 1 |

## *Cloth Meaſure.*

| Yds. | qr. | nails | in. |
|---|---|---|---|
| 94 | 3 | 2 | 2 |
| 78 | 2 | 3 | 1½ |
| 49 | 0 | 3 | 1 |
| 31 | 3 | 1 | 2 |
| 56 | 2 | 1 | 0¼ |
| 73 | 2 | 2 | 1 |
| 94 | 3 | 2 | 2 |
| 84 | 2 | 0 | 1¾ |
| 75 | 1 | 2 | 2 |
| 40 | 0 | 3 | 1½ |
| 680 | 0 | 1 | 1½ |

| Fl. ells. | qr. | nails. |
|---|---|---|
| 588 | 2 | 1 |
| 65 | 1 | 3 |
| 100 | 2 | 2 |
| 10 | 0 | 1 |
| 70 | 1 | 3 |
| 116 | 1 | 0 |
| 45 | 2 | 2 |
| 311 | 1 | 0 |
| 96 | 0 | 3 |
| 183 | 1 | 2 |
| 1589 | 0 | 1 |

| Eng. ells. | qr. | nails | in. |
|---|---|---|---|
| 60 | 4 | 3 | 1 |
| 32 | 2 | 1 | 2 |
| 87 | 3 | 0 | 1½ |
| 14 | 2 | 1 | 1¾ |
| 75 | 1 | 3 | 2 |
| 86 | 3 | 2 | 1½ |
| 38 | 4 | 1 | 0 |
| 42 | 1 | 0 | 2 |
| 23 | 2 | 1 | 1 |
| 50 | 4 | 3 | 2 |
| 513 | 1 | 1 | 1¼ |

## *Wine Meaſure.*

| Tuns | Pipes | Hhds. | Gal. | Pints |
|---|---|---|---|---|
| 86 | 1 | 0 | 62 | 6 |
| 43 | 1 | 1 | 60 | 7 |
| 65 | 1 | 1 | 48 | 4 |
| 38 | 0 | 1 | 37 | 5 |
| 17 | 1 | 0 | 56 | 3 |
| 99 | 1 | 1 | 22 | 1 |
| 64 | 1 | 1 | 18 | 2 |
| 37 | 1 | 1 | 7 | 0 |
| 9 | 0 | 0 | 16 | 7 |
| 14 | 1 | 1 | 14 | 5 |
| 479 | 0 | 0 | 30 | 0 |

| Tuns | Pipes | Hhds. | Gal. | Qt. | Pints |
|---|---|---|---|---|---|
| 464 | 1 | 1 | 60 | 2 | 1 |
| 74 | 0 | 1 | 62 | 3 | 0 |
| 160 | 1 | 0 | 9 | 1 | 1 |
| 9 | 1 | 1 | 14 | 1 | 0 |
| 22 | 1 | 1 | 19 | 2 | 1 |
| 46 | 1 | 0 | 6 | 1 | 1 |
| 133 | 0 | 1 | 15 | 0 | 1 |
| 76 | 1 | 1 | 0 | 1 | 1 |
| 9 | 1 | 1 | 26 | 1 | 0 |
| 314 | 1 | 0 | 15 | 1 | 1 |
| 1313 | 1 | 0 | 41 | 0 | 1 |

## *Ale or Beer Meaſure.*

### *Engliſh.*

| Hhds. | Gal. | Qr. | Pints |
|---|---|---|---|
| 150 | 49 | 3 | 0 |
| 19 | 16 | 2 | 1 |
| 109 | 15 | 1 | 1 |
| 15 | 9 | 1 | 0 |
| 76 | 14 | 0 | 1 |
| 44 | 12 | 1 | 1 |
| 39 | 5 | 1 | 1 |
| 154 | 24 | 1 | 0 |
| 68 | 14 | 0 | 1 |
| 56 | 12 | 1 | 1 |
| 733 | 20 | 2 | 1 |

### *Scotch.*

| Butts | Gal. | Pints | Mutch. | Gills |
|---|---|---|---|---|
| 784 | 15 | 7 | 3 | 2 |
| 39 | 12 | 6 | 2 | 2 |
| 100 | 11 | 4 | 1 | 1 |
| 46 | 10 | 5 | 1 | 3 |
| 9 | 14 | 0 | 1 | 4 |
| 38 | 12 | 4 | 0 | 1 |
| 10 | 10 | 3 | 1 | 2 |
| 118 | 9 | 6 | 1 | 1 |
| 73 | 7 | 5 | 1 | 1 |
| 96 | 4 | 4 | 0 | 1 |
| 1319 | 13 | 7 | 2 | 3 |

## *Corn or Dry Meaſure.*

| *Engliſh.* | | | | | *Scotch.* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Chal. | Qr. | Buſh. | Pecks | Gal. | Chal. | Bolls | Fir. | Pecks | Lip. |
| 136 | 3 | 7 | 3 | 1 | 716 | 11 | 3 | 2 | 1 |
| 14 | 2 | 3 | 2 | 0 | 57 | 12 | 2 | 1 | 2 |
| 9 | 1 | 5 | 1 | 0 | 4 | 9 | 1 | 3 | 3 |
| 25 | 0 | 6 | 1 | 1 | 100 | 10 | 1 | 2 | 2 |
| 71 | 1 | 4 | 0 | 1 | 66 | 8 | 0 | 1 | 1 |
| 56 | 1 | 3 | 1 | 1 | 9 | 5 | 1 | 1 | 1 |
| 71 | 0 | 2 | 1 | 0 | 114 | 4 | 3 | 1 | 0 |
| 6 | 1 | 4 | 0 | 1 | 73 | 3 | 2 | 1 | 1 |
| 11 | 3 | 6 | 1 | 1 | 314 | 10 | 1 | 3 | 3 |
| 17 | 2 | 5 | 1 | 1 | 16 | 9 | 1 | 2 | 2 |
| 421 | 0 | 0 | 2 | 1 | 1474 | 6 | 0 | 1 | 0 |

## *Long Meaſure.*

| *Engliſh.* | | | | | *Scotch.* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Miles | Fur. | Yards | Feet | In. | Miles | Fur. | Falls | Ells | In. |
| 146 | 6 | 190 | 2 | 10 | 264 | 6 | 38 | 5 | 36 |
| 73 | 5 | 11 | 1 | 9 | 365 | 7 | 39 | 4 | 30 |
| 174 | 7 | 119 | 1 | 11 | 35 | 4 | 36 | 3 | 34 |
| 386 | 3 | 114 | 2 | 6 | 47 | 5 | 18 | 4 | 32 |
| 63 | 4 | 219 | 1 | 4 | 173 | 6 | 29 | 5 | 35 |
| 761 | 4 | 110 | 2 | 9 | 98 | 4 | 36 | 1 | 18 |
| 489 | 0 | 67 | 1 | 8 | 145 | 5 | 9 | 3 | 25 |
| 19 | 7 | 100 | 2 | 3 | 357 | 3 | 14 | 4 | 18 |
| 814 | 5 | 148 | 1 | 5 | 398 | 6 | 7 | 5 | 25 |
| 79 | 6 | 84 | 1 | 4 | 164 | 5 | 34 | 0 | 16 |
| 3010 | 4 | 68 | 1 | 9 | 2053 | 1 | 26 | 5 | 10 |

## *Land Meaſure.*

| *Engliſh.* | | | | *Scotch.* | | | |
|---|---|---|---|---|---|---|---|
| Acres | Roods | Poles | Yards | Acres | Roods | Falls | Ells |
| 345 | 1 | 25 | 30 | 176 | 3 | 39 | 35 |
| 272 | 2 | 17 | $25\frac{1}{4}$ | 314 | 1 | 34 | 30 |
| 98 | 3 | 36 | $28\frac{1}{2}$ | 96 | 1 | 35 | 16 |
| 144 | 1 | 39 | 30 | 34 | 2 | 16 | 17 |
| 76 | 2 | 34 | $16\frac{1}{4}$ | 145 | 1 | 17 | 14 |
| 33 | 1 | 15 | $4\frac{3}{4}$ | 46 | 2 | 16 | 36 |
| 176 | 3 | 13 | 26 | 637 | 3 | 15 | 18 |
| 54 | 0 | 10 | 30 | 248 | 1 | 18 | 19 |
| 430 | 2 | 26 | $14\frac{1}{2}$ | 784 | 0 | 19 | 22 |
| 876 | 1 | 18 | 19 | 67 | 1 | 16 | 30 |
| 2509 | 2 | 0 | $12\frac{1}{2}$ | 2552 | 0 | 31 | 21 |

*Time.*

| Months | Weeks | Days | Hours |
|---|---|---|---|
| 67 | 2 | 6 | 20 |
| 176 | 3 | 5 | 23 |
| 39 | 1 | 0 | 21 |
| 100 | 3 | 6 | 20 |
| 148 | 2 | 5 | 19 |
| 46 | 1 | 3 | 16 |
| 313 | 2 | 4 | 9 |
| 95 | 3 | 5 | 14 |
| 76 | 2 | 3 | 23 |
| 188 | 1 | 4 | 22 |
| 1254 | 2 | 6 | 19 |

| Years | Mon. | Wks. | Days | Hours | Min. | Sec. |
|---|---|---|---|---|---|---|
| 404 | 12 | 3 | 6 | 23 | 59 | 59 |
| 167 | 6 | 2 | 3 | 20 | 48 | 28 |
| 76 | 7 | 2 | 5 | 22 | 33 | 45 |
| 328 | 4 | 1 | 4 | 18 | 45 | 20 |
| 169 | 8 | 0 | 1 | 12 | 50 | 35 |
| 86 | 9 | 3 | 2 | 15 | 39 | 40 |
| 70 | 5 | 2 | 6 | 19 | 35 | 28 |
| 53 | 10 | 1 | 4 | 21 | 50 | 56 |
| 420 | 12 | 3 | 5 | 18 | 45 | 59 |
| 94 | 11 | 1 | 6 | 15 | 33 | 25 |
| 1873 | 12 | 0 | 0 | 22 | 23 | 35 |

*Queſtions for Practice.*

1. In the year 1766, the value of goods exported to Sweden was L.59678; to Ruſſia, L.109900; to Spain, L.1078731; to Portugal, L.667101; to Holland, L.1602924; and to Germany, L. 1811268. Required the amount?

2. From the creation to the flood were 1656 years; from that to the call of Abraham, 426;—to the departure of the Iſraelites from Egypt, 430;—to the building of Solomon's temple, 487;—to the Babyloniſh captivity, 415;—to the Chriſtian æra, 590;—to the year 1800. Required the time from the creation?

3. A computation was made of the population of Glaſgow and ſuburbs in 1791, and ſtated as follows:—Number of perſons within the city, 41777; in the Calton, 6695; Anderſton, 3895; Grahamſton, 896; Gorbals, 6448; Cowcaddens, &c. 1257; and Camlachie, 977. How many do they amount to?

¶ 4. Received from A, L.150 : 14 : 6; from B, four times as much; from C, L.238 : 17 : 10; from D, L.185 : 19 : 8; from E, as much as from A and B; from F, as much as from C and D; and from G as much as from all the reſt. What was the whole ſum?

5. A jeweller purchaſed 2 pieces of gold plate weighing 11dwt. 20 grains; 3 gold rings, each 2 dwt. 18 grains; 5 gold bracelets, each 6 dwt. 22 grs.; and 2 gold ear-rings, each 1 dwt. 10 grs. What is the weight of the whole?

6. An apothecary made a compoſition of five ingredients, the firſt of which weighed 2 ounces 4 drams, 2 ſcruples, 10 grains;

2d, 5 ℥. 2 ʒ. 1 ℈. 18 grs.; 3d, 1 ℔. 2 ʒ. 15 grs.; 4th, 7 ℥. 6 ʒ. 2 ℈.; 5th, 6 ℥. 1 ʒ. 1 ℈. 19 grs. How much do they weigh together?

7. A grocer bought 7 cheſts tea, N°. 1, weighs 3 qrs. 24 lb.; N°. 2, 1 cwt. 12 lb.; N°. 3, 1 cwt. 1 qr. 8 lb.; N°. 4, 2 qrs. 26 lb; N°. 5, 3 qrs. 21 lb.; N°. 6, 1 cwt. 17 lb.; N°. 7, 3 qrs. 25 lb. What is the weight of them altogether?

8. A plumber has 6 barrs lead, weighing, 1ſt, 7 ſtones 10 lb. Dutch; 2d, 5 ſtones 6 lb. 11 oz.; 3d, 4 ſtones 8 lb. 15 oz.; 4th, 3 ſtones 13 lb. 10 oz.; 5th, 2 ſtones 12 lb. 12 oz.; 6th, 1 ſtone 9 lb. Required the weight of the whole?

9. A Woollen-draper, on taking an inventory of his ſhop, finds he has 56 yards 1 qr. 3 nails of blue cloth; 49 yds. 3 qrs. 2 nails of black; 84 yds. 3 nails of brown; 65 yds. 3 qrs. of ſcarlet; 120 yds. 1 nail of mixt. Required the amount?

10. A wine-dealer has in his cellar as follows: 3 pipes 48 gallons of port; 1 hhd. 60 gal. 5 pints, claret; 62 gallons 7 pints, Madeira; 2 pipes 1 hhd. ſherry; 45 gallons 3 pints, cyder; 2 tun 36 gallons, Liſbon. Required the amount of his ſtock?

11. A brewer ſent to A, 2 butts 15 gallons ale; to B, 3 quarts 1 pint; to C, 3 butts 10 gal.; to D, 5 butts 2 qrts. 1 chopin. On examining his cellar he found there were 10 butts 1 pint 1 chopin ſtill remaining. How much had he on hand before theſe ſales were made?

12. A miniſter's glebe being meaſured off; 2 acres 1 rood 5 falls were taken from A's ground; 3 acres 2 roods 16 ells, from B's; 1 acre 32 falls 24 ells, from C's; 3 acres 30 falls 18 ells, from D's; and 2 acres 3 roods 35 ells, from E's. How much does the glebe contain?

13. From London to Bigilſwade is 46 miles 2 fur. 18 poles $3\frac{1}{2}$ yds.; from that to Stilton, 30 miles 19 poles;—to Newark, 50 miles 1 fur. 17 poles 4 yds.;—to Doncaſter, 37 miles 1 fur. 7 poles 2 yds.;—to York, 37 miles 12 poles, 1 yd. What is the diſtance betwixt London and York?

¶ 14. A gentleman paid for ground to build on, L.583 : 10 : 6; to the maſon, L.1268 : 18 : 10; the carpenter, L.1521 : 17 : 9; the ſlater, L.198 : 14 : 3; the ſmith, L.65 : 18 : 6; the glazier, L.295 : 4 : 10; the painter, L 76 : 10 : 11; the upholſterer, L.220 : 16 : 8; and other petty charges to the amount of L. 19 : 14 11. Required the nett coſt of the houſe?

15. Imported from Liſbon, cotton-wool to the amount of L 3675 : 18 : 6; paid for agent's commiſſion, L.90 : 16 : 8; for freight, L.98 : 17 : $9\frac{1}{2}$; inſurance, L.126 : 13 : 4; duty, L.115 19 : $10\frac{3}{4}$; ſhipping charges, L.101 : 14 : $7\frac{1}{2}$. I intend to keep it for ſome time, and to pay for cellar-rent, L. 15 : 10. How muſt I ſell it, to gain L.365 : 15 upon the whole?

16. A corn-merchant purchaſed from John Gibb, 145 bolls barley for L.152 : 17 : 6; and 199¾ bolls wheat for L.321 : 8 : 4; from Adam Ker, 132¼ bolls oats for L.118 : 7 : 9; and 100 bolls peaſe for L.75 : 10; from Nicol Bell, 87¾ bolls wheat for L.142 11 : 8; 223½ bolls barley for L.236 : 5 : 6; and 195 bolls peaſe for L.137 : 15; from James Mill, 118¼ bolls oats for L.105 : 13 : 4; and 150 bolls peaſe for L.112 : 10 : 6; from Peter Reid, 176¾ bolls barley for L.189 : 7 : 6; 260 bolls wheat for L.330 : 16 : 10; and 430 bolls oats for L.384 : 12. Required his ſtock on hand of each kind, the total amount, and the coſt of the whole?

## CHAP. III.

## SUBTRACTION.

SUBTRACTION is the method of taking a leſs number from a greater, in order to find their difference.

The greater number is called the *minuend*, and the leſs the *ſubtrahend*.

### Sect. I. SIMPLE SUBTRACTION.

*RULE 1ſt. Place the leſs number under the greater, units under units, tens under tens, &c.*

*2d. Begin at the right hand, and ſubtract each figure of the lower line, from the figure above it, and ſet down the remainder.*

*3d. When the upper figure is leſs than the under one, borrow ten, to the upper figure, and add one for it, to the next figure in the lower line, and proceed as formerly.*

*Methods of Proof.*

Add the remainder to the leſs number, and if the ſum be equal to the greater, the work is right. This is done in example 2d.

Or, ſubtract the remainder from the minuend, and if the difference be equal to the ſubtrahend, the operation is right. This is done in example 3d.

EXAMPLES.

| | 1. | 2. | 3. | 4. |
|---|---|---|---|---|
| From | 9789676 | 7567598 | 89543107 | 25024315 |
| Take | 6467545 | 5431542 | 30468298 | 23987654 |
| | 3322131 | 2136056 | 59074809 | 1036661 |
| | | 7567598 | 30468298 | |

| | 5. | 6. |
|---|---|---|
| Minuend | 47075219656 | 10000000000 |
| Subtrahend | 24578100824 | 9876543210 |

*Note.* We add 10 to the minuend, when the correſpondent figure in the ſubtrahend is greater, becauſe numbers increaſe in a ten-fold proportion. If, therefore, before ſubtraction, the *minuend* be increaſed by 10, and after ſubtraction the *ſubtrahend* be increaſed by 1, the ſtate of neither will be altered; for 1 in the one place is equal to 10 in the other, and there will be the ſame difference between 19 and 28 as between 9 and 18.

## Sect. II. Compound Subtraction.

*Rule 1ſt. Place like denominations under like, and ſubtract the lower number of each from the upper.*

2d. *When the under number of any name, exceeds that in the upper, add as many to the upper, as will make one of the next higher.*

3d. *Set down the remainder, and for what you borrowed add 1 to the next denomination in the lower line.*

The method of proof is the ſame as in Simple Subtraction.

In example 2d. 10 pence cannot be ſubtracted from 6 pence; but 6 and 12 (the pence in a ſhilling) make 18, from which take 10, there remains 8.

But it is eaſier to ſubtract the number in the lower line, from the value of the next higher denomination; thus, 10 from 6 we cannot, but take 10 from 12, there remains 2; to which 6 being added, makes 8.

### EXAMPLES.

### *Sterling Money.*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| From | L. | 65 | 18 | 10 | Lent | L. | 1564 | 14 | 6 | Bor. L. | 675 | 10 | 10¼ |
| Take | | 44 | 14 | 7 | Rec. | | 360 | 6 | 10 | Paid | 385 | 19 | 11¼ |
| Rem. | L. | 21 | 4 | 3 | Due | L. | 1204 | 7 | 8 | Unpd. L. | 289 | 10 | 10¼ |
| From | L. | 367 | 16 | 8 | | L. | 7865 | 17 | 10¼ | | L. 9654 | 19 | 9¼ |
| Take | | 195 | 17 | 6 | | | 3978 | 14 | 3¼ | | 2765 | 17 | 3¼ |

*Troy Weight.*

| | lb. | oz. | dwt. | gr. |
|---|---|---|---|---|
| From | 75 | 10 | 16 | 6 |
| Take | 47 | 11 | 18 | 20 |
| Rem. | 27 | 10 | 17 | 10 |

*Dutch Weight.*

| | Stones | lb. | oz. | dr. | gr. |
|---|---|---|---|---|---|
| | 375 | 15 | 14 | 13 | 35 |
| | 298 | 10 | 15 | 13 | 30 |

*Apothecaries Weight.*

| | lb | ℥ | ʒ | ℈ | gr. |
|---|---|---|---|---|---|
| From | 93 | 6 | 6 | 0 | 9 |
| Take | 84 | 7 | 5 | 2 | 12 |
| Rem. | 8 | 11 | 0 | 0 | 17 |

| | lb | ℥ | ʒ | ℈ | gr. |
|---|---|---|---|---|---|
| | 186 | 11 | 7 | 2 | 19 |
| | 144 | 9 | 6 | 0 | 15 |

*Avoirdupois, Greater and Leſſer.*

| | Tons | cwt. | qr. | lb. |
|---|---|---|---|---|
| From | 56 | 17 | 0 | 27 |
| Take | 38 | 16 | 3 | 10 |
| Rem. | 18 | 0 | 1 | 17 |

| | Stones | lb. | oz. | dr. |
|---|---|---|---|---|
| | 87 | 6 | 10 | 14 |
| | 56 | 10 | 12 | 15 |

*Wool Weight.*

| | Laſts | Sac. | Wey | Tod | St. | lb. |
|---|---|---|---|---|---|---|
| From | 87 | 10 | 0 | $5\frac{1}{4}$ | 1 | 13 |
| Take | 38 | 11 | 1 | 6 | 0 | 10 |
| Rem. | 48 | 10 | 0 | $5\frac{3}{4}$ | 1 | 3 |

| | Laſts | Sac. | Wey | Tod | St. | lb. |
|---|---|---|---|---|---|---|
| | 99 | 11 | 1 | $4\frac{1}{2}$ | 0 | 12 |
| | 80 | 10 | 1 | 0 | 0 | 13 |

*Cloth Meaſure.*

| | Yds. | qr. | nails | in. |
|---|---|---|---|---|
| From | 94 | 3 | 2 | $1\frac{1}{2}$ |
| Take | 78 | 1 | 3 | 2 |
| Rem. | 16 | 1 | 2 | $1\frac{3}{4}$ |

| | Flem. ells. | qr. | nails. |
|---|---|---|---|
| | 576 | 2 | 2 |
| | 378 | 0 | 3 |
| | 198 | 1 | 3 |

| | E. ells. | qr. | nails |
|---|---|---|---|
| | 645 | 4 | 3 |
| | 474 | 3 | 1 |
| | 171 | 1 | 2 |

## *Wine Meaſure.*

| | Tuns | Pipes | Hhds. | Gal. | Pints | Tuns | Pipes | Hhds. | Gals. | Pints. |
|---|---|---|---|---|---|---|---|---|---|---|
| From | 84 | 0 | 1 | 60 | 6 | 785 | 1 | 1 | 48 | 4 |
| Take | 46 | 1 | 0 | 62 | 7 | 365 | 1 | 1 | 56 | 6 |
| Rem. | 37 | 1 | 0 | 60 | 7 | | | | | |

## *Engliſh Ale Meaſure.*

| | Hhds. | Gal. | Qr. | Pints | Hhds. | bar. | kild. | fir. | gal. |
|---|---|---|---|---|---|---|---|---|---|
| From | 89 | 36 | 3 | 1 | 875 | 1 | 0 | 0 | 6 |
| Take | 69 | 47 | 2 | 0 | 746 | $1\frac{1}{4}$ | 1 | 1 | $7\frac{1}{2}$ |
| Rem. | 19 | 40 | 1 | 1 | | | | | |

## *Scotch Ale Meaſure.*

| | Butts | Gal. | Pints | Gills | Butts | Gal. | Pint | Mut. | Gills |
|---|---|---|---|---|---|---|---|---|---|
| From | 523 | 14 | 7 | 6 | 784 | 14 | 7 | 3 | 2 |
| Take | 346 | 15 | 6 | 7 | 395 | 10 | 6 | 0 | 3 |
| Rem. | 176 | 15 | 0 | 15 | | | | | |

## *Engliſh Land Meaſure.*

| | Acres | Roods | Poles | Yards | Acres | Roods | Poles | Yds. | Feet |
|---|---|---|---|---|---|---|---|---|---|
| From | 765 | 1 | 25 | 30 | 896 | 2 | 36 | 29 | 7 |
| Take | 675 | 2 | 30 | $25\frac{1}{4}$ | 507 | 3 | 30 | 30 | 8 |
| Rem. | 89 | 2 | 35 | $4\frac{3}{4}$ | | | | | |

## *Scotch Land Meaſure.*

| | Acres | Roods | Falls | Ells | Acres | Roods | Falls | Ells | Feet |
|---|---|---|---|---|---|---|---|---|---|
| From | 314 | 1 | 25 | 30 | 989 | 2 | 30 | 27 | 4 |
| Take | 105 | 3 | 39 | 25 | 376 | 3 | 24 | 35 | 8 |
| Rem. | 208 | 1 | 26 | 5 | | | | | |

## *Time.*

| | Mon. | Wks. | Dys. | Hrs. | Years | Mo. | Wks. | Dys. | Hrs. | Min. | Sec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| From | 67 | 3 | 6 | 20 | 565 | 6 | 2 | 6 | 23 | 49 | 58 |
| Take | 19 | 2 | 5 | 23 | 407 | 12 | 3 | 3 | 20 | 58 | 49 |
| Rem. | 48 | 1 | 0 | 21 | | | | | | | |

*Form of an Houſehold Accompt.*

| 1800. | Received. | | | Paid. | | |
|---|---|---|---|---|---|---|
| Jan$^{y}$. 1. Received, . . . . . £. | 5 | | | | | |
| 3. Paid for Coals, . . . . . | | | | | 14 | 6 |
| 7. —— for 2 ſtone of Butter, | | | | 1 | 15 | |
| —— for Butcher-meat, . | | | | | 10 | 3 |
| 10. —— for a ſet of China, | | | | 1 | 1 | |
| 12. Received, . . . . . | 4 | 10 | | | | |
| Paid for 3 gals. Whiſky, | | | | 1 | 5 | 6 |
| 15. —— for 2 lb. Tea, . . . | | | | | 14 | |
| 16. —— for Sugar, . . . . . | | | | | 13 | 8 |
| 17. —— for 1 ſtone Candles, | | | | | 12 | 4 |
| 21. —— for 3 Cheeſes, . . . | | | | 1 | 13 | 9 |
| 29. —— for 3 lb. Soap. . . . | | | | | 2 | 3 |
| | 9 | 10 | 0 | 9 | 2 | 3 |
| | 9 | 2 | 3 | | | |
| 30. On hand, . . . . . | 0 | 7 | 9 | | | |

*Note.* Although it be a general practice to place the leſs number under the greater, and that order ſhould be adopted when there is no reaſon for doing otherwiſe; yet the greater number may be placed under the leſs, with equal propriety, and the learner ought to acquire the habit of finding the difference either way, with the ſame readineſs, as this laſt method is ſometimes more convenient in balancing accompts, &c.

## *Queſtions for Practice.*

1. The Univerſity of Glaſgow was founded in the year 1454. How old is it this preſent year 1800?

2. How long is it from the diſcovery of the Gun-powder-plot, on the 5th of November, 1605, to the 29th January, 1800.

3. The average value of goods exported annually from Britain, amounts to L.14950000; and the value of goods imported, to L.11833000. How much does the exportation exceed the importation?

4. A maid went to the market with a five pound note, and laid out, on beef, 9s. 8½d.; on mutton, 3s. 9d.; on lamb, 12s. 6d.; on greens, &c. 1s. 1½d.; on eggs, 1s. 10d.; on butter, 7s. 4d.; and on cheeſe, 15s. 8d. How much money ought ſhe to bring home?

5. A druggiſt has 3 lb. 10 grains of rhubarb, he diſpoſes of 6 pieces as follows: the 1ſt. 3 ounces 6 drams 2 ſcruples 18 grains; 2d. 4 ℥. 7 ʒ. 2 ℈.;—3d. 5 ℥. 2 ʒ. 12 grs.;—4th. 6 ℥. 5 ʒ. 1 ℈.; 5th. 3 ℥. 2 ʒ. 15 grs.;—6th. 2 ℥. 43. 2 ℈. 9 grs. How much is ſtill remaining?

6. A mercer had a piece of ſilk, conſiſting of 105 yards: he ſold to one perſon, 15 yds. 3 nails; to another, 20 yds. 2 qrs. 2 inches; to another, 12 yds. 3 nails; to another, 3 qrs. 2 nails 1½ inch; and to another, 5 yds. 1 qr. 1 inch. How much ſhould remain?

7. A brewer has in his cellars 45 butts 2 barrels 10 gallons beer; he receives orders for 10 butts 18 gals. from A;—12 butts 1 bar. 25 gals. from B;—5 butts 2 bar. 32 gals. from C;—6 butts 1 bar. 20 gals. from D. How much will remain after ſerving theſe cuſtomers?

8. A corn-merchant had on hand 66 chalders 2 bolls corn: he bought from one perſon 28 chal. 13 bolls 3 firlots;—from another 32 chal. 15 bolls 2 fir. 3 pecks. He ſold at one time 23 chal. 10 bolls 2 pecks;—at another 16 chal. 8 bolls 1 peck;—at another 35 chal. 3 fir. 3 pecks 2 lippies;—at another 13 chal. 2 firlots: after which there remained in his granary only 38 chal. 2 bolls 1 peck. What is the deficiency?

9. A goldſmith purchaſed from A, 10 lb. 10 oz. 18 dwt. 15 grs. of ſilver; from B, 13 lb. 10 dwt. 18 grs; from C, 19 lb. 9 oz.; from D, 18 lb. 8 oz. 20 grs. He ſold to one perſon 8 lb. 7 oz. 18 dwt.; to another, twice as much; to a third, 7 lb. 9 dwt. 10 grs.; to a fourth 10 lb. 11 dwt.; to a fifth 6 lb. 8 oz.; and to a ſixth 9 lb. 4 oz. 21 grs. Required how much is unſold?

10. Bought 11 hogſheads of tobacco N°. 1. weighed groſs 5 cwt. 2 qrs. 19 lb. tare, 2 qrs. 10 lb.; N°. 2.—7. 0. 24. tare, 2 qrs. 14 lb.; N° 3.—6. 3. 17. tare, 2 qrs. 17 lb.; N°. 4.—3. 0. 27. tare, 1 qr. 14 lb.; N°. 5.—5. 2. 20. tare, 2 qrs. 3 lb.; N°. 6. and 7. each 4. 0. 17. tare of each, 2 qrs. 10 lb.; N°. 8.—5. 1. 18. tare, 2 qrs. 18 lb.; N°. 9.—7. 0. 11. tare, 3 qrs. 12 lb.; N°. 10.—6. 3. 27. tare, 2 qrs. 26 lb.; and N°. 11.—5. 0. 25. tare, 2 qrs. 17 lb. Required the amount of the groſs, tare, and nett weights?

11. A garden contains 4 acres 2 roods; the graſs walks meaſure 3 roods 20 poles; the gravel walks, 35 poles 28 yards; and the flower borders, 1 acre 2 roods 15 yards. How much remains for kitchen garden?

12. A gentleman's rent is paid by 8 tenants: A, pays L. 250: 10: 6; B, L.265: 13: 4; C, L.287: 10: 6; D, L.220: 16: 8; E, L.276: 19: 10; F. L.490: 18: 3; G, L.365: 11: 10; H, L.289: 7: 6. His expences are, for houſe-keeping, L.985: 10: 8; tradeſmens' accompts, L.560: 14: 6; merchants' accompts, L.438: 13: 9; carriage and horſes, L.250: 12: 7; garden-expences, L.67: 14: 8; duties, L.98: 10: 6; improvement of land, L.325: 6: 6; private expences, L.98: 10: 6. Required what money he ſaves, or what debt he contracts?

13. A Jokey went to the races, where he loſt by betting againſt A, L.52: 10; won from B, L.47: 5; loſt by C, L.31: 10; won from D, L.94: 10: 6; won from E, L.85: 13: 4; recovered an old debt of L.276: 6: 8; and paid a bill of L.320: 10. His expences came to L.17: 14: 9; and, reckoning his caſh, when he came home, found L.482: 10: 6, ſtill in his pocket. How much money had he when he ſet out?

14. A wine-merchant imported at one time 15 tuns 1 hhd. 40 gallons of claret; and 10 tuns 3 hhds. 45 gals. port; at another time, 12 tuns 2 hhds. 18 gals. Malaga; and 14 tuns 1 hhd. 47 gals. Canary; at another, 8 tuns 2 hhds. 35 gals. ſherry; and 10 tuns 3 hhds. Madeira. He ſold to A, 5 tuns 48 gals. port, and 2 tuns 1 hhd. claret; to B, 1 pipe ſherry, and 6 tuns Canary; to C, 4 tuns port, and 6 tuns 3 hhds. Malaga; to D, 4 tuns ſherry, and 3 pipes of Madeira. Required how much he imported in whole, how much he ſold, and how much of each kind he has on hand?

15. A merchant ſent his clerk to a market, where he bought woollen-cloth amounting to L.785: 19: 6½; corduroys—L.325: 15: 8; linen—L.158: 17: 6; hats—L.284: 13: 4; ſtockings—L.186: 11: 10; he received accompts—L.898: 14: 6½, got payment of a bill of L.150: 14: 3; and paid debts—L.576: 10: 5; his accompt of petty charges came to L.2: 7: 6; and he brought back to his maſter, L.48: 13. How much money did he receive before he ſet out?

16. A merchant in balancing his books, finds he has in ready money, L.756: 14: 6¾; goods, viz. wine valued at L.1639: 17: 8¼; rum—L.1865: 13: 6½; gin—L.1087: 10: 10½; brandy—L.985: 14: 10½; tea—L.578: 15: 6½; ſugar—L.558: 17: 8½; a ſhip worth L.2575: 19: 7; houſes valued—L.7832: 12: 6; due him in open accompts—L.2705: 14: 7½; and in bills—L.949: 19: 11. He owes A, L.1560: 19: 10¼;—B, L.1987: 9: 8½;—C, L.2199: 11: 7;—D, L.1490: 10: 10;—E, L.834: 12: 6;—F, L.786: 15: 11;—G, L.1000;—H, L.586: 6: 8½;—I, L.657: 16: 7;—K, L.365: 10: 6;—the Thiſtle Bank, L.380;—the Royal Bank, L.690. Required his nett ſtock?

17. A merchant became bankrupt; and owed John Ker, per accompt, L.1256 : 14 : 3; Robert Webb, per do. L.1365 : 10 : 6; James Gordon & Co. per do. L 198 : 17 : 10; William Orr, per do. L.646 : 18 : 9; his acceptance to David Young, for L.450 : 13 : 4; to Henry Burns, L.165 : 10 : 10; to Smith & Baird, L.525 : 15 : 6; to Colin Dunlop, L.636 : 6 : 9; to George Boyd, L.120 : 10. His effects were as follows: accompts due him by James Inglis, L.365 : 10 : 6; by John Glen, L.35 : 16 : 8; by Wilſon & Gray, L.150 : 5 : 10; by Patrick Aird, L 98 : 13 : 3; bills on Thomas King for L.108 : 17 : 6; on Ramſay & Connell, for L.75 : 11 : 5; on Hugh Potter, for L.135 : 5 : 8; a houſe value, L.780; a ſhip worth, L.985 : 16 : 8; houſehold furniture, value at L.292 : 6 : 8; goods to the value of L 236 : 9 : 4; and other articles amounting to L.47 : 2 : 6. Required a ſtate of his affairs, allowing L.50 : 10, for the expence of ſettling them?

18. James I. King of Scotland, acceded to the throne of England on the 4th March, 1603, and died 27th March, 1625; his ſon Charles I. was beheaded 30th January, 1649; his ſon Charles II. was reſtored 29th May, 1660, and died 6th February, 1685; his brother, James II. abdicated the crown 23d December, 1688, and William III. Prince of Orange, was elected King, who died 8th March, 1702. Queen Anne, daughter of James II. died 1ſt Auguſt, 1714. George I. Elector of Hanover, ſucceeded, and died 11th June, 1727; his ſon, George II. died 25th October, 1760, and was ſucceeded by George III. his preſent Majeſty. Required the length of each reign, and the whole time from James I. to the 1ſt January, 1800?

## CHAP. IV.

## MULTIPLICATION.

MULTIPLICATION is a compendious method of performing a manifold addition of the ſame number.

The number to be multiplied, is called the *multiplicand*, that given to multiply by, the *multiplier*, and the amount, the *product*.

*Note.* Both the multiplier, and multiplicand, are often called Terms or Factors.

*The Table.*

| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 times | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| 3 times | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 |
| 4 times | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 40 | 44 | 48 |
| 5 times | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| 6 times | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 7 times | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 70 | 77 | 84 |
| 8 times | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 80 | 88 | 96 |
| 9 times | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 90 | 99 | 108 |
| 10 times | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 |
| 11 times | 22 | 33 | 44 | 55 | 66 | 77 | 88 | 99 | 110 | 121 | 132 |
| 12 times | 24 | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 |

*Explanation.*

To find the product of any two figures, look for the one, on the left, and for the other, in the top line, then in the angle of meeting, is their product: thus, 2 times 2 is 4, 2 times 3 is 6, 2 times 4 is 8: and 3 times 2 is 6, 3 times 3 is 9, and so on. If both factors are 12, or under, the product is found by the table at once.

When the multiplier does not exceed 12, begin at the unit place of the multiplicand, and multiply the figures in their order, carrying the tens to the next higher place, as in Addition.

*Example.*

58421 multiplied by 3, or 58421 added 3 times.

| | |
|---|---|
| 3 | 58421 |
| | 58421 |
| | 58421 |
| 175263 | 175263 |

Thus, the operation is nothing else than addition of the same numbers, several times repeated.

*RULE. If the multiplier conſiſt of ſeveral figures, multiply the multiplicand by each figure of the ſame multiplier; and place the right-hand figure of each product, under the figure by which you are multiplying. Add the products.*

*Proof.* Make the former multiplier the multiplicand.

EXAMPLE.

To multiply 1238 by 342.

| 1238 | or | 342 | or | 1238 |
|---|---|---|---|---|
| 342 | | 1238 | | 342 |
| 2476 | | 2736 | | 3714 |
| 4952 | | 1026 | | 4952 |
| 3714 | | 4104 | | 2476 |
| 423396 | | 423396 | | 423396 |

Make either of the factors the multiplier, as is moſt convenient, for 1238 multiplied by 342, gives the ſame product, as 342 multiplied by 1238; as in method 2d.

It anſwers equally well, in all caſes, to begin the work at the higheſt place of the multiplier; as in method 3d.

To make the rule appear as plain as poſſible, we ſhall work the above example, by multiplying ſeparately by each figure.

| 1238 | 1238 | 1238 | | | |
|---|---|---|---|---|---|
| 2 | 40 | 300 | 2476 | = | 2 times |
| | | | 49520 | = | 40 times |
| 2476 | 49520 | 371400 | 371400 | = | 300 times |
| | | | 423396 | | 342 times |

## *Examples for Practice.*

Multiply 987654321 by 4, 5, 6, 7, 8, 9, 10, 11, 12.

| | | | | |
|---|---|---|---|---|
| 1. | 932714 by | 52 | = | 48501128 |
| 2. | 640809 by | 93 | = | 59595237 |
| 3. | 573216 by | 264 | = | 151329024 |
| 4. | 864567 by | 603 | = | 521333901 |
| 5. | 720843 by | 867 | = | 624970881 |
| 6. | 654825 by | 932 | = | 610296900 |
| 7. | 3785946 by | 659847 | = | 2498145110262 |
| 8. | 873456789 by | 6046 | = | 5280919746294 |
| 9. | 932101573 by | 8905 | = | 830036450756 5 |
| 10. | 6247386495 by | 27356 | = | 170903504957220 |

When the multiplier is the product of two, or more factors, neither of which exceeds 12; multiply ſucceſſively by theſe factors.

If there be cyphers annexed to either, or both factors, multiply by the ſignificant figures, and annex the cyphers to the product.

Ex. 1. Multiply 538546 by 72.

| 9 | | 8 |
|---|---|---|
| 4846914 | or | 12 |
| 38775312 | | 38775312 |

Ex. 2. 375400 by 10800.

| 6 | 12 |
|---|---|
| 3231276 | 45048 |
| 12 | 9 |
| 38775312 | 4054320000 |

## *Examples for Practice.*

| | | | | |
|---|---|---|---|---|
| 1. | 65428 | by 45 | = | 2944260 |
| 2. | 568976 | by 81 | = | 46087056 |
| 3. | 456789 | by 96 | = | 43851744 |
| 4. | 238463 | by 112 | = | 26707856 |
| 5. | 1516145 | by 126 | = | 191034270 |
| 6. | 5410101 | by 132 | = | 714133332 |

In multiplying by 10, annex a cypher to the multiplicand, and in multiplying by 100, annex two cyphers; and ſo on.

In multiplying by 9, which is one leſs than 10, we may annex a cypher, and ſubtract the multiplicand from itſelf thus increaſed. And in multiplying by 99, 999, or any number of nines, annex as many cyphers as there are nines, and ſubtract the multiplicand from it.

1ſt. 42165 by 9.

Thus 421650
42165
379485

2d. 38642 by 999.

38642000
38642
38603358

3d. 93647 by 1000.

93647000

| | | | | |
|---|---|---|---|---|
| 1. | 569278 | by 9 | = | 5123502 |
| 2. | 874106 | by 99 | = | 86536494 |
| 3. | 694345 | by 995 | = | 690873275 |
| 4. | 75981353 | by 9998 | = | 759661567294 |

In example 1ſt, we multiply by 9 and 8, or by 6 and 12, which gives a product equal to 72 times the multiplicand.

In example 2d, we multiply by 12 and 9, the component parts of 108, and annex the four cyphers, which are on the right of the two factors.

In example 3d, to multiply by 1000, we have only to annex three cyphers.

## Sect. II. Compound Multiplication.

*Rule 1ſt. Write the multiplier under the loweſt name of the multiplicand: multiply its ſeveral denominations in ſucceſſion, beginning at the loweſt, and carry according to the value of the next higher place.*

EXAMPLES.

| | | | | Cwt. | qr. | lb. | | lb. | oz. | dwt. | grs. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| L. | 11 | 17 | 6½ | 15 | 3 | 10 | | 9 | 10 | 5 | 12 |
| | | | 7 | | | 9 | | | | | 12 |
| | 83 | 2 | 9½ | 142 | 2 | 6 | | 118 | 3 | 6 | 0 |

*Rule 2d. When the multiplier is a compoſite number, whoſe component parts do not exceed 12, multiply ſucceſſively by theſe parts.*

EXAMPLES.

What is the value of 72 bags cotton, at L. 11 : 14 : 8 per bag?

| L. | 11 | 14 | 8 | L. | 11 | 14 | 8×2 | L. | 11 | 14 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 8 | | | | 7 | | | | 12 |
| | 93 | 17 | 4 | | 82 | 2 | 8 | | 140 | 16 | 0 |
| | | | 9 | | | | 10 | | | | 6 |
| | 844 | 16 | 0 | | 821 | 6 | 8 | L. | 844 | 16 | 0 |
| | | | | | 13 | 9 | 4 | | | | |
| | | | | L. | 844 | 16 | 0 | | | | |

What is the weight of 125 ingots of ſilver, each weighing 12lb. 10 oz. 18 dwt. 21 gr.

| 12 | 10 | 18 | 21 | 12 | 10 | 18 | 21×5 |
|---|---|---|---|---|---|---|---|
| | | | 5 | | | | 10 |
| 64 | 6 | 14 | 9 | 129 | 1 | 8 | 18 |
| | | | 5 | | | | 12 |
| 322 | 9 | 11 | 21 | 1549 | 5 | 5 | 0 |
| | | | 5 | 64 | 6 | 14 | 9 |
| 1613 | 11 | 19 | 9 | 1613 | 11 | 19 | 9 |

*RULE 3d. When the multiplier is not a compoſite number, multiply as often by ten as there are figures in the multiplier except one; then multiply the laſt product by the left hand figure, and the product of the ten above that by the next figure, and ſo on, till you have multiplied by all the figures, placing each product below that of the left hand figure; then add them, and the ſum is the product.*

EXAMPLE.

What is the value of 120 bags cotton wool, containing nett 4567 lbs. at 3s. 5½d. ?

| | | | | | |
|---|---|---|---|---|---|
| L.0 | 3 | 5½ × 7 | | | |
| | | 10 | | | |
| 1 | 14 | 7 × 6 | | | |
| | | 10 | | | |
| 17 | 5 | 10 × 5 | | | |
| | | 10 | | | |
| 172 | 18 | 4 | | | |
| | | 4 | | | |
| 691 | 13 | 4 | ditto of 10 × 10 × 10 × 4 | = | 4000 lbs. |
| 86 | 9 | 2 | ditto of 10 × 10 × 5 | = | 500 |
| 10 | 7 | 6 | ditto of 10 × 6 | = | 60 |
| 1 | 4 | 2½ | ditto of 1 × 7 | = | 7 |
| Anſ. L.789 | 14 | 2½ | | | 4567 lbs. |

*Note.* When, to find the anſwer it is neceſſary to multiply only once, or twice, the foregoing rules may be uſed with advantage; but when the multiplier is large, (as in the laſt example,) or not a compoſite number; the learner will find in the *Rules for Practice*, methods for ſolving ſuch queſtions, much more expeditious, and leſs burdenſome to the memory.

*RULE 4th. When higher denominations are to be reduced to lower, multiply the given number continually by its equivalent in the next inferior denomination, adding the number belonging to it, (if there be any,) and the laſt product will be the anſwer.*

EXAMPLES.

1ſt. Reduce L.568 : 18 : $6\frac{3}{4}$ to farthings.

| | | |
|---|---|---|
| | 20 | |
| Shillings | 11378 | (add 18) |
| | 12 | |
| Pence | 136542 | (add 6) |
| | 4 | |
| Farthings | 546171 | (add 3) |

2d. In 68 cwt. 1 qr. 16 lb. how many lbs.?

| | | |
|---|---|---|
| | 68 | 1 16 |
| | 4 | |
| | 273 | (add 1) |
| | 28 | |
| | 2190 | |
| | 547 | |
| lb. | 7660 | (add 16) |

or by addition.

| | |
|---|---|
| 68 | |
| 68 | |
| 68 | |
| 6828 = 1 qr. | |
| 16 lb. | |
| lb. | 7660 |

*Note.* When the value, weight, or meaſure, of one article is given, to find the value, weight, or meaſure, of any number of articles; multiply by the number of articles. And to find the amount of wages, proviſions, or any thing that is increaſed by length of time; multiply by the time.

## *Queſtions for Practice.*

1. How often does a clock ſtrike in 365 days?

2. How many grains of wheat will fill 1260 buſhels? A pint contains 7680 grains.

3. How often, during a life of 80 years, does the pulſe beat, at the rate of 70 times per minute?

4. How many letters are there in a book conſiſting of 18 volumes; each volume, of 625 pages; each page, of 47 lines; and each line, of 42 letters?

5. How many perſons inhabit an iſland which contains 56 counties; each county, 37 pariſhes; each pariſh, 99 families; and each family, at an average, 7 perſons?

6. How many herrings are there in a ſhoal 3 miles long, 2 broad, and 340 yards deep, allowing 132 herrings to the ſolid foot?

7. How many frogs were there in Egypt, when they covered the land, reckoning Egypt to contain 5119876o Engliſh acres, and each ſquare foot, 24 frogs?

8. How many grains of wheat are in the produce of a field 460 yards long, divided into 325 drills, allowing 5 plants to each foot in length, to each plant 12 ſtalks, and to each ſtalk, 19 grains?

9. How many ſalmon will be caught by 14 boats employed for 30 days, drawing 15 times a day, and taking, at an average, 13 fiſhes each draught?

10. The ſhadow of a cloud was obſerved to move 7 yards in a ſecond of time: what was its hourly motion?

11. The weight of a cod fiſh was 13 lb. Troy, its roan, 2 lb. 3 oz. and each grain contained 250 ſeeds: allowing each ſeed to produce a fiſh of the ſame weight, what is their number, and the whole weight?

12. If an acre of graſs feed 3 cows, and each cow yield 16 pints of milk per day, how many pints of milk may, at that rate, be expected in 14 days, from a meadow of 32 acres?

13. The ſilk mill at Derby, throws off 73726 yards ſilk, every time the water-wheel turns round, being 3 times in a minute, for 10 hours every lawful day: how much at this rate will be produced in a year?

¶14. What is the value of 65 yards ſhalloon, at 11½d. per yard?

15. ——— Of 48 lb. green tea, at 8s. 10d. per lb.?

16. ——— Of 56 gallons brandy, at 9s. 8½d. per gallon?

17. ——— Of 125 yards broad cloth, at 13s. 4d. per yard?

18. ——— Of 110 ſtones wool, at 18s. 7½d. per ſtone?

19. ——— Of 54 bolls wheat, at 27s. 9d. per boll?

20. ——— Of 72 lb. ſilver, at L.2 : 18 : 4 per lb.?

21. ——— Of 66 cwt. ſugar, at L.4 : 17 : 6 per cwt.?

22. ——— Of 49 bales cotton, at L.18 : 15 : 9 per bale?

23. ——— Of 88 puncheons rum, at L.25 : 13 : 4 each?

24. ——— Of 112 acres land, at L.32 : 16 : 8 per acre?

25. ——— Of 48 weeks wages, at 14s. 6d. per week?

26. ——— Of 35 ſet of china, at 2 guineas each?

27. ——— Of 42 ſcore of lambs, at L.8 : 17 : 6 per ſcore?

28. ——— Of 81 pipes wine, at L.22 : 11 : 8 per pipe?

¶ 29. What is the weight of 480 guineas, each 5 dwt. 9 grains?

30. ——— Of 12 parcels medicine, each 10 oz. 7 dr. 2 ſcr.?

31. ——— Of 65 hhds. tobacco, at 13 cwt. 3 qrs. 25 lb. nett?

32. ——— Of 28 packs wool, each 3 la. 7 ſac. 1 w. 6 todds?

¶ 33. How much cloth in 37 pieces, each 25 yds. 2 qrs. 3 nails?

34. ——— Wine in 150 dozen, each 2 gallons, 6 pints?

35. ——— Ale in 56 caſks, each 27 gals. 3 mutchkins?

36. ——— Flour in 33 bags, each 2 buſhels, 2 pecks?

37. ——— Corn in 13 ſhips, each 95 ch. 12 bolls, 2 pecks?

38. ——— Land in 18 farms, each 63 acres, 2 r. 28 poles?

¶ 39. How far will a man travel in 21 days, at the rate of 32 miles, 6 furlongs, 25 poles, per day?

40. If the intereſt of the national debt amount to 14s. 2d. each ſecond of time, how much does it amount to in a year?

41. How much corn in 27 ſacks, each containing 5 buſhels, 2 pecks, 10 pints?

42. Required the weight of a log 15 feet long, 2 broad, and $1\frac{1}{2}$ thick, at 27 lb. per ſolid foot; the price of it at 1s. 9d. per foot, and the expence of carrying it, at a farthing per lb.?

43. A farmer ſold laſt ſeaſon 120 bolls of wheat, at 52s. 6d.; 99 bolls of barley, at 45s.; 250 bolls of oats, at 32s. 6d. and 1000 ſtones hay, at 1s $3\frac{1}{2}$d. per ſtone: required the amount of his ſales?

¶ 44. How many farthings in L.547 : 15 : $7\frac{1}{2}$?

45. How many merks Scots in L.1266 ſterling?

46. How many grains in 15 lb. 11 oz. 21 grains?

47. How many ſcruples in 28 lb. 4 oz. 6 drs.?

48. How many ounces in 36 tons 17 cwt. 3 qrs. 10 lb.?

49. How many drops in 430 ſtones 12 lb. 8 oz. Dutch?

50. How many lbs. wool in 75 laſts 11 ſt. 1 wey $4\frac{1}{2}$ todds?

51. How many half nails in 165 yards 2 qrs. 2 nails?

52. How many Flemiſh ells of cloth in 567 French ells?

53. How many gallons in 45 pipes 1 hhd. 38 gallons?

54. How many pints ale in 86 butts 7 gallons 4 pints?

55. How many pints in 68 quarters 6 buſhels 2 pints?

56. How many lippies in 19 chalders 3 firlots 1 peck?

57. How many gills in 54 gallons 3 quarts 1 choppin?

58. How many inches in 21 miles 30 poles 4 yards?

59. How many ells in 35 Scots acres 3 roods 15 falls?

60. How many yards in 54 Engliſh acres 25 poles?

61. How many barley corns in 681 miles 2 fur. 7 poles?

62. How many minutes have elapſed in 32 years 6 months?

63. How many ſeconds in 365 days 5 h. 48 min. 49 ſec.?

¶ 64. What is the value of 15 chalders of grain, at 18s. 6d. per boll, and what is their weight at 81b. 10 oz. avoirdupois per peck?

65. What is the groſs, tare, and nett weight of 38 hhds. ſugar, each weighing 15 cwt. 2 grs. 14 lb. groſs; tare, 3 qrs. 8 lb.

66. Required the capital of a trading company conſiſting of 180 ſhares, each ſhare L.1388 : 12 : $2\frac{3}{4}$?

67. A perſon ſpends 13s. 4d. at an average, per day, and lays up at the year's end L.60: what is his yearly income?

68. A perſon left to his widow, L.900; to each of his three ſons, L751 : 6 : 8; to each of his ſix daughters, L.500 : 3 : 4; to each of ten poor relations, L.30; and in charities, L.145. He had been 18 years in trade, and had cleared, at an average, L.300 per annum Required his capital at the time he began buſineſs?

69. A gentleman gave his daughter a ſcrutoire in which there were 16 drawers, each having 9 diviſions, and in each diviſion there were a joannes, a moidore, a guinea, a merk, a half guinea, a crown, and half crown, a ſhilling and ſixpence. Required the lady's fortune?

## Sect. III. Cross Multiplication.

Duodecimal, or Croſs Multiplication, is uſed by artificers in computing the contents of their work.

*Rule.* 1*ſt*, *Multiply each denomination of the given length by the feet in breadth, and place each product under the denomination of the multiplicand, from which it ariſes; carry by* 12.

2*d*, *In like manner multiply by the inches, and ſet each product a place farther towards the right.*

3*d*, *Multiply by the parts, and ſet each product another place towards the right. The ſum of the products is the anſwer.*

*Note.* A foot is divided into 12 inches, an inch into 12 parts or lines, a part into 12 ſeconds, a ſecond into 12 thirds, and ſo on.

| | |
|---|---|
| Feet mult. by feet give feet, | Inches mult. by inches give parts, |
| Feet mult. by inch. give inches, | Inches mult. by parts give ſeconds, |
| Feet mult. by parts give parts, | Parts mult. by parts give thirds. |

### *Example.*

Multiply 5 feet 6 inches, by 4 feet 3 inches.

| Feet | Inches. | |
|---|---|---|
| 5 | 6* | |
| 4 | 3 | |
| 22 | 0 | |
| 1 | 4 | 6 |
| 23 | 4 | 6 |

*Note.* Here 4 f. × 6 *in.* = 24 *in.* we ſet down 0, and carry 2; then ſay 4 f. × 5 f. + 2 f. = 22 f. which we ſet down: we then multiply by the 3 inches thus; 3 *in.* × 6 *in.* = 18 parts, we ſet down 6 parts and carry 1 *in.* then 3 *in.* × 5 f. + 1 = 16 *in.* or 1 foot 4 inches, which we ſet down, and then add the products.

* Or we may work by reduction; thus,

| Feet | In. | In. |
|---|---|---|
| 5 | 6 | = 66 |
| 4 | 3 | = 51 |
| | | 66 |
| | | 330 |
| | | 3366 |
| | | 23 4 6 |

144 { 12 / 12 }

Here we reduce both factors to inches, and multiply them into each other; the product is ſquare inches or parts, which we divide by 144, and it gives the anſwer in feet.

Or by aliquot parts; thus,

| Feet | In. | |
|---|---|---|
| 5 | 6 | |
| | | 4¼ feet |
| 22 | 0 | |
| 1 | 4 | 6 |
| 23 | 4 | 6 |

Here we multiply by feet, and take the fourth part of the multiplicand, becauſe 3 in. = ¼ of a foot.

*Superficial* meaſure reſpects the ſurface of any thing, and is found by multiplying the length by the breadth, as above.

*Solid* meaſure is computed by multiplying the length by the breadth, and the product by the thickneſs.

### EXAMPLE.

How many ſolid feet are in a wall 37 feet 10 inches long, 7 feet 4 inches high, and 2 feet 6 inches thick?

| | Feet | Inch. | |
|---|---|---|---|
| Length | 37 | 10 | |
| Height | 7 | 4 | |
| | 264 | 10 | |
| | 12 | 7 | 4 |
| Surface | 277 | 5 | 4 |
| Breadth | 2 | 6 | |
| | 544 | 10 | 8 |
| | 138 | 8 | 8 |
| Solid Contents | 693 | 7 | 8 |

## *Queſtions for Practice.*

| | F. | In. | Pts. | | F. | In. | Pts. | | Feet. | In. | Pts. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Mult. | 7 | 6 | | by | 3 | 8 | | = | 27 | 6 | | | |
| 2. —— | 8 | 11 | | by | 7 | 10 | | = | 69 | 10 | 2 | | |
| 3. —— | 9 | 7 | | by | 3 | 6 | | = | 33 | 6 | 6 | | |
| 4. —— | 46 | 9 | | by | 9 | 11 | | = | 463 | 7 | 3 | | |
| 5. —— | 71 | 7 | | by | 24 | 3 | | = | 1735 | 10 | 9 | | |
| 6. —— | 36 | 3 | 10 | by | 1 | 7 | 3 | = | 58 | 3 | 1 | 9″ | 6‴ |
| 7. —— | 44 | 1 | 2 | by | 5 | 6 | 7 | = | 244 | 8 | 1 | 8 | 2 |
| 8. —— | 13 | 6 | 3 | by | 0 | 8 | 6 | = | 9 | 6 | 11 | 1 | 6 |

¶ 9. How many ſquare feet are there in an area, 179 feet long, and 140 broad?

10. How many ſuperficial feet are in the floor of a room, 37 feet 5 inches long, and 24 feet 7 inches wide?

11. What is the meaſure of a road, 840 yards 2 feet long, and 15 feet 9 inches broad?

12. What is the meaſure of a pavement, containing 350 ſtones, each 19 inches by 13?

¶ 13. How many ſolid feet are in a block of marble, 4 feet 9 inches long, 3 feet 3 inches broad, and $2\frac{1}{2}$ feet thick?

14. Required the ſolid contents of a wall, 48 feet 6 inches long, 15 feet 3 inches high, and 2 feet 10 inches thick?

15. What is the meaſure of a carpet, 7 yards long, and $5\frac{1}{4}$ broad; and what is the value of it, at 4s. 9d. per yard?

16. How many ſolid feet are in a log of mahogany, 15 feet long, 3 feet 5 inches broad, and 2 feet 3 inches thick?

17. What is the value of an area, 61 yards 2 feet long, and 42 yards 1 foot broad, at 8s. 6d. per ſquare yard?

18. A court, 95 feet 2 inches long, and 84 feet 3 inches broad, is to be paved with ſtones 12 inches ſquare; how many will it require?

19. The length of a floor of a weaver's factory, is 87 feet 3 inches 4 lines, and its breadth 18 feet 1 inch 7 lines; what is the ſuperficial content of it?

20. A piece of ground to be dug for the foundation of a houſe, is 63 feet long, 36 feet broad, and 5 feet deep; how many ſolid yards muſt be dug, and what will be the expence, at 1s. $4\frac{1}{2}$d. per ſolid yard?

---

# CHAP. V.

## DIVISION.

DIVISION teaches to find how often one number is contained in another. It is a compendious method of Subtraction, and the quotient ſhows the number of ſubtractions.

The number to be divided is called the *dividend*; that given to divide by, the *diviſor*; the number of times the diviſor is contained in the dividend, the *quotient*, and what is over is called the *remainder*.

### Sect. I. SIMPLE DIVISION.

As Multiplication ſupplies the place of many additions, ſo does diviſion that of many ſubtractions. The multiplier ſhows how many additions would be neceſſary to produce the number, and the quotient, how many ſubtractions would be neceſſary to exhauſt it.

If it be required, for example, to divide 20 by 6, or to find how often 6 is contained in 20; the anſwer is 3 times, and 2 over.

The operation, performed by ſubtraction, conſiſts in taking the diviſor from the dividend, and then from the remainder, as often as it can be done; the number of ſubtractions is the anſwer: as in the margin.

20
6 1ſt ſubtraction.
14
6 2d ſubtraction.
8
6 3d ſubtraction.
2 remainder.

As operations, performed in this manner, prove extremely tedious; they are always performed according to the following rule.

☞ A dividual is ſuch a part of the dividend as is neither leſs than the diviſor, nor equal to its product by ten. In example 1ſt, the dividuals are 61, 147, 195.

*RULE. 1ſt, Find how often the diviſor is contained in the firſt dividual, and place the number in the quotient.*

*2d, By this number multiply the diviſor, and ſubtract the product from the dividual.*

*3d, For the next dividual, annex to the remainder the next figure of the dividend, and proceed as before.*

*Note* 1. To prevent miſtakes, mark with a dot each figure of the dividend as it is brought down.

2. If the product exceed the dividual from which it is to be ſubtracted, the quotient figure is too great; and if the remainder be equal to, or exceed the diviſor, the quotient figure is too ſmall.

3. If, to form a dividual, it be neceſſary to annex to the remainder more figures of the dividend than one, for each figure thus annexed, place a cypher in the quotient. This is done in example 2d.

EXAMPLES.

(1.)

23)6175(268
46··
147
138
195
184
11

6175
Rem. 11
268)6164(23 diviſor,
method I.

46 firſt product
138 ſecond prod.
184 third prod.
11 remainder.
6175 dividend.
method II.

(2.)

7812)3516178075 2(450096
31248·····
39137
39060
77807
70308
74995
70308
46872
46872

*Proof.* Subtract the remainder (if any) from the dividend, divide the dividend thus leſſened, by the quotient, and the anſwer will be the former diviſor.

Or, add the remainder, and all the products of the quotient figures, as they ſtand in the operation; and the ſum will be equal to the dividend.

The reaſon of the rule will appear, by reſolving the dividend and quotient into their ſeparate values, and comparing the ſteps: thus, in example 1ſt.

Diviſor) 6175 dividend.

| | | |
|---|---|---|
| 1ſt part of the dividend is | 6100 | |
| 23 × 200 = | 4600 | 200 1ſt part of the quotient. |
| 1ſt remainder, | 1500 | |
| add | 70 | |
| 2d part of the dividend | 1570 | |
| 23 × 60 = | 1380 | 60 2d part of the quotient. |
| 2d remainder, | 190 | |
| add | 5 | |
| 3d part of the dividend, | 195 | |
| 23 × 8 = | 184 | 8 3d part of the quotient. |
| Laſt remainder, | 11 | 268 ſum, or whole quotient. |

When there is a remainder, the operation is completed by annexing to the queſtion the remainder placed above a line, and the diviſor below it. Thus, in the above example, $268\frac{11}{23}$ is the anſwer.

As it is ſometimes difficult, when the diviſor conſiſts of ſeveral figures, to diſcover how often the diviſor is contained in the ſeveral dividuals; we may try how often the firſt figure of the diviſor may be had in the firſt figure, or firſt and ſecond figures of the dividend; that number diminiſhed by one, or two, is generally the quotient figure.

When the diviſor is 12, or under, we readily find the higheſt product, by the multiplication table; therefore the ſubtractions may be performed mentally, and only the quotient put down.

EXAMPLE.

| (1.) | (2.) | (3.) |
|---|---|---|
| 5)856450 | 8)19749925 | 11)74061988 |
| 171290 quotient. | $2468740\frac{5}{8}$ | 6732908 |

In example 1ſt we proceed thus; the fives in 8, once and 3 over; we then put down 1, and ſuppoſing 3 prefixed to the next figure, we ſay the fives in 35, ſeven times and 0 over; having put down ſeven, we ſay the fives in 6, once and 1 over; then having put down 1, the fives in 14, twice and 4 over; having put down 2, we ſay the fives in 45, nine times and 0 over; and having put 9, we add a 0 for the 0 in the dividend.

## *Examples for Practice.*

Divide 340608572 by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.

| | | | | | |
|---|---|---|---|---|---|
| 1. | 477826524 | by | 59 | = | $8098754\frac{38}{59}$ |
| 2. | 748694435 | by | 98 | = | $7639739\frac{13}{98}$ |
| 3. | 218860142 | by | 271 | = | 807602 |
| 4. | 3405657254 | by | 345 | = | $9871470\frac{104}{345}$ |
| 5. | 73997918756 | by | 809 | = | $91468379\frac{145}{809}$ |
| 6. | 726584095504 | by | 1564 | = | 464567836 |
| 7. | 29062914930 | by | 6005 | = | 4839786 |
| 8. | 1709035049573 68 | by | 27356 | = | $6247386495\frac{148}{27356}$ |
| 9. | 151380561320 95 | by | 19799 | = | 764586905 |
| 10. | 5059458180348 0 | by | 7146087 | = | 7080040 |

When the diviſor is a compoſite number, inſtead of dividing by it at once, we may divide by the component parts ſucceſſively.

*Note.* If the firſt diviſor have a remainder, ſet it down; then multiply the remainder from each of the following diviſions, ſucceſſively by each of the diviſors preceding its own diviſor, and the ſum of them is the true remainder.

Ex. 1ſt,

48 {
4) 536807 by 48 — 3 1ſt rem.
12) 134201—3 — 20 = 2d rem. 5 × 4
11183—5 — 23 true remainder
}

Ex. 2d.

168 {
12) 4536837 by 168 — 9 1ſt rem.
7) 378069—9 — 72 = 2d rem. 6 × 12
2) 54009—6 — 84 = 3d rem. 1 × 7 × 12
27004—1 — 165 true remainder.
}

1. 105420 by 49 = $2151\frac{21}{49}$.
2. 6786453 by 63 = $107721\frac{30}{63}$ or $\frac{10}{21}$.
3. 17890245 by 81 = $220867\frac{18}{81}$ or $\frac{2}{9}$.
4. 32109865 by 99 = $324342\frac{7}{99}$.
5. 78436539 by 108 = $726264\frac{27}{108}$ or $\frac{1}{4}$.
6. 8076345929 by 125 = $64610767\frac{54}{125}$

When there are cyphers on the right of the diviſor, cut them off, and cut off alſo the ſame number of figures on the right of the dividend; annex theſe figures to the remainder.

To divide by 10, 100, and ſo on, cut off as many figures on the right of the dividend, as there are cyphers in the diviſor; the figures on the left are the quotient, and thoſe on the right, the remainder.

Example 1ſt.

261|00)97966|35(375
783 ··
1966
1827
1396
1305
9135

Example 2d.

12)463705,719 by 12,000
$38642\frac{1719}{12000}$

3d. 3596,47 by 100 = $3596\frac{47}{100}$

4th, 8978,500 by 1000 = $8978\frac{500}{1000}$ or $\frac{1}{2}$

## *Examples for Practice.*

1. 7435169 by 800 = $9293\frac{769}{800}$
2. 747786600 by 9900 = 75534
3. 8567539200 by 7200 = 1189936
4. 1683800000 by 26800 = $62828\frac{96}{208}$ or $\frac{24}{67}$

When there is a fraction in the diviſor, multiply both diviſor and dividend by the under-figure of the fraction, adding the upper-figure to the product of the diviſor; then divide the products. As in examples firſt and ſecond.

*Note.* When the multiplier contains a fraction, firſt, multiply the whole number; then multiply by the upper-figure, and divide by the under-figure, and add the quotient to the former product, as in example 3d.

Ex. 1ſt, $5\frac{1}{2}$ ) 965467 ( 2
2
11) 1930934
175539 $\frac{5}{11}$

Ex. 2d, $36\frac{5}{7}$ ) 95681 ( 7
7
257) 669767 (2606
514 · · ·

Ex. 3d, 41263 × $11\frac{7}{8}$
453893
$36105\frac{1}{8}$
489998 $\frac{1}{8}$ Anſ.

41263 × 7 upper-figure,
8) 288841
$36105\frac{1}{8}$

1557
1542
1567
1542
15

## *Examples for Practice.*

1. 674105 ÷ $8\frac{2}{3}$ = $77781\frac{9}{26}$
2. 1861546 ÷ $25\frac{3}{8}$ = $73361\frac{85}{203}$
3. 56279 × $10\frac{1}{5}$ = $574045\frac{4}{5}$
4. 73541 × $18\frac{11}{12}$ = $1391150\frac{7}{12}$

*Note.* Multiplication and Diviſion, being in their nature and tendency directly oppoſite, one proves the other. To prove multiplication, divide the product by either factor, and the quotient will be the other factor. And, to prove diviſion, multiply the diviſor by the quotient, add the remainder, if there be any, and the amount will make up the dividend.

Beſides the methods of proof already given for multiplication and diviſion, there is one more expeditious, though indeed leſs deciſive; which is that of caſting out the nines.

To prove multiplication. Caſt the nines out of both factors, and multiply the remainders together; what remains after caſting the nines out of their product, will be equal to what remains, after caſting the nines out of the total product.

To prove diviſion. Caſt the nines out of the diviſor and quotient, and multiply the remainders together; what remains, after caſting the nines out of their products, and adding the remainder, if any, will be equal what remains, after caſting the nines out of the dividend.

BIBLIOTHECA BODLEIANA

## Sect. II. Compound Division.

*Rule 1ſt. Begin at the higheſt denomination, and proceed as in Simple Diviſion.*

*2d, Reduce the remainder to the next lower denomination, and add the number belonging to it.*

*3d, Divide this ſum in the ſame manner, and ſo on to the loweſt.*

### EXAMPLES.

(1.)

Divide L. 1346 : 14 : 10½ by 38.

38)1346 : 14 : 10½ (L. 35 : 8 : 9¾

114

206
190

16
20

334
304

30
12

370
342

28
4

114
114

(3.)

9)L. 685 : 17 : 8¼

L. 76 : 4 : 2¼

(4.)

What coſt 8½ yds. at L. : 15 : 7

8½

6 : 4 : 8
7 : 9½

L. 6 : 12 : 5 Anſ.

(2.)

Divide 138 cwt. 2qr. 27lb. by 41.

41)138 2 7 (3c. 1qr. 15lb.

123

15
4

62
41

21
28

175
44

615
41

205
205

If the diviſor be 12 or under, we may work mentally, as in example 3d.

To multiply by ½, divide the multiplicand by 2; thus in example 4th, we take the ½ of 15s. 7d. for the price of ½ yard.

If the diviſor be a compoſite number, we may divide ſucceſſively by the component parts.

## *Examples for Practice.*

| | | |
|---|---|---|
| 1. | L. 650 : 14 : 6 by 12. | Anſ. L.54 : 4 : 6½. |
| 2. | 3076 : 14 : 4½ by 35. | —— 87 : 18 : 1½. |
| 3. | 6523 : 18 : 3 by 87. | —— 74 : 19 : 9. |
| 4. | 1109 cwt. 3 qrs. 20 lb. by 164. | —— 6 cwt. 3 qr. 2 lb. |
| 5. | 322 ft. 6 lb. 2 oz. Dutch by 42. | —— 7 ft. 10 lb. 13 oz. |
| 6. | 2050 yds. 1 foot 6 inches by 54. | —— 37 yds. 2 feet 11 in. |
| 7. | 1094 acres 2 r. 20 poles by 63. | —— 17 acres 1 r. 20 poles. |

*Rule 2d. When the diviſor is of different denominations, reduce both diviſor and dividend to the loweſt denomination mentioned in either, and proceed as in Simple Diviſion.*

(1.)

Divide L.229 : 16 : 9 by L.8 : 10 : 3

8 : 10 : 3)229 : 16 : 9(

20 20

170 4596

12 12

2043 ) 55161(27 times the diviſor is contained in the dividend.

4086·

14301·

14301

Or, we might reduce the diviſor and dividend only to 3 pences; as each of them conſiſts of an even number.

(2.)

Divide 277 cwt. 1 qr. 26 lb.

cwt. qr. lb.

by 3 1 15)277 . 1 . 26

4 4

13 1109

28 28

109 8878

27 2220·

379 )31078(82 quote.

3032·

758

758

## *Examples for Practice.*

| | | |
|---|---|---|
| 1. | L.210 : 7 : 6 by L.4 : 2 : 6. | Quote 51. |
| 2. | L.197 : 10 : 0 by L.5 : 18. | —— 25. |
| 3. | 162 acres 36 poles by 5 ac. 3 r. 7 p. | —— 28. |
| 4. | 975 m. 3 f. 24 p. by 17 m. 3 f. 14 p. | —— 56. |

*Rule 3d. When lower denominations are to be reduced to higher, divide ſucceſſively by its equivalent in the next higher denomination, and the laſt quotient will be the anſwer.*

This rule is the reverſe of rule 4th in Multiplication.

EXAMPLES.

(1.)

Reduce 546171 farthings to pounds, ſhillings and pence.

4)546171

12)136542¾ pence

20) 11378 : 6 ſhillings

L.568 : 18 : 6¾

(2.)

Reduce 7660 lbs. to cwts.

28 { 4)7660 / 7)1915

4) 273 16 lb.

68 cwt. 1 qr. 16 lb.

*Note.* To find the value, weight or meaſure of one article, when the value &c. of a number is given, divide by the number of articles. And to find the number of articles, divide the value, weight or meaſure of the whole by that of one, after both are reduced to the loweſt denomination mentioned in either.

To find the work, wages, &c. per day, month or year, divide by the days, months, or years; or to find the time, divide the whole by the amount of the daily, monthly, or yearly allowance.

## *Queſtions for Practice.*

1. How many caſks will contain 4704 bottles, at 3½ dozen to each caſk?

2. How many pages are there in a book containing 1087780 letters, and each page 1985?

3. How many dozen quart bottles will be required to contain a pipe of wine?

4. How many hens would be required to conſume a peck (273000 grains) of barley in 2 minutes, allowing each hen a grain per ſecond?

5. How many bottles, 7 Scotch gills each, will be ſufficient to hold 13 caſks brandy, each containing 30 pints?

6. How much land, each acre yielding 8 qrs. of wheat, would be neceſſary to produce 35000000 buſhels? The annual crop in England.

7. How many reapers will cut the ſame down in 14 days, 4 reaping an acre per day?

8. How many perſons will it require to ſhear the annual wool-fleeces of England in 16 days, which are ſaid to amount to 12 millions, reckoning 50 to each per day?

9. A ſpring of water affording 6 gallons per minute, ſupplies 3600 families; how much water may each family have per day?

10. The planet Mercury revolves 148 times round the ſun, in 35 years 249 days; required the period of one revolution?

11. A General commanded an army of 12500 men, which he increaſed one-fourth by recruiting, afterwards loſt $\frac{1}{8}$ by diſeaſe, and $\frac{2}{7}$ of the remainder fell in battle; how many ſtill remain?

¶ 12. If 3 cwt. tea coſt L.75 : 12, what will 1 lb. coſt?

13. If 42 yards linen coſt L.7 : 10 : 6, what will one coſt?

14. If 97½ yards muſlin coſt L.20 : 14 : 4½, what will one coſt?

15. If 37 oz. ſilver coſt L.10 : 1 : 2½, what will one coſt?

16. If 65 bales cotton coſt L.2440 : 4 : 2, what will one coſt?

¶ 17. If 480 guineas weigh 10 lb. 9 oz. what is the weight of one?

18. If 12 parcels weigh 10 lb. 11 ℥ 43, what is the wt. of one?

19. If 65 hhds. weigh 908 c. 1qr. 1 lb., what is the wt. of one?

20. If 28 packs weigh 102 la. 6 ſac. 1 w. 5½ t., what is the weight of one?

21. If 37 pieces contain 950 yards 1 qr. 3 n., what is the length of one?

22. If 150 dozen wine contain 7 hhds. 34 gals. 4 pints, how much will one contain?

23. If 56 caſks ale contain 94 butts 13 gals. 2 pints, how much does one contain?

24. If 33 bags flour contain 11 qrs. 2 b. 3 p., how much does one contain?

25. If 13 ſhips contain 1244 ch. 13 b. 2 f. 2 p. corn, how much does one contain?

26. If 18 farms contain 1143 acres 16 p. 20 yds., how much does one contain?

¶ 27. What is the length of a road, which, being 27½ feet broad, contains an Engliſh acre?

28. How much ground in a road of the ſame breadth, and a mile in length?

29. How many deals 12 feet long and 9 inches broad, will be required for a floor 8 yards by 6?

30. How many ſhillings, each weighing 3 dwt. 21 grs., may be coined from a piece of ſilver 23 lb. 3 oz.?

31. A labourer ſaves 7½d per day; how long muſt he work to be able to pay a debt of L10.?

32. If the revenues of Glaſgow Infirmary amount to L.1848, how many patients may it maintain at L.9 : 12 : 6 each?

33. If 24 Scotch acres yield 184 bolls of grain, what is the produce of each acre, and how much land will be required to yield a boll?

34. The ſquare contents of a room is 241 feet 8 inches, and its breadth 14½ feet; required its length;

35. A log of wood weighs 25 cwt. 3 qrs.; allowing each ſolid foot to weigh 42 lb., what is the ſolid meaſure of the whole?

36. If a cow for 256 days yield 9 pints milk per day, and if 12 pints afford 1 lb. of butter; how many lb. will be obtained, and what will be the value at 1s. 3d. per lb?

37. A mercer ſold 75 yards ſilk at 30s. per yard., and allowed a twentieth part for ready mony; how much caſh did he receive?

38. If an acre produce $4\frac{1}{2}$ qrs. wheat, and each peck give 20lb. bread; how much land will ſupply 4800 families with bread for a year, each family uſing 12 lb. per day?

39. How much land will ſupply the inhabitants of Glaſgow for the ſame time, eſtimating their number at 65000, and allowing each perſon $1\frac{1}{4}$ lb. per day?

40. The time between obſerving the fire of a cannon and hearing the report was half a minute; required the diſtance, when ſound travels 1142 feet in a ſecond?

41. How long is the interval between ſeeing the fire, and hearing the report of a gun, diſcharged at the diſtance of 7 miles 6 furlongs 64 yards?

¶ 42. How many pounds Sterling in 4532769 farthings?

43. How many pounds Sterling in 24182 merks Scots?

44. How many lb. Troy in 1834020 grains?

45. How many lb. Apothecaries in 16356 ſcruples?

46. How many tons Avoirdupois in 6611040 ounces?

47. How many ſtones Dutch in 441120 drops?

48. How many laſts wool in 133945 lb.

49. How many yards cloth in 10596 half nails?

50. How many ells French in 2268 ells Flemiſh?

51. How many pipes wine in 11562 gallons?

52. How many butts ale in 16602 pints?

53. How many quarters grain in 17601 pints?

54. How many chalders corn in 39016 lippies?

55. How many gallons milk in 10524 gills?

56. How many miles in 2004966 inches?

57. How many Scotch acres in 412920 ells?

58. How many Engliſh acres in 187635 yards?

59. How many miles in 65408760 barley-corns?

60. How many days in 15423050 ſeconds?

61. How many years in 8409600 minutes?

¶ 62. Bought at a ſale a quantity of cloth for L.78 : 8 : 3, at the rate of 15s. $4\frac{1}{2}$d. per yard; required the number of yards?

63. A Gentleman, whoſe income is L.309 : 13 : 4, ſaves L.50 per annum; how much at an average does he ſpend per day?

64. Bought 5 bales cotton containing nett 1450 lb. for L.271 : 17 : 6; at what muſt it be ſold per lb. to gain L.36 : 5?

65. Twenty-eight perſons joined in purchaſing a lottery ticket of 15 guineas, which turned out a prize of L.20,000; required each perſon's ſhare, and how much each contributed?

66. The capital of a trading company is L.500,000, conſiſting of 150 ſhares; how much ſhould B, who holds $19\frac{1}{2}$ ſhares, draw?

67. Divide L.7600 : 13 : 4 among 8 men, and 3 women; and let the ſhare of each woman be $\frac{1}{4}$ leſs, than that of each man?

68. Divide L.7464 : 17 : 7 among 3 men, A, B and C; give B L.84 : 10 : 8 more than A, and C, L.95 : 18 : 6 more than B?

69. Divide an eſtate, value L.17800 : 16 : 9, among a family of 11 children, 4 ſons and 7 daughters; giving the eldeſt ſon $\frac{1}{3}$ more than each of his brothers, and each of the daughters $\frac{1}{2}$ leſs than each of their younger brothers, and $\frac{1}{9}$ of the whole to their mother for an annuity?

70. Required to divide a prize of L.3375 : 9s., after having allowed to his Majeſty $\frac{1}{6}$ of the whole, among the crew of a privateer, as follows; 10 ſhares to the captain, to his firſt mate 6, and to the ſecond 4, to the ſurgeon 8, to the carpenter 6, and 1 to each of 146 ſailors: how much will each draw?

## Sect. III. Reduction.

Reduction is the application of Multiplication and Diviſion, in reducing money, weights and meaſures, from one denomination to another.

*Rule. By multiplication reduce the given denomination to ſome lower one contained in that required; then, by diviſion, reduce it to the required denomination.*

*Note.* The work may be often ſhortened by adding or ſubtracting a certain part of the given number, as follows:

To reduce guineas to pounds, mult. by 21 and divide by 20; or add $\frac{1}{20}$.
——— Pounds to merks, mult. by 3, and divide by 2; or add $\frac{1}{2}$.
——— Merks to pounds, mult. by 2, and divide by 3; or ſubtract $\frac{1}{3}$.
——— Guineas to moidores, mult. by 21, and divide by 27; or ſubtract $\frac{3}{9}$.
——— Moidores to guineas, mult. by 27, and divide by 21; or add $\frac{3}{7}$.
——— Moidores to pounds, × by 27, and ÷ by 20, or add $\frac{1}{4}$ and $\frac{1}{20}$.
——— Guineas to joannes, × by 21, and ÷ by 27; or to $\frac{1}{2}$ add $\frac{1}{6}$ of that $\frac{1}{2}$.
——— Joannes to guineas, mult. by 36, and divide by 21; or from twice the number take $\frac{1}{7}$ thereof; for 7 half-joannes, are equal to 6 guineas.
——— Joannes to pounds, mult. by 36, and divide by 20; or divide by 5, and mult. by 9; for 5 joannes are equal to L.9: and converſely.

To reduce Joannes to moidores, mult. by 36, and divide by 27; or add $\frac{1}{3}$.
——— Moidores to joannes, mult. by 27, and divide by 36; or ſubtract $\frac{1}{4}$, as four moidores are equal to three joannes.
——— Crowns to guineas, mult. by 5, and divide by 21; or divide by $4\frac{1}{5}$.
——— Half-guineas to piſtoles, mult. by 3, and divide by 5.
——— Piſtoles to half-guineas, mult. by 5, and divide by 3; for 5 half-guineas are equal to three piſtoles.
——— Yards to Engliſh ells, mult. by 4, and divide by 5; or ſubtract $\frac{1}{5}$.
——— Ells Engliſh to yards, mult. by 5, and divide by 4; or add $\frac{1}{4}$.

## EXAMPLES.

1ſt, Reduce L.2322 to guineas.

20

21 { 3)46440 / 7)15480

2211 guin. 9s.

2d. Red. 2211guin. 9s. to L.

21

2220(adding 9s.
4422 or add $\frac{1}{20}$)2211:9s.
110:11

20)46440

L.2322

2322 pounds.

3d, Reduce 810 crowns to dollars of 4s. 6d.

$$\frac{810 \times 10 \text{ ſixpences}}{9 \text{ ſixpences.}} = 900 \text{ dollars}$$

Or, add $\frac{1}{9}$ 810
90

900 as before.

4th, Red. 900 dollars to crowns?

$$\frac{900 \times 9 \text{ ſixpences}}{10 \text{ ſixpences.}} = 810 \text{ crowns}$$

Or, ſubtract $\frac{1}{10}$)900
90

810 as before.

5th, Red. 1072 hhds. to punchs.?

$$\frac{1072 \times 36 \text{ gallons?}}{84 \text{ g.}} = 804 \text{ punch.}$$

Or, ſubtract $\frac{1}{4}$) 1072
268

804 as before.

6th, Red. 804 punch. to hhds.?

$$\frac{801 \times 84 \text{ gal.}}{63 \text{ gal.}} = 1072 \text{ hhds.}$$

Or add $\frac{1}{3}$)804
268

1072 as before.

7th, Red. 1470 drs. Apothecaries to dwts. Troy?

$$\frac{1470 \times 60 \text{ gr.}}{24 \text{ gr.}} = 3675 \text{ dwt.}$$

Or, mult. by 5 and divide by 2.

8th Red. 3675 dwt. Troy to drs. Apothecaries?

$$\frac{3675 \times 24 \text{ grains}}{60 \text{ grains.}} = 1470 \text{ drs.}$$

Or, mult. by 2, and divide by 5.

## *Queſtions for Practice.*

1. How many guineas in 37254 pounds?
2. How many merks in 11952 pounds?
3. How many moidores in 7668 guineas?
4. How many pounds in 7880 moidores?
5. How many pounds in 8220 joannes?
6. How many guineas in 5544 joannes?
7. How many moidores in 4446 joannes?
8. How many crowns in 5095 guineas?
9. How many half guineas in 2238 piſtoles?
10. How many lb. Troy in 4320 lb Avoirdupois?
11. How many lb. Dutch in 3040 lb. Avoirdupois?
12. How many Scotch ells in 71669 yards?
13. How many Engliſh ells in 4320 yards?
14. How many Scotch pints in 1260 Engliſh gallons?
15. How many ale gallons in 1410 wine gallons?

¶ 16. How many pounds in 8870 guineas?

17. How many pounds in 7391 merks?
18. How many guineas in 9546 moidores?
19. How many moidores in 7407 pounds?
20. How many joannes in 9879 pounds?
21. How many joannes in 7698 guineas?
22. How many joannes in 7410 moidores?
23. How many guineas in 8763 crowns?
24. How many piſtoles in 6346 half-guineas?
25. How many lb. Avoirdupois in 3045 lb. Troy?
26. How many lb. Avoirdupois in 2310 lb. Dutch?
27. How many yards in 1350 Scotch ells?
28. How many yards in 3375 Engliſh ells?
29. How many Engliſh gallons in 2425½ Scotch pints?
30. How many wine gallons in 2078½ ale gallons?

¶ 31. How much Sterling will the King of Portugal's revenue amount to, which is ſaid to be 2667000 dollars, each 4s. 6d.?

32. How much will L.392 : 18 Sterling, be worth in Ireland, when the par of an Engliſh ſhilling is 13d.?

33. How many guineas, half-guineas, ſeven-ſhilling-pieces and quarter-guineas, of each an equal number, are there in L.735?

34. King Solomon's annual revenue was 666 talents of gold, each weighing 114lb. 15dwt. Troy; how much Sterling would this amount to, at 3s. 10½d. per dwt.

35. How many Britiſh ſtatute miles are equal to 375 geographical ones, 69½ of the former being equal to 60 of the latter?

36. How long would a perſon take to count 10 millions of money at the rate of L.100 per minute, without intermiſſion?

37. How much money would purchaſe a ſquare mile of land, at as many half-pence as would cover $\frac{1}{8}$ of it, allowing a ſquare inch to every half-penny?

38. How many Engliſh acres in 315 Scotch acres, without regard to the Scotch and Engliſh foot; and alſo making allowance for their difference?

39. How long would a chariot take to go from Edinburgh to London, the diſtance being 320 Engliſh miles, whoſe wheels meaſure 18 feet in circumference, and turn 30 times in a minute?

40. I owe L.576 : 10 : 6, and have given in part 25 joannes, 40 moidores, 70 guineas, 90 crowns, 520 ſixpences; and granted a bill for the balance: required the contents?

# CHAP VI.

## RULE OF PROPORTION.

### Sect. I. Simple Proportion.

Simple Proportion teaches when three numbers are given, to find a fourth, to which the third bears the ſame proportion, as the firſt does to the ſecond. As in this rule three numbers are given, it is often called the Rule of Three; and becauſe of its uſefulneſs, it is often called the Golden Rule.

*Rule.* *1ſt, Write down that term for the ſecond, which is of the ſame name with the number ſought.*

*2d, Conſider whether the anſwer will be greater or leſs than the ſecond term; if greater, of the other terms, place the leſs for the firſt, and the greater for the third.*

*3d, But if the anſwer be leſs, place the greater term for the firſt, and the leſs, for the third.*

*4th, Multiply the ſecond and third terms together, and divide the product by the firſt; the quotient will give the anſwer in the ſame name with that of the middle term* *.

*Note.* The firſt and third terms muſt be of the ſame kind, that is, both muſt be money, weights and meaſures, or the like, of the ſame name; or both ſimple numbers.

* Or we may proceed by the following

Rule. 1ſt, Write down that term, which is of the ſame name with the number ſought.

2d, Place on the right of it, that term which implies the demand, and the remaining term of the ſame name on the left.

3d, Conſider whether the anſwer will be greater or leſs than the middle term; *if greater*, multiply the middle term by the greater number, and divide by the leſs; *but if leſs*, the contrary.

EXAMPLES.

1ſt, If 8 yards of cloth coſt L.5 : 16 : 4; what will 72 coſt?

yds. L. yds.
If 8 : 5 16 4 : : 72
12

69 : 16 : 0
6

8) 418 : 16 : 0

Anſ. L.52 : 7 : 0

Here, becauſe the anſwer is to be in money, the price according to the rule, is put for the middle term: as 72 yds. will coſt more than 8, we place the leſs of the remaining terms for the firſt, and the greater term for the third.

The work may be greatly ſhortened by dividing (when poſſible) the firſt and ſecond, or the firſt and third terms, by any number which leaves no remainder, and uſing the quotients in place of the original numbers: thus in example 1ſt.

8 yds. : L.5 16 4 : : 72 yds.
1 9 9

L.52 : 7 : 0 as before.

Here 8 and 72 are both meaſured by 8, and as the firſt term comes out 1, we have only to multiply the middle term by 9, for the anſwer.

When the terms are of more denominations than one, we may reduce each term to the loweſt name. But this is not always neceſſary. For inſtance, if the firſt and third terms conſiſt of an even number of ſixpences, fourpences, or the like, it is better to reduce them to ſixpences, or fourpences, than to pence.

2d, If L.5 : 16 : 4 purchaſe 8 yards, how many may be bought for L.52 : 7.

L. yds. L.
5 16 4 : 8 : : 52 7
20 20

116 ſh. 1047
3 3 fourpences in a ſhilling.

349 fourpences. 3141
8 yds. ſecond term.

349)25128(72 yds. Anſ.
2443

698
698

When there happens to be a remainder after the diviſion, if the nature of the thing admit of lower denominations, reduce the remainder to the next lower one, and continue the diviſion, as long as there is any remainder. If there had been a remainder in example 2d, (after finding the 72 yards) we would have multiplied it by 4 for quarters, by 4 for nails, &c.

3d. If 42 men do a piece of work in 36 days; in what time will it be done by 56 men?

| Men | | days | | men |
|---|---|---|---|---|
| 56 | : | 36 | : : | 42 |
| 8 | | 3 | | 6 |
| 4 | | | | 3 |
| | | 4)208 | | |
| | | 52 | | |

Anſ. 27 days.

The firſt and third terms are abridged firſt by 7 and then by 2.

Here as the number ſought is days, we place 36 for the middle term; and as 56 men will perform any piece of work in a ſhorter time than 42 men, the anſwer will be leſs than the middle term; therefore we make the greater term [56] the firſt, and the leſs [42] the third.

Every queſtion conſiſts of a ſuppoſition, and demand; in the firſt example the ſuppoſition is, *that* 8 *yards coſt* L.5 : 16 : 4; and the demand, *what will* 72 *coſt*.

When the terms of a queſtion are ſo connected, that while one is increaſed, the other increaſes; or while one is diminiſhed, the other diminiſhes at the ſame time, the queſtion is ſaid to be direct; and in this caſe the diviſor is always to be found in the ſuppoſition. Thus in example 1ſt, the greater the quantity of goods the greater the value; and 8, one of the terms of the ſuppoſition, is the diviſor.

But when the terms are ſo connected, that when one increaſes, the other diminiſhes at the ſame time, the queſtion is ſaid to be inverſe, and the diviſor is here to be found in the demand: thus in example 3d, when the number of men is increaſed, the time requiſite for the work becomes ſhorter; and 27, the term which implies the demand, is the diviſor.

## *Queſtions for Practice.*

1. If 9 gals. of honey coſt L.3 : 15, what is the price of 15 gals?
2. If 50 lb. lead coſt 6s. 3d. what will a fodder, or 19½ cwt. coſt?
3. If 27 yards of lace coſt L.5 : 13 : 4, what will 10 yds coſt?
4. If 2 cwt. 1 qr. of ſugar coſt L.8 : 13 : 3, how much may be purchaſed for L.121 : 5 : 6?
5. If 2lb. 6oz. of ſilver-plate coſt L.10 : 1 : 3, what is the price of 65 lb. 7 oz. 10 dwt.?
6. If 7 acres 3 roods produce 416 bolls 1 firlot, how much will 209 acres 1 rood produce?
7. How many buſhels of oats may be purchaſed for 40 guineas, at 32s. 6d. per quarter?

8. If 650 men conſume 54 barrels of proviſions, how much will 1000 men conſume in the ſame time?

9. If the expence of flooring a room 30 feet by 22, be L26 : 2 : 6; what will be the expence of another 24 feet by 18?

10. If a wedge of gold, which weighs 7 lb. 1 oz. 14 dwt. coſt L.271 : 7 : 8, how much will 1 lb. coſt?

11. If the intereſt of L.100 be L.4 : 15 for a year, what is the intereſt of L.685 for the ſame time?

12. If the freight of a ſhip, for 3 months, be L.87 : 10, what will the freight be, for $8\frac{1}{2}$ months?

13. If 9 men cut down 25 acres of graſs, how many acres will 24 men cut down in the ſame time?

14. If a gentleman's eſtate be valued at L.750 a year, and the land tax aſſeſſed at 2s. $9\frac{1}{2}$d. per L.; what is his nett annual income?

15. If a grocer gain 4d. on the lb. of cinnamon, value 1s. 9d.; how much will he gain on L.100 value?

¶ 16. How much land at a guinea per acre, ſhould be given in exchange for 280 acres at 36s. 9d.?

17. In what time will the intereſt of L 85, be equal to the intereſt of L.30 for 60 days?

18. How many gallons of wine will be contained by a caſk, which contains $57\frac{3}{4}$ gallons of ale?

19. If a 6d. loaf weigh $2\frac{1}{2}$ lb. Avoirdupois, when wheat is ſold at 5s. 6d. per buſhel; what is the price of wheat when the loaf weighs $3\frac{1}{2}$ lb.?

20. A perſon travelling 16 hours a day, performs a journey in 54 days; in what time will he do it, travelling at the rate of 12 hours a day?

21. When wine coſt L.105 per pipe, it was retailed in dozens at 48s. 6d.; at what ſhould the dozen be charged, when wine is at L.95?

22. It was computed that 16 men would build a wall in 60 days; but the proprietor would have it done in 24 days; how many men muſt be employed to finiſh it in that time?

23. If a perſon drink 20 pints of wine when it coſts 8s. a gallon; how much may he drink, without increaſing the expence, when wine is at 10s.?

24. If the 9d. loaf weigh 4 lb. 8 oz. Avoirdupois, when flour is ſold at 65s. 6d. per bag; how much ſhould the loaf weigh, when flour is at 56s.?

25. If 30 horſes be kept for a certain time on hay at $10\frac{1}{2}$d. per ſtone; how many will be maintained at the ſame expence, when hay falls to 6d?

¶ 26. If an ounce of gold be worth 5 guineas, what is the value of 9 grains?

27. If 7 buſhels of oats maintain 8 horſes for 6 weeks; how many horſes will 343 buſhels maintain?

28. If 8 horſes plow 30 acres in 14 days; how many acres may be plowed by 28 horſes?

29. Laſt year a farm produced 560 bolls, which was ſold at 21s. 6d.; this year it produced only 320 bolls; at what price muſt it be ſold, to bring the ſame money?

30. A lb. of ſilver having 18 dwt. of alloy, is coined into 62 ſhillings; what is the price of a lb. of pure ſilver at that rate?

31. If L.100 in 12 months yield L.5 of intereſt, what ſum will yield the ſame in 8 months?

32. A bankrupt who pays his creditors 10s. 6d. per pound, pays in all L.1080; what was his debt?

33. If the intereſt of a certain ſum at 5 per cent. be L.9: 15; how much is it for the ſame time at 4 per cent.?

34. If 1 lb. of gold having 1 ounce of alloy, be coined into $44\frac{1}{2}$ guineas, at what ought 1 lb. of pure gold to be valued?

35. A mercer purchaſed 350 lbs. of ſilk at 38s. 6d. per lb. Troy weight, and ſold it by the lb. Avoirdupois at 52s. 6d.; required his profit or loſs?

36. If 18 acres maintain 14 oxen; how many cows will be maintained on 45 acres, ſuppoſing 3 cows to eat as much as 2 oxen?

37. A corn-merchant bought 4398 buſhels of wheat at 7s. 3d. per buſhel, and ſold it by the Scotch firlot at 30s. per boll; required the gain or loſs?

38. If 12 men, or 15 women reap 35 acres of wheat; how many acres will 8 men and 10 women reap in the ſame time?

39. Bought 280 lb. of indigo, and paid at the rate of 19s. 6d. per lb. Dutch weight; how muſt it be ſold per lb. Avoirdupois, to gain L.27: 16: 8?

40. If 1000 men are beſieged in a garriſon, and have proviſions for 6 months; how many muſt depart, that the proviſion may laſt 3 months longer?

41. If the breadth of a board be 10 inches, how many feet in length muſt it be, to make a door 7 feet in length, and 5 feet in breadth?

42. A garriſon of 3500 men have proviſion for 90 days; how long will the ſame quantity ſerve them, ſuppoſing 500 added to their number?

43. My ſtaff is 3 feet 8 inches in height, and it caſts a ſhadow of 6 feet 10 inches; required the height of an object, which gives a ſhadow of 454 feet 5 inches?

44. If a garriſon's proviſion will laſt 95 days, at the rate of 15 oz. to each man per day, what muſt each man be allowed, that the proviſions may laſt 120 days?

45. A gave B cloth at 12s., worth only 10s. 6d., in exchange for wool, value 18s. 4d. at 21s.; who had the advantage, and how much?

46. What ſhould A value his cloth in barter, when it is worth 15s. 9d., to be equal with B, who rates his ſugar at 2d. per ounce, which is worth only $1\frac{1}{3}$d.?

47. The arms of the beam of a balance, from end to end meaſure $36\frac{1}{2}$ inches, and an Engliſh lb. hung on the one end will balance a lb. Dutch on the other; what is the length of each arm of the beam?

48. Two perſons hired a chaiſe for L.1:15 to go 30 miles, and when they had gone 12 miles, they overtook a traveller who wiſhed for a ſeat; what part of the hire ought he to pay?

## Sect. II. Compound Proportion.

In compound proportion, there are either five terms given to find a ſixth, or ſeven to find an eighth, &c.

Every queſtion in this rule may be anſwered by two, three, or more ſtatings of the ſimple rule, according as it conſiſts of five, ſeven, or more terms; the anſwer of the former ſtating, being always the middle term in the next.

Ex. If 6 horſes plow 15 acres in 12 days; how many acres will 14 horſes plow in 30 days? As this queſtion has 5 terms; it may be reſolved into two ſimple queſtions: thus,

1ſt, If 6 horſes plow 15 acres; how many will 14 horſes plow in the ſame time? Anſ. 35 acres.

2d. If a certain number of horſes plow 35 acres in 12 days; how many will they plow in 30 days? Anſ. 87 acres, 2 roods.

Inſtead of working theſe queſtions ſeparately, it would anſwer the ſame purpoſe, and is generally better, to collect all the terms by which we multiply, into one product, and the terms by which we divide into another, according to the following

*Rule.* *1ſt, Write down that term for the ſecond, which is of the ſame name with the anſwer; as in the ſimple rule.*

*2d, Take any two terms of the ſame name with each other, and ſtate them for the firſt and third terms, as there directed.*

*3d, Proceed in this manner with every remaining pair of like terms, and place them directly under the former.*

*4th, Multiply the product of the third terms by the middle term for a dividend; divide by the product of the firſt terms, and the quotient is the anſwer in the ſame name with that of the middle term.*

The above queſtion according to this rule is ſtated thus,

6 horſes : 15 acres : : 14 horſes
12 days 420 30 days

72 )6300( 420
576 ·(87 acres 2 r.
540
504
36
4
144
144

Here both ſtatings are direct. Firſt, 14 horſes will evidently plow more than 6. Secondly, more work will be done in 30 days, than in 12; we therefore place the greater numbers [14 and 30] for the third terms, and the leſs numbers [6 and 12] for the firſt. We next multiply the third terms together, and their product by [15] the middle term, for a dividend; and we multiply the firſt terms together for a diviſor.

Ex. 2d, If 15 men conſume 39s. worth of bread in 6 days, when wheat is at 24s. per boll; how many will conſume L.6 : 10 worth in 12 days, when wheat falls to 20s.?

39s. : 15 : : 130s. Then $\frac{130 \times 6 \times 24 \times 15}{39 \times 12 \times 20}$ = 30 men.
12 days 6 days Anſ.
20s. 24s.

Here the firſt ſtating is direct, for the larger the ſum laid out on proviſions, the more men will be required to conſume them; but the ſecond and third ſtatings are inverſe; for the longer the time is, fewer men will conſume an equal value of proviſions, and the cheaper the proviſions, more men are neceſſary to conſume the ſame value.

*Note.* The terms here may be alſo abridged, as in the ſimple rule.

## *Queſtions for Practice.*

1. If the intereſt of L.100 for a year be L.4 : 15, what is the intereſt of L.280 for 292 days?
2. If L.18 be the intereſt of L.640 for 9 months, what is the intereſt of L.100 for a year?
3d. If 14 reapers cut down 21 acres of wheat in 6 days, how many reapers will cut down 150 acres in 10 days?
3. If 20 reapers in 5 days cut down 36 acres of corn, in what time will 50 reapers cut down 180 acres?

5. If 75 men reap a field of barley containing 105 acres in a week, how much will 25 men reap in 15 days?

6. If the freight of a ſhip of 150 tons, for 7 months be L.185, what ought to be paid for a ſhip of 150 tons, for 4 months?

7. I lent my friend L.500 for 100 days at 5 per cent., how long ought he to lend me L.800, when intereſt falls to 4 per cent.?

8. If 34 men perform a piece of work in 27 days of 9 hours each; in what time will 27 men do the ſame, when the day is 17 hours long?

9. If the expence of 9 horſes for corn be L.11 : 5 for $4\frac{1}{2}$ months, when the price is 18s. 4d. per boll, how many horſes will, at that rate, conſume the value of L.27 in 6 months, when corn is 16s.?

10. If 15 lads of 18 years of age, do a piece of work in 60 days; in what time will 9 men 24 years old, do the ſame, ſuppoſing their ſtrength to increaſe in the ſame proportion as their age?

11. A garriſon of 3600 men have proviſion for 70 days, at 24 oz. to each man per day; how much ought each man to be allowed, that the proviſions may laſt 90 days, after the garriſon is reinforced by a body of 1200 men?

12. If a ſhip's crew of 120 men uſe L.50 value of wine in 3 weeks, at 1 pint per day each, when the price is L.45 per pipe; how long will L.1000 value ſerve 250 men, when each is allowed $1\frac{1}{2}$ pint per day, and wine at L.48 per pipe?

13. An architect engages to build a wall 240 yards long in 60 days, and hires 30 men for that purpoſe, but at the end of 45 days he finds that no more than 160 yards of it are done; how many men muſt he add, that it may be finiſhed in the ſtipulated time?

14. A farmer computed that 30 reapers would finiſh his harveſt in 5 weeks; but after they had wrought 9 days, he finds his corn too ripe, and reſolves to have the remainder cut down in 14 days; how many reapers muſt be added for that purpoſe?

## Sect. III. Distributive Proportion, or, Company-Accompts.

To ſettle the affairs of a company, and compute the profit or loſs of each partner, in proportion to his ſtock, and the time it was employed in the buſineſs, obſerve the following proportion:

*As the total ſtock : is to the whole dividend :: ſo is each particular ſtock : to the reſpective ſhares of it.*

*Note.* When the times of their continuing their ſtock in company are unequal, their reſpective ſtocks muſt be multiplied by their reſpective times.

Ex. 1ſt. Three merchants enter into partnerſhip; A's ſtock is L.340, B's L.290 and C's L.150; they gain L.260; how much will each draw in proportion to his ſtock?

| | | | | | | |
|---|---|---|---|---|---|---|
| A's ſtock | L.340 | 780 : 260 : : 340 : | L.113 | 6 | 8 | A's. |
| B's do. | 290 | 780 : 260 : : 290 : | 96 | 13 | 4 | B's. |
| C's do. | 150 | 780 : 260 : : 150 : | 50 | 0 | 0 | C's. |
| Total ſtock | L.780 | Proof, | L.260 : | 0 : | 0 | |

To prove the operation, add together the ſhares of the partners, and the ſum is the dividend. If there be remainders they muſt be added, the ſum divided by the common diviſor, and the quotient carried to the place of farthings.

Ex. 2d. A bankrupt owes to A, L.326 : 15, B, L.218 : 10, C, L.375 : 5, and D, L 543 : 10, his effects amount only to L.610; what ſhould each draw in proportion to his reſpective credit, and how much is the compoſition per pound?

| | | | | | | |
|---|---|---|---|---|---|---|
| A, | L.326 : 15 | 1464 : 610 : : 326 15 : | L.136 | 2 | 11 | to A. |
| B, | 218 : 10 | 1464 : 610 : : 218 10 : | 91 | 0 | 11 | to B. |
| C, | 375 : 5 | 1464 : 610 : : 375 5 : | 156 | 7 | 1 | to C. |
| D, | 543 : 10 | 1464 : 610 : : 543 10 : | 226 | 9 | 1 | to D. |
| L.1464 — | | 1464)610 × 20(8s. 4d. | L.610 — — | | | Proof. |

Inſtead of ſtating as above, we may calculate by the rules in the next ſection, what each creditor draws at 8s. 4d. the compoſition per pound.

## *Queſtions for Practice.*

1. Four partners continue in trade for a year; A, advances L.350, B, L.290, C, L 260 and D, L.200; how ſhould the gain, which amounts to L.275, be divided among them?

2. A bankrupt's effects amount to L 182 : 11 : 8; he owes to A, L.110 : 8 : 3, to B, L.100 : 3, and to C, L 62 : 6 : 3, how much can he pay per pound, and what muſt each creditor have?

3. A, B and C, continue in company for 3 years; they advance L.4500, L.3500, and L.2800 reſpectively; at the end of that time, the profits amount to L.10,000, what ſum will each receive at ſettlement?

4. Three graziers rent a park for L.40 per annum, A puts in 40 cows for 5 months, B, 60 cows for 4½ months, and C, 70 cows for the reſt of the year; what proportion of the rent ſhould each pay?

5. A, having L.1000, began buſineſs in 1796, and 9 months after he took in B as a partner, who advanced L.1500; and 6 months after they admitted C into Co. who advanced L.2000. At the end of the year 1798; their profits amount to L.1050 : 18, how much is each partner entitled to draw?

6. Three perſons in trade join in an adventure to Jamaica; A advances L.1260, B, L.1050, and C, L.890. They buy goods to the amount of their ſtock, and inſure to the value of L.2000; the goods are loſt at ſea; and they recover only what was inſured. How much will each recover, and what loſs will each ſuſtain?

# CHAP. VII.

## RULES FOR PRACTICE.

THE whole ſyſtem of arithmetic is comprehended in the foregoing chapters: the operations contained in them are ſufficient for every computation. In many caſes, however, practice has ſuggeſted a variety of contractions, where the joint application of ſeveral rules is required, which therefore could not be handled in the chapters, in which the rules are ſeparately conſidered. We ſhall in this chapter point out, and explain to the learner, the readieſt methods of performing the various ſorts of computations, which occur in buſineſs.

### Sect. I. COMPUTATION OF PRICES BY ALIQUOT PARTS.

Here, when the price of one article is given, that the value of any number may be found, we ſuppoſe the price of each article to be a pound, a ſhilling, or a penny, as is moſt convenient; accordingly the number of articles will be the value in pounds, ſhillings, or pence: we divide the number of articles by the aliquot part or parts of this ſuppoſed price, which are contained in the real price, and the quotient or ſum of the quotients is the anſwer.

*Table of Aliquot Parts.*

| Of a ſhilling. | | Of a pound. | | | | Of an cwt. | | |
|---|---|---|---|---|---|---|---|---|
| 1d. | is $\frac{1}{12}$ | 10s. | is $\frac{1}{2}$ | 1s. 8d. | is $\frac{1}{12}$ | 56 lb. | is $\frac{1}{2}$ | |
| 1½d. | — $\frac{1}{8}$ | 6s. 8d. | — $\frac{1}{3}$ | 1s. | — $\frac{1}{20}$ | 28 | — $\frac{1}{4}$ | |
| 2d. | — $\frac{1}{6}$ | 5s. | — $\frac{1}{4}$ | 8d. | — $\frac{1}{30}$ | 16 | — $\frac{1}{7}$ | |
| 3d. | — $\frac{1}{4}$ | 4s. | — $\frac{1}{5}$ | 6d. | — $\frac{1}{40}$ | 14 | — $\frac{1}{8}$ | |
| 4d. | — $\frac{1}{3}$ | 3s. 4d. | — $\frac{1}{6}$ | 4d. | — $\frac{1}{60}$ | 7 | — $\frac{1}{4}$ | qr. cwt. |
| 6d. | — $\frac{1}{2}$ | 2s. 6d. | — $\frac{1}{8}$ | 3d. | — $\frac{1}{80}$ | 4 | — $\frac{1}{7}$ | |
| | | 2s. | — $\frac{1}{10}$ | 2d. | — $\frac{1}{120}$ | | | |

*RULE* I. *When the rate is an aliquot part of a penny, of a ſhilling, or of a pound, divide the quantity by that aliquot part, and the quotient will be the anſwer, in that name of which the rate is an aliquot part, which, if pence or ſhillings, reduce to pounds.*

**Ex.** What coſt 2416 yards of tape at 1½d. and 2d. per yard?

$\frac{1}{8}$)2416 $\frac{1}{120}$)2416 or, $\frac{1}{8}$)2416

20) 302 L.20 : 2 : 8 20) 402 : 8

L.15 : 2 L.20 : 2 : 8

In example 1ſt we divide by 8, becauſe 1½d. is $\frac{1}{8}$ of a ſhilling, which gives the anſwer in ſhillings, then by 20 for the value in pounds. In example 2d, when we divide by $\frac{1}{120}$ for the ſecond, the quotient is L.20, and the remainder 16, being two-pences, is 2s. 8d.

What coſt 2645 yards of ribbon at 3d. and 4d. per yard?

$\frac{1}{4}$) 2645 or, $\frac{1}{80}$)2645 $\frac{1}{3}$)2645 at 4d. $\frac{1}{60}$)2645

20) 661 : 3 L.33 : 1 : 3 20) 881 : 8d. L.44 : 1 : 8

L.33 : 1 : 3 L.44 : 1 : 8

What coſt 3564 lb. of ſugar at 6d. and 8d. per lb.?

$\frac{1}{2}$)3564 at 6d. or $\frac{1}{240}$)3564 $\frac{1}{3}$)3564 at 8d. $\frac{1}{360}$)3564

20)1782 L.89 : 2 ſub. 1188 or, L.118 : 16

L.89 : 2 20)2376

L.118 : 16

Calculate 1987 yards of linen at 1s., 1s. 8d., 2s. and 2s. 6d.

20)1987 at 1s. $\frac{1}{120}$)1987 at 1s. 8d. $\frac{1}{10}$)1987 at 2s. $\frac{1}{8}$)1987 at 2s. 6d.

L.99 : 17 L.165 : 11 : 8 L.198 : 14 L.248 : 7 : 6

## *Examples for Practice.*

1. Cal. 3526 yards at ¼d.
2. ——2365 yards at ½d.
3. ——1784 yards at 1d.
4. ——4321 yards at 1½d.
5. ——2640 yards at 2d.
6. ——2576 yards at 3d.
7. ——4684 yards at 4d.
8. ——3763 yards at 6d.
9. ——5432 yards at 8d.
10. Cal. 4874 yards at 1s.
11. ——3715 yards at 1s. 8d.
12. ——2968 yards at 2s.
13. ——6374 yards at 2s. 6d.
14. ——3782 yards at 3s. 4d.
15. ——5169 yards at 4s.
16. ——4565 yards at 5s.
17. ——7834 yards at 6s. 8d.
18. ——4673 yards at 10s.

*RULE* II. *When the rate is a ſimple number, but not an aliquot part, multiply the quantity by it; the product will be the anſwer in the ſame name as the rate.*

*Or, divide the rate into two or more aliquot parts, work for theſe as in the laſt rule, and add the quotients.*

*Note.* If the rate be an even number of ſhillings, multiply by half their number, and double the firſt figure of the product for ſhillings; the reſt will be pounds.

Ex. What coſt 842 lb. of raiſins at 5d. per lb?

| | | | |
|---|---|---|---|
| $\frac{1}{3}$)842 at 5d. | or, $\frac{1}{6}$, $\frac{1}{4}$)842 | or, | 842 |
| | | | 5d. |
| $\frac{1}{4}$)280 : 8 = 4d. | 210 : 6 = 3d. | | 12)4210 |
| 70 : 2 = 1d. | 140 : 4 = 2d. | | 20) 350 : 10 |
| 20)350 : 10 | 20)350 : 10 | | L.17 : 10 : 10 |
| L.17 : 10 : 10 | L.17 : 10 : 10 | | |

What coſt 564 lb. of butter at 10d. per lb.?

| | | | |
|---|---|---|---|
| $\frac{1}{3}$ $\frac{1}{2}$)564 at 10d | or, $\frac{1}{20}$)564 | or, $\frac{1}{40}$)564 | or, 12)5640 |
| | | $\frac{1}{60}$ | |
| 282 = 6d. | $\frac{1}{6}$)28 : 4 | 14 : 2 | 20)470 |
| 188 = 4d. | ſub. 4 : 14 | 9 : 8 | L.23 : 10 |
| 20)470 | L 23 : 10 | L.23 : 10 | |
| L.23 : 10 | | | |

What coſt 496 yards of muſlin at 3s. per yard?

| | | | |
|---|---|---|---|
| $\frac{1}{10}$)496 at 3s. or, | $\frac{1}{5}$)496 | or, $\frac{1}{10}$ $\frac{1}{4}$)496 | 496 |
| | | | 3 |
| $\frac{1}{2}$)49 : 12 : 0 = 2s. | $\frac{1}{4}$) 99 : 4 | 124 : 0 | 20)1488 |
| 24 : 16 : 0 = 1s. | ſub. 24 : 16 | 49 : 12 | |
| L.74 : 8 : 0 | L.74 : 8 | L.74 : 8 | L.74 : 8 |

What coſt 686 gallons of whiſky at 6s. per gallon?

| | | | |
|---|---|---|---|
| $\frac{1}{3}$)686 at 6s. or, | $\frac{1}{4}$)686 | or, 686 | 686 |
| | | 6 | 3 |
| $\frac{1}{2}$)137 : 4 : 0 = 4s. | $\frac{1}{5}$)171 : 10 | 20)4116 | L.205 : 16 |
| 68 : 12 : 0 = 2s. | 34 : 6 | | |
| L.205 : 16 | L.205 : 16 | L.205 : 16 | |

What coſt 754 gallons of brandy at 8s. per gallon?

| | | | |
|---|---|---|---|
| $\frac{1}{3}$)754 at 8s. | $\frac{1}{2}$)754 | 754 | 754 |
| | | 8 | 4 |
| 150 : 16 = 4s. | $\frac{1}{5}$)377 : 0 | | |
| 150 : 16 = 4s. | 75 : 8 | $\frac{1}{20}$)6032 | L.301 : 12 |
| L 301 : 12 : 0 | L.301 : 12 | L.301 : 12 | |

What coſt 265 lbs. of green tea at 9s. per lb.?

$\frac{1}{2}$)265 at 9s. or, $\frac{1}{5}$ $\frac{1}{4}$)265 or, 265 20)265
9 4
$\frac{1}{10}$)132 : 10 = 10s. 66 : 5 20)2385 106
ſub. 13 : 5 = 1s. 53 : 0 L.119 : 5 13 : 5
L.119 : 5 : 0 L.119 : 5 L.119 : 5

What coſt 376 gallons of rum at 11s. per gallon?

$\frac{1}{2}$)376 at 11s. or, $\frac{1}{10}$ $\frac{1}{5}$)376 or, $\frac{1}{10}$)376 5 or, 376 11
$\frac{1}{10}$)188 : 0 = 1s. $\frac{1}{2}$)125 : 6 : 8 188 : 0 20)4136
18 : 16 = 11s. 62 : 13 : 4 18 : 16 L.206 : 16
L.206 : 16 : 0 18 : 16 L.206 : 16
L.206 : 16 L.206 : 16

What coſt 456 yards of ſcarlet at 14s. and 15s. per yard?

$\frac{1}{5}$ $\frac{1}{4}$)456 at 14s. or, 456 7 $\frac{1}{2}$)456 at 15s. $\frac{1}{4}$)456 114
228 : 0 L.319 : 4 $\frac{1}{2}$)228 L.342
91 : 4 114
L.319 : 4 L.342

What coſt 378 bolls of corn at 18s. and 19s. per boll?

$\frac{1}{10}$)378 at 18s. or, 378 9 $\frac{1}{20}$)378 at 19s. $\frac{1}{10}$)378 9
ſub. 37 : 16 ſub. 18 : 18 340 : 4
18 : 18
L.340 : 4 L.340 : 4 L.359 : 2 L.359 : 2

Calculate 429 bolls of wheat at 21s. 22s. 25s. and 30s. per boll?

Add $\frac{1}{20}$)429 at 21s. $\frac{1}{10}$)429 at 22s. $\frac{1}{4}$)429 at 25s. $\frac{1}{2}$)429 at 30s.
21 : 9 42 : 18 107 : 5 214 : 10
L.450 : 9 L.471 : 18 L.536 : 5 L.643 : 10

## *Examples for Practice.*

1. Cal. 3684 yards at 5d.?
2. —— 7453 yards at 7d.?
3. —— 6858 yards at 9d.?
4. —— 3987 yards at 10d.?
5. —— 4536 yards at 11d.?
6. Cal. 2789 yards at 3s.?
7. —— 3765 yards at 6s.?
8. —— 5143 yards at 7s.?
9. —— 2468 yards at 8s.?
10. —— 7686 yards at 9s.?

11. Cal. 4164 yards at 11s.?
12. —— 2506 yards at 12s.?
13. —— 3890 yards at 13s ?
14. —— 1486 yards at 14s.?
15. —— 9008 yards at 15s.?
16. —— 7514 yards at 16s.?
17. —— 6843 yards at 17s.?
18. —— 3715 yards at 18s.?
19. —— 4567 yards at 19s.?
20. —— 6342 yards at 20s.?
21. Cal. 4915 yards at 22s.?
22. —— 2436 yards at 23s.?
23. —— 1867 yards at 24s.?
24. —— 1984 yards at 25s.?
25. —— 1799 yards at 28s.?
26. —— 1045 yards at 35s.?
27. —— 1561 yards at 47s.?
28. —— 1422 yards at 54s.?
29. —— 1359 yards at 65s.?
30. —— 1010 yards at 72s.?

*RULE* III. *When the rate is a mixt number, and not an aliquot part, multiply by the higheſt name, and take parts for the lower ones; the ſum of theſe is the anſwer, in the ſame name as the higheſt.*

*Or, when the rate is leſs than one pound, it may be divided into two or more aliquot parts, as in the laſt rule.*

*Note.* If there be a troubleſome fraction in the rate, multiply the whole number by the under-figure of the fraction, adding the upper-figure, take parts for the rate thus multiplied, and divide the anſwer by the under figure of the fraction.

Ex. What coſt 4684 yards of cord at $\frac{3}{4}$d. per yard?

4685 × 3 = 14055

4)14055
12) 3513 $\frac{3}{4}$
20) 292 : 9
L.14 : 12 : 9 $\frac{3}{4}$

or, $\frac{1}{2}$)4685
$\frac{1}{2}$)2342 $\frac{1}{2}$
1171 $\frac{1}{4}$
12)3513 $\frac{3}{4}$
20) 292 : 9
L.14 : 12 : 9 $\frac{3}{4}$

or, $\frac{1}{4}$)4685
1171 $\frac{1}{4}$
12)3513 $\frac{3}{4}$
20) 292 : 9
L.14 : 12 : 9 $\frac{3}{4}$

What coſt 478 lb. of lead at 1 $\frac{3}{4}$d. and 2 $\frac{1}{2}$d. per lb.

$\frac{1}{8}$)478 at 1 $\frac{3}{4}$d.
$\frac{1}{6}$) 59 : 9
9 : 11 $\frac{1}{2}$
20)69 : 8 $\frac{1}{2}$
L.3 : 9 : 8 $\frac{1}{2}$

$\frac{1}{120}$)478
$\frac{1}{8}$ )3 : 19 : 8
sub. 9 : 11 $\frac{1}{2}$
L.3 : 9 : 8 $\frac{1}{2}$

$\frac{1}{6}$)478 at 2 $\frac{1}{2}$d.
$\frac{1}{4}$) 79 : 8
19 : 11
20)99 : 7
L.4 : 19 : 7

$\frac{1}{120}$)478
$\frac{1}{4}$) 3 : 19 : 8
19 : 11
L.4 : 19 : 7

What is the duty on 525 lb. tobacco at 5 $\frac{5}{8}$d. and 6 $\frac{2}{3}$d. per lb.?

6 $\frac{2}{3}$d. × 3 = 20d. or, 1s. 8d.

$\frac{1}{12}$)525 at 1s. 8d.
3) 43 : 15 = 1s. 8d.
L.14 : 11 : 8

or, $\frac{1}{40}$)525 at 6 $\frac{2}{3}$d.
$\frac{1}{9}$ ) 13 : 2 : 6 = 6d.
1 : 9 : 2 = $\frac{2}{3}$d.
L.14 : 11 : 8

What coſt 534 ſtones hay at 9¼d. and 10¼d. per ſtone?

¼)534,0 =10d.
133½ = ¼
12)5206½
20) 433 : 10
L.21 : 13 : 10½

¼)534 at 10¼d.
½) 13 : 7
½) 6 : 13 : 6
3 : 6 : 9
L.23 : 7 : 3

⅛)534
66 : 9 = 1½d.
20)467 : 3
L.23 : 7 : 3

What coſt 347 lb. copper at 1s. 9d. per lb.?

$\frac{1}{10}$)347 at 1s. 9d.
⅛) 34 : 14 : 0 = 2s.
ſub. 4 : 6 : 9 = 3d.
L.30 : 7 : 3

or, $\frac{1}{80}$)347
4 : 6 : 9 =3d.
7
L.30 : 7 : 3

or, $\frac{1}{12}$)347
$\frac{1}{10}$)28 : 18 : 4=1s.8d
1 : 8 : 11= 1d.
L.30 : 7 : 3

What coſt 473 ſpindles of yarn at 2s. 7d. and 2s.8d. per ſpindle?

⅛)473 at 2s. 7d. or,
$\frac{1}{10}$) 59 : 2 : 6=2s. 6d.
1 : 19 : 5= 1d.
L.61 : 1 : 11

$\frac{1}{10}$)473
¼) 47 : 6 : 0=2s.
⅙) 11 : 16 : 6=6d.
1 : 19 : 5=1d.
L.61 : 1 : 11

$\frac{1}{12}$ $\frac{1}{10}$)473 at 2s. 8d.
23 : 13 : 0=1s.
39 : 8 : 4=1s.8
L.63 : 1 : 4

What coſt 322 lb. cotton-wool at 3s. 9d. per lb.?

⅛)322 at 3s. 9d. or,
½) 40 : 5 : 0=2s. 6d.
20 : 2 : 6=1s. 3d.
L.60 : 7 : 6

⅙)322
⅛) 53 : 13 : 4 =3s. 4d.
6 : 14 : 2 =5d.
L.60 : 7 : 6

or, $\frac{1}{80}$ ⅕)322
⅕) 64 : 8 : 0=4s.
ſub. 4 : 0 : 6=3d.
L.60 : 7 : 6

What coſt 536 yards gauze at 3s. 10d. 3s. 10½d. and 3s. 11d.

$\frac{1}{40}$ ⅙)536 at 3s. 10d.
89 : 6 : 8
13 : 8 : 0
L.102 : 14 : 8

$\frac{1}{12}$ $\frac{1}{10}$)536 at 3s. 10½d.
53 : 12 : 0
⅛) 44 : 13 : 4
5 : 11 : 8
L.103 : 17 : 0

$\frac{1}{120}$ ⅛)536 at 3s. 11d.
½) 67 : 0 : 0
33 : 10 : 0
4 : 9 : 4
L.104 : 19 : 4

What coſt 435 pair of ſtockings at 7s. 10½d. each?

$\frac{1}{12}$ ⅕)435 at 7s. 10½d.
½) 87 =4s.
43 : 10 =2s.
⅛) 36 : 5 =1s.8d.
4 : 10 : 7½ =2½d.
L.171 : 5 : 7½

⅛) 435
8
3480
54 : 4½
20)3425 : 7½
L.171 : 5 : 7½

435
7
⅛)3045
380 : 7½d.
20)3425 : 7½
L 171 : 5 : 7½

What coſt 574 yards dimity at 9s. 6d. per yard?

$\frac{2}{3}$)574 at 9s. 6d. or, $\frac{1}{2}\frac{1}{4}$)574 or, $\frac{1}{2}\frac{1}{0}$)574

4

$\frac{1}{2}\frac{1}{0}$)287 =10s. 143 : 10=5s. 229 : 12=8s.

ſub. 14 : 7=6d. $\frac{1}{8}$)114 : 16=4s. $\frac{1}{2}$) 28 : 14=1s.

14 : 7=6d. 14 : 7= 6d.

L.272 : 13 L.272 : 13 L.272 : 13

What coſt 285 ſheep at 13s. 4d. each?

$\frac{1}{3}$)285 at 13s. 4d. or, $\frac{1}{3}$)285 or, $\frac{1}{2}$)285

ſub. 95=6s. 8d.

95=6s. 8d. $\frac{1}{3}$)142 : 10=10s.

L.190 95=6s. 8d. 47 : 10=3s.4d.

L.190 L.190

What coſt 284 cattle at L.2 : 16 : 8, L.3 : 17 : 6, L.4 : 18 : 4?

$\frac{1}{6}$)284 at 56s. 8d. $\frac{1}{8}$)284 at 77s. 6d. $\frac{1}{1\frac{1}{2}}$)284 at 98s. 4d.

3 4 5

852 =60s. 1136 =80s. 1420

ſub. 47 : 6 : 8=3s.4d. ſub. 35 : 10=2s. 6d. 23 : 13 : 4

L.804 : 13 : 4 L.1100 : 10 L.1336 : 6 : 8

## *Examples for Practice.*

1. Cal. 4560 yards at $1\frac{2}{3}$d.?
2. —— 5798 yards at $2\frac{3}{4}$d.?
3. —— 4984 yards at $3\frac{7}{8}$d.?
4. —— 5238 yards at $4\frac{1}{4}$d.?
5. —— 8326 yards at $5\frac{3}{4}$d.?
6. —— 7845 yards at $6\frac{1}{2}$d.?
7. —— 6903 yards at $7\frac{2}{3}$d.?
8. —— 5464 yards at $8\frac{1}{8}$d.?
9. —— 7845 yards at $9\frac{4}{5}$d.?
10. —— 6456 yards at $10\frac{5}{8}$d ?
11. —— 5406 yards at $11\frac{5}{6}$d.?
12. —— 4674 yards at 1s. $2\frac{1}{2}$d.?
13. —— 6539 yards at 1s. $7\frac{3}{4}$d.?
14. —— 4567 yards at 1s. $11\frac{1}{2}$d.?
15. —— 4345 yards at 2s. $2\frac{3}{4}$d.?
16. —— 4686 yards at 3s. $8\frac{1}{2}$d.?
17. —— 5744 yards at 4s. $3\frac{1}{4}$d.?
18. —— 4860 yards at 5s. $7\frac{1}{2}$d.?
19. —— 3680 yards at 6s. $9\frac{3}{4}$d.?
20. —— 4536 yards at 7s. $7\frac{1}{2}$d.?
21. Cal. 2843 yards at 8s. $4\frac{3}{4}$d.?
22. —— 6431 yards at 9s. $5\frac{1}{4}$d.?
23. —— 5613 yards at 10s. 10d.?
24. —— 5986 yards at 11s. 11d.?
25. —— 7845 yards at 12s. 8d.?
26. —— 6784 yards at 13s. 2d.?
27. —— 4567 yards at 14s. 10d.?
28. —— 5432 yards at 15s. 9d.?
29. —— 5134 yards at 16s. 5d.?
30. —— 4583 yards at 17s. 6d.?
31. —— 4432 yards at 18s. 3d.?
32. —— 3567 yards at 19s. 7d.?
33. —— 2456 yards at 20s. 11d.?
34. —— 964 pieces at 45s. 6d.?
35. —— 876 pieces at 52s. 4d.?
36. —— 785 pieces at 67s. 9d.?
37. —— 640 pieces at 75s. 10d.?
38. —— 598 pieces at 86s. 3d.?
39. —— 483 pieces at 95s. 5d.?
40. —— 365 pieces at 99s. 9d.?

*CASE* IV. *When the quantity is in ſeveral denominations, and the rate of the higheſt given, multiply the price by the higheſt denomination, and take parts for the other denominations.*

*Or, If there be a fraction in the quantity, take a proper proportion of the rate for it.*

Ex. 1ſt.

What coſt 11 cwt. 3 qr. 14 lb. at L 3 : 17 : $6\frac{1}{2}$

11

42 : 12 : $11\frac{1}{2}$ = 11 cwt.
$\frac{1}{2}$) 1 : 18 : $9\frac{1}{4}$ = 2 qr.
$\frac{1}{2}$) : 19 : $4\frac{3}{4}$ = 1 do.
9 : $8\frac{1}{4}$ = 14 do.

L.46 : 0 : $9\frac{3}{4}$

Ex. 2d.

What coſt 8 lb. 6 oz. 18 dwt. at L 4 : 13 : 4 per lb.

8

37 : 6 : 8 = 8 lb.
$\frac{1}{8}$) 2 : 6 : 8 = 6 oz.
$\frac{1}{3}$) 5 : 10 = 15 dwt.
1 : 2 = 3 dwt.

L.40 : 0 : 4

Ex. 3d.

$\frac{4}{5}$ $\frac{1}{2}$)$874\frac{1}{3}$ yards at 14s. 6d.

437 = 10s.
$\frac{1}{8}$)174 : 16 = 4s.
21 : 17 = 6d.
$\frac{1}{3}$ of 14s.6d is : 4 : 10 = $\frac{1}{3}$ yd.

L.633 : 17 : 10

Ex. 4th.

$586\frac{5}{8}$ pieces at L.7 : 5 : 10

7

4102 = L. 7.
$\frac{1}{5}$) 146 : 10 = 5s.
24 : 8 : 4 = 10d.
$\frac{1}{4}$) 3 : 12 : 11 = $\frac{4}{8}$ ps.
18 : $2\frac{1}{4}$ = $\frac{1}{8}$ do.

L.4277 : 9 : $5\frac{1}{4}$

In example 1ſt, we multiply the rate of one cwt. by the number of cwts.; then we take half the rate of one cwt. for 2 qrs., the half of that, for 1 qr., and the half of 1 qr. for the 14 lb.

In example 3d, After taking parts for 14s. 6d. (the rate,) we take the third of it for $\frac{1}{3}$ of a yard.

## *Examples for Practice.*

1. Cal. $653\frac{1}{4}$ yards at 3s. 5d.?
2. ——$475\frac{1}{2}$ yards at 5s. $7\frac{1}{2}$d.?
3. ——$530\frac{3}{4}$ yards at 6s. 6d.?
4. ——$386\frac{2}{3}$ yards at 7s. 5d.?
5. ——$648\frac{3}{5}$ yards at 8s. $9\frac{1}{4}$d.?
6. ——$543\frac{5}{6}$ yards at 9s. 9d?
7. ——$406\frac{5}{8}$ yards at 11s. $4\frac{1}{3}$d.?
8. ——$364\frac{7}{8}$ yards at 15s. 2d.?
9. Cal. $480\frac{1}{8}$ pieces at 47s. $6\frac{1}{2}$d.?
10. ——$346\frac{8}{9}$ pieces at 49s. $8\frac{4}{5}$d.?
11. ——$531\frac{4}{5}$ pieces at 51s. 8d.?
12. ——$245\frac{3}{8}$ pieces at 63s. $8\frac{1}{2}$d.?
13. ——$392\frac{1}{6}$ pieces at 78s. 9d.?
14. ——$426\frac{2}{5}$ pieces at 84s. 7d.?
15. ——$247\frac{5}{7}$ pieces at 91s. $7\frac{3}{4}$d.?
16. ——$454\frac{1}{12}$ pieces at 97s. $11\frac{2}{3}$d.

¶ 17. What coſt 15 cwt. 1 qr. 16 lb. at L.4 : 16 : 3 per cwt.?
18. What coſt 18 cwt. 3 qr. 25 lb. at L.3 : 18 : 6 per cwt.?
19. What coſt 19 cwt. 0 qr. 17 lb. at L.3 : 15 : 4¼ per cwt.?
20. What coſt 22 cwt. 1 qr. 22 lb. at L.1 : 19 : 6 per cwt.?
21. What coſt 14 cwt. 2 qr. 27 lb. at L 2 : 18 : 4 per cwt.?
22. What coſt 5 lb. 11 oz. 10 dwt. 12 gr. at L.4 : 11 : 8 per lb.
23. What coſt 25 bolls 2 fir. 3 pecks at 19s. 10½d. per boll?
24. What coſt 38 acres 3 r. 25 pol. at L.15 : 10 per acre?

To prevent miſtakes every calculation ſhould be tried by a different method, as one is apt to fall into the ſame miſtake if he reviſe it by the ſame method, by which he performed it; this will not only ſerve the purpoſe of proving the operation, but will make the learner expert at diſcovering the beſt methods of ſolving each queſtion. We ſhall here add a few practical methods of calculation ſuited to particular caſes.

1ſt, Sometimes the value of goods may be eaſily calculated by putting the quantity for the rate, and the rate for the quantity. Thus 18 yards at 6d., or 6 yards at 18d. is 9s.

2d, If the number of articles be 100 [5 ſcore] and the rate given in ſhillings, as each ſhilling makes L.5 of the amount; multiply the rate by 5 for the anſwer—If the rate be pence, divide the anſwer found as above by 12, and every unit of the remainder is 1s. 8d. If the rate be farthings, multiply it by 5, and the product is 5 pences.

3d, If the number be 112 [lbs. in a cwt.] each penny of the rate makes 9s. 4d. of the amount, and a farthing makes 2s. 4d., 2 farthings 4s. 8d., and 3 farthings 7s.

4th, If the number be 144 [12 dozen] multiply the rate by 3, and divide by 5 for the anſwer; as every penny of the rate makes 12s. is $\frac{3}{5}$ of a pound.

5th, If the number be 240 every penny of the rate makes a pound of the amount, and every farthing 5s.

6th, If the number be 120 [6 ſcore] every penny of the rate makes 10s. of the amount. If there be farthings, take ſuch a part of a pound as they are of a penny.

7th, If the number of articles be near any of theſe numbers, or an aliquot part of them, the value is eaſily found by making a proper addition or deduction.

## Sect. II. Deduction on Weights.

The whole weight of any commodity, together with that of the caſk, box or other package, in which it is contained is called the GROSS weight. From this we make proper deductions to diſcover the quantity, for which price or duty ſhould be charged, the weight then is called NETT weight.

TARE is a deduction for the weight of the package; and this ſhould be aſcertained by weighing it before the goods are packed. Frequently, however, inſtead of this ſo much is allowed per cwt., or ſo much per 100 lb. The remainder, if other allowances are to be made, is called SUTTLE.

TRET is an allowance on goods on which there is waſte: This is always 4 lb. on 104 or 1lb. on 26, and is found by dividing the ſuttle by 26.

CLOFF is a further allowance, granted in London, on certain goods for the turn of the ſcale, which is generally 2 lb. on every 3 cwt. or $\frac{1}{168}$, and is found by dividing by 168.

In computing theſe allowances we may reject any thing leſs than $\frac{1}{4}$ lb., and yet obtain an anſwer ſufficiently exact; for the purchaſer is always allowed 1 lb. if the fraction be equal to $\frac{1}{2}$ lb.

**Ex. 1ſt,** What is the nett weight of 15 cwt. 3 qr. 21 lb., tare 12 lb. per cwt.

$\frac{1}{7}$)15 3 21 groſs

$\frac{1}{2}$) 2 1 3 = 16 lb.

deduct 2 $7\frac{1}{4}$ = 4

1 2 $23\frac{1}{4}$ tare

14 0 $25\frac{1}{4}$ nett

**Ex. 2d,** What is the tare on 6 cwt. 1qr. 20lb. at 5lb. per 100?

6 cwt.

6 or, 720

6 5 lb.

6,48 100)36,00

20)720

36 lb.

In Ex. 1ſt we might have taken $\frac{1}{8}$ of the groſs weight for 14 lb. and ſubtracted $\frac{1}{7}$ of that. Or, the groſs weight may be multiplied by 12, and the tare will be 1 lb. for each cwt. of the product.

In example 2d, we reduce the groſs weight to lbs. (by addition) as the tare is 5 lb. per 100, or 5 per cent., we divide by 20; or we multiply by 5 and divide by 100.

3d, What is the tret on 44 cwt. 3 qr. 10 lb.

26)44 3 10

1 2 25

4th, What is the uſual cloff on 37 cwt. 2 qr.

168)37 2(25 lb. or, 37 2

2

3)75 (25 lb.

When the cloff is 2 lb. per 3 cwt. we may multiply by 2, and divide by 3, as above.

### *Queſtions for Practice.*

1. What is the tare on 186 cwt. 2 qr. at 16 lb. per cwt?
2. What is the tare on 135 cwt. 1 qr 10 lb. at 2½ lb. per 100?
3. What is the nett weight of 8 cwt. 1 qr. 21 lb. tare 10 lb. per cwt.?
4. What is the nett weight of 75 bags of cotton, weighing 248 cwt. 1 qr. 27 lb., draught 1 lb. per bag, tare 5 per cent?

¶ 5. What is the tret on 175 cwt. 2 qrs.?

6. What is the nett weight of 230 cwt. 1 qr. 20 lb., allowing 7 lb. per cwt. for tare, and the ordinary tret?
7. What is the nett weight of 1920 lb. coffee, allowing 12½ per cent. for tare, and tret as uſual?

¶ 8. What is the uſual cloff on 45 cwt. 3 qr. 14 lb.?

9. What is the nett weight of 154 cwt. 19 lb., allowing 15 lb. per cwt. for tare, and the uſual tret and cloff?

¶ 10. How many gallons are there in 5 caſks of oil, each weighing 2 cwt. 3 qr. 25 lb., allowing 7½ lb. nett to the gallon, tare 30 lb. per caſk?

11. How much pure gold is there in 54 lb. 9 oz. of coin, allowing 1 oz. 4 dwt. of alloy to each lb.?
12. A farmer has occaſion to kilndry 390 bolls of corn, by which it lacks 7 bolls and a half in the hundred. How much will it meaſure when dry?
13. A wine-dealer importing 1325 gallons of Madeira, on paying the duties is allowed 12 per cent. For how many gallons muſt he pay duty?

## Sect. III. Commission.

Commiſſion is an allowance of ſo much per L 100, to a Factor or Agent, for buying, or ſelling goods, negociating bills, or tranſacting any kind of buſineſs for his employer.

*Rule. Multiply the ſum by the rate, and divide the product by* 100. *If the rate has a fraction, take a proportional part for it.*

*Note.* To divide by 100, cut off two figures on the right of the product, as was formerly ſhewn in diviſion.

By the above rule may be calculated, the Premium on Stocks, or the allowance given for any ſhare of a public ſtock above the original value; alſo Premium of Insurance, and Exchange, of which afterwards.

Ex. What is the commiſſion on L.635, at $2\frac{1}{2}$ per cent.

635 — $2\frac{1}{2}$ — 1270 — 317 10 — 1,00)15,87 10

1|00)15|87 10 — 20 — 17|50 — 12 — 6|00

Anſ. L 15 17 6

or, $\frac{1}{40}$)635(L.15 17 6

As $2\frac{1}{2}$ per cent. is the 40th part of 100, we may divide the ſum by 40, as above.

## *Queſtions for Practice.*

1. What is the commiſſion on L 1645, at 1 per cent.?
2. ——— On L.974 : 14, at $1\frac{1}{4}$ per cent.?
3. ——— On L.889, at $1\frac{1}{4}$ per cent.?
4. ——— On L.755 : 10, at $2\frac{1}{4}$ per cent ?
5. ——— On L.1860, at $3\frac{1}{4}$ per cent.?
6. ——— On L.251 : 13 : 4, at 4 per cent.?
7. ——— On L.1456 : 5, at 5 per cent.?

¶ 8. Diſcounted bills to the amount of L.36627 : 10. What is my commiſſion at $\frac{1}{4}$ per cent.?

9. Tranſacted buſineſs for my employer to the amount of L.4875 : 8 : 4. What am I entitled to, at 6s. 8d. per L.100?

10. Negociated bills for A. B. to the extent of L.18765 : 16 : 8. What is my commiſſion, at $\frac{1}{2}$ per cent.?

¶ 11. What is the value of L.1540 bank ſtock, at 125 per cent.?

12. What ſum will purchaſe L.1260 of 3 per cent. annuities, at $75\frac{1}{2}$ per cent.?

In buſineſs the following methods are uſeful for calculating diſcounts on cotton yarn or other goods, at ſo much per cent.

For $1\frac{1}{4}$ per. cent. take $\frac{1}{80}$ of the ſum. For 2—take $\frac{1}{50}$. For $2\frac{1}{2}$—take $\frac{1}{40}$. For 5—take $\frac{1}{20}$. For $7\frac{1}{2}$—take $\frac{1}{10}$ and $\frac{1}{2}$ of that, and add. For 10—take $\frac{1}{10}$. For $12\frac{1}{2}$—take $\frac{1}{8}$. For 15—take $\frac{1}{10}$ and $\frac{1}{2}$ of that and add. For $17\frac{1}{2}$—take $\frac{1}{5}$ and deduct $\frac{1}{8}$ of that $\frac{1}{5}$, or multiply by $3\frac{1}{2}$, and divide by 20. For 20—take $\frac{1}{5}$. For $22\frac{1}{2}$—take $\frac{1}{5}$ and $\frac{1}{8}$ of that, or multiply by $4\frac{1}{2}$ and divide by 20. For 25—take $\frac{1}{4}$. For $27\frac{1}{2}$—take $\frac{1}{4}$ and $\frac{1}{10}$ of that, or mult. by $5\frac{1}{2}$ and divide by 20. For 30—take $\frac{1}{3}$ and $\frac{1}{2}$ of that. For $32\frac{1}{2}$—take $\frac{1}{3}$, $\frac{1}{2}$ of that and $\frac{1}{3}$ of that $\frac{1}{2}$. For $33\frac{1}{3}$—take $\frac{1}{3}$, for $33\frac{1}{3}$ is $\frac{1}{3}$ of 100. For 35—take $\frac{1}{4}$ and $\frac{1}{10}$ of the ſum. For $37\frac{1}{2}$—take $\frac{1}{4}$ and $\frac{1}{10}$ of the ſum, and $\frac{1}{4}$ of $\frac{1}{10}$, or multiply by $7\frac{1}{2}$ and divide by 20. For 40—take twice $\frac{1}{5}$ of the ſum. For $42\frac{1}{2}$—take twice $\frac{1}{5}$, and $\frac{1}{8}$ of $\frac{1}{5}$. For 45—take $\frac{1}{4}$ and $\frac{1}{5}$ of the ſum. For $47\frac{1}{2}$—take $\frac{1}{2}$, and ſubtract $\frac{1}{20}$ of that $\frac{1}{2}$. For 50—take $\frac{1}{2}$. For $52\frac{1}{2}$—take $\frac{1}{2}$, and $\frac{1}{20}$ of that $\frac{1}{2}$.

## Sect. IV. Interest.

Intereſt is an allowance granted by the borrower, to the lender of money, in conſideration of the uſe he has had of it.

The twentieth part of any ſum, is one year's intereſt of it at 5 per cent., which is the legal intereſt at preſent in Britain, and is due upon all debts, which are not paid at the proper term. The rate of intereſt may be under 5 per cent. if ſo ſtipulated between the parties, for bankers give only 4 per cent.; but more than 5 per cent., which is called uſury, is prohibited by the Britiſh laws. When the rate is not mentioned, legal intereſt is always underſtood.

As the intereſt of any number of pounds for a year at 5 per cent. is one-twentieth part, or one ſhilling for every pound, the given ſum multiplied by the number of days will give the intereſt in ſhillings for an equal number of years. That product divided by 365, gives the anſwer for days, and the quotient divided by 20 reduces it to pounds. Hence we may infer the following rules.

I. To calculate intereſt at 5 per cent. *Multiply the ſum by the number of days, and divide the product by* 365 *for the anſwer in ſhillings.*

*Or, divide the product by* 7300 [365 × 20] *for the anſwer in pounds.*

II. To calculate intereſt at any other rate. *Take a proper proportion of the intereſt at 5 per cent. for the rate required.*

*Or, Multiply the intereſt at 5 per cent. by the given rate, and divide the product by* 5.

Ex. 1ſt, What is the intereſt of L.657 for 75 days, at 5 p. cent.?

657
75
3285
4599
365)49275(135s.
365
1277
1095
1825
1825
L.6 : 15

or, 73|00)492|75(L.6 : 15

2d, Intereſt of L.127 for 50 days, at 4 per cent.?

127
50 ($\frac{1}{5}$)
365)6350 (17s. $4\frac{3}{4}$d. = 5 p. cent.
365 (3 $5\frac{3}{4}$ = 1 do.
2700 13 11 = 4 do.
2555
145
12
1740
1460
280
4
1120
1095
25

When the time is greater than a year, it is beſt to calculate firſt for the years, and then for the odd days. In leap-years the 29th of February is not reckoned, nor do we reckon the day *from* which, but the day *to* which we compute.

### *Examples for Practice.*

1. What is the intereſt of L.292 for 25 days, at 5 per cent.?
2. ——— Of L.182 : 10 for 40 days, at do.
3. ——— Of L.1209 for 57 days, at do.
4. ——— Of L.365 for 91 days, at do.
5. ——— Of L.328 : 10 for 60 days, at $4\frac{1}{2}$ per cent.?
6. ——— Of L.1460 for 118 days, at 4 per cent.?
7. ——— Of L.194 : 5 for 106 days, at do.
8. ——— Of L.438 for 75 days, at do.
9. ——— Of L.1650 for 146 days, at $3\frac{3}{4}$ per cent.?
10. ——— Of L.913 from 11th Nov. to 15th May, at 5 p.cent.?
11. ——— Of L.786 from 31ſt March to 1ſt July, at 4 p.cent.?
12. ——— Of L.536 from 15th September 1798, to 21ſt December 1800, at 4 per cent.?

Some bankers in computing intereſt, when they uſe the method of dividing by 365, (as in example 2d,) if there be a remainder after the ſhillings are obtained, they divide it by 30, inſtead of multiplying by 12 for pence, and by 4 for farthings. Others proceed by the following rule: Multiply the ſum by the days, as before, and divide the product by 30, the quotient gives pence, which reduce to ſhillings, and for every 6s. abate 1 penny. Thus in example 2d.

365)6350(17s $4\frac{3}{4}$d.
365 (at 5 per cent.
2700
2555
30)145
$4\frac{3}{4}$

30)6350
12)211$\frac{3}{4}$ pence
17|7$\frac{3}{4}$
abate 3
17|4$\frac{3}{4}$ as before

As the intereſt of a pound at 5 per cent. for 12 months is one ſhilling, and for a twelfth part of a year one penny. Therefore, if a month's intereſt on any ſum be required, we may reckon a penny for every pound. Thus, a month's intereſt on L.30 is 30 pence, or 2s. 6d.; 2 months, 5s.; 3 months, 7s. 6d. &c. This method would be exact if each month were alike long, however, when February is not included in the time the error in moſt caſes will not be regarded in buſineſs.

To compute intereſt on a debt when partial payments are made, multiply the ſum, and the ſeveral balances in their order, by the number of days from each payment, and divide the ſum of the products by 7300; the quotient is the legal intereſt.

Ex. If a bill of L.360 be due April 10th, of which L 180 was paid May 10th, L.80 July 4th, and the balance on the 13th Auguſt. Required how much is due at 5 per cent?

| | | days. | |
|---|---|---|---|
| April 10th, due | L.360 | × 30 = | 10800 |
| May 10th, paid | 100 | | |
| bal. | 180 | × 55 = | 9900 |
| July 4th, paid | 80 | | |
| bal. | 100 | × 40 = | 4000 |
| Aug. 13th, paid | 100 | | |
| | | 7300)24700 | |
| | | L.3 7 8 | |

In calculating intereſt on current and caſh accompts, add and ſubtract the ſums paid and received in the order of their dates, and if the balance be ſometimes due to one party and ſometimes to the other, extend the products in different columns.

Ex. Required the intereſt at 5 per cent. on the following accompt to be ſettled 31ſt December.

Dr. Mr. W. Inglis his accompt current with C. Todd, Cr.

| | | | |
|---|---|---|---|
| May 15, To caſh | L.182 — | July 5, By caſh | L.198 : 10 |
| June 29, To do. | 136 : 10 | Oct. 10, By do. | 145 : 15 |
| Sept. 16, To do. | 275 : 15 | Nov. 18, By do. | 126 : — |

| | £. | s. | days. | | |
|---|---|---|---|---|---|
| May 15, To | 182 | : — | × 45 = | 8190 | |
| June 29, To | 136 | : 10 | | | |
| | 318 | : 10 | × 6 = | 1911 | |
| July 5, By | 198 | : 10 | | | |
| | 120 | : — | × 73 = | 8760 | |
| Sept. 16, To | 275 | : 15 | | | |
| | 395 | : 15 | × 24 = | 9498 | |
| Oct. 10, By | 145 | : 15 | | | |
| | 250 | : — | × 39 = | 9750 | |
| Nov. 18, By | 126 | : — | | | |
| Laſt balance | 124 | : — | × 43 = | 5332 | |
| | | | 230 | | |
| | | | 73\|00)434\|41 | | |
| | | | L.5 : 19 | | |

Dr. ſide L.594 : 5
Cr. ſide 470 : 5

Laſt balance L.124 : 0

| | |
|---|---|
| May | 16 |
| June | 30 |
| July | 31 |
| Aug. | 31 |
| Sept. | 30 |
| Oct. | 31 |
| Nov. | 30 |
| Dec. | 31 |
| | 230 days. |

Before we find the days, we try if the laſt balance [L.124] be the ſame as the balance of the accompt, which proves the additions and ſubtractions, and before multiplying by the days, we try if [230] the ſum of the column of days be equal to the number of days, that interveen from [15th May] the date the accompt commences to bear intereſt, to [31ſt Dec.] the day of ſettlement.

As the multiplying the odd ſhillings and pence by the days gives but a very ſmall increaſe to the intereſt, and as they are very troubleſome in accompts of this kind, in practice it will be ſufficiently exact to neglect the ſhillings, when they are below 10; if they be 10, it is eaſy to add half the number of days to the product, and if they exceed 10, add 1 to the pounds.

Ex. 2d, Required the intereſt and balance on the following caſh accompt, allowing 5 per cent. when the balance is due to the bank, and 4 per cent. when due to A. B.

Dr. Mr. A. B. his caſh accompt with the Paiſley bank, Cr.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Jan. | 25th, | To caſh drawn | L.230 | Feb. | 14th, | By caſh remitted | L.185 |
| March | 16th, | To caſh do. | 175 | April | 10th, | By caſh do. | 140 |
| June | 1ſt, | To caſh do. | 25 | May | 20th, | By caſh do. | 145 |
| Aug. | 2d, | To caſh do. | 340 | July | 4th, | By caſh do. | 300 |
| Sept. | 12th, | To caſh do. | 176 | Oct. | 22d, | By caſh do. | 120 |
| Nov. | 7th, | To caſh do. | 100 | | | | |

| | | | £. | | Due the Bank. | Due A. B. |
|---|---|---|---|---|---|---|
| Jan. | 25 | Drawn | 230 | 20 | 4600 | |
| Feb. | 14 | Remitted | 185 | | | |
| | | By | 45 | 30 | 1350 | |
| March | 16 | Drawn | 175 | | | |
| | | By | 220 | 25 | 5500 | |
| April | 10 | Remitted | 140 | | | |
| | | By | 80 | 40 | 3200 | |
| May | 20 | Remitted | 145 | | | |
| | | To | 65 | 12 | | 780 |
| June | 1 | Drawn | 25 | | | |
| | | To | 40 | 33 | | 1320 |
| July | 4 | Remitted | 300 | | | |
| | | To | 340 | 29 | | 9860 |
| Aug. | 2 | Drawn | 340 | | | |
| | | | | 41 | | |
| Sept. | 12 | Drawn | 176 | | | |
| | | By | 176 | 40 | 7040 | |
| Oct. | 22 | Remitted | 120 | | | |
| | | By | 56 | 16 | 896 | |
| Nov. | 7 | Drawn | 100 | 286 | 22586 | 11960=5 per cent. |
| | | By | 156 | | 9568 | ſub. 2392=1 do. |
| | | | | | 7300)13018 | 9568=4 per cent. |

Balance due the Bank L.156
Intereſt due do. 1 15 8
Due do. L.157 15 8

L.1 15 8 intereſt.

1. What is the intereſt on a bill of L.320, due 25th March, of which L.110 was paid the 1ſt April, L.160 the 30th May, and the balance 15th July.

2. Borrowed L.1260 June 8th, and made the following partial payments: on the 30th Auguſt L.360, 11th November L.250, 18th January L.230, 19th March L.180. How much is the balance at Whitſunday including intereſt?

3. A bill of L.480 : 15 was due 20th September, of which L.48 : 17 was paid the 24th October, L.209 : 10 the 12th Nov. L.90 the 1ſt January, and the balance at Candlemaſs. Required the legal intereſt?

4. Required the intereſt on a bill of L.400, due on Tueſday 25th February, of which L.25 was paid every Tueſday following, till the whole was paid up?

5. Borrowed L.960 1ſt December, of which paid L.80 the firſt day of every ſucceeding month till the whole was paid up. How much legal intereſt is due?

6. Lent James Smith L.1000 per bill 20th October, and received the following payments: on the 10th January L.300, 18th March L.260, 11th June L.390, and on the 4th Auguſt received a new bill at 6 months date for the balance, including intereſt. Required the contents?

¶ 7. What intereſt at 5 per cent. is due on the following accompt, to 31ſt December.

Dr. A. Blair his accompt current with C. Dun, Cr.

| | | | | | |
|---|---|---|---|---|---|
| 1799. | May 15, To caſh | L.105 | 1799. | July 11, By caſh | L.180 |
| | June 1, To do. | 190 | | Aug. 7, By do. | 115 |
| | Sept. 14, To do. | 436 | | Nov. 19, By do. | 98 |
| | Oct. 18, To do. | 290 | | | |

8. How much intereſt is due on the following accompt.

Dr. Mr. E. Fulton his accompt current with G. Hill & Co. Cr.

| | | | | | |
|---|---|---|---|---|---|
| 1800. | Jan. 10, To caſh | L.160 | 1800. | April 21, By caſh | L.344 |
| | May 6, To do. | 148 | | July 25, By do. | 196 |
| | Aug. 31, To do. | 216 | | Sept. 17, By do. | 297 |
| | Oct. 9, To do. | 435 | | Nov. 28, By do. | 310 |

9. Required the intereſt on the following accompt to 1ſt May.

Dr. Meſſ. Iſaac Jones & Co. their accompt current with Ker and Lang, Cr.

| | | | | | |
|---|---|---|---|---|---|
| April | 8, To caſh | L.256 : 14 | June | 12, By caſh | L.325 : 8 |
| July | 19, To do. | 164 : 11 | Sept. | 16, By do. | 149 : 12 |
| Oct. | 2, To do. | 201 : 7 | Oct. | 22, By do. | 227 : 10 |
| Nov. | 30, To do. | 272 : 9 | Jan. | 18, By do. | 400 : 4 |
| March | 15, To do. | 240 : 15 | | | |

10. Required a ſtate of the following accompt to be ſettled at Martinmaſs 1801, allowing the legal intereſt?

Dr. Meſſ. Muir, Napier & Co. their accompt current with Orr and Park, Cr.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1799. | Nov. | 14, To bal. | L.126 | 1799. | Dec. | 4, By caſh | L.107 |
| 1800 | Jan. | 10, To caſh | 244 | 1800. | Jan. | 24, By do. | 202 |
| | March | 31, To do. | 373 | | March | 12, By do. | 634 |
| | April | 7, To do. | 428 | | May | 16, By do. | 467 |
| | July | 16, To do. | 612 | | June | 30, By do. | 39 |
| | Aug. | 20, To do. | 25 | | Aug. | 29, By do. | 46 |
| | Oct. | 21, To do. | 199 | | Sept. | 30, By do. | 84 |
| | | 30, To do. | 239 | | Octr. | 8, By do. | 241 |
| | Nov. | 1, To do. | 311 | | Nov. | 5, By do. | 615 |

¶ 11. My caſh accompt with the Thiſtle Bank for laſt year turned out as under.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| March | 24, | Drawn | L.200 | Feb. | 8, | Paid | L.1000 |
| April | 21, | do. | 400 | | 24, | do. | 160 |
| | 30, | do. | 646 | May | 19, | do. | 240 |
| June | 16, | do. | 500 | July | 20, | do. | 842 |
| Auguſt | 7, | do. | 10 | Oct. | 9, | do. | 130 |
| Sept. | 14, | do. | 650 | Nov. | 11, | do. | 410 |

Required the balance of principal and intereſt, to be ſettled 1ſt January, allowing the bank 5, and me 4 per cent. intereſt.

12. Required the balance of principal and intereſt due on the following caſh accompt.

Dr. Meſſrs. A. B. & Cos. caſh accompt with Bank of Scotland, Cr.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1799. | | | | 1799. | | | |
| Jan. | 1, To bal. at laſt ſettlement | | L.245 | Jan. | 8, By caſh paid | | L.190 |
| | 4, To caſh drawn | | 110 | | 20, By caſh | do. | 265 |
| | 15, To caſh | do. | 280 | Feb. | 7, By caſh | do. | 390 |
| | 26, To caſh | do. | 365 | | 21, By caſh | do. | 375 |
| Feb. | 19, To caſh | do. | 220 | | 28, By caſh | do. | 195 |
| | 27, To caſh | do. | 70 | March | 14, By caſh | do. | 120 |
| March | 9, To caſh | do. | 430 | | 26, By caſh | do. | 135 |
| | 20, To caſh | do. | 145 | April | 8, By caſh | do. | 375 |
| | 30, To caſh | do. | 480 | | 10, By caſh | do. | 160 |
| April | 18, To caſh | do. | 400 | May | 6, By caſh | do. | 540 |
| | 25, To caſh | do. | 175 | | 11, By caſh | do. | 245 |
| May | 1, To caſh | do. | 615 | | 21, By caſh | do. | 345 |
| | 16, To caſh | do. | 150 | | 26, By caſh | do. | 240 |
| June | 5, To caſh | do. | 960 | June | 18, By caſh | do. | 700 |
| | | | | July | 9, By caſh | do. | 150 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| June | 8, | To cash drawn | L.290 | July | 20, | By cash paid | L.165 |
| | 13, | To cash do. | 55 | | 31, | By cash do. | 650 |
| | 22, | To cash do. | 235 | Aug. | 13, | By cash do. | 465 |
| | 29, | To cash do. | 145 | | 20, | By cash do. | 170 |
| July | 1, | To cash do. | 400 | | 31, | By cash do. | 700 |
| | 25, | To cash do. | 185 | Sept. | 24, | By cash do. | 285 |
| Aug. | 5, | To cash do. | 700 | Oct. | 1, | By cash do. | 460 |
| Sept. | 8, | To cash do. | 390 | | 21, | By cash do. | 160 |
| | 16, | To cash do. | 190 | Nov. | 5, | By cash do. | 85 |
| | 30, | To cash do. | 340 | | 12, | By cash do. | 140 |
| Oct. | 9, | To cash do. | 895 | Dec. | 4, | By cash do. | 170 |
| | 28, | To cash do. | 185 | | 17, | By cash do. | 200 |
| Nov. | 18. | To cash do. | 360 | | 31, | By cash do. | 80 |
| | 30, | To cash do. | 195 | | | | |
| Dec. | 11, | To cash do. | 155 | | | | |
| | 24, | To cash do. | 180 | | | | |

Allowing the Bank 5, and A. B. & Co. 4 per cent., to be settled the 1st January, 1800?

## Sect. V. Merchants' Accompts.

In this section we are to give a specimen of Bills of Parcels, an Invoice and Accompt Sales, and to subjoin a few exercises for practice under each.

### I. *Bills of Parcels.*

Mr. William Edmond, Glasgow, 24th April, 1800

Bought of James Cochran,

| | | | | |
|---|---|---|---|---|
| Water Twist, N°. | 20, | 10 bundles at | 42s. 6d. | L.21 : 5 |
| | 23, | 12 do. | at 44s. 9d. | 26 : 17 |
| 6 months. credit. | | | | L.48 : 2 |

Mr. William Edmond, Glasgow, 19th May, 1800.

Bought of James Cochran,

| | | | | |
|---|---|---|---|---|
| Cording, N°. | 7, | 6 bundles at | 43s. | L.12 : 18 |
| | 10, | 8 do. | 44s. 6d. | 17 : 16 |
| | 13½, | 4 do. | 46s. 3d. | 9 : 5 |
| | | | | L.39 : 19 |

In making out accompt of goods formerly ſold, it is ſufficient to expreſs only the date and ſum of each bill, and to refer for particulars to the bill itſelf: when the accompt is ſettled a receipt is granted at the foot of it. An accompt for the above would be made out as follows:

Glaſgow,

Mr. William Edmund,

1800. Dr. to James Cochran,

| | | |
|---|---|---|
| April 27, | To cotton yarn as per invoice, | L.48 : 2 |
| May 19, | To do. do. | 39 : 19 |
| | | L.88 : 1 |

June 2, By your promiſory note at 6 months.

James Cochran.

Glaſgow, 20th June, 1800.

Mr. Peter Buchanan,

Bought of Gray & Downie,

| | | | | |
|---|---|---|---|---|
| 20 pieces, | 210 yds. | ⅝ Jaconet Muſlin at | 2s. 3½d. | L.24 : 1 : 3 |
| 16 do. | 168 do. | do. | 2s. 7¼d. | 21 : 17 : 6 |
| 10 do. | 10 dozen | ¾ check'd hkfs. at | 9s. 6d. | 4 : 15— |
| 3 do. | 3 dozen | yard wide do. | 10s. 9d. | 1 : 12 : 3 |
| | | | | L.52 : 6 |
| | | Diſcount, 5 per cent. for caſh | | 2 : 12 : 4 |
| | | | | L.49 : 13 : 8 |
| | | July 14, By caſh in full, | | 49 : 13 : 8 |

Gray & Downie.

I. Mancheſter, 11th March, 1800. Adam Wood, Bought of Robert Fullerton, 13 pieces muſlin, each 12 yards at 2s. 3¼d.; 5 pieces do. each 10 yards at 1s. 10½d.; 18 pieces, each 30 yards, printed cotton at 1s. 9¼d. per yard; 10 pieces linen, each 45½ yds. at 2s. 1d.; 10 pieces ſtriped calicoes qt. 450 yards at 1s. 9d.; 2 pieces ſcarlet, each 39½ yards, at 13s. 4d.; 15 pieces ribbon, 640 yards, at 5¼d.; 10 pieces do. 325 yards, at 7⅛d.; 8 pieces gauze, each 15½ yards, at 3s. 6d.; 1 piece, 37 yards, of figured cloth at 4s. 9d.; 6 ſilk umbrellas at 16s. 6d. each; 2 dozen cotton do. at 10s. 6d.; 3 muffs at 2½ guineas each; 5 do. at 19s.

II. Glaſgow, 19th July, 1800. Mr. A. Lindſay, To William Simpſon, to $3\frac{1}{2}$ gallons ſtrong gin at 14s. 9d. per gallon; 5 gallons do. at 10s. 6d.; $4\frac{1}{2}$ dozen old port wine at 32s. 6d. per dozen; $3\frac{1}{2}$ dozen ſherry at 35s.; $2\frac{1}{2}$ dozen Madeira at 51s.; and on the 11th Auguſt, 15 gallons ſtrong whiſky at 11s. 9d. per gallon; 19 gallons common do. at 6s. 6d.; 13 gallons French brandy at 14s. 6d.; 5 dozen claret at 37s. 6d.; 19 gallons Jamaica rum at 13s. 9d. The accompt to be ſettled, by ready money, 1ſt September, and a diſcount of 5 per cent. to be allowed.

III. Glaſgow, 20th May, 1800. Mr. John Armſtrong, Bought of Murray & Wilſon: $1\frac{1}{16}$ yards French blue cloth at 24s. per yd.; $1\frac{1}{2}$ dozen faney ſteel buttons at 3s. per dozen; $\frac{1}{2}$ dozen ſmall do. at 1s. per dozen; $18\frac{3}{8}$ yards broad India Nankeen at 3s. per yard; $\frac{7}{16}$ yard of black Genoa velvet at 18s. per yard. On the 2d. June, 3 pair of ſilk hoſe at 18s. each pair; 35 yards of fine holland at 3s. 9d. per yard; $1\frac{7}{8}$ yards of herſeymere at 12s. 6d. per yard; 1 piece of Iriſh linen qt. 49 yards at 2s. 10d. per yd.; and on the 31ſt July, $3\frac{1}{2}$ yards fine black cloth at 21s. per yd.; $2\frac{1}{2}$ yards callico at 1s. 6d. per yd.; $\frac{3}{8}$ yard queens crape at 2s. per yd.; 3 pair of mens fine black worſted hoſe at 7s. each pair; $\frac{1}{2}$ yard of Ruſſia duck at 1s. 10d. per yd.; a patent hat at 26s. A diſcount of $7\frac{1}{2}$ per cent. allowed for ready money.

IV. Liverpool, 11th November. Mr. James Scott, Bought of Henry Robinſon & Co. 3 caſks Havannah brown ſugar, N°. 1 qt. 14 cwt. 1 qr. 10 lb., tare 3 qr. 19 lb.; N°. 2 and 3 each 13 cwt. 3 qr. 25 lb., tare of each 2 qr. 27 lb. at 56s. per cwt.; 4 caſks do. yellow, N°. 4, 12 cwt. 2 qr., tare 2 qr. 10 lb.; N°. 5, 14 cwt. 17 lb. tare 3 qr. 3 lb.; N°. 6, 13 cwt. 3 qr. 22 lb., tare 3 qr. 12 lb.; N°. 7, 14 cwt. 1 qr., tare 3 qr. 15 lb. at 63s. per cwt., and 3 caſks do. white, N°. 8, 9 & 10, each 13 c. 2 qr. 20 lb., tare of each 3 q. 7 lb.; 5 caſks Muſcovado brown ſugar, N°. 11 qt. 12 c. 1 qr. 23 lb., tare 2 qr. 26 lb.; N°. 12, 13 cwt. 2 qr., tare 3 qr. 6 lb.; N°. 14, 13 c. 15 lb., tare 3 qr.; N°. 15 and 14 each, 12 cwt. 3 qr. 12 lb.; tare of each 2 qr. 24 lb.; N°. 16, 13 cwt. 1 qr. 18 lb., tare 3 qr. 9 lb. at 84s. per cwt.; 2 boxes coffee, N°. 1, qt. 2 cwt. 1 qr. 15 lb.; N°. 2, 2 cwt. 2 qr. 26 lb., tare 38 lb. per box, at 1s. 10d. per lb.; 1000 oranges at $\frac{1}{2}$d. each, and 120 lemons at $\frac{3}{4}$d.

V. Mr. Charles Rollin, Bought of Gilbert Sword & Co., Auguſt 12th, 1799, 5 caſks double flooring nails containing 25 thouſand, at 7s. 6d. per M.; 8 caſks ſingle do. cont. 36 M. at 5s. 9d.; 1 caſk taſk tacks cont. 32 M. at 1s. 9d.; 9 dozen pair of hinges at 10s. 6d. per dozen; 18 large locks at 3s. 6d. each; 2 dozen ſmall do. at 2s. 6d.; 2 chimneys each 3 ſtone 10 lb. at $8\frac{1}{4}$d. per lb.; 3 Car-

ron grates at 17s. 6d. each; and 6 do. at 12s.; 7 ſets of tongs and pockers at 5s. 9d. each ſet; a jack at 2 guineas; 180 lb. German ſteel at 11½d.; 19 bars iron wt. 13 cwt. 2 qr. 8 lb. at 2⅛d. per lb.; 4 dozen ſpades at 2s. 3d. each; and 1½ dozen hammers at 6s. 9d. per dozen. A bill for the value including 3 months intereſt, was granted at 6 months date.

VI. London, 31ſt October, 1800. Samuel Solomon, Eſq. Bought of David Walker, a ſilver punch bowl weighing 2 lb. 4 oz. 12 dwt. at 5s. 10d. per oz.; half a dozen decanters, each weighing 11oz. 6dwt. 18grs. at 6s. per oz.; 3 tea pots each 1lb. 9oz. 10grs. at 5s. 3d. per oz.; 3 dozen ſpoons, weighing each 2 oz. 5 dwt.; and 2 dozen ſmall ditto, weighing each 13 dwt. 12 grs. at 5s. 6d.; 6 pieces of plate, N°. 1, weighing 11 oz. 15 grs.; N°. 2, 1 lb. 2 oz. 18 grs.; N°. 3, 1 lb. 5 oz. 10 dwt; N°. 4, 10 oz. 4 dwt. 8 grs.; N°. 5, 8 oz. 18 dwt. 20 grs.; N°. 6. 1 lb. 1 oz. 10 grs. at 5s. per oz. To be ſettled 1ſt November, by a bill payable in 4 months.

VII. Leith, 3d November, 1798. Meſſrs. James Dixon & Co. Bought of Nimmo & Bannerman: 175 buſhels wheat at 5s. 6d.; 162 bolls 2 firlots 3 pecks do. at 25s. 6d. per boll; 184 bolls 3 pecks barley at 18s. 9d. per boll; 15 quarters 7 buſhels oats at 3s. 2d. per buſhel; 199¾ bolls do. at 16s. 8d. per boll; 480 buſhels India corn at 4s. 3d. per buſhel: on the 7th, 12 qrs. 5 buſhels peaſe at 2s. 9d. per buſhel; 125½ bolls ditto at 15s. per boll; 168 barrels American flour at 54s. 6d. per barrel. On the 25th, 9 qrs. 3 buſhels beans at 2s. 6d. per buſhel; 364 bolls 2 fir. 3 pecks do. at 15s. per boll; 35¼ cwt. of ſplit peaſe at 28s. per cwt. and 64½ cwt. of ſplit beans at 24s. 6d. per cwt., and 320 lb. rice at 8½d. per lb. A diſcount of 2½ per cent. to be allowed for a bill granted at 3 months date.

VIII. Glaſgow, 14th Dec. 1799. Robert Gentle, Eſq. To John Wright, to 151 yards 5 feet of roofing and ſarking at 7s. 6d. per yard; 99 yards 4 feet of bare joiſting at couple legs at 2s.; 2 floors and joiſts containing 191 yds. 3 feet at 7s.; lead and rudge 45 feet at 1s. 3d. per foot; 3 ceilings lath'd cont. 280 yards at 9d.; 2 croſs partitions double lath'd and ſtandards, 62 yards 2 feet at 2s. 3d; 11 windows 286 feet, 2 ditto 24 feet, all at 2s. per foot; 3 doors, 7 yards at 8s; 3 door frames at 5s. 6d. each; a wooden ſtair with 16 ſteps at 3s. 6d.; 11 pair of ſhutters, 25 yards 1 foot 6 inches; 2 ditto, 2 yards 2 feet 9 inches at 6s. 6d. per yard; ſcaffolds, treſſes and gangways, L.2 : 15. What is the amount?

## II. Specimen of an Invoice.

Invoice of goods ſhipped by Scruton and Campbell, per the Induſtry, John Kincaid maſter, from London to Grangemouth, for account and riſk of Mr. William Millar. Glaſgow.

7 caſks madder. N°. 1, a 7.

Draught 4 lb. per caſk; tare 10 lb. per cwt.

marked W. M. G.

| | Cwt. | qr. | lb. | | Cwt. | qr. | lb. | |
|---|---|---|---|---|---|---|---|---|
| N°. 4. | 9 | 1 | 14 | N°. 1. | 11 | 1 | 24 | |
| 5. | 10 | 2 | 22 | 2. | 8 | 3 | 20 | |
| 6. | 7 | 3 | 24 | 3. | 13 | 2 | 6 | |
| 7. | 12 | 2 | 25 | | | | | |
| | 40 | 3 | 1 | | 33 | 3 | 22 | |
| Draft, | | | 16 | Draft, | | | 12 | |
| | 40 | 2 | 13 | | 33 | 3 | 10 | |
| Tare, | 3 | 2 | 14 | Tare, | 3 | 0 | 3 | |
| | 36 | 3 | 27 | at 84s. | 30 | 3 | 7 | at 80s. L.123 : 5 : 0 |
| | | | | | | | | 155 : 7 : 3 |

12 boxes Indigo. N°. 1 a 12.

| | | | | | | |
|---|---|---|---|---|---|---|
| N°. 1. | 78 lb. | N°. 6. | 81 lb. | N°. 10. | 89 lb. | |
| 2. | 75 | 7. | 84 | 11. | 83 | |
| 3. | 74 | 8. | 77 | 12. | 86 | |
| 4. | 82 | 9. | 85 | | | |
| 5. | 76 | | | | 258 at 4s. 3d. | 54 : 16 : 6 |
| | 385 lb. nett at 2s. 9d. | | 327 at 3s. 6d. | | | 57 : 4 : 6 |
| | | | | | | 52 : 18 : 9 |

Charges.

| | | |
|---|---|---|
| Loading, | L.— : 6 : 8 | |
| Cartage, | 14 : 6 | |
| Wharfage, &c. | 7 : 2 | |
| Poſtage, | 3 : 10 | 1 : 12 : 2 |
| | | 445 : 4 : 2 |
| Commiſſion on L.445 : 4 : 2 at 2 per cent. | | 8 : 18 : 1 |
| | | L.454 : 2 : 3 |

Errors excepted.

London, 12th Dec. 1800.

Scruton & Campbell.

I. Invoice of two bales cotton yarn from Robert Stewart & Co., Mancheſter, purchaſed by an order, and for account of James Cochran, Glaſgow—forwarded by Scott's carts, 13th March, 1799.

Bale, N°. 1. Mule Weft, N°. 44, 5 lb. at 4s. 2d. per lb.; N°. 48, 10 lb. at 4s. 4d.; N°. 50, 15 lb. at 4s. 5d.; N°. 52, 25 lb. at 4s. 6d.; N°. 54, 20 lb. at 4s. 7d.; N°. 56, 5 lb. at 4s. 8d; N°. 60, 10 lb. at 4s. 10d.; N°. 62, 50 lb. at 4s. 11d; N°. 64, 35 lb. at 5s.; N°. 66, 15 lb. at 5s. 1½d.; N°. 70, 18 lb. at 5s. 3d. Bale, N°. Mule Twiſt, N°. 40, 12 lb. at 5s. ½d.; N°. 43, 17lb. at 5s. 2d¾.; N°. 44, 36 lb. at 5s. 3½d.; N°. 46, 10 lb. at 5s. 5¼d. N°. 47, 25 lb. at 5s. 6d.; N°. 49, 18 lb. at 5s. 7½d.; N°. 51, 24 lb. at 5s 8d.; N°. 52, 40 lb. at 5s. 9d.; N°. 55, 30 lb. at 6s. ½d.; N°. 56, 20 lb. at 6s. 1d.; N°. 59, 12 lb. at 6s. 4½d.; N°. 60 28 lb. at 6s. 5½d.; N°. 61, 32 lb. at 6s. 6¼d.; N°. 65, 19 lb. at 6s. 9¾d.; N°. 67, 18 lb. at 6s. 11½d.; papering, 7s. 9d; packing, 3s. 4d.; ſheets and ropes, 19s. 6d. Commiſſion, 2½ per cent.

II. Greenock, 1ſt September, 1798. Invoice of ſundries, ſhipped on board the Charlotte, captain John Bruce, bound for Dantzick, conſigned to James Hardy & Co. agents there, to ſell on my accompt as under, viz. 190½ cwt. pig lead at 3¼d. per lb.; 153¼ cwt. ſheet do. at 3¼d.; 136½ cwt. of allum at 22s. 6d.; 350 cwt. of hops at 78s. 4d.; 1260 buſhels malt at 5s. 6d.; 1550 lb. tanned leather at 8¼d.; 2 bales woollen cloth, N°. 1. qt. 3 pieces ſerge, each 49½ yards at 3s. 6d.; 5 pieces brown cloth, each 52 yards at 9s. 6d.; 9 pieces drab, each 32 yards at 3s. 3½d.; N°. 2 qt. 7 pieces blue, 295 yards at 12s. 9d.; 6 pieces grey, 230 yards at 13s. 4d.; 4 pieces mixt, 186 yards at 7s. 6d. One box ſtockings, qt. 7 doz. pairs worſted at 2s. 9d. per pair; 10 dozen of thread do. at 3s. 2d.; 8 dozen of ſilk do. at 14s. 6d.; 9 dozen of cotton do. at 4s. 9d; 27 crates earthen-ware, at 4½ guineas each. One box hardware qt. 184 razors at 1s. 1½d.; 84 do. at 1s 6d.; 30½ dozen pen-knives at 10½d.; 6 dozen at 1s. 9d.; 45 ſets of buckles at 1s. 2d.; 35 do. at 2s. 9d.; 3 dozen of locks at 1s. 3d.; 4 dozen do. at 2s. 9d.; 15 M. nails at 8s. 4d.; 25 dozen pair of hinges at 7s. 6d.; 5 doz. patent ſcrews at 21s. 8 dozen common do. at 7s. 8d.; 9 boxes of glaſs, value L.7:18:4 each; 2 bales ſail-cloth, N°. 1, qt. 8 ps. 316 yards at 11⅛d. 13 pieces, 540 yards at 12⅓d.; N°. 2, qt. 5 pieces, 235 yards at 13¾d.; 9 pieces, 427 yards at 13¾d.; 186 lb. of cinnamon at 14s. 3d.; 54 cwt. of ginger at 7d. per lb.; cartage, &c. 19s. 6d. wharfage 11s. 9d.; charges at ſhipping 8s. 10d.

III. Invoice of goods ſhipped by Robert Sanderſon & Co. on the 19th October, 1800, per the Betſey, Duncan M'Iver, maſter, from Leith to Liverpool, for account and riſk of R. & W. Graham.

10 bags Sea Iſland Georgia cotton, marked R. G. N°. 1, wg.

3 cwt. 1 qr. 4 lb.; N°. 2, 3 cwt. 2 qr.; N°. 3, 2 cwt. 3 qr. 24 lb.; N°. 4, 3 cwt. 15 lb.; N°. 5, 2 cwt. 3 qr. 12 lb.; N°. 6, 2 cwt. 3 qr.; N°. 7, 2 cwt. 2 qr. 25 lb.; N°. 8, 3 cwt. 1 qr. 16 lb; N°. 9, 2 cwt. 3 qr. 17 lb.; N°. 10, 3 cwt. 4 lb. draught 1 lb. per bag, tare 2½ lb. per 100, at 2s. 5½d. per lb.;—15 bags Demerara cotton, marked R. & W. G; N°. 1, 2 cwt. 1 qr. 10 lb.; N°. 2, 2 cwt. 3 qr. 9 lb.; N°. 3, 2 cwt. 2 qr. 18 lb.; N°. 4, 3 cwt. 1 qr. 3 lb.; N°. 5, 2 cwt. 1 qr. 25 lb.; N°. 6, 1 cwt. 2 qr. 23 lb.; N°. 7, 2 c. 3 qr. 20 lb.; N°. 8, 3 cwt. 1 qr.; N°. 9, 2 cwt. 2 qr. 17 lb.; N°. 10, 2 cwt. 1 qr. 3 lb.; N°. 11, 2 cwt. 3 qr. 8 lb.; N°. 12. 3 cwt. 19 lb.; N°. 13, 2 cwt. 1 qr. 6 lb.; N°. 14, 1 cwt. 3 qr. 27 lb.; N°. 15, 2 cwt. 2 qr. 5 lb. draught as before, tare 4 lb. per cwt. at 2s. 3¼d. per lb.; 50 barrels of pot-aſh weighing 166 cwt. 1 qr. 4 lb., tare 14 lb. per cwt. at 45s. 9d. per cwt.; 38 barrels pearl do. wg. 125 cwt. 2 qr. 12 lb., tare 12 lb. per cwt. at 56s.; 25 tons logwood at 16 guineas per ton; porterage, 7s.6d.; cartage, 22s. 9d.; ſhipping charges, 6s. 8d. Commiſſion, 1¼ per cent.

IV. The following goods were purchaſed on commiſſion by Stirling & Gordon of Glaſgow, for Benjamin Maurice and Co. Savannah, and ſhipped on board the Lydia, George Gibb, maſter; 13th March, 1800.

2 boxes of muſlins from Wm. Monteith, N°. 1, qt. 16 pieces 6/4 jaconet lappet, 168 yards at 2s. 4½d.; 11 pieces do. 115 yards at 2s. 11¼d.; 9 pieces tambour'd 7/8 jaconet, 95 yards at 3s. 7½d.; N°. 2, 13 pieces 6/4 plain jaconet, 140 yards at 3s. 2d.; 80 dozen and 7, yard wide plain hkfs. at 17s. 6d. per dozen, 5 per cent. diſcount for bill at 3 months:—2 bales linen from John Jamieſon & Co. N°. 1, qt. 25 pieces Scotch linen, 970 yards at 1s. 10½d.; 12 pieces do. 542 yards at 2s. 6d.; 19 pieces do. 835 yards at 2s. 10d.; N°. 2, 30 pieces Iriſh linen, 1760 yards at 1s. 8¼d.; 15 pieces do. 734 yds. at 2s. 3d.; 17 ps. do. 846 yds. at 2s. 5½d.; 5 per cent. diſcount for ready money:—one bale Oſnaburgs from Rt. Watſon, qt. 14 pieces, 1640 yards at 9 5/12d.; 17 pieces 1950 yards at 9⅛d. at 6 months credit:—from Alex. Rodger, 84 pieces cotton pack-ſheet, 5610 yards; at 8 3/12d.; 42 pieces do. 3540 yards at 7½d. from John Wilſon & Co. 19 dozen of Aberdeen yard wide ſhawls at 15s. 6d. per dozen; 11 dozen 7/8 do. at 18s. 9d. bill at 6 months date:—from Finlay & Burns, 17 pieces 7/8 Glaſgow calicoes, 276 yards at 13¾d; 14 pieces yard wide ditto, 225 yards at 1s. 4d.: 4 per cent. diſcount for bill at 3 months date:—S. and G. paid all charges, viz. porterage, 2s. 9d.; cartage to the Broomielaw, 6s. 6d.; freight down the river, L.1 : 7 : 6; cuſtom-houſe dues at Greenock, 13s. 8d.; charges at ſhipping, 5s. 10d.; commiſſion, 3½ per cent.; inſurance on L.1260 at 5 guineas per cent.; policy 19s. Required the bills of parcels with the receipts and invoice?

## III. Accompt Sales.

Accompt ſales of 133 bundles cotton yarn for account of Mr. James Henderſon, Glaſgow.

1798.

| | | | | | |
|---|---|---|---|---|---|
| Aug. 24. | Water twiſt, No. 32, | 5 bdls. a 50s. | L. 12 : 10 | | |
| | 33, | 18 do. 52s. | 46 : 16 | | |
| | 36, | 17 do. 58s. | 49 : 6 | | |
| | | | 108 : 12 | | |
| | Diſcount 10 per cent. | | 10 : 17 : 2 | | |
| | | | | 97 : 14 : 10 | |
| Sept. 4. | Ditto, No. 30, | 16 bdls. a 48s. | L. 38 : 8 | | |
| | 31, | 13 do. 49s. | 31 : 17 | | |
| | 32, | 15 do. 50s. | 37 : 10 | | |
| | 34, | 17 do. 54s. | 45 : 18 | | |
| | | | 153 : 13 | | |
| | Diſcount, 12½ per cent. | | 19 : 4 : 2 | | |
| | | | | 184 : 8 : 10 | |
| 10. | Ditto, No. 35, | 12 bdls. a 56s. | L. 33 : 12 | | |
| | 36, | 9 do. 58s. | 26 : 2 | | |
| | 37, | 11 do. 60s. | 33 : 0 | | |
| | 133 | | 92 : 14 | | |
| | Diſcount, 15 per cent. | | 11 : 11 : 9 | | |
| | | | | 81 : 2 : 3 | |
| | | | | | L. 313 : 5 : 11 |

Charges.

| | | |
|---|---|---|
| Odd pence not received here, | L. 0 : 1 : 11 | |
| Damage allowed on the parcel ſold 4th September. | 0 : 8 : 9 | |
| Carriage from Glaſgow, - - - - - | 6 : 9 : 6 | |
| Commiſſion & Guarantee 5 p. cent. | 15 : 13 : 3 | |
| | | 22 : 13 : 5 |
| Nett proceeds to the Cr. of Mr. J. Henderſon, | | L. 290 : 12 : 6 |

Mancheſter, 11th September, 1798.
Errors excepted.

Robert Stewart & Co.

I. The following 5 bales Oſnaburghs per the Bell, was conſigned by Walter Jobſon of Dundee to John Campbell & Co. agents, London, and ſold as under, viz.

Jan. 13, 5 pieces lint Oſnaburghs, qt. N°. 1, 128 yards;—3, 116;—5, 142;—8, 114;—9, 126 at 9$\frac{11}{12}$d. per yard.

Jan. 25, 4 pieces tow ditto, qt. N°. 1, 125 yards;—2, 118;—3, 136;—4, 113, at 8$\frac{1}{2}$d. per yard.

Feb. 6. 12 pieces lint ditto, qt. N°. 2, 115 yards;—4, 112;—6, 134;—7, 106;—10, 114;—11, 100;—12, 109; 13, 105;—14, 122;—15, 114;—16, 108; 17, 112 at 9$\frac{1}{4}$d. per yard.

Feb. 11, 6 pieces tow ditto, qt. N°. 5, 110 yards;—6, 114;—7, 120;—8, 124;—9, 108;—10, 132 at 8$\frac{1}{8}$d. per yard.

Charges.—Freight from Dundee, L.3 : 14 : 10; wharfage 5s. 6d.; carriage to ware-houſe, 3s. 8d.; poſtage 2s. 4d.; commiſſion and riſk of recovering the debts, 5 per cent.

II. A cargo of 1000 buſhels barley, and 350 buſhels oats, ſent per the Brig Mary, by Alex. Williamſon, Ayr, to John & Andrew Buckſton of Lancaſter, was ſold as under.

Oct. 10, Daniel Young, 125 buſhels oats at 4s.
17, Allan Kay, 275 buſhels barley at 6s.
19, Thomas Edwards, 164 buſhels barley at 6s. 6d.
27, James Maxwell, 130 buſhels oats at 4s. 3d.
Nov. 14, For ready money, 196 buſhels barley at 6s.
20, Joſeph Green, 93 buſhels oats at 4s. 6d.
27, John Thompſon, 192 buſhels barley at 7s.
29, Andrew Couper, 173 buſhels do. at 7s.

The oats lacked 2 bolls. Charges, viz. freight of 1350 buſhels a t2$\frac{1}{4}$d.; cartage to the granary, 9s. 6d.; ſhore dues, 18s. 4d.; cuſtom-houſe dues, 10s. 8d.; mettage L.1 : 7 : 6; granary rent, 15s. commiſſion, 3 per cent.

III. Robert Gemmill & Co. received 19 bags cotton per the Thiſtle, Geo. Adam's, maſter, from Greenock, to ſell on account and riſk of William & Thomas Robertſon, merchants there.

1800. May 15, William Ferguſon, 4 bags common W. India cotton N°. 1, 2 cwt. 1 qr. 10 lb.; N°. 2, 1 cwt. 3 qr. 22 lb.; N°. 3, 1 cwt. 2 qr. 15 lb.; N°. 4, 2 cwt. 2 qr. 19 lb; draught 1 lb. per bag, tare 5 lb. per cwt. at 2s. 1d. per lb.

19. John Simpſon, 2 bags ditto, N°. 5, 1 cwt. 3 qr. 23 lb.; N°. 6, 2 cwt. 2 qrs. 15 lb.; draught and tare as before, at 2s. 1$\frac{3}{4}$d.

26. Henry Irvine, 3 bags Pernambucca cotton, N°. 7, 1 cwt. 1 qr. 4 lb.; N°. 8, 1 cwt. 2 qr. 12 lb; N°. 9, 1 cwt. 3 qr. 26 lb., draught as above, tare 2$\frac{1}{2}$ lb. per 100, at 2s. 5$\frac{1}{2}$d.

June 3. Jonathan Pollard, 6 bags Pernambucca cotton, N°. 10, 1 cwt. 1 qr. 13 lb.; N°. 11, 1 cwt. 2 qr. 7 lb.; N°. 12, 1 cwt. 1 qr.; N°. 13, 1 cwt. 2 qrs. 19 lb.; N°. 14, 1 cwt. 17 lb.; N°. 15, 2 cwt. 1 qr. 21 lb.; draught and tare as above, at 2s. $7\frac{1}{4}$d.

10. Forbes & Bell, 4 bags ditto, N°. 16, 1 cwt. 2 qr. 14 lb.; N°. 17, 1 cwt. 2 qr.; N°. 18, 1 cwt. 2 qr. 8 lb.; N°. 19, 1 cwt. 2 qr. 20 lb.; N°. 20, 1 cwt. 2 qr.; draught and tare as above, damage on N°. 17, 3 lb; at 2s. $6\frac{1}{4}$d. Charges, viz. freight from Greenock, L.3 : 14 : 5 ; towns duty, 5s. 9d.; mending bags and canvas, 7s. 3d.; cartage to weigh-houſe, 3s. 6d.; weighing and delivering, 2s. 8d.; cellar rent, 7s. 6d.; poſtages, 2s. 9d.; commiſſion, 1 per cent.

# CHAP. VIII.

## VULGAR FRACTIONS.

### INTRODUCTION.

AS the idea of numbers is acquired by obſerving ſeveral objects collected, ſo that of fractions by obſerving an object divided into ſeveral parts; to underſtand, therefore, the nature of fractions, we muſt ſuppoſe a unit, or any thing conſidered as a whole, divided into ſeveral equal parts, one or more of theſe parts is called a fraction, and is expreſſed by two numbers; one placed above a line, the other below it: for example, three fourth parts is a fraction and written thus $\frac{3}{4}$. The number [4] under the line is called the DENOMINATOR, and ſhews into how many parts the unit is divided; the number [3] above the line is called the NUMERATOR, and ſhews how many of theſe parts are expreſſed.

And becauſe the whole is always equal to the ſum of its parts, the value of a fraction becomes greater, when the numerator is increaſed, and leſs, when the denominator is increaſed. Hence it follows, that if both terms be multiplied by the ſame number, or divided by any number which meaſures both, the fraction obtained is ſtill of equal value. Thus $\frac{2}{4}$, both terms multiplied by 2 produces $\frac{4}{8}$, and divided by 4, gives $\frac{1}{2}$, which is of the ſame value as $\frac{2}{4}$. On this principle moſt of the following problems depend.

A fraction having one numerator and denominator as $\frac{3}{4}$, is called a SIMPLE FRACTION. A fraction of a fraction, as $\frac{2}{3}$ of $\frac{3}{4}$, is called a COMPOUND FRACTION. An integer with a fraction annexed, as $3\frac{3}{4}$ is called a MIXT NUMBER *. A fraction whoſe numerator is greater than its denominator, as $\frac{15}{4}$ is called an IMPROPER FRACTION.

* See page 1, Def. 3d.

Integers may be written or underſtood to be written in the form of vulgar fractions whoſe numerator is 1; for example, 5 may be expreſſed by $\frac{5}{1}$. As fractions can, in moſt caſes, be neither added nor ſubtracted, till they be reduced, it is proper to begin with reduction.

## Sect. I. Reduction of Vulgar Fractions.

*Problem* I. *To reduce mixt numbers to improper fractions, multiply the integer by the denominator of the fraction, and to the product add the numerator, under which ſum place the given denominator.*

Ex. Red. $3\frac{1}{4}$ to an improper fraction? $3 \times 4 = 12$
add the numerator, 1
numerator required, 13
given denominator, 4

1. Red. $5\frac{2}{3}$
2. —— $7\frac{3}{5}$
3. —— $8\frac{1}{2}$
4. —— $13\frac{5}{7}$
5. —— $19\frac{1}{4}$
6. Red. $21\frac{8}{11}$
7. —— $28\frac{5}{6}$
8. —— $35\frac{7}{8}$
9. —— $46\frac{13}{27}$
10. —— $97\frac{11}{14}$

Theſe examples are reverſed by thoſe in next problem.

As every integer is equal to twice as many halves, or four times as many quarters, and ſo on; therefore, every integer may be written in the form of an improper fraction, having any given denominator: the numerator is found by multiplying the integer into the denominator: thus in the above example, 3 reduced to an improper fraction whoſe denominator is 4, makes $\frac{12}{4}$ and $\frac{1}{4}$ added to this, $\frac{13}{4}$ as above.

*Problem* II. *To reduce improper fractions to whole or mixt numbers; divide the numerator by the denominator.*

Ex. Red. $\frac{13}{4}$ to a whole or mixt number.

$$\begin{array}{r|l} 4 & 13 \\ & 12 \\ \hline & 1 \end{array} \quad 3\frac{1}{4}$$

1. Red. $\frac{17}{3}$
2. —— $\frac{38}{5}$
3. —— $\frac{17}{2}$
4. —— $\frac{96}{7}$
5. —— $\frac{77}{4}$
6. Red. $\frac{239}{11}$
7. —— $\frac{173}{6}$
8. —— $\frac{287}{8}$
9. —— $\frac{1255}{27}$
10. —— $\frac{1175}{12}$

This problem being the reverſe of the former, the reaſon of the one may be inferred from that of the other.

*Problem* III. *To reduce fractions to their loweſt terms: divide both numerator and denominator by their greateſt common meaſure, which is found thus: divide the greater term by the leſs, and the diviſor by the remainder continually, till nothing remain. The laſt diviſor is the greateſt common meaſure.*

Ex. Red. $\frac{540}{612}$ to is loweſt terms.

540)612(1
540
72)540(7
504
36)72(2
72

Then to reduce $\frac{540}{612}$ to the loweſt poſſible terms we divide both terms by 36, and it gives $\frac{15}{17}$. If the laſt diviſor had been 1, the fraction is already in the loweſt terms.

1. Red. $\frac{144}{162} = \frac{8}{9}$
2. —— $\frac{343}{490} = \frac{7}{10}$
3. —— $\frac{242}{286} = \frac{11}{13}$
4. Red. $\frac{182}{196} = \frac{13}{14}$
5. —— $\frac{273}{299} = \frac{21}{23}$
6. —— $\frac{714}{1071} = \frac{54}{99}$

That by dividing both the numerator and denominator by the ſame number, we obtain another of equal value is evident. And if theſe diviſions be performed as often as can be done, the laſt diviſor will be the greateſt common meaſure, which may be ſhewn from the above example. For any number which meaſures 612, and 540, will alſo meaſure 72 their difference, and 504 which is a multiple of 72 (being 72 × 7) and any number which meaſures 540, and 504, will alſo meaſure their difference 36, conſequently, no number greater than 36, can meaſure 612, and 540. Again, 36 will meaſure them both, for it meaſures 72, and therefore meaſures 504, and 540 (or 504 + 36) and becauſe it meaſures 540 and 72 it will alſo meaſure 612 their ſum; and the ſame will apply to any other numbers.

As the above method of reducing fractions to their loweſt terms is rather inconvenient in practice, we may therefore in general divide by ſuch numbers as are found to anſwer on inſpection: To facilitate which we obſerve,

1ſt, Any number whoſe unit's place is 2, 4, 6, 8 or 0, is meaſured by 2.

2d, Any number whoſe unit's place is 5, or 0, is meaſured by 5.

3d, Any number whoſe figures when added, amount to an even number of 3's and 9's, is meaſured by 3 or 9 reſpectively.

*PROBLEM* IV. *To reduce fractions to others of equal value, that have the ſame denominator, multiply each numerator into all the denominators except its own, for a numerator, and multiply all the denominators together for a common denominator.*

Ex. Red. $\frac{2}{3}$, $\frac{5}{6}$ and $\frac{7}{8}$ to a common denominator.

2 × 6 × 8 = 96 the new numerator for $\frac{2}{3} = \frac{96}{144}$
5 × 3 × 8 = 120 the new numerator for $\frac{5}{6} = \frac{120}{144}$
7 × 3 × 6 = 126 the new numerator for $\frac{7}{8} = \frac{126}{144}$
3 × 6 × 8 = 144 the common denominator.

or $\frac{16}{24}$ ÷6 $\frac{20}{24}$ $\frac{21}{24}$

By placing the numbers properly under one another, it will be ſeen that both terms of each fraction are multiplied by the ſame number, and therefore their value is not altered. Thus in the above example.

$$\frac{1|\times 6\times 8}{3|\times 6\times 8} \qquad \frac{1|\times 3\times 8}{3|\times 3\times 8} \qquad \frac{7|\times 3\times 6}{8|\times 3+6}$$

The lower that fractions are reduced the better is their value apprehended, and the more ſimple and eaſy will any operation be, wherefore, after the fractions are reduced to a common denominator, if the ſeveral numerators and denominators be meaſured by the ſame number, divide by that number, and write the quotients inſtead of the original terms. In the above example all the terms are meaſured by 6.

1. Red. $\frac{3}{4}, \frac{2}{5}, \frac{5}{7} = \frac{105}{140}, \frac{56}{140}, \frac{100}{140}$.
2. —— $\frac{5}{8}, \frac{8}{9}, \frac{7}{10} = \frac{225}{360}, \frac{320}{360}, \frac{252}{360}$
3. —— $\frac{1}{3}, \frac{2}{5}, \frac{5}{8} = \frac{40}{120}, \frac{48}{120}, \frac{75}{120}$
4. —— $\frac{5}{11}, \frac{6}{13}, \frac{2}{7} = \frac{455}{1001}, \frac{462}{1001}, \frac{286}{1001}$

*PROBLEM* V. *To reduce lower denominations to fractions of higher, place the given number for the numerator, and the value of the higher for the denominator.*

If the given quantity be in more denominations than one, reduce it to the loweſt for the denominator. See Ex. 2d.

If a fraction be given, multiply its denominator by the value of the higher denomination. See Ex. 3d.

If a mixt number be given reduce it to an improper fraction. See Ex. 4th.

Ex. 1ſt, Red. 7d. to the fraction of a ſhilling. 7d. $= \frac{7}{12}$ Anſ.

Ex. 2d, Red. 16s. 5d. to the fraction of a pound.

16s. 5d. $\times$ 12
20s. $\times$ 12 $= \frac{197}{240}$ Anſ.

Ex. 3d, Red. $\frac{5}{6}$ of one penny to the fraction of a pound.

$\frac{5}{6} = \frac{5}{6}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{5}{1440}$ or $\frac{1}{288}$.

Ex. 4th, Red. $4\frac{3}{5}$d. to the fraction of a pound.

$4\frac{3}{5}$d. $= \frac{23}{5}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{23}{1200}$.

In example 2d, we reduce 16s. 5d. to 197 pence for the numerator. In example 3d. we multiply the denominator 6 by 12 and 20, or 240 the value of a pound, and the product 1440 is the denomination required, or when reduced to its loweſt terms 288. In example 4th we reduce $4\frac{3}{5}$d. to an improper fraction by problem I. and proceed as before. The following examples are the reverſe of thoſe in next problem: we have expreſſed the anſwer in its loweſt terms.

Reduce as follows:

1. 5d. to the fraction of a ſh.
2. 11d. —— of a L.
3. 12s. 4d. —— of a do.
4. 17s $8\frac{1}{2}$d. —— of a do.
5. $\frac{6}{7}$ of 1d. —— of a ſh.
6. $\frac{7}{8}$ of 1d. —— of a L.
7. 9 dwt. 18 gr. — of a lb.
8. 3 oz. $10\frac{2}{3}$ drs. — of a lb.
9. 2 qr. 16 lb. —— of a cwt.
10. 5 ſtone —— of a laſt
11. 3 qr. 21 lb. —— of a ton
12. 12 gal. wine —— of a tun
13. $2\frac{3}{4}$d. to the fraction of a ſh.
14. $6\frac{2}{3}$d. —— of a L.
15. 3 qr. $15\frac{5}{9}$ lb. —— of 1 cwt.
16. $3\frac{1}{3}$ inches —— of a foot
17. $\frac{3}{4}$ of an inch. —— of a yard
18. 3 pec. 2 lip. —— of a boll
19. 2 fir. $3\frac{1}{4}$ pec. —— of 1 chal.
20. 3 bus. 3 pec. —— of a qr.
21. 14 fa. 18 ells —— of an acre
22. 2 ro. 24 poles —— of an acre
23. 8 yds. $2\frac{1}{3}$ feet —— of a mile
24. 14 h. 40 min. —— of a day

*PROBLEM* VI. *To find the value of fractions; reduce the numerator to the next lower denomination, and divide by the denominator: if there be a remainder, reduce it to the next denomination, and divide as before, and ſo on as far as neceſſary.*

Ex. 1ſt, value $\frac{19}{40}$ of 1 L.

19
20 ſh.

40)380(9s. 6d.
360

20
12

240
240

Ex. 2d. value $\frac{43}{60}$ of 1 cwt.

43
4 qr. in 1 cwt.

60)192(3 qr. $5\frac{3}{5}$
180

12
28

336 $\frac{36}{60}=\frac{3}{5}$
300

36

In example 1ſt, we multiply the numerator by 20, and divide the product 380 by 40, the denominator of the fraction, and obtain a quotient of 9's.; then we multiply the remainder 20, by 12, which produces 240, divided by 40, quotes 6d. without a remainder. In example 2d, we proceed in a like manner; but as there is a remainder, the quotient is completed by a fraction.

What is the value of

| | | |
|---|---|---|
| 1. $\frac{5}{12}$ of a ſh. | 9. $\frac{9}{14}$ of 1 cwt. | 17. $\frac{1}{28}$ of a yard |
| 2. $\frac{11}{240}$ of a L. | 10. $\frac{5}{273}$ of a laſt | 18. $\frac{7}{32}$ of a boll |
| 3. $\frac{37}{600}$ of do. | 11. $\frac{3}{64}$ of a ton | 19. $\frac{45}{1024}$ of a chal. |
| 4. $\frac{85}{900}$ of do. | 12. $\frac{3}{578}$ of a tun | 20. $\frac{15}{32}$ of a qr. |
| 5. $\frac{1}{2880}$ of a ſh. | 13. $\frac{11}{9600}$ of a ſh. | 21. $\frac{29}{800}$ of a S. ac. |
| 6. $\frac{7}{19200}$ of a L. | 14. $\frac{1}{360}$ of a L. | 22. $\frac{13}{200}$ of a E. do. |
| 7. $\frac{39}{9600}$ of 1 lb. Tr. | 15. $\frac{8}{9}$ of 1 cwt. | 23. $\frac{1}{1768}$ of a mile |
| 8. $\frac{11}{448}$ of 1 lb. Av. | 16. $\frac{5}{128}$ of a foot | 24. $\frac{11}{128}$ of a day. |

To prepare the fractions for the operations in the following rules, reduce mixt numbers to improper fractions by problem I; fractions of different denominations to thoſe of the ſame, by problem IV, which is neceſſary for addition and ſubtraction, but not for multiplication and diviſion; compound fractions to ſimple ones, by multiplying all the numerators together and all the denominators together, as may be inferred from the examples given in problem V.

If the anſwer of any operation be an improper fraction, reduce it to a mixt number, by problem II; or, if it be a fraction of any denomination, reduce it to value, by problem VI.

## Sect. II. Addition of Vulgar Fractions.

*Rule. Prepare the fractions as above, then add the numerators, and under their ſum place the common denominator.*

Ex. 1ſt, Add $\frac{5}{8}$, $\frac{4}{5}$. $= \frac{25}{40} + \frac{32}{40} = \frac{57}{40}$ by Prob. II. or $1\frac{17}{40}$ Anſ.

The reaſon of the rule appears by conſidering, that none but ſimilar, or like parts, can be added, and when fractions are reduced to the ſame denominator, the numerator ſignifies like parts.

If the fractions be of different denominations, we reduce them ſeparately, and then add them, as in example 2d.

Ex. 2d, Add, L. $\frac{5}{6}$, $\frac{7}{8}$ ſh.?

| | ſh. | den. | |
|---|---|---|---|
| By Prob. VI. $\frac{5}{6} \times 20 =$ | 100 | $\div 6 =$ | 16s. 8d. |
| $\frac{7}{8} \times 12 =$ | 84d. | $\div 8 =$ | $10\frac{1}{2}$ |
| | | Anſwer | L.0 : 17 : $6\frac{1}{2}$ |

If mixt numbers be given, we may find the ſum of the fractions, and add it to that of the integers.

1. Add $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $= 1\frac{11}{12}$
2. —— $\frac{1}{4}$, $\frac{5}{7}$, $\frac{1}{3}$, $= 1\frac{25}{84}$
3. —— $\frac{2}{5}$, $\frac{7}{8}$, $\frac{8}{9}$, $= 2\frac{59}{360}$
4. —— $\frac{9}{10}$, $\frac{3}{4}$, $\frac{15}{16}$, $= 3\frac{27}{80}$
5. Add $\frac{5}{7}$ of $\frac{2}{3}$, $\frac{3}{5}$ of $\frac{7}{8}$ $= 1\frac{11}{840}$
6. —— $3\frac{1}{3}$, $4\frac{2}{5}$, $7\frac{3}{4}$ $= 15\frac{29}{60}$
7. —— $6\frac{1}{2}$, $9\frac{5}{6}$, $10\frac{1}{9}$ $= 26\frac{4}{9}$
8. —— $15\frac{4}{11}$, $48\frac{2}{7}$, $63\frac{5}{8}$ $= 127\frac{609}{1232}$

¶ 9. Add $\frac{5}{6}$ of a ſh. and $\frac{3}{4}$ of a L. = 15s. 10d.
10. —— $\frac{1}{2}$ of 1d. $\frac{3}{8}$ L. $\frac{2}{3}$ ſh. = 8s. $2\frac{1}{2}$d.
11. —— $\frac{5}{9}$ of 1 qr. $\frac{2}{3}$ buſh. $\frac{3}{5}$ gal. = 5 buſh. 1 gal. $3\frac{41}{45}$ pts.
12. —— $\frac{3}{4}$ chal. $\frac{5}{8}$ boll, $\frac{1}{3}$ peck = 12 b. 2 fir. 2 p. $1\frac{1}{3}$ lip.
13. —— $\frac{4}{7}$ hhd. wine $\frac{3}{5}$ gall. = 36 gals. $4\frac{4}{5}$ pints.
14. —— $\frac{5}{6}$ yd. $\frac{3}{4}$ feet, $\frac{2}{3}$ inch. = 3 feet 3 in. 8 parts.
15. —— $\frac{1}{4}$ week $\frac{3}{7}$ day $\frac{2}{5}$ hour = 2 days 3 h. 24 min.

Queſt. 1. Paid at one time L.$32\frac{2}{7}$, at another L.$18\frac{2}{15}$, at another L.$49\frac{8}{9}$. Required the amount?

2. Sold to A $4\frac{1}{3}$ cwt. ſugar; to B $7\frac{2}{5}$ cwt.; to C $5\frac{1}{5}$ cwt.; to D $2\frac{4}{7}$ cwt., and to E $2\frac{5}{8}$ qrs.; what is the amount?

3. Required how many yards in $18\frac{1}{3}$ ells Flem., $29\frac{2}{5}$ ells Eng., $42\frac{2}{8}$ yards, and $21\frac{5}{8}$ ells French?

4. A goldſmith purchaſed 5 pieces plate wg. $4\frac{1}{4}$ oz., $11\frac{1}{6}$ oz., $7\frac{3}{4}$ oz., $8\frac{4}{5}$ oz.; what is the weight of the whole?

5. A has $\frac{3}{11}$ of a ſhip, value L.$1260\frac{7}{15}$, and if he ſhould buy B's $\frac{1}{5}$ ſhare for L.$1325\frac{1}{6}$, what part of her will belong to him, and what will be the value?

## Sect. III. Subtraction of Vulgar Fractions.

*Rule. Prepare the fractions as before, and ſubtract the numerator of the ſubtrahend from the numerator of the minuend, and place the remainder above the common denominator.*

In mixt numbers, if the numerator of the fraction of the ſubtrahend exceed that in the minuend, ſubtract it from the common denominator, and add 1 to the unit-place of the ſubtrahend, as in example 2d.

Ex. 1ſt, Subtract $\frac{2}{3}$ from $\frac{4}{5}$.

$4\times3 = 12$
$2\times5 = 10$
rem. $2$
$2\times5 = 15$
} by Prob. IV.

Ex. 2d. From $76\frac{2}{3}$ take $35\frac{7}{8}$.

$\frac{2}{3} = \frac{16}{24}$, $\frac{7}{8} = \frac{21}{24}$ } Prob. IV.

$76\frac{16}{24}$
$35\frac{21}{24}$
$40\frac{19}{24}$

In example 2d, becauſe [21] the numerator of the ſubtrahend is greater than [16] the numerator of the minuend, we ſubtract 21 from 24 (the denominator) and there remains 3, which added

to 16 makes 19, for the numerator of the fraction, and in ſubtracting the integer, we add 1 to [5] the unit-place of the ſubtrahend.

As none but like parts can be added, ſo none but like parts can be ſubtracted; hence there is the ſame reaſon for reducing the fractions here as in addition. The operations in addition and ſubtraction will appear plain, if the numerators of the fractions be conſidered as lower denominations, and added or ſubtracted as ſuch, and the denominator as the value of the higher place.

1. Sub. $\frac{3}{4}$ from $\frac{7}{8} = \frac{1}{8}$
2. —— $\frac{2}{5}$ from $\frac{5}{6} = \frac{13}{30}$
3. —— $\frac{1}{10}$ from $\frac{1}{9} = \frac{1}{90}$
4. —— $\frac{2}{3}$ from $\frac{17}{20} = \frac{11}{60}$
5. —— $\frac{5}{7}$ from $\frac{8}{11} = \frac{1}{77}$
6. Sub. $\frac{1}{3}$ of $\frac{5}{6}$ from $\frac{8}{9} = \frac{11}{18}$
7. —— $4\frac{2}{5}$ from $5\frac{3}{4} = 1\frac{7}{20}$
8. —— $\frac{8}{9}$ from $12\frac{1}{8} = 11\frac{17}{72}$
9. —— $\frac{7}{10}$ from $54\frac{1}{2} = 53\frac{4}{5}$
10. —— $19\frac{5}{13}$ from 81 $= 61\frac{8}{13}$

¶ 11. Sub. $\frac{1}{12}$ of a penny from $\frac{2}{3}$ of a ſh. $= 7\frac{11}{12}$d.
12. —— $\frac{5}{8}$ of a ſh. from $\frac{7}{9}$ of a pound = 14s. $11\frac{1}{9}$d.
13. —— $\frac{3}{5}$ of a dwt. from $\frac{1}{3}$ of a lb. = 3oz. 19dwt. $9\frac{3}{5}$ grs.
14. —— $\frac{4}{7}$ of a cwt. from $\frac{7}{10}$ of a ton = 13 cwt. 1 qr. 20 lb.
15. —— $\frac{3}{5}$ of a yd. from $\frac{3}{4}$ of an ell E. = 1 qr. 1 nail $0\frac{9}{10}$ in.

Qu. 1. A has $\frac{1}{4}$ ſhare of a cotton-mill, B $\frac{1}{3}$, C $\frac{3}{8}$, and D the remainder. Required his ſhare?

2. After paying a debt of L.21 $\frac{2}{5}$, how many pounds remained in a purſe containing $36\frac{5}{7}$ guineas?

3. Sold $\frac{4}{5}$ of a hhd. wine, and $\frac{2}{3}$ of a runlet, out of a caſk containing $1\frac{1}{4}$ puncheon: how much remains unſold?

4. Out of a cheſt of tea, qt. $15\frac{9}{16}$ lb. there was ſold $8\frac{1}{3}$ oz., $7\frac{1}{5}$ oz., $5\frac{1}{4}$ oz., $6\frac{6}{7}$ oz., and $3\frac{5}{8}$ oz. how much is on hand?

5. What is the difference between $\frac{5}{8}$ of a chalder and $\frac{8}{9}$ of a boll, alſo between $\frac{1}{3}$ of a firlot and $\frac{3}{4}$ of a peck?

## Sect. IV. Multiplication of Vulgar Fractions.

*Rule. Multiply all the numerators together for the numerator of the product, and all the denominators for the denominator.*

To multiply an integer by a fraction, multiply it by the numerator, and divide the denominator, as in example 2d.

To multiply an integer by a mixt number, we may multiply it firſt by the integer, and then by the fraction, and add the products, as in page 48, example 3d.

Ex. 1ſt. $\frac{7}{8} \times \frac{3}{4} = \frac{21}{32}$

For, $7 \times 3 = 21$ num.
$8 \times 4 = 32$ den.

Ex. 2d. $543 \times \frac{5}{8} = 339\frac{3}{8}$

$$\begin{array}{r} 5 \\ \hline 8)2715(339\frac{3}{8} \end{array}$$

As multiplication is the taking of the multiplicand as often as the multiplier contains unity, therefore, if the multiplier be leſs than unity, the product will in the ſame proportion be leſs than the multiplicand. Thus if we multiply by $\frac{1}{2}$, $\frac{1}{3}$, or the like, we obtain the ſame anſwer as when we divide by 2, or 3, and the product in this caſe will be equal to $\frac{1}{2}$, or $\frac{1}{3}$ of the multiplicand.

1. Mult. $\frac{5}{6}$ by $\frac{1}{2} = \frac{5}{12}$
2. —— $\frac{6}{7}$ by $\frac{3}{4} = \frac{9}{14}$
3. —— $\frac{7}{8}$ by $\frac{1}{7} = \frac{7}{24}$
4. —— $\frac{8}{9}$ by $\frac{4}{7} = \frac{32}{63}$
5. —— $\frac{1}{2}$ of $\frac{3}{5}$ by $\frac{3}{4} = \frac{9}{40}$
6. —— $18\frac{1}{3}$ by $\frac{1}{3}$ of $5 = 30\frac{5}{9}$
7. Mult. 115 by $\frac{7}{9} = 89\frac{4}{9}$
8. —— 249 by $\frac{5}{6} = 207\frac{1}{2}$
9. —— 65 by $7\frac{8}{11} = 502\frac{3}{11}$
10. —— $26\frac{5}{7}$ by $13 = 347\frac{1}{7}$
11. —— $87\frac{1}{8}$ by $\frac{9}{10} = 78\frac{7}{80}$
12. —— $26\frac{4}{5}$ by $14\frac{2}{3} = 393\frac{1}{15}$

Qu. 1. What is the value of $32\frac{15}{16}$ yds. of ſcarlet at $21\frac{1}{8}$s. per yd.

2. How many ſquare feet in a floor $16\frac{7}{8}$ feet by $15\frac{8}{9}$?

3. What is the weight of $99\frac{1}{3}$ guineas at 6 dwt. $9\frac{9}{20}$ grs. each?

4. How much is the duty on 110 lbs. Spaniſh ſilk at 3s. $4\frac{4}{20}$d. and $\frac{2}{3}$ of $\frac{1}{20}$ per lb.?

5. What is the price of a piece of mahogany $8\frac{5}{6}$ feet long, and $22\frac{1}{12}$ inches broad, at 3s. $5\frac{1}{4}$d. per ſquare foot.?

6. Required the weight of a log of wood $6\frac{1}{4}$ feet long, $3\frac{4}{5}$ broad, and $2\frac{1}{3}$ thick, at $27\frac{1}{8}$ lb. per ſolid foot?

## Sect. V. Division of Vulgar Fractions.

*Rule.* *1ſt, Multiply the numerator of the dividend by the denominator of the diviſor, for the numerator of the quotient.*

*2d, Multiply the denominator of the dividend by the numerator of the diviſor, for the denominator of the quotient.*

Or, we may invert the diviſor, by placing the denominator for numerator, and proceed as in multiplication.

Ex. 1ſt, Divide $\frac{2}{3}$ by $\frac{5}{7}$, quotient, $\frac{14}{15}$.

Thus, $2 \times 7 = 14$
$3 \times 5 = 15$

or, $\frac{7}{3} \times \frac{2}{3} = \frac{14}{15}$

To divide an integer by a fraction, we may multiply it by the denominator of the fraction, and divide the product by the numerator, as in example 2d.

To divide a fraction by an integer, we may multiply the denominator by the integer, and place the product under the numerator, as in example 3d.

Ex. 2d, Divide 8 by $\frac{3}{4}$

4

3)32($10\frac{2}{3}$

Ex. 3d, Divide $\frac{7}{8}$ by 6

$8 \times 6 = \frac{7}{48}$

As in diviſion the quotient ſhews how often the diviſor is contained in the dividend, therefore if any number be divided by a proper fraction, the quotient will be greater than the dividend; for it is obvious that any integer contains more halves, more thirds, or the like, than it contains units. Thus, multiplication by fractions has the ſame effect as diviſion by integers; and diviſion by fractions, as multiplication by integers.

If the diviſor and dividend have the ſame denominator, we have only to divide the numerators. Thus, $\frac{8}{11}$ divided by $\frac{4}{11}$ quotes 2.

If the dividend be given in more denominations than one, reduce them to the loweſt; as in the following example.

What is the price of 1 yard at L.3 : $14\frac{3}{8}$s. for $4\frac{1}{4}$ yards.

$4\frac{1}{4} = \frac{17}{4}$, and L.3 : $14\frac{3}{8} = 74\frac{3}{8}$s.

8

$\frac{17}{4})595(\frac{2380}{136}$s. = 17s. 6d.

1. Divide $\frac{5}{6}$ by $\frac{1}{3}$ = $2\frac{1}{2}$
2. —— $\frac{17}{18}$ by $\frac{5}{9}$ = $1\frac{7}{10}$
3. —— $\frac{15}{16}$ by $\frac{3}{16}$ = 5
4. —— $\frac{25}{32}$ by $\frac{4}{7}$ = $1\frac{47}{128}$
5. —— $1\frac{11}{12}$ by $\frac{1}{2}$ of $\frac{3}{4}$ = $5\frac{1}{9}$
6. —— $\frac{5}{8}$ by 7 = $\frac{5}{56}$
7. Divide 143 by $\frac{6}{7}$ = $166\frac{5}{6}$
8. —— 112 by $\frac{8}{11}$ = 154
9. —— 68 by $5\frac{8}{9}$ = $11\frac{29}{53}$
10. —— 86 by $7\frac{3}{5}$ = $11\frac{6}{19}$
11. —— $165\frac{5}{6}$ by $4\frac{7}{8}$ = $34\frac{2}{117}$
12. —— $239\frac{3}{4}$ by $8\frac{1}{3}$ = $28\frac{77}{100}$

Qu. 1. Divide L.72 : 11 : 3 into $18\frac{2}{3}$ ſhares.

2. Divide $15\frac{1}{6}$ acres among 13 men equally.

3. Required the price of 1 yard at $95\frac{2}{3}$s. for $7\frac{7}{8}$ yds.

4. How many ſtones, $17\frac{1}{3}$ inches by $13\frac{3}{8}$, will be required for a floor $35\frac{3}{4}$ feet long, and $19\frac{1}{4}$ broad?

5. A farm of $49\frac{1}{3}$ acres was let for L.$88\frac{7}{10}$; what was the rent per acre?

6. Divide L.$435\frac{7}{8}$ among 5 men, 3 women, and 2 boys; and give a woman $\frac{2}{3}$ of a man's ſhare, and a boy $\frac{2}{3}$ of a woman's?

# CHAP. IX.

## DECIMAL FRACTIONS.

### INTRODUCTION.

THE practice of collecting units into tens, has univerſally prevailed; it has therefore been found convenient to follow a like method in fractions, by dividing an unit into ten equal parts, and each of theſe into ten ſimilar parts, which are called DECIMAL FRACTIONS.

A decimal fraction is expreſſed by writing only the numerator with a POINT before it; the denominator being an unit with as many cyphers as the numerator has places. The figure next the point ſignifies tenth parts, the next, hundredth parts, the next, thouſandth parts, and ſo on; as in the following examples.

.5 ſignifies Five tenth parts.
.05 ——— Five hundredth parts.
.005 ——— Five thouſandth parts.
.723 ——— 723 thouſandth parts.
6.500 ——— Six and five tenth parts.

From theſe examples it appears, that the value of decimals depends upon their diſtance from the POINT, and therefore each cypher placed on the left of decimals diminiſhes their value ten times; but when cyphers are placed on the right, they have no ſignification, as the diſtance of the figures from the point is not thereby altered.

When a vulgar fraction can be reduced to a decimal without a remainder, the decimal is called FINITE, or TERMINATE; if it cannot, the decimal is called INFINITE, or INTERMINATE.

### Sect. I. REDUCTION OF DECIMALS.

*PROBLEM* I. *To reduce vulgar fractions to decimals; annex cyphers to the numerator, and divide by the denominator.*

If to form a dividual, it be neceſſary to annex more cyphers than one to the numerator, prefix as many to the figures of the quotient. This occurs in example 2d.

Ex. 1ſt, Red. $\frac{17}{50}$ to a decimal.

50)17.00(.34 finite
150
200
200

Ex. 2d. Reduce $\frac{1}{16}$.

16)1.0000

.0625 finite alſo.

The numerator of a vulgar fraction is underſtood to be divided by the denominator, and this diviſion is actually performed when it is reduced to a decimal. Hence the reaſon of the rule is evident. Thus in example 1ſt, $\frac{17}{100}$ or 17 divided by 50, is equal to 1700 hundredth parts by 50, that is 34 hundredth parts, or .34, as above.

| Ex. 3d, $\frac{2}{9}$ | Ex. 4th, $\frac{7}{12}$ | Ex. 5th, $\frac{3}{11}$ | Ex. 6th, $\frac{3}{22}$ |
|---|---|---|---|
| 9)2.0 | 12)7.0 | 11(3.0 | 22)3 0 |
| .$\dot{2}\dot{2}$ | .58$\dot{3}$ | $\dot{2}.\dot{7}$ | .1$\dot{3}\dot{6}$ |
| pure repeater. | mixt do. | pure circul. | mixt do. |

Interminate decimals may be diſtinguiſhed into, 1ſt, REPEATING decimals, when the quotient repeats the ſame figure; 2d, CIRCULATING decimals; when two or more figures return in their order. If the figures repeat or circulate from beginning as in example, 3d and 5th, they are called pure repeaters, or circulates; but if there be figures before them, as in examples 4th and 6th, they are called mixt repeaters, or circulates; and the figures before the repeating ones are called the Finite part.

Repeaters are generally marked either with a point, or a daſh, and circulates, with a point above the firſt and laſt figures of the circle.

| | | | | | |
|---|---|---|---|---|---|
| 1. | Red. $\frac{1}{4}$ | = .25 | 8. | Red. $\frac{2}{3}$ | = $\cdot\dot{6}$ |
| 2. | —— $\frac{1}{2}$ | = .5 | 9. | —— $\frac{5}{6}$ | = .8$\dot{3}$ |
| 3. | —— $\frac{3}{4}$ | = .75 | 10. | —— $\frac{8}{15}$ | = $\cdot\dot{5}\dot{3}$ |
| 4. | —— $\frac{4}{5}$ | = .8 | 11. | —— $\frac{1}{75}$ | = .013 |
| 5. | —— $\frac{37}{40}$ | = .925 | 12. | —— $\frac{9}{11}$ | = $\cdot\ddot{8}\dot{1}$ |
| 6. | —— $\frac{7}{3125}$ | = .00224 | 13. | —— $\frac{4}{27}$ | = .1$\dot{4}\dot{8}$ |
| 7. | —— $\frac{3}{64}$ | = .046875 | | | |

*PROBLEM* II. *To reduce lower denominations to decimals of higher. Annex cyphers to the lower denomination, and divide it by the value of the higher. If there be ſeveral denominations, begin at the loweſt, and reduce them in their order to the higheſt.*

Ex. 1ſt, Red. 12s. $8\frac{1}{4}$ to the decimal of L. 1

4)1.00

12)8.25

20)12.6875

.634375

Ex. 2d, Red. 3 oz. 14 dwt. 8 grs. to the decimal of 1 lb.

4)8

6) 20

20)14.3

12) 3.716

.30972

In example 1ſt, To reduce $\frac{1}{4}$d. to a decimal, we annex a cypher, and divide by 4 the value of a penny, which gives 25. We next prefix the 8d. to it, and divide by 12 the value of a ſhilling, and it comes to .6875, and then prefix 12s. and divide by 20, the ſhillings in L.1, the quotient is the decimal required. In example 2d, we divide by the component parts of 24, the decimal we obtain is 3· a repeater; and in dividing by 28 and 12, the repeating figure is annexed mentally.

The following examples for practice are reverſed by thoſe in the next problem.

Reduce as follows:

1. 9d. to the decimal of a ſh.
2. 7s. 3d. —— of a L.
3. 13s. 4d. —— of do.
4. 19s $9\frac{3}{4}$ —— of do.
5. 5 dwt. 8 grs. —— of an oz.
6. 3 qr. $9\frac{1}{3}$ lb. —— of 1 cwt.
7. 6 cwt. 1 qr. —— of a ton
8. 3 r. 20 fa. —— of an acre
9. 3 qrs. 2 nails —— of a yard
10. 1 fir. 3 peck —— of a boll
11. 4 fur. 15 pol. —— of a mile
12. 5 h. 45 min. —— of 1 day
13. $\frac{3}{4}$d. to the decimal of a ſh.
14. $4\frac{1}{2}$d. —— of a do.
15. 6s. $0\frac{3}{4}$d. —— of a L.
16. 18s. 8d. —— of do.
17. 6 oz. 8 dr. —— of 1 lb.
18. 12 dwt. 16 gr. —— of 1 lb.
19. 15 c. 3 qr. 14 lb. — of a ton
20. 9 bolls 1 fir. —— of 1 ch.
21. 1 foot 9 in. —— of a yard
22. 36 gal. 6 pts. —— of a hhd.
23. 3 buſh. 2 pec. —— of a qr.
24. 2 r. $28\frac{1}{2}$ pol. —— of an acre.

*PROBLEM* III. *To value a decimal fraction. Multiply it by the value of the different denominations, ſucceſſively pointing off from the right, as many places as in the given decimal. The figures pointed off give the anſwer.*

When the given decimal ends with a repeater, carry by 9 when you multiply the repeating figure, and when a cypher occurs on the right of the multiplier, annex the repetend for it: This is done in example 2d.

Ex. 1ſt, Value, .634375

20

12.687500

12

8.250000

4

1.000000

the anſwer is 12s. $8\frac{1}{4}$

Ex. 2d, Value .30972̇

12 oz. in all

oz. 3.71666

20

dwt. 14.33333

6

200000

4

grs. 8.00000

What is the value of

1. .75 of a ſh.
2. .3625 of L.1
3. .666 of do.
4. .990625 of do.
5. .266 of an oz.
6. .833 of 1 cwt.
7. .3125 of 1 ton
8. .875 of an acre
9. .875 of a yard
10. .4375 of a boll
11. .546875 mile
12. .239583 day
13. .0625 of a ſh.
14. .375 of do.
15. .303125 of L.
16. .933 of do.
17. .40625 of 1lb. Av.
18. .527 of 1 lb. Troy
19. .79375 of a ton
20. .578125 of a chal.
21. .583 of a yard
22. .583 of a hhd.
23. .4375 of a quarter
24. .677083 of 1 acre

To value the decimal of a pound ſterling by Inſpection. *Double the firſt decimal place for ſhillings, if the ſecond place be 5 or above, reckon a ſhilling more, then the remainder of the ſecond with the third is farthings, abating 1 for 25, and 2 for 40.*

Ex. 1. .423=8s. 5¾d. 4. .93 =18s. 7¼d. 7. .995=19s. 10¾d.
2. .634=12s. 8¼d. 5. .3865=7s. 8¾d. 8. .095=1s. 10¾d.
3. .785=15s. 8¼d. 6. .158 =3s. 2d. 9. .020= 5d.

In example 1ſt, we proceed thus: twice 4 is 8s. and 23 far. is 5¾d. In example 2d, twice 6 is 12s. and becauſe it is above 25 we abate 1, which makes 8¼d. In example 3d, becauſe (8) the ſecond decimal place exceeds 5, we add 1 to twice 7, which gives 15s. then we take 5 from 8, the remainder is farthings, abating as before, and it comes to 8¼d. In example 4th, the third place is ſuppoſed to be filled with a cypher, which makes 30. and abating 1, is 29 far. or 7¼d. In example 5th, the fourth decimal place is rejected, being leſs than farthings.

Becauſe 960 farthings make a pound, and the rule ſuppoſes 1000, we therefore abate 1 for 25. The anſwer obtained by it, unleſs the decimal terminate in 25, 50 or 75, a little more than the true value; for there ſhould be abatement not only of 1 for 25, but alſo of $\frac{1}{25}$ on the remaining figures. To correct this we abate 2 when the farthings amount to 40 or upwards.

*PROBLEM* IV. *To reduce finite decimals to vulgar fractions. Place the given decimal for the numerator, and a unit with as many cyphers annexed as there are figures in the decimal, for the denominator.*

Ex. .125 = $\frac{125}{1000}$ and when reduced to its loweſt terms is $\frac{1}{8}$.

As the arithmetic of circulating decimals is of little or no uſe in buſineſs, we ſhall only give rules by which they may be reduced to vulgar fractions, by which any queſtion where they occur may be wrought more eaſily than by circulating decimals.

*RULE* I. *If the decimal be a pure repeater or circulate, place* 9 *for the denominator of the repeater, and* 9 *for every figure in the circle.*

II. *If the decimal be mixt (whether repeating or circulating) ſubtract the finite part from the whole decimal. The remainder is the numerator; place* 9 *below each figure of the circle, with a cypher for every finite place, for the denominator.*

Ex. 1ſt, $\dot{6} = \frac{6}{9}$ or when reduced $\frac{2}{3}$. 2d. $8\ddot{1}$ a pure circ. $= \frac{81}{99}$ or $\frac{9}{11}$

If $\frac{1}{9}$ be reduced to a decimal it will produce a pure repeater $\dot{1}$ and ſince $\dot{1}$ is the decimal equivalent to $\frac{1}{9}$, $\dot{2} = \frac{2}{9}$; $\dot{3} = \frac{3}{9}$ and ſo on till $9 = \frac{9}{9}$; hence every repeating figure is the numerator of a fraction whoſe denominator is 9.

Ex. 3d. $58\dot{3}$ a mixt repeater

Thus, $58\dot{3}$

Finite part $58$

Remainder $525$ num. $= \frac{7}{12}$

$900$ den.

Ex. 4th, $.9\ddot{2}7$ a mixt circul.

Subtract $9$ the finite part

$918$

$990$ or $\frac{51}{55}$

The reaſon of this will appear by dividing the decimal into its finite and circulating parts. Thus in example 4th, the finite decimal is 9, and the circle $.0\ddot{2}7$; but $9 = \frac{9}{10}$, and $.0\ddot{2}7$, ſhould be $\frac{27}{99}$, provided the circulation began immediately after the place of units; but as it begins after the place of tenths it is $\frac{27}{99}$ of $\frac{1}{10}$ or $\frac{27}{990}$. The ſum of the two vulgar fractions ſhould be the value of the decimal ſought. To add which, we reduce them to a common denominator. Thus, $\frac{9}{10} = \frac{891}{990}$, and add $\frac{27}{990}$ to it, the ſum is $\frac{918}{990}$, or $\frac{51}{55}$, which is the ſame as by the rule.

1. Red. $.375 = \frac{3}{8}$
2. —— $.3125 = \frac{5}{16}$
3. —— $.1\dot{6} = \frac{1}{6}$
4. —— $.13\dot{8} = \frac{5}{36}$
5. Red. $.958\dot{3} = \frac{23}{24}$
6. —— $.0\dot{3}7 = \frac{1}{27}$
7. —— $.2\dot{1}6 = \frac{8}{37}$
8. —— $.8\ddot{1}2 = \frac{134}{165}$.

## Sect. II. ADDITION OF DECIMALS.

*RULE* I. *Write down the numbers, placing the decimal points under each other.*

CASE I. When the decimals are finite, find their ſum as in integers.

CASE II. When the decimals repeat extend them one place more than the longeſt finite ones, and carry by 9 on the right. This is done in example 2d and 3d.

| Ex. 1ſt. | Ex. 2d. | Ex. 3d. |
|---|---|---|
| 68.075 | $86\frac{7}{8} = 86.875$ | L. 9 7 6 = 9. |
| .68075 | $35\frac{2}{3} = 35.\dot{6}666$ | 16 18 4 = 16. |
| 75.865 | $74\frac{3}{4} = 74.75$ | 7 14 3 = 7. |
| 178. | $29\frac{1}{6} = 29.1\dot{6}66$ | 12 16 7 = 12. |
| 322.62075 | $= 226.458\dot{3}$ | L 46 16 8 = 46.8$\dot{3}$ |

The reaſon of extending the repeaters a place beyond the longeſt finites, and carrying by 9, will be obvious, if we conſider, that by this means like things come to be added; for the finite decimals are tenth parts, but repeaters ſignify ninth parts.

1. Add .525+.005+145.+91.125+.350+.5=237.505
2. —— 14.1864+.3456+3.456+34.56+3456.=3508.548
3. —— 132.5+16.83+.416+84.1+6.875 =240.7361
4. —— $28\frac{1}{4}+15\frac{2}{3}+76\frac{4}{9}+65\frac{1}{3}+39\frac{12}{15}$ =224.587

| Reduce and add. | | | cwt. qr. lb. | | | A. R. P. | | |
|---|---|---|---|---|---|---|---|---|
| L.12 | 10 | $1\frac{1}{2}$=12. | 18 | 2 | 16=18. | 13 | 1 | 17=13. |
| 11 | 6 | 8 =11. | 39 | 1 | 25=39. | 18 | 3 | 25=18. |
| 15 | 17 | $3\frac{1}{4}$=15. | 17 | 3 | 24=17. | 16 | 2 | 18=16. |
| 9 | 4 | $10\frac{3}{4}$= 9. | 25 | 2 | 14=25. | 14 | 0 | 32=14. |

When the decimals would extend to a great many places, it will be ſufficiently exact, in practice, to limit them to three, four, or five places, according to the nature of the articles, and add 1 to the laſt decimal place, when the next figure (if extended) would have been 5 or upwards.

## Sect. III. SUBTRACTION OF DECIMALS.

*RULE I. Place the numbers according to their value.*

CASE I. When the decimals are finite, ſubtract as in integers.

II. When the decimals repeat, extend them as in addition, and borrow 9 on the right if neceſſary.

| Ex. | | L. | | | |
|---|---|---|---|---|---|
| 147.5 | | 154 | 14 | 3 | = 154.7125 |
| 5.325 | | 126 | 13 | 4 | = 126.66666 |
| 42.175 | | 28 | 0 | 11 | = 28.0458$\dot{3}$ |

| | | | |
|---|---|---|---|
| From | 67.385 | 17.99 | .6875 .95 |
| Take | 49.5 | .1799 | .1189 .833 |
| From | $96\frac{7}{8} = 96.$ | $75\frac{241}{400} = 75.$ | $84\frac{1}{6} = 84.$ |
| Sub. | $69\frac{9}{16} = 69.$ | $56\frac{7}{9} = 56.$ | $45\frac{1}{14} = 45.$ |

| | | | | | |
|---|---|---|---|---|---|
| | | | C. | qr. | lb. |
| L. | 35 | 5 6 $= 35.$ | 72 | 3 | $16\frac{4}{5} = 72.9$ |
| | 28 | 16 $7\frac{1}{2} = 28.$ | 25 | 1 | $11\frac{3}{8} = 25.40625$ |

## Sect. IV. Multiplication of Decimals.

*Rule. From the right of the product point off as many decimal places as there are in both factors. If the product has not so many places, supply the defect by prefixing cyphers.* See example 3d.

Case I. When both factors are finite, proceed as in integers.

II. When one of the factors is finite, and the other repeats, multiply by the finite factor, and carry by 9 on the right; then extend and add them as in addition.

III. When both factors repeat, reduce either of them to a vulgar fraction, and take parts of the multiplicand for it.

| Ex. 1st, .627 | Ex. 2d, 168·25 | Ex. 3d, .1684 |
|---|---|---|
| ·43 | ·35 | ·15 |
| 1881 | 84125 | 8420 |
| 2058 | 50475 | 1684 |
| .26961 | 58.8875 | .025260 |

The reason of fixing the decimal point, as directed, appears by considering that the operation here is the same as in multiplication of vulgar fractions: thus in example 1st, $627 \times .43 = \frac{627}{1000} \times \frac{43}{100} = \frac{26971}{100000}$ or .26961 by the nature of notation, and has as many places as one in both numbers; for since each decimal place in either factor diminishes its value ten times, it must equally diminish the value of the product.

Ex. 4th, .713
.452
1426
35666
285333
.322426

Ex. 5th, $574.6 \times 8\frac{3}{6}$ or, 574.6
5 num.
$\frac{1}{2}$)574.6
3)287.3 = $\frac{3}{6}$
95.7 = $\frac{1}{6}$
95.7 = $\frac{1}{6}$
478.8
den.6)2873.3
478.8

To multiply by 10, remove the decimal point one place to the right; to multiply by 100, 1000, or the like, remove it as many places as there are cyphers.

To multiply by $3\dot{3}$, take one-third of the multiplicand, and to multiply by $6\dot{6}$ we take two-thirds, or subtract $\frac{1}{3}$.

1. $282.5 \times 2.64 = 745.800$
2. $1.736 \times .125 = .217000$
3. $1406 \times .342 = 480.852$
4. $.748 \times .17 = .12716$
5. $6.23 \times .049 = .30527$
6. $.1745 \times 100 = 17.45$
7. $.357 \times .3\dot{3} = .119$
8. $.526 \times .6\dot{6} = 350.6\dot{6}$
9. $.145 \times .4\dot{8} = .07088\dot{8}$
10. $4.93 \times .1\dot{6} = .8\dot{2}$
11. $.789 \times .4\dot{6} = .350.6\dot{6}$
12. $37.23 \times .2\dot{6} = 9.92\dot{8}$

Q. 1. What coſt 9 lb. 8 oz. 16 dwt. of indigo at 19s. 6d. per lb.?

2. What coſt 12 cwt. 3 qr. 21 lb. of ſugar, at L.3 : 13 : 4 per lb.?

3. What is the value of 5 tons 4 cwt. 3 qr. 21 lb. of pot-aſhes at L.45 : 17 : 6 per ton.?

4. What is the rent of 5 acres, 3 roods, 13 falls, 9 ells of land, at 31s. 6d. per acre.?

5. What is the expence of building a wall $14\frac{1}{2}$ yards long, $3\frac{1}{4}$ yards high, and $\frac{1}{2}$ yard thick, at 5s. 9d. per ſolid yard.?

6. What is the ſolid contents of a plank 6 feet 3 inches long, 1 foot 6 inches broad, and 9 inches thick.

## Sect I. Division of Decimals.

*Rule. Point the quotient, ſo that there may be as many decimal places in the diviſor and quotient together, as in the dividend.*

1ſt, If the diviſor and dividend have the ſame number of decimal places, there will be none in the quotient, being an integer. See example 1ſt.

2d, If there be more in the diviſor, annex as many cyphers to the dividend as will make them equal, and the quotient is ſtill an integer. See example 2d.

3d, If there be more in the dividend, the quotient muſt have as many as the dividend has more than the diviſor. See Ex. 3d.

4th, If after the diviſion is finiſhed, the quotient has not ſo many decimals as the rule requires, ſupply them by prefixing cyphers. See example 4th.

Case I. When both factors are finite, proceed as in integers; and if there be a remainder, annex cyphers, and continue the diviſion to as many decimal places as are neceſſary.

Ex. 1ſt, 1.32)2175.36(1648 Ex. 2d, .132)21753.600(164800

Ex. 3d, 13.2)21.7536(1.648 Ex. 4th, 132)2.17536(.01648

Ex. 5th, 16.25)383.75(23.61538 +

| | | |
|---|---|---|
| 3250 | | |
| | 8750 | |
| 5875 | 8125 | |
| 4875 | | |
| | 6250 | |
| 10000 | 4875 | |
| 9750 | | |
| | 13750 | |
| 2500 | 13000 | |
| 1625 | | |
| | 750 | |
| Carried up 875 | | |

Here we annex cyphers to the remainder after the dividend is uſed, and continue the diviſion till the quotient has five decimal places, which is ſufficient for moſt computations.

The reaſon of pointing off as many decimals in the quotient as the dividend exceeds the diviſor, will eaſily appear, ſince the quotient multiplied by the diviſor will give the dividend; and therefore the number of places in the dividend, muſt be equal to theſe in the diviſor and quotient together.

Case II. When the dividend repeats, proceed as before; but after the dividend is exhauſted, annex the repeating figure to the remainder inſtead of cyphers.

III. When the diviſor, or both diviſor and dividend repeat, multiply them both by any figure that will exterminate the repeater, then proceed as before.

Or, if the diviſor be a decimal, reduce it to a vulgar fraction; multiply the dividend by the denominator, and divide the product by the numerator, as in example 4th.

Ex. 1ſt, 6.25)39.41.6(6.306 Ex. 2d, 16.8)224.139031
3750. 9 9
1916 152.)201725 1280(13.27139
1875
4166 Ex. 3d, 5)3.8456 ÷5
3750 76913
416 Ex. 4th, 1134 ÷7=$\frac{7}{9}$, therefore
9
7)10206
1458 quotient.

To divide by 10, move the decimal point one place to the left; to divide by 100, 1000, or the like, move it as many places to the left as there are cyphers.

To divide by .3, multiply by 3; and to divide by .6, add $\frac{1}{2}$ of the dividend to it.

1. 353.25 ÷.15 =2235
2. 920178 ÷.218=422100
3. 425.95 ÷1.75=243.4
4. 5.172 ÷.27 =191.5
5. 17.8848 ÷192 =.09315
6. .3.6265.4=×67148 ÷+
7. 150.6 ÷ 1.5=100.4
8. 18.3 ÷ .25=7.3
9. 169.3 ÷ .05=3.386.6
10. 4.216 ÷.5 = 843
11. 1056 ÷.12 = 8640
12. 545450.6 ÷85.3 =6392

Q. 1. What is the price of one yard at L.38 : 17 : 9 for 48$\frac{4}{7}$ yds.?
2. How many yds. at 5s. 10d. may be bought for L.11 : 6 : 6$\frac{3}{4}$?
3. Divide 16$\frac{2}{3}$ acres of land among 36 men equally?
4. If 6 cwt. 9 lb. coſt L.10 : 10 : 11$\frac{1}{2}$, what will 1 cwt. coſt?
5. Divide a prize of L.1000 among 120 men and a boy, and give the boy $\frac{7}{8}$ of a man's ſhare?
6. If an acre of good land be worth 5 acres, 3 roods, 20 falls of waſte land, how much good land is equal to 84 acres, 13$\frac{3}{4}$ falls of waſte?

For a practical exerciſe, we ſhall here add a few queſtions, which may be wrought either by vulgar or decimal fractions. Any queſtion which belongs to the rule of proportion is ſtated as in integers, and the multiplications and diviſions performed, as directed, in fractions.

## *Queſtions in Vulgar or Decimal Fractions.*

1. Bought $83\frac{1}{5}$ yards broad cloth for L.$72\frac{19}{40}$; what muſt it be ſold at per yard, to gain L.$10\frac{1}{8}$ on the whole?

2. Divide a guinea among four men, A, B, C, and D, in the proportion of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ reſpectively; how much will each draw?

3. How many ſquare feet are contained in a floor whoſe length is 23 feet $10\frac{1}{2}$ inches, and breadth 18 feet 6 inches?

4. Purchaſed a ſhip for L.$1850\frac{5}{6}$, at what ſhould $\frac{2}{3}$ of $\frac{6}{7}$ be charged, to gain $250\frac{3}{7}$ guineas upon the whole?

5. The dimenſions of a block marble are 5 feet 11 inches, 4 feet $2\frac{1}{2}$ inches, and 3 feet 4 inches; what is its ſolidity?

6. Bought a pair of ſilver buckles, wg. 4 oz. $8\frac{1}{2}$ dwt. at 4s. 9d. per oz. and received $\frac{3}{40}$ of the price for diſcount; what did they coſt me?

7. Required the ſolidity and price of a log of mahogany $16\frac{4}{5}$ feet long, $5\frac{1}{3}$ broad, and $4\frac{1}{4}$ feet thick, at $10\frac{1}{2}$d. per ſolid foot?

8. What is the value of a ſilver tea-pot weighing $1\frac{5}{12}$ lb. at 7s. 6d. for $1\frac{7}{10}$ ounce?

9. If $\frac{3}{4}$ of a yard, $\frac{2}{3}$ ell Engliſh wide coſt 16s. 8d.; what will $15\frac{1}{2}$ yards $\frac{7}{8}$ yard wide, coſt of the ſame fineneſs?

10. How many deals, 12 feet 8 inches by 9 inches broad, will be required for a floor $36\frac{1}{2}$ feet by $24\frac{2}{3}$, allowing $\frac{1}{2}$ inch in breadth for ſeaming?

11. A box of goods, $6\frac{1}{2}$ feet long, $3\frac{5}{6}$ broad, and $4\frac{3}{4}$ deep; what is the weight at $9\frac{3}{5}$ lb. per ſolid foot, and what is the freight at L.4 : 13 : 4 per ton, containing 40 ſolid feet?

12. Three men can do a piece of work, the firſt in 10 days, the ſecond in 12 days, and the third in 15 days; in what time will all the three do it?

13. How many yards of paper, $\frac{3}{8}$ yard wide, will line a room 19 feet 7 inches long, 15 feet 10 inches broad, and the height from the belt to the cornice $8\frac{1}{2}$ feet?

14. Three partners, A, B, and C, purchaſe a ſugar work, of which A paid $\frac{4}{11}$, B $\frac{3}{8}$, and C paid L.750; what was C's ſhare? what did the work coſt? and what did A and B each contribute towards the purchaſe?

15. A, B, and C, were to ſhare $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ reſpectively of L.15000; but C's part being loſt by his death, it is required to divide the whole ſum proportionably between the other two?

# CHAP. X.

## VARIETIES IN PROPORTION.

### Sect. I. INSURANCE.

INSURANCE is a contract, whereby one party engages to pay the losses which the other may sustain, for a stipulated premium, which varies according to the risk. The parties who engage to pay the damage, are called the Insurers or Underwriters; and the parties for whose security they engage, are called the Insured.

POLICY is the writ specifying the conditions agreed upon between the underwriters and the insured. It is an usual article in the policy, that in case of loss, the underwriters are to be allowed a small discount or abatement, which is generally 2 per cent.; in this case the insured receives only L.98 for the L.100, and this L.98 is called the SHORT RECOVERY.

COVERING PROPERTY, or covering the Out-set, is when the value of the cargo, with the premium and discount, are also insured, and although insurances for a greater sum than the insured had really at risk, be contrary to law, yet some latitude is allowed in this respect; for if the owner were to insure no more than the exact value of his property, he would lose the premium of insurance, and the abatement, if any was agreed on.

1st, To find the premium, work by the rule in COMMISSION.

Or, when the rate is given in guineas, we may add $\frac{1}{20}$ part to the sum before we calculate for the pounds; or we may calculate for the pounds, and add $\frac{1}{20}$ part to the answer.

Ex. What is the premium on L.635 at 4 guineas per cent.?

| | | or add $\frac{1}{20}$ | or, |
|---|---|---|---|
| | 635 | 635 | 635 |
| We point off | $4\frac{1}{5}$ L. = 4 gs. | 31.75 | 4 |
| places from | | | |
| the right for | 2540 | 666.75 | $\frac{1}{20}$)2540 |
| dividing by | 127 | 4 | 127 |
| 100. | | | |
| | 26.67 = L.26 : 13 : 5 | 26.67 00 | 26.67 |

2d, To find the short recovery, subtract the discount from L. 100. As 100 is to the remainder, so is the sum to the short recovery; or work by aliquot parts.

**Ex.** What is the ſhort recovery of L.1250; diſcount 2 per cent.?

100 : 98 : : 1250 : L.1225 or $\frac{1}{50}$)1250

25

L.1225 ſhort recovery.

3d, To find how much ſhould be inſured to cover any ſum, ſubtract the amount of the premium and diſcount (if any) from L.100. As the remainder is to L.100, ſo is the value, to the ſum which covers it.

Ex What ſum muſt be inſured to cover L.180, premium 8 per cent. abatement 2 per cent.

100

8+2= 10

90 : 100 : : 180 : L.200

Proof. Sum inſured is L.200

abatement 2 p. cent. 4

In caſe of loſs the } 196
inſurer pays }

deduct 8 per cent. 16

covered property, L.180

4th, If a voyage be inſured out and home, the premium outward muſt be conſidered as part of the value on the homeward property, and the ſum neceſſary to cover it computed accordingly.

Ex. To inſure L.180 out and home, at 8 per cent. each voyage, abatement 2 per cent.; compute thus:

90 : 100 : : L.180 : L.200, to be inſured outward, premium on L.200 outwards at 8 per cent. is L.16.

90 : 100 : : L.196 : L.217 : 15 : $6\frac{2}{3}$ Anſ.; ſum to be inſured home; the premium on which is L.17 : 8 : $5\frac{1}{3}$; and if the ſhip be loſt on the homeward voyage, from the ſum inſured

| | | |
|---|---|---|
| home, - - - - - | | L.217 : 15 : $6\frac{2}{3}$ |
| Subtract the diſcount, 2 per cent. - - | | 4 : 7 : $1\frac{1}{3}$ |
| Sum for which the inſurers are liable, - | | L.213 : 8 : $5\frac{1}{3}$ |
| Inſurance out, - - | L.16 | |
| Inſurance home, - - | 17 : 8 : $5\frac{1}{3}$ | 33 : 8 : $5\frac{1}{3}$ |

Covered property, L.180

*The Rule is.* Find by the laſt caſe how much will cover the value for the voyage out, on this ſum calculate the premium which add to the value on board, then find how much will cover this ſum.

### *Queſtions for Practice.*

1. What is the premium on L.320 at $1\frac{1}{4}$ guineas per cent.?
2. ——— on L.542 at 2 guineas per cent.?
3. ——— on L.1265 at $3\frac{1}{2}$ guineas per do.?
4. ——— on L.1850 at $12\frac{1}{2}$ per cent.?
5. ——— on L.6760 at 13 guineas per cent.?

¶ 6. At $2\frac{1}{2}$ per cent. diſcount, what ſum will be recovered for L.2396 : 10.?

7. What is the ſhort recovery of L.1974 : 13 : 4 inſured, when diſcount is allowed at $1\frac{7}{8}$ per cent.?

¶ 8. What ſum muſt be inſured to cover L.1305, premium 10 per cent.?

9. How much muſt be inſured to cover L.987 : 18, premium $12\frac{1}{2}$ guineas, abatement 2 per cent.?

¶ 10. If the premium be 8 per cent. and abatement 2 per cent.; what ſum muſt be paid to inſure L.2160 for a voyage out and home?

11. What will be the amount of inſurance out and in, to cover L.1486 : 7, premium at 9 guineas diſcount, diſcount 2 per cent. in caſe of loſs, and what ſum muſt be inſured to cover the inſet?

12. Inſured at the ſun-fire office on my tenement in the Tron-gate, to the value of L.1575, what ſum muſt I pay yearly, at 3s. 6d. per L.100, to keep the policy in force?

## Sect. II. Gain and Loss.

1ſt, To find the gain or loſs per cent., on any article, when the prime coſt and profit or loſs upon it is given. As the prime coſt is to the profit or loſs, ſo is L.100 to the rate per cent.?

Ex. 1ſt, Bought cotton at 3s. 4d. per lb. and ſold it for 4s. what was the gain per cent.? As 40d. : 8d. : : 100 : 20 per cent.

2d. Sold cloth for 9s. 7d. per yard, which coſt 10s. 5d. what was the loſs per cent.? 125d. : 10d. : : 100. : 8 per cent.

2d. To find the ſelling price, when the prime coſt and rate per cent. propoſed to be gained or loſt is given. As L.100 is to 100 with the rate per cent. added to it in caſe of gain, and deducted in caſe of loſs, ſo is the prime coſt to the ſelling price.

Ex. 1ſt, Bought cotton at 3s. 4d.; at what muſt I ſell it to gain 20 per cent.?

100 : 120 : : 3s. 4d.
$3\frac{1}{3}$

1,00)4,00

4s. Anſwer.

Ex. 2d, Loſt 8 per cent. by cloth which I bought at 10s. 5s.; what did I ſell it at?

100 : 92 : : 10s. 5d. : 9s. 7d. Anſ.

3d, To find the prime coſt, when the rate per cent. and ſelling price is given. As L. 100 with the rate per cent. added or deducted is 100, ſo is the ſelling price to the prime coſt.

Ex. 1ſt, Sold cotton at 4s. by which I cleared 20 per cent. what did I buy it for?

12,0 : 10,0 : : 4s.
4

12) 40

3s. 4d. Anſwer.

Ex. 2d, By ſelling cloth at 9s. 7d. I loſt 8 per cent.; what was the prime coſt?

92 : 100 : : 9s. 7d. : 10s. 5d. Anſwer.

4th, To find a proportional rate on one advanced price by having another, and the rate on it given. As the price whoſe rate per cent. is given, is to L. 100 with the rate per cent. added or deducted, ſo is the given price, to a fourth number, from which ſubtract 100, in caſe of gain; but which ſubtract from 100, in caſe of loſs.

Ex. 1ſt, By ſelling rum at 10s. I cleared 15 per cent.; what do I gain by ſelling at 12s. 6d.?

Sixpences. Sixpences.
20 : 115 : : 25
4 5 5

4)575

$143\frac{3}{4}$ — 100 = $43\frac{3}{4}$ per cent. Anſwer.

Ex. 2d, When cloth was ſold at 6s. 8d. there was gained $12\frac{1}{2}$ per cent.; what is gained or loſt when the ſame is ſold at 5s. 4d.

80d. : 112.5 : : 64d.

64

4500
6750

8,0)720,0.0

100—90=10 per cent. loſs, Anſwer.

## *Queſtions for Practice.*

1. Sold muſlins at 2s. $9\frac{3}{4}$d. per yard, which coſt me 2s. 6d.; what was gained per cent.?

2. Bought cloth at 6s. 8d. per yard, and was obliged to ſell it at 6s. 3d.; what was loſt per cent.?

3. Bought a houſe for L.420, and ſold it immediately for 30 guineas profit; required the gain per cent.?

¶ 4. Gained $12\frac{1}{2}$ per cent on goods, which I bought for 7s. 6d.; what did I ſell them at?

5. Loſt $7\frac{1}{2}$ per cent. on rum which I bought for 11s. 8d.; at what did I ſell it?

6. Bought goods to the value of L.250 : 10, and ſold them at 15 per cent. advance; how much will I receive?

¶ 7. When I ſold yarn at 3s. $7\frac{1}{2}$d. per ſpindle, I gained $8\frac{3}{4}$ per cent.; what was the prime coſt?

8. Sold linen at 3s. per yard, by which I loſt 10 per cent.; what was the prime coſt?

9. Selling a houſe for 30 guineas profit, I gained $7\frac{1}{2}$ per cent.; what did it coſt me?

¶ 10. By ſelling ſugar at 8d. per lb., I gained 10 per cent.; what did I gain per cent. by ſelling at $10\frac{1}{2}$d.?

11. Sold coffee at 3s. 9d. by which was loſt 5 per cent; it afterwards roſe to 4s. 2d.; what was then gained or loſt per cent.?

12. A grocer ſells tea at 7s. 8d. and gains 15 per cent; how much will he gain ſhould the price riſe to 8s. 4d.; and how much will he loſe if the price fall to 6s. 3d.?

13. A, ſells his goods at $12\frac{1}{2}$ per cent. profit; B, buys at 11s. 8d. and ſells at 13s. $1\frac{1}{2}$d.; C, buys at $1\frac{1}{2}$d. and ſells at $1\frac{3}{4}$d. which of theſe charge the higheſt?

14. If $1\frac{1}{2}$d. on a ſhilling be a merchant's profit, what is that per cent., and to what extent muſt he deal, to gain 300 guineas at the year's end?

## Sect. III. Exchange, or Foreign Monies.

Exchange, is the method of computing what ſum of money of one country, is equal to any given ſum of another, according to a given course of exchange.

The par of the money of one nation computed with that of another is fixed, being always according to their intrinſic value.

The rate of exchange is the preſent value allowed for money of one country, when reduced to the money of another. Owing to the balance of trade being in favour of one place more than another, the exchange is ſometimes above and ſometimes below par, or real value. Thus if more goods are imported from any foreign country than are exported to it, this will occaſion a demand for more money of that country, or its bills of exchange, to even the accompt, than can readily be procured, and raiſes their value above par. On the other hand, if the value of goods exported be greater than the value imported, the bills on that country exceed the demand, and therefore their value falls below par.

### I. with London.

In many places of Britain, bills on London, if payable at ſight, or at a ſhort date, are negotiated at a variable premium, according to the demand. Bills at a long date paſs at a diſcount in proportion to the diſtance of the term of payment.

Ex. Glaſgow draws on London for L.286 : 13 : 4 exchange $1\frac{1}{2}$ per cent.; how much muſt be paid at Glaſgow for the bill?

100 ) 286 : 13 : 4
$\frac{1}{2}$ ) 2 . 17 : 4 = 1 per cent.
1 : 8 : 8 = $\frac{1}{2}$ do.

L.290 : 19 : 4

### *Queſtions for Practice.*

1. Leith draws on London for L.320 : 18, exchange $\frac{3}{4}$ per cent.; how much was paid at Leith for the bill?

2. Edinburgh draws on London for L.452 : 12s. and was allowed a premium of 30 days; how much did the bill coſt?

3. A of Glaſgow draws on his friend in London for L.584 : 18 6; but when the bill became due, it returns under proteſt; what will take up the bill, re-exchange $3\frac{1}{4}$ per cent. other charges a guinea?

## II. WITH IRELAND.

Accompts are kept in pounds, ſhillings and pence Iriſh, which are inferior to ſterling. Their real coins of gold and ſilver are the ſame as the Britiſh, but they have halfpennies and farthings of their own.

A ſhilling ſterling = 13d. currency.
A pound ſterling = 21s. 8d. currency.
A guinea paſſes for 22s. 9d. currency.

The value of L100 ſterling at par is L.108 : 6 : 8 Iriſh. The courſe of exchange varies from 6 to 12 per cent.

*Note.* To reduce Iriſh to ſterling. *As L.100 with the courſe added : L.100 : : the given Iriſh : the required ſterling.* And to reduce ſterling to Iriſh. *As L.100 : L.100 with the courſe added : : the given ſterling : the required Iriſh.*

### EXAMPLES.

1. How much Iriſh money in L.685 : 8 : 4 ſterling ex. 110 per cent.

Ster. Iriſh. Ster.
100 : 110 : : 685 8 4
11

10)7539 : 11 : 8

Anſwer, L.753 : 19 : 2 Iriſh.

or by aliquot parts.
10)685 : 8 : 4 = L.100
68 : 10 : 10 per 10

L.753 : 19 : 2

2. How much ſterling money in L.451 : 10 Iriſh ex. 107½ per cent?

Iriſh. Ster. Iriſh.
107.5 : 100 : : 451.5
100

107.5)45150.0(L.420 ſterling.
4300

2150
2150

As the rate of exchange is variable, the drawing and remitting of money may be attended either with loſs or advantage. It is evident, that the leſs value the money of a merchant's own country bears abroad, the more he will gain by drawing, and loſe by remitting; and the greater its value, the contrary. Therefore, when

the *pound Sterling* is the medium, draw when the exchange is low, and remit when it is high.

But when the exchange is tranſacted by *foreign coin*, Britain ought to draw, when the courſe is high, and remit, when it is low.

3d, When the exchange was at 107½ per cent. Edinburgh drew on Ireland L.2725; what will Edinburgh gain or loſe by replacing the draught, exchange 109.

If 107½ : 2725 : : 109 inverſe

| | | |
|---|---|---|
| 107½ | | 2725 |
| | | 2687 : 10 |
| 19075 | | |
| 2725 | Edin. gains | L.37 : 10 |
| 1362 : 10 | | |

109)292937 : 10 (L.2687 : 10

## *Queſtions for Practice.*

1. What is the Sterling value of a prize of L 5000 Iriſh, exchange at par?

2. Glaſgow remits to Dublin L.532 : 10s. Sterling, for how much Iriſh muſt Glaſgow be credited, exchange 110½ per cent.?

3. Ireland draws on Britain for L.1146 : 18s. Iriſh, how much Sterling will pay the bill, exchange 101 per cent.?

4. A debt in Ireland of L.691 : 13 : 9 Iriſh, was paid with 607 guineas 3s. Britiſh, what was the exchange?

5. A merchant in London draws L.1100 on Dublin, exchange at par, and remits for the ſame, when the exchange is at 110½ per cent. Required his gain or loſs?

## III. WITH AMERICA.

Accompts are generally kept in pounds, ſhillings and pence currency, whoſe value is very fluctuating, but always inferior to Sterling.

Sometimes in dollars and cents, 100 cents being equal to a dollar, the par of which is 4s. 6d. Sterling; but bills of exchange are commonly negociated in pounds, ſhillings and pence. The ſums of the invoices are often made out both ways.

EXAMPLES.

1. How much Sterling money in L.830 : 6s. currency of New York, exchange 152 per cent.?

Cur. Ster. Cur.
152 : 100 : : 830.3 : L546 : 5 : 0 Ster.
100

152)83030.0(546.25

2. How much currency of Barbadoes in L1164 Sterling, exchange 135 per cent.?

Ster. Cur. Ster.
100 : 135 : : 1164 : L.1571 : 8s. currency.
135

5820
3492
1164

Point off two places for dividing by 100. 1571.40

*Queſtions for Practice.*

1. Boſton is indebted to Britain L.1280 currency; how much Sterling muſt Boſton remit, exchange 155 per cent.?

2. Leith draws on Jamaica for L.1060 : 15s. Sterling; how much currency will pay the draught, exchange 140 per cent.?

3. Glaſgow owes Maryland for tobacco L.2078 : 10s. currency; how much Sterling will compenſate the debt, exchange 145½ per cent.?

4. A reckoning of L.7 currency in Jamaica, was paid with L.5 Sterling; what was the exchange?

5. A merchant in Leith has owing him in New York, L.1342 10s. currency, exchange 153 per cent.; in St. Kitt's L.1150 : 15s. exchange 145; in Virginia L.1456 : 17 : 6, exchange 160; in Jamaica L.980 : 18s. exchange 135; in Philadelphia L.1760 : 12s. exchange 130; how much Sterling will this amount to?

## IV. WITH HOLLAND.

At AMSTERDAM there are two ſorts of money, *banco* and *currency*. The current money is the coin which circulates in the country, and the bank money is the property which a perſon poſſeſſes in the bank. As no money defective in weight or fineneſs, is received into the bank; the bank treaſure is accounted of ſuperior value to the current money, and the difference is called *agio*, which varies from 2 to 5 per cent.

Accompts are kept in current money, and bills of exchange negociated in bank money. The pound Flemiſh is divided as the Britiſh pound, and the guilder as follows:

| | | | |
|---|---|---|---|
| 16 pennings | = 1 ſtiver. | 2 pence groſs | = 1 ſtiver. |
| 20 ſtivers | = 1 guilder or flor. | 40 pence groſs | = 1 guilder. |
| 2 guilders | = 1 dollar. | 12 pence groſs | = 1 ſchilling. |
| $2\frac{1}{2}$ guilders | = 1 rix-dollar. | 20 ſchil. groſs | = 1 pound groſs |
| $5\frac{1}{4}$ guilders | = 1 ducat. | | |

Exchange with Britain is from 34 to 37 ſch. groſs or Flemiſh per pound Sterling. The par is 36s. 7d. current, and therefore the value of a guilder is about $21\frac{7}{8}$d.

To reduce bank money into current, and the contrary, ſay
100 : 100 with the agio added : : banco : current.
100 with the agio added : 100 : : current : banco.

### EXAMPLES.

1. How much Sterling money in 5421 guilders current, agio $3\frac{1}{2}$, exchange 35s. 9d.?

Cur. Banco Cur.
$103\frac{1}{2}$ : 100 . : 5421
100

103·5)542100

guild. 5237.681 banco.
40d. Flem. = 1 guild.

ex. 35s. 9d. × 12 = 429)209507.240

Anſwer L.488 : 7 : 3 Sterling.

2. How many current guilders in L.850 Sterling, exchange 36s. 4d., agio 2½ per cent.?

436d. Flem. in the exchange.

850 L.

21800

3488

1 guilder = 4,0 Banco 37060,0 Cur.

Then 100 : 102½ :: 9265 guilders banco.

102½

18530

9265

46325

9496.625 = 9496 guild. 12 ſtiv. 8 pen.

3. When the exchange was at 36s. 6d. Britain drew on Amſterdam for 8400 guilders, but was obliged to remit, to keep credit there, at 35s.; what was loſt or gained, and how much per cent.?

Guilders.

(1.) If 36s. 6d. : 8400 :: 35s.

2 73 2

73 25200 70

58800

7,0)61320,0

8760 remitted

8400 drawn.

guilders, 360 loſt.

÷ by 12 70

840,0 : 360 :: 100

3

100

7,0) 30,0

$4\frac{3}{7}$ per cent.

4. A of London drew on B of Holland 35000 guilders, exchange 35s. at 3 months date, at the end of which B redrew on A, for the value at 2 months, including ¼ per cent. commiſſion, exchange 36s.; required A's gain or loſs, allowing intereſt at 5 per cent.?

Ex. 35s. 6 ſtiv. = 1 L. Flem.

21,0

35000 / 20 ſtiv.

21,0 { 7)70000,0 / 3)10000

3333 : 6 : 8

add 3 & 2 months intereſt, 69 : 8 : $10\frac{2}{3}$

A draws on B for 3402 : 15 : $6\frac{2}{3}$
B draws on A for 3256 : 18 : $10\frac{2}{3}$

A gains L. 145 : 16 : 8

Ex. 36s. 35000 / 6 / 20

216 | 700000 ſt.

$\frac{1}{2\,0\,0}$)3240.7407
16.2037

3256.944

5. Amſterdam owes Edinburgh 15375 guilders current, which the merchant can ſell at $22\frac{1}{2}$d.; or, the exchange at London is at 34s. 9d. agio $2\frac{1}{2}$, and the premium on London bills is 2 per cent., agent's commiſſion $\frac{1}{4}$ per cent. Whether ought he to negociate at Edinburgh or London?

$\frac{1}{1\,2\,\frac{1}{2}}$)15375 at $22\frac{1}{2}$d.

$\frac{1}{8}$ )1281 : 5 : 0 = 20d.
160 : 3 : $1\frac{1}{2}$ $2\frac{1}{2}$d.

1441 : 8 : $1\frac{1}{2}$

$102\frac{1}{2}$ : 100 : : 15375

100

102.5)1537500

15000 guild. banco
40 pence

34s. 9d. × 12 = 417)600000

At London he gets L. 1463 : 19 : $1\frac{1}{2}$
At Edinburgh . . . 1441 : 8 : $1\frac{1}{2}$

Better at London by L. 22 : 11 : 0

$\frac{1}{5\,0}$)1438.849
add 28.776 = 2p.ct.

$\frac{1}{4\,0\,0}$)1467.625
ſub. 3.669 = $\frac{1}{4}$p.ct.

1463.956

## *Queſtions for Practice.*

1. How much of a debt in current money will 4420 guilders banco compenſate, agio $3\frac{1}{8}$ per cent.?

2. A merchant in Holland has $3852\frac{1}{2}$ guilders current; how much will it reckon banco, agio $3\frac{1}{2}$?

3. Dundee draws on Amſterdam for L 1435 : 10s. Sterling; how much Flemiſh will retire the draught, exchange 35s. 8d.?

4. Britain remits to Holland 6149 gs. 11 ſtiv. 12 pen.; how much Sterling was paid for the bill, exchange 35s. 10d.?

5. Rotterdam owes Leith L.1201 : 5 : 6 Sterling; how many current guilders may Leith draw, exchange 36s. 6d. agio $4\frac{1}{4}$.?

6. If the pay of a Britiſh ſailor be L.1 : 10 per month, and that of a Dutch ſailor 16 guilders; what is the difference, ex. 36s. 8d.?

7. What is the courſe of exchange between Britain and Holland when the Bank guilder ſells at $22\frac{1}{2}$d.?

8. When the value of the current guilder is $21\frac{1}{4}$d.; what is the value of the guilder banco, the agio being 4 per cent.?

9. What is the value of the current guilder when the courſe of exchange is 35s. and agio $3\frac{3}{4}$ per cent.?

10. Britain remitted to Amſterdam L.2070, exchange 36s. 3d. and drew for the ſame when the exchange was at 34s. 6d.; what was received for the draught?

11. A merchant remits L.2000 to Amſterdam, exchange 35s. 4d. agio $3\frac{1}{2}$d.; and allowing his agent to retain $\frac{1}{2}$ per cent. commiſſion; he draws 3850 g. at $22\frac{1}{4}$d.; 2500 at $22\frac{1}{3}$d.; 4250 at $22\frac{1}{2}$d.; and the remainder at $22\frac{3}{8}$d.; required the gain or loſs?

## V. WITH GERMANY.

At HAMBURGH, money is diſtinguiſhed as at Amſterdam into banco and current: bills are negociated in the former, accompts kept in the latter. The agio here varies from 15 to 25 per cent.?

| | | | |
|---|---|---|---|
| 12 phennings | = 1 ſchil. lubs. | 6 phen. | = 1 pence grs. |
| 16 ſchil. lubs | = 1 marc lubs. | 2 pen. gr. | = 1 ſchil. lubs. |
| 2 marcs | = 1 dollar. | 6 ſch. lubs | = 1 ſchil. groſs. |
| 3 marcs | = 1 rix dollar. | 32 pen. gr. | = 1 marc lubs. |
| $6\frac{1}{4}$ marcs | = 1 ducat. | 120 ſch. lubs | = 1 L. groſs or $7\frac{1}{2}$ m. lubs. |

The value of the marc is 1s. 6d.; and therefore the par of exchange is about 35 ſch. $6\frac{1}{3}$d. current. The courſe of exchange with Britain runs from 33 to 36 ſch. banco.

Exchange with Holland about 33 ſtivers banco per dollar of Hamburgh.

The computation here is nearly the ſame as with Holland, obſerving that the marc lub contains 16 ſchillings lubs; whereas the guilder contains 20 ſtivers.

*Note.* As 40 groſs or Flemiſh pence make a guilder of Holland, and 32 a marc of Hamburgh; guilders multiplied by 5 and divided by 4 make marcs, and marcs multiplied by 4 and divided by 5, make guilders.

## EXAMPLES.

1. How much Sterling money in 1640 marks lubs, agio 25 per cent. exchange 34s. 2s.?

Cut. Banco.
125 : 100 : : 1640
abridged 5 4 4

5)6560

1312 ms. banco
16 ſch. in a marc

7872
1312

)20992(102 : 8 Anſ.

Ex. 34 : 2
6

ſch. lubs 205

2. How many marcs current in 1950 guilders current, agio in Holland 4 per cent. exchange 22½ ſtiv. per dollar, agio in Hamburgh 20 per cent.?

Cur. Banco Cur.
1. If 104 : 100 : : 1950 : 1875 guilders banco.
Stiv. Marcs Guilders
2. — 32½ : 2 : : 1875 × 20 : 2307.692 ms. banco.
Banco Cur. Banco
3. — 100 : 120 : : 2307.692 : 2769 ms. 3 ſch. 8 pen. cur.

4. Britain remitted to Hamburgh L.8600 exchange 35s. 5d.; what was gained or loſt by drawing when the exchange is at 33s. 4d.

If 35s.5d. : 8600 : : 33s.4d.
12 12
425 400
8600
255000
3400
4,00)36550,00
9137 : 10 drawn
8600 remitted
L.537 : 10 gained

Then 8600 : 537.5 : : 100
100
86,00)537,50,0(6.25 = 6¼ p. c.
516
215
172
430
430

4. A merchant in Leith has due him in Hamburgh 5000 marcs lubs; he may order it to be remitted directly, exchange 1s. 6d. per m. l.; or by Holland, exchange 32 ſtiv. per dollar: and from Holland on London, exchange 35s.; required the cheapeſt way?

20)5000 marks at 1s. 6d.

250
125

L. 375 directly
386 : 18 : 1 by Holland

L. 11 : 18 : 1 difference

Ex. 35
6 ſtiv.
21,0

m. ſtiv. m.
2 : 32½ : : 5000
5000

2)162500

3 ) 81250

7,0) 27083.3

386.904

## *Queſtions for Practice.*

1. Hamburgh is indebted to Britain 6160 m. l. current; how much bank money will compenſate the debt, agio 18½ per cent.?

2. London owes Hamburgh 7845 marcs l. banco; how much Sterling will even the accompt, exchange 34½ ſch. lubs?

3. How much Hamburgh money in 1860 g. current of Holland, agio there 4¼ per cent. ex. 32½ ſtivers, agio in Hamburgh 18?

4. How many current guilders of Holland in 3650 marcs lubs current, agio in Hamburgh 20 per cent. exchange 32¾, agio in Hamburgh 3⅓?

5. Britain draws on Hamburgh for L.1093 : 15s.; how many marcs will pay the draught, ex. 34s. 9d. Flem. banco?

6. When the exchange is 35s. 5d. Flemiſh banco per pound Sterling; what is the value of the marc lub banco?

7. What is the Sterling value of the current marc lub, when the exchange is at 33s. 4d. Flemiſh banco, agio 20 per cent.?

8. Hamburgh owes Glaſgow 9645 m. 10 ſch. lubs current money, agio 22½ per cent.; how much Sterling may be drawn, exchange 35s. 4d.?

9. When the exchange was 35s. 5d. Britain drew on Hamburgh for 10,000 marcs, when the draught became due, Britain was obliged to remit at 33s. 4d.; what was loſt or gained, and how much per cent.?

10. A, of London remits to B in Hamburgh 10,000 marcs l. exchange 35s. payable in 2 months; and when B receives payment, he remits a bill to A, at 3 months date for the value, retaining ¼ per cent. commiſſion, exchange 35s. 10d.; required A's gain or loſs?

## VI. WITH FRANCE.

At PARIS, BOURDEAUX, &c. accompts are kept in livres, ſols, and deniers Tournois.

12 deniers = 1 ſol. 3 livres = 1 ecu, or crown.
20 ſols = 1 livre. 24 livres = 1 louis d'or.

Exchange with Britain, on the crown, from 28d. to 34d. par 29¼d.
———— with Holland, about 28 ſtivers banco per crown.
———— with Hamburgh, about 26 ſchillings lubs per crown.

### EXAMPLES.

1. How much Sterling in 8325 Lrs. exchange 32½d. per crown?

8325
32½
16650
24975
4162.5
3)270562.5
12) 90187.5
20)7515.625
375.78125

or thus, 3)8325 livres
½)2775 crowns at 32½d.
1/12) 346 : 17 : 6 = 30d.
28 : 18 : 1½ = 2½d.
L.375 : 15 : 7½

2. How many livres in L.4369 Sterling, ex. 31½d. per ecu?

4369
20
87380
12
ex. 31. 5)1048560(33287.619 crowns
3
99862.857 livres
or Lrs.99862. 17 ſols 1¼ den.

3d, How many livres in 2052 guilders, ex. 28½ ſtivers per ecu?

Stiv. Liv.
28½ : 3 : : 2052
2 40

57 half ſt. 82080 half ſtiv.
3

57)246240(4320 Lrs.
228 · · ·

182
171

114
114

4th, How many marcs lubs in 1821 livres, ex. 26, agio 20?

3)1821 livres

607 crowns
26

ſch. 16)15782 ſch.
100 : 120 : : 986 : 6
5 6 6

5)5917 : 16

Lrs. 1183 : 11⅕

*Note.* In all exchanges on the foreign piece, as the French crown, millree, piaſtre, &c. the Britiſh Banker muſt remit when the exchange is low, and draw when it is high, to avail himſelf of the difference, as was formerly obſerved.

## *Queſtions for Practice.*

1. France ſhips for Britain, 35 pipes wine at 5½ livres per gallon; how much ſterling does this amount to, ex. 31½d. per ecu?

2. Britain exports to France 25 hhds. tobacco, wg. 365000 lbs. at 9⅓d. per lb.; how many livres does this amount to, ex. 30½d.?

3. Glaſgow draws on France 3250 livres, 16 ſols, 8 den.; how much Sterling will compenſate the draught, ex. 28¾d.?

4. How much current money of Holland 1840 livres, ex. 28 ſtivers per crown, agio 3¼ per cent.?

5. How many livres in 7680 marcs lubs current of Hamburgh, agio 20 per cent., ex. 26½ ſch. lubs per ecu?

6. London remitted L. 5400 to Paris when the ex. was at 29¼d. and drew for the ſame when the ex. roſe to 30½d; what advantage attended the negotiation?

7. A merchant in Holland remits to Paris lrs. 36000, ex. 28¼d. allowing his agent there ½ per cent. commiſſion, re-draws for the value as follows, viz. 5400 g. ex. 28½d. 6800 g. ex. 28¾d. and the balance at 30¼d.; required his gain or loſs?

## VII. WITH PORTUGAL.

At LISBON, OPORTO, &c. accompts are kept in milrees and rees. As a ree is the thouſandth part of a milree, the computation proceeds as in decimals.

1000 rees = 1 milree. 400 rees = 1 cruſado of ex.
4800 recs = 1 moidore. 6400 rees = 1 joannes.

Exchange with Britain, 65d. to 70d. per milree, par 67½d.?
——— with Holland, about 50d. groſs per cruſado.
——— with France, about 430 rees per crown.

### EXAMPLES.

1. How much Sterling in 13608128 milrees, ex. 68d.

$\frac{1}{12}$, $\frac{1}{5}$)1360 at 5s. 8d.

272 at 4s.
113 : 6 : 8 = 1s. 8d.
$\frac{1}{8}$ of 5s.8d. $8\frac{1}{2}$ = 125 rees.

L.385 : 7 : $4\frac{1}{2}$

or,

1360.125
68d.

12)92488.500

20) 7707 : 4d.

L.385 : 7 : $4\frac{1}{2}$d.

2d, How much money of Portugal, in L.342 : 10s. ex. 66d.?

342 : 10s.
20

6850
12

65)82200(1264.615=1264 m.
780 · · 615 rees.

420 400
390 390

300 100
260 65

40 350
325

25

3d. How much Portugal money in 4325 livres, ex. 428?

3)4325 livres

1475 crowns
428 rees

11800
2950
5900

631.300=631 m. 300 rees.

Point off 3 places for dividing by 1000; which makes rees.

### *Queſtions for Practice.*

1. Portugal draws on Britain, 4786 m. 455 rees; how much Sterling will pay the draught, ex. 67d. per milree?

2. London owes Liſbon L. 1565 : 13 : 4; how many milrees muſt be remitted by London to balance the accompt, ex. at par?

3. How many current guilders of Holland in 4230 milrees, ex. 48d. groſs, per cruſado, agio 3 per cent.?

4. How much money of France in 720 m. 850 rees, ex. 430 rees per crown?

5. Leith owes Portugal L. 1560, ex. 5s. 8d.; how much will diſcharge the debt when the exchange is at 5s. 6d.?

6. A perſon brings 1800 moidores from Portugal to Britain, where they are current for 27s. How much will he gain or loſe when the exchange was at 67d.?

7. Glaſgow receives from Oporto, 38 pipes port wine, at 695 rees per gallon ex. 65½d.; in return Glaſgow ſends 65 pieces broad cloth, each 19½ yds. at 13s. 4d.; and 86 pieces linen, qt. each 25 yards, at 2s. 4d.; what is the difference of theſe tranſactions, and to whom is it due?

## VIII. WITH SPAIN.

At MADRID, CADIZ, &c. the money is diſtinguiſhed into vellon and old plate; the latter is the moſt valuable, and is to the former, as 32 to 17. Shop-keepers reckon by vellon or copper-money, and foreign dealers, by plate or ſilver money, in which bills of exchange are always negociated. Accompts are kept in rials and mervadies.

| | |
|---|---|
| 34 marvadies = 1 rial. | 4 piaſtres = 1 piſtole of ex. |
| 8 rials plate = 1 piaſtre of ex. | 5 piaſtres = 1 piſtole. |
| 10 rials plate = 1 dollar. | 375 marvadies = 1 ducat. |

Exchange with Britain, 40 to 45d. per piaſtre, par 43d.
——— with Holland, about 110d. groſs per ducat.
——— with France, about 18 livres per piſtole.
——— with Portugal, about 630 rees per piaſtre.

### EXAMPLES.

1. How much Sterling in 7536 rials plate, ex. 44d.?

8)7536 rials
$\frac{1}{12}$ $\frac{1}{10}$) 942 piaſtres at 3s. 8d.
94 : 4 = 2s.
78 : 10 = 1s. 8d.
L. 172 : 14

942d.
44
3768
3768
12)41448 pence
20) 3454
L. 172 : 14

2. What is the value of 6432 rials vellon, ex. 42d.?

32 : 17 : : 6432 : 3417 rials plate

$\frac{1}{8}$ = 427$\frac{1}{8}$ piaſtres

3$\frac{1}{2}$ s. ex.

1281

213 : 6d.

$\frac{1}{8}$ of 42d. - - - 5$\frac{1}{4}$

20)1495 : 11$\frac{1}{4}$

L. 74 : 14 : 11$\frac{1}{4}$

427.125 piaſtres

42 d.

12)17939.250 pence

20)1494 : 11d.

L. 74 : 14 : 11$\frac{1}{4}$

## *Queſtions for Practice.*

1. Spain remits to Britain 5420 piaſtres 2 rials; how much Sterling is it, ex. 42$\frac{3}{4}$d. per piaſtre.?

2. Glaſgow owes Cadiz L.1391 : 14s. how much Spaniſh does this debt amount to, ex. 43$\frac{4}{5}$d.?

3. How much Dutch money in 4560 rials plate, ex. 112d. groſs per ducat, agio 3 per cent.?

4. How much French money in 3264 rials vellon, ex. 17 livres 15 ſols per piſtole?

5. How much money of Portugal is equal to 6500 rials plate, ex. 630 rees per piaſtre?

6. Remitted L.1860 to Spain when the ex. was at 42$\frac{1}{2}$d., and drew to be reimburſed, ex. at 45d.; what was gained or loſt?

7. Conſigned to Cadiz 18 bales cloth qt. 53 pieces of 18$\frac{1}{2}$ yds., which per accompt ſales was ſold at 4$\frac{1}{4}$ piaſtres per yard; how much Sterling may I draw for, ex. 42$\frac{7}{8}$d. allowing 6 per cent. for commiſſion and charges.

## IX. WITH ITALY.

Here, as in Holland, the money is diſtinguiſhed into banco, and current, the former having a conſtant ſuperiority of 20 per cent. and alſo a variable agio. It alſo conſiſts of lire and exchange money. Accompts are kept in the former, and exchange tranſacted by the latter.

12 piſtoli = 1 ſoldo. 20 ſoldi = 1 lire.

Venice exchanges by the ducat banco, value 4s. 2$\frac{1}{4}$d.
Genoa ——— by the pezzo of 5$\frac{3}{4}$ lires, value 4s. 2d.
Leghorn ——— by the piaſtre of 6 lires, value 4s. 2d.
Florence ——— by the ducat of 7$\frac{1}{2}$ lires, value, 5s. 2$\frac{1}{2}$d.

The ducat, pezzo, and piaſtre, are each divided in 20 ſoldi; and theſe into 12 denari, in the ſame manner as the lire money, or as our pound Sterling.

In the POPE'S TERRITORIES, accompts are kept in crowns and julios. Exchange by the ſtamped crown. 10 julios = 1 current crown; 12 julios = 1 ſtamped crown, value 6s.

At NAPLES, Accompts are kept in ducats, tarins, and grains.

20 grains = 1 train, 5 tarins = 1 ducat.

Exchange by the ducat, value 3s. 4d.

## EXAMPLES.

1. In 1980 lires of Leghorn, how much Sterling, ex. 50d.?

a piaſtre = 6 lires) 1980

330 piaſtres
50d. ex.

12)16500 pence

20) 1375

L. 68 : 15

2. How many lires of Florence in L.66 : 5 : 3 ex. 62d.?

lires.
If 62d. : $7\frac{1}{2}$ : : 66 : 5 : 3
20

1325
12

15903
$7\frac{1}{2}$

62)119272$\frac{1}{2}$(1923$\frac{3}{10}$ lires.

3. What French money is equal to 1656 lires of Genoa, ex. 108 ſols per piaſtre.?

lires. ſols.
If $5\frac{1}{4}$ : 108 : : 1656
108

13248
1656

$5\frac{3}{4}$)178848
4 ) 4

23 )715392(3110$\frac{3}{5}$ ſol

20=153 liv. 10$\frac{3}{5}$ ſols.

4. How many current crowns of Rome in 1075 ducats banco of Venice, ex. 66 ſtamped crs. per 100 ducats?

d. crowns.
If 100 : 66 : : 1075
66

6450
6450

Then 12 julios : 709.50 : : 10 jul.
12

851.400=851$\frac{2}{5}$ crowns.

## *Queſtions for Practice.*

1. Britain draws on Venice 6180 ducats banco, ex. 51½d.; how much Sterling will the draught amount to?

2. Leith remits to Genoa L.730 : 12s. Sterling; how much will this compenſate at Genoa, ex. 52¼ per pezzo?

3. Glaſgow owes Leghorn 73130 lires, for a cargo per the Betſey; what Sterling does it amount to, ex. 51d.?

4. How much money of Holland in 6590 ducats banco of Venice, ex. 92d. Flemiſh per piaſtre?

5. How much Hamburgh money in 18760 lires current of Venice, agio 25 per cent., ex. 91d. agio in Hamburgh 17½?

6. How much Venetian money in 3718 guilders current of Holland, agio there 4 per cent. ex. 96d. per ducat, agio in Venice 22½d.?

7. How many ducats banco of Venice in 5150 current crowns of Rome, ex. 65 ſtamped crowns per 100 ducats?

8. How much Florence money in 1624 rials plate of Spain, exchange 430 mervadies per ducat?

9. How much Portugueſe money in 6870 current crowns of Rome, ex. 1028 rees per ſtamped crown?

10. How much Spaniſh money in 8560 livres, 15 ſols of Florence, ex. 380 mervadies per ducat?

11. How much Sterling money, ex. 3s. 5d. and livres Tournois in 4380 ducats of Naples, ex. 73 ducats per 100 crowns?

11. How much French money in 3270 lires of Genoa, ex. 108 ſols per pezzo, and what is the value in Sterling, ex. 30½d. per ecu?

13. London drew on Venice 38,000 ducats, ex. 32½d., and remitted the ſame, when the exchange fell to 50d.; what Sterling was gained or loſt, and how much per cent.?

## X. WITH DENMARK AND NORWAY.

At COPENHAGEN, BERGIN, &c. accompts are kept in rix-dollars Daniſh, marcs, and ſkillings.

| | | | |
|---|---|---|---|
| 16 ſkillings | = 1 marc. | 4 marcs | = 1 ort. |
| 6 marcs | = 1 rix-dollar. | 11 marcs | = 1 ducat. |

Exchange with Britain, from 4 to 5 rix-dollars per L. par 4s. 6d.

——— with Holland, about 110 rix-dollars Daniſh per 100 rix-dollar banco.

——— with Hamburgh, about 250 marcs lubs per 100 rix-dollars Daniſh.

EXAMPLES.

1. How many rix-dollars in L.1840 : 10s., ex $4\frac{1}{2}$?

1840 : 10
$4\frac{1}{2}$ rix-dol.

7362 : 0
920 : 5

8282 : 5 = $8282\frac{1}{4}$ rix-dol.

2. How much Sterling in 8282 rix-dol. 1 m. 8 ſkil. ex. $4\frac{1}{2}$?

rix-dol. 4.5 } 5)8282.25 / 9)1656.45

1840.5 = L.1840 : 10s.

3. How many rix-dollars in 63544 guilders cur. agio 4, ex. $108\frac{1}{2}$?

If 104 cur. : 100 banco : : 63544 cur. : 61100 guild. banco. $1\frac{1}{2}$ guilders = 1 rix-dol. therefore 61100 ÷ $2\frac{1}{2}$ = 24440 rix-d. 100 rix-d. : $108\frac{1}{2}$ ex. : : 24440 rix-d. : 26517 rix-d. 1 m. 8 ſkil.

4. How many marcs lubs current of Hamburgh, in 4175 rix-dol. ex. 254, agio 18?

100 rix-d. : 254 marcs : : 4175 rix-d. : 10604.5 marcs
100 banco : 118 cur. : : 10604.5 mar
118

848360
1166495

Anſwer 12513.310 = 1251 m. 4 ſch. $11\frac{1}{2}$ pen.

## *Queſtions for Practice.*

1. Norway owes Britain 1345 rix-dollars; how much Sterling may be drawn, ex. $51\frac{1}{2}$d.?

2. How many current guilders of Holland in 5640 rix-dollars, 109, agio 3 per cent.?

3. How much Daniſh money in 3980 marcs lubs of Hamburgh, ex. 252, agio $18\frac{1}{2}$ per cent.?

4. What is the value of 6540 rix-dollars drawn on Amſterdam, ex. 110 per cent., commiſſion there $\frac{1}{2}$ per cent., and drawn from Amſterdam on London, ex. 33s. 8d.?

5. How many rix-dollars will equal L.1510 : 10s. Sterling drawn on Hamburgh, ex. 33s. 4d. commiſſion there $\frac{1}{4}$ per cent. and drawn from Hamburgh to Denmark, ex. 250?

## XI. WITH SWEDEN.

At STOCKHOLM, &c. accompts are kept in copper-dollars, marcs and ures.

| | | | |
|---|---|---|---|
| 8 ures | = 1 cop. marc. | 2 ſilv. dol. | = 1 rix-d. |
| 4 copper marcs | = 1 cop. dollar = $6\frac{2}{3}$d. | 12 runſtics | = 1 ſkilin. |
| 3 copper marcs or 4 ſilver marcs | = 1 ſilver dol. | 48 ſkilins | = 1 rix-d. value 5s. |

Exchange with Britain, at ſo many copper dollars per L. Ster.
———— with Holland and Hamburgh, at ſo many ſilver marcs per rix dollar of theſe places.

*Note.* To reduce copper dollars to ſilver marcs, multiply by 4 and divide by 3.

### EXAMPLES.

1. How many guilders are in 26134½ copper dollars, ex. 12½?

26134½
4
3)104538
12½ : 2½ guil. :: 34846 ſilv. marcs
2½ g. in 1 r. d.
12½) 87115 (6969 guil.
4 ſtiv.

2. How much Swediſh in 2619 marcs lubs, ex. 14?

3)2619 marcs
873 rix-dol.
14 ex.
12222 ſilver marcs
3
4)36666 cop. marcs
9166½ cop. dollars

### *Queſtions for Practice.*

1. Sweden draws on Britain 85760 copper dollars; how much Sterling will pay the bill, ex. 40½?
2. London remits to Stockholm L.1540 : 18s.; how much Swediſh is equal to the remittance, ex. 39½?
3. How much Swediſh money in 1680 guilders of Holland, ex. 12½ ſilver marcs per rix-dollar banco?
4. How much Hamburgh money in 14750 copper dollars, ex. 14 ſilver marcs per rix-dollar?
5. A Britiſh merchant pays a debt in Sweden, by a credit on Holland, exchange from Sweden to Holland 14s. m. and from

Holland to Britain 35s. 8½d.; how much will it coſt him per copper dollar?

6. London owes Stockholm L.1230 : 15s.; how much muſt be remitted to Hamburgh to even the accompt, ex. 34s. 2d.; and how many dollars may Stockholm draw on Hamburgh, at 7½ dollars per rix-dollar of Hamburgh?

## XII. WITH POLAND AND PRUSSIA.

At DANTZIC, &c. accompts are kept in Poliſh florins and groſs.

30 groſs = 1 florin. 3 florins = 1 rix-dollar.

Exchange with Britain, at ſo many pence per florin, par 1s. 2d.
——— with Holland, at ſo many groſs per L. Flemiſh banco.
——— with Hamburgh, at ſo many groſs per rix-dollar banco.

### EXAMPLES.

1. How many guilders in 2079 florins, ex. 308?

2079 fl.
30

308 gr. : 6 guild. : : 62370 groſs
6

308)374220(1245
guild.

2. How much Poliſh in 1090 marcs lubs, ex. 120?

If 3 marcs : 120 gr. . : 1090
120

3)220800

a florin = 30 groſs) 73600

2453⅓ f.

### *Queſtions for Practice.*

1. Britain owes Dantzic 2360 f. 25 gr.; how much Sterling muſt be remitted to even the accompt, ex. at par?

2. How much Poliſh money in 5420 guilders current, agio 2½ per cent., ex. 310 groſs per rix-dol. banco?

3. How much current money of Hamburgh in 3560 f. 15 gr. ex. 120 gr. per rix-dol. agio 17½ per cent.?

4. What is the value of 6760 Poliſh florins; drawn on Holland, ex. 312, and from Holland on London, ex. 35s. 10; of the ſame drawn on Hamburgh, ex. 122, and from Hamburgh on London, ex. 34s. 2d.?

### XIII. WITH RUSSIA.

At PETERSBURGH, &c. accompts are kept in roubles and copecs.

100 copecs = 1 rouble.

Exchange with Britain, at ſo many pence per rouble, par 4s. 6d.
———— with Holland, about 50 ſtivers per rouble.
———— with Hamburgh, about 110 copecs per rix-dollar lubs.

EXAMPLES.

1. How many guilders in 1786 roubles, ex. 50?

1786
50 ſtiv. ex.

20)89300

4465 guilders.

2. How many roubles in 1365 marcs lubs, ex. 110?

3 m. : 110 copecs :: 1365
110

3)150150

500,50 = 500 rubles, 50 copecs.

*Queſtions for Practice.*

1. What is the value of 4368 roubles drawn on London, ex. 4s. 5½d.?
2. How many roubles in 3465 guilders, 15 ſtivers, ex. 49 ſtivers, per rouble?
3. How much Hamburgh money in 2830 roubles, ex. 108 copecs per rix-dollar?
4. What is the value of 3450 roubles drawn on Holland, ex. 49, and from Holland on London, ex. 35s. 9d.?
5. Required the value of 4980 roubles drawn on Hamburgh, ex. 110, commiſſion ¼ per cent. and from Hamburgh on London, ex. 34s. 6d.?

## Sect. II. ARBITRATION OF EXCHANGE.

On account of the variableneſs of the courſe of exchange, a large field is open for the ſpeculator, which may be attended with gain or loſs, according to circumſtances. The deſign of arbitration from this irregularity in the courſes of exchange, is not only to know how to draw and remit with advantage to any one place, but likewiſe by comparing the rate between two or more places, to calculate when it will be moſt profitable to draw upon one place, and to replace the draught by remitting to another, where the exchange is in your favour. Arbitration is commonly divided into ſimple, and compound.

## I. Simple Arbitration,

Finds the rate of exchange, which ſhould prevail between two places, by comparing the rates of theſe places with that of a third.

The queſtions are ſtated as in ſimple proportion, the firſt and third terms being always of the ſame kind, and the ſecond the ſame as the required par.

### EXAMPLES.

1. If the exchange from France to Britain be 30d. per crown, and to Holland 54½d. Flem.; the arbitrated courſe between Britain and Holland is found thus:

As 30d. Ster. : 54½d. Flem. : : 240d. Ster. 36s. 4d. Flem.

2. If the exchange from Britain to France be 30d., and to Holland 36s. 4d. per L. Sterling; the arbitrated rate between France and Holland is computed thus:

As 240d. Ster. : 36s. 4d. Flem. : : 30d. Ster. : 54½d.

3. If the exchange from Britain to Holland be 36s. 4d.; and from France to Holland 54½d. Flem. Required the arbitrated par between Britain and France?

As 36s. 4d. Flem. : 240d. Ster. : : 54½d. Flem. : 30d. Ster. the value of the French crown, if the money were circulated through Holland. If the adviſed rate of exchange be higher than 30d. per crown, ſuppoſe 32d. a banker may remit money to France by way of Holland, and draw for the ſame directly, by which he will gain 2d. per crown. But if, on the other hand, the courſe be lower than the arbitrated *par*, for example 28d., he may remit the money directly to France, and draw for it by way of Holland, by which he will alſo gain 2d. per crown. Hence it is obvious, that whether the adviſed courſe, be above or below the arbitrated courſe, there is always a profit to be made by drawing and remitting: and as it very ſeldom happens that the courſes are at par, or correſponding to one another, advantageous opportunities may occur every poſt.

4. If bills on Liſbon ſell at Cadiz for 165 mervadies per cruſado, when Glaſgow exchanges with Cadiz at 3s. 6d. per piaſtre, and with Liſbon at 65d. per milree; what is the arbitrated price of the cruſado at Cadiz, and how ought Glaſgow to draw and remit L.100?

Firſt find the arbitrated par.

42d. : 272 merv. : : 65d.
65

1360
1632

42)17680(420$\frac{20}{21}$ merv.

10,00 rees : 420$\frac{20}{21}$ : : 4,00
5 2 2

5)841$\frac{10}{21}$

168$\frac{8}{21}$ mervadies arbitrated par of the cruſado: then as the money of Portugal is below par, ſay as

65d. : 1000 rees : : L.100
240d.

24000 pence
1000

65)24000000

a cruſado = 4,00) 3692.30.7 rees

draw for 923.076 cruſadoes on Liſbon
165 merv. ex.

4615380
5538358
923076

a piaſtre = 272 merv.) 152307,540 merv.

$\frac{1}{6}$) 559.9542 piaſtres remit to Cadiz

20) 93.3257 = 3s. 4d.
4.6662 = 2d.

and L.100 — 97.9919 = L.2 : 0 : 1 gained

5. If bills at London on Paris be at 30d. per crown, and on Amſterdam at 35s. 10d.; what will be gained per cent. by drawing on Paris and remitting to Amſterdam, when London is adviſed, that the exchange between Paris and Amſterdam is 52$\frac{1}{2}$d. Flem.?

If 240d. Ster. : 430d. Flem. : : 30d. Ster. : 53$\frac{3}{4}$d. Flem. par by arbitration.

30d. Ster. : 1 crown : : 100 L. : 800 crowns debit at Paris.

1 crown : 52$\frac{1}{2}$d Flem. : : 800 cr. 1050 guilders credit at Amſt.

35s. 10d. Flem. : 240d. Ster. : : 1050 g. : L.97 13 5$\frac{1}{4}$ to be remitted.

And L.100 — 97 : 13 : 5$\frac{1}{4}$ = L.2 : 6 : 6$\frac{3}{4}$ gained per cent.

But if the advice had been that the exchange between Amſterdam and Paris, had riſen above par, ſuppoſe to 55d. in this caſe, the method of negociation muſt be altered: draw on Amſterdam, and remit to Paris.

If 1 L. Ster. : 35s. 10d. : : 100 L. : 1075 guild. debit at Amſt.
55d. Flem. : 1 crown : : 1075 g. : $781\frac{9}{11}$ crowns credit at Paris
1 crown : 30d. Ster. : : $781\frac{9}{11}$ cr. : L.97 : 14 : $6\frac{6}{11}$ to be rem.
Then L.100 — 97 : 14 : $6\frac{6}{11}$ = L.2 : 5 : $5\frac{5}{11}$ gained per cent.

In negociations of this kind, the money you receive for your draught furniſhes you with money to pay your remittance; and therefore your debit at the one place is paid by your credit at the other. Hence an extenſive credit, and a thorough knowledge in the arbitration of exchanges, makes a ſufficient capital to carry on this beneficial buſineſs.

## *Queſtions for Practice.*

1. If London exchange with Holland at 36s. 3d.; and Holland with Hamburgh at 34 ſtivers; what is the rate of exchange between London and Hamburgh by arbitration?

2. When the exchange from London to Hamburgh is 35s.; and to Holland 33 ſtivers, what is the arbitrated courſe between London and Holland?

3. What is the arbitrated price of the milree, when the exchange between Britain and France is $29\frac{1}{4}$d.; and between Portugal and France 425 rees?

4. Required the arbitrated courſe of exchange between Spain and Portugal, when the exchange between Spain and Britain is $42\frac{1}{2}$d.; and between Britain and Portugal 65d.?

5. Amſterdam exchanges with London at 35s. 5d; and with Liſbon at 50d. per cruſado; how ought the exchange to go between London and Liſbon, to be on par with the other two?

6. The courſe of exchange from Britain to Holland is 35s. 10d.; and from Holland to Ruſſia 49 ſtivers; required the arbitrated value of the rouble?

7. London can draw on Amſterdam at 35s.; and on Paris at 30d. exchange between Amſterdam and Paris is 55d. per crown; how ought London to draw and remit L.500 to take the advantage of the courſe?

8. Bills at London on Paris ſell at 30d. per crown; and on Cadiz at 3s. 6d. per piaſtre; bills at Paris on Cadiz alſo ſell at 4 livres per piaſtre; in what manner ſhould London negociate L.350?

## II. Compound Arbitration.

Here the rate of exchange between three, four, or more places, is given to find whether a direct or circuitous draught, ſhall be preferable, or to find the arbitrated price, between the firſt place and the laſt. Obſerve the following directions:

*First*, Diſtinguiſh the given courſes into antecedents and conſequents, by placing them in different columns fronting one another by way of equation, ſo that each conſequent may be of the ſame kind with the next antecedent, and the firſt antecedent of the ſame kind with the laſt conſequent.

*Secondly*, Multiply the antecedents continually for a diviſor, and the conſequents for a dividend. The quotient will be the value of the ſum, or antecedent required.

*Thirdly*, Then compute the value by the direct draught, and by comparing the values together, you will perceive the moſt advantageous method.

1. A banker in Paris remits to his agent in Amſterdam 2275 crowns; by way of London at 30d.; thence to Rome at 65d. per ſtamped crown; thence to Venice, at 100 ſtamped crowns per 140 piaſtres; and thence to Leghorn, at 100 ducats per 100 piaſtres; and thence to Amſterdam, at 86d. groſs per piaſtre. How many guilders will be received at Amſterdam, excluſive of charges, and how many crowns will be remitted to Paris, ex. 54d.?

| Antecedents. | | Conſequents. | Abridged. | | |
|---|---|---|---|---|---|
| 1 crown, | = | 30 pence | 1 | = | 6 |
| 65d. Flem. | = | 1 ſtam. crown | 1 | = | 1 |
| 100 ſtam. cr. | = | 140 ducats | 1 | = | 7 |
| 100 ducats | = | 100 piaſtres | | | |
| 1 piaſtre | = | 86d. Flem. | 1 | = | 86 |
| How many Flem. pen. | = | 2275 crowns | | = | 35 |

Then $6 \times 7 \times 86 \times 35 = 126420$d. Flem. $\div$ 40d. $= 3160$ guild. 10 ſtiv.

Next 54 pence : 1 crown : : 126420d. : 2341$\frac{1}{9}$ crowns.

In all caſes of circuitous remittance, the agents at the different places through which the money paſſes, charge a commiſſion for their trouble which is generally $\frac{1}{2}$ per cent. to each. This is obtained by deducting the 200th part from each conſequent.

2. London has 1500 piaſtres at Madrid, which may be drawn at 51d. But to try what a circulation of the money will produce, orders them to be remitted firſt to Venice, at 94 piaſtres per 100 ducats; from thence to Paris, at 60 ducats per 100 crown; thence to Amſterdam, at 56d. per crown; and laſtly, draws on Amſterdam, at 35s. 10d.; what is the arbitrated value of the piaſtre, be-

tween London and Madrid, and how much is the circuitous remittance better than the direct draught, allowing $\frac{1}{2}$ per cent. commiſſion to each agent?

| Antecedents. | | Conſequents. | |
|---|---|---|---|
| 94 piaſtres | = | 99.5 ducats | } Commiſſion deducted. |
| 60 ducats | = | 99.5 crowns | |
| 1 crown | = | 55.72d. Flem. | |
| 430d. Flem. | = | 240d. Ster. | |
| How many pence Ster. | = | 1 piaſtre | |

$$\frac{99.5 \times 99.5 \times 55.72 \times 240}{94 \times 60 \times 430} = 54.59\text{d. per piaſtre arbitrated par.}$$

Then 1500 piaſtres at the arbitrated price is L.341 : 3 : 9
Ditto, at the direct courſe, - 318 : 15 : 0

The circuitous remittance is better by L.22 : 8 : 9

Inſtead of dividing each *conſequent* by 200 for the commiſſion, which prevents the terms from being properly abridged, and of courſe renders the calculation troubleſome, by a tedious multiplication and diviſion: we may allow as many commiſſions on the original ſum as there are agents employed in the circulation of the money, this will give an anſwer with more eaſe, which differs very little from the true one.

| | | | Abridged. | |
|---|---|---|---|---|
| 94 piaſtres | = | 100 ducats | 47 | = 50 |
| 60 ducats | = | 100 crowns | 1 | = 10 |
| 1 crown | = | 56 Flem. | 1 | = 56 |
| 430d. Flem. | = | 240d. Ster. | 43 | = 4 |
| How many pence Ster. | = | 1500 piaſtres | | 1500 |

$$\frac{50 \times 10 \times 56 \times 4 \times 1500}{47 \times 43} = 83127\text{d.} = \text{L.}346 : 7 : 3$$

Deduct $1\frac{1}{2}$ per cent. for the three places, 5 : 3 : $10\frac{1}{4}$

Value of the circuitous courſe, - - 341 : 3 : $4\frac{1}{4}$
Direct courſe, - - - - 318 : 15 : 0

Gained, - - - - L. 22 : 8 : $4\frac{1}{4}$

To find the arbitrated par of the piaſtre,

Say, 1500 piaſtres : L.341 : 3 : $4\frac{1}{2}$ : : 1 piaſt. : 54.59d. nearly.

*Queſtions for Practice.*

1. If L.1 Sterling be equal to 36s. Flemiſh, 54d. Flemiſh to 1 French crown; 100 French crowns to 54 roubles; how many roubles are equal to the pound Sterling?

2. When 6 yards of Hamburgh make 5 in Holland, and 7 in Holland make 4 in France, and 5 in France make 5 in England; how many yards Engliſh will meaſure 588 yards of Hamburgh?

3. Money may be remitted from Britain to Holland, ex. 35s. 8d.; from Holland to France, ex. 28 ſtivers per crown, from France to Spain 18 livres per piaſtre; required the rate of the piaſtre by arbitration?

4. Leith has 1000 ducats at Venice, which may be drawn directly, ex. 50$\frac{1}{4}$d.; or the value may be drawn on Holland, ex. 36s. 3d.; from Holland on Portugal, ex. 50d. groſs; from Portugal on Spain, ex. 630 rees, and from Spain on Venice, ex. 318 mervadies per ducat; required the cheapeſt way and the difference?

5. A, of Britain has L.2460 cur. due at Jamaica, which may be remitted him, ex. 140 per cent.; but orders his agent to remit the money to Boſton at L.160 Jamaica currency for L.180 Boſton currency; and to Holland at L.1 Boſton cur. for 25s. Flem.; from Holland to France at 60d. groſs, per crown, and draws on France for the whole, ex. 32d. Whether is the circular remittance better than the direct draught, reckoning $\frac{1}{2}$ per cent. commiſſion at each place?

# CHAP. XI.

## INTEREST.

### Sect. I. Simple Interest.

Interest is of two kinds, ſimple and compound. Simple intereſt is only computed on the ſum originally lent, although it ſhould remain unpaid for ſeveral years.

We explained the more uſeful computations in this rule in Chap. VII. Sect. IV. and have reſerved ſome caſes for this place, becauſe the ſolutions ſometimes can be more eaſily performed by the help of decimals.

To calculate intereſt for any number of years, proceed by either of the following rules.

1. *Divide the principal by* 20, *the quotient is one year's intereſt at* 5 *per cent., which multiply by the number of years for the anſwer; and for any other rate take proportional parts.*

II. *Or, Multiply the rate by the time, and conſider the product as the rate per cent.*

III. *Or, Multiply the principal by the product of the rate and time, and divide by* 100 *for the anſwer.*

When the operation is performed by decimals, and the rate any other than 5 per cent., multiply the intereſt at 5 per cent. by 9, for $4\frac{1}{2}$ per cent. by 8 for 4, by 7 for $3\frac{1}{2}$, and by 6 for 3 per cent.

Ex. What is the intereſt of L.347 : 16 : 8 for 6 years at 5 per cent.?

(1.) 20)347 : 16 : 8

1 year 17 : 7 : 10

6 yrs.

L.104 : 7 : 0

or, 5 p. c.

6 yrs.

30 p. c.

(2.) $\frac{1}{2}$)347 : 16 : 8

$\frac{1}{2}$) 69 : 11 : 4 = 20 p. c.

34 : 15 : 8 = 10 do.

L.104 : 7 : 0

(3.) 347.83

30

104.35 . .

or,

(4.) 347.83

6 the time

2087.00

.05 the rate

104.35 as before

1. Required the intereſt of L.342 : 10 for 3 years at 5 per cent.
2. ——— Of L.163 : 6 : 8 for 10 years at do.?
3. ——— Of L.192 : 17 : 6 for 5 years at $4\frac{1}{2}$ per cent.?
4. ——— Of L.546 : 18 : 4 for $8\frac{1}{3}$ years at 4 per cent.?
5. ——— Of L.465 : 13 : 4 for 15 years at $3\frac{1}{2}$ per cent.?
6. ——— Of L.247 : 15 : 10 for $7\frac{1}{2}$ years at 3 per cent.?
7. ——— Of L.546 : 14 : 3 for 3 years, 3 months and 25 days at 4 per cent.?
8. What ſum will retire a bond of 100,000 merks Scots, with intereſt at 5 per cent. from Lammas 1779, to Lammas 1798?

To calculate intereſt on bonds, or bills, when the payments are made at conſiderable diſtances of time; add the intereſt due at the date of each payment, to the principal, and from that amount deduct the payment.

Ex. A bond of L.650 was due 17th Jan. 1786, of which there was paid L.80 the 25th of April, 1787; L.115, 29th July, 1789, and L.195, 25th May 1790; required the intereſt and balance due the 8th October, 1791?

| | | |
|---|---|---|
| A bond due 17th January, 1786, - - | per L.650. | |
| Add int. to 25th April, 1787, = 1 year and 98 days - - - | L.41 : 4 : 6½ | 41.226 |
| Amount, | | 691.226 |
| Paid 25th April, 1787, - - - - | | 80. |
| Balance due 25th April, 1787 - - - | | 611.226 |
| Int. to 29th July, 1789, = 2 yrs. 35 days, | 69 : 1 : 6½ | 69.0769 |
| Amount, | | 680.3029 |
| Paid 29th July, 1789, - - - - | | 115. |
| Balance due 29th July, 1789, - - - | | 565.3029 |
| Intereſt to 25th May, 1790, = 300 days, | 23 : 4 : 7½ | 23.2316 |
| | | 588.5345 |
| Paid 25th May, 1790, - - - - - | | 195. |
| Balance due 25th May, 1790, - - - | | 393.5345 |
| Int. to 8th Oct. 1791, = 1 yr. 136 days, | 27 : 0 : 2 | 27.0083 |
| Amount of the Intereſt, | L.160 : 10 : 10 | 420.5428 |
| Balance due 8th Oct. 1791, - - - | | L.420 : 10 : 10 |

Qu. 1. Lent on bond 23d July, 1789, at 5 per cent. L.1500, and received the following partial payments, viz. on the 16th Feb. 1792, L.500; on the 8th Auguſt, 1793, L.250; on the 30th Jan. 1795, L.350; on the 6th Dec. 1796, L.100; required the balance due 14th November, 1797?

2. Bought an eſtate at Candlemas 1790, with the burden of L.700 borrowed upon it ſince 11th Nov. 1788; of which paid L.350; 1ſt Auguſt 1792, L.300 at Whitſunday 1793; and L.150, 31ſt Jan. 1795; what ſum will retire the bond at Lammas, 1796?

3. A bond for L.1900, being due 11th Nov. 1786, there was paid on the 24th October, 1787, L.560; on 15th April, 1790, L.480; on 31ſt Dec. 1791, L.300; on 18th July, 1793, L.250, on 1ſt Sept. 1795, L.200, and the balance 15th May, 1796; how much will it amount to, reckoning intereſt at 4 per cent.?

4. An eſtate was purchaſed for L.6000, payable, one half at Martinmas 1790, and the other at Whitſunday 1792; however, it was only paid as follows: on the 1ſt March, 1791, L.1200; 21ſt Sept. 1793, L.1200; 14th Oct. 1794, L.1200; 25th Feb. 1795, L.1200, and 18th April, 1796, L.1200; required the legal intereſt?

DISCOUNT or REBATE, is the allowance which ought to be made for payment of a debt before it becomes due. The remainder or preſent value is the ſum which, if lent out at the rate of intereſt propoſed, would amount to the debt upon the day when it is payable.

*RULE. As* L.100 *with its intereſt for the given rate and time, is to the intereſt of* L.100 *for the ſame; ſo is the debt to the diſcount. Or as the amount of* L.100 *to* L.100, *ſo is the debt, to the preſent value.*

Ex. What is the diſcount of L.246, due 6 months at 5 per cent.?

40)100
2.5
102.5 : L.2.5 : : L 246
25
1230
492
102.5)6150(L.6

or, 102.5 : 100 : : 246
100 246
102.5)24600(240
2050
L.6
4100
4100

What is the preſent value of L.561 due 146 days hence?

146 days 102 : 100 : : 561 preſent worth is L.250
100 100 add 146 days int. 11
73,00)146,00 102)56100 Proof L.561
L.2 L.550

## *Queſtions for Practice.*

1. How much ready money will take up a bill of L.360 : 10 in 219 days?
2. What ſum lent at 4 per cent. will amount to L.1040 in 10 years?
3. How much preſent money is equivalent to L.102, due at the end of 146 days, intereſt at 5 per cent.?
4. What diſcount ſhould be allowed on receiving preſent payment of L.369, due 6 months hence?
5. How much ready money ſhould be given to diſcharge a Legacy of L.810 due 7 years hence, allowing intereſt at 5 per cent.?

When the principal, amount and rate are given, the time may be computed by the following rule. As a *year's intereſt of the principal, is to a year, ſo is the whole intereſt, to the time required.* Or, when the

principal, amount, and time, are given, the rate may be found thus. *As the product of the time and principal, is to the whole intereſt, ſo is* L.100 *to the rate.*

## *Queſtions for Practice.*

1. What is the amount of L.380 for 9 years, at 5 per cent.?
2. What is the amount of L.500 for 219 days, at 4 per cent.?
3. In what time will L.500 gain L.12 of intereſt, at 4 per cent.?
4. In what time will L.320 amount to L.440, at 5 per cent. per annum?
5. At what rate of intereſt will L.450 amount to L.463 : 10 in 292 days?
6. L.250 was lent for 7 years, when the amount was L.320; required the rate per cent.?
7. I have a bond on the bank of Scotland, which yields annually 50 guineas of intereſt; required the contents?
8. A certain banker diſcounts bills at two months date, or at an average at 63 days, for which he charges $\frac{1}{2}$ per cent. beſides intereſt at 5 per cent. At what rate per cent. does he lend his money?

EQUATION of PAYMENTS, is to find a time when a debt due at different times may be paid at once, without loſs either to the borrower or lender.

Common Rule. *Multiply each ſum by the time before it be due; and divide the ſum by the products of the whole debt, the quotient is the equated time.*

Ex. Suppoſe I purchaſe goods to the value of L.50 at 2 months credit; L.100 at 5 months, and L.150 at 8 months; at what term ought I to grant my acceptance for the whole?

| | | | | |
|---|---|---|---|---|
| L. 50 | × | 2 months | = | 100 |
| 100 | × | 5 —— | = | 500 |
| 150 | × | 8 —— | = | 1200 |
| 300 | | | | )1800(6 months |
| | | | | 1800 |

## *Queſtions for Practice.*

1. L.95 is due as follows: L.25 in 6 months; L.30 in 7 do.; and L.40 in 10 do.; at what time ought the whole to be paid at once?
2. I am to pay L.860 as follows, L.210 in ready money, L.400 in 60 days, and the reſt in 162 days; what is the equated time to pay the whole at once?

3. A debt of L.1000, whereof $\frac{1}{2}$ is to be paid at 8 months; $\frac{1}{4}$ at 12 months, and the remainder in 15 months; required the time for paying the whole together?

4. A owes B L 360 due in 9 months; but in 3 months pays him L.90, and in 6 months after that L.170; how much longer than 9 months ſhould B, in equity, defer the balance?

*Note.* The above rule is not ſtrictly true, as there is no difference made between *intereſt* and *diſcount*, whereas the latter is always leſs than the former, by the intereſt of the diſcount, but as this error is trifling, the above method being ſimple and eaſy for practice, is always uſed, and affords a good approximation, as it is ſufficiently exact for buſineſs.

PRACTICAL DISCOUNT. Although the foregoing method of diſcount be ſtrictly true, yet bankers and others who diſcount bills, never uſe it, becauſe they would have no more than the intereſt of the money they pay down, which they reckon too ſmall a conſideration for keeping money by them, for the purpoſes of diſcounting: they therefore deduct the intereſt from the ſum of the bill, computing from the time the bill is diſcounted to the day it falls due, (*i. e.* 3 days beyond the term of the bill.)

## *Queſtions for Practice.*

1. What deduction ſhould be allowed for advancing money on a bill of L.246 due at the end of 4 months, intereſt 5 per cent.?

2. A bill of L.320 : 10s. dated 23d June, at 6 months, was diſcounted the 11th September; how much money was paid down?

3. Diſcounted with the Royal Bank, a bill of L.153 : 15s. due in 3 months; how much money did I receive.

4. A bill drawn the 7th April, payable in 5 months, was diſcounted on the 12th June; what did the holder receive, the contents being L.730?

We ſhall inſert here two tables, the one ſhews the dominical (or Sunday) letter. The other table, by the help of the dominical letter, ſhows the day of the week on which any month begins; and by which the diſadvantage of making bills or promiſſory notes to fall due on Sundays, or other holidays, may be eaſily avoided.

## A PERPETUAL CALENDAR.

Showing the Dominical letter from the firſt year of the Chriſtian Æra, to the year 4000, and which may be continued for ever.

The even hundred years, are found on the right hand ſide.

☞

The odd years are found below, and in the angle of meeting ſtands the dominical letter for that year.

| | | | 000 |
|---|---|---|---|
| 100 | 200 | 300 | 400 |
| 500 | 600 | 700 | 800 |
| 900 | 1000 | 1100 | 1200 |
| 1300 | 1400 | 1500 | 1600 |
| 1700 | 1800 | 1900 | 2000 |
| 2100 | 2200 | 2300 | 2400 |
| 2500 | 2600 | 2700 | 2800 |
| 2900 | 3000 | 3100 | 3200 |
| 3300 | 3400 | 3500 | 3600 |
| 3700 | 3800 | 3900 | 4000 |

| | | | | |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | C E G BA |
| 1 | 29 | 57 | 85 | B D F G |
| 2 | 30 | 58 | 86 | A C E F |
| 3 | 31 | 59 | 87 | G B D E |
| 4 | 32 | 60 | 88 | FE AG CB DC |
| 5 | 33 | 61 | 89 | D F A B |
| 6 | 34 | 62 | 90 | C E G A |
| 7 | 35 | 63 | 91 | B D F G |
| 8 | 36 | 64 | 92 | AG CB ED FE |
| 9 | 37 | 65 | 93 | F A C D |
| 10 | 38 | 66 | 94 | E G B C |
| 11 | 39 | 67 | 95 | D F A B |
| 12 | 40 | 68 | 96 | CB ED GF AG |
| 13 | 41 | 69 | 97 | A C E F |
| 14 | 42 | 70 | 98 | G B D E |
| 15 | 43 | 71 | 99 | F A C D |
| 16 | 44 | 72 | | ED GF BA CB |
| 17 | 45 | 73 | | C E G A |
| 18 | 46 | 74 | | B D F G |
| 19 | 47 | 75 | | A C E F |
| 20 | 48 | 76 | | GF BA DC ED |
| 21 | 49 | 77 | | E G B C |
| 22 | 50 | 78 | | D F A B |
| 23 | 51 | 79 | | C E G A |
| 24 | 52 | 80 | | BA DC FE GF |
| 25 | 53 | 81 | | G B D E |
| 26 | 54 | 82 | | F A C D |
| 27 | 55 | 83 | | E G B C |
| 28 | 56 | 84 | | DC FE AG BA |

## EXPLANATION,

To find the Day of the Week on which any Month happens.

For example, 18th Dec. 1801, on a line with 1 and under 1800 is D, the dominical letter for that year: then by the following table, on a line with D, and below December, we find *Tueſday:* then, Tueſday 1, Tu. 8, Tu. 15, Wed. 16, Thurſ. 17, Fr. 18, Sat. 19, Sunday 20. If a bill fall due 20th Dec. 1801, being Sunday, it muſt be paid on Saturday.

| Domin. Letter | Jan. Oct. | May. | Aug. | Feb. Mar. Nov. | June | Sep. Dec | Apr. July | Day of the Month. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G | M. | Tu. | W. | Th | F. | Sa. | Su. | 1 | 8 | 15 | 22 | 29 |
| F | Tu. | W. | Th. | F. | Sa. | Su. | M. | 2 | 9 | 16 | 23 | 30 |
| E | W. | Th. | F. | Sa. | Su. | M. | Tu. | 3 | 10 | 17 | 24 | 31 |
| D | Th. | F. | Sa. | Su. | M. | Tu. | W. | 4 | 11 | 18 | 25 | |
| C | F. | Sa. | Su. | M. | Tu. | W. | Th. | 5 | 12 | 19 | 26 | |
| B | Sa. | Su. | M. | Tu. | W. | Th. | F. | 6 | 13 | 20 | 27 | |
| A | Su. | M. | Tu. | W. | Th. | F. | Sa. | 7 | 14 | 21 | 28 | |

## Sect. II. Compound Interest.

Compound Interest is computed by accumulating the intereſt with the principal, at the term when it is payable, and charging intereſt on the amount, during the following period: thus, if L.100 be lent at 5 per cent. the amount, at the end of a year is L.105, which bears intereſt during the following year; and as a year's intereſt of L.105 is L.5 : 5 the amount at the end of two years will be L.110 : 5, and in like manner the amount at the end of three years will be L.115 : 15 : 3

It is not lawful to charge compound intereſt directly, but the lender may raiſe his intereſt when due, and lend it out again; and the computations in compound intereſt are therefore neceſſary for aſcertaining the improvement of money, and the value of annuities.

As the computations here, and in annuities, are very tedious, and therefore tables are commonly uſed in buſineſs, we ſhall inſert the moſt uſeful ones, and ſhew their uſe by examples.

TABLE I. Amount of L.1 Compound Intereſt.

| Years. | 3 p.cent. | 4 p. cent. | 5 p. cent. | Years. | 3 p. cent. | 4 p. cent | 5 p. cent. |
|---|---|---|---|---|---|---|---|
| 1 | 1.03000 | 1.04000 | 1.05000 | 26 | 2.15659 | 2.77247 | 3.55567 |
| 2 | 1.06090 | 1.08160 | 1.10250 | 27 | 2.22129 | 2.88337 | 3.73346 |
| 3 | 1.09273 | 1.12486 | 1.15763 | 28 | 2.28793 | 2 99870 | 3.92013 |
| 4 | 1.12551 | 1 16986 | 1.21551 | 29 | 2.35657 | 3.11865 | 4.11614 |
| 5 | 1.15927 | 1.21665 | 1.27628 | 30 | 2.42726 | 3.24340 | 4.32194 |
| 6 | 1.19405 | 1.26532 | 1.34010 | | | | |
| 7 | 1.22987 | 1.31593 | 1.40710 | 31 | 2.50008 | 3.37313 | 4.53804 |
| 8 | 1.26677 | 1.36857 | 1.47746 | 32 | 2.57508 | 3.50806 | 4.76494 |
| 9 | 1.30477 | 1.42331 | 1 55133 | 33 | 2.65234 | 3.64838 | 5.00319 |
| 10 | 1.34392 | 1.48024 | 1.62890 | 34 | 2.73191 | 3.79432 | 5.25335 |
| | | | | 35 | 2.81386 | 3.94609 | 5.51602 |
| 11 | 1.38423 | 1.53945 | 1.71034 | 36 | 2.89828 | 4.10393 | 5.79182 |
| 12 | 1.42576 | 1.60103 | 1.79586 | 37 | 2.98523 | 4.26809 | 6.08141 |
| 13 | 1.46853 | 1.66507 | 1.88565 | 38 | 3.07478 | 4.43881 | 6.38548 |
| 14 | 1.51259 | 1.73168 | 1.97993 | 39 | 3.16703 | 4.61637 | 6.70475 |
| 15 | 1.55797 | 1.80094 | 2.07893 | 40 | 3.26204 | 4.80102 | 7.03999 |
| 16 | 1.60471 | 1.87298 | 2.18287 | | | | |
| 17 | 1.65285 | 1.94790 | 2 29202 | 41 | 3.35990 | 4.99306 | 7.39199 |
| 18 | 1.70243 | 2.02582 | 2.40662 | 42 | 3.46070 | 5.19278 | 7.76159 |
| 19 | 1.75351 | 2.10685 | 2.52695 | 43 | 3.56452 | 5.40050 | 8.14967 |
| 20 | 1.80611 | 2.19112 | 2.65330 | 44 | 3.67145 | 5.61652 | 8 55715 |
| | | | | 45 | 3.78160 | 5.84118 | 8.98501 |
| 21 | 1.86029 | 2.27877 | 2.78596 | 46 | 3.89504 | 6.07482 | 9.43426 |
| 22 | 1.91610 | 2.36992 | 2.92526 | 47 | 4.01190 | 6.31782 | 9.90597 |
| 23 | 1.97359 | 2.46472 | 3.07152 | 48 | 4.13225 | 6.57053 | 10.40127 |
| 24 | 2.03279 | 2.56330 | 3.22510 | 49 | 4.25622 | 6.83335 | 10.92133 |
| 25 | 2.09378 | 2.66584 | 3.38635 | 50 | 4.38391 | 7.10068 | 11.46740 |

1ſt, To find the amount and intereſt of any ſum; take the amount of L.1 for the time and rate propoſed, from Table I. and multiply the ſame by the given ſum.

Ex. What is the amount of L.800 for 17 years, at 4 per cent.?

Amount of L.1 for 17 years 1.9479.

800.

Anſwer L.1558 : 6 : 5 — 1558.3200.

2d, To find the principal which will increaſe to a given amount in any number of years, or the ſum payable at any future period, equivalent to a given ſum at preſent. Divide the given ſum, by the amount of L.1 for the rate and time, in Table I.

Ex. What is the preſent value of L.1558 : 6 : 5 due 17 years hence, at 4 per cent. diſcount compound intereſt? Or what ſum lent for that time and at that rate, would amount to L.1558 : 6 : 5?

Amount of L.1 is 1.9479)1558.3200(L.800. Anſ.
1558.32..

3d, To find the rate of intereſt at which a ſum will increaſe to any propoſed amount divide the amount; by the ſum, and the quotient will be found in Table I. oppoſite to the given time, and under the rate required.

Ex. At what rate of compound intereſt, will L.800 amount to L.1558 : 6 : 5 in 17 years?

800)1558.32

1.9479 found under 4 per cent.

4th, To find the time, when the principal, rate and amount are given.—Divide the amount by the principal, and look for the quotient in Table I. under the given rate per cent. oppoſite to which you will find the number of years.

In what time will L.800, amount to L.1558 : 6 : 5 at 4 per cent.?

Ex. 800)1558.3200(

1.9479 found under 4 per cent., and oppoſite to 17 years.

When the number does not correſpond to the table, the number of days to be added to the years, may be found nearly by this proportion.

As the difference between the next lower, and next higher numbers in the table, : is to the difference between the number looked for, and the next lower one : : ſo is 365, the days in a year : to the number of days required.

Ex. L.100 was lent at 5 per cent. compound intereſt, till the amount was L.350; what was the time?

100)350

26 years = 3.55567 3.5 found between 25 and 26 years.
25 years 3.38635 3.38635 = 25 years.

16932 : 11365 : : 365 days : 245 days.

Therefore the anſwer is 25 years, 245 days.

If the intereſt or preſent value of any ſum for a period greater than 50 years be required, take two or more terms from the tables correſponding to the number of years, whoſe ſum may be equal to the given numbers. The product of the terms is the amount, or preſent value of L.1 for the time propoſed.

Ex. What is amount of L.1 for 70 years at 5 per cent.?

| | |
|---|---|
| Amount in 50 years, | 11.4674 |
| Multiplied by amount in 20 years, | 2.6533 |
| Amount in 70 years, | 30.42645 |

## *Queſtions for Practice.*

1. What is the amount of L.500 for 30 years, at 4 per cent. compound intereſt?

2. What is the amount of L.100 at the end of 99 years, reckoning compound intereſt, at 5 per cent.?

3. In what time will any ſum be doubled at 5 per cent. compound intereſt?

4. What ſum improved at 5 per cent. compound intereſt will amount to L.1500 in 20 years?

5. At what rate of compound intereſt will L.400 amount to L.1968 in 28 years?

6. A ſubſcription of L.1000 for a tontine, was to lie at 5 per cent. compound intereſt, till there ſhould be only one ſurvivor of the ſubſcribers, who ſhould be entitled to call up the money: ſuppoſe 55 years elapſed, how much will he receive?

TABLE II. Amount of L.1 Annuity Compound Intereſt.

| Years. | 3 p. cent. | 4 p. cent. | 5 p. cent | Years. | 3 p. cent. | 4 p. cent. | 5 p. cent. |
|---|---|---|---|---|---|---|---|
| 1 | 1.0000 | 1.0000 | 1.0000 | 26 | 38.5530 | 44.3117 | 51.1135 |
| 2 | 2.0300 | 2.0400 | 2.0500 | 27 | 40.7096 | 47.0842 | 54.6691 |
| 3 | 3.0909 | 3.1216 | 3.1525 | 28 | 42.9309 | 49.9676 | 58.4026 |
| 4 | 4.1836 | 4.2465 | 4.3101 | 29 | 45.2189 | 52.9663 | 62.3227 |
| 5 | 5.3091 | 5.4163 | 5.5256 | 30 | 47.5754 | 56.0849 | 66.4388 |
| 6 | 6.4684 | 6.6330 | 6.8019 | — | — | — | — |
| 7 | 7.6624 | 7.8983 | 8.1420 | 31 | 50.0027 | 59.3283 | 70.7608 |
| 8 | 8.8923 | 9.2142 | 9.5491 | 32 | 52.5028 | 62.7015 | 75.2988 |
| 9 | 10.1591 | 10.5828 | 11.0266 | 33 | 55.0778 | 66.2095 | 80.0638 |
| 10 | 11.4639 | 12.0061 | 12.5779 | 34 | 57.7302 | 69.8579 | 85.0670 |
| — | — | — | — | 35 | 60.4621 | 73.6522 | 90.3203 |
| 11 | 12.8078 | 13.4864 | 14.2068 | 36 | 63.2759 | 77.5983 | 95.8363 |
| 12 | 14.1920 | 15.0258 | 15.9171 | 37 | 66.1742 | 81.7022 | 101.6281 |
| 13 | 15.6178 | 16.6268 | 17.7130 | 38 | 69.1594 | 85.9703 | 107.7095 |
| 14 | 17.0863 | 18.2919 | 19.5986 | 39 | 72.2342 | 90.4091 | 114.0950 |
| 15 | 18.5089 | 20.0236 | 21.5786 | 40 | 75.4013 | 95.0255 | 120.7998 |
| 16 | 20.1569 | 21.8245 | 23.6575 | — | — | — | — |
| 17 | 21.7616 | 23.6975 | 25.8404 | 41 | 78.6633 | 99.8265 | 127.8398 |
| 18 | 23.4144 | 25.6454 | 33.1324 | 42 | 82.0232 | 104.8196 | 135.2318 |
| 19 | 25.1169 | 27.6712 | 30.5390 | 43 | 85.4839 | 110.0124 | 142.9933 |
| 20 | 26.8704 | 29.7781 | 33.0660 | 44 | 89.0484 | 115.4128 | 151.1430 |
| — | — | — | — | 45 | 92.7199 | 121.0294 | 159.7002 |
| 21 | 28.6765 | 31.9692 | 33.7193 | 46 | 96.5014 | 126.8706 | 168.6852 |
| 22 | 30.3568 | 34.2480 | 38.5052 | 47 | 100.3965 | 132.9453 | 178.1194 |
| 23 | 32.4529 | 36.6179 | 41.4305 | 48 | 104.4084 | 139.2632 | 188.0254 |
| 24 | 34.4265 | 39.0826 | 44.5020 | 49 | 108.5406 | 145.8337 | 198.4267 |
| 25 | 36.4593 | 41.6459 | 47.7271 | 50 | 112.7969 | 152.6671 | 209.3480 |

TABLE III. Preſent Value of L.1 Annuity Compound Intereſt.

| Years. | 3 p. cent. | 4 p. cent. | 5 p. cent. | Years. | 3 p. cent. | 4 p. cent. | 5 p. cent. |
|---|---|---|---|---|---|---|---|
| 1 | 0.9707 | 0.9615 | 0.9254 | 26 | 17.8768 | 15.9828 | 14.3752 |
| 2 | 1.9135 | 1.8861 | 1.8594 | 27 | 18.3270 | 16.3296 | 14.6430 |
| 3 | 2.8286 | 2.7751 | 2.7232 | 28 | 18.7640 | 16.6631 | 14.8981 |
| 4 | 3.7171 | 3.6299 | 3.5460 | 29 | 19.1885 | 16.9837 | 15.1411 |
| 5 | 4.5797 | 4.4518 | 4.3295 | 30 | 19.6004 | 17.2920 | 15.3725 |
| 6 | 5.4172 | 5.2421 | 5.0757 | | | | |
| 7 | 6.2303 | 6.0021 | 5.7864 | 31 | 20.0004 | 17.5885 | 15.5928 |
| 8 | 7.0197 | 6.7327 | 6.4632 | 32 | 20.3888 | 17.8736 | 15.8027 |
| 9 | 7.7861 | 7.4353 | 7.1078 | 33 | 20.7658 | 18.1476 | 16.0025 |
| 10 | 8.5302 | 8.1109 | 7.7217 | 34 | 21.1318 | 18.4112 | 16.1929 |
| | | | | 35 | 21.4872 | 18.6646 | 16.3742 |
| 11 | 9.2526 | 8.7605 | 8.3064 | 36 | 21.8323 | 18.9083 | 16.5469 |
| 12 | 9.9540 | 9.3851 | 8.8633 | 37 | 22.1672 | 19.1426 | 16.7113 |
| 13 | 10.6350 | 9.9856 | 9.3936 | 38 | 22.4925 | 19.3679 | 16.8679 |
| 14 | 11.2961 | 10.5631 | 9.8986 | 39 | 22.8082 | 19.5845 | 17.0170 |
| 15 | 11.9379 | 11.1184 | 10.3797 | 40 | 23.1148 | 19.9728 | 17.1591 |
| 16 | 12.5611 | 11.6523 | 10.8378 | | | | |
| 17 | 13.1661 | 12.1657 | 11.2741 | 41 | 23.4124 | 19.9931 | 17.2944 |
| 18 | 13.7535 | 12.6593 | 11.6896 | 42 | 23.7014 | 20.1856 | 17.4232 |
| 19 | 14.3238 | 13.1340 | 12.0853 | 43 | 23.9819 | 20.3708 | 17.5460 |
| 20 | 14.8775 | 13.5903 | 12.4622 | 44 | 24.2543 | 20.5488 | 17.6628 |
| | | | | 45 | 24.5187 | 20.7200 | 17.7741 |
| 21 | 15.4150 | 14.0292 | 12.8212 | 46 | 24.7754 | 20.8847 | 17.8801 |
| 22 | 15.9369 | 14.4511 | 13.1630 | 47 | 25.0247 | 21.0429 | 17.9810 |
| 23 | 16.4436 | 14.8568 | 13.4886 | 48 | 25.2667 | 21.1951 | 18.0772 |
| 24 | 16.9355 | 15.2470 | 13.7986 | 49 | 25.5017 | 21.3415 | 18.1687 |
| 25 | 17.4131 | 15.6221 | 14.0939 | 50 | 25.7298 | 21.4822 | 18.2559 |

## CHAP. XII.

### ANNUITIES.

WHEN a ſum of money is to be paid annually to any perſon, for a term of years, for life, or for ever, it is called an annuity. When an annuity continues unpaid, after it falls due, it is then ſaid to be in arrear.

If the payment of an annuity be delayed for ſeveral years, we may compute on the ſame principles as before, how much the whole will amount to, allowing compound intereſt on each year's annuity, from the time it became due. For an annual penſion may be conſidered as intereſt ariſing, from an imaginary principal, and admits of the ſame improvement.

## Sect. I. Annuities for a certain time.

1ſt, To find the amount of an annuity at compound intereſt.

*Multiply the amount of £.1 annuity by Table* II. *for the given rate and time, by the annuity. The product is the amount required.*

In like manner as in laſt chapter, the annuity, rate and time may be found by Table II.

Ex. 1ſt, What will an annuity of L.40 amount to in 19 years, at 5 per cent. compound intereſt?

The amount of L.1 annuity is 30.539
Multiply by 40

L.122.156 anſwer.

Ex. 2d, What annuity will amount to L.122.159 in 19 years at 5 per cent. compound intereſt?

L.1 annuity = 30.539)122.156(40L. annuity.

Ex. 3d, At what rate of intereſt will an annuity of L.40 amount to L.122.156 in 19 years?

40)122.156

30.539 found under 5 per cent.

Ex. 4th, In what time will an annuity of L.50 amount to L.1000 intereſt at 5 per cent.?

50)1000

15 years = 21.5786 20. found between 14 and 15 years.
14 years = 19.5986 19.5986

As diff. 1.98 : 4014 :: 365 :: 74 days.
Anſwer, 14 years, 74 days.

2d, To find the preſent value, or ſum of money that will purchaſe an annuity. *Multiply the preſent value of £.1 annuity by Table* III. *for the rate and time, by the annuity. The product is the preſent value required.*

Ex. What is the preſent value of a penſion of L.10, to continue 18 years at 4 per cent. diſcount, compound intereſt?

Amount of L.1 12.6593
10L.

126.593

3d, To find what annuity may be purchaſed for a given ſum. *Divide the given ſum by the value of an annuity of £.1. The quotient is the annuity required.*

Ex. 2d, What annuity, to continue 22 years, will L.2632 : 12 purchaſe, compound intereſt at 5 per cent.?

Amount of L.1 is 13.163)2632.600(200L. ann. Anſ.
2632.6

00

The rate and time may be found as in laſt problem.

## *Queſtions for Practice.*

1. What is the amount of an annuity of L.80, in 10 years, at 5 per cent. compound intereſt?
2. What ſalary will amount to L.1200 in 14 years, at 4 per cent. compound intereſt?
3. In what time will a penſion of L.30 amount to L.400, intereſt 4 per cent.?
4. What is the preſent value of L.500, due at the end of 35 years, at 5 per cent. diſcount compound intereſt?
5. What is the preſent value of an eſtate of L.300 per annum, to be ſold at 20 years purchaſe, compound intereſt, at 4 per cent.
6. A gentleman has L.1500, which he propoſes to lay out upon an annuity to continue 25 years. How much will it purchaſe, intereſt as above?
7. A owes B L.1000 due at preſent, which he agrees to pay by an annuity to continue 7 years, what equivalent ſum per annum ought A to pay, computing intereſt at 5 per cent.?
8. A farmer, in obtaining a leaſe of ground for 19 years, pays a fine or graſſum of L.500. How much additional rent would have been equal to the ſame, compound intereſt as above?

## Sect. II. ANNUITIES FOR EVER, OR FREEHOLD ESTATES.

In annuities for ever, or fee ſimple, there are to be conſidered, 1ſt, The annuity, or yearly rent; 2dly, The price, or preſent value; 3dly, The rate of intereſt: all of which fall under one or other of the following problems.

*PROBLEM* I. *To find the price, the annuity or rent and rate of intereſt being given. As the rate of £.1 : to £.1 : : ſo is the rent : to the price.*

Ex. The yearly rent of an eſtate is L.250; how much ready money is it worth at 5 per cent?

.05 . 1 : : 2500 : L.5000 Anſwer.

*PROBLEM* II. *To find the rent or annuity, when the price, and rate of intereſt are given. As £.1 : to its rate : : ſo is the price : to the rent.*

Ex. A gentleman by purchaſing an eſtate for L.5000, had 5 per cent. for his money. Required the yearly rent?

1 : .05 : : 5000 : L.250 rent per annum.

*PROBLEM* III. *To find the rate of intereſt; the price and rent being given. As the price : to the rent : : ſo is* 100 *: to the rate.*

Ex. An eſtate of L.250 of yearly rent is bought for L.5000; what rate of intereſt has the purchaſer for his money?

5000 : 250 : : 100 : 5 per cent.

*PROBLEM* IV. *The rate of intereſt given, to find at how many years purchaſe an eſtate may be bought. Divide* 100 *by the rate.*

Ex. A gentleman would purchaſe an eſtate and have 5 per cent. for his money. How many years purchaſe ſhould he offer.

5)100

20 years purchaſe. Anſ.

*PROBLEM* V. *Given the number of years purchaſe at which an eſtate is bought or ſold; to find the rate of intereſt. Divide* 100 *by the number of years.*

Ex. A gentleman gives 20 years purchaſe for an eſtate; what intereſt has he for his money?

20)100

Anſ. 5 per cent.

## *Queſtions for Practice.*

1. The yearly rent of an eſtate is L.900; what is its value in ready money, computing intereſt at $4\frac{1}{2}$ per cent.?

2. A gentleman purchaſes an eſtate for L.10,000 and has 6 per cent. for his money; what is the yearly rent?

3. An eſtate of L.500 a year is bought for L.8000, what rate of intereſt has the purchaſer for his money?

4. A gentleman is willing to purchaſe an eſtate, provided he can have $6\frac{2}{3}$ per cent. for his money; how many years purchaſe ſhould he offer?

5. A gentleman gives 24 years purchaſe for an eſtate; what intereſt has he for his money?

## Sect. III. Annuities in Reversion.

An annuity is said to be in reversion, when the purchaser on paying the price, does not immediately enter upon possession; the annuity not commencing till some time after.

*Problem* I. *Given the rate of interest, and rent of a freehold estate in reversion, to find the present value of the reversion.*

*Find the value of the estate, as if possession were to commence presently, then by Table* III. *find the present value of the rent for the time prior to the commencement; subtract this value from the first, and the remainder is the value of the reversion.*

Ex. A has the possession of an estate of L.300 for 14 years; B has the reversion of the same for ever, after A. Required the value of the estate, of A's possession and of B's reversion, interest at 5 per cent.

.05)300.00

L.6000 value of the estate,
By Table III. 9.8986 × 300 = 2969.580 value of the possession.

3030.420 value of the reversion.

*Problem* II. *Given the price or value of a reversion, the time prior to the commencement, and the rate of interest, to find the rent or annuity.*

*Find the amount of the price of the reversion for the time prior to the commencement, by Table* I. *then find the annuity, which that amount will purchase.*

Ex. The reversion of a freehold estate, to commence 19 years hence, is bought for L 5000, compound interest, at 5 per cent.; what is the annuity or rent?

By Table I. the amount of L.1. is 2.52695

5000

12634.75 . . .
.05 rate per cent.

Rent required, 631.7375 = L.631 : 14 : 9

### *Questions for Practice.*

1. What is the present value of 50 years possession of an estate of L.300, to begin at the expiration of 19 years, compound interest at 4 per cent.?

2. Required the preſent value of an eſtate of L.300, which is not to be enjoyed till the expiration of 99 years, reckoning compound intereſt at 3 per cent.?

3. The reverſion of a freehold eſtate, upon which there is an annuitant for 17 years, is purchaſed for L.1000, compound intereſt being allowed at 4 per cent; required the yearly rent?

## Sect. IV. Annuities on Lives.

The values of annuities for lives depends as well on the probability of their duration, as the intereſt of money. The calculations are deduced from compariſons on bills of mortality, the only method, in ſuch caſes, that can be depended on.

The probability that a perſon, whoſe age is given, ſhall live to any propoſed age, is denoted by a fraction, whoſe numerator is the number of perſons in life at the propoſed age, and its denominator, the number in life at the given age. Thus, the probability that a perſon now 35 ſhall live to 42 is $\frac{427}{490}$ or $\frac{61}{70}$ by Table IV.; and $\frac{274}{340}$ by Table V. And the chance of his dying before he reach that age is $\frac{63}{490}$ or $\frac{9}{70}$ by the former table, and $\frac{66}{340}$ by the latter.

The extremity of life is that period beyond which there is no probability of ſurviving. In Table VI. Mr. Demoivre aſſumed the age of 86 as the utmoſt probable extent of life, and ſuppoſed that equal numbers died at all ages; ſo that, of 86 perſons born at the ſame time, it might be expected one ſhould die each year, till the whole were extinct.

*Problem* I. *To find what is the probability that any number of perſons of given ages ſhall ſurvive a certain term of years.*

*Rule. Find from Table* IV. *or* V. *the probability of each perſons ſurviving the term: then the product of theſe probabilities will be the probability required.*

Ex. What is the probability of two perſons, whoſe ages are 25 and 35, ſhall be both living 10 years hence?

The probability that a perſon of 25 ſhall live 10 years, is $\frac{490}{567}$ by Dr. Halley's Table; and of one whoſe age is 35, ſhall ſurvive that term is $\frac{397}{490}$. The product of theſe is $\frac{490}{567} \times \frac{397}{490} = \frac{397}{567}$, or nearly $\frac{3}{7}$ the probability that they are both living 10 years hence.

If it be required to know the probability of certain perſons being alive, and alſo of others being dead at the end of any propoſed term, then the reſpective probabilities of living and dying muſt be multiplied together. The product will be the probability required.

*PROBLEM* II. *To find the value of an annuity during the life of a perſon whoſe age is given.*

*RULE. Take from the Table the value of £.1 for the age and rate of intereſt propoſed, and multiply by the given annuity.*

Ex. What is the value of an annuity of L.20 on a perſon's life whoſe age is 50, reckoning compound intereſt at 4 per cent.?

The amount of L.1 on Table VI. 12.511

20

250.22 = L.250 : 4 : 5

*PROBLEM* III. *To find the value of an annuity during the joint lives of two perſons, and to ceaſe when either of them dies.*

*RULE. By Table* VII. *look for the age of the younger in the firſt column, and the age of the elder in the ſecond column: oppoſite to which is the number of years purchaſe.*

Ex. What is the value of L.150 annuity for the joint lives of two perſons, the one 35, and the other 60 years of age, the rate of intereſt being 4 per cent.?

The value of two joint lives of 35 and 60, is 7.658

150 L.

1048.7 = L.1048 : 14

If the ages had been 35 and 62, the value muſt have been determined by taking a proportional part, as under.

The value of two joint lives of 35 and 60 as before 7.658

35 and 65 6.662

Difference .996

Since the given age of the elder is two years above 60, and as the table increaſes by periods of 5 years, ſubtract 2-5th of the difference from the former (7.658) and the remainder is 7.26 years, the value of the two joint lives, 35 and 62.

But if the ages were given 38 and 62, neither of which is found in the table, proceed as follows:

The value of two joint lives is 35 and 62 as above 7.26

40 and 60 = 7.510 40 and 62 7.128

40 and 65 = 6.556

7.510 Difference .132

$\frac{2}{5}$ of .954 = 382

7.128

Subtract (38—35=3) 3-5ths of the difference from the former, viz. 7.26 which give 7.181, the value at the ages required. By thus proportioning the differences, the value for any other ages within the limits of the table, may be determined.

*PROBLEM* IV. *To find the value of an annuity during the joint continuance of three lives.*

*RULE. Take the value of the joint lives of any two, and find the value of a ſingle life equal to that value. Then find the value of the joint lives of the remaining perſon, whoſe age is the age of a ſingle life, which will be the value required.*

Ex. A is 20 years of age, B 35, and C 45; what is the value of their joint lives, reckoning intereſt at 4 per cent.?

Here the value of the two lives 20, and 35, is 11.314, and the age neareſt to this in the table of ſingle lives, is 50. Alſo, the value of the joint lives, whoſe ages are 45 and 50, is 8.619, the year's purchaſe for an annuity for A, B, and C.

*PROBLEM* V. *To find the value of an annuity to continue during the longeſt of two lives.*

*RULE. From the ſum of the values of the ſingle lives, ſubtract the value of the joint lives, and the remainder is the value of an annuity for £.1, on the longeſt of the two lives.*

Ex. What is the value of L.100 annuity, upon the longeſt of two lives, the one 25, and the other 50 years, intereſt at 4 per cent.?

| | |
|---|---|
| Value of a life of 25 years is | 15.318 |
| of 50 years is | 11.344 |
| | 26.662 |
| Alſo the value of the joint lives is | 9.509 |
| Value of the annuity, | 17.153 |
| | 100 |
| | 1715.3 = L.1715 : 6 |

*PROBLEM* VI. *To find the preſent value of a reverſionary annuity, to which a perſon will be entitled, if he ſurvive another, during the remainder of his life.*

*RULE. From the value of the ſucceſſor's life, ſubtract the joint value of his incumbent's life; the remainder is the value of the expectation.*

Ex. A enjoys an annuity of L.30, and B would purchaſe it for his life after the death of A; what is it worth, allowing A to live to 50 and B to 30, intereſt 4 per cent.?

| | |
|---|---|
| From the value of the life in expectation, aged 30 | 14.684 |
| Subtract the value of the joint lives, aged 30 and 50 | 9.345 |
| | 5.339 |
| Which multiply by the annuity, | 30 |
| Anſwer, L.160 : 3 : 5 | L.160.170 |

*PROBLEM* VII. *To find how much a married man ſhould pay annually, during the continuance of his marriage, or during life, in order to purchaſe an annuity for his widow.*

*RULE. Find by laſt problem what ſum in a ſingle payment would be neceſſary for that purpoſe: then divide that ſum by the value of the joint lives;*

This rule ſuppoſes the firſt payment is made at the end of the year; but if it be made preſently, *divide by the value of the joint lives increaſed by unity;* for an annuity is more valuable by one year's purchaſe, when the firſt payment is made preſently, than when it is only made at the end of the year.

Ex. Let the man's age be 50, and his wife's 30, and intereſt 4 per cent. as in laſt queſtion.

The value in a ſingle payment, as above, was L.160.170, and this divided by 10.345, the value of the joint lives increaſed by unity, gives L.15 : 9 : 8, the amount of the annual payment, during marriage, to purchaſe an annuity of L.30.

If the payments be continued during the life of the huſband, divided by the value of the huſband's life, increaſed by unity when the firſt payment is inſtantly made. Thus L.160.170 divided by 12.344 gives L.12 : 19 : 6, annual payments during life.

*PROBLEM* VIII. *To find how much a married man ſhould give in a ſingle payment, or in annual payments, to purchaſe an annuity for his widow, which is not to take place, unleſs the marriage continue a certain term (ſay* 10 *years.)*

*RULE. Find the value in a ſingle payment for lives* 10 *years older than the given ones, multiply the ſame by the probability that both parties ſhall be alive at the end of the* 10 *years, and this product by the preſent value of £.*1 *due in* 10 *years.*

Ex. A man whoſe age is 40, is married to a wife of 30, and wiſhes to ſecure her in an annuity of L.20, if he live 10 years; required what annual contribution he ſhould pay, intereſt 4 per c.?

The huſband will be 50 years old, and the wife 40, at the end of 10 years, and therefore

From 13.196, the value of the wife's life, ſubtract 8.911, the value of the joint lives, the remainder is 4.285.

The probability of the huſband's living 10 years, is $\frac{346}{531}$, and of the wife $\frac{445}{531}$, that both ſhall be alive is $\frac{346}{531}$, by Prob. I.

Then $4.285 \times \frac{346}{531} \times .67556$ (the preſent value of L.1 due 10 years hence) the product is 1.8862, which multiplied by the annuity, gives L.37.724, the value in a ſingle payment. If we divide this by 11.428 the value of the joint lives + 1, we obtain L 3.301, the annual payment during marriage; or if we divide it by 14.196 the value of the huſband's age + 1, the quotient is L.2.657, the annual payment during the huſband's life.

TABLE IV. Shewing the probabilities of Life, compoſed by Dr. HALLEY, from the Bills of Mortality kept at Breſlaw in Sileſia.

| Age. | Living. | Die. | Age. | Living. | Die. | Age. | Living. | Die. | Age. | Living. | Die. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1000 | 145 | 23 | 579 | 6 | 45 | 397 | 10 | 67 | 172 | 10 |
| 2 | 855 | 57 | 24 | 573 | 6 | 46 | 387 | 10 | 68 | 162 | 10 |
| 3 | 798 | 38 | 25 | 567 | 7 | 47 | 377 | 10 | 69 | 152 | 10 |
| 4 | 760 | 28 | 26 | 560 | 7 | 48 | 367 | 10 | 70 | 142 | 11 |
| 5 | 732 | 22 | 27 | 553 | 7 | 49 | 357 | 11 | 71 | 131 | 11 |
| 6 | 710 | 18 | 28 | 546 | 7 | 50 | 346 | 11 | 72 | 120 | 11 |
| 7 | 692 | 12 | 29 | 539 | 8 | 51 | 335 | 11 | 73 | 109 | 11 |
| 8 | 680 | 10 | 30 | 531 | 8 | 52 | 324 | 11 | 74 | 98 | 10 |
| 9 | 670 | 9 | 31 | 523 | 8 | 53 | 313 | 11 | 75 | 88 | 10 |
| 10 | 661 | 8 | 32 | 515 | 8 | 54 | 302 | 10 | 76 | 78 | 10 |
| 11 | 653 | 7 | 33 | 507 | 8 | 55 | 292 | 10 | 77 | 68 | 10 |
| 12 | 646 | 6 | 34 | 499 | 9 | 56 | 282 | 10 | 78 | 58 | 9 |
| 13 | 640 | 6 | 35 | 490 | 9 | 57 | 272 | 10 | 79 | 49 | 8 |
| 14 | 634 | 6 | 36 | 481 | 9 | 58 | 262 | 10 | 80 | 41 | 7 |
| 15 | 628 | 6 | 37 | 472 | 9 | 59 | 252 | 10 | 81 | 34 | 6 |
| 16 | 622 | 6 | 38 | 463 | 9 | 60 | 242 | 10 | 82 | 28 | 5 |
| 17 | 616 | 6 | 39 | 454 | 9 | 61 | 232 | 10 | 83 | 23 | 4 |
| 18 | 610 | 6 | 40 | 445 | 9 | 62 | 222 | 10 | 84 | 19 | 4 |
| 19 | 604 | 6 | 41 | 436 | 9 | 63 | 212 | 10 | 85 | 15 | 4 |
| 20 | 598 | 6 | 42 | 427 | 10 | 64 | 202 | 10 | 86 | 11 | 3 |
| 21 | 592 | 6 | 43 | 417 | 10 | 65 | 192 | 10 | 87 | 8 | 3 |
| 22 | 586 | 7 | 44 | 407 | 10 | 66 | 182 | 10 | 88 | 5 | 2 |

TABLE V. Shewing the probabilities of Life as deduced by Mr. SIMPSON, from ten years obſervation, on the Bills of Mortality in London.

| Age. | Living. | Die. | Age. | Living | Die. | Age. | Living. | Die. | Age. | Living. | Die. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1280 | 410 | 23 | 441 | 7 | 46 | 237 | 9 | 69 | 75 | 6 |
| 1 | 870 | 170 | 24 | 434 | 8 | 47 | 228 | 8 | 70 | 69 | 5 |
| 2 | 700 | 65 | 25 | 426 | 8 | 48 | 220 | 8 | 71 | 64 | 5 |
| 3 | 635 | 35 | 26 | 418 | 8 | 49 | 212 | 8 | 72 | 59 | 5 |
| 4 | 600 | 20 | 27 | 410 | 8 | 50 | 204 | 8 | 73 | 54 | 5 |
| 5 | 580 | 16 | 28 | 402 | 8 | 51 | 196 | 8 | 74 | 49 | 4 |
| 6 | 564 | 13 | 29 | 394 | 9 | 52 | 188 | 8 | 75 | 45 | 4 |
| 7 | 551 | 10 | 30 | 385 | 9 | 53 | 180 | 8 | 76 | 41 | 3 |
| 8 | 541 | 9 | 31 | 376 | 9 | 54 | 172 | 7 | 77 | 38 | 3 |
| 9 | 532 | 8 | 32 | 367 | 9 | 55 | 165 | 7 | 78 | 35 | 3 |
| 10 | 524 | 7 | 33 | 358 | 9 | 56 | 158 | 7 | 79 | 32 | 3 |
| 11 | 517 | 7 | 34 | 349 | 9 | 57 | 151 | 7 | 80 | 29 | 3 |
| 12 | 510 | 6 | 35 | 340 | 9 | 58 | 144 | 7 | 81 | 26 | 3 |
| 13 | 504 | 6 | 36 | 331 | 9 | 59 | 137 | 7 | 82 | 23 | 3 |
| 14 | 498 | 6 | 37 | 322 | 9 | 60 | 130 | 7 | 83 | 20 | 3 |
| 15 | 492 | 6 | 38 | 313 | 9 | 61 | 123 | 6 | 84 | 17 | 3 |
| 16 | 486 | 6 | 39 | 304 | 10 | 62 | 117 | 6 | 85 | 14 | 2 |
| 17 | 480 | 6 | 40 | 294 | 10 | 63 | 111 | 6 | 86 | 12 | 2 |
| 18 | 474 | 6 | 41 | 284 | 10 | 64 | 105 | 6 | 87 | 10 | 2 |
| 19 | 468 | 6 | 42 | 274 | 10 | 65 | 99 | 6 | 88 | 8 | 2 |
| 20 | 462 | 7 | 43 | 264 | 9 | 66 | 93 | 6 | 89 | 6 | 1 |
| 21 | 455 | 7 | 44 | 255 | 9 | 67 | 87 | 6 | 90 | 5 | 1 |
| 22 | 448 | 7 | 45 | 246 | 9 | 68 | 81 | 6 | 91 | 4 | 1 |

TABLE VI. Value of an annuity of L.1 for a Single Life, according to Mr. De MOIVRE's Hypotheſis.

| Age | 3 p. C. | 4 p. C. | 5 p. C. | Age | 3. p. C. | 4 p. C. | 5 p. C. |
|---|---|---|---|---|---|---|---|
| 9.10 | 19.868 | 16.882 | 14.607 | 50 | 12.511 | 11.344 | 10.348 |
| 8.11 | 19.736 | 16.791 | 14.544 | 51 | 12 255 | 11.135 | 10.176 |
| 7.12 | 19.604 | 16.698 | 14.480 | 52 | 11.994 | 10.921 | 9.999 |
| 13 | 19.469 | 16.604 | 14.412 | 53 | 11.729 | 10.702 | 9.817 |
| 6.14 | 19.331 | 16.508 | 14.342 | 54 | 11.457 | 10.478 | 9.630 |
| 15 | 19.192 | 16.410 | 14.271 | 55 | 11.183 | 10.248 | 9.437 |
| 16 | 19.050 | 16.311 | 14.197 | 56 | 10.902 | 10.014 | 9.239 |
| 5.17 | 18.905 | 16.209 | 14.123 | 57 | 10.616 | 9.773 | 9.036 |
| 18 | 18.759 | 16.105 | 14.047 | 58 | 10.325 | 9.527 | 8.826 |
| 19 | 18.610 | 15.999 | 13.970 | 59 | 10.029 | 9.275 | 8.611 |
| 4.20 | 18.458 | 15.891 | 13.891 | 60 | 9.727 | 9.017 | 8.389 |
| 21 | 18.305 | 15.781 | 13.810 | 61 | 9.419 | 8.753 | 8.161 |
| 22 | 18.148 | 15.669 | 13.727 | 62 | 9.107 | 8.482 | 7.926 |
| 23 | 17.990 | 15.554 | 13.642 | 63 | 8.787 | 8.205 | 7.684 |
| 3.24 | 17.827 | 15.437 | 13.555 | 64 | 8.462 | 7.921 | 7.435 |
| 25 | 17.664 | 15.318 | 13.466 | 65 | 8.132 | 7.631 | 7.179 |
| 26 | 17.497 | 15.197 | 13.375 | 66 | 7.794 | 7.333 | 6.915 |
| 27 | 17.327 | 15.073 | 13.282 | 67 | 7.450 | 7.027 | 6.643 |
| 28 | 17.154 | 14.946 | 13.186 | 68 | 7.099 | 6.714 | 6.362 |
| 29 | 16.979 | 14.816 | 13.088 | 69 | 6.743 | 6.394 | 6.073 |
| 30 | 16.800 | 14.684 | 12.988 | 70 | 6.378 | 6.065 | 5.775 |
| 2.31 | 16.620 | 14.549 | 12.855 | 71 | 6.008 | 5.728 | 5.468 |
| 32 | 16.436 | 14.411 | 12.780 | 72 | 5.631 | 5.383 | 5.152 |
| 33 | 16.248 | 14.270 | 12.673 | 73 | 5.246 | 5.029 | 4.826 |
| 34 | 16.057 | 14.126 | 12.562 | 74 | 4.854 | 4.666 | 4.489 |
| 35 | 15.864 | 13 979 | 12.449 | 75 | 4.453 | 4.293 | 4.143 |
| 36 | 15.666 | 13.829 | 12.333 | 76 | 4.046 | 3.912 | 3.784 |
| 37 | 15.465 | 13.676 | 12.214 | 77 | 3.632 | 3.520 | 3.415 |
| 38 | 15.260 | 13.519 | 12.091 | 78 | 3.207 | 3.111 | 3.034 |
| 1.39 | 15.053 | 13.359 | 11.966 | 79 | 2.776 | 2.707 | 2.641 |
| 40 | 14.842 | 13.196 | 11.837 | 80 | 2.334 | 2.284 | 2.235 |
| 41 | 14.626 | 13.028 | 11.705 | 81 | 1.886 | 1.850 | 1.816 |
| 42 | 14.407 | 12.858 | 11.570 | 82 | 1.429 | 1.406 | 1.384 |
| 43 | 14.185 | 12.683 | 11.431 | 83 | 0.961 | 0.950 | 0.937 |
| 44 | 13.958 | 12.504 | 11.288 | 84 | 0.484 | 0.481 | 0.476 |
| 45 | 13.728 | 12.322 | 11.142 | 85 | 0.000 | 0.000 | 0.000 |
| 46 | 13.493 | 12.135 | 10.992 | | | | |
| 47 | 13.254 | 11.944 | 10.837 | | | | |
| 48 | 13.012 | 11.748 | 10 679 | | | | |
| 49 | 12.764 | 11.548 | 10.515 | | | | |

The marginal figures on the left of the column of *age* ſerve to ſhorten the table, and ſignify, that the value of an annnity for the age denoted by them, is the ſame with the value of annuity for the age denoted by the numbers before which they ſtand.

TABLE VII. Value of an Annuity of L1. on two Joint Lives, according to Mr. De MOIVRE's Hypothesis.

| Ages. | | 3 p. C. | 4 p. C. | 5 p. C. | Ages. | | 3 p. C. | 4 p. C. | 5 p. C. |
|---|---|---|---|---|---|---|---|---|---|
| | 10 | 15.206 | 13.342 | 11.855 | | 30 | 12.434 | 11.182 | 10.133 |
| | 15 | 14.878 | 13.093 | 11.661 | | 35 | 12.010 | 10.838 | 9.854 |
| | 20 | 14.503 | 12.808 | 11.430 | | 40 | 11.502 | 10.428 | 9.514 |
| | 25 | 14.074 | 12.480 | 11.182 | 30 | 45 | 10.898 | 9.936 | 9 112 |
| | 30 | 13.585 | 12.102 | 10.884 | | 50 | 10.183 | 9.345 | 8 620 |
| | 35 | 13.025 | 11.665 | 10.537 | | 55 | 9.338 | 8.634 | 8.018 |
| 10 | 40 | 12.381 | 11.156 | 10.128 | | 60 | 8.338 | 7.779 | 7.280 |
| | 45 | 11.644 | 10.564 | 9.646 | | 65 | 7.161 | 6.748 | 6.373 |
| | 50 | 10.796 | 9.871 | 9.074 | | 70 | 5.777 | 5.505 | 5.254 |
| | 55 | 9.822 | 9.059 | 8.391 | — | — | — | — | — |
| | 60 | 8.704 | 8.105 | 7.572 | | 35 | 11.632 | 10.530 | 9.600 |
| | 65 | 7.417 | 6.980 | 6.585 | | 40 | 11.175 | 10.157 | 9.291 |
| | 70 | 5.936 | 5.652 | 5.391 | | 45 | 10 622 | 9.702 | 8.913 |
| — | — | — | — | — | | 50 | 9.955 | 9.149 | 8.450 |
| | 15 | 14.574 | 12.860 | 11.478 | 35 | 55 | 9.156 | 8.476 | 7.879 |
| | 20 | 14.225 | 12.593 | 11.266 | | 60 | 8.202 | 7.658 | 7.172 |
| | 25 | 13.822 | 12.281 | 11.022 | | 65 | 7.066 | 6.662 | 6.294 |
| | 30 | 12.359 | 11.921 | 10.736 | | 70 | 5.718 | 5.450 | 5.203 |
| | 35 | 12.824 | 11.501 | 10.402 | — | — | — | — | — |
| | 40 | 12.207 | 11.013 | 10.008 | | 40 | 10.777 | 9.826 | 9.014 |
| 15 | 45 | 11.496 | 10.440 | 9.541 | | 45 | 10.283 | 9.418 | 8.671 |
| | 50 | 10.675 | 9.767 | 8.985 | | 50 | 9.677 | 8 911 | 8.244 |
| | 55 | 9.727 | 8.975 | 8.318 | 40 | 55 | 8.936 | 8.283 | 7.710 |
| | 60 | 8.632 | 8.041 | 7.515 | | 60 | 8.038 | 7.510 | 7.039 |
| | 65 | 7.377 | 6.934 | 6.544 | | 65 | 6.951 | 6.556 | 6.198 |
| | 70 | 5.932 | 5.623 | 5.364 | | 70 | 5.646 | 5.383 | 5.141 |
| — | — | — | — | — | — | — | — | — | — |
| | 20 | 13.904 | 12.341 | 11.067 | | 45 | 9.863 | 9.063 | 8.370 |
| | 25 | 13.531 | 12.051 | 10.840 | | 50 | 9.331 | 8.619 | 7.987 |
| | 30 | 13.098 | 11.711 | 10.565 | | 55 | 8.662 | 8.044 | 7.500 |
| | 35 | 12.594 | 11.314 | 10.278 | 45 | 60 | 7.831 | 7.332 | 6.875 |
| 20 | 40 | 12.008 | 10.847 | 9 o 70 | | 65 | 6.807 | 6.425 | 6.080 |
| | 45 | 11.325 | 10.297 | 9.420 | | 70 | 5.556 | 5.300 | 5.063 |
| | 50 | 10.536 | 9.648 | 8.880 | — | — | — | — | — |
| | 55 | 9.617 | 8.879 | 8.233 | | 50 | 8.892 | 8.235 | 7.660 |
| | 60 | 8.549 | 7.967 | 7.448 | | 55 | 8.312 | 7.738 | 7.230 |
| | 65 | 7.308 | 6.882 | 6.495 | 50 | 60 | 7.568 | 7.091 | 6.664 |
| | 70 | 5.868 | 5.590 | 5.333 | | 65 | 6.623 | 6.258 | 5.926 |
| — | — | — | — | — | — | 70 | 5.442 | 5.193 | 4.964 |
| | 25 | 13.192 | 11.786 | 10.621 | | 55 | 7.849 | 7.332 | 6 873 |
| | 30 | 12.794 | 11.468 | 10.367 | 55 | 60 | 7.220 | 6.781 | 6 386 |
| | 35 | 12.333 | 11.095 | 10.067 | | 65 | 6.379 | 6.036 | 5.724 |
| | 40 | 11.776 | 10.655 | 9.708 | | 70 | 5.291 | 5.053 | 4.833 |
| 25 | 45 | 11.130 | 10.131 | 9.278 | — | 60 | 6.737 | 6.351 | 6.001 |
| | 50 | 10.374 | 9.509 | 8.761 | 60 | 65 | 6.043 | 5.730 | 5.444 |
| | 55 | 9.488 | 8.766 | 8.134 | | 70 | 5.081 | 4.858 | 4.653 |
| | 60 | 8.452 | 7.880 | 7.371 | — | 65 | 5.547 | 5.277 | 5.031 |
| | 65 | 7.421 | 6.826 | 6.440 | 65 | 70 | 4.773 | 4.571 | 4.385 |
| | 70 | 5.826 | 5.551 | 5.294 | — | — | — | — | — |
| | | | | | 70 | 70 | 4.270 | 4.104 | 3 952 |

*Queſtions for Practice.*

1. What is the probability that three inhabitants of London ſhall be living 10 years hence, whoſe ages are 40, 50 and 60, reſpectively?

2. What is the value of an annuity of L.100, depending on the life of a perſon whoſe age is 54, allowing compound intereſt at 4 per cent.?

3. What annuity may a perſon, aged 50 years, purchaſe for L.1000, reckoning compound intereſt at 5 per cent.?

4. A merchant marries a Lady of 30 years, with an annuity of L.100, which he purpoſes to ſell to enlarge his capital; how much ſhould he receive, intereſt as above?

5. At what age may a perſon purchaſe an annuity of L.40 per annum for L.500, compound intereſt at 5 per cent.?

6. What is the value of L.120 annuity for the joint lives of two perſons, the one 40 and the other 66 years of age, reckoning intereſt at 4 per cent.?

7. What is the value of an annuity of L.60, to which a perſon of 25, will be entitled, after the death of another, whoſe age is 35 years, intereſt as above?

8. A perſon aged 35, who is married to a wife of 25, deſires to ſecure her in an annuity of L 20, by annual payments, during his life. How much ſhould he pay, allowing intereſt at 4 per cent.?

## Miscellaneous Exercises.

I. A gardner receives L 10 : 10 for his yearly wages, beſides a free houſe at L.2 : 5, coal and candle, value 17s. 6d., garden articles, value 13s. 4d.; $4\frac{1}{2}$ bolls meal, at 16s. 8d. and a cow's graſs, valued at a guinea and a half; how much do theſe amount to, and how much would he gain or loſe, if, inſtead of the above articles, he received 1s. 4d. each working day during the year?

II. A grocer buys $1\frac{3}{4}$ cwt. of tea, at L.22 : 8 per cwt., and begins to retail it at 4s. 9d.; but as that kind of tea is ſcarce, he raiſes the price 4d. per lb. after ſelling 50lb; and raiſes it always 4d. after ſelling the ſame quantity; required his gain?

III. An architect employs 24 maſons at 2s. 6d.; 10 barrowmen at 1s. 8d.; and 6 miners at 2s.; for every work day, from the 5th Feb. to 11th November inclusive; but reduces their wages, during the winter, as follows: maſons, 2s.; barrowmen, 1s. 4d., and miners, 1s. 8d. per day; required the weekly wages of each, ſummer and winter, the whole weekly wages of both ſeaſons, and the yearly income of each?

IV. A butcher buys 15 oxen at L.9 : 10s. each; and agrees with a grazier to paſture them at 2s. a head per week, for 6 weeks. He then feeds them with 90 pecks of corn, at 10½d., and 120 ſtones hay, at 5d., and ſlaughters them, each weighing, at an average, 32½ ſtones beef, which he ſells at 5¼d. per lb.; 70 lb. tallow, at 8s. per ſtone of 14 lb.; and hide 25s.; required his profit or loſs?

V. A woollen-draper ſold 25 yards black cloth at 19s.; 14 yds. blue at 18s. 4d.; and 15 yards mixt at 12s. 8d.; and allows the purchaſer a diſcount of 5 per cent. for ready money; how much will he receive?

VI. A delivers to B 30 pieces cambric, each 12 yards at 3s. 9d.; and 15 dozen ſhawl cloths at 28s., in barter for 15 dozen red port wine at 32s.; and 12 dozen ſherry at 30s.; and the balance is to be given in linen at 1s. 8d. per yard; how much is due?

VII. A ſhop-keeper ſells 15 pieces linen, each 52 yards, at 2s. 8d.; 175 yards printed cottons, at 2s. 6d.; and 120 yards gingham at 2s. 3d.; but the purchaſer is willing to allow 7½ per cent. to have a year's credit; how much will he have to pay at the end of the year?

VIII. A merchant purchaſed 88 bolls barley at 19s.; 125 at 20s. 6d.; 99 at 22s.; 108 at 21s. 9d.; and while he kept it on hand it loſt 2½ per cent. in meaſure; granary rent and charges, L.25 : 10s.; he ſold one fourth of it at 25s.; one fourth at 23s. 6d.; 120 bolls at 21s.; and the remainder at 19s. 6d.; required his gain or loſs?

IX. I gave 5 puncheons rum at 11s. 6d. per gallon; and 8 hhds. ſugar each 14¼ cwt. at 75s. in barter for 6150 lb. cotton-wool, and received L.15 : 11 : 3 as the balance; what is the value of the wool per lb.?

X. A baker purchaſed 650 bolls wheat at 27s. 6d. which having ſuſtained damage, the ſeller agrees to deduct 2 per cent.; the freight and incidental charges, came to L.21 : 10s.; having kept it on hand for 6 months, he ſold the whole at 30s. per boll; loft rent L.22 : 15s.; required the prime coſt of the wheat, and what he gained and loſt by the ſales, allowing intereſt at 5 per cent.?

XI. If 3 cwt 2 qrs. of ſugar value 80s. per cwt. be mixed with 2 cwt. 1 qr at 75s. and 1 cwt. 3 qrs. at 7½d. per lb; what is the value of 1 cwt of the mixture, and at what rate per lb. muſt it be ſold, ſo that the owner may gain 2d. on the ſhilling?

XII. A field of graſs containing 9 acres, will yield per acre 210 ſtones hay at 6½d.; the expence of making the hay being L.2 : 15s.; or it will fatten 15 oxen, which may be bought for 9 guineas, and

when fat, will yield each 34 ſtones beef at 5s. 10d.; hide and tallow L.3 : 5s.; or it will keep 9 milk cows 15 weeks; each will yield 6 lb. butter per week at 11½d.; and 32 pints milk at ¾d.; expence of the dairy L.3 : 10s.; or it will paſture 30 horſes for 40 days at 9d.; required which is the moſt profitable?

XIII. If 36 reapers cut down 85 acres 2 roods of corn, Scotch meaſure, in 3 weeks, and receive for their wages L.48 : 12s; required what extent of ground is reaped each day, what extent each reaps in all, and per day; how many are required to reap an acre per day; the expence of reaping an acre, the daily wages, the whole daily wages, and the whole wages of each reaper?

XIV. A quantity of waſte land, conſiſting of 1260 acres, is to be divided into 3 ſhares of equal value, among A, B, and C; now ſuppoſing 240 acres at 7s. 6d.; 285 at 6s. 8d.; 420 at 5s.; 315 at 4s., and allotting the firſt ſhares on the moſt valuable land; how much of each kind falls to each?

XV. A gentleman dying, left his wife pregnant, and an eſtate valued at L.9875 : 15 : 6; ordered by his teſtament, that if his wife ſhould be delivered of a ſon, ¾ of the fortune ſhould go to him, and the reſt to the widow; but if a daughter, the widow ſhould enjoy ¾, and the daughter the remainder; it happened that ſhe had both a ſon and a daughter at a birth, in this caſe how ought the fortune to be divided?

XVI. The canal which joins Forth and Clyde, is 27 miles long, 36 feet broad, taking one place with another, and 7 feet deep; how many men, working 12 hours a day, would be required to dig it in 5 years, when 15 men, working 9 hours a-day, can dig a trench 100 feet long, 6 broad and 3 deep, in 12 days; what is the expence at 11⅞d. per ſolid yard?

XVII. A commercial company became inſolvent, and agreed with their creditors at 13s. 9d. per pound; they owed to William Smith and Co. L.956 : 14 : 6; to John Chriſtie and Son, L.1032 15s.; to Robert Gordon, L.1246 : 17 : 6; to Forbes and Bell, L.650 : 10s; to James Tennant, L.860; to Charles Todd, L.685 10s.; John Paterſon, L.1090; and to Thomas Stevenſon, L.780 15s.; how much will each receive in proportion to their reſpective ſums?

XVIII. A privateer with a captain, 2 lieutenants, a ſurgeon, and purſer, 4 midſhipmen, and 60 ſailors, took a prize, being a ſhip, ſold for L.960; and cargo, conſiſting of 115 hhds. wine at L.19 : 10s.; 1560 gallons brandy at 5s. 6d.; and 8400 livres at 9½d., from which there is to be deducted L.24 : 13s.; for charges, and 2½ per cent. for agent's fee; it is required to divide the nett produce as follows, viz. The proprietors to have ⅓ of the whole: of

the remainder, each midſhipman is to have as much as 2 ſailors; the ſurgeon and purſer each as much as 8 ſailors; and each of the lieutenants as much as 12 ſailors; and the captain as much as 32 ſailors?

XIX. A farmer planted 12 acres with potatoes, at the rate of a peck for 3 falls, the rent of the ground is 4 guineas per acre; the expence of plowing is 5s. 6d. per acre; ſeed 11s. 4d. per boll; 30 loads dung, per acre, at 3s.; expence of ſetting the whole is L.12 : 14 : 2; double hoeing, 24s. per acre; digging them up, and cartage, 8d. per boll; produce, at an average, a boll for each peck ſown. He ſells 165 bolls at 9s. 6d.; 250 at 9s.; 126 at 8s. 6d.; and the remainder at $7\frac{1}{2}$d. per peck; required his gain or loſs?

XX. Two merchants, A and B, traded in company, A's ſhare being two-thirds; at the diſſolution of the copartnery, the ſtate of their affairs were as follows: debts due by them to the amount of L.1210 : 15s.; debts due to them to the amount of L.4765 : 18 : 4; and the goods belonging to the company to L.2980 : 16 : 8; A agrees to take the riſk of recovering the debts for an allowance of $7\frac{1}{2}$ per cent.; and B takes the goods at 5 per cent. diſcount; how will accompts ſtand between them?

XXI. A has on hand 3 cwt. 2 qr. 8 lb. of tea, for which he paid L.28 per cwt. one year ago; it is required to find how he muſt rate it per lb. to B, that by taking his bill at 6 months, he may gain L.18 by the bargain?

XXII. Three butchers rented a large graſs incloſure, for 12 months, at 100 guineas; A put in 60 cows for 2 months, at the end of which he took out 30 for ſlaughter, and put in 20 in their place; at the expiration of $3\frac{1}{2}$ months after, he took out 30, and continued the remainder 3 months longer; B kept in 50 cows for 3 months, then he took out 20, and put 30 in their ſtead, which continued 5 months longer; C put in 40 cows for 4 months, then he added 25, and continued them for 2 months; required the proportion each butcher muſt pay of the rent?

XXIII. A had $\frac{1}{2}$, B $\frac{1}{3}$, C $\frac{1}{4}$, and D $\frac{1}{5}$, ſhare in a muſlin manufactory: their original ſtock was L.6000, which they increaſed by $45\frac{1}{2}$ per cent. profit; as they intend to diſſolve the copartnery, and ſeparate, what ſhould each draw, allowing A 100 guineas, beſides his proportional ſhare for managing the buſineſs?

XXIV. A merchant in Glaſgow orders from London 30 caſks madder, weighing groſs 253 cwt. 2 qr. 8 lb., draught 4 lb. per caſk, and tare 10 lb. per cwt.; average price 74s. 8d. per cwt.; he pays cartage, loading and wharfage, L.5 : 14s. Inſurance $1\frac{1}{4}$ guineas per cent.; freight to Grangemouth 13s. per caſk, cartage

to Glaſgow 11s. 6d. per ton. He ſells 8 caſks qt. 64 cwt. 3 qrs. 18 lb., tare as before, at 88s. 8d. per cwt.; 10 ditto, containing 93 cwt. 12 lb. at 84s.; and the remaining 12 caſks at 86s. 4d.; cellar rent, L.1 : 7 : 6; required his gain or loſs?

XXV. The capital of a trading company, conſiſting of 39 ſhares, was L.28080, A who held 3 ſhares: drew for his ſtock at 17½ per cent. profit, upon receiving the money; he laid it out on the government funds, purchaſing in the Three per cent. annuities at per cent.; required the capital he will hold in that fund?

XXVI. A tradeſmen engages an apprentice for 7 years, and agrees to maintain him, the expence of which is reckoned at 10d. per day at an average; and allow him L.3 for the firſt three years for clothes; L.5 for the fourth; L.7 for the fifth; L.8 for the ſixth; and L.10 for the ſeventh. Allowing nothing to be reckoned for his firſt year's ſervice, but the ſecond year the value of it amounts to L.15; the third year to L.20; the fourth to L.25; and the remaining years always L.5 more than the year preceding; what will the maſter gain or loſe by his ſervice?

XXVII. A gentleman was to have 30,000 merks Scots by contract of marriage; the one half to be paid the ſame day he was married, and the other half upon the death of his mother-in-law. He married the lady the 11th of May, 1792, and his mother-in-law died July 16th, 1795, and the following payments were made on the 11th November, 1793, L.198 : 10s.; on the 1ſt January, 1796, L.500; on the 16th May, 1797, L.185; on the 4th Feb. 1799, L.395; required a ſtate of the accompt up to Whitſunday following, charging the legal intereſt?

XXVIII. A merchant ſtops payment, and preſents to his creditors a ſtatement of his affairs, as follows: bills due by A, L.242 15s.; by B, L.217 : 1 : 6; by C, L.112 : 16; in open accompts due by D, L.78 : 10s.; by E, L.63 : 4 : 8; by F, L.56 : 18s.; by G, L.39 : 5 : 10; and goods on hand, viz. 350 gallons rum, valued at 12s. 6d.; 12 ankers brandy, at 13s. 6d. per gallon; 1050 lb. cotton, at 1s. 9½d.; 132 cwt. 3 qrs. ſugar, at 4 guineas per cwt. 1260 lb. tobacco, at 1s. 3d. per lb.; and other articles to the value of L.35 : 10s. He owes to H, L.625 : 16; to I, L.470 : 12 4d.; to J, L.256 : 4 : 2; to K, L.185 : 17 : 6; to L, L.143 : 4s.; to M, L.119 : 13 : 4; to N, L.70 : 12s.; to O, L.67 : 10s; to P, L.52 : 8 : 4; to Q, L.31 : 9 : 2; to R, L.16 : 2 : 6: required the amount of his effects and debts, and the deficiency, allowing 30 guineas for the expence of ſettling his affairs, alſo what compoſition he is able to pay per pound, and how much each creditor will draw?

XXIX. The expence of building a church, to contain 2000 people, is as follows: ground 75 feet by 70, at a guinea per ſq. yard; maſon-work, L.783 : 15s.; flater-work, L.128 : 16 : 6; wright-work, L.1210 : 7 : 5; plumber work, L.83 : 16 : 3; plaſter-work, L.89 : 17 : 8; ſmith-work, L.52 : 14 . 11; luſtres and other charges, L.68 : 2 : 3; 120 of the ſeats are let at 7s. 6d.; 180 at 6s. 8d.; 420 at 5s.; 480 at 4s.; 510 at 3s. 4d.; and the remainder at 2s. 6d. After paying the miniſter L.200 annually, from the ſeat-rents, how much per cent. will the proprietors receive for their money?

XXX. A merchant failing in buſineſs, offered his creditors 15s. 6d. per pound, ready money, or good ſecurity to pay 20s. per pound in 5 years without charging him intereſt, which of theſe offers is the beſt, and what is the difference to A, who ſtands creditor for L.1200?

XXXI. A linen manufacturer purchaſes 12 matts rough flax, at 25 guilders per matt, at 23¼d. per g.; he dreſſes it, the expence of which is L.6 : 10s.; and when dreſſed, it yields 32½ ſtones tow, and 680 lb. flax; he ſells the tow at 5½d. per lb.; and delivers the flax to be ſpun into yarn, every 4 lb. produces 5 ſpindles, and every ſpindle makes 3½ yards of linen; expence of ſpinning, 1s. 4½d. per ſpindle; weaving, 5¾d.; and bleaching, 2½d. per yard. He then ſells one-fourth of the linen at 1s. 9d.; one-fourth, at 1s. 8d.; and the remainder, at 1s. 6d. per yard; required his gain or loſs?

XXXII. A pipe of madeira wine is bought at 125 milrees, ex. 5s. 8d. per M.; charges at Madeira 7½ per cent.; freight L.2 10s. per tun; duty at 4s. 6d per gallon; charges at home, 15s. 3½d. The pipe is bottled off, which contains 52½ dozens; bottles and corks, 2s. 6d. per dozen; required at what price the proprietor can ſell it per dozen, to gain 30 per cent?

XXXIII. The rent of a ſalmon fiſhery is 300 guineas; the tenant employs 10 men at 20d. per day, and an overſeer at L.50; the fiſhing ſeaſon continues 245 days, and they catch 210 fiſh each week, at an average weighing 9 lb. each. Expence of boats and nets is L.60 : 16 : 8. The fiſh are ſalted, and packed in barrels, each containing 350 lb; price of the barrels, 3s. 4d.; ſalt and other charges, 2s. 6d. per barrel; required the prime coſt per barrel?

XXXIV. A grazier buys 30 calves at 25s. each, and intends to keep them 3 years, at the expence of 9s. the firſt year, 15s. the ſecond, and 21s. the third, for ſummer's graſs; and 11s. 8d. the firſt, 17s. 6d. the ſecond, and 24s. the third, for winter feeding; after which the cattle will ſell at L.9 : 9s.; required the gain

or loſs by bringing them up, ſuppoſing one to die each ſummer, another each winter; and allowing ſimple intereſt from the end of each year?

XXXV. A diſtiller purchaſes 150 quarters barley at 31s. 6d. and converts it into malt, at 10 buſhels per quarter, and pays for duty 4½d. per buſhel; for malt-houſe rent, L.6 : 7s.; for ſervants wages, L.3 : 9 : 10; he diſtils the malt into ſpirits, with a ſtill of 100 gallons content, which conſumes 15 qrs. malt in 6 days, the produce being 15 gallons per quarter. The daily expence of fire, rent, ſervice, and wear of utenſils is 17s. 6d.; the duty upon the ſpirits is 2s. 6d.: required the prime coſt of the malt per buſhel, and of the ſpirits per gallon, alſo what duty upon the ſtill per gallon, will be equivalent to the above duty upon the ſpirits, allowing the ſtill to be employed 300 days in the year?

XXXVI. A farmer poſſeſſes 35 acres, rent 2 guineas per acre, which he manures, and keeps under fallow for the firſt year; expence of plowing and harrowing, L.10 : 12 : 6; 320 loads dung, at 3s. 9d.; and 650 buſhels lime, at 2s. 6d.: ſecond year it is ſown with wheat, expence of labour, L.5 : 12s.; ſeed, 10 qrs. at 6s. 3d. per buſhel; reaping and other incidents, 9s. 6d. per acre; produce, 4 qrs. per acre; price, 6s. per buſhel: third year, barley is ſown, expence of labour, L.9 : 10s.; ſeed, 16 qrs. 4 buſhels, at 4s. 6d. per buſhel; reaping, &c. 10s. 6d. per acre; produce, 3 qrs. per acre, price, 4s. per buſhel: fourth year it is ſown with 5 qrs. 2 buſhels rye-graſs, at 5s. per buſhel, and 620 lb. clover ſeed, at 7½d. per lb.; mowing, 3s. 6d. per acre; winnowing and ſtacking, L.10 15s.; produce, 3165 truſſes hay, at 1s.; 45 oxen paſtured on the foggage 6 weeks, at 2s. 9d. per week: required his profit or loſs at the end of the four years?

XXXVII. A manufacturer buys 495 lb. cotton wool, at 2s. 5d.; which is ſpun into yarn of 50 hanks in the lb., allowing 36 lb. for waſte; the expence of carding and roving is L.8 : 11 : 4½; and ſpinning, 8d. per lb.; the yarn is woven in a yard wide 10$^{00}$ reed: how much cloth will it make, allowing the weft to require $\frac{1}{8}$ more than the warp, and that the cloth loſes 8$\frac{1}{3}$ per cent. in the manufacturing; alſo, what is the prime coſt per yard; expence of winding, warp and weft, 3d. per ſpindle, and warehouſe charges, 5 per cent.; and at what price, per yard, can the manufacturer ſell it, to gain 1½d. on the ſhilling?

XXXVIII. London conſumes annually, 98245 black cattle, ſuppoſe at 15 guineas each, at an average; 711124 ſheep and lambs, at 35s.; 186934 hogs, at 42s.; 16,000,000 lbs. butter, at 12½d.; 20,000,000 lbs. cheeſe, at 7½d.; 7,000,000 gallons milk, at 9d.: how much does the city lay out upon theſe articles; and

what extent of ground is neceſſary to ſupply it in theſe; allowing 2 acres for rearing, and the produce of one-third of an acre for fattening each of the cattle, and an acre for rearing and fattening 5 ſheep; 5 buſhels of corn for fattening each of the hogs, the ground producing at an average 4 qrs. per acre; 3 roods for each cow, which yields 6 lb. butter, or 8 lb. cheeſe, or 20 gallons milk for 26 weeks?

XXXIX. A merchant in Glaſgow imported from New-York, 50 barrels pot aſhes, weighing groſs 1665 cwt. 3 qrs. 20 lb.; tare 14 lb. per cwt. at 140 dollars per ton, ex. 4s. 8d. ſterling; commiſſion 5 per cent.; charges at ſhipping, 180 dollars; freight, L.5 : 6 : 8 per ton; inſurance on L.2500 at 6 guineas per cent.; charges at Greenock, and freight up the river, 1s. 3d. per barrel, and porterage, L.2 : 1s.: how can he ſell it per cwt. to clear $7\frac{1}{2}$ per cent., allowing the out-come weight, when landed, to make up the loſs of the intereſt of his money?

XL. A young trader, laid out L.2325 upon goods in Glaſgow, ſuited for the American market, and ſhipped them on board the Fanny, freight and inſurance, $12\frac{1}{2}$ per cent. on the value; and went himſelf ſupercargo, at 13 guineas paſſage. When he arrived in America, he ſold the cargo at $125\frac{1}{2}$ per cent. advance on the invoice, currency for ſterling; charges while he ſtaid there came to L.120 currency. He brought home the proceeds in bills of exchange at 155 per cent.: what is the amount in ſterling, and what is gained per cent.?

XLI. A merchant in Britain ſends to the Weſt Indies, 350 barrels herrings, at 25s. each, freight, 6s. 6d.; charges at ſhipping, 3d. per barrel, inſurance on the out-ſet, 6 guineas per cent.; or 12 guineas out and home. The cargo is ſold for 65s. currency; ſtorage, $2\frac{1}{2}$ per cent.; commiſſion and inſurance of debts, $7\frac{1}{2}$ per cent.; wharfage and other charges 2s. 3d. per barrel. He may have the returns in bills of exchange, at 156 per cent.; or in ſugar, at L.70 currency per ton; charges there 8 per cent. and the ſugar will ſell at 70s. per cwt.; freight, 5 guineas per ton: required the gain or loſs, ariſing from both theſe methods of drawing the returns?

XLII. Edinburgh draws on Amſterdam, 7500 guilders, at $22\frac{7}{12}$d., and orders London to draw for the ſame, deducting agio, $3\frac{1}{2}$ per cent.; and remits the proceeds in bills, retaining $\frac{1}{2}$ per cent. commiſſion; agreeably to this order, London draws at 35s. 10d. and remits bills purchaſed at $2\frac{1}{2}$ per cent. diſcount: what is the difference of theſe negotiations.

XLIII. A merchant in Glaſgow draws on Holland for 3600 guilders at $22\frac{1}{2}$. His agent in Holland draws for the value including $\frac{1}{2}$ per cent. commiſſion; exchange, at 35s. 8d.; agio, $3\frac{1}{2}$ per

cent., and the merchant remits a bill to his correſpondent in London for the value, with $\frac{1}{4}$ per cent. commiſſion, for which he pays $\frac{3}{4}$ per cent. exchange: required the gain or loſs.

XLIV. Greenock conſigns to Hamburgh 30 hhds. ſugar, qt. 346 cwt. 2 qr. 14 lb. The ſales of which are adviſed, at 37 marcs 8 ſch. per cwt. deducting 215 marcs 10 ſch. for charges, and 6 per cent. commiſſion. How many rix-dollars may Greenock draw, and how much ſterling will they amount to, at 33s. 9d. Flem. baneo?

XLV. A merchant in Leith owes 2720 marcs l. in Hamburgh; he may order it to be drawn on London, exchange, at 34s. 2d.; agio $17\frac{1}{2}$ per cent. Or on Holland, ex. $33\frac{1}{2}$ ſtiv. per dollar; commiſſion there $\frac{1}{2}$ per cent., exchange from Holland on London, 35s. 10d.; required the cheapeſt way, and the difference?

XLVI. Hamburgh owes Glaſgow 20,000 marcs lubs baneo, which can be drawn at 1s. $6\frac{1}{4}$d.; or the exchange at London is 34s. 1d; and bills on London at a ſhort date ſell at Glaſgow $1\frac{1}{4}$ per cent. premium. In which of the ways ought Glaſgow to negotiate, allowing $\frac{1}{2}$ per cent. commiſſion at London?

XLVII. A merchant in Vienna owes London 3600 rix-dollars; he may remit it directly, at 3s. 6d. per rix-dollar; or through Amſterdam, ex. $36\frac{3}{4}$ per cent.; commiſſion there, $\frac{1}{2}$ per cent.; and exchange to London, 35s.; or through Hamburgh, ex. 36 per cent.; commiſſion $\frac{1}{2}$ per cent.; and ex. to London, 34s. Required the cheapeſt medium, and how much is the difference?

XLVIII. A in London owes B at Paris, Lrs. 12400, which he can remit directly, exchange $29\frac{1}{2}$d.; or by way of Amſterdam, ex. 36s. 8d. commiſſion there $\frac{1}{2}$ per cent.; exchange between Amſterdam and Paris, 27 ſtiv. per crown: required the cheapeſt way, and the difference?

XLIX. Glaſgow ſhips for Bourdeaux 28 hhds. tobacco qt. 342 cwt. 3 qr. 26 lb. nett, at 1s. $7\frac{1}{2}$d. per lb.; in return for which Bourdeaux ſends 30 pipes claret, at 84 ſols, 6 den. per gallon; and 3600 gallons brandy, at 59 ſols, 4 den.; how ſtands the accompt between the correſpondents, and what ſhould the creditor draw, exchange at 30d. per crown.?

L. Oporto conſigns to Leith, 15 pipes port wine, for which the factor pays at landing, freight, 25s. per pipe; duty per tun of 2 pipes, L.52 : 10s.; he bottles the wine into dozens, which run at the rate of 49 dozen per pipe; expence, L.2 : 10 : 6; bottles, 2s. 6d. per dozen, corks, 1s. 4d. per groſs. He ſells one third of it, at 31s. per dozen; one third at 32s.; and the remainder, 33s. His commiſſion is $7\frac{1}{2}$ per cent.; required the nett proceeds, and how much muſt be remitted to Oporto, ex. 5s. $6\frac{1}{2}$d. per milree.

LI. A cotton dealer in Greenock, orders from Liſbon, 390 bags cotton-wool, weighing nett 475 cwt. 2 qr. 10 lb., at 420 rees per lb., exchange, 5s. 8d. per milree; agent's commiſſion, 2½ per cent.; ſhipping charges and ſundry dues, 4s. 8d. per cwt; freight, 7 guineas per ton; inſurance, 5½ per cent.; duty 1½d. per lb. He kept it on hand 2 months, cellar rent, 2d. per bag each month, and he ſold it for 3s. 4d per lb., bill at 4 months: required the gain or loſs, allowing intereſt at 5 per cent.?

LII. A of Liſbon may draw on L of London 3500 milrees, exchange, 5s. 9d; or on H of Holland, ex. 50½d gr. per cruſado, who will draw on L for the value, including ½ per cent. for commiſſion, ex. 36s. 4d.; or, on P of Paris, ex. 432 rees per crown: who will draw on L, commiſſion ¼ per cent. ex. 29½d. per crown: required the amount each way?

LIII. A merchant in London owes at Madrid, 16800 rials plate, which may be remitted directly, at 44½d.; or by way of Amſterdam, exchange between London and Amſterdam, 36s. 4d.; commiſſion there ½ per cent.; ex. between Amſterdam and Madrid, 110 gr. per ducat; or by France, ex. between London and Paris 29d. per crown, commiſſion ½ per cent.; and ex. between Paris and Madrid 18 livres per 4 piaſtres: required the cheapeſt medium?

LIV. New England conſigns to Leghorn 840 quintals of fiſh, with orders to remit the proceeds to London. The cargo is ſold at 14 piaſtres, 15 ſol. per guinea; freight and commiſſion 7½ per cent.; how much ſterling muſt the factor remit to London, ex. 4s. 4d. per piaſtre, and for how much currency will New England be credited at London, ex. 152 per cent.?

LV. G of Greenock owes Ruſſia 7600 rubles for a cargo of timber. He may order it to be drawn directly, ex. 4s. 7d.; or, on Holland, ex. 50 ſtivers per roble; and from Holland on London, ex. 36s. 3d.; or, on Hamburgh, ex. 108 copecs per rix-dollar lubs; and from Hamburgh on London, ex. 33s. 4d.; required which is the cheapeſt way.

LVI. A cargo of 450 barrels ſalmon bought at L.3 : 8s per barrel, may be ſent to Bourdeaux, where it will ſell for Lrs. 105 per barrel, charges there 7½ per cent. ex. 28½d. per crown; freight, 4s. 6d. per barrel, inſurance, 4 guineas per cent.; or, it may be ſent to Bilboa, where it will ſell for 350 rials vellon per barrel, charges there 26 rials vellon, ex. 3s. 8d. per piaſtre, freight, 15s. 3d.; inſurance, 4½ per cent.; required the gain or loſs at both places.

LVII. A merchant has on hand 18 hhds. tobacco imported from Virginia qt. 6 cwt. 3 qr. 24 lb.; prime coſt there, 4½d. per lb.; freight, 21s. per hhd. It may be ſold in Britain, at 2s. 2d. per lb; on paying the duty and charges, 1s. 8½d. per lb.; or, it may be ſent to France, where it will ſell for a livre per lb of Paris, 100 lb. of which is equal to 108½ avoirdupois, duty and charges there, 8 ſols per lb; freight, 8s. 6d. per hhd.; ex. 29½d.; inſurance, 4½ per cent. on the outſet: or, to Holland, where it will ſell for 10 ſtiv. per lb. of Amſterdam, (100 = 108½ Av.); duty and charges there, 4 ſtiv.; freight, 9s. per hhd.; inſurance, 6 per cent.; agio, 3½; ex. 36s. 4d.; or, to Liſbon, where it will ſell for 165 rees per lb. of Liſbon, (100 = 95 av.) charges there 94 rees per lb.; freight, 11s. 6d. per hhd.; inſurance, 4 guineas per cent.; ex. 5s. 6d. required the gain or loſs at each place?

LVIII. A corn merchant exports 1500 quarters wheat to Madeira, bought at 37s. 6d. per quarter, and receives a debenture for the bounty at 5s. per quarter, which he ſells at 7½ per cent. diſcharges at ſhipping, L.27 : 12 : 6 freight, 25s. per ton of 5 quarters; inſurance on the covered property, 5 per cent.; diſcount 2 per cent. in caſe of loſs It is ſold for 900 rees per alquier, whereof 9½ make a quarter; charges, 75 rees per alquier; commiſſion 3½ per cent. He may have returns in bills of exchange, at 5s. 7d. per milree; or, in Madeira wine, at 140 milrees per pipe; charges at Madeira, 5 per cent.; freight, L.2 : 8s., and duty, L 31 10s. per ton; inſurance home the ſame as the inſurance outwards; price in Britain, L 75 per pipe; and the odd money remitted at 5s. 7d.; required the gain or loſs by both methods?

LIX. The national debt, ſome time ago, was ſtated at 430 millions ſterling. Required how long a man would take to count it it in guineas and ſhillings, reckoning 150 pieces in a minute for 12 hours a-day? How far would they extend in a line if the pieces were laid cloſe to each other, the diameter of each being an inch; and how much ground would they cover? Alſo, how many waggons loaded with 1500 lb. each, would be ſufficient to carry it, the weight of a guinea being 5 dwt. 9 grs. and that of a ſhilling, 3 dwt. 21 grs.; and how long a train would they form, allowing 35 feet for each waggon and horſes; alſo, what annuity, to continue 30 years, would be ſufficient to pay off the debt, allowing compound intereſt at 4 per cent.; and ſuppoſing the whole property of Britain to be 2200 millions, and this aſſeſſed with 1½ per cent. to raiſe an annuity to pay off the debt; how long muſt this aſſeſſment continue, intereſt as above; and how much muſt the Britiſh proprietors be aſſeſſed per cent. ſuppoſing it to be paid off at once?

# APPENDIX.

## INVOLUTION AND EVOLUTION.

I. Involution is the operation by which we find any power of any given number. The number to be involved is itſelf the firſt power; or it is called the root of that power to which it is required to be raiſed. If it be multiplied once into itſelf, the product is the ſquare, or ſecond power. If twice into itſelf, the product is the cube, or third power; and ſo on.

The following table ſhews the ſecond and third powers of the nine digits.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Firſt power, or root, | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Second power, ſquare, | 1 | 4 | 9 | 16 | 25 | 36 | 49 | 64 | 81 |
| Third power, or cube, | 1 | 8 | 27 | 64 | 125 | 216 | 343 | 512 | 729 |

From this table the ſquare-root of any number under 100, and the cube root of any number under 1000 is found in the neareſt integers.

II. Evolution, or extraction of roots, is the operation by which we find any root of any given number; and is the reverſe of Involution.

When it is required to extract the root of any number, the firſt thing we do is to divide the number into periods of two places for the ſquare root, of three places for the cube root, and ſo on. This is done by placing a point above the right hand figure of each period, beginning at the units place: the number of periods ſhows how many places there are in the root.

If there be a remainder after all the periods are brought down, the root may be continued to a decimal, by annexing periods of cyphers, to any degree of exactneſs required; but the root can never be exactly completed; for any fraction, or mixed number, multiplied into itſelf, produces another fraction, or mixed number; and therefore, the root of an integer, which cannot be expreſſed in integers, can never be expreſſed in fractions.

## RULE for extracting the SQUARE ROOT.

*1ſt, Find by trials the neareſt root of the firſt period, which ſet in the quotient, ſubtract its ſquare from that period, bring down the next period to the remainder for a new dividend.*

*2d, Double the quotient for a new diviſor, and enquire how often it can be had in the dividend, except the unit's place, and annex the quotient, both to the new diviſor and the former quotient.*

*3d, Multiply the diviſor thus increaſed by the laſt found term in the quotient and ſubtract the product from the dividend. Bring down the next period to this remainder, and proceed as before.*

1. Req. the ſquare root of 2916? 2. Req. the ſquare root of 784?

```
    2916(54 root      54          784(28
5×5=25                54            4
                     ----          ----
 104) 416            216          48)384
      416            270            384
     ----           ----          ----
                    2916
                   ----
```

In example 2d we can get 4 nine times in 38, but 49 multiplied by 9 would exceed the dividend; therefore we ſubtract 1, and try 8, which anſwers.

3d, Req. the ſq. root of 651249? 4th, Req. ſq. root of 552.25?

```
    651249(807          552.25(23.5
      64                  4
     ----                ----
1607)11249              43)152
     11249                129
     -----               ----
                        465) 2325
                             2325
                            ----
```

In example 3d, The firſt diviſor, 16 is not contained in 11; therefore we place a cypher in the root, which gives 160 for a new diviſor, and annex another period to the dividend.

| | | | |
|---|---|---|---|
| 1. | Required the ſquare root of 6084 | = | 78. |
| 2. | ——— ——— of 363609 | = | 603. |
| 3. | ——— ——— of 1669264 | = | 1292. |
| 4. | ——— ——— of 194481 | = | 441. |
| 5. | ——— ——— of 203461696 | = | 14264. |
| 6. | ——— ——— of 42852312064 | = | 207008. |

| | | | | |
|---|---|---|---|---|
| 7. | the ſquare root of | 1234321 | = | 1111 |
| 8. | ——— ——— of | 54990.25 | = | 234.5 |
| 9. | ——— ——— of | .00032754 | = | .01809 |
| 10. | ——— ——— of | .44 | = | .66 |
| 11. | ——— ——— of | 1320.1 | = | 36.33 |
| 12. | ——— ——— of | $\frac{169}{196}$ and $\frac{289}{361}$ | = | $\frac{13}{14}$ and $\frac{17}{19}$ |

Qu. 1. There is a round floor, whoſe content is $272\frac{1}{4}$ ſquare feet; required the ſquare floor equal to it in area?

2. A gentleman has a garden of an irregular form, that meaſures 54856 links, which he wants to exchange for a ſquare one of equal content: required the ſide of the ſquare?

3. A miniſter's glebe conſiſts of four fields, the firſt contains 3 acres 1 rood 10 poles; the ſecond, 1 acre 2 roods 20 poles; the third, 2 acres 24 roods 2 poles, and the fourth, 1 acre 1 rood 30 poles; for which his heritors agree to give him a ſquare field equal to all the four: required its ſide?

4. A malt kiln whoſe diameter is 12 feet, dries 4 bolls of corn at a time: what muſt be the diameter of a kiln which will dry 6 bolls?

5. A malſter has a kiln, 16 feet in diameter, which is too large by one-third for his buſineſs: required the diameter of a kiln to anſwer his purpoſe?

6. The wall of a garriſon is 108 feet high, and a ditch ſurrounding it 81 feet wide: required the length of a ſcaling ladder that will reach to the top of the wall from the other ſide of the ditch?

7. Standing on the ſide of the river Clyde, I found that a line ſtretched from the top of a precipice, riſing perpendicularly 180 feet on the oppoſite ſide, meaſured 360 feet: required the breadth of the river at that place?

8. A ladder 40 feet long may be ſo placed, upon one ſide of the ſtreet, that it will reach a window 32 feet from the ground; and without moving it at the bottom, it will reach a window on the oppoſite ſide, 24 feet high: required the breadth of the ſtreet?

*Note* 1. To increaſe or diminiſh a circle in any given proportion.—Square the diameter, enlarge or diminiſh it in the proportion required, and extract the ſquare root thereof. Ex. 4th and 5th.

*Note* 2. The ſquare of the hypothenuſe (or ſlanting ſide) of a right angled triangle, is equal to the ſum of the ſquares of the other two ſides, therefore, the hypothenuſe is equal to the ſquare root of the ſum of the ſquares of the two ſides (Ex. 6.), and either ſide equal to the ſquare root of the difference of the ſquares of the hypothenuſe and other ſide. Ex. 7, &c.

## RULE for extracting the CUBE ROOT.

*1ſt, Find the neareſt root of the firſt period, which ſet in the quotient, ſubtract its cube from the period, and bring down the next period to the remainder for a new dividend.*

*2d, Find a diviſor, by multiplying the ſquare of the part of the root found by* 300, *divide the dividend by it, and put the quotient figure for the ſecond figure in the root.*

*3d, Multiply the part of the root formerly found by the laſt figure placed in the root, and this product by* 30; *which place under the diviſor under which write the ſquare of the figure laſt placed in the root.*

*4th, Multiply the ſum of theſe three, by the figure laſt placed in the root, and ſubtract the product from the dividend: to the remainder annex the next period for a new dividend, with which proceed as before.*

When there are decimals in the given number, each period muſt conſiſt of three decimal places; and if the given decimal has not ſo many places, the deficiency muſt be ſupplied by annexing cyphers.

Ex. 1. What is the cube root of 262144?

262144(64 root

$6^3 = 216$

46144 dividend

$6^2 \times 300 = 10800$

$6 \times 4 \times 30 = 720$

$4^2 = 16$

Sum 11536--46144

Example 2d.

4106362 5(345

27

14063

12304

1759625

1759625

In example 1ſt, the neareſt root of 262 the firſt period is 6, which we ſet in the quotient as the firſt figure of the root ſought, and ſubtract 216, its cube, from 262, which leaves a remainder of 46, to this we bring down 144, the next period, which makes 46144. The ſquare of 6 multiplied by 300, is 10800 the diviſor, and the dividend divided thereby, quotes 4; then 4 times 6 multiplied by 30 is 720, and the ſquare of 4 is 16. The ſum of theſe three numbers, is 11536, and being multiplied by 4 gives 46144, the ſame as the dividend. Therefore the root is exactly 64.

Ex. 3d, What is the cube root of 674593540042485129?

$$\begin{array}{l}
\qquad\qquad 674593540042485129\ (4070809\ \text{root.}\\
4^3 = 64\\
\hline
40^2\times 300 = 480000)\ 3459354\\
40\times 7\times 30 = 8400\\
7^2 = 49\\
\hline
488449\times 7 = 3419143\\
\hline
4070^2\times 300 = 4969470000)\ 40211004042\\
4070^2\times 8\times 30 = 976800\\
8^2 = 64\\
\hline
497044864\times 8 = 3976357491 2\\
\hline
407080^2\times 300 = 49714237920000)\ 44742913048 5129\\
407080\times 9\times 30 = 10991600)\\
9^2 = 81\\
\hline
4971434783168 1\times 9 = 44742913048 5129\\
\hline
\end{array}$$

Required.

| | | | | | |
|---|---|---|---|---|---|
| 1. | The cube root of | | 2985984 | = | 144. |
| 2. | ——— | of | 87528384 | = | 444. |
| 3. | ——— | of | 247673152 | = | 628. |
| 4. | ——— | of | 13713306·31 | = | 1111. |
| 5. | ——— | of | 22.069810125 | = | 2.805. |
| 6. | ——— | of | 5184 | = | 17·306. |
| 7. | ——— | of | 784.67341688 | = | 9.2235. |
| 8. | ——— | of | $\frac{343}{512}$ and $\frac{729}{2197}$ | = | $\frac{7}{8}$ and $\frac{9}{13}$. |

Qu. 1. The ſolid content of a cube is 13824 feet; what is the length of a ſide?

2. If a bullet of 18 inches diameter weigh 62½ lb.; what will a bullet weigh whoſe diameter is 6 inches?

3. Required the diameter of a ball whoſe weight is 27 lb. when one of the ſame kind, whoſe diameter is 10 inches, weighs 32½ lb.?

4. If 36 grains of gold, gild a wooden globe which weighs 343 ounces; how many grains will gild one that weighs 216 ounces?

5. A diſtiller has a granary 17 feet long, 10 broad, and 8 deep, which holds 170 bolls barley; but he wiſhes a ſimilar one which will hold 680 bolls: required its dimenſions?

# SUPPLEMENT

## Containing ANSWERS to the QUESTIONS, propoſed in the foregoing Work.

N. B. In ſome of the Rules the fractions under farthings are rejected.

### ADDITION.

| Queſt. | |
|---|---|
| 1. | L.532962 |
| 2. | Years 5804 |
| 3. | Perſons 61945 |
| ¶ 4. | L.4714 |
| 5. | 2 oz. 17 dwt. 12 grs. |
| 6. | 2 lb. 10 oz. 2 dr. 2 grs. |
| 7. | 7 cwt. 21 lb. |
| 8. | 25 ſtones 13 lb. |
| 9. | 376 yds. 1 qr. 1 nail |
| 10. | 6 tuns 7 pints |
| 11. | 21 butts 10 gal. 2 qts. 1 pint |
| 12. | 12 a. 3 r. 29 fa. 21 ells |
| 13. | 200 miles 5 f. 34 p. 5 yds. |
| ¶ 14. | L.4251 7 2 |
| 15. | L.4591 5 9¾ |

| | Bolls. | |
|---|---|---|
| 16 Barley | 544¾ | L.578 10 6 |
| Wheat | 547½ | L.794 16 10 |
| Oats | 680¾ | L.608 13 1 |
| Peaſe | 445 | L 325 15 6 |
| Bolls | 2218 | L.2307 15 11 |

### SUBTRACTION.

| | |
|---|---|
| 1. | years 346 |
| 2. | 194 years 85 |
| 3. | L.3117000 |
| 4. | L.2 8 1 |
| 5. | 9 oz. 2 dr. 2 ſcr. 16 gr. |

### SUBTRACTION.

| Queſt. | |
|---|---|
| 6. | 50 yds. 3 qr. 2 nails |
| 7. | 10 butts 1 bar. 17 gal. |
| 8. | 9 bolls 2 fir. 3 p. 2 lip. |
| 9. | 3 lb. 3 oz. 14 dwt. 22 gr. |
| 10. | groſs, 61 cwt. 2 qr. 26 lb.<br>tare, 6 cwt. 3 qr. 11 lb.<br>nett, 54 cwt. 3 qr. 15 lb. |
| 11. | 1 ac. 3 roods 23 p. 17½ yds. |
| 12. | L.378 5 3 |
| 13. | L400 19 9 |
| 14. | imp. 72 tuns 1 pipe 59 g.<br>ſold, 30 tuns — 48 gal.<br>on hand, 42 tuns 1p. 11g. |
| 15. | L.820 0 0 |
| 16. | L.8997 17 2¼ |
| 17. | deficiency L.2105 11 9 |

| | Years. | Days. |
|---|---|---|
| 18. James I. | 22 | 3 |
| Charles I. | 23 | 309 |
| *Interim*, | 11 | 119 |
| Charles II. | 24 | 253 |
| James II. | 3 | 320 |
| William III. | 13 | 75 |
| Q. Anne, | 12 | 146 |
| George I. | 12 | 314 |
| George II. | 33 | 136 |
| George III. to 1ſt Jan. 1800. | 39 | 68 |
| The whole time | 196 | 283 |

## MULTIPLICATION.

Queſt.

1. Strokes 56940
2. 619315200
3. Times 2943360000
4. Letters 22207500
5. Perſons 1435896
6. 22521286656000
7. 535252316544000
8. grains 511290000
9. yards 81900
10. yards 25200
11. Fiſhes 3240000
lb. 42120000
12. pints 21504
13. yards 41537228400
¶ 14. L.3 2 3½
15. 21 4 0
16. 27 3 8
17. 83 6 8
18. 102 8 9
19. 74 18 6
20. 210 0 0
21. 321 15 0
22. 920 11 9
23. 2258 13 4
24. 3677 6 8
25. 34 16 0
26. 73 10 0
27. 372 15 0
28. 1829 5 0
¶ 29. 10 lb. 9 oz.
30. 10 lb. 11 oz. 4 drs.
31. 908 cwt. 1 qr. 1 lb.
32. 102 la. 6 fac. 1 w. 5½ t.
¶ 33. 950 yds. 1 qr. 3 nails
34. 6 hhds. 34 gal. 4 pints
35. 94 hhds. 13 gal. 2 pints
36. 2 ch. 3 qrs. 2 b. 3 p.
37. 1244 ch 13 b. 2 fir. 2 p.
38. 1146 acres, 24 poles
¶ 39. 689 miles, 3 fur. 5 poles
40. L.2233800
41. 194rs 2 pecks 1 gal. 6 pts.

Queſt.

42. wt. 1215 lb. price L.3 18 9
expence, L.1 5 3½
43. L 1008 11 8
44. farthings 525870
45. merks Scots 22788
46. grains 91701
47. ſcruples 8178
48. ounces 1322208
49. drops 1764480
50. lbs. 331912
51. half nails 5300
52. Flem. ells 1134
53. gallons 5771
54. S. pints 11068
55. pints 35202
56. lippies 19508
57. gills 7016
58. inches 1336644
59. ells 206460
60. yards 262116¼
61. bar. corns 129496158
62. minutes 17082000
63. ſeconds 31556929
¶64. value L.222, wt. 14 ton 15 cwt. 2 qr. 24 lb.
65. groſs 593 cwt. 3 qr.
tare 31 24 lb.
nett 562 2 q. 4
66. L.24995o
67. L.303 6 8
68. L.1200
69. L.841 4s.

## CROSS MULTIPLICATION.

Queſt.

9. 25060
10. 919 feet 9 in. 11 pts.
11. 4413 yds. 4 feet 6 in.
12. 600 feet 4 in. 2 pts.
13. 38 feet 7 in. 1 p. 6 ſec.
14. 2095 feet 7 in 3 pts.
15. 37⅓ yds. val. L.8 17 4
16. 115 feet 3 in. 9 pts.

Queſt.

17. L 1109 9 $8\frac{1}{7}$
18. 8017 feet 9 in. 6 pts.
19. 1582 f. 6 in. 2 pts. 2″ 3‴ 4⁗
20. 420 yds. exp. L. 28 17 6

## DIVISION.

Queſt.

1. caſks 112
2. pages 548
3. dozen 42
4. hens 2275
5. bottles $245\frac{1}{7}$
6. acres 546875
7. $9765\frac{5}{8}$, or 9766 reap.
8. perſons 15000
9. each perſon, $2\frac{2}{7}$ gallons
10. days 88
11. men $10937\frac{1}{7}$
¶12. per lb. 4s. 6d.
13. per yard 3s. 7d.
14. ——— 2s. $1\frac{1}{2}$
15. per ounce 5s. $5\frac{1}{4}$
16. L. 37 10 10
¶17. 5 dwt. 9 grs.
18. 10 oz. 7 drs. 2 ſcr.
19. 13 cwt. 3 qr. 25 lb.
20. 3 la. 7 ſac. 1 w. 6 todds
21. 25 yds. 2 qrs. 3 nails
22. 3 galls $1\frac{9}{25}$ pints
23. 1 butt 11 gal. 3 mutch.
24. 2 buſh 3 pecks
25. 95 ch. 12 b. 2 pecks
26. 63 acre 2 r. 28 yds.
¶27. feet 1584
28. 3 ac. 1 r. $13\frac{1}{3}$ poles
29. deals 48
30. ſhillings 1440
31. days 320
32. patients 192
33. 7 bolls 2 fir. $2\frac{2}{3}$ pecks / 20 fal. $31\frac{7}{23}$ ells
34. 16 feet 8 inches

Queſt.

35. ſolid feet $68\frac{2}{7}$
36. 192 lb. value L. 12 0 0
37. L. 106 17 6
38. acres 7300
39. 12356 a. 3 r. $3\frac{1}{3}$ poles
40. 6 m. 3 fur. 36 p. 2 yds.
41. 36 ſeconds
¶42. L. 4721 12 $8\frac{1}{4}$
43. 1343 8 $10\frac{2}{7}$
44. 318 lb. 4 oz. 17 dwt. 12 grs.
45. 56 lb. 9 oz. 4 drs.
46. 184 tons 9 cwt. 22 lb.
47. 107 ſtone, 11 lb. 2 oz.
48. 30 la. 7 ſac. 1 w. $5\frac{1}{2}$ t. 1 ſt. 1 cl.
49. 331 yds. 2 nails
50. 1134 ells French
51. 91 pipes 1 hhd. 33 gals.
52. 129 butts 11 gal. 2 pints
53. 34 grs. 3 buſh. 1 pint
54. 38 ch. 1 boll 2 fir. 2 pecks
55. 82 gal. 1 p. 1 chop. 1 mut.
56. 31 miles 5 fur. 6 p. 1 f. 6 in.
57. 71 acres 2 roods 30 falls
58. 38 acres 3 r. 2 p. $24\frac{1}{2}$
59. 344 m. 35 p. $3\frac{1}{2}$ yds. 2 f.
60. 178 days 12 h. 10 m. 50 ſec.
61. 16 years
¶62 102 yards
63. 14s. $2\frac{1}{2}$ $\frac{70}{71}$d. per day
64. 4s. 3d. per lb.
65. each ſhare L. 714 5 $8\frac{4}{7}$ / each contributed 11 3
66. L. 65000
67. a woman's ſhare is L. 556 2 $11\frac{15}{41}$ / a man's do. 741 10 $6\frac{14}{41}$
68. A's ſhare L. 2399 19 3 / B's do. 2484 9 11 / C's do. 2580 8 5
69. eldeſt ſon L. 2966 16 $1\frac{1}{2}$ / his brothers 1977 17 5 / their ſiſters 988 18 $8\frac{1}{2}$ / their mother 1977 17 5

| Queſt. | | | | |
|---|---|---|---|---|
| 70. | his Majeſty | L 562 | 11 | 6 |
| | Captain | 156 | 5 | 5 |
| | 1ſt Mate & Carpr. each | 93 | 15 | 3 |
| | 2d Mate | 62 | 10 | 2 |
| | Surgeon | 125 | 0 | 4 |
| | each Sailor | 15 | 12 | $6\frac{1}{2}$ |

## REDUCTION.

Queſt.

1. 35480 guineas
2. 17928 merks
3. 5964 moidores
4. 10638 pounds
5. 14796 pounds
6. 9504 guineas
7. 5928 moidores
8. 21399 crowns
9. 3730 half-gs.
10. 5250 lb. Troy
11. 2800 lb. Dutch
12. 69732 Scotch ells
13. 3456 Engliſh ells
14. 2772 Scotch pints
15. 1155 E. ale gals.
¶16. L.9313 10s.
17. L.4927 6 8
18. $12273\frac{3}{7}$ guineas
19. $5486\frac{2}{3}$ moidores
20. $5488\frac{1}{3}$ Joannes
21. $4490\frac{1}{2}$ Joannes
22. $5557\frac{1}{2}$ Joannes
23. $2086\frac{3}{7}$ guineas
24. $3807\frac{4}{5}$ piſtoles
25. $2505\frac{3}{5}$ avoirdupois
26. 2508 lb. do.
27. $1387\frac{1}{2}$ yards
28. $4218\frac{3}{4}$ yards
29. $903\frac{21}{1848}$ Eng. gals.
30. $2537\frac{30}{77}$ wine gals.
¶31. L.600075
32. L.425 12 10
33. 336 of each

Queſt.

34. L.3532401 11 3
35. 434 miles 3 fur.
36. 69 days 10 h. 40 min.
37. L.1045440
38. 395 a. 3 r. 38 p. $20\frac{1}{2}$ yds.
4co 1 5 $16\frac{2}{5}$
39. 52 hours $8\frac{8}{9}$ minutes
40. L.368 10 6

## RULE OF PROPORTION.

### SIMPLE PROPORTION.

Queſt.

1. L.6 5 0
2. L.13 13 0
3. L.2 1 $11\frac{19}{21}$
4. 31 cwt. 1 qr.
5. L.264 2 $9\frac{3}{4}$
6. 11238 bolls 3 fir.
7. 206 buſh. $3\frac{1}{13}$ pecks
8. $83\frac{1}{13}$ barrels
9. L.17 2s.
10. L.38
11. L.32 10 9
12. L.247 18 4
13. $66\frac{2}{3}$ acres
14. L.645 6 3
15. L.19 0 $11\frac{3}{7}$
¶16. 490 acres
17. $21\frac{3}{17}$ days
18. $70\frac{1}{2}$ gallons
19. 3s. $11\frac{1}{7}$d.
20. 72 days
21. 43s. $10\frac{3}{7}$d.
22. 40 men
23. 16 pints
24. 5 lb. 4 oz. $3\frac{3}{7}$ drs.
25. $52\frac{1}{2}$ horſes
¶26. 1s. $11\frac{5}{6}$d.
27. 392 horſes
28. 105 acres
29. 37s. $7\frac{1}{2}$
30. L.3 7 $\frac{1}{4}$ $\frac{1}{3}$ $\frac{1}{7}$
31. L.150

Queſt.
32. L.2057 2 $10\frac{2}{7}$
33. L 7 16s.
34. L.50 19 $5\frac{1}{4}$ $\frac{9}{11}$
35. profit L.82 5
36. $52\frac{1}{2}$ cows
37. gain L 92 11 3
38. $46\frac{2}{3}$ acres
39. 19s. $9\frac{1}{2}$d. per lb.
40. $333\frac{1}{3}$ men
41. 42 feet
42. $78\frac{3}{4}$ days
43. 243 feet 10 in.
44. 11 oz. 14 drs.
45. B by $\frac{4}{7}$d.
46. 18s. per yard
47. 19 in. and $17\frac{1}{2}$
48. 1cs. 6d.

## Com. Proportion.

Queſt.
1. L.10 12 $9\frac{3}{5}$
2. L.3 15s.
3. 60 reapers
4. 10 days
5. 87 acres 2 roods
6. L.132 2 $10\frac{2}{7}$
7. $78\frac{1}{8}$ days
8. 18 days
9. $18\frac{9}{16}$ horſes
10. 75 days
11. 14 ounces
12. 18 weeks
13. 45—30=15 men
14. 15 reapers

## Dist. Proportion.

Queſt.
1. A, L.87 10s.
B, 72 10s.
C, 65
D, 50
2. A, L.73 17 $6\frac{1}{2}$ 2098
B, L.67 0 $2\frac{1}{2}$—1946
C, L.41 13 $10\frac{1}{2}$—322
3. A, L.8666 13 4
B, 6740 14 $9\frac{7}{9}$
C, 5392 11 $10\frac{2}{9}$

## Distr. Proportion.

Queſt.
4. A, L.12 8 $0\frac{1}{2}$—630
B, L.16 14 $10\frac{1}{2}$—270
C, L.10 17 $0\frac{1}{2}$—390
5. A, L.391 0 $7\frac{3}{4}$—165
B, L.366 11 $10\frac{1}{4}$—195
C, L.293 5 $5\frac{3}{4}$—285
6. A loſſes L.472 10s
recovers L.787 10s.
B loſſes L.393 15s.
recovers L 656 5s.
C loſſes L.333 15s.
recovers L.556 5s.

## Rules for Practice.

*Computation of Prices.*

### Rule I.

Queſt.

| | | | |
|---|---|---|---|
| 1. | L. 3 | 13 | $5\frac{1}{2}$ |
| 2. | 4 | 18 | $6\frac{1}{2}$ |
| 3. | 7 | 8 | 8 |
| 4. | 27 | 0 | $1\frac{1}{2}$ |
| 5. | 22 | 0 | 0 |
| 6. | 32 | 4 | 0 |
| 7. | 78 | 1 | 4 |
| 8. | 94 | 1 | 6 |
| 9. | 181 | 1 | 4 |
| 10. | 243 | 14 | 0 |
| 11. | 309 | 11 | 8 |
| 12. | 296 | 16 | 0 |
| 13. | 796 | 15 | 0 |
| 14. | 630 | 6 | 8 |
| 15. | 1033 | 16 | 0 |
| 16. | 1141 | 5 | 0 |
| 17. | 2611 | 6 | 8 |
| 18. | 2336 | 10 | 0 |

### Rule II.

Queſt.

| | | | |
|---|---|---|---|
| 1. | L. 76 | 15 | 0 |
| 2. | 217 | 7 | 7 |
| 3. | 257 | 3 | 6 |
| 4. | 166 | 2 | 6 |
| 5. | 207 | 18 | 0 |
| 6. | 418 | 7 | 0 |
| 7. | 1129 | 10 | 0 |
| 8. | 1800 | 1 | 0 |
| 9. | L. 987 | 4 | 0 |
| 10. | 3458 | 14 | 0 |
| 11. | 2290 | 4 | 0 |
| 12. | 1503 | 12 | 0 |
| 13. | 2528 | 10 | 0 |
| 14. | 1040 | 4 | 0 |
| 15. | 6756 | 0 | 0 |
| 16. | 6011 | 4 | 0 |
| 17. | 5816 | 11 | 0 |
| 18. | 3343 | 10 | 0 |
| 19. | 4338 | 13 | 0 |
| 20. | 6659 | 2 | 0 |
| 21. | 5406 | 10 | 0 |
| 22. | 2801 | 8 | 0 |
| 23. | 2240 | 8 | 0 |
| 24. | 2480 | 0 | 0 |
| 25. | 2518 | 12 | 0 |
| 26. | 1828 | 15 | 0 |
| 27. | 3668 | 7 | 0 |
| 28. | 3839 | 8 | 0 |
| 29. | 4416 | 15 | 0 |
| 30. | 3636 | 0 | 0 |

### Rule III.

Queſt.

| | | | |
|---|---|---|---|
| 1. | L. 31 | 13 | 4 |
| 2. | 66 | 8 | $8\frac{1}{2}$ |
| 3. | 80 | 9 | 5 |
| 4. | 92 | 15 | $1\frac{1}{2}$ |
| 5. | 199 | 9 | $6\frac{1}{2}$ |
| 6. | 212 | 9 | $4\frac{1}{2}$ |
| 7. | 220 | 10 | 3 |
| 8. | 190 | 13 | 5 |
| 9. | 320 | 6 | 9 |
| 10. | 285 | 16 | 3 |
| 11. | 266 | 10 | 11 |
| 12. | 282 | 7 | 9 |
| 13. | 538 | 2 | $1\frac{1}{4}$ |
| 14. | 447 | 3 | $8\frac{1}{2}$ |
| 15. | 484 | 5 | $8\frac{1}{4}$ |
| 16. | 868 | 17 | 3 |
| 17. | 1226 | 11 | 8 |
| 18. | 1366 | 17 | 6 |
| 19. | 1253 | 10 | 0 |
| 20. | 1729 | 7 | 0 |
| 21. | 1193 | 9 | $4\frac{1}{4}$ |
| 22. | 3034 | 12 | $6\frac{1}{4}$ |
| 23. | 3040 | 7 | 6 |

| Queſt. | | | |
|---|---|---|---|
| 24. | L. 3566 | 13 | 2 |
| 25. | 4968 | 10 | 0 |
| 26. | 4466 | 2 | 8 |
| 27. | 3387 | 3 | 10 |
| 28. | 4277 | 14 | 0 |
| 29. | 4214 | 3 | 2 |
| 30. | 4010 | 2 | 6 |
| 31. | 4044 | 4 | 0 |
| 32. | 3492 | 13 | 9 |
| 33. | 2568 | 11 | 4 |
| 34. | 2193 | 2 | 0 |
| 35. | 2292 | 4 | 0 |
| 36. | 2659 | 3 | 9 |
| 37. | 2426 | 13 | 4 |
| 38. | 2578 | 17 | 6 |
| 39. | 2304 | 6 | 3 |
| 40. | 1820 | 8 | 9 |

## RULE IV.

| | | | |
|---|---|---|---|
| 1. | L. 111 | 11 | 11¼ |
| 2. | 133 | 14 | 8¼ |
| 3. | 172 | 9 | 10½ |
| 4. | 143 | 7 | 9⅓ |
| 5. | 284 | 8 | 9¾ |
| 6. | 265 | 2 | 4½ |
| 7. | 230 | 19 | 9 |
| 8. | 276 | 13 | 11¼ |
| 9. | 1141 | 5 | 11¼ |
| 10. | 862 | 11 | 11¼ |
| 11. | 1373 | 16 | 4 |
| 12. | 781 | 12 | 5 |
| 13. | 1544 | 3 | 1½ |
| 14. | 1803 | 6 | 4 |
| 15. | 1135 | 1 | 11¾ |
| 16. | 2228 | 9 | 2⅓ |
| 17. | 74 | 1 | 6¾ |
| 18. | 74 | 9 | 4¾ |
| 19. | 72 | 3 | 6¾ |
| 20. | 44 | 6 | 7½ |
| 21. | 42 | 19 | 10¾ |
| 22. | 27 | 6 | 4½ |
| 23. | 25 | 10 | 6½ |
| 24. | 603 | 0 | 11¼ |

## DEDUCTION ON WEIGHTS.

| Queſt. | *Cwt.* | *qr.* | *lb.* |
|---|---|---|---|
| 1. *Tare,* | 26 | 2 | 16 |
| 2 | 3 | 1 | 15 |
| 3. *Nett,* | 7 | 2 | 20¾ |
| 4. | 235 | 1 | 20⅞ |
| 5. *Tret,* | 6 | 3 | 0 |
| 6. *Nett,* | 207 | 2 | 24 |
| 7. | 14 | 1 | 19½ |
| 8. *Cloff,* | 0 | 1 | 2½ |
| 9. *Nett,* | 127 | 2 | 13⅓ |
| 10. | 202 gallons | | |
| 11. | 49 lb. 3 oz. 6 dwt. | | |
| 12. | 360 bolls 3 fir. | | |
| 13. | 1166 gallons | | |

## COMMISSION.

| Queſt. | | | |
|---|---|---|---|
| 1. | L. 16 | 9 | 0 |
| 2. | 12 | 3 | 8 |
| 3. | 15 | 11 | 1¾ |
| 4. | 16 | 19 | 11½ |
| 5. | 69 | 15 | 0 |
| 6. | 10 | 1 | 4 |
| 7. | 72 | 16 | 3 |
| 8. | 91 | 11 | 4½ |
| 9. | 16 | 5 | 0⅓ |
| 10. | 93 | 16 | 7 |
| 11. | 1925 | 0 | 0 |
| 12. | 951 | 6 | 0 |

## INTEREST.

| Queſt. | | | |
|---|---|---|---|
| 1. | L. 1 | 0 | 0 |
| 2. | 1 | 0 | 0 |
| 3. | 9 | 8 | 9¼ |
| 4. | 4 | 11 | 0 |
| 5. | 1 | 17 | 2½ |
| 6. | 18 | 17 | 7 |
| 7. | 2 | 5 | 2½ |
| 8. | 3 | 12 | 0 |
| 9. | 24 | 15 | 0 |
| 10. | 23 | 2 | 9 |
| 11. | 7 | 18 | 5¾ |
| 12. | 48 | 11 | 6½ |

*Page* 82.

| | | | |
|---|---|---|---|
| 1. | L. 52 | 6 | 4½ |
| 2. | 274 | 14 | 1½ |
| 3. | 5 | 9 | 4 |
| 4. | L. 3 | 5 | 2½ |
| 5. | 25 | 19 | 5½ |
| 6. | 74 | 19 | 7 |
| 7. | 11 | 2 | 3 |
| 8. | 0 | 2 | 5 |
| 9. | 2 | 1 | 2 |

10. due Orr and Park L. 125 5 8¾

11. principle due me, L. 376 0 0
and int. L. 11 9 1½

12. Prin. L. 1390 0 0
Intereſt, L. 37 12 0

## MERCH. ACCOMPTS.

*Bills of Parcels.*

| | | | |
|---|---|---|---|
| I. | L. 295 | 1 | 8½ |
| II. | L. 68 | 1 | 1¼ |
| III. | 26 | 19 | 0 |
| IV. | 787 | 7 | 2¾ |
| V. | 76 | 13 | 7 |
| VI. | 90 | 14 | 4¾ |
| VII. | 1662 | 11 | 3 |
| VIII. | 203 | 3 | 2½ |

*Invoices.*

| | | | |
|---|---|---|---|
| I. | L. 156 | 7 | 11½ |
| II. | 3884 | 9 | 11½ |
| III. | 1981 | 12 | 2½ |
| IV. W.M. | 139 | 8 | 0 |
| J. J. | 581 | 8 | 9½ |
| R. W. | 138 | 9 | 9 |
| A. R. | 309 | 10 | 5 |
| J. W. | 25 | 0 | 9 |
| F. & B. | 29 | 11 | 7 |
| | L. 1336 | 5 | 11 |

*Accompt Sales.*

| | | | |
|---|---|---|---|
| I. | L. 112 | 1 | 11 |
| II. | 367 | 6 | 4½ |
| III. | 445 | 15 | 7½ |

## VULGAR FRACTIONS.

*Addition.*

Queſt.

1. L. 100 6 6¾ $\frac{85}{252}$

Queſt.
2. cwt. 20 0 $23\frac{13}{15}$
3. 125 yards 3 nails
4. 2lb. 8oz. 4dw. 8g.
5. $\frac{20}{33}$ L.2585 13 $9\frac{1}{3}$

*Subtraction.*

Queſt.
1. D's ſhare $\frac{1}{24}$
2. L.17 3 0
3. 42 gal. $4\frac{4}{5}$ pints
4. 13lb. 8oz. $13\frac{37}{105}$d.
5. 9 bolls $1\frac{7}{9}$ pecks & $\frac{17}{20}$ pecks

*Multiplication.*

Queſt.
1 L.35 4s. $\frac{5}{128}$
2. $268\frac{1}{8}$ feet
3. 2lb. 7oz. $15\frac{9}{80}$dw.
4. L.18 8 $9\frac{2}{3}$
5. L.2 15 $10\frac{1}{2}\frac{5}{288}$
6. $1503\frac{17}{96}$ lb.

*Diviſion.*

Queſt.
1. L.3 17 $8\frac{3}{4}\frac{1}{14}$
2. 1ac. 26po. $20\frac{1}{6}$yds.
3. 12s. $1\frac{7}{9}$d.
4. $427\frac{49}{107}$ ſtones
5. L.1 15 $11\frac{1}{4}\frac{4}{74}$
6. M. L.55 11 $1\frac{37}{71}$
W. 36 16 $8\frac{20}{71}$
B. 24 11 $1\frac{37}{71}$

## DECIMAL FRACTIONS

*Multiplication.*

Queſt.
1. L.9.49
2. L.47.4375
3. L240.700390625
4. L9.1866796875
5. L6.513671875
6. feet, 7.03125

*Diviſion.*

Queſt.
1. .796875L.
2. 38.839285+yds.
3. .4629+acre
4. L.1.73475+
5. M. L.8.273+
B. 7.2389—
6. 14.3125 acres

*Queſtions for Practice.*

1. 19s. 11d.
2. A, 8s. $2\frac{2}{11}$d.
B, 5s. $5\frac{5}{11}$d.
C, 4s. $1\frac{1}{11}$d.
D, 3s. $3\frac{3}{11}$d.
3. 441.6875 feet
4. L.1207 17 $6\frac{1}{4}\frac{1}{7}$
5. $82\frac{4}{43}\frac{1}{2}$ feet
6. 19s. $5\frac{1}{3}$d. nearly
$380\frac{2}{5}$ S. feet
7. L.16 13 $2\frac{2}{5}$
8. L.3 15s.
9. L.18 1 8
10. $100\frac{1}{3}\frac{1}{2}\frac{2}{3}$ deals
11. $1136\frac{1}{5}$ lb.
L.13 16 $1\frac{3}{4}$
12. 4 days
13. 178.394 yards
14. C's ſhare $\frac{2}{8}\frac{3}{8}$
L.2869 11 $3\frac{15}{17}$
A, 1043 9 $6\frac{8}{17}$
B, 1076 1 $8\frac{20}{37}$
15. A, L.8571 8 $6\frac{6}{7}$
B, 6428 11 $5\frac{1}{7}$

## VARIETIES IN PROPORTION.

*Insurance.*

Queſt.
1. L. 4 4 0
2. 11 7 $7\frac{3}{4}$
3. 46 9 $9\frac{1}{4}$
4. 231 5 0
5. 922 14 $9\frac{3}{5}$
6. 2336 11 9
7. 1937 12 10
8. 1450 0 0
9. 1163 9 11
10. 2613 6 8
11. 354 13 8
2074 14 $5\frac{6}{7}$
12. L.2 15 $1\frac{1}{2}$

## GAIN & LOSS.

Queſt.
1. $12\frac{1}{2}$ per cent.
2. $6\frac{1}{4}$ per cent.
3. $7\frac{1}{2}$ per cent.
4. 8s. $5\frac{1}{4}$d.
5. 10s. $9\frac{1}{2}$d.
6. L 288 1 6
7. 3s. 4d per ſp.
8. 3s. 4d. per yd.
9. L.420
10. $44\frac{3}{8}$ per cent.
11. $5\frac{5}{9}$ per cent gained
12. 25 p. cent. gained
$7\frac{3}{9}\frac{1}{2}$ per cent. loſt
13. A and B, equal and C, 20 per cent.
14. $12\frac{1}{2}$ per cent.
To extent of L.2520

## EXCHANGE

*with London.*

Queſt.
1. L 323 6 $1\frac{1}{2}$
2. 450 14 $9\frac{1}{2}$
3. 606 8 $11\frac{1}{4}$

*With Ireland.*

Queſt.
1. L.4615 7 $8\frac{1}{4}$
2. 588 8 3
3. 1042 12 9
4. $8\frac{1}{2}$ per cent.
5. gain L.21 11 5

*With America.*

Queſt.
1. L.825 16 $1\frac{1}{2}$
2. 1485 1 0
3. 1428 10 $5\frac{1}{2}$
4. 140 per cent.

Queſt.
5. L.4662 10 4

*With Holland.*

Queſt.
1. 4558g. 2ſtiv. 8pen.
2. 3722$\frac{1}{9}$ guilders
3. L.2559 19 6
4. 573 9 0
5. 13713 g. 9 ſtiv. 1p.
6. bet. in Br. by 10$\frac{10}{11}$d.
7. 35s. 6$\frac{2}{3}$d.
8. 22$\frac{1}{10}$d.
9. about 22d.
10. L.1970 1 4$\frac{1}{4}$
11. loſs, L.49 4 3

*With Germany.*

Queſt.
1. M. 5198.5
2. L.606 7 6$\frac{1}{4}$
3. M. 2592 2 8 cur.
4. G. 2573 7 6
5. M. 14252 14 10
6. 18$\frac{6}{85}$d. ſter
7. 16d.
8. L 594 5 4
9. 625 marcs loſt or 6$\frac{1}{4}$ per cent.
10. L 2 14 2$\frac{1}{2}$

*With France.*

Queſt.
1. L.1061 3 1$\frac{1}{2}$
2. Lrs.349917.35
3. L.129 16 2
4. g. 886 11 5
5. Lrs. 11592 45
6. L.136 2 8$\frac{1}{2}$

*With Portugal.*

Queſt.
1. L.1336 4 4$\frac{1}{2}$
2. M. 5566.814
3. Guild. 1307 14
4. Cr. 1676.395
5. L.1514 1 4$\frac{1}{4}$
6. 18 0 0
7. dueG.L.187 13 2$\frac{1}{4}$

*With Spain.*

Queſt.
1. L.965 9 7$\frac{3}{4}$
2. pias. 7625 6
3. 1192.36 guilders
4. Lrs. 961 16s. 7d.
5. M. 511.875
6. gain L.105 17 9$\frac{1}{4}$
7. L699 15 5$\frac{3}{4}$

*With Italy.*

Queſt.
1. L.1326 2 6
2. 3355.866 pez
3. L.2590 0 5
4. 15157 guilders
5. mrs. 6684.376 cur.
6. ducats 1215.986
7. ducats 6602$\frac{116}{119}$
8. lires 963
9. 5885.300 milrees
10. rials 12757.25
11. ſter. L 748 5 0
livres 18000
12. lrs. 3070.965
ſterling L 130 1 9$\frac{3}{4}$
13. 1900 ducats or 5 per cent.

*With Denmark.*

Queſt.
1. L 288 12 3$\frac{1}{2}$
2. G. 13423 17 ſtiv
3. R. 1332 4m. 12$\frac{1}{2}$ſk.
4. L.1430 6 9$\frac{3}{9}$
5. R. 7571.2 36 ſk.

*With Sweden.*

Queſt.
1. L.2117 10 7$\frac{1}{4}$
2. cop. dol. 60865.55
3. cop. dollar 6300
4. m l. 4214.285
5. 5$\frac{1}{4}$d. per cop. dol.
6. L.2102 10 7$\frac{1}{2}$
dol. 39422.46

*With Poland.*

Queſt.
1. L 137 14 3$\frac{3}{4}$
2. *F.* 21856.26
3. m. l. 3137 69
4. L.362 15 9$\frac{1}{2}$
5. L.389 4 5

Queſt. *With Ruſſia.*
1. L.973. 14s.
2. R. 1414.59
3. m. l 8861.11
4. L 788 2 2$\frac{1}{2}$
5. L.1057 13 6

SIMPLE ARBITRATION

Queſt.
1. 34s. 1$\frac{7}{19}$d. per L.
2. 36s. 1$\frac{1}{8}$d.
3. 5s. 10d. per mil.
4. 653$\frac{11}{13}$ rees
5. 5s. 4d. per m.
6. 4s 6$\frac{30}{43}$d.
7. Drawn on Amſterdam and remit to Paris profit
L.22 4 6$\frac{6}{11}$
8. Draw on Cadiz, and remit to Paris, profit L.16 13 4

COMP. ARBITRATION.

Queſt.
1. 5$\frac{1}{5}$ roubles
2. 280 yards
3. 47$\frac{11}{107}$d.
4. Draw by Holland, &c. profit L.2 6 6
5. The circular draft is better by L.60 6 5$\frac{1}{2}$

SIMPLE INTEREST.

Queſt. page 146.
1. L. 51 7 6
2. 81 13 4
3. 43 7 11$\frac{1}{4}$
4. 182 6 1$\frac{1}{3}$
5. 244 7 6
6. 55 15 0$\frac{3}{4}$
7. 72 11 5
8. 10833 6 8

*Page* 147.

Queſt. 1ſt.

1500 lent
192.7397
1692.7397
500. rec.
1192.7397
87.9032
1280.6429
250. rec.
1030.6429
76.2393
1106.8822
350. rec.
756.8822
69.9856
826.8678
100. rec.
726.8678
34 1528
761.0206
or,
L.761 0 5

Queſt. 2d.

700 bor.
130.2192
830.2192
350. paid
480.2192
18.8799
499.0991
300. paid
199.0991
17.0733
216.1724
150. paid
66.1724
4.9584
71.1308
or,
L.71 2 7¼

*Page* 147.

Queſt. 3d.

1900. bond
72.2520
1972.2520
560. paid
1412.2520
139.7550
1552.0070
480.paid.
1072.0070
73 4257
1145.4321
300. paid
845.4321
52.2547
897.6868
250. paid
647.6868
55.0090
702.6958
200. paid
502.6958
14 1030
516.7988
or,
L.516 15 11½

Queſt. 4th.

3000. due
45.2055
3045.2055
1200. paid
1845.2055
111.2178
3000 due
4956.4233
335.4073
5291.8306
1200. paid
4091.8306
217.4836

*Page* 147.

Queſt. 4th.

4309.3142
1200. paid
3109 3142
57.0751
3166.3893
1200. paid
1966.3893
112.3266
2078.7159
1200. paid
878.7159
or,
L.878 14 3¼

*Diſcount and Rebate.*

Queſt.

1. L.350 0 0
2. 693 6 8
3. 100 0 0
4. 9 0 0
5. 600 0 0

*Page* 149.

1. L.551 0 0
2. 512 0 0
3. 219 days
4. 5 years
5. 3¾ per cent.
6. 4 per cent.
7. L.1312 10 0
8. 8 per cent.

*Equation of Payments.*

1. 8 months
2. 75 days
3. 10¼ months
4. 5⅔ months

*Practical Diſcount.*

1. L. 4 2 0
2. 315 16 11
3. 151 16 6¾

Queſt.
4. L.721 0 0

*Compound Intereſt.*

Queſt.
1. L.1621 14 0
2. L12523 18 6
3. 14 years, 74 days
4. L.565 6 8
5. $4\frac{1}{2}$ per cent.
6. L.14635 12 $3\frac{1}{4}$

*Annuities*, Sect. I.

Queſt.
1. L1006.232
2. 65.602
3. 10 years, 354 days
4. L86.3268
5. L3738.665
6. 96.0223
7. 149.9475
8. 41.3725

*Annuities*, Sect. II.

Queſt.
1. L.20000
2. L.600 0 0
3. $6\frac{1}{4}$ per cent.
4. 15 years
5. $4\frac{1}{6}$ per cent.

*Annuities*, Sect. III.

Queſt.
1. L3409.725
2. L535.9415
3. L.77 18 4

*Annuities*, Sect. IV.

Queſt.
1. $\frac{69}{194}$ or $\frac{23}{98}$
2. L1047.8
3. L95.615
4. L1298.8
5. $34\frac{1}{2}$ years
6. L758.64
7. L253.38
8. L5.64

# SOLUTIONS

OF THE

# MISCELANEOUS EXERCISES.

I. A gardner receives in money, - - L.10 10 0
A houſe, - - 2 5 0
Coal and candle, - 0 17 6
Garden articles, - 0 13 4
$4\frac{1}{2}$ bolls meal at 16s.8d. 3 15 0
A cow's graſs, - 1 11 6

Amount is L.19 12 4
313 days at 1s. 4d. is 20 17 4

He therefore gains L. 1 5 0

II. A grocer buys $1\frac{3}{4}$ cwt. tea at L.22 8s. is L.39 4 0
He ſells
50 lb. at 4s. 9d. L.11 17 6
50 lb. at 5s. 1d. 12 14 2
50 lb. at 5s. 5d. 13 10 10
46 lb. at 5s. 9d. 13 4 6

L.51 7 0
coſt, 39 4 0

Anſwer L.12 3 0

III. A maſon's wages at 2s. 6d. pr. day, is 15s. pr. week × 24 = L.18 0 0
A barrowman's do. at 1s.8d. per day, is 10s. do. × 10 = 5 0 0
A miner's do. at 2s. per day, is 12s. do. × 6 = 3 12 0

The whole weekly wages for ſummer, L.26 12 0

A maſon at 2s. per day, is 12s. per week × 24 = L. 14 8 0
A barrowman at 1s. 4d. per day, is 8s. do. × 10 = 4 0 0
A miner at 1s. 8d. per day, is 10s. do. × 6 = 3 0 0

The whole weekly wages for winter, L. 21 8 0

From the 4th Feb. to the 11th Nov. is 280 days.
From which deduct, for Sundays, $\frac{1}{7}$ 40

240 work days.

And, from 11th Nov to 4th Feb. is 85 days.
From which deduct the Sundays, 12

73 work days.

| | | | | | |
|---|---|---|---|---|---|
| Then 240 days at 2s. 6d. is | L. 30 | 0 | 0 | 240 days at 2s. is L. | 24 0 0 |
| 73 do. at 2s. - | 7 | 6 | 0 | 73 do. at 1s. 8d. is | 6 1 8 |
| A maſon's income is L. | 37 | 6 | 0 | A miner's income is L. | 30 1 8 |

IV. A butcher buys 15 oxen at L. 9 10s. each, L. 142 10 0
He paſtures them at 2s. each per wk. for 6 wks. 9 0 0
Feeds them with 90 pecks corn, at 10½d. - 3 18 9
And 120 ſtones hay, at 5d. per ſtone, - 2 10 0

The expence is, 157 18 9

32½ ſtones beef each, is 487½ ſtones, or
6825 lb. at 5d. per lb. is, L. 156 8 1½
70 lb. tallow in each, or 75 ſtones at 8s. 30 0 0
15 hides at 25s each, is - - 18 15 0

They bring him, 205 3 1½

He gains, L. 47 4 4½

V. A woollen draper ſold
25 yards at 19s. is L. 23 15 0
14 yards at 18s. 4d. 12 16 8
15 do. at 12s. 8d. 9 10 0

L. 46 1 8
5 per cent. diſcount is 2 6 1
He receives, L. 43 15 7

VI. A delivers to B
30 pieces, each 12 yards, which at 3s. 9d. is, L. 67 10 0
15 doz. ſhawls, at 28s. 21 0 0
For which B gives A
15 doz. port, at 32s. L. 24 88 10 0
12 doz. ſher. at 30s. 18 42 0 0

46 10 0
20

930
12

And the balance in linen, at 20d. )11160

Anſwer 558 yds

VII. A ſhop-keeper ſells, 15 pieces
qt. 780 yds. at 2s 8d. L. 104 0 0
175 yds. cotton at 2s. 6d. 21 17 6
120 do. gingham, 2s. 3d. 13 10 0

L. 139 7 6
5 per cent. is $\frac{1}{20}$ 6 19 4½
2½ do $\frac{1}{40}$ 3 9 8¼
He pays L. 149 16 0¾

VIII. A merchant purchaſed 88 bolls at 19s. L. 83 12 0
125 do. 20s. 6d. 128 2 6
99 do. 22s. 108 18 0
108 do. 21s. 9d. 117 9 0

$\frac{1}{20}$) 420 438 1 6
Inlake $2\frac{1}{2}$ per cent. $10\frac{1}{2}$ rent, 25 10 0

4)$409\frac{1}{2}$ 463 11 6

He ſells $102\frac{3}{8}$ bolls at 25s. L.127 19 $4\frac{1}{2}$
$102\frac{3}{8}$ do. at 23s. 6d. 120 5 $9\frac{3}{4}$
120 do. at 21s. 126 0 0
The remainder is $84\frac{1}{4}$ do. at 19s. 6d. 82 2 $10\frac{1}{2}$

456 7 $0\frac{3}{4}$
Loſs L. 7 3 $5\frac{1}{4}$

IX. 5 pun. rum qt. 420 gallons at 11s. 6d. L.241 10 0
8 hhds. ſugar, each $14\frac{1}{4}$ cwt. = 114 cwt. at 75s. 427 10 0
669 0 0
Received, 15 11 3
which for 6150 lb. comes to 2s. $1\frac{1}{4}$d. per lb. L.652 8 9

X. A baker purchaſed 650 bolls at 27s.6d. L.893 15 0
Deduct 2 per cent. 17 17 6
875 17 6
Incident charges 21 10 0
The prime coſt L.897 7 6
He ſold 650 bolls at 30s. L.975 0 0
6 ms. intereſt on L.897 7 6 is L.22 8 $8\frac{1}{4}$
Loſt rent, 22 15 0
45 3 $8\frac{1}{4}$
Nett proceeds of the ſales, 929 16 $3\frac{1}{4}$
He gained, 32 8 $9\frac{1}{4}$

XI. $3\frac{1}{2}$ cwt. ſugar, at 80s. is L. 14 0 0
$2\frac{1}{4}$ do. 75s. 8 8 9
$1\frac{3}{4}$ do. at $7\frac{1}{2}$d. per lb. 6 2 6
$7\frac{1}{2}$ $7\frac{1}{2}$)28 11 3
per cwt. L.3 16 2
2d. on the ſhilling is $\frac{1}{6}$ 0 12 $8\frac{1}{3}$
1 cwt. = 112 lb. )4 8 $10\frac{1}{3}$
per lb. about $9\frac{1}{2}$d.

XII. 9 acres hay, each 210 ſtones is 1890 ſtone
at 6½d. - - L.51 3 9
Expence of making, 2 15 0

Profit of the hay, 48 8 9

Or, 15 oxen, each 34 ſtones is 510 ſt. at 5s. 10d. L.148 15 0
tallow and hides at L.3 5s. each, 48 15 0

197 10 0
Deduct the 15 oxen at 9 gs. each, 141 15 0

55 15 0

Or, 9 milk cows, each give 6 lb. butter, is 54 lb.
per wk. for 15 wks. is 810 lb. at 11½d. pr. lb. L.38 16 3
32 pints milk from each cow for 15 weeks, is
4320 pints, at 3 farthings, is - - 13 10 0

52 6 3
Expence of the dairy, 3 10 0

48 16 3

Or, 30 horſes paſtured for 40 days at 9d. per
day is 30s. each, and in all, - - - L.45 0 0
The profit of fattening the oxen is the greateſt by L.6 18 9

XIII. 85 ac. 2 r. ÷ 18 days gives 4 a. 3 r. the ground reaped per day.
85 acres 2 roods ÷ 36 reap. = 2 a. 1 r. 20 fa. each reaps in all.
2 acres 1 do. 20 f. ÷ 18 days = 20 falls each reaps per day.
An acre is 160 fa. ÷ 20 fa. = 8 men to reap an acre per day.
L.48 12s. ÷ 18 days gives L.2 14s. the whole daily wages.
L.48 12s. ÷ 36 reapers = L.1 7s. the whole daily wages of each.
L.1 7s. ÷ 18 days = 1s. 6d. the daily wages of each.

XIV. Diviſion of Waſte Land.

| | | | |
|---|---|---|---|
| 240 acres at 7s. 6d. | L.90 | 0 | 0 |
| 285 do. 6s. 8d. | 95 | 0 | 0 |
| 420 do. 5s. | 105 | 0 | 0 |
| 315 do. 4s. | 63 | 0 | 0 |
| | 353 | 0 | 0 |
| whereof ⅓ is | 117 | 13 | 4 |

L. acres. L.
95 : 285 : : 27 13 4
3 83 3
285) 83
23555
286—83 acres = 202

| | | | |
|---|---|---|---|
| Firſt ſhare 240 at 7s. 6d. | L.90 | 0 | 0 |
| Do. 83 at 6s. 8d. | 27 | 13 | 4 |
| | L.117 | 13 | 4 |
| 2d. ſhare 202 at 6s. 8d. | L.67 | 6 | 8 |
| Do. 201⅓ 5s. | 50 | 6 | 8 |
| | L.117 | 13 | 4 |

105 : 420 : : 50 6 8
3 3
315 151
420
315)63420
420—201⅓ ac. = 218⅔

| | | | | |
|---|---|---|---|---|
| Third ſhare | 218½ | at 5s. | L54 13 | 4 |
| Do. | 315 | at 4s. | 63 0 | 0 |
| In all, | 1260 acres. | | L.117 13 | 4 |

XV. *Note.* By the father's *will* the ſon was to have triple the mother's ſhare, and the mother triple the daughters; therefore,

The Daughters 1 ſhare 13)L.9875 15 6

Mother 3 do.

Son 9 do.

| | | |
|---|---|---|
| 759 13 6 | the daughters' ſhare. | |
| 2279 0 6 | the mother's | do. |
| 6837 1 6 | the ſon's | do. |

diviſor, 13

L.987, 15 6

XVI. The number of men and expence to dig a canal.

100×6×3 = 1800 ſolid feet.

5280 f.×27×3 ×7 =35925120 do.

If 1800 ſolid feet : 15 men : : 35925120 ſolid feet.

313×5 = 1565 days. 12 hours.

diviſor, 33804,000 prod.

12 days.
9 hours.
15 men.

)58198694,400 prod.

1722 *adding* 1 *for the fraction over.*

And 35925120 ſolid feet divided by 27, the number of ſolid feet in a ſolid yard, is 1330560 ſolid yards, which at 11⅞d. amounts to L.65835, the expence of digging.

XVII. Diviſion of an inſolvent company's affairs.

| | | | |
|---|---|---|---|
| W.Smith&Co draws | L.657 | 14 | 11⅝ |
| J. Chriſtie & Son, | 710 | 0 | 3¾ |
| Robert Gordon, | 857 | 4 | 6⅜ |
| Forbes & Bell, | 447 | 4 | 4½ |
| James Tennant, | 591 | 5 | 0 |
| Charles Todd, | 471 | 5 | 7½ |
| John Paterſon, | 749 | 7 | 6 |
| Thomas Stivenſon, | 536 | 15 | 3¼ |

William Smith & Co's. Credit.

| | | | | |
|---|---|---|---|---|
| ½)L.956 | 14 | 6 | at 13s. 9d. | |
| ¼)L.478 | 7 | 3 | at 10s. | |
| ½) 119 | 11 | 9¾ | at 2s. 6d. | |
| 59 | 15 | 10⅞ | at 1s. 3d. | |
| L.657 | 14 | 11⅝ | | |

The ſhares of the reſt of the creditors may be found in the ſame manner.

XVIII. Diviſion of a prize taken at ſea.

| | | | | ſhares. | |
|---|---|---|---|---|---|
| Value of the ſhip, | L. 960 | 0 | 0 | 60 | 60 ſailors. |
| 115 hhds. wine at L.19 10s. is | 2242 | 10 | 0 | 8 | 2 lieutenants. |
| 1560 gal. brandy at 5s. 6d. | 429 | 0 | 0 | 8 | a ſurgeon. |
| 8400 livres at 9½d. | 332 | 10 | 0 | 8 | a purſer. |
| | | | | 24 | 4 midſhipmen. |
| Carried over. | L.3964 | 0 | 0 | 32 | the captain. |
| | | | | 140 | |

| | | | | |
|---|---|---|---|---|
| Brought over. | | | L.3964 | 0 0 |
| Agent's fee, 2½ per cent. | L 99 | 2s | | |
| Other charges, - | 24 | 13s. | | |
| | | | L.123 | 15 0 |
| | | | 3840 | 5 0 |
| The proprietors get, ⅓ which is | | | 1280 | 1 8 |

The ſum of their ſhares is 140 = 20)2560 3 4 / 7) 128 0 2 × 2 × 8 × 12 × 3

| | | | |
|---|---|---|---|
| Each ſailor gets | L. 18 | 5 | 8 7 |
| Each midſhipman, | 36 | 11 | 5 5/7 |
| Surgeon and purſer, each | 146 | | 10 |
| The lieutenant, - | 219 | 8 | 10 7 |
| The captain, - - | 585 | 3 | 7 3/7 |

XIX. A farmer planted 12 acres with potatoes, at a peck for 3 falls, which takes for ſeed 640 pecks, or 40 bolls at 11s. 6d. is L.22 13 4

| | | |
|---|---|---|
| Rent of 12 acres, at 4 guineas per acre, - - | 50 | 8 0 |
| 30 loads dung per acre, is 360 loads, at 3s. - - | 54 | 0 0 |
| Plowing, 5s. 6d. per acre, is, . - - - | 3 | 6 0 |
| Expence of ſetting the potatoes, - - - - | 12 | 14 2 |
| Double hoeing at 24s. per acre, - - - - | 14 | 8 0 |
| The whole expence is | L.157 | 9 6 |

| | | | | |
|---|---|---|---|---|
| He ſells 165 bolls at 9s. 6d. | | | L. 78 | 7 6 |
| 250 | do. | 9s. | 112 | 10 0 |
| 126 | do. | 8s. 6d. | 53 | 11 0 |
| 99 | do. is 1584 pecks, at 7½d. | | 49 | 10 0 |
| | | | 293 | 18 6 |
| digging u[illegible], and carriage | | | | |
| which at 8d. per boll, is - - | | | 21 | 6 8 |
| | | | L.272 | 11 10 |
| | | He gains, | L.115 | 2 4 |

XX. Settlement of a Company's affairs.

| | | | |
|---|---|---|---|
| Debts due to the Company, is - | L.4765 | 18 | 4 |
| They owe, - - - - | 1210 | 15 | 0 |
| A takes the riſk of recovering this | L.3555 | 3 | 4 |
| for 7½ per cent. which is - | 266 | 12 | 9 |
| | | 3288 | 10 7 |
| The value of goods belonging to them is | L.2980 | 16 | 8 |
| B takes the goods at 5 per cent. diſcount, | 149 | 0 | 10 |
| | | 2831 | 15 10 |
| Nett amount of their effects is - - - | | L.6120 | 6 5 |

Whereof A's ſhare is $\frac{2}{3}$ds. or, L.4080 4 $3\frac{2}{7}$
B - $\frac{1}{3}$ or, - 2040 2 $1\frac{5}{7}$

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Debts aſſigned to A, | L.3288 | 10 | 7 | Goods to B, | L.2831 | 15 | 10 |
| B owes A, - - | 791 | 13 | $8\frac{5}{7}$ | B owes A, | 791 | 13 | $8\frac{5}{7}$ |
| | L.4080 | 4 | $3\frac{2}{7}$ | | L.2040 | 2 | $1\frac{2}{7}$ |

XXI. A has on hand,
3 cwt. 2qr. 8 lb. tea, at L.28 is L.100
3 add 1 years intereſt, 5
105
A wiſhes to gain, 18
123
The diſc. of L123 due in 6 months, 3
Carried up 126

3
3,64
400 lb.

Brought up 126
20
400)2520(6s.$3\frac{1}{5}$d.lb.
2400
120
12
1440
1200
240

XXII. Diviſion of the rent of an incloſure.

| Cows. months. | Cows. months. | Cows, months. |
|---|---|---|
| A, 60×2 = 120 | B, 50×3 = 150 | C, 40×4 = 160 |
| 50×$3\frac{1}{2}$ = 175 | 60×5 = 300 | 65×2 = 130 |
| 20×3 = 60 | 450 | 290 |

355+450+290=1095

| | | | | | |
|---|---|---|---|---|---|
| 1095 : 105 | L. : : 355 : | A pays, | L.34 | 0 | $9\frac{3}{4}\frac{99}{119}$ |
| 1095 : 105 | : : 450 : | B pays, | 43 | 3 | 0 $\frac{144}{119}$ |
| 1095 : 105 | : : 290 : | C pays, | 27 | 16 | $1\frac{3}{4}\frac{105}{119}$ |
| | | Proof, | L.105 | 0 | 0 |

XXIII. Diviſion of a company's effects.

The company's ſtock was L.6000, when increaſed by $45\frac{1}{2}$ per cent. is L. 8730
From which deduct A's ſalary 105
The remainder is - - 8625
And when divided by the ſum of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, is 6720 15 7

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| whereof $\frac{1}{2}$ is | L.3360 | 7 | $9\frac{1}{2}$ | $\frac{1}{3}$ is | 2240 | 5 | $2\frac{1}{2}$ B's ſhare |
| A's ſalary is | 105 | | | $\frac{1}{4}$ is | 1680 | 3 | $10\frac{3}{4}$ C's |
| | | | | $\frac{1}{5}$ is | 1344 | 3 | $1\frac{1}{4}$ D's |
| A's ſhare | 3465 | 7 | $9\frac{1}{2}$ | | 3465 | 7 | $9\frac{1}{2}$ A's |

Proof L. 8730

**XXIV.** A merchant orders from London 30 caſks madder, weighing Cwt. qr. lb. 253 2 8; deduct 4 lb. for each caſk 1 0 8

| | | | | | |
|---|---|---|---|---|---|
| | 252 | 2 | 0 | | |
| Tare 10 lb. per cwt. - | 22 | 2 | 5 | | |
| Nett - - - - | 229 | 3 | 23 | at 74s. 8d. | L. 858 10 |
| Cartage, wharfage and loading | | - | | - | 5 14 |
| | | | | | 864 4 |
| Inſurance on L. 864 4, at $1\frac{1}{4}$ gs. is | | | | | L. 11 6 10 |
| Freight to Grangemouth, 33s. p. caſk | | | | | 19 10 0 |
| Cartage to Glaſgow, at 11s. 6d. p. ton | | | | | 7 5 $9\frac{1}{2}$ |
| | | | | | 38 2 $7\frac{1}{2}$ |
| Coſt | | | | | L. 902 6 $7\frac{1}{2}$ |

| | C. | qr. | lb. | | | |
|---|---|---|---|---|---|---|
| He ſells 8 caſks wg. | 64 | 3 | 18 | | | |
| Tare 10 lb. per C. | 5 | 3 | 5 | | | |
| Nett | 59 | 0 | 13 | at 88s. 8d. | L. 262 | 1 $7\frac{1}{2}$ |
| 10 caſks wg. | 93 | 0 | 12 | | | |
| Tare | 8 | 1 | 7 | | | |
| | 84 | 3 | 5 | at 84s. | 356 | 2 9 |
| 12 caſks wg. | 95 | 2 | 6 | | | |
| Tare | 8 | 2 | 3 | | | |
| | 87 | 0 | 3 | at 86s. 4d. | 375 | 13 $3\frac{3}{4}$ |
| | | | | | 993 | 17 $8\frac{1}{4}$ |
| | | | | cellar rent | 1 | 17 6 |
| | | | | | 992 | 0 $2\frac{1}{4}$ |
| | | | | gain L. | 89 | 13 $6\frac{3}{4}$ |

**XXV.** A trading Co's. capital is L. 28080

39th part is 720

3 ſhares

A's ſtock is 2 60

10 pr. cent. is 2 6

5 do. is 108

$2\frac{1}{2}$ do. is 54

100 : $166\frac{2}{3}$ :: 2538

$166\frac{2}{3}$

4225,77

or L. 4225 15 5

**XXVI.** 7 years is 2555 days, which at 10d. is L. 106 9 2

| | exp. | work L. |
|---|---|---|
| First and 2d years | 6 0 0 | 15 0 0 |
| 3d year | 3 0 0 | 20 0 0 |
| 4th year | 5 0 0 | 25 0 0 |
| 5th year | 7 0 0 | 30 0 0 |
| 6th year | 8 0 0 | 35 0 0 |
| 7th year | 9 0 0 | 40 0 0 |
| His work amounts to | | 165 0 0 |
| His expence | | 145 9 2 |
| The maſter gains | | L. 19 10 10 |

XXVII. A gentleman is to receive 30,000 merks Scots, one half due

| | | | |
|---|---|---|---|
| May 11th 1792, which is - - - - L. | 833 | 6 | 8 |
| Intereſt to Nov. 11th 1793, 1 year and 184 days | 62 | 13 | 5 |
| Amount | 896 | 0 | 1 |
| Nov. 11th 1793, received in part | 198 | 10 | 0 |
| Amount | 697 | 10 | 1 |
| Intereſt to July 16th, 1795, 1 year and 247 days | 58 | 9 | 6 |
| July, 1795, The other half due this day | 833 | 6 | 8 |
| Amount | 1589 | 6 | 3 |
| Intereſt to Jan. 1ſt, 1796, 169 days | 36 | 15 | 11 |
| Amount | 1626 | 2 | 2 |
| Jan. 1ſt, 1796, received in part | 500 | 0 | 0 |
| Amount | 1126 | 2 | 2 |
| Intereſt to May 16th, 1797, 1 year and 135 days | 77 | 2 | 7 |
| Amount | 1203 | 4 | 9 |
| May 16th, 1797, received in part | 185 | 0 | 0 |
| Amount | 1018 | 4 | 9 |
| Intereſt to 4th Feb. 1799, 1 year and 264 days | 87 | 14 | 9 |
| Amount | 1105 | 19 | 6 |
| Feb. 4th, 1799, received in part | 395 | 0 | 0 |
| Amount | 710 | 19 | 6 |
| Intereſt to 15th May, 100 days | 9 | 14 | 9 |
| Amount at Whitſunday is L. | 720 | 14 | 3 |

XXVIII. Diviſion of a bankrupt's eſtate.

| | His effects. | | | | His debts | | | | The creditors ſhares. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A owes him | L. 242 | 15 | 0 | H | L. 625 | 16 | 0 | he draws | L. 391 | 2 | 6 | |
| B | 117 | 9 | 7 | I | 470 | 12 | 4 | | 294 | 2 | 8 | 1/4 |
| C | 112 | 16 | 0 | J | 256 | 4 | 2 | | 160 | 2 | 7 | 1/4 |
| D | 78 | 10 | 0 | K | 185 | 17 | 6 | | 116 | 3 | 5 | 1/4 |
| E | 63 | 4 | 8 | L | 143 | 4 | 0 | | 89 | 10 | 0 | |
| F | 56 | 18 | 0 | M | 119 | 13 | 4 | | 74 | 15 | 10 | |
| G | 39 | 5 | 10 | N | 70 | 12 | 0 | | 44 | 2 | 6 | |
| 350gal.at 12s 6d. | 218 | 15 | 0 | O | 67 | 10 | 0 | | 42 | 3 | 9 | |
| 120 at 13s. 6d. | 81 | 0 | 0 | P | 52 | 8 | 4 | | 32 | 15 | 2 | 1/4 |
| 1050lb.at 1s. 9½d. | 94 | 1 | 3 | Q | 31 | 9 | 2 | | 19 | 13 | 2 | 1/4 |
| 20¾ Cwt. at 84s. | 87 | 3 | 0 | R | 16 | 2 | 6 | | 10 | 1 | 6 | 1/4 |
| 1260lb. at 1s. 3d. | 78 | 15 | 0 | | | | | | | | | |
| Articles value | 35 | 10 | 0 | Am. | 2039 | 9 | 4 | | L. 1274 | 13 | 4 | |
| Amount | 1306 | 3 | 4 | | 1274 | 13 | 4 | | | | | |
| Exp. of ſettling | 31 | 10 | 0 | | 764 | 16 | 0 | deficiency. | | | | |
| | 1274 | 13 | 4 | | | | | | | | | |

4 : 1274 13 4 :: 1l. : 12s. 6d. the compoſition per pound.

XXIX. Expence of building a church.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Ground 75 yds. × 70 = 5250 ÷ 9 | | | | 120 ſeats at 7s. 6d. | | L. 45 | 0 |
| = 583⅓ yds. which at 21s. is | L. 612 | 10 | | 180 | at 6s. 8d. | 60 | 0 |
| Maſon's accompt | 783 | 15 | | 420 | at 5s. | 105 | 0 |
| Slater's do. | 128 | 16 | 6 | 480 | at 4s. | 96 | 0 |
| Wright's do. | 1210 | 7 | 5 | 510 | at 3s. 4d. | 85 | 0 |
| Plumber's do. | 83 | 16 | 3 | 290 | at 2s. 6d. | 36 | 5 |
| Plaſterer's do. | 89 | 17 | 8 | | | | |
| Smith's do. | 52 | 14 | 11 | | | 427 | 5 |
| Luſtres, &c. | 68 | 2 | 3 | Miniſter's ſtipend | | 200 | 0 |
| | 3030 | 0 | 0 | Remainder | | L. 227 | 5 |

L. 3030 : L. 227 5 : : L. 100 : 7½ per cent. annually.

XXX. A's credit L. 1200 at 15s. 6d. is L. 930, which amounts to 1186 18 9½ at 5 per cent. compound intereſt.

Gain L. 13 1 2½ by giving 5 years credit.

XXXI. A manufacturer buys 12 matts flax, which at

| | | |
|---|---|---|
| 25 guilders each, = 300g. ex. 23¾d. is | L. 29 | 13 9 |
| Expence of dreſſing | 6 | 10 0 |
| 680lb. = 850 ſpindles, ſpinning at 1s 4½d. | 58 | 8 9 |
| 850 ſpindles make 2720 yds. cloth, weaving at 5¾d. | 65 | 3 4 |
| Expence of bleaching 2720 yds linen at 2½d. | 28 | 6 8 |
| Whole expence | L. 188 | 2 6 |

| | | | | |
|---|---|---|---|---|
| 32½ ſtones tow at 5½d. | L | 11 | 18 | 4 |
| ¼ of 2720 is 680 yds. linen at 1s. 9d. | | 59 | 10 | 0 |
| ¼ —— is 680 do. at 1s. 8d. | | 56 | 13 | 4 |
| ½ —— is 1360 do. at 1s. 6d. | | 102 | 0 | 0 |
| | | 230 | 1 | 8 |
| He gains | L. | 41 | 19 | 2 |

XXXII. A pipe of wine at 125 milrees, ex. 5s. 8d. is L. 35 8 4

| | | | |
|---|---|---|---|
| Charges at Madeira, 7½ per cent. | 2 | 13 | 1½ |
| Freight L. 2 10 per tun, is per pipe | 1 | 5 | 0 |
| Duty on 126 gallons at 4s. 6d. | 28 | 7 | 0 |
| Charges at home | 1 | 5 | 3½ |
| The pipe contains 52½ dozen | | | |
| Bottles and corks 2s. 6d. per dozen | 6 | 11 | 3 |
| | 75 | 0 | 0 |
| Add 30 per cent. | 22 | 10 | 0 |
| 52½ dozen, at 37s. 1½d. come to | L. 97 | 10 | 0 |

XXXIII. The rent of a fiſhery is 300 guineas, L. 315 0 0
10 men for 245 days, at 20d. each per day, is 204 3 4
An overſeer at - - 50 0 0
Expence of boats and nets is - - 60 16 8
They catch 210 fiſhes per week, which in 245 days, or 35 weeks, are 7350 fiſhes, weighing 9lb. each, = 66150lb. which, at 350lb. per barrel, is 189 barrels, at 3s. 6d. - - 31 10 0
Salt and other charges, 2s. 6d. per barrel - 23 12 6

189 barrels at L. 3 12 6 come to L. 685 2 6

XXXIV. A grazier has 30 calves at 25s. - - L. 37 10 0
Intereſt on L. 37 10 for 3 years is - 5 12 6
1ſt year, ſummer's graſs for 30 calves at 9s. is L. 13 10 0
Winter feeding for 29 do. at 11s. 8d. 16 18 4
2 years intereſt on - 30 8 4
is 3 0 10 — 33 9 2
2d year, ſummer's graſs for 28 calves at 15s. is 21 0 0
Winter feeding for 27 do. 17s. 6d. 23 12 6
1 year's intereſt on - - 44 12 6
is 2 4 7½ — 46 17 1½
3d year, ſummer's graſs for 26 calves at 21s. is 27 6 0
winter feeding for 25 do. at 24s. is 30 0 0 — 57 6 0
whole expence 180 14 9½
He ſells the remaining 24 cattle at 9 guineas each 226 16 0

Gain by bringing them up L. 46 1 2½

XXXV. A diſtiller buys 150qrs. barley at 31s. 6d. L. 236 5 0
150qrs. barley at 10 bus. per qr. is 1500 bus. malt at 4½d. 28 2 6
Malt-houſe rent - - 6 7 0
Servants wages for making the malt - 3 9 10

The whole coſt of 1500 buſhels malt is - L. 274 4 4
which comes to 3s. 7¾d. $\frac{1}{3}\frac{8}{7}\frac{7}{5}$ per buſhel.
The ſtill conſumes 1500 buſhels malt, or 187½ qrs. in 75 days, the expence of which, at 17s. 6d. per day, is - - - - - 65 12 6
187½qrs. malt at 15 gals. per qr. produces 2812½ gals. ſpirits, the duty on which, at 2s. 6d. per gallon is 351 11 3

2812½ gallons of ſpirits at 4s. 11d. is - - L. 691 8 1

The ſtill in 6 days produces 225 gallons; in 300 days 6750 gallons, the duty at 2s. 6d. per gal. is L. 1406 5, which comes to L. 14 1 3 on the ſtill per gallon.

XXXVI. A farmer has 35 acres at 3 gs. per acre, per ann. which 4 years is

| | | Expence. | Produce. |
|---|---|---|---|
| | | 294 0 0 | |
| 1ſt year, plowing and harrowing | L. 10 12 6 | | |
| 320 loads dung at 3s. 9d. is | 60 0 6 | | |
| 650 buſh. lime at 2s. 6d. is | 81 5 0 | | |
| | L. 151 17 6 | | |
| 2d year, expence of labour is | 5 12 0 | | |
| Seed 10qrs. or 80 bus. at 6s. 3d. | 25 0 0 | | |
| Reaping and other charges, at 9s. 6d. per acre | 16 12 6 | | |
| | | 47 4 6 | |
| Produce 4 qrs. per acre, or 140 qrs. is 1120 buſh. wheat at 6s. | | | 336 0 0 |
| 3d year, expence of labour is | 9 10 0 | | |
| Seed 16½qrs. or 132 buſh. at 4s. 6d. | 29 14 0 | | |
| Reaping &c. 10s. 6d. per acre | 18 7 6 | | |
| | | 57 11 6 | |
| Produce 3 qrs. per acre, or 105 qrs. is 840 buſh. barley at 4s. 6d. | | | 168 0 0 |
| 4th year, 5¼qrs. or 42 buſh. rye graſs at 5s. | 10 10 0 | | |
| 620 lb. clover ſeed at 7½d. | 19 7 6 | | |
| mowing 3s. 6d. per acre | 6 2 6 | | |
| winnowing and ſtacking | 10 15 0 | | |
| | | 46 15 0 | |
| Produce 3165 truſſes hay at 1s. | L. 158 5 0 | | |
| 45 oxen grazed for 6 weeks at 2s. 9d. each per week | 37 2 6 | | |
| | | | 195 7 6 |
| | | | 699 7 6 |
| The whole produce of the farm is | | | 597 8 6 |
| ——— expence of the ſame is | | | |
| The farmer's profit at the end of 4 years is | | | L. 101 19 0 |

XXXVII. A manufacturer buys 495lb. cotton; allowing 36lb. for waſte, the remaining 459lb. is ſpun into 50 hanks yarn, which gives 22950 hanks, or 160650 ſkenes, or 12852000 threads, or 19278000 yards; being wove in a 10°° reed each yard.

| | |
|---|---|
| requires for warp | 2000 yds. yarn |
| And for weft ⅛ more | 2250 |
| For one yard of cloth | 4250 yds. yarn |

The whole number of yards of yarn divided by 4250
gives 4536 yds.
Loſt in manufacturing $\frac{1}{12}$ 378 = $8\frac{1}{3}$ per cent.

Therefore it will make 4158 yards cloth

| | | | |
|---|---|---|---|
| 459 lb. cotton wool at 2s. 5d. is | L. 59 | 16 | 3 |
| Expence of carding and roving | 8 | 11 | $4\frac{1}{2}$ |
| Spinning 459 lb. cotton into yarn at 8d. | 15 | 6 | 0 |
| Winding 1275 ſpindles yarn at 3d. | 15 | 18 | 9 |
| Weaving 4158 yards of cloth at $4\frac{1}{2}$d. | 73 | 12 | $7\frac{1}{2}$ |
| | 173 | 5 | 9 |
| Add 5 p. cent. for manufacturing charges | 8 | 13 | 3 |
| The whole expence of 4158 yards is | 181 | 18 | 3 |

which comes to 10$\frac{1}{2}$d per yd.
1$\frac{1}{2}$d. in the ſhilling is $\frac{1}{8}$ 1$\frac{5}{10}$d.

The price per yard is 11$\frac{1}{10}$d. to gain 1$\frac{1}{2}$d. on the ſhilling.

XXXVIII. London is ſaid to conſume annually

| | | | | |
|---|---|---|---|---|
| 98245 black cattle at 15 gs. | L. 1547358 | 15 | 0 | |
| 711124 ſheep & lambs at 35s. | 1244467 | 0 | 0 | |
| 186934 hogs at 42s. | 392561 | 8 | 0 | |
| 16000000 lb. butter at 12$\frac{1}{2}$d. | 833333 | 6 | 8 | |
| 20000000 lb. cheeſe at 7$\frac{1}{2}$d. | 625000 | 0 | 0 | |
| 7000000 gal. milk at 9d. | 262500 | 0 | 0 | |
| The city lays out, | L. 4905220 | 9 | 8 | |

| | Acres. | R. | P. |
|---|---|---|---|
| For rearing 98245 black cattle at 2 acres each, | 196490 | | |
| fattening do. do. at $\frac{1}{3}$ acre do. | 32748 | 1 | $13\frac{1}{3}$ |
| For rearing & fattening 711124 ſheep at $\frac{1}{5}$ acre, | 142224 | 3 | 8 |
| For fattening 186934 hogs at 5 buſhels to each, the ground producing 4 qrs. per acre, | 29208 | 1 | 30 |

A cow yielding 6 lb. butter per week, in 26 weeks yields 156 lb.; there are required for 16000000lb. 101564 cows.
Or, 8 lb. cheeſe per week, is 208 lb in all, there are required for 20000000 lb. 96154
Or, 20 gallons milk, in all 520 gallons, there are required for 7000000 gals. 13462

In all, 212180 cows.
which at 3 roods for each, is 159135 0 0

The ground neceſſary, is Acres, 559806 2 $11\frac{1}{3}$

XXXIX. A merchant imported from New-York,

50 barrels aſhes, w. g. groſs 1685 c. 3 q. 20 lb.
tare, 14 lb. per cwt. 208 0 27

1457 2 21 which
at 140 dollars per ton, = 10203$\frac{13}{16}$ dollars.
Commiſſion 5 per cent. is, 510$\frac{3}{16}$ dol.
Shipping charges, 180

690$\frac{3}{16}$

10894 ex. 4s. 8d. L.2541 18 8

| | | | | |
|---|---|---|---|---|
| Freight at L.5 6 8 per ton groſs, | L444 | 5 | 0 | |
| Inſurance on L.2500 at 6 gs. | 157 | 10 | 0 | |
| Freight up Clyde, at 1s. 3d. - | 3 | 2 | 6 | |
| Porterage, - - - - | 2 | 1 | 0 | |
| | | | | 606 18 6 |
| whole coſt, | | | | L.3148 17 2 |

which on 1457 cwt. 2 qr. 21 lb. come to 46s. 5$\frac{1}{3}$d. per cwt. nearly.

XL. As L100 ſter. : 225$\frac{1}{4}$ cur. : : 2325 ſter. : L.5242 17 6
Charges at America, - 120 0 0

155 cur. : 100 ſter. : : L.5122 17 6
100

155)512287 10 0

Nett proceeds of the Sales in ſterling, L.3305 1 7

| | | | | |
|---|---|---|---|---|
| Value of the goods, | L.2325 | 0 | 0 | |
| Freight &c. 12$\frac{1}{2}$ per cent. | 290 | 12 | 6 | |
| Paſſage, - - - | 13 | 13 | 0 | |
| | | | | L.2629 5 6 |
| | | | | 675 16 1 |

L.2629 5 6 : L.675 16 1 : : 100 : 25.7 per cent.

XLI. A merchant ſends to the Weſt Indies,

| | | | | |
|---|---|---|---|---|
| 350 barrels herrings at 25s. - - | | | L.437 | 10 0 |
| Charges at ſhipping, 3d. per barrel, - | | | 4 | 7 6 |
| Inſurance on L.441 17 6, at 6 gs. per cent. | | | 27 | 16 9$\frac{1}{2}$ |
| Freight on 350 barrels at 6s. 6d. - | | | 113 | 15 0 |
| Outſet coſt, - - - | | | | L.583 9 3$\frac{1}{2}$ |
| Sales. | | | Currency. | |
| 350 barrels at 65s. currency, - | | | L.1137 | 10 0 |
| Storage 2$\frac{1}{2}$ per cent. | L.28 | 8 9 | | |
| Com. & guarantee, 7$\frac{1}{2}$ per c. | 85 | 6 3 | | |
| | | | L.113 | 15 0 |

Nett proceeds of the ſales is, L.1023 15

Brought over. Outſet coſt, L 583 9 3½
L.1023 15s. currency, ex. 156 is - - 656 5 0

Gain by bills of exchange, - - L.72 15 8½

*Returns in Sugar.* Currency.
13ton, 10cwt. 3qr. 9⅓ lb. at L.70 per ton, L.947 18 4
Charges there, 8 per cent. 75 16 8

Amount of Invoice, 1023 15 0

T. C. qr. lb.
13, 10, 3, 9⅓ at 70s. per cwt. ſter. L.947 18 4
Inſurance as above, L.27 16 9½
Freight 5 gs. per ton, 71 1 10 98 18 7½

L.848 19 8½
deduct outſet coſt, 583 9 3½

Gain by importing Sugar, L.265 10 5

LXII. Edinburgh draws on Amſterdam
for 7500 guilders at 22 7/12d. which amount to L.705 14 7
London draws for 7500 g. current, agio 3½,
is g. 7246 : 7 banco, ex. 35s. 10d. L.674 1 7
Commiſſion at London, ½ per cent. 3 7 5

100—2½ = 97½ : 100 : : 670 14 2 : 687 18 1½

Better at Glaſgow by L. 17 16 5½

XLIII. A merchant draws on Holland
3600 guilders at 22⅓d. which come to - - L.340 0 0
3600 g. current, agio 3⅓=g. 3483 17 banco.
Commiſſion, ½ per cent. 17 8

3501 5 ex. 35s 8d.
is L.327 4 5
¾ per cent. premium, L.2 9 4
¼ per cent. commiſſion, 0 16 1 3 5 5

330 9 10
He gains, L.9 10 2

XLIV. Greenock conſigns to Hamburgh
30 hhds. ſugar, qt. 345 cwt. 2 qr. 14 lb. which is ſold
at 37½ marcs, amount M. 12998 7
Charges, - - 215 10
Commiſſion. 6 per cent. 779 14

995 8

12002 16 which
divided by 3, give R. 4000, 2 m 15 ſch. ex. 33s. 9d. is L.948 7 8
ſterling.

XLV. A merchant in Leith owes in Hamburgh,
M. 2720 cur. agio 17½, is 2314 : 14 banco, ex. 34s. 2d. L.180 13 4
M. 2314 : 14 drawn on Holland, ex. 33½
is g. 1938 : 14
Commiſſion, ½ per cent. - 9 : 14

1948 : 8 ex.35s.4d. 183 16 3

It is beſt to draw on London directly, by L. 3 2 11

XLVI. Hamburgh owes Glaſgow
20000 marcs, which may be drawn at 1s. 6¼d. L.1520 16 8
Or, 20000 marcs banco, ex. 34s. 1d. L.1364 15 10
Commiſſion at London, ½ per cent. - 7 16 6

1556 19 4
1¼ per cent. ex. for a bill on London, 19 9 2

1576 8 6

Better at London, and the difference is L. 43 11 10

XLVII. A merchant in Vienna owes London
3600 R. which he can remit directly at 3s. 6d. L.630 0 0 directly.
Then 136¾ : 100 : : 3600 : 2632.54 R.
Commiſſion at Amſt. ½ per cent. 13.16

2645.7 which at
100d. groſs per rix dollar, ex. 35s. is L.629 18 7 by Hol.
Next, 136 : 100 : : 3600 : 2647.06
Com. at Hamburgh ½ per cent. 13.23

2660.29 at 96d.
groſs per rix dollar, ex. 34s. is 625 18 10 by Ham.

XLVIII. A in London, owes B of Paris, Lrs. 12400
Or, 4133⅓ cr. which he can remit directly, ex. 29½d. - L.508 1 1
Or, 4133⅓ cr. by Amſterdam, at 27 ſtiv.
is g. 5580.
Commiſſion there ½ per cent. 27 18

5607 18, ex. 36s. 8d. 509 16 2

It is cheapeſt to remit directly, by L. 1 15 1

XLIX. Glaſgow ſhips for Bourdeaux
28 hhds. tobacco qt. 342 cwt. 2 qr. 26 lb. at 1s. 7½ L.3121 2 9
For which Bourdeaux ſends
30 pipes, or 3780 gal. at 84½ ſols 319400
3600 gal. brandy, at 59⅓ ſols 214200

Carried forward. 1 crown = 60 ſols)533600

Brought over, Amount of tobacco, L.3121 2 9
1 crown = 60 ſols) 533600

8883⅓ cr. at 30d. is 1110 8 9

Bourdeaux owes Glaſgow, L.2010 14 0
which at 30d. per crown amounts to 16085⅗ crowns.

L. Oporto conſigns to Leith, 15 pipes wine.

| | | | |
|---|---|---|---|
| Freight of 15 pipes, at 25s. | L. 18 | 15 | 0 |
| Duty on ditto, at L.52 10s. per ton, | 393 | 15 | 0 |
| Expence of bottling, - - - | 2 | 10 | 6 |
| Each pipe contains 49 dozen, or in all 735 dozen bottles at 2s. 6d. | 91 | 17 | 6 |
| 735 dozen is 61¼ groſs, corks at 1s. 4d. | 4 | 1 | 8 |
| whole charges, | | | 510 19 8 |

The Factor ſells

| | | | | |
|---|---|---|---|---|
| ⅓ which is 245 doz. at 31s. - - | L.379 | 15 | 0 | |
| ⅓ 245 do. at 32s. - - | 392 | 0 | 0 | |
| ⅓ 245 do. at 33s. - - | 404 | 5 | 0 | |
| | 1176 | 0 | 0 | |
| Commiſſion 7½ per cent. | 88 | 4 | 0 | |
| | | | | 1087 16 0 |
| To be remitted, - - - - | | | | L.576 16 4 |

which at 5s. 6½d. per milree, is 2081.744 milrees.

LI. A cotton dealer orders from Liſbon
390 bags cotton qt. 475 cwt. 2 qrs. 10 lb. or 53266 lb.
which at 420 rees per lb. is 22371.720 milrees.
Agent's com. 2½ per cent. 559.293

22931.013 ex. 5s. 8d. L.6497 2 5
Shipping charges and ſundry dues, 4s. 8d. per cwt. 110 19 5
L.6608 1 10

| | | | | |
|---|---|---|---|---|
| Inſurance on L.6608 1 10, at 5½ per cent. | L.330 | 8 | 11 | |
| Freight, 7 guineas per ton, - - | 174 | 15 | 7 | |
| Duty on 53266 lb. at 1½d. - - | 332 | 18 | 3 | |
| | | | | 871 2 9 |
| | | | | 7479 4 7 |
| 2 months intereſt on L.7479 4 7 is | L.62 | 6 | 7 | |
| Cellar rent on 390 bags at 2d. each per mo. | 6 | 10 | 0 | |
| | | | | 68 16 7 |
| | | | | 7548 1 2 |
| 53266 lb. at 3s. 4d. per lb. = L.8877 13 4, the preſent value of which due in 4 months is, - - | | | | 8732 2 7 |
| | | | Gain, | L.1184 1 5 |

LII. A of Liſbon may draw on London
for 3500 milrees, ex. 5s. 9d L.1006 5 0 directly.
Or, on Holland, ex. 50½d. for 441875d. Flem.
Commiſſion, ½ per cent. - 2209

444084, ex.36s.4d. L.1018 10 10 by Hol.
Or, on Paris, ex. 432 rees, for Cr. 8101.85
Commiſſion, ½ per cent. 20.25

8121.1, ex.29½d. L.998 6 10 by Paris.

LIII. A merchant owes at Madrid
16800 rials, or 2100 piaſtres, which may be remitted
directly at 3s. 8½d. L.380 12 6 directly.
Or, the ſame by Amſterdam, at 110d. groſs,
per ducat, of 375 merv. is 167493½d. Flem.
Commiſſion, ½ per cent. 837½

166656, ex.36s.4d. L.382 4 9½ by Amſt.
Or by France, at 18 livres for 4 piaſtres,
is, 3150 cr.
Commiſſion, ½ per cent. 15.75

3134.25, ex. 29d. L.378 15 5½ by France.

LIV. New England conſigns to Leghorn
840 quintals fiſh, at 14¾ piaſtres each, is 12390 Piaſ.
Commiſſion, 7½ per cent. - 929¼

11460¾
Piaſtres, ex. 4s. 4d. = L.2483 3 3 ſter. to be remitted to London.
Ster. Cur. Ster.
Next, 100 : 152 : 2483 3 3 : L.3774 8 1½ currency at New England's credit.

LV. Greenock owes Ruſſia
7600 rubles, which may be drawn directly, ex. 4s. 7d. L.1741 13 4
Or, on Holland, at 50 ſtiv. per ruble, ex. 36s. 3d. 1747 2 6
Or, on Hamburgh, at 108 cop. per rix. d. ex. 33s. 4d. 1720 15 1
It is cheaper by Hamburgh.

LVI. A cargo of 450 barrels ſalmon, at L.3 8s. is L.1530 0 0
If ſent to Bourdeaux,
Price of 450 barrels, at Lrs. 105, is Lrs.47250
Charges, 7½ per cent. - - - 3543 15

Lrs. 43706 5

| | | | | | | |
|---|---|---|---|---|---|---|
| Brought over. | Value of Salmon, | | | | L.1530 | 0 0 |
| Lrs.43706 5, ex. 28½d. per crown, is | | L.1730 | 0 | 9 | | |
| Freight of 450 bar. at 4s. 6d. | L.101 5 | | | | | |
| Insurance on L.1530 at 4 gs. | 64 5 2 | 165 | 10 | 2 | | |
| | | | | | L.1564 | 10 7 |
| Gain by the sales at Bourdeaux, | | | | | L.34 | 10 7 |

| If sent to Bilboa. | rials vellon. | | | |
|---|---|---|---|---|
| 450 barrels at 350 rials, | 157500 | | | |
| Charges, 26 rials per barrel, | 11700 | | | |
| | 145800 | | | |
| is 77456 rials plate, or 968 2 piaſ. ex. 3s. 8d. | | L.1775 | 0 | 8 |
| Freight at 5s. 3d. per bar. | L.118 2 6 | | | |
| Inſ. on L.1530 at 4½ p. c. | 68 17 0 | | | |
| | 186 19 6 | | | |
| Nett proceeds of the sales, | | L.1588 | 1 | 2 |
| Coſt, | | 1530 | 0 | 0 |
| Gain by sales at Bilboa, | | | | L.58 1 2 |

LVII. A merchant has on hand
18 hhds. Virginia tobacco, qt. each 6 cwt. 3 qr. 24 lb.

| | | | | |
|---|---|---|---|---|
| Or in all 14040 lb. which at 4½d. coſt | L.263 | 5 | 0 | |
| Freight of 18 hhds. at a guinea each, | 18 | 18 | 0 | |
| Coſt, | L282 | 3 | 0 | |
| Sales in Britain. | | | | |
| 14040 lb. tobacco, at 2s. 2d. per lb. is | L.1521 | 0 | 0 | |
| Duty at 1s. 8½d. per lb. - - | 1199 | 5 | 0 | |
| Nett proceeds in Britain, | L.321 | 15 | 0 | |
| Coſt, | 282 | 3 | 0 | |
| | | | | L.39 12 0 |

Sales in France.
14040 lb. avoir. is 12940 lb. of Paris, which at
a livre per lb. is Lrs.12940
Duty and charges. 8 ſols per lb. 5176

Carried over. 7764, ex.29½d. L.318 2 2

| | | | |
|---|---|---|---|
| Brought over. | L.318 | 2 | 2 |
| Freight at 8s. 6d. per hhd. L. 7 13 0 | | | |
| Inſ. on L.282 3s at 4½ p. c. 12 13 11 | | | |
| | L.20 | 6 | 11 |
| Nett proceeds in France, | L.297 | 15 | 3 |
| Coſt, | 282 | 3 | 0 |
| Gain in France, | | | L.15 12 3 |

Sales in Holland.

14040 lb. avoir. is 12940 lb. of Amſterdam, which at 10 ſtiv. per lb. is, Guild. 6470
Duty and charges at 4 ſtiv. 2588

3882 cur.

| | | | |
|---|---|---|---|
| agio 3½, is G. 3750 : 14 : 8 banco, ex. 36s. 4d. | L.344 | 2 | 1 |
| Freight, 9s. per hhd. L. 8 2 0 | | | |
| Inſ. on L.282 3s. at 6 per cent. 16 18 7 | | | |
| | 25 | 0 | 7 |
| Nett proceeds in Holland, | L.319 | 1 | 6 |
| Coſt, | 282 | 3 | 0 |
| Gain in Holland, | | | L.36 18 6 |

Sales in Portugal.

14040 lb. avoir. is 14779 lb. of Liſbon, which at 165 rees per lb. is, 2438.535 M.
Charges, 94 rees lb. 1389.226

1049.309 ex. 5s. 6d. L.288 11 2

| | | | |
|---|---|---|---|
| Freight, 11s. 6d. per hhd. L.10 7 0 | | | |
| Inſ. on L.282 3s. at 4 gs. 11 17 0 | | | |
| | L.22 | 4 | 0 |
| Nett proceeds in Portugal, | 266 | 7 | 2 |
| Coſt, | 282 | 3 | 0 |
| Loſs in Portugal, | | | L.15 15 10 |

LVIII. A corn merchant exports to Madeira

| | | | |
|---|---|---|---|
| 1500 qrs. wheat, at 37s. 6d. per qr. | L.2812 | 10 | 0 |
| Charges at ſhipping, | 27 | 12 | 6 |
| | 2840 | 2 | 6 |
| Bounty on 1500 qrs. at 5s. L.375 0 0 | | | |
| Diſcount, 7½ per cent. 28 2 6 | | | |
| | 346 | 17 | 6 |
| Carried over. | 2493 | 5 | 0 |

| | | | |
|---|---|---|---|
| Brought over. | L.2493 5 0 | | |
| Inſurance on L.2681 at 5 per cent. to cover L.2493 5 0 | 134 1 0 | | |
| Freight on 1500 qrs. or 300 ton, at 25s. | 375 0 0 | | |
| Amount of outſet charges, | | L.2902 | 6 0 |

Sales at Madeira.

| | | |
|---|---|---|
| 1500 qrs. = 14250 alquiers, at 900 rees, | M. 12825 | |
| Charges, 75 rees per alquier, | 1068.750 | |
| Commiſſion, at 3½ per cent. | 448.875 | |
| | 1517.625 | |
| | M * 11307.375 | |
| Nett proceeds, at 5s. 7d. | | 3156 12 10 |
| Gain by remitting bills of exchange, | | L.254 6 10 |

Returns in Wine.

| | | | |
|---|---|---|---|
| 76 pipes of Madeira, at 140 milrees, | | 10640 | |
| Charges at Madeira, 5 per cent. | | 532 | |
| Amount of the Invoice, | | 11172 | |
| Balance to be remitted, | | 135.375 | |
| Same as nett proceeds, | | * 11307.375 | |
| 76 pipes wine at L.65 per pipe, | L.4940 | | |
| Inſurance as above, | L. 134 1 0 | | |
| Freight at L.2 8s. per ton | 91 4 0 | | |
| Duty at L.31 10s. do. | 1197 0 0 | | |
| | | 1422 5 0 | |
| | | 3517 15 0 | |
| Odd money 135.375 m. remitted at 5s. 7d. | | 37 15 10 | |
| | | 3555 10 10 | |
| Outſet charge, | | 2902 6 0 | |
| | | | L.653 4 10 |

LIX. The National Debt, ſtated at L.430000000
is in Shillings, - - - - 8600000000
in Guineas, - - - - 409523809+

A man reckoning 150 pieces in a minute, will tell 108000 pieces in a day of 12 hours.

| | Years. | Days. | Hours. |
|---|---|---|---|
| He would tell it in guineas in 3791 $\frac{10}{12}$d. or | 10 | 141 | 10+ |
| And in ſhillings 79629 $\frac{7}{12}$d. | 218 | 59 | 7+ |

The gold in a line would extend, 6463 miles, 3 fur. 121 yds.+
And the ſilver, 135732 miles 2 fur. 128 yds.+

The gold would cover, 65 acres, 1 ro. 5 poles, 29 yds.—
And the ſilver, 1371 acres, —— 5 poles, 11 yds.—
The weight of 409523809 guineas, at 5 dwt. 9 grs is 9171626 lb.—
And of 8600000000 ſhillings, at 3 dwt. 21 grs. is 138854160$\frac{2}{3}$ lb.
Therefore the gold would require 6115—waggons of 1500 each. And at 35 feet to each waggon, they would extend 40 miles, 4 fur. 61$\frac{2}{3}$ yds.
The ſilver would require 92570 — waggons, and they would extend, 613 miles, 5 fur. 3$\frac{1}{3}$ yds.

By Table III. of Annuities, the preſent value of L.1 annuity is L.17.292 and L.1 divided by this, gives, .057830215 the annuity which L.1 would purchaſe, and this multiplied by 430000000, gives an annuity of - - - - - - - L.24866992 9 0
The yearly intereſt of 430 millions, is - 17200000 0 0

It would require a ſinking fund of - L.7666992 9 0
to pay off the national debt in 30 years.
1$\frac{1}{4}$ per cent. on L.2200000000 is L.27500000, and the debt divided by this 15.6363, or 15$\frac{7}{11}$ per cent., is the rate at which the Britiſh proprietors muſt be aſſeſſed.

And, 15.6363 being found on Table III. between 12 and 13 years; which computed as in page 154, is 12 years 139 days, the time that the aſſeſſment muſt continue.

## APPENDIX.

| Queſt. | *Square Root.* | Queſt. | *Cube Root.* |
|---|---|---|---|
| 1. | 16$\frac{1}{2}$ feet | 1. | 24 feet |
| 2. | 234.2 links | 2. | 13$\frac{1}{2}$ lb. |
| 3. | 28 poles | 3. | 10.6 lb. |
| 4. | 14.7 feet nearly | 4. | 31.2 grains |
| 5. | 13.06 feet | 5. | 26.9+feet, length |
| 6. | 135 feet | | 15.8+feet, breadth |
| 7. | 311.7 feet | | 12.7—feet, depth |
| 8. | 56 feet | | |

Printed by Niven, Napier & Khull, Trongate, Glaſgow.

BIBLIOTHECA BODLEIANA

December 77

Compound interest

Time at which money doubles

| Rate p Cent | Years | days |
|---|---|---|
| 2% | 35 | 1 |
| 2½% | 28 | 26 |
| 3% | 23 | 164 |
| 3½% | 20 | 54 |
| 4 | 17 | 246 |
| 4½ | 15 | 273 |
| 5% | 14 | 75 |

Carriage 152