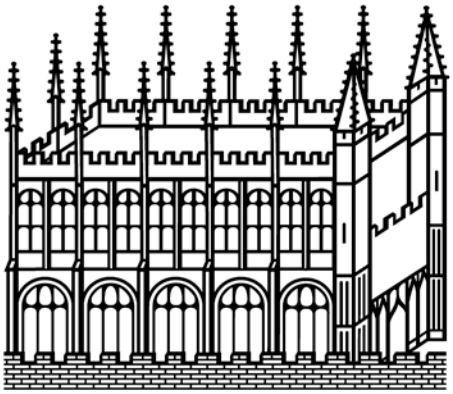
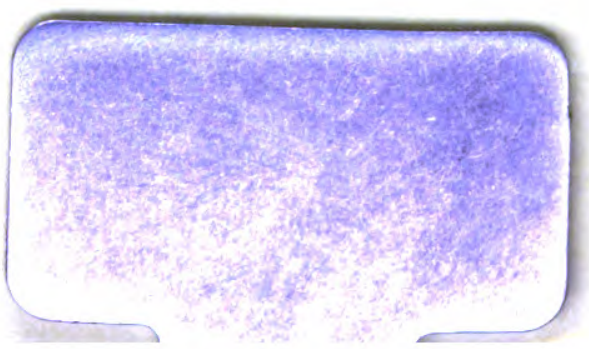


LESSONS IN ARITHMETIC

J. BROWN.



EVERY CHILD'S ARITHMETIC.

PREPARATORY LESSONS

IN

ARITHMETIC.

GIVING ANALYTICAL DIVISIONS OF THE FIRST FOUR RULES,

AND THE VARIOUS FORMS IN WHICH QUESTIONS CAN BE EXPRESSED;

ALSO,

EXERCISES IN MENTAL ARITHMETIC, AND CLASSIFIED TABLES OF WEIGHTS & MEASURES, WITH MENTAL ARITHMETIC QUESTIONS ON EACH TABLE.

BY

J. BROWN,

Author of "Classified Spelling," and "Unique Copy Slips," consisting of 2000 facts.

LONDON:
DEAN & SON, LUDGATE HILL.

DEDICATED

TO THE

ENGLISH YOUTH THROUGHOUT THE WORLD.

—o—

When the author of this little book was himself a youth at school, he had a very false notion concerning the study of arithmetic. It was his impression that arithmetic was so *very difficult*, there was no use in his attempting to learn it. His determination to avoid the study of this most necessary branch of knowledge was so strong that he succeeded but too well in escaping the watchfulness of his master. At last, however, he began to feel ashamed of his ignorance in numbers; and as he could favourably bear comparison with his schoolfellows in other branches of

study, the idea struck him that there must have been a greater obstacle in his mind not going to arithmetic than there was in arithmetic not coming to his mind. He made one bold attack upon the citadel of figures, and soon perceived he had made a breach in its walls; he afterwards continued his efforts until the whole fabric lay at his feet, and was ever after ready to yield him instant service whenever occasion required.

The author thus writes in order to show boys that they must not be frightened, as Robinson Crusoe was, at seeing the print of a man's naked foot upon the sand, and then run home in terror and hide himself; but to be more courageous, and manfully look arithmetic in the face, and so prepare the way to conquer all its fancied difficulties.

PREFACE.

THE celebrated educationist, Mr. Stow, of Glasgow, once remarked to the author, that he considered that teacher who, in useful instruction, could engage the attention of young children—say from four to six years of age—the longest, and with the least restlessness, was superior to one who could only do the same with pupils of more advanced ages ; as the power the former possessed of simplifying and making attractive the elements of knowledge to the simplest understanding, was the highest point to which a trainer of youth could attain.

The author considers the same remark applicable to the composing of elementary

works for the young; and he has, therefore, humbly endeavoured to attain to that desirable point of simplicity in the present treatise.

As the study of arithmetic immediately calls abstract reasoning into operation,—a condition of thought generally so foreign to the minds of youth,—a kind of half concrete and half abstract treatment seems necessary as a preliminary, in order that the change from one to the other may be as gradual and as natural as possible

Books on arithmetic are made to materially simplify the *abstract;* but it lies entirely in the hands of intelligent teachers to supply the *concrete.*

Children in general fail most lamentably in comprehending the nature of the first principles of arithmetic. This is not to be wondered at, as after a little consideration the causes are very apparent.

Firstly. When a child commences the

study, he is left pretty much to his own notions about the values of figures in their relative positions, as in Numeration; therefore Numeration is treated in this work on an extended scale of varied repetition, so as to fix the values of figures upon the mind with some degree of certainty.

Secondly. On entering Addition, he is provided merely with *one rule* to satisfy all requirements, whereas *four rules* seem to be nearer the truth.

Thirdly. *One form* of working only is usually given, with little or no explanation; and it is almost always assumed that for the other forms no explanation whatever is necessary.

Carry out the investigation into the causes why children are so long in comprehending the true nature of the first simple rules, and the scrutiny will soon remove all surprise at their being so dull at arithmetic.

Is it much to be wondered at that the

young mind should at first be so baffled, when, as it were, a complicated machine is presented to its understanding before it has been taught the nature of the simple lever powers, from the varied appliances of which springs all this complication?

With all the antiquity of the Multiplication Table, and its endorsement by arithmeticians from the first dawn of the science of numbers, the author, notwithstanding, considers that its completeness is questionable; for the only idea it teaches is that of *increase*, while the *nought* and the *one* are entirely ignored to the great detriment of the learner. The *nought* and the *one* as frequently become multipliers as the rest of the figures; as such, therefore, they should occupy a place in the Table—the *negative* character of the one and the *affirmative* nature of the other being duly represented.

The Tables of Weights and Measures are arranged according to their relative import-

ance, and each divided with due regard to its practical application to the ordinary rules of arithmetic. As it is of the highest consequence for the pupil to be thoroughly acquainted with them before entering upon compound work, the author has attached to each a sufficient number of mental exercises in order to test his efficiency in their acquirement.

That this humble effort may be the means of accomplishing much for the pupil and something for the master, is the fervent wish of the author.

J. B.

P.S. All great teachers, whether in the rostrum, in the pulpit, or at the desk, have been noted for the repetition of fundamental principles or ideas in a kaleidoscopic form. In this work, and in this respect, the author confesses himself to be a feeble imitator.

CONTENTS.

Containing in all over 2,200 Questions.

BROWN'S

PREPARATORY LESSONS

IN

ARITHMETIC.

SKETCH OF THE HISTORY OF ARITHMETIC.

THE word Arithmetic comes from a Greek word which means number, and is therefore used by us to express that branch of education which teaches how to reckon or calculate according to certain rules, so that correct answers may be obtained.

As this science or branch of knowledge was not known in ancient times, children used then to be taught to count with pebbles; and each child brought a box, called a loculus, full of these stones to school. Each had also a board, called an abacus, upon which to place the pebbles in rows, in order to learn how to add numbers together, and how to subtract them, or take them away from one another.

Although this method is clumsy when compared with ours, one thing that children may still learn from it is, that numbers can only be increased or diminished; that is, added together, or taken away from one another. These two principles lie at the foundation of all arithmetic, and are now called Addition and Subtraction.

Different names are given to rules that give short ways of working out both addition and subtraction; these are Multiplication, Division, etc.

Calculus is the Latin word for pebble, and from which *calculation* is derived.

The figures from 0 to 9 now in use, and the system of arithmetic generally, had their origin in Arabia, and began first to be used in Europe about eight hundred years ago—shortly after their introduction by one Gerbert, a Benedictine monk of Fleury, in France, who afterwards became Pope Sylvester II. When this monk had acquired a knowledge of the science of numbers from the Moors in Spain, he returned to his native country, and was received by the learned with great delight; while his enemies said he was, and the ignorant generally *believed* him to be, a magician, and in league with the infernal powers.

EXPLANATION OF THE SIMPLE TERMS AND SIGNS USED IN ARITHMETIC.

The Terms or Figures are 0, or nought, which means nothing, it is also called zero or cipher; 1 or one, unit or unity; 2 or two, 3 or three, 4 or four, 5 or five, 6 or six, 7 or seven, 8 or eight, and 9 or nine.

0 1 2 3 4 5 6 7 8 9 are sometimes called the ten digits, the word *digit* meaning originally a finger—hence something to point with.

NAMES AND VALUES OF SIMPLE NUMBERS.

The cipher	0	or nought
One is	|	or 1
Two are	| |	or 2
Three are	| | |	or 3
Four are	| | | |	or 4
Five are	| | | | |	or 5
Six are	| | | | | |	or 6
Seven are	| | | | | | |	or 7
Eight are	| | | | | | | |	or 8
Nine are	| | | | | | | | |	or 9
Ten are	| | | | | | | | | |	or 10

Eleven	are	11	or	ten and one
Twelve	are	12	or	ten and two
Thirteen	are	13	or	ten and three
Fourteen	are	14	or	ten and four
Fifteen	are	15	or	ten and five
Sixteen	are	16	or	ten and six
Seventeen	are	17	or	ten and seven

Eighteen	are	18	or	ten and eight
Nineteen	are	19	or	ten and nine
Twenty	are	20	or	two tens
Twenty-one	are	21	or	two tens and one
		&c.		
Thirty	are	30	or	three tens
Forty	are	40	or	four tens
Fifty	are	50	or	five tens
Sixty	are	60	or	six tens
Seventy	are	70	or	seven tens
Eighty	are	80	or	eight tens
Ninety	are	90	or	nine tens
A hundred	are	100	or	ten tens
A thousand	are	1000	or	tens of hundreds

A hundred and forty-five are 145, or ten tens, four tens, and five units.

Four thousand three hundred and twenty-seven, are 4327, or four tens of hundreds, three tens of tens, two tens, and seven units.

&c., &c.

THE ART OF WRITING AND READING NUMBERS.

NUMERATION TABLE.

This Table shows how numbers are written and read; very important for beginners to understand at once, as the want of a clear knowledge of this, at first, gives every one a great deal of trouble in valuing numbers afterwards.

Figures are placed in *lines* or *columns*. Figures in *lines* are horizontal, as—

1 2 3 4 5 6 7 8 9

Figures in *columns* are vertical, or perpendicular, as—

1
2
3
4
5
6
7
8
9

The following table gives both *lines* and *columns* of figures. All numbers must be read from left to right, as—

= one, or a unit
= tens, and units
123 = hundreds, tens, and units
1,234 = thousands, hundreds, tens, and units
12,345 = tens of thousands, thousands, hundreds, tens, and units
123,456 = hundreds of thousands, tens of thousands, thousands, hundreds, tens, and units
1,234,567 = millions, hundreds of thousands, tens of thousands, thousands, hundreds, tens, and units
12,345,678 = tens of millions, millions, hundreds of thousands, tens of thousands, thousands, hundreds, tens, and units
123,456,789 = hundreds of millions, tens of millions, millions, hundreds of thousands, tens of thousands, thousands, hundreds, tens, and units

1	2	3,	4	5	6,	7	8	9,
100's	10's	units.	100's	10's	units.	100's	10's	units.
		of millions.			of thousands.			of units.

Or otherwise read—

1 = one
12 = twelve
123 = one hundred and twenty-three
1,234 = one thousand, two hundred and thirty-four
12,345 = twelve thousand, three hundred and forty-five
123,456 = one hundred and twenty-three thousand, four hundred and fifty-six
1,234,567 = one million, two hundred and thirty-four thousand, five hundred and sixty-seven
12,345,678 = twelve millions, three hundred and forty-five thousand, six hundred and seventy-eight
123,456,789 = one hundred and twenty-three millions, four hundred and fifty-six thousand, seven hundred and eighty-nine

Or thus—

1 = one
1 2 = 10 and 2 ones
1 2 3 = 100, two 10's, and 3 ones
1, 2 3 4 = 1000, two 100's, three 10's, and 4 ones
1 2, 3 4 5 = twelve 1000's, three 100's, four 10's, and 5 ones
1 2 3, 4 5 6 = 123 thousand, 456 ones
1, 2 3 4, 5 6 7 = 1 million, 234 thousand, and 567 ones
1 2, 3 4 5, 6 7 8 = 12 millions, 345 thousand, and 678 ones
1 2 3, 4 5 6, 7 8 9 = 123 millions, 456 thousand, 789 ones

When a line of figures is to be read off, first begin at the right and divide into periods of three figures in each; a large number will thus be more easily read, as 965,432,679,547, or 965 thousand 432 millions, 679 thousand, 547 *units*.

millions units.

As formerly remarked, 1 is termed a unit or unity; 2 are called two units, and so on to 9.

0 placed after the unit, changes the unit figure into ten or tens; as, 10 equal to ten; 90 equal to nine tens.

00 placed after the unit, make 100, equal to a hundred, or ten tens; 900 equal to nine hundred, or ninety tens.

000 placed after the unit, make 1000, equal to a thousand, or ten hundred, and so on; every additional 0 raising the number ten times more than it was before; as more distinctly shown in the following table.

9	or	nine
90	or	ninety
900	or	nine hundred
9,000	or	nine thousand
90,000	or	ninety thousand
900,000	or	nine hundred thousand
9,000,000	or	nine millions
90,000,000	or	ninety millions
900,000,000	or	nine hundred millions

State in writing the following figures—

7—18—24—36—40—59—67—95—100—101—110—111—120—102—117—180—200—209—290—507—590—505—550—666—711—909—1000—1012—1021—1111—1404—1440—1550—1606—1990—1909—2000—2202—2968—5694—10,000—10,041—10,600—17,060—19,099—20,000—30,606—51,717—97,008—100,000—109,090—111,111—1,101,101—1,000,000—1,999,999—1,080,760—1,007,067—2,767,676—10,065,430—17,064,000—20,504,007—176,458,793.

State in figures the following written numbers—

Three—ten—eleven—seventeen—twenty—twenty-five—thirty-seven—forty-nine—seventy-eight—a hundred—a hundred and one—a hundred and eleven—a hundred and seventy-four—five hundred and nine—six hundred and seventeen—eight hundred and nineteen—eight hundred and ninety-one—nine hundred and ten—a thousand—a thousand and fifty-seven—twelve hundred and twelve—eighteen hundred and sixty-eight—two thousand nine hundred and eleven—seventeen thousand three hundred and three—fifty thousand and fifty—one hundred thousand—a hundred and twenty-five thousand

three hundred and fifteen—one million—seven millions sixty thousand and ninety.

DIVISIONS OF NUMBERS.

Numbers are divided into three terms, Cardinal, Ordinal, and Sectional.

Cardinal numbers are the first or simplest form of numbers.

Ordinal numbers are so called because they follow each other in regular order.

Sectional numbers are used to number sections, or such divisions as sermons or lectures may be divided into.

These numbers are written in the following different ways :—

First—Cardinal numbers written in words :

As, one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty, twenty-one, and so on.

Or the same in figures,—1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, etc.

Second—Ordinal numbers written in words :

As, once, twice, thrice ; or first, second,

third, fourth, fifth, sixth, seventh, eighth, ninth, tenth, eleventh, twelfth, thirteenth, fourteenth, fifteenth, sixteenth, seventeenth, eighteenth, nineteenth, twentieth, twenty-first, etc.

Or the same in figures—1st, 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, etc.

Third—Sectional numbers written in words:

As, firstly, secondly, thirdly, fourthly, fifthly, sixthly, seventhly, eighthly, ninthly, tenthly, eleventhly, twelfthly, thirteenthly, and so on.

Or the same in figures with the endings of the words above attached to them: as, 1stly, 2ndly, 3rdly, 4thly, 5thly, 6thly, 7thly, 8thly, 9thly, 10thly, 11thly, 12thly, 13thly, etc.

Numbers are also divided into Fractions and Mixed Numbers.

Fractions are broken numbers, and less than 1, or unity.

As $\frac{1}{2}$, or a half; $\frac{1}{4}$, a quarter, or fourth; $\frac{1}{8}$, an eighth; $\frac{1}{16}$, a sixteenth; $\frac{3}{4}$, three quarters or fourths; $\frac{5}{8}$, five eighths; $\frac{7}{10}$, seven tenths; $\frac{8}{17}$, eighth seventeenths, etc.

Mixed Numbers are such as contain both whole numbers and fractions, thus $1\frac{1}{4}$, or one and a fourth; $4\frac{1}{2}$, four and a half; $7\frac{3}{4}$, seven and three quarters; $9\frac{5}{8}$, nine and five eighths, etc.

Whole numbers from 1 and upwards are sometimes termed *integers* or *integral* numbers, as being different from fractions. Each fraction is said generally to be less than 1, or unity. But it must here be observed that 12 of anything is called an *integer*; then 3 whole numbers being $\frac{1}{4}$ of 12, 6 whole numbers being $\frac{1}{2}$ of 12, and 9 whole numbers being $\frac{3}{4}$ of 12, may also be called fractional parts of the integral number 12, although 3, 6, and 9, are each actually more than 1 or unity. A $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, etc., in relation to 1 are fractions of unity. A $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, etc. in relation to 12, are fractions of an integral number, each of which fractions is greater than 1 or unity, but less than the whole or integral number 12.

To make this very clear, suppose an orange to be divided into four equal parts, each part will then be called a fourth of the orange, or $\frac{1}{4}$ of 1, or unity.

But 12 oranges may also be divided into four equal parts, and then each part, although containing 3 oranges, is called a fourth part of the 12 oranges, or $\frac{1}{4}$ of 12, the integral number.

EXPLANATION OF SIGNS.

The Sign of Equality = read *equal to*, shows that the figures between which it is placed are equal;

For example, 2 and 2 = 4.

The sign of Addition + read *plus*, or *more*, shows that the figures between which it is placed are to be added together;

For example, 8 + 4 = 12, which answer is called the *sum*.

The sign of Subtraction — read *minus*, or *less*, shows that the figure or figures after it are to be subtracted from the figures before it:—

For example, 8 — 4 = 4, called the remainder or difference.

The sign of Multiplication × read *multiplied by* means that the figures between which it is placed are to be multiplied together:—

For example, 8 × 4 = 32, called the product.

The sign of Division ÷ read *divided by*, means that the figure which goes before it is to be divided by the figure that comes after it:—

For example, 8 ÷ 4 = 2, called the quotient.

From the above it is easily seen that the answer in Addition is called the *sum;* the answer in Subtraction the *remainder* or *difference;* the answer in Multiplication, the *product;* and the answer in Division, the *quotient.*

The more compact form of the signs and their uses is as follows :—

Sign of Equality = means *equal to*, as 2 and 2 = 4.
Sign of Addition + means *plus*, or *more*, as 8 + 4 = 12, the sum.
Sign of Subtraction — means *minus*, or *less*, as 8 — 4 = 4, the remainder.
Sign of Multiplication × means *multiplied by*, as 8 × 4 = 32, the product.
Sign of Division ÷ means *divided by*, as 8 ÷ 4 =2, the quotient.

The common forms of working the above questions are as follow, with the names of the quantities or numbers of which they are composed :—

Addition.

8 } the quantities.
4 }

12 the sum.

Subtraction.

8 the minuend.
4 the subtrahend.

4 the remainder.

Multiplication.

8 the multiplicand.
4 the multiplier.

32 the product.

Division.

the divisor 4)8 the dividend.

2 the quotient

Examples of *continued* Addition, Subtraction, etc.

$4 + 4 + 4 + 4 = 16$, sum.
$16 - 4 - 4 - 4 = 4$, rem.
$4 \times 4 \times 4 \times 4 = 256$, prod.
$256 \div 4 \div 4 \div 4 = 4$, quot.

The common forms of working these are :—

Addition.	Subtraction	Multiplication.	Division.
4	16	4	4)256
4	4	4	——
4	—	—	4)64
4	12	16	——
—	4	4	4)16
16 sum.	—	—	——
=	8	64	4 quot.
	4	4	=
	—	——	
	4 rem.	256 prod.	
	=	=	

ADDITION.

Addition is the art of adding numbers of the same name or kind together, so as to make one total amount, called their sum.

Rule 1.—After figures have been put down exactly under one another in column, draw a line; begin at the bottom and add upwards till the top figure is reached; then place the answer directly under the column.

Noughts—whether few or many—can never become anything; therefore in adding them together their answer must always be 0.

ADDITION OF SINGLE COLUMNS OF NOUGHTS AND UNITS.

0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
—	0	0	0	0	0	—	0	0	0	—	1	1	1	1
=	—	0	0	0	0	1	1	1	1	2	—	1	1	1
	=	—	0	0	0	=	—	0	0	=		1	1	1
		=	0	0	0		=	1	1		=	—	1	1
			—	0	0			0	0			=	1	1
			=	0	0			1	1				—	1
				—	0			—	0				=	1
				=	0			=	1					—
					—				—					=
					=				=					

RULE 2.—If the sum of the column be 10 or more, place the last figure, being a unit, under the column of units; and set down the ten, or tens, one place to the left.

1	1	1	1	1	1	1	2	3	4	5	6	7
2	2	2	2	2	2	2	3	4	5	6	7	7
1	1	1	1	3	3	3	4	5	6	7	8	7
—	2	2	2	1	1	4	5	6	7	8	9	8
=	—	1	1	2	2	1	2	3	4	5	6	8
	=	2		3	3	2	3	4	5	6	7	8
		—	1	—	1	3	4	5	6	7	8	9
		=	2	=	2	4	5	6	7	8	9	9
			—		3	—	—	—	—	—	—	9
			=		—	=	=	=	=	=	=	—
					=							=

RULE 3.—When there are two or more

columns to add, commence at the right hand or column of units; and if the sum of that column be ten or more, place the last or unit figure under the unit column, and carry the tens into the column of tens; and so proceed with all the rest.

12	23	34	45	10	27	123	654	361	400
23	34	45	56	9	32	234	876	4	76
34	45	56	67	26	7	345	950	72	5
45	56	67	78	3	5	456	407	611	43
56	67	78	89	17	69	567	365	7	291
67	78	89	90	50	70	678	409	420	687
237									

RULE 4.—Simple numbers expressing the same thing can only be added together; as 7 sheep, 12 sheep, and 20 sheep=39 sheep.

Simple numbers expressing different things cannot be added together, as 7 sheep, 12 bullocks, and 20 horses; because they cannot equal 39 sheep, or 39 bullocks, or 39 horses.

They may be added together, however, under the *general* name *animals*, and therefore be equal to 39 animals.

So with 24 chairs, 9 tables, 15 pictures, and 7 sofas—these, if it be desirable to add them together, can be done, considered only as *articles*: hence we shall have=55 articles.

But suppose it be asked, How many are 50 men, 28 horses, 17 hats, 14 pounds of sugar, and 16 gallons of ale? It is very plain that they cannot be added together, as there is no term in use so general as will apply to all of these taken together. They cannot be called *persons*, as that applies only to the *men*; they cannot be called *animals*, as that applies only to the *horses*; they cannot be called *articles*, as that applies only to the *hats*; they cannot be called *weights*, as that applies only to the *pounds* of sugar; and neither can they be called *measures*, as that applies only to the *gallons* of ale. It is therefore clear that unlike quantities, having no *general name*, cannot be added together.

Examples of UNLIKE QUANTITIES for addition, giving a GENERAL name to each sum.

1. Find the sum of 13 balls, 9 bats, and 12 wickets.

2. Add together 161 goats, 1016 sheep, 120 pigs, and 1469 mules.

3. What do 100 roses, 268 tulips, 97 lilies, and 1000 daisies amount to?

4. *How much do 13 ships, 19 horses, 15 yards of cloth, and 100 stars come to?

* Without a general name to add them by.

5. What is the amount of 190 men, 1760 women, 109 boys, 1000 girls, 97 servants, 1000 soldiers, 579 sailors, and 10,000 slaves?

6. Add together 19 canaries, 120 black-birds, 1005 crows, 75 eagles, 12 geese, 17 ostriches, and 1375 humming-birds.

7. How many are 57 steam-engines, 45 spinning-jennies, 290 turning-lathes, 12 balloons, 45 water-wheels, and 100 galvanic batteries?

8. How much do 131 gallons of rum, 2021 gallons of ale, 17 gallons of vitriol, 202 gallons of water, and 7 gallons of oil amount to?

9. Add 12 pebbles, 17 diamonds, 29 amethysts, 160 garnets, 7 carbuncles, 201 rubies, and 91 onyx-stones together.

10. How many are 111 piano-fortes, 23 harmoniums, 107 harps, 40 violins, 254 flutes, 15 drums, and 1000 cymbals?

THE FIVE DIFFERENT FORMS OF ADDITION.

There are five different forms in which numbers for addition may be given.

First—By written numbers, thus:—Twelve and nine = 21.

Second—By figures and the signs + and = as 12+9 = 21.

Third—By figures without signs, as $\begin{array}{r} 12 \\ 9 \\ \hline 21 \\ = \end{array}$

Fourth—By means of a question, such as :—

A letter-carrier delivered 25 letters in the Strand, 13 in Fleet Street, 29 in Cheapside, and 15 in Holborn; how many letters did he deliver altogether? Ans. 82.

Fifth—By continued addition; as, 3+5+8+4+7 = 27.

EXERCISES ON THE FIRST FORM OF ADDITION.

Numbers written in words, in order to be turned into figures, and added together.

Add together Nought and one—One and one—One and two—Two and two—Two and three—Three and three—Three and four—Four and four—Four and five—Five and five—Five and six—Six and six—Seven and six—Seven and seven—Eight and nine—Nine and ten—Ten and ten—Ten and twelve—Twelve and twelve.

Find the sum of Fifteen and fifteen—Sixteen and seventeen—Nineteen and twenty-one—Eighteen and thirty-five—Fifty and fifty—Sixty and ninety—A hundred and twenty-eight and seventy-nine—Five hun-

dred and eleven and three hundred and fifty-nine—Seven hundred and forty-eight and nine hundred and sixty-three.

What is the amount of One thousand five hundred and forty-seven and twelve hundred and sixteen? Nine thousand and five thousand four hundred and ten?—Twelve thousand and sixty-three and fifteen thousand seven hundred and nineteen?—Three hundred thousand five hundred and seven and fifty-seven thousand and eighty-nine?—Two millions four hundred and sixteen thousand five hundred and eight, and nine hundred and eleven thousand four hundred and eleven?

EXERCISES ON THE SECOND FORM OF ADDITION.

Numbers may be added together by means of figures and the signs plus and equality.

For Example, $0 + 1 = 1$; $1 + 1$; $2 + 1$; $3 + 2$: $3 + 4$; $4 + 5$; $5 + 6$; $6 + 7$; $7 + 8$; $9 + 9$; $10 + 10$; $11 + 12$; $13 + 14$: $17 + 19$; $20 + 20$; $24 + 27$; $30 + 37$; $45 + 54$; $63 + 75$; $104 + 170$; $275 + 901$; $1867 + 1043$.

ALSO IN CONTINUED ADDITION.

What are the sums of $3 + 6 + 4$; $9 + 12 + 17$; $19 + 10 + 5$; $20 + 20 + 20$; $50 + 4 + 60 + 80$; $100 + 76 + 109 + 70$; $196 + 4 + 73$; $1000 + 100 + 10 + 1$; $675 + 872 + 11 + 49 + 7645$.

EXERCISES ON THE THIRD FORM OF ADDITION.

Numbers may be added together by means of figures in columns, and without signs—the commonest form of addition.

Find the amounts of

74	603	6832	87654	65000	796304
91	71	7351	20307	41726	172500
63	4	6004	65470	300	689287
49	362	3129	97623	24	300101
56	548	2087	41005	765	287594
82	231	3542	74650	76345	673020

EXERCISES ON THE FOURTH FORM OF ADDITION.

Numbers may be given in order to be added together by means of written questions.

1. A London merchant sent 20 tons of bar iron to New York, 37 tons to Australia, 25 tons to New Zealand, and 38 tons to Cape Town; how many tons did he send abroad altogether?

2. A Sheffield cutler exported to America 500 carving knives, 1000 table knives, 1000 table forks, 1500 swords, 300 saws, 1200 surgeons' lances, and 10,000 pocket knives; how many pieces of cutlery did he export altogether?

3. A London butcher imported from the

Continent 500 bullocks, 1200 sheep, 358 calves, and 367 pigs; how many animals did he import altogether?

4. The commander-in-chief sent a regiment of infantry, consisting of 850 strong, to the Cape of Good Hope, another of 1047 to Calcutta, another 698 to Bombay, and another of 905 to New South Wales; how many soldiers were sent away from this country?

5. A London wine merchant sent 100 dozens of port to Glasgow, 203 dozens to Dublin, 720 dozens of sherry to Liverpool, 411 doz. to Manchester, and 56 doz. to Norwich; how many doz. of wine did he send to Scotland, Ireland, and the provinces?

6. A ship from Spain entered the London Docks with 1378 boxes of oranges, 299 bags of nuts, 104 casks of wine, 1009 parcels of cork, and 515 boxes of raisins; how many packages did she bring to London?

EXERCISES ON THE FIFTH FORM OF ADDITION.

By means of continued addition, as:—

$$1 + 2 + 3 + 4 + 5 = 15.$$

What is the sum of $1 + 1 + 1 + 0 + 0 + 1 + 2$? $2 + 1 + 3 + 4 + 1$? $3 + 2 + 1 + 4 + 5 + 6$? $4 + 5 + 6 + 7 + 8 + 9$? $5 + 6 + 7 + 8 + 9 + 10$? $6 + 7 + 8 + 9 + 10 +$

11 + 12? 10 + 10 + 10 + 11 + 11 + 11? 12 + 12 + 12 + 12?

What is the amount of 12 + 13 + 14 + 10 + 9 + 13? 15 + 15 + 13 + 20 + 17? 30 + 45 + 70 + 69? 100 + 200 + 301 + 517 + 19? 761 + 89 + 4 + 507 + 1? 100 + 111 + 1010 + 73? 1268 + 73 + 480 + 3 + 5000? 7601 + 5 + 981 + 70006 + 8181 + 900600?

SUBTRACTION.

Subtraction is the method of taking a less number from a greater. The answer is called the remainder, or difference.

Rule 1.—First write down in one line the figures containing the greater number, called the minuend, then write under it the figures containing the less number, called the subtrahend, placing units under units, tens under tens, etc. Draw a line, begin at the units' place, and subtract.

Exercises in Subtraction, without adding ten.

Example—Subtract 24 from 78.

78 minuend.
24 subtrahend.
—
54 remainder.
=

Subtract 2 from 4; 3 from 5; 4 from 7;

5 from 9; 3 from 8; 2 from 9; 11 from 22; 14 from 26; 27 from 59; 31 from 63; 54 from 79; 85 from 97; 124 from 369; 216 from 578; 3,764 from 8,976; 724,315 from 948,647, etc.

RULE 2.—When noughts in the subtrahend are taken from noughts in the minuend, the results are noughts.

For example:—600 from 900.

900
600
300

Exercises.—Take 200 from 300; 400 from 700; 5000 from 9000; 120000 from 360000; 2030 from 6050; 80072 from 90087; 10101010 from 70605040; 5006203 from 9009708.

RULE 3.—When figures in the subtrahend are subtracted from figures of equal value in the minuend, the results are noughts.

For example.—From 965 take 465.

965
465
500

Exercises.—From 74 take 34; 689 take 289; 5632 take 2632; 79999 take 39999;

6487 take 3457; 91463 take 51263; 875468 take 342468; 620407 take 320407; 8940075 take 7240072.

RULE 4.—When noughts in the subtrahend are taken from figures in the minuend, the results are the same figures brought down.

For example—Take 700 from 964.

964
700
264

Exercises.—Take 40 from 76; 60 from 99; 300 from 854; 2000 from 9687; 40000 from 86754; 50060310 from 78769319; 400862305 from 675963595.

RULE 5.—When a figure in the subtrahend is greater than its corresponding figure in the minuend, ten is added to the lesser figure, the subtraction can then take place. But *one* is added to the left hand figure in the subtrahend, which *one*, in reality, is equal to the *ten* added to the figure in the minuend, as it is a *one ten*—the subtraction then proceeds.

Ten first being added to the minuend and then to the subtrahend, the equality is kept up; as follows: 9 — 4 = 5 or 19—14= 5, the same result.

Exercises in Subtraction where *ten* is added.

For example—Subtract 578 from 732.

732
578
154

Subtract 362 from 751; 549 from 834; 675 from 980; 4999 from 9541; 607607 from 870066; 3749 from 1203541; 9009870 from 11008712; 10909 from 75141; 919191 from 1000000; 98989898 from 1000000000; 760959 from 109019019.

THE FIVE DIFFERENT FORMS OF SUBTRACTION.

As in addition, there are Five different forms in which numbers for Subtraction may be given.

First. By written numbers, as nine from twelve = 3.

Second. By figures and the signs — and =, as 12 — 9 = 3.

Third. By figures without the signs, as

12
9
3

Fourth. By means of a question, such as :—

The distance from the earth to the sun is 95,000,000 of miles; the distance from the earth to the moon 240,000 miles. What is their difference? Ans. 94,760,000.

Fifth. By means *of continued Subtraction:* as 20—4—5—3—4=4.

EXERCISES ON THE FIRST FORM OF SUBTRACTION.

Numbers written in words, in order to be turned into figures, and subtracted from one another.

Subtract Five from nine; seven from twelve; nine from sixteen; eleven from eighteen; seventeen from thirty; twenty-three from forty-nine; sixty-five from eighty-one; seventy-nine from a hundred and eleven.

Find the difference between ninety-seven and a hundred and fifty-one; A hundred and seventeen and three hundred and five; Seven hundred and eighty-four and four hundred and eighty-nine; Nine hundred and nineteen and a thousand and fifty-five; Three thousand eight hundred and thirty-five and two thousands five hundred and forty-nine.

EXERCISES ON THE SECOND FORM OF SUBTRACTION.

Numbers may be subtracted from one another by means of figures and the signs minus and equality.

For example 1—0=1. 1—1; 2—1; 4—2; 7—3; 9—5; 12—7; 15—8; 19—12; 27—19; 34—27; 48—39; 76—58; 90—

45; 101—50; 176—98; 100—19; 300—150; 511—379; 1205—870; 2111—1999.

EXERCISES ON THE THIRD FORM OF SUBTRACTION.

Numbers may be subtracted from one another by means of figures without the signs—the commonest form of subtraction.

For example :—

17	29	300	567	7630	12713
11	14	267	249	307	1198
6					

46007	7060732	10000000	9999999	90909090
39548	1458769	9999999	1010101	9090909

EXERCISES ON THE FOURTH FORM OF SUBTRACTION.

Numbers may be given in order to be subtracted from one another by means of questions.

Exercise :—From London to Paris is 227 miles, from London to New York is 2100 miles. What is their difference? Answer:—1873 miles further to New York than to Paris.

1. What is the difference between 1900 gallons of wine, and 19,000 gallons of water?

2. The surface of the globe consists of 145,500,000 square miles of water, and 51,000,000 square miles of land. How many more square miles of water than of land?

3. Which is the greater number, 1 2 3 4 5 6 7 8 9, or 9 8 7 6 5 4 3 2?

4. Kunchin-junga, in the Himalaya range, the highest mountain in the world, is 28,000 feet. Mount Blanc, the highest mountain in the Alps, is 15,730 feet. What is their difference?

5. The Normans invaded England in 1066. How many years is it since, this being 1868?

6. How many miles does the circumference of the earth exceed that of its diameter, the former being about 25,000 miles, and the latter about 8000 miles?

7. The British army consists of about 220,000 men in all; the French army about six hundred and fifty thousand. Which army has the most soldiers, and how many more?

EXERCISES ON THE FIFTH FORM OF SUBTRACTION.

By means of continued subtraction, *as* :— 22—4—3—2—5=8.

What is the remainder of 16—3—5—4? 25—4—6—3—7? 30—7—6—10? 46—

9—11—12? 59—11—9—8—17—1? 64—8—8—8—8? 73—13—20—15—5? 84—12—18—20—34?

What is the difference between 90—45—12—3? 100—50—10—7? 144—12—24—48—19? 310—50—65—78? 507—17 401—27? 756—311—61—4—222? 890—1—11—111—567? 999—701—203? 1005—48—731—16—5? 1869—547—81—18—6? 2000—1000—100?

Find the result of 10000—2000—600—5000—777—21; 46891—3846—15—27); 100102—20120—654—7—1982; 711011—85111—2683—21—3786; 1000000—100000—10000—1000.

THE MULTIPLICATION TABLE.

REMARKS.

Nought, the negating column, and Once, the affirming column, here prefixed, are set down in their natural places, in order to show their relation to the increasing columns commencing with Twice; and so for ever do away with any doubt as how to multiply by a *nought* or a *one*.

The author believes that the omission of these first two columns, simple as they may appear, has been an obstacle of the most inveterate kind to the tyro, when we consider that in the usual stereotyped Table from Twice to Twelve times there is nothing impressed on the mind but *increase* of numbers.

The transition, in the simplicity of the reasoning powers, from this strong impression, is not so easy as is generally imagined; as the multiplication of a number by *one* is merely *affirmative* of that number, while the multiplication of the same by *nought* is an absolute negation of any number whatever.

MULTIPLICATION TABLE.

0 times	Once	Twice	3 times	4 times	5 times	6 times
0=0	0= 0	0= 0	0= 0	0= 0	0= 0	0= 0
1=0	1= 1	1= 2	1= 3	1= 4	1= 5	1= 6
2=0	2= 2	2= 4	2= 6	2= 8	2=10	2=12
3=0	3= 3	3= 6	3= 9	3=12	3=15	3=18
4=0	4= 4	4= 8	4=12	4=16	4=20	4=24
5=0	5= 5	5=10	5=15	5=20	5=25	5=30
6=0	6= 6	6=12	6=18	6=24	6=30	6=36
7=0	7= 7	7=14	7=21	7=28	7=35	7=42
8=0	8= 8	8=16	8=24	8=32	8=40	8=48
9=0	9= 9	9=18	9=27	9=36	9=45	9=54
10=0	10=10	10=20	10=30	10=40	10=50	10=60
11=0	11=11	11=22	11=33	11=44	11=55	11=66
12=0	12=12	12=24	12=36	12=48	12=60	12=72

Nought times any number is 0.

Once any number is that number.

7 times	8 times	9 times	10 times	11 times	12 times
0= 0	0= 0	0= 0	0= 0	0= 0	0= 0
1= 7	1= 8	1= 9	1= 10	1= 11	1= 12
2=14	2=16	2= 18	2= 20	2= 22	2= 24
3=21	3=24	3= 27	3= 30	3= 33	3= 36
4=28	4=32	4= 36	4= 40	4= 44	4= 48
5=35	5=40	5= 45	5= 50	5= 55	5= 60
6=42	6=48	6= 54	6= 60	6= 66	6= 72
7=49	7=56	7= 63	7= 70	7= 77	7= 84
8=56	8=64	8= 72	8= 80	8= 88	8= 96
9=63	9=72	9= 81	9= 90	9= 99	9=108
10=70	10=80	10= 90	10=100	10=110	10=120
11=77	11=88	11= 99	11=110	11=121	11=132
12=84	12=96	12=108	12=120	12=132	12=144

THE MULTIPLICATION TABLE INVERED.

0 times	Once	Twice	3 times	4 times	5 times	6 times
12=0	12=12	12=24	12=36	12=48	12=60	12=72
11=0	11=11	11=22	11=33	11=44	11=55	11=60
10=0	10=10	10=20	10=30	10=40	10=50	10=54
9=0	9=9	9=18	9=27	9=36	9=45	9=48
8=0	8=8	8=16	8=24	8=32	8=40	8=42
7=0	7=7	7=14	7=21	7=28	7=35	7=36
6=0	6=6	6=12	6=18	6=24	6=30	6=30
5=0	5=5	5=10	5=15	5=20	5=25	5=24
4=0	4=4	4=8	4=12	4=16	4=20	4=18
3=0	3=3	3=6	3=9	3=12	3=15	3=12
2=0	2=2	2=4	2=6	2=8	2=10	2=6
1=0	1=1	=2	1=3	1=4	1=5	1=0
0=0	0=0	=0	0=0	0=0	0=0	0=0

7 times	8 times	9 times	10 times	11 times	12 times
12=84	12=96	12=108	12=120	12=132	12=144
11=77	11=88	11=99	11=110	11=121	11=132
10=70	10=80	10=90	10=100	10=110	10=120
9=63	9=72	9=81	9=90	9=99	9=108
8=56	8=64	8=72	8=80	8=88	8=96
7=49	7=56	7=63	7=70	7=77	7=84
6=42	6=48	6=54	6=60	6=66	6=72
5=35	5=40	5=45	5=50	5=55	5=60
4=28	4=32	4=36	4=40	4=44	4=48
3=2	3=24	3=27	3=30	3=33	3=36
2=1	2=16	2=18	2=20	2=22	2=24
1=	1=8	1=9	1=10	1=11	1=12
0=	=0	0=0	0=0	0 0	0=0

MULTIPLICATION.

Multiplication is a short way of adding or repeating a number as often as we require it. The number to be multiplied is called the Multiplicand, and the number we multiply by is called the Multiplier. The answer is termed the Product.

For example—Suppose we wanted 6 to be added to itself 5 times, we have $6 + 6 + 6 + 6 + 6 = 30$, or

$$\begin{array}{r} 6 \\ 6 \\ 6 \\ 6 \\ 6 \\ \hline 30 \\ == \end{array}$$

By knowing the Multiplication Table, we at once save the trouble to which this continued addition would lead, and say 5 times 6 are 30, or $6 \times 5 = 30$.

Although we say Multiplication is a short method of Addition, still it is only one form of Addition that can be shortened by it, and that is when a number is to be repeated any given number of times.

Multiplication does not apply to addition when *different* numbers are to be added to-

gether; as $5 + 7 + 9 + 11$. In such cases we must be content to use common addition.

General Rule.—When two numbers are to be multiplied together, place the units of the multiplier under the units of the Multiplicand, the tens under the tens, &c., and proceed with the work, placing each first resulting figure under its own multiplier. Add together the lines produced, the answer will be the *product*.

Example.

4567840 = Multiplicand.
312 = Multiplier.

9135680 = Line produced by the unit figure.
4567840 = Line produced by the tens.
13703520 = Line produced by the hundreds.

1425166080 = the Product or Answer.

From this example, it is plain that by each figure in the Multiplier a line is produced; there are *three* multiplying figures here used, therefore there are *three* lines. So with *four*, *five*, or more figures in the Multiplier, *four*, *five*, or more lines will be produced, but which must afterwards be added together in order to find the answer in *one* line, so that we may be able to read it.

When, however, there are any *noughts* in the Multiplier, they are merely brought down underneath themselves, and you then proceed

to multiply by the next figure; the noughts, therefore, do not require separate lines for themselves, such as—

37654	67435618
206	70004
225924	269742472
753080	472049326000
7756724	4720763002472

Last example showing the uselessness of the noughts in the Multiplier having lines to themselves.

67435618
70004

269742472
0000000 } These lines of course
00000000 } are not required, as
00000000 } shown in the former
472049326 example.

4720763002472

RULE 1.—When the Multiplier is a unit number, a ten, an eleven, or a twelve, multiply by the whole number, and the answer or product will be obtained in one line; as:—

49	96	123	261	315	478	527	694
2	3	4	5	6	7	8	9
98							

7845	896340	695321	40360	97365048
10	10	11	12	12

RULE 2.—When the Multiplier ends in noughts, place it so that the noughts will fall outside the Multiplicand to the right, then multiply by the whole number, as :—

26	34	45	56	68	73	87	94
20	30	40	50	60	70	80	90
520							

671	794	876	953	1000
700	800	900	1000	1000

RULE 3.—When the Multiplicand contains noughts, these noughts are merely brought down; as noughts multiplied by any number produce noughts only. But a carried number may take the place of a nought, as :—

10	204	300	400	500	600	700	800
2	3	4	5	6	7	8	9
20	612						

900	1007	80607	7040687	9000400670
10	11	12	8	7

RULE 4.—When the Multiplier contains simple units or *ones*, the figure in the Multiplicand is merely brought down; as any number multiplied by one *is* that number; as:—

243	354	5462	6394	78503	546
111	111	111	1111	11111	312
243					
243					
243					
26973					

678	7541	89706	9476004	10006508
17	181	2115	14101	110416

MULTIPLICATION MAY ASSUME FIVE FORMS.

1st. By means of written numbers, as Four times five are 20.

2nd. By means of figures and the signs × and =, as 5×4=20.

3rd. By means of figures without the signs, or the common form, as:—

$$\begin{array}{r} 5 \\ 4 \\ \hline 20 \end{array}$$

4th. By means of questions, as:—There are 4 bags, each containing 5 books; how many books are there in all? Ans. 20.

5th. By means of continued multiplication, as: 3×2×4×5=120.

EXERCISES ON THE FIRST FORM OF MULTIPLICATION.

By means of written numbers expressed in words.

Multiply together Three and four; Five and three; Six and five; Eight and seven; Nine and six; Ten and twelve; Thirteen and nine; Seventeen and eleven; Nineteen and twenty-one.

Find the product of Eighteen and nineteen; Twenty and twelve; Sixteen and twenty-three; Twenty-nine and thirty; Forty-one

and thirty-seven; Fifty-nine and sixty-five, Seventy-eight and seventeen; Ninety-three and seventy-seven.

Multiply—A hundred and eight by fifty-nine; A hundred and sixty-five by eighty-seven; Two hundred and eleven by thirty-eight; Three hundred and five by nineteen; Four hundred and seventy-six by a hundred; Seven hundred and twenty-five by forty-four; A thousand and fifty-three by one hundred and eleven; Thirteen thousand six hundred and fifty-five by twelve hundred and eleven.

EXERCISES ON THE SECOND FORM OF MULTIPLICATION.

By means of figures and the Signs (×) multiplied by and (=) equality.

What is the product of 5×4; 6×5; 7×4; 3×9; 9×6; 7×9; 8×8; 9×9; 10×10; 11×11; 12×12; 8×12; 0×7; 15×7; 17×11; 20×20; 30×17; 45×11; 57×12; 90×40; 100×63; 101×19; 486×40; 760×30; 800×200; 901×300; 1000×100.

The squares and cubes of numbers may readily be seen and worked under this form; for example, the square of any number is merely that number multiplied by itself, such as—2×2=4, or 3×3=9. Here 4 is the square of 2, and 9 is the square of 3.

The cube of any number is found by multiplying the number into itself twice, such as :—$2\times2\times2=8$, or $3\times3\times3=27$. Here 8 is the cube of 2, and 27 is the cube of 3.

Find the squares of 4; 5; 6; 7; 8; 9; 10; 11; 12; and 13.

What are the cubes of 4; 5; 6; 7; 8; 9; 10; 11; 12; and 13?

EXERCISES ON THE THIRD FORM OF MULTIPLICATION.

By means of figures without the signs.

Multiply 5 by 3,

$$\begin{array}{r} 5 \\ 3 \\ \hline 15 \\ = \end{array}$$

The larger number is generally made the multiplicand, and the less number the multiplier.

6	7	8	9	10	11	12	14	16
4	5	6	7	8	9	10	11	12

17	19	23	37	49	54	68	76	87
20	30	40	50	60	70	80	90	100

From 17 × 20 to 87 × 100 the multipliers are the larger numbers in these instances, as the answer is obtained in *one* line instead of *two* by the usual method.

147	235	379	485	587	694	725
13	17	23	26	37	43	51

809	973	1016	1781	2769	3947
69	74	104	236	375	468

43765	396	57689046	69005482
1010	1000	3807	40063

786590111	102030406
57111	296091

EXERCISES ON THE FOURTH FORM OF MULTIPLICATION.

By means of questions in different forms.

1.—There are seven days in a week; how many days are there in thirteen weeks?

2.—There are four quarters in a yard; how many quarters are there in thirty yards?

3.—What is the product of 7096 multiplied by 47 ?

4.—A horse dealer sold 27 horses at 45 pounds sterling each ; how many pounds did he receive ?

5.—How many oranges in 39 boxes, if each box contains 450 oranges ?

6.—There are sixty miuutes in an hour ; how many minutes are there in a day, or 24 hours ?

7.—Suppose a city contained 500 churches with 1000 persons in each ; and 400 chapels with 800 persons in each. What number of persons did these churches and chapels contain altogether ?

9.—The great fire of London destroyed 13,700 houses, suppose each house to have contained, on an average, 3 families of 7 persons each ; how many persons became houseless ?

10.—The moon is 240,000 miles from the earth, there are 1760 yards in a mile ; how many yards is the moon from the earth ?

EXERCISES ON THE FIFTH FORM OF MULTIPLICATION.

By means of continued multiplication, as : $2 \times 3 \times 4 \times 5 = 120$.

What is the product of $3 \times 2 \times 1$? $4 \times 4 \times 2 \times 0$? $3 \times 5 \times 4 \times 1$? $4 \times 5 \times 3 \times 0 \times$

7×2? $2 \times 2 \times 2 \times 2 \times 2$? $3 \times 3 \times 3 \times 3 \times 3$? $1 \times 1 \times 1 \times 1$? $6 \times 5 \times 7 \times 8 \times 3 \times 1$? $7 \times 8 \times 10 \times 6 \times 11$? $16 \times 4 \times 20 \times 3$? $20 \times 12 \times 17$? $35 \times 2 \times 81 \times 17$? $100 \times 100 \times 100 \times 100$? $111 \times 11 \times 1 \times 1111$? $760 \times 0 \times 49$?

DIVISION.

Division is the finding of how many times one number is contained in another.

The number to be divided is called the Dividend.

The number by which we divide is termed the Divisor.

The number of times found is called the Quotient.

Division is a short method of Subtraction; but although this is said of it, it applies only to *one* form of Subtraction; and that is when the number to be subtracted is itself repeated a certain number of times; for example—Divide 30 by 5, or how many times will 5 be found in 30? By Division we at once get the answer $\left(\begin{array}{r} 5)30 \\ \hline 6 \text{ times} \end{array}\right)$

6 times, because six fives are thirty.

Working by Subtraction would be

30
5...1
—
25
5...2
—
20
5...3
—
15
5...4
—
10
5...5
—
5
5...6 times in 30 exactly, and
—
0 nothing over
=

But suppose from 30 we wish to take 5 and 12 and 7 and 6, in this case Division does not apply to it, as the numbers to be taken are all of different values, and therefore must be taken from 30 by means of Subtraction only, as

30
5
—
25
12
—
13
7
—
6
6
—
0
=

Here 5, 12, 7, and 6 are found in 30, but we cannot say they are found any *number of times*, as is the case with the repeating number 5.

General Rule.—Set down in line, the dividend, or number to be divided; draw a curve line on the left of the figures, and a straight line under them; place the divisor, or the number by which you are to divide, to the left of the curve line, and proceed to divide from left to right. The quotient, or answer, will next find its place under the straight line already drawn.

For example, divide 8462482 by 2.

Divisor. Dividend.
2)8462482
4231241 Quotient.

If the learner should not readily perceive the working of this sum, it would be well for him to attend to the following simple explanation. In the first place it is required to find how many *twos* there are in 8, the first figure; proceed thus,

1 2 3 4 times 2 are 8. 1 2 times 2 are 4.
II, II, II, II, or 8; II, II, or 4;
1 2 3 times 2 are 6.
II, II, II, or 6, etc., etc.

It is here seen that in dividing numbers we must use multiplication, as How many

twos in 8? 4 times 2 are 8, 4 being the first number required. But this example is one of the simplest in Division, as there are no figures over in dividing it.

The following example is more difficult, as in it there are figures over, which are to be carried on to those that follow. It must also be borne in mind that in such an example all the former three rules are used, viz. :— Addition, Subtraction and Multiplication.

Divide 734069 by 3. $3\overline{)734069}$

$244689\frac{2}{3}$

here 3 is found in 7 twice; because by *Multiplication* twice 3 are 6; 6 are then *subtracted* from the 7, and leave 1, but this 1 becomes a *ten* to the next figure 3, therefore by *Addition* we find that 10 and 3 are 13; now 3 into 13 are 4 times 3 are twelve and 1 over, which becomes 10 to the next figure 4, and makes 14; now 3 in 14 are 4 times 3 are twelve and 2 over; this 2 becomes again 2 tens or 20 to the next figure, but that figure being only a nought, no addition to 20 takes place, therefore 20 is to be divided by 3 which are 6 times and 2 over, which again becomes 20 with the next figure 6 added make 26, then 3 in 26 are 8 times and 2 over, this 2 becomes 20 to the last figure 9,

which makes 29, now 3 in 29 are 9 times and 2 over, which is called the remainder, and is written at the end of the quotient $\frac{2}{3}$, that is 2 to be divided by 3 which cannot be done, and it therefore thus remains in the form of a fraction at the end of the answer.

RULE 1.—When the divisor exactly measures each figure in the dividend; divide from left to right as before stated, and place the quotient under the straight line.

For example:—Divide 12468462I by 1

1)124684621

124684621

This example is given in order to show that when a number is to be divided by 1, there is really no occasion to trouble ourselves with such work, as the answer must always be the number so divided; one being an exact measurer of all numbers.

Divide 246848624 by 2.

The divisor 2)246848624 the dividend.

123424312 the quotient.

Divide 2222222 by 2; 3333333 by 3; 444444 by 4; 5555555 by 5; 6666666 by 6; 7777777 by 7; 8888888 by 8; 9999999 by 9; 24682468 by 2; 369369 by 3; 484848 by 4; 2468024680 by 2;

306900369 by 3; 408040800 by 4; 50505050 by 5; 60060660 by 6; 6060303 by 3; 6060066 by 2; 8080888 by 4; 8080800 by 2; 9090099 by 3;

RULE 2.—When there are figures in the dividend that are *less* than the *divisor*, they cannot be divided by themselves, they must therefore be called tens and added to the figure that follows; and then divided; for example:—

Divide 120120120 by 2

2)120120120

60060060

Divide 120120120 by 3; 12121212 by 4; 126126 by 6; 12691269 by 3; 2481212 by 4; 3750575 by 5; 18248418 by 6; 4998294 by 7; 144096328 by 8; 6340417290 by 9; 10101010 by 10; 20202020 by 10.

Find the quotient of 34345670 ÷ 10; 79684090 ÷ 10; 9876543210 ÷ 10; 11011011 ÷ 11; 44044044 ÷ 11; 888888 ÷ 11; 99099099 ÷ 11; 726871211 ÷ 11; 12012012 ÷ 12; 24242424 ÷ 12; 48048048 ÷ 12; 841248108 ÷ 12; 287612036048 ÷ 12; 1005460380 ÷ 12; 1081081092840 ÷ 12.

RULE 3.—When the quotient or answer in division ends with a figure remaining, which figure must always be *less* than the *divisor*, place that figure a little higher than the quotient, draw a line under it, and place the divisor under the line; it will then form a fraction, or something less than unity; for example :—

Divide 7204613 by 2

2)7204613

$3602306\frac{1}{2}$

Divide 460237592 by 3 : 34657491 by 4; 107960532 by 5; 876407327 by 6; 10040768 by 7; 870698732 by 8; 1411321476 by 9; 47083479 by 10; 365749016 by 11; 973210483 by 12.

RULE 4.—When the divisor ends in a nought, or noughts; first cut off the nought, or noughts in the divisor, and then cut off as many figures from the end of the dividend as noughts have been cut off from the divisor; and divide by the first figures of the divisor, taking care to divide only the figures in the dividend that are not cut off; the figure or figures, so cut off, will form the remainder, which turn into a fraction by placing *the whole of the divisor* under it. For example :—Divide 46753746 by 200.

2,00)467537,46

$233768\frac{146}{200}$

What is the quotient of 739060548÷10; 987463÷20; 2806347÷30; 6574893÷40; 63950476×50: 246211407÷60; 2730052 ÷70; 96431112÷80; 111100476÷90; 479631011÷100; 54863215÷120; 9463104 ÷110.

Divide 6320473 by 1000; 20641000 by 2000; 749632987 by 3000; 5111000632 by 4000; 390487231 by 5000; 72810046010 by 6000; 4620081139 by 7000; 680110482 by 8000; 1110076391 by 9000; 547601300 by 11,000; 437601548 by 12,000.

QUESTIONS IN DIVISION MAY TAKE FIVE DIFFERENT FORMS.

1. By means of written numbers, as twelve divided by three, are equal to *four times* three.

2. By means of figures and the signs ÷ and =, as 12÷3=4.

3. By means of figures without the signs, or the common form,

As 3)12
4

4. By means of questions, as:—There are 72 marbles to be divided among 8 boys; how many marbles will each boy receive? *Ans.* 9.

5. By means of continued division, as:— 64÷4÷2÷4=2.

EXERCISES ON THE FIRST FORM OF DIVISION.

By means of written numbers expressed in words.

Divide.—Four by two; six by three; eight by four; nine by three; ten by five; twelve by six; twelve by three; twelve by four; twelve by two; fourteen by two; fourteen by three; fifteen by three; sixteen by four; seventeen by five; eighteen by six; nineteen by seven; twenty by four.

Find the quotient of thirty-two divided by four; thirty-seven by seven; forty-nine by six; fifty-four by seven; sixty-eight by eight; seventy-five by nine; eighty-three by ten; ninety-nine by eleven; a hundred by ten; a hundred and twenty by eleven; a hundred and forty-four by twelve. Two hundred and eleven by five; three hundred and ninety-six by seven; five hundred and forty-eight by nine; nine hundred and nine by ten: a thousand and forty-nine by eleven; twelve thousand and eighty-seven by twelve.

EXERCISES ON THE SECOND FORM OF DIVISION.

By means of figures and the sign (÷) divided by, and (=) equal to, $8 \div 2$; $12 \div 3$; $17 \div 5$; $21 \div 6$; $35 \div 7$; $49 \div 8$; $73 \div 9$; $100 \div 10$; $217 \div 11$; $426 \div 12$; $792 \div 2$; $1014 \div 3$.

What is the quotient of 1370÷4; 9603÷5; 10408÷6: 79213÷7; 840031÷8; 948726÷9; 10000149÷10; 794063÷11; 12379046÷12; 846203101÷100; 87634002÷1000; 76540807÷20; 30104065÷30; 72094653÷50; 89643012÷70; 46280541÷90; 736540812÷120; 49570412÷1200.

EXERCISES ON THE THIRD FORM OF DIVISION.

By means of figures without the signs, or the common form,

2)9 | 3)12 | 6)18 | 7)21 | 8)32 | 9)75 | 10)89

11)1111 | 12)102468 | 100)6400876 | 200)37246800

300)41420673 | 400)86504873 | 500)137001101

700)95406171 | 900)548726004 | 1000)7320465120

6000)72004000 | 8000)842316528 | 11000)90087631114

12000)763004287 | 10000)1000000000 | 11000)101010101010

12000)654328769004

EXERCISES ON THE FOURTH FORM OF DIVISION.

By means of questions, as :—

1. If a ship sails 148 miles in a day of 12 hours, what number of miles does it sail in one hour ?

2. In 10 hours a train travels 470 miles ; how many miles does it travel in an hour ?

3. The Persians, under Xerxes, at the invasion of Greece, amounted to 2,100,000 men—the largest army the world ever saw—of how many regiments did it consist, supposing each to contain 800 men ?

4. The National Debt of England is 800,000,000 pounds sterling ; how much, to clear it off, must each person pay, taking the population at 30,000,000 ?

5. The great temple in Lassa, Thibet, contains 10,000 apartments, and suppose it has a hundred and fifty thousand windows ; how many windows are there to each apartment ?

6. The earth, in its course round the sun, travels at the rate of sixty-eight thousand miles an hour ; how many miles is this in a minute ?

7. The earth is 8000 miles in diameter ; the sun is 900,000 miles ; how many times less in diameter is the earth to that of the sun

8. One million is to be divided among twelve children; how much money will each receive?

9. Kunchin-junga, the highest mountain in the world, is $5\frac{1}{4}$ miles high, or 28,000 feet; the highest spire, Salisbury cathedral, in Britain, is about 400 feet; how many of these spires placed the one on the top of the other, would it take to reach the height of Kunchin-junga?

10. A carriage wheel is 12 feet in circumference; how many times must it turn round in travelling over a distance of 50 miles, there being 5280 feet in a mile?

EXERCISES ON THE FIFTH FORM OF DIVISION.

By means of continued division, as :—

$$240 \div 4 \div 3 \div 5 = 4.$$

What is the quotient of

$1680 \div 4 \div 5 \div 7 \div 2$?; $33600 \div 8 \div 10 \div 12$?; $672000 \div 12 \div 8 \div 7$?; $1000000 \div 10 \div 100 \div 1000$?; $14641 \div 11 \div 11 \div 11$?; $20736 \div 12 \div 12 \div 12$?; $320000 \div 20 \div 20 \div 20 \div 20$?

ADDITIONAL RULES AND FORMS OF THE MULTIPLICATION OF SIMPLE NUMBERS.

Rule 1.—When for the multiplier you can find two numbers, which, when multi-

plied together, produce that multiplier, use them instead of the multiplier, as it saves the addition of lines; always excepting 12, 20, 30, etc., 100, 200, etc.

Multiply 756 by 14. Here use the numbers 2 and 7, factors of 14, because the composite numbers, $2 \times 7 = 14$.

$$\begin{array}{r} 756 \\ 2 \\ \hline 1512 \\ 7 \\ \hline 10584 \end{array}$$

In the ordinary way this would be

$$\begin{array}{r} 756 \\ 14 \\ \hline 3024 \\ 756 \\ \hline 10584 \end{array}$$

But, suppose it is required to multiply by 13, 17, 19, 23, 26, 29, etc., for which you cannot find composite numbers; then in these cases the multiplication must be carried on in the ordinary way.

Exercises in multipliers, for which composite numbers, or factors can be found.

368 × 15	4786 × 16	3087 × 18	9508 × 20
3	4	3	20
5	4	6	

4978 × 21
3
7

40831 × 22; 695104 × 24; 101248 × 25;
6931102 × 27; 31406703 × 28; 72849 × 32;
2931104 × 33; 210641 × 35; 6758970 × 36;
724912 × 42; 3110695 × 44; 102632 × 45;
8764103 × 48; 2764903 × 50; 2911047 × 54;
392765 × 55; 7200648 × 56; 9213254 × 60;
1982437 × 63; 472589 × 64; 8563124 × 66;
2973546 × 66: 492831 × 72; 231046 × 77;
1334567 × 80; 2135462 × 81; 3765912 × 84;
695489 × 88; 7862004 × 96; 11223344 × 99;
6842051 × 100; 64915 × 108; 943261 × 110;
7102132 × 120; 246541 × 121; 478630 × 132;
95419687359876 × 144.

MULTIPLIERS CONTAINING FRACTIONS.

RULE 2.—When multipliers contain a fraction whose upper figure is 1, first multiply by the whole number, and then divide the multiplicand by the lower figure of the fraction, and add this to that part of the answer already found. The amount will be the answer.

For example, multiply 468 by $2\frac{1}{4}$.

4)468
$2\frac{1}{4}$

936 = 2 times the multiplicand.
117 = $\frac{1}{4}$ of the multiplicand.
1053 = $2\frac{1}{4}$ times, the product.

EXERCISES.—Multiply 346 by $2\frac{1}{4}$; 476 by $3\frac{1}{2}$; 396 by $4\frac{1}{4}$; 762 by $5\frac{1}{2}$; 1000 by $6\frac{1}{4}$; 1278 by $7\frac{1}{2}$; 1728 by $8\frac{1}{4}$: 6902 by $9\frac{1}{2}$; 13465 by $10\frac{1}{5}$; 467036 by $11\frac{1}{6}$; 52134 by $12\frac{1}{7}$; 69493 by $13\frac{1}{8}$; 76945 by $19\frac{1}{9}$; 940073 by $20\frac{1}{10}$; 100469 by $26\frac{1}{11}$; 79485 by $37\frac{1}{12}$

RULE 3.—When multipliers contain fractions having their upper figures more than 1, multiply by the whole number, then take the multiplicand to one side, and multiply it by the upper figure of the fraction, and divide the result by the lower figure; this number is then placed under that part of the answer already found, and added to it. The amount will be the product required.

For example. Multiply 6421 by $11\frac{3}{4}$.

6421
$11\frac{3}{4}$

70631 = 11 times.
$4815\frac{3}{4}$ = $\frac{3}{4}$ „
$75446\frac{3}{4}$ = $11\frac{3}{4}$ times.

6421
3
4)19263
$4815\frac{3}{4}$ carry over.

EXERCISES. — Multiply 7694 by $17\frac{3}{4}$; 47061 by $23\frac{3}{4}$; 5061 by $30\frac{3}{4}$; 96321 by $39\frac{3}{4}$; 46284 by $43\frac{2}{3}$; 56912 by $57\frac{3}{5}$; 76904 by $61\frac{5}{6}$; 48009 by $73\frac{6}{7}$; 731204 by $82\frac{7}{8}$; 49261 by $95\frac{8}{9}$; 30462 by $100\frac{9}{10}$; 50962 by $120\frac{10}{11}$; 1748653 by $2463\frac{11}{12}$.

ADDITIONAL RULES AND FORMS OF THE DIVISION OF SIMPLE NUMBERS.

RULE 1.—When for the divisor you can find two numbers which, when multiplied together produce that divisor, use them instead of the divisor.

For example. Divide 4360152 by 18.

$$18 \left\{ \times \begin{array}{l} 3)4360152 \\ 6)1453384 \\ \hline 242230\frac{12}{18} \end{array} \right.$$

In the above example it will be seen that there is a remainder of $\frac{12}{18}$. How this is got is thus: there is the remaining figure 4 in the second line, which may be called the second remainder; this is multiplied by the first divisor 3, which make 12 the true remainder, and under it is placed the whole divisor, 18—hence $\frac{12}{18}$.

Second Example.—Divide 4726084 by 21.

$$21 \left\{ \times \begin{array}{l} 3)4726084 \\ 7)1575361-1 \\ \hline 225051-4 \end{array} \right\} = \frac{3}{1}\frac{1}{2}$$

In this example there are two remainders, which may be called the First and Second Remainders: here again the second remainder and the first divisor are multiplied together, and the first remainder is merely

added; as 4 times 3 are 12 and 1 = 13; under which place the whole divisor, making the true remainder $\frac{13}{21}$.

EXERCISES.

Divide 394652 by 14; 840113 by 16; 392145 by 18; 628341 by 21; 485632 by 22; 116644 by 24; 867905 by 25; 710248 by 27; 143279 by 28; 621347 by 32; 391002 by 33; 215864 by 35; 876491 by 42; 271014 by 44; 1100224 by 45.

Find the quotient of 7291043 ÷ 48; 920047 ÷ 49; 301684 ÷ 54; 8271532 ÷ 55; 421604 ÷ 56; 347104 ÷ 63; 742853 ÷ 64; 2105376 ÷ 66; 284231 ÷ 72; 369548 ÷ 77; 4869152 ÷ 81; 479386 ÷ 84; 682491 ÷ 88; 4276310 ÷ 96; 728145 ÷ 99; 287634 ÷ 108; 2463129 ÷ 110; 468731 ÷ 121; 654307 ÷ 132; 648729146 ÷ 144.

DIVISORS CONTAINING FRACTIONS.

RULE 2.—When divisors contain a fraction, place the *under figure* of the fraction under the whole number of the divisor and multiply it, and at the same time take care to add in the *upper figure* of the fraction; thus making a simple number of the divisor. But if the divisor be multiplied by any number in this way, you must also multiply the dividend by the same number, and then proceed with the division.

For example, divide 431628 by $4\frac{1}{2}$.

$4\frac{1}{2}$ | $4\frac{1}{2})431628$
2 | 2
— | 9)863256
9 | $95917\frac{3}{9}$
=

EXERCISES.

Divide 763210 by $1\frac{1}{2}$; 2473852 by $1\frac{1}{4}$; 6847003 by $1\frac{3}{4}$; 3285674 by $1\frac{1}{3}$; 3687490 by $1\frac{2}{5}$; 369485 by $1\frac{4}{7}$; 347281 by $1\frac{3}{8}$; 762843 by $1\frac{3}{9}$; 286413 by $2\frac{1}{4}$; 765391 by $3\frac{1}{2}$; 684312 by $2\frac{3}{4}$; 629472 by $3\frac{2}{3}$; 654701 by $4\frac{1}{2}$; 765391 by $5\frac{1}{2}$.

RULE 3.—Before dividing a given dividend by a given divisor, first consider if each of them can be divided by some number without leaving a remainder; if so, use the two numbers found instead of the dividend and divisor already given; the answer will be the same.

For example, divide 1000 by 24; here the common form would be in long divisison.

24)1000(41$\frac{2}{3}$ Ans.
96
—
40
24
—
16
— = $\frac{2}{3}$
24

But suppose we first divided the divisor and dividend by 8, the result would be the same, with the advantage of short division, viz. :—

$$\begin{array}{r|l} 24 & 1000 \\ 3 & 125 \\ \hline & 41\frac{2}{3} \end{array}$$ Ans. the same as above.

EXERCISES IN ABRIDGED DIVISION.

Divide 84680 by 64; 73297 by 63; 86493 by 77; 71016 by 108; 89460 by 110; 76356 by 132; 96780 by 144.

LONG DIVISION.

RULE 4.—When the divisor is more than 12, and when composite numbers cannot be found for it, long division is required. This form of division proceeds as follows :—If the divisor consists of two figures, take the first two in the dividend and try if the divisor will go into them; if not, you must then take the next figure and divide, placing the number of times found, in the quotient, on the right of the dividend; then multiply the divisor by the figure so placed in the quotient, and place the result under the first two or three figures taken in the dividend; subtract the result from these figures, and to the remainder found, bring down and attach the next figure in the dividend to this remainder; proceed to divide this number as before, and continue in this manner till all the figures are brought down and the whole division completed.

For example, divide 8765432 by 13.

```
13)8765432(674264   Quotient or answer.
  78
  ---
 13) 96
     91
     --
 13)  55
      52
      --
 13)  34
       26
       --
 13)  83
       78
       --
 13)  52
       52
       ==
```

You must here observe that each remainder, with the figure brought down from the dividend, forms a new dividend, and the divisor is repeated as often as dividends are formed. Generally, however, we repeat the divisor from memory, or casting up our eyes to it, in order to avoid placing it opposite each new dividend: thus

```
13)8765432(674264.
  78
  --
  96
  91
  --
  55
  52
  --
  34
  26
  --
  83
  78
  --
  52
  52
  ==
```

Exercises in Long Division.

Find the quotient of 1035548 ÷ 17; 569473 ÷ 19; 8960453 ÷ 23; 4873011 ÷ 26; 6938041 ÷ 29; 4210162 ÷ 31; 3964872 ÷ 34; 2876500 ÷ 37; 9632548 ÷ 38; 3290654 ÷ 39; 7631410 ÷ 41: 7006325 ÷ 43; 7277661 ÷ 46; 2873916 ÷ 47; 8642019 ÷ 51; 6330221 ÷ 52; 2876390 ÷ 53; 647283 ÷ 57.

Divide 3961047 by 58; 6824131 by 59; 9647017 by 61; 5601283 by 62; 4867106 by 65; 8909090 by 67; 7019023 by 68; 7629148 by 69; 3476000 by 69; 3876904 by 71; 648908 by 73; 4687689 by 74; 4896947 by 75; 9006699 by 76; 1100111 by 78.

How many times will seventy-nine be found in 635480672? Eighty-two in 4867301? Eighty-three in 569094? Eighty-five in 1000000? Eighty-six in 11111111? Eighty-seven in 1010101? Eighty-nine in 9999999? Ninety-one in 8888888? Ninety-two in 7777777? Ninety-three in 6,666,666? Ninety-four in 555555? Ninety-five in 4444444? Ninety-seven in 3333333? Ninety-eight in 2,222,222?

101 in seven hundred and thirty-nine thousand four hundred and eighty-five?

102 in 3 millions 4 hundred and 20 thousand and 22? 103 in 7 millions 54 thousand 9 hundred and seventeen? 217 in 19 millions? 513 in twenty-two thousand 900 and 24? 438 in 200000011? 796 in thirteen millions and 762? 4695 in 310463287? 57041 in 96547289? 89204 in 11012348?

DIVISORS CONTAINING FRACTIONS.

Divide 407632 by 23 .

$$
\begin{array}{l}
23\tfrac{1}{2})407632 \\
\quad 2 \qquad\quad 2 \\
\overline{47\ })815264(17346\tfrac{2}{47} \\
\quad\ 47 \\
\quad\overline{345} \\
\quad\ 329 \\
\quad\overline{\ 162} \\
\quad\ 141 \\
\quad\overline{\ 216} \\
\quad\ 188 \\
\quad\overline{\ 284} \\
\quad\ 282 \\
\quad\overline{\ 2}
\end{array}
$$

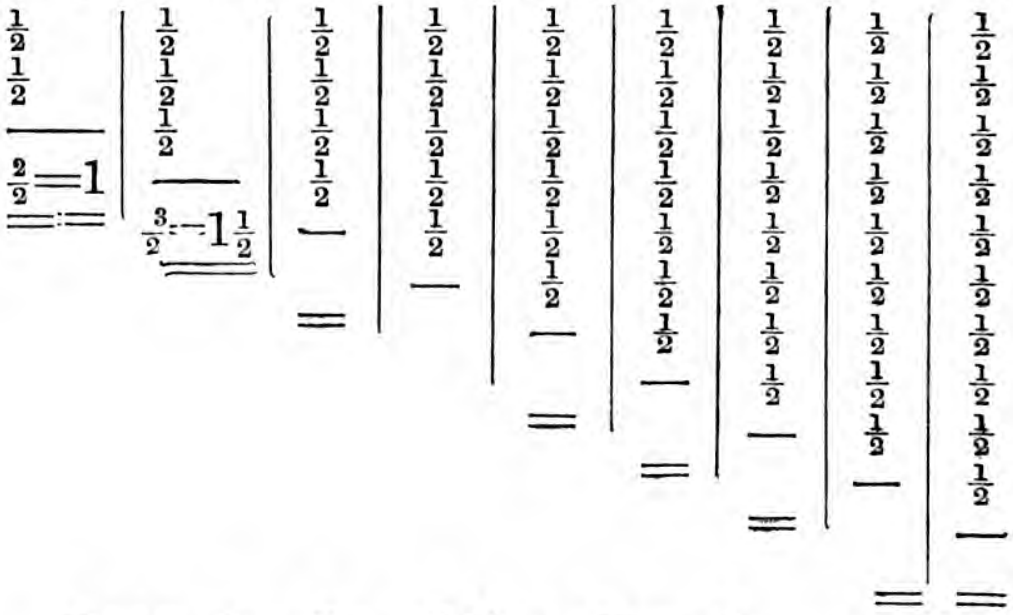
Divide 632087 by $19\frac{3}{4}$; 549687 by $29\frac{1}{4}$; 698404 by $37\frac{1}{2}$; 849625 by $43\frac{1}{4}$; 568723 by $59\frac{3}{4}$; 729004 by $68\frac{1}{4}$; 276487 by $71\frac{1}{2}$; 864932 by $97\frac{1}{8}$; 999999 by $99\frac{3}{8}$.

Find the quotient of $1010101 \div 100\frac{1}{4}$; $2121210 \div 111\frac{1}{2}$; $1313136 \div 137\frac{7}{8}$; $2780001 \div 379\frac{5}{16}$; $76904887 \div 7632\frac{17}{25}$; $4689128 \div 5004\frac{1}{10}$; $30625476 \div 76104\frac{46}{100}$; $8964785 \div 372\frac{476}{1001}$.

ADDITION OF THE SIMPLER FRACTIONS.

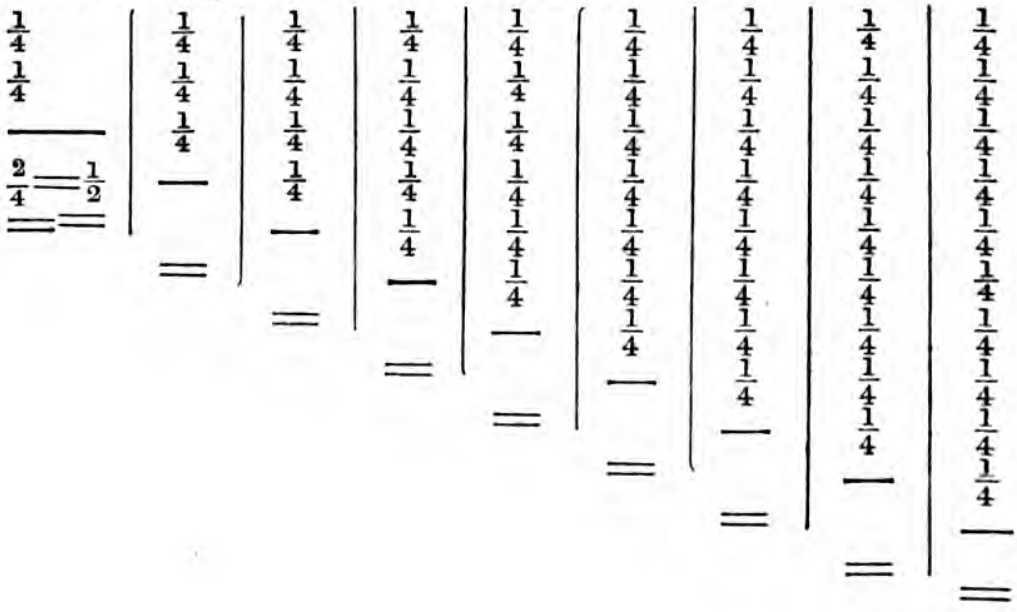
RULE 1.—In adding Halves or Half-pennies, *the ones*, or upper figures, called the numerators of the fractions, are merely added together, and the amount divided by 2, the under figure, or denominator common to them all.

EXERCISES.



RULE 2.—In adding Fourths, or Farthings, the *ones* are also added, and then divided by 4.

EXERCISES.

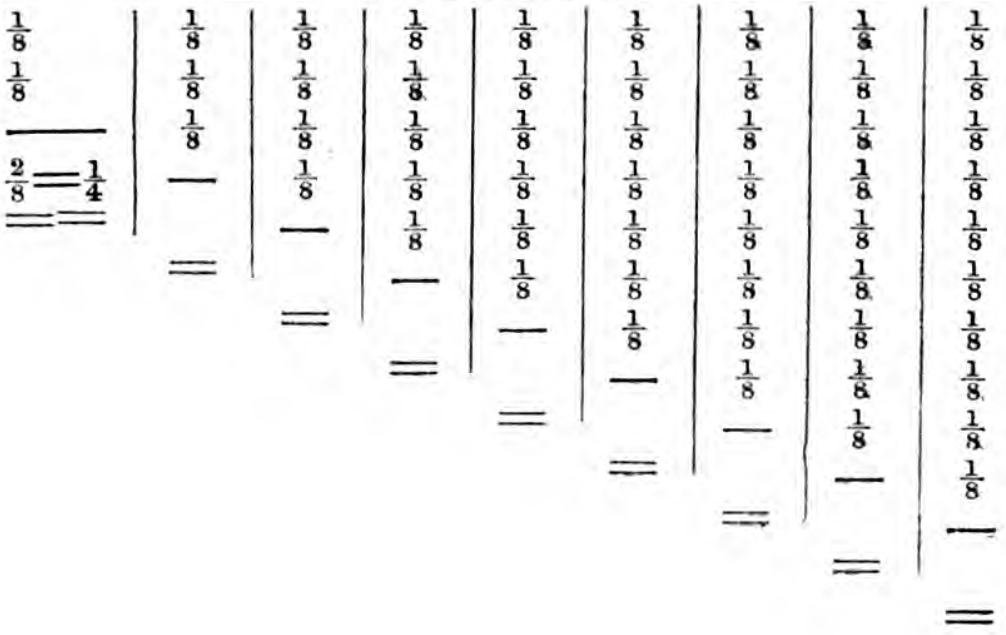


RULE 3.—In adding Three-fourths, or Three-farthings, the *threes* are added, and afterwards divided by 4.

EXERCISES.

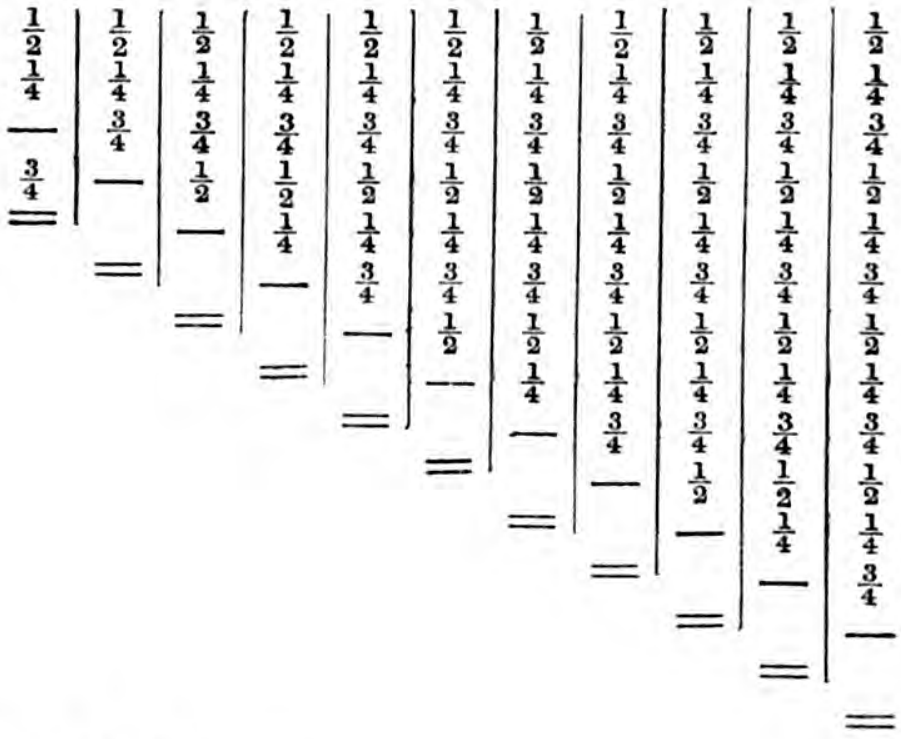
RULE 4.—In adding Eighths, or Half-farthings, the *ones* are added, and then divided by 8.

EXERCISES.



RULE 5.—In adding Halves and Fourths, or Halfpennies and Farthings, the halves are turned into fourths by multiplying by 2, then all the upper figures are added, and the sum divided by 4.

EXERCISES.



Find the sum

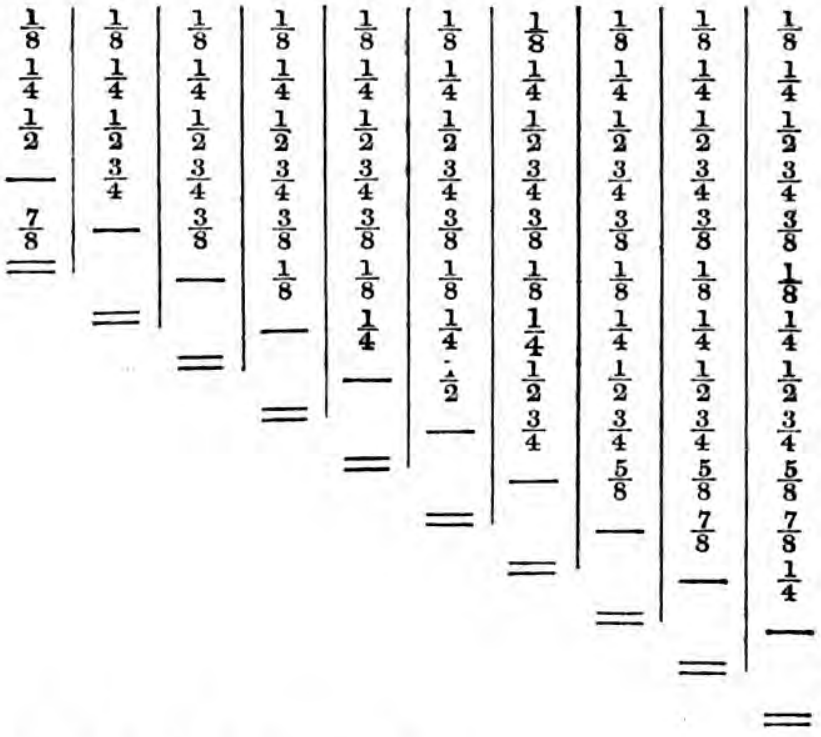
of $\frac{1}{4} + \frac{1}{2} + \frac{3}{4} + \frac{1}{4} + \frac{3}{4} + \frac{1}{2} + \frac{1}{4} + \frac{3}{4} + \frac{1}{2}$; and

Find the amount

of $\frac{3}{4} + \frac{1}{4} + \frac{1}{2} + \frac{1}{4} + \frac{3}{4} + \frac{1}{2} + \frac{3}{4} + \frac{1}{4} + \frac{1}{2}$.

RULE 6.—In adding Eighths, Fourths, and Halves, the fourths are turned into eighths by multiplying by 2, and the halves are turned into eighths by multiplying by 4; the upper figures are then added, and their sum divided by 8.

EXERCISES.



What is the amount

of $\frac{1}{4} + \frac{3}{8} + \frac{1}{2} + \frac{7}{8} + \frac{1}{4} + \frac{5}{8} + \frac{1}{2} + \frac{3}{4} + \frac{3}{8}$;

Find the answer

of $\frac{3}{4} + \frac{7}{8} + \frac{3}{8} + \frac{1}{2} + \frac{5}{8} + \frac{3}{4} + \frac{1}{2} + \frac{7}{8} + \frac{1}{4} + \frac{1}{8}$.

ADDITION OF MIXED NUMBERS.

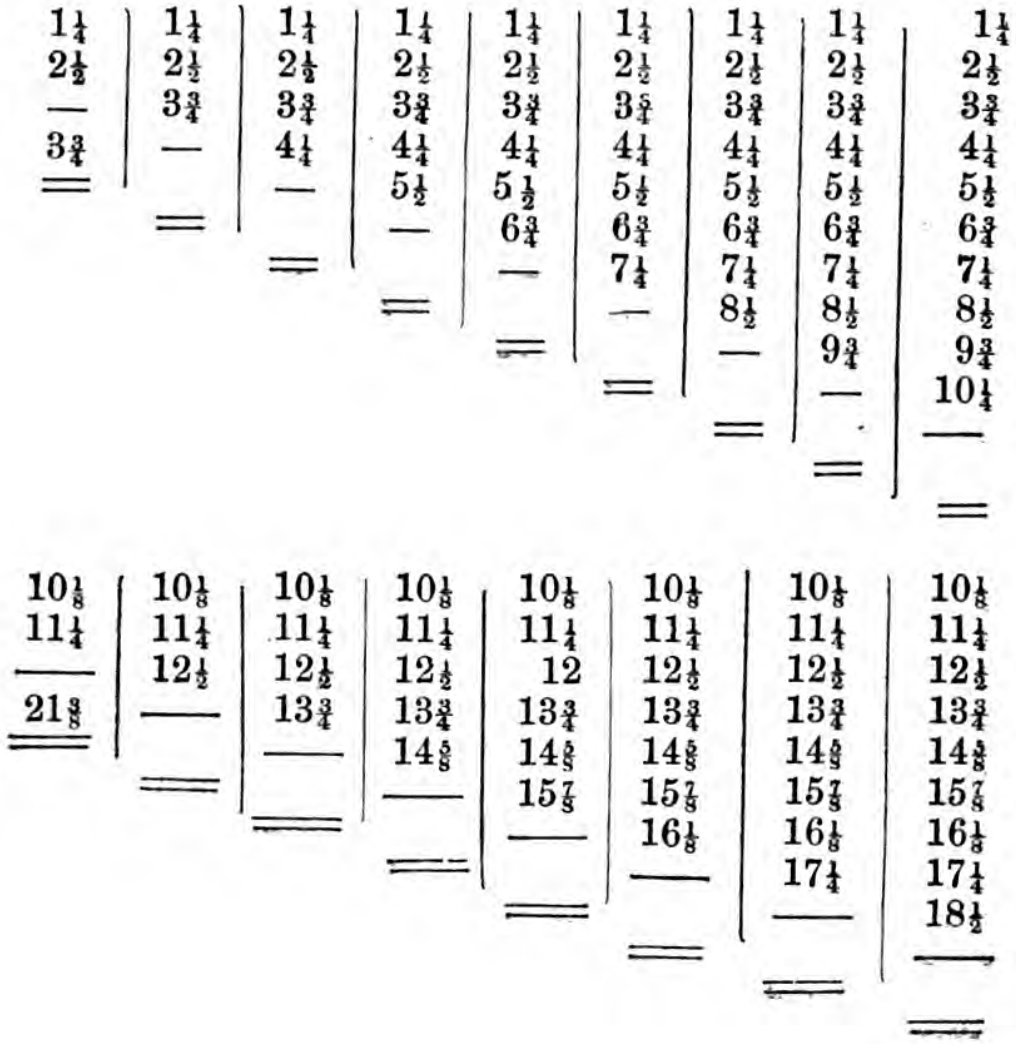
GENERAL RULE.

In adding Mixed Numbers, the addition of the fractions, according to the rules already given, is first performed, and the *whole* numbers found are carried to the units column.

EXERCISES.

$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$
	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$
4		$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$
			$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$
				$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$
					$7\frac{1}{2}$	$7\frac{1}{2}$	$7\frac{1}{2}$	$7\frac{1}{2}$
						$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$
							$9\frac{1}{2}$	$9\frac{1}{2}$
								$10\frac{1}{2}$

$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$
$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$
	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$	$3\frac{1}{4}$
$3\frac{1}{2}$		$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{4}$
			$5\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{1}{4}$
				$6\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{1}{4}$	$6\frac{1}{4}$
					$7\frac{1}{4}$	$7\frac{1}{4}$	$7\frac{1}{4}$	$7\frac{1}{4}$
						$8\frac{1}{4}$	$8\frac{1}{4}$	$8\frac{1}{4}$
							$9\frac{1}{4}$	$9\frac{1}{4}$
								$10\frac{1}{4}$



SUBTRACTION OF THE SIMPLE FRACTIONS.

GENERAL RULE.

Reduce the fractions to the same name, subtract the numerator of the lower fraction from the numerator of the fraction above it, and place the remainder underneath.

EXERCISES.

$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{3}{8}$	$\frac{3}{4}$
$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{5}{8}$
—	—	—	—	—	—	—	—	—	—	—	—
=	=	=	=	=	=	=	=	=	=	=	=

SUBTRACTION OF MIXED NUMBERS.

GENERAL RULE.

When the *upper* is *less* than the *under* fraction, add a *whole* number to the upper, and then subtract; at the same time bearing in mind that *one* is to be added to the under unit column before subtracting from the whole number :—for example, From $48\frac{1}{2}$
Take $33\frac{3}{4}$
$14\frac{3}{4}$

EXERCISES.

$2\frac{1}{2}$*	$4\frac{3}{4}$	$6\frac{3}{4}$	$8\frac{7}{8}$	$10\frac{5}{8}$	$12\frac{3}{4}$	$14\frac{1}{4}$	$16\frac{1}{8}$
$1\frac{1}{4}$	$2\frac{1}{4}$	$3\frac{1}{2}$	$4\frac{5}{8}$	$7\frac{1}{4}$	$9\frac{3}{8}$	$12\frac{1}{2}$	$13\frac{3}{4}$
—	—	—	—	—	—	—	—
=	=	=	=	=	=	=	=

$18\frac{3}{8}$	$20\frac{1}{2}$	$22\frac{1}{8}$	$24\frac{1}{2}$	$26\frac{3}{4}$	$30\frac{1}{8}$	$36\frac{3}{8}$
$15\frac{1}{4}$	$17\frac{3}{4}$	$19\frac{1}{2}$	$21\frac{3}{4}$	$24\frac{7}{8}$	$26\frac{1}{2}$	$31\frac{3}{4}$
—	—	—	—	—	—	—
=	=	=	=	=	=	=

ROMAN NUMERAL LETTERS.

I.= 1.	XV.=15.	C.= 100.
II.= 2.	XVI.=16.	CC.= 200.
III.= 3.	XVII.=17.	CCC.= 300.
IV.= 4.	XVIII.=18.	CD.= 400.
V.= 5.	XIX.=19.	D.= 500.
VI.= 6.	XX.=20.	DC.= 600.
VII.= 7.	XXI.=21.	DCC.= 700.
VIII.= 8.	XXX.=30.	DCCC.= 800.
IX.= 9.	XL.=40.	CM.= 900.
X.=10.	L.=50.	M.=1000.
XI.=11.	LX.=60.	MM.=2000.
XII.=12.	LXX.=70.	*MDCCCLXVIII.=1868.
XIII.=13.	LXXX.=80.	
XIV.=14.	XC.=90.	

* The number of the year in which this book was written. It will also be observed that this is the style of numbering the year when engraved on tombstones.

MENTAL ARITHMETIC.

Plus (+) means *more;* hence Addition.

1+0	=	1	11+11+11	=	33
1+1	=	2	12+12+12	=	36
1+1+1+1	=	4	13+13	=	26
2+0+1+2	=	5	13+13+13	=	39
2+0+3+2	=	7	14+14	=	28
3+3+3	=	9	14+14+14	=	42
3+4+3+2	=	12	15+15	=	30
3+4+5+6	=	18	16+16+15	=	47
6+7+5+4	=	22	17+17	=	34
7+8+7+2	=	24	17+17+18	=	52
8+8+8	=	24	18+18	=	36
9+9+9	=	27	18+18+19	=	55
10+10+10	=	30	19+19	=	38
10+11+12	=	33	19+19+20	=	58

20+20	= 40	50+50+60	= 160
20+20+30	= 70	90+90+90	= 270
30+30	= 60	100+100+90	= 290
30+30+40	= 100	250+250	= 500
40+40	= 80	300+300+300	= 900
40+40+50	= 130	450+450	= 900
50+50	= 100	500+500	= 1000

Minus (—) means *less;* hence Subtraction.

1—0	= 1	23—9—4	= 10
1—1	= 0	31—7—1	= 23
2—1	= 1	42—6—12	= 24
2—2	= 0	50—25—10	= 15
4—2	= 2	60—20—3	= 37
5—2	= 3	90—45	= 45
7—3	= 4	100—50—25	= 25
9—4	= 5	200—50	= 150
9—3—2	= 4	400—25—300	= 75
15—7—6	= 2	1000—500—250	= 250
18—11—2	= 5		

Plus and Minus mixed.

1+3—2	= 2	17+4—19	= 2
2+4—1	= 5	20—11+9	= 18
5+6—4	= 7	25+25—15	= 35
7+7—5	= 2	89—19+12	= 82
8—5+7	= 10	95+5—50	= 50
9+9—9	= 9	100—25+19	= 94
9—3+10	= 16	200+150—100	= 250
10+2—5	= 7	500—250+10	= 260
11—11+17	= 17	1000+400—75	=1325
13+11—21	= 3	1000—500+500	=1000
13—11+21	= 23	1000+500—1500	= 0

Multiplication.

1×0	= 0	11×11 (square of 11)	= 121
9×0	= 0	12×12 (,, 12)	= 144
100×0	= 0	1×1×0	= 0
1000×0	= 0	1×1×1×1	= 1
1×1 (square of 1)	= 1	9×12×0	= 0
5×1	= 5	12×0×375	= 0
39×1	= 39	1×1×1 (cube of 1)	= 1
1004×1	=1004	2×2×2 (,, 2)	= 8
1×2	= 2	3×3×3 (,, 3)	= 27
2×2 (square of 2)	= 4	4×4×4 (,, 4)	= 64
3×3 (,, 3)	= 9	5×5×5 (,, 5)	= 125
4×4 (,, 4)	= 16	6×6×6 (,, 6)	= 216
5×5 (,, 5)	= 25	7×7×7 (,, 7)	= 343
6×6 (,, 6)	= 36	8×8×8 (,, 8)	= 512
7×7 (,, 7)	= 49	9×9×9 (,, 9)	= 729
8×8 (,, 8)	= 64	10×10×10 (,, 10)	=1000
9×9 (,, 9)	= 81	11×11×11 (,, 11)	=1331
10×10 (,, 10)	= 100	12×12×12 (,, 12)	=1728

+, —, and × mixed.

1+1—1×1	= 1	3+36×1—19	= 20
1+2—1×0	= 0	17×3—9+13	= 50
5—1+4×2	= 16	50—45+5×10	=100
3×6—12+3	= 9	1000+300—1300×12	= 0
8—2×3+12	= 30	6×7+58—(10×10)	= 0
27×0+13—2	= 11	1+17—2×4	= 64
13—6×12+0	= 84	33—3×4+120	=240

Division or divided by (÷)

1÷1	=	1	18÷3	=	6
2÷1	=	2	15÷5	=	3
3÷1	=	3	12÷3÷2	=	2
12÷1	=	12	15÷3÷5	=	1
0÷1	=	0	28÷4÷7	=	1
379÷1	=	379	45÷5÷3	=	3
1000÷1	=	1000	60÷4÷3	=	5
6÷2	=	3	96÷8÷2	=	6
8÷2	=	4	100÷4÷5	=	5
9÷3	=	3	144÷3÷12	=	4
12÷4	=	3	1000÷10÷4	=	25

Plus, Minus, multiplied by, and divided by, mixed, or +, —, ×, and ÷ mixed.

1+1—1×1÷1	= 1	11+11—11×11÷11	= 11
2+2—2×2÷2	= 2	12—12×12÷12+12	= 12
3+3—3×3÷3	= 3	11+9—4×2÷4	= 8
4—4×4÷4+4	= 4	12+14—8×2÷4	= 9
5×5÷5+5—5	= 5	25+15—8×3÷8	= 12
6÷6+6—6×6	= 6	32×2—20+6÷5	= 10
7+7—7×7÷7	= 7	75—15×2÷10+5	= 17
8—8×8÷8+8	= 8	87+9÷12—4×5	= 20
9×9÷9+9—9	= 9	100÷4×3—15+11	= 71
10÷10+10—10×10	= 10	1000+500×4÷600—10	= 0

TABLES OF WEIGHTS AND MEASURES.

These may be divided into Seven Sections.

1. Measures of **Value**, as in Money.
2. ,, ,, **Weight**, as in Troy Weight.
3. ,, ,, **Capacity**, as in Liquids and Grain.
4. ,, ,, **Time**, as in Years, Days, etc.
5. ,, ,, **Length**, as in Miles, Yards, etc.
6. ,, ,, **Length and Breadth**, as in Surfaces.
7. ,, ,, **Length, Breadth, and Thickness**, as in Solids.

ENGLISH MONEY.

Contractions of words, etc., used in this Table.

¼d. means a farthing, or fourth part of a penny.
½d. ,, two farthings, or a halfpenny.
¾d. ,, three farthings, or three fourths of a penny.
1d. ,, a penny.
1s. or 1/- means a shilling.
£1 means a pound, or 20 shillings.
@ ,, at; such as 25 @ 4/- = £5.
% ,, per cent. or per 100, or £100: such as 5 %, or 5 per cent. or per 100.

4 farthings = 1*d.*, or penny.
12 pence = 1/-, or shilling.
20 shillings = £1, or pound.
21 shillings = 1 guinea.

2 shillings = a florin.
2/6 = half-a-crown.
5/- = a crown.
10/- = half a sovereign.

48 farthings = 1/-
960 ,, = £1.
1008 ,, = 1 guinea.
24 pence = 2/-
30 ,, = 2/6

60 pence = 5/-
120 ,, = 10/-
240 ,, = £1.
252 ,, = a guinea.

d.		*s.*	*d.*	*d.*		*s.*	*d.*	*d.*		*s.*	*d.*	
18	=	1	6	60	=	5	0	108	=	9	0	
20	=	1	8	70	=	5	10	120	=	10	0	
24	=	2	0	72	=	6	0	132	=	11	0	
30	=	2	6	80	=	6	8	144	=	12	0	
36	=	3	0	84	=	7	0	180	=	15	0	
40	=	3	4	90	=	7	6	200	=	16	8	
48	=	4	0	96	=	8	0	500	=	£2	1*s.*	8*d.*
50	=	4	2	100	=	8	4	1000	=	£4	3	4
								1200	=	£5	0	0

Numbers are called *compound* when expressing higher or lower values of things; as a pound (or £1) is of higher value than a shilling (or 1/-); a shilling a higher value than a penny (or 1*d.*); a penny a higher value than a farthing (or $\frac{1}{4}d.$) So the reverse, a $\frac{1}{4}d.$ is of lower value than a 1*d.*; a penny of lower value than 1/-; a shilling of lower value than a £1; and so on with the different weights and measures. The common name used for these values, is the word *denomination:* thus we say a pound is of higher denomination than a shilling, and a farthing is of lower denomination than a penny.

Hence the numbers of £3 12*s.* $6\frac{1}{4}d.$, or three pounds twelve shillings and sixpence farthing.

4 lbs. 7 oz. 8 drs., or 4 pounds 7 ounces 8 drams.

15 miles 3 furlongs 27 poles $3\frac{1}{2}$ yards.
3 months 17 days 11 hours 29 minutes and 31 seconds, are all *compound* numbers.

MENTAL ARITHMETIC QUESTIONS ON THIS TABLE.

The following Rules, however, must first be observed.

REDUCTION ASCENDING.

Reduction Ascending means reducing a lower to a higher name, as from farthings upwards.

When farthings are to be turned into pence. Divide the number of farthings by 4; the quotient will be the pence, and any remainder will be *farthings over*.

EXAMPLE.—Reduce 39 farthings to pence.

4)39

$9\frac{3}{4}$

When pence are to be turned into shillings: Divide the number of pence by 12; the quotient will be the shillings, and any remainder will be *pence over*.

EXAMPLE.—Reduce 76 pence to shillings.

12)76

6*s.* 4*d.*

When shillings are to be turned into pounds: Divide the number of shillings by 20; the quotient will be the pounds, and any remainder will be *shillings over*.

EXAMPLE.—Reduce 219 shillings to pounds.

20)219

£10 19*s*.

EXERCISES IN REDUCTION ASCENDING.

The numbers given to be divided by 4.

REDUCE 5 farthings to pence; 6 far. to pence; 7 far. to pence; 8 far. to pence; 9 far. to pence; 10 far. to pence; 11 far. to pence; 12 far. to pence; 13 far. to pence; 15 far. to pence; 18 far. to pence; 27 far. to pence; 39 far. to pence: 54 far. to pence; 98 far. to pence; 100 far. to pence; 120 far. to pence.

The numbers given to be divided by 12.

REDUCE 15 pence to shillings; 17 pence to shills.; 18 pence to shills.; 20 pence to shills.; 27 pence to shills.; 40 pence to shills.; 63 pence to shills.; 79 pence to shills.; 84 pence to shills.; 98 pence to shills.; 100 pence to shills.; 129 pence to shills.; 200 pence to shills.; 240 pence to shills.

The numbers given to be divided by 20.

REDUCE 25 shillings to pounds; 30s. to £; 40s. to £; 55s. to £; 63s. to £; 79s. to £; 87s. to £; 96s. to £; 100s. to £; 130s. to £; 160s. to £; 200s. to £; 240s. to £.

REDUCTION DESCENDING.

Reduction Descending means reducing from a higher to a lower name; as, from pounds to farthings.

When pounds are to be turned into shillings: Multiply the number of pounds by 20; the product will be the shillings.

EXAMPLE.—Reduce £37 to shillings.

37
20
740 shillings.

When shillings are to be turned into pence: Multiply the number of shillings by 12; the product will be the pence.

EXAMPLE.—Reduce 16 shillings to pence.

16
12
192 pence.

When pence are to be turned into farthings: Multiply the number of pence by 4; the product will be the farthings.

EXAMPLE.—Reduce 7 pence to farthings.

7
4
28 farthings.

N.B.—The above two modes of reduction are applied to all the other Tables, having regard to the different numbers used in each.

EXERCISES IN REDUCTION DESCENDING.

The numbers given to be multiplied by 20.

REDUCE £1 to shillings; £2 to shills.; £5 to shills.; £10 to shills.; £15 to shills.; £27 to shills.; £35 to shills.; £79 to shills.; £96 to shills.; £100 to shills.; £150 to shills.; £217 to shills.; £729 to shills.; £1000 to shills.; £4893 to shills.

The numbers given to be multiplied by 12.

REDUCE 1s. to pence; 2s. to pence; 2s. 6d. to pence; 4s. to pence; 5s. to pence; 7s. to pence; 9s. to pence: 10s. to pence; 14s. to pence; 17s. to pence; 19s. to pence; 20s. to pence; 27s. to pence; 35s. to pence; 49s. to pence; 56s. to pence; 70s. to pence; 84s. to pence; 96s. to pence; 100s. to pence.

The numbers given to be multiplied by 4.

REDUCE 1d. to farthings; 2d. to far.; 3d. to far.; 5d. to far.; 6d. to far.; 8d. to far.; 9d. to far.; 10d. to far.; 11d. to far.; 12d.

to far.; 14d. to far.; 16d. to far.; 18d. to far; 20d. to far.; 30d. to far.; 36d. to far.; 40d. to far.; 80d. to far.; 100d. to far.

MENTAL EXERCISES IN REDUCTION DESCENDING.

How many farthings in twopence? in 3d.? in 5d.? in 7d.? in 8d.? in 9d.? in 10d.? in 11d.? in 13d.? in 15d.? in 17d.? in 20d.? in 24d.? in 30d.? in 36d? in 40d? in 50d.? in 60d.? in 73d.? in 80d.? in 96d.? in 100d.?

How pence in 2 shillings? in 3s.? in 4s.? in 5s.? in 6s.? in 7s.? in 8s.? in 9s.? in 10s.? in 12s.? in 14s.? in 15s.? in 17s.? in 18s.? in 19s.? in 20s.?

How many shillings in 2 pounds? in £3? in £4? in £5? in £7? in £9? in £10? in £12? in £13? in £15? in £17? in £18? in £19? in £20? in £50? in £70? in £90? in £100?

MENTAL EXERCISES IN REDUCTION ASCENDING.

How many pence in 8 farthings? in 10 far.? in 12 far.? in 14 far.? in 15 far.? in 16 far.? in 18 far.? in 20 far.? in 24 far.? in 30 far.? in 32 far.? in 40 far.? in 48 far.? in 50 far.? in 56 far.? in 84 far.? in 96 far.? in 1000 far.? in 120 far.? in 132 far.? in 144 far.? in 242 far.? in 480 far.? in 960 far.?

How many shillings in 12 pence? in 15d.? in 18d.? in 20d.? in 24d.? in 30d.? in 40d.? in 48d.? in 50d.? in 60d.? in 70d.? in 72d.? in 80d.? in 84d.? in 90d.? in 96d.? in 100d.? in 120d.? in 144d.? in 200d.? in 240d.?

How many pounds in 20 shillings? in 30s.? in 40s.? in 50s.? in 60s. in 70s.? in 80s.? in 90s.? in 100s.? in 120s.? in 130s.? in 140s.? in 150s.? in 160s.? in 170s.? in 180s.? in 190s.? in 200s.? in 300s.? in 400s.? in 500s.? in 1000s.?

How many pence in a florin? in half-a-crown? in a crown? in ten shillings? in a pound? in a guinea?

AVOIRDUPOIS WEIGHT.

This weight is the most generally used in trade.

16 drams, or drs.	= 1 ounce, or oz.
16 oz.	= 1 pound, or lb.
28 lbs.	= 1 quarter, or qr.
4 qrs.*	= 1 hundred weight, or cwt.
20 cwt.	= 1 ton.

* A quarter is a fourth part of a hundred weight.

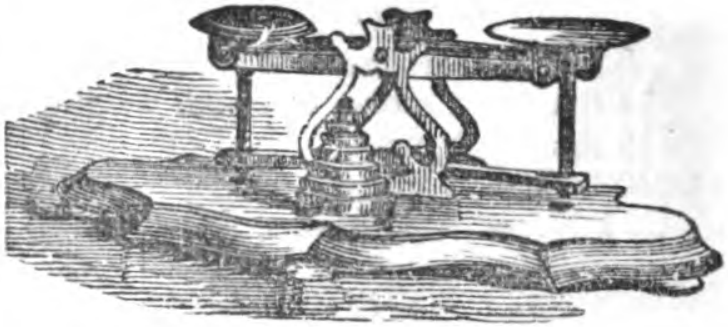
ADDITIONAL.

8 lbs. = 1 stone of Butchers' meat.
14 lbs. = 1 stone, common weight.
112 lbs. = 1 cwt.
2240 lbs. = 1 ton.
1 lb. = 7000 grains.

EXERCISES.

How many ounces in 16 drams? How many pounds in 16 ounces? How many quarters in 28 lbs.? How many hundred weight in 4 quarters? How many tons in 20 hundred weight? How many pounds in 1 stone of butchers' meat? How many pounds in 1 stone of common weight? How many pounds in 1 hundred weight? How many pounds in 1 ton? How many grains in 1 lb. avoir.?

In 1 ton how many cwts.? In 1 cwt. how many qrs.? In 1 qr. how many lbs.? In one lb. how many oz. In 1 oz. how many drs.? How many oz. in 32 drs.? in 48 drs.? in 64 drs.? How many lbs. in 32 oz.? in 48 oz.? in 64 oz.? How many qrs. in 56 lbs.? in 84 lbs.? in 112 lbs.? How many cwts. in 5 qrs.? in 6 qrs.? in 7 qrs.? in 8 qrs.? in 10 qrs.? in 11 qrs.? in 12 qrs.? How many tons in 30 cwts.? in 40 cwts.? in 50 cwts.? in 60 cwts.? in 80 cwts.; in 100 cwt.? How many stones in 28 lbs.? in 42 lbs.? in 56 lbs.? in 112 lbs.? How many cwt. in 224 lbs.? in 336 lbs.? in 448 lbs.?



TROY WEIGHT.

This weight is used in weighing precious stones and metals, also liquids.

24 grains, or grs.	= 1 pennyweight, or dwt.
20 dwts.	= 1 oz.
12 oz.	= 1 lb.
4 grs.	= 1 carat.
25 lbs.	= 1 qr.
100 lbs.	= 1 cwt.
20 cwt.	= 1 ton.
1 lb.	= 5760 grs.

Exercises.

How many grains in 1 dwt.? How many dwts. in 1 oz.? How many ozs. in 1 lb.? How many grs. in 1 carat? How many lbs. in 1 qr.? How many lbs. in 1 cwt.? How many grs. in 1 lb.? How many tons in 20 cwt.? How many cwts. in 100 lbs.? How many grs. in 25 lbs.? How many carats in 4 grs.? How many lbs. in 12 ozs.? How many ozs. in 20 dwts.? How many dwts. in 24 grs.? How many dwts. in 48 grs.? in 72 grs.? in 96 grs.? in 120 grs.?

How many ozs. in 40 dwts.? in 60 dwts.? in 80 dwts.? in 100 dwts.? How many lbs. in 24 ozs.? in 36 ozs.? in 48 ozs.? in 60 ozs.? in 72 ozs.? in 84 ozs.? in 96 ozs.? in 144 ozs.? How many grs. in 2 lbs.? in 3 lbs.? in 5 lbs.? in 10 lbs.?

APOTHECARIES' WEIGHT.

This weight is used by chemists in weighing medicines.

The grain, ounce, and pound are the same as in Troy weight.

20 grs.	=	1 scruple, or ℈.
3 ℈	=	1 dram, or ʒ.
8 ʒ	=	1 ounce, or ℥.
12 ℥	=	1 lb.
1 lb.	=	5760 grs.

Exercises.

How many grs. in 1 scruple? How many scruples in 1 dram? How many drams in 1 oz.? How many ozs. in 1 lb.? How many grains in 1 lb.? How many lbs. in 12 ozs.? How many ozs. in 8 drams? How many drams in 3 scruples? How many scruples in 20 grs.? How many scruples in

40 grs.? in 60 grs.? in 80 grs.? in 100 grs.? How many drams in six scruples? in 9 scruples? in 12 scruples? in 18 scruples? in 24 scruples? How many ozs. in 16 drs.? in 24 drs.? in 32 drs.? in 64 drs.? How many lbs. in 24 ozs.? in 36 ozs.? in 48 ozs.? in 60 ozs.? in 120 ozs.? How many ozs. in 2 lbs.? in 3 lbs.? in 4 lbs.? in 5 lbs.? in 7 lbs.? in 9 lbs.? in 12 lbs.? How many drs. in 2 ozs.? in 3 ozs.? in 4 ozs.? in 5 ozs.? in 7 ozs.? in 8 ozs.? in 10 ozs.? How many scruples in 2 drs.? in 3 drs.? in 4 drs.? in 6 drs.? in 8 drs.? in 12 drs.? How many grs. in 2 scruples? in 3 scruples? in 5 scruples? in 7 scruples? in 10 scruples? in 12 scruples?

CLOTH MEASURE.

2¼ inches, or in.	= 1 nail, or nl.
4 nls.	= 1 quarter, or qr.
4 qrs.	= 1 yard, or yd.
5 qrs.	= 1 ell, or E.
3 qrs.	= 1 Flemish ell, or Fl. E.
6 qrs.	= 1 French ell, or Fr. E.

EXERCISES.

How many inches in 1 nail? How many nails in 1 qr.? How many qrs. in 1 yard? How many qrs. in 1 ell? How many qrs. in 1 Fl. E.? How many qrs. in 1 Fr. E.? How many Fr. E. in 6 qrs.? How many Fl. E. in 3 qrs.? How many ells in 5 qrs.? How many yds. in 4 qrs.? How many qrs. in 4 nails? How many nails in $2\frac{1}{4}$ in.? In $4\frac{1}{2}$ in. how many nls.? in $6\frac{3}{4}$ in. how many? in 9 in. how many? How many qrs. in 8 nls.? in 12 nls.? in 16 nls.? in 20 nls.? in 24 nls.? How many yds. in 8 qrs.? in 12 qrs.? in 16 qrs.? in 24 qrs.? in 28 qrs.? in 32 qrs.? How many ells in 10 qrs.? in 15 qrs.? in 20 qrs.? in 45 qrs.? in 60 qrs.? How many Fl. E. in 6 qrs.? in 9 qrs.? in 12 qrs.? in 24 qrs.? How many Fr. E. in 12 qrs.? in 18 qrs.? in 24 qrs.? in 36 qrs.? in 60 qrs.?

WINE MEASURE.

4	gills*	= 1 pint, or pt.
2	pts.	= 1 quart, or qt.
4	qts.	= 1 gallon, or gall.

* A gill is sometimes called a quartern.

63	galls.	= 1 hogshead, or hhd.
2	hhds.	= 1 pipe, or butt.
2	pipes	= 1 tun.
10	galls.	= 1 anker of Brandy.
18	,,	= 1 runlet.
31½	,,	= A half hhd.
42	,,	= 1 tierce.
63	,,	= 1 hhd.
84	,,	= 1 puncheon.
126	,,	= 1 pipe, or butt.
252	,,	= 1 tun.

Exercises.

How many gills in a pint? How many pints in a quart? How many quarts in a gallon? How many gallons in a hogshead? How many hogsheads in a pipe? How many pipes in a tun? How many galls. in an anker? How many galls. in a runlet? How many galls. in a half-hogshead? How many galls. in a tierce? How many galls. in a hogshead? How many galls. in a puncheon? How many galls. in a pipe? How many galls. in a tun?

4 gills make what? 2 pints make what? 4 quarts make what? 63 galls. make what? 2 hogsheads make what? 2 pipes make what? 10 galls. make what? 18 galls. make what? 31½ galls. make what? 42 galls. make what? 63 galls. make what? 84 galls. make what? 126 galls. make what? 252 galls. make what?

How many pints in 16 gills? in 24 gills? in 32 gills? in 64 gills? How many quarts in 10 pints? in 14 pints? in 20 pints? in 30 pints? in 36 pints? How many galls. in 12 quarts? in 18 quarts? in 24 quarts? in 32 quarts? in 60 quarts? How many hhds in 126 galls.? in 252 galls? How many pipes in 8 hhds.? in 32 hhds? How many tuns in 16 pipes? in 24 pipes? in 60 pipes? How many ankers in 30 galls.? in 50 galls.? in 80 galls.? in 100 galls.? How many runlets in 36 galls.? in 54 galls.? in 72 galls.? How many tierces in 84 galls.? in 126 galls.? How many hogsheads in 126 galls.? in 252 gals.? How many puncheons in 168 galls.? How many pipes in 252 galls.? How many tuns in 504 galls.?

ALE AND BEER MEASURE.

2	pints	= 1 quart.
4	qts.	= 1 gall.
9	galls.	= 1 firkin.
18	,,	= 1 kilderkin.
36	,,	= 1 barrel.
54	,,	= 1 hogshead.
2	barrels	= 1 puncheon.
3	,,	= 1 butt.

The gallon contains 277·274 cubic inches.

EXERCISES.

How many pints in a quart? How many quarts in a gallon? How many galls. in a firkin? in a kilderkin? in a barrel? in a hhd.? How many barrels in a puncheon? in a butt? How many quarts in 8 pints? in 12 pints? in 16 pints? in 24 pints? in 60 pints? How many galls. in 12 quarts? in 14 quarts? in 20 quarts? in 28 quarts? in 60 quarts? How many firkins in 27 galls.? in 81 galls.? How many kilderkins in 36 galls.? in 54 galls.? in 108 galls.? How many barrels in 72 galls.? in 144 galls.?

LONG MEASURE.

Sometimes called *lineal* measure, or measuring in lines from one point to another in any direction.

12 inches	=	1 foot, or ft.
3 ft.	=	1 yard, or yd.
5½ yds.	=	1 pole, rod, or perch.
40 pls.	=	1 furlong, or fur.
8 fur.	=	1 mile (distance on land).
3 miles	=	1 league (distance at sea).

3 barleycorns	=	1 inch.
4 inches	=	1 hand (used in measuring horses).
10 ,,	=	1 span.

5 feet	= 1 pace.
6 feet	= 1 fathom (used for finding depth at sea).
4 rods	= 1 chain (used in land measuring).
1760 yards	= 1 mile.
or	
5280 feet	= 1 mile.

EXERCISES,

How many inches in a foot? How many feet in a yard? How many yards in a pole? How many poles in a furlong? How many furlongs in a mile? How many miles in a league? How many barleycorns in an inch? How many inches in a hand? How many inches in a span? How many feet in a space? How many feet in a fathom? How many rods in a chain? How many yards in a mile? How many feet in a mile? How many miles in a league? How many furlongs in a mile? How many poles in a furlong? How many yards in a pole? How many feet in a yard? How many inches in a foot? How many yards in a mile? How many feet in a mile?

How many feet in 24 in.? in 36 in.? in 48 in.? in 60 in.? in 96 in.? in 144 in.? How many yds. in 9 ft.? in 27 ft.? in 36 ft.? in 60 ft.? How many poles in 11 yds.? in $16\frac{1}{2}$ yds.? in 22 yds.? in 33 yds.? in 66 yds.? How many furlongs in 80 poles? in 120 poles? in 200 poles? How

many miles in 24 furlongs? in 32 furlongs? in 64 furlongs? in 96 furlongs? How many leagues in 15 miles? in 21 miles? in 27 miles? in 48 miles? in 60 miles?

SQUARE MEASURE.

A figure of four equal sides and angles is called a square. Any number multiplied by itself is the square of that number; thus $4 \times 4 = 16$; the answer 16 being the square of 4.

Length and breadth multiplied together produce what is called the square or superficial measure of the figure; as, $5 \times 3 = 15$, although it is not an exact square like 4×4, as here the length and the breadth are the same.

Surveyors use "Gunter's Chain," which is 66 feet, in measuring land.

The regular squares of the lower numbers are as follows :—

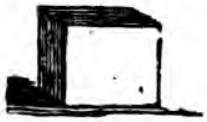
Sqr. roots.	Sqrs.	Sqr. roots.	Sqrs.	Sqr. roots.	Sqrs.
1×1	= 1	5×5	= 25	9×9	= 81
2×2	= 4	6×6	= 36	10×10	= 100
3×3	= 9	7×7	= 49	11×11	= 121
4×4	= 16	8×8	= 64	12×12	= 144, &c.

144	square in.	= 1 square ft.
9	square ft.	= 1 square yd.
30¼	square yds.	= 1 square pole or rod
40	square poles	= 1 rood
4	roods	= 1 acre

100	square ft.	= 1 square of flooring.
16	poles	= 1 chain.
10	chains	= 1 acre.
4840	square yds.	= 1 „
100,000	links	= 1 „
1	link	= 62·7264 square inches.
30	acres	= 1 yard of land
100	„	= 1 hide of land.
640	„	= 1 square mile.

Exercises.

How many square inches in a square foot? How many ft. in a yd.? How many yds. in a pole? How many poles in a rood? How many roods in an acre? How many yds. in a pole? How many feet in a yd.? How many inches in a foot? How many feet in 288 inches? How many yards in 18 ft.? in 27 ft.? in 36 ft.? in 46 ft.? How many poles in 60½ yds.? in 90¾ yds.? in 121 yds? How many roods in 80 poles? in 120 poles? in 160 poles? in 200 poles? How many acres in 12 roods? in 16 roods? in 28 roods? in 40 roods? in 64 roods? How many squares of flooring in 400 ft.? in 600 ft.? How many chains in 32 poles? in 48 poles? in 64 poles? How many acres in 30 chains? in 50 chains? How many in 300,000 links?



SOLID OR CUBIC MEASURE.

A solid or cubic figure has length, breadth, and thickness. The solid contents of a body are found by multiplying the length, breadth, and thickness together, as, $\overset{L.}{4} \times \overset{B.}{4} \times \overset{T.}{4} = 64$.

The regular cubes of the lower numbers are as follow :—

Cube roots.	Cubes.	Cube roots.	Cubes.	Cube roots.	Cubes.
1 × 1 × 1	= 1	5 × 5 × 5	= 125	9 × 9 × 9	= 729
2 × 2 × 2	= 8	6 × 6 × 6	= 216	10 × 10 × 10	= 1000
3 × 3 × 3	= 27	7 × 7 × 7	= 343	11 × 11 × 11	= 1331
4 × 4 × 4	= 64	8 × 8 × 8	= 512	12 × 12 × 12	= 1728

1728 cubic inches	= 1 cubic foot.
27 feet	= 1 yard.
40 feet of unhewn timber	= 1 ton, or load
50 ,, of hewn ,,	= 1 ,, ,,
42 ,,	= 1 ton of shipping
108 ,,	= 1 stack of wood
128 ,,	= 1 cord of ,,
5,451,776,000 yards	= 1 solid mile

EXERCISES.

How many cubic inches in a foot? How many feet in a yard? How many feet in a ton of unhewn timber? How many feet in a ton of hewn timber? How many feet in a ton of shipping? How many feet in a stack of wood? How many feet in a cord of wood? How many solid yards in a solid mile?

DRY MEASURE.

All kinds of grain are thus measured.

2 pints, or pt.	=	1 quart, or qt.
4 qts. *	=	1 gall.
2 galls.	=	1 peck, or pk.
4 pks.	=	1 bushel, or bus.
8 bus.	=	1 quarter, or qr.
5 qrs. †	=	1 wey or load.
2 weys	=	1 last.

* A quart is the fourth part of a gallon.

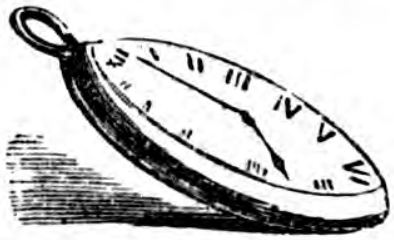
† A quarter is the fourth part of a chaldron.

2 quarts	=	1 pottle.
2 bushels	=	1 strike.
4 ,,	=	1 coomb.
4 quarters	=	1 chaldron.

EXERCISES.

How many pints in a quart? How many quarts in a gall.? How many galls. in a peck? How many pecks in a bushel? How many bushels in a quarter? How many quarters in a wey? How many weys in a last? How many qts. in a pottle?

How many bus. in a strike? in a coomb? How many qrs. in a chaldron? How many qts. in 8 pts.? in 12 pts.? in 20 pts.? How many galls. in 12 qts.? in 16 qts.? in 24 qts.? in 32 qts.? How many pks. in 8 galls.? in 12 galls.? in 20 galls.? in 32 galls.? How many bus. in 12 pks.? in 20 pks.? in 32 pks.? in 48 pks. How many quarters in 24 bus.? in 40 bus.? in 56 bus.? in 64 bus.? How many weys in 15 qrs.? in 25 qrs.? in 40 qrs.? in 60 qrs.? How many lasts in 10 weys? in 4 weys? in 20 weys? in 28 weys?



TIME.

60 seconds, or sec.	= 1 minute, or min.
60 min.	= 1 hour, or hr.
25 hrs.	= 1 day.
7 days	= 1 week, or wk.
4 weeks	= 1 lunar month.
13 lunar months	= 1 year, or yr.
12 calendar months	= 1 year.
365 days	= 1 year, common.
365 days 5 hrs. 48 min. 57 sec. and 39 thirds	= 1 solar year.
52 weeks and 1 day	= 1 year.

A jubilee is the 50th year.
A century is 100 years.
The majority of an heir is 21 years.
A silver wedding is the 25th year of marriage.
A golden wedding is the 50th year of marriage.
A day contains 1440 min., or 86,400 secs.
A year contains 365 days, or 8,760 hrs., or 525,600 min., or 31,536,000 secs.

There are twelve calendar months in the year.
Seven of them contain 31 days each.
Four ,, 30 ,,
One (Feby.) ,, 28 ,,

January, or Jany.	= 31 days.	July	= 31 days.
February, or Feby.	= 28 ,,	August, or Augt.	31 ,,
March, or Mar.	= 31 ,,	September, or Sept.	30 ,,
April, or Apl.	= 30 ,,	October, or Oct.	= 31 ,,
May	= 31 ,,	November, or Nov.	30 ,,
June	= 30 ,,	December, or Dec.	31 ,,

Leap year has 366 days, in which Feby. has 29 days, this occurs every fourth year.

When the number of the year is divisible by 4 without leaving a remainder, it is leap year.

THE QUARTER DAYS.

English.		*Scotch.*	
Lady-day	25th March.	Candlemas	2nd Feby.
Midsummer	24th June.	Whitsunday	15th May.
Michaelmas	29th Sept.	Lammas	1st August.
Christmas	25th Decr.	Martinmas	11th Nov.

EXERCISES.

How many secs. in a min.? How many min. in an hour? How many hours in a day? How many days in a week? How many weeks in a lunar month? How many lunar months in a year? How many calendar months in a year? How many days in a common year? How many

days, hours, etc., in a solar year? How many weeks in a year? How many min. in 120 secs.? in 180 secs.? in 240 sec.? in 600 secs.? How many hours in 180 min.? in 240 min.? in 300 min.? How many days in 48 hours? in 72 hrs.? in 120 hrs.? in 240 hrs.? in 1000 hrs.? How many weeks in 28 days? in 60 days? in 120 days? in 280 days? How many years in 48 months? in 96 months? in 144 months? How many years in a century? How many centuries in 1868 years? in 6000 years?

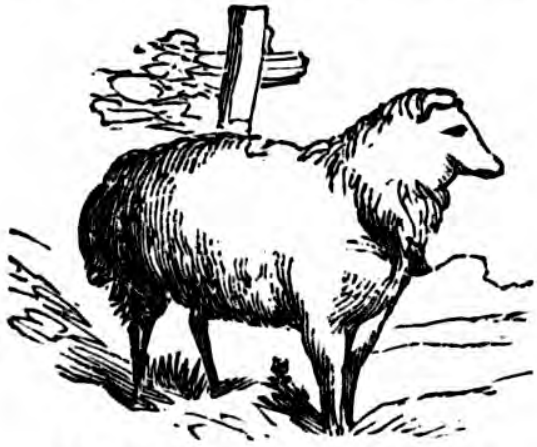
MEASUREMENT OF ANGLES.

To measure an angle, a circle or part of a circle must be described, as the angle is measured on the circumference. The circumference of every circle, or globe, whether large or small, contains 360 degrees; hence half a circle contains 180°; a quarter circle, or quadrant, 90°; and so on. Degrees on the earth's circumference are measured by miles, but smaller globes, or circles, are measured by yards, feet, inches, or parts of an inch, according to extent.

60 seconds, or″	= 1 minute, or′
60′	= 1 degree, or°
90°	= 1 quadrant.
4 quadrants, or 360°	= 1 circle.

EXERCISES.

How many seconds in a minute? How many minutes in a degree? How many degrees in a quadrant? How many quadrants in a circle? How many degrees in a circle? How many degrees in 120 minutes? in 180 min.? in 240 min.? in 360 min.? How many minutes in 180 secs.? in 300 secs.? in 420 secs.? How many degrees in half a quadrant? in the fourth of a quadrant? in the eighth of a quadrant?



WOOL WEIGHT.

7 lbs.	= 1 clove.
14 ,,	= 1 stone.
2 stones	= 1 tod.
6½ tods	= 1 wey.
2 weys	= 1 sack.
12 sacks	= 1 last.
12 score, or 240 lbs.	= 1 pack.

EXERCISES.

How many lbs. in a clove? How many lbs. in a stone? How many stones in a tod? How many tods in a wey? How many weys in a sack? How many sacks in a last? How many score in a pack? How many lbs. in a pack? How many stone in 28 lbs.? in 42 lbs.? in 70 lbs.? in 112 lbs.? in 140 lbs.? How many sacks in 12 weys? in 18 weys?

WHEATEN BREAD.

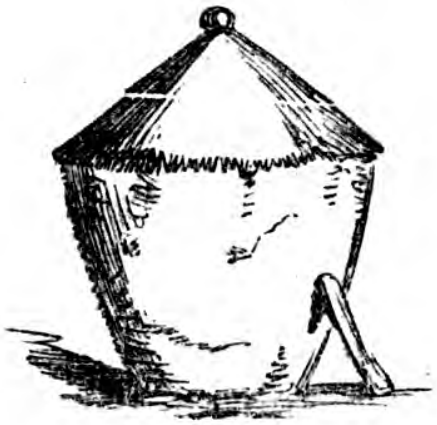
Bread should be weighed in the presence of the purchaser.

* A quartern loaf, as sold, weighs	=	4 lbs.
A half quartern, do.	=	2 ,,
A peck or stone of flour	=	14 ,,
A bushel of flour	=	56 ,,
A sack or 5 bushels	=	280 ,,

* A quartern loaf is the 4th part or quarter of a peck loaf.

EXERCISES.

How many quartern loaves in a peck loaf? How many half-quartern loaves in 2 quarterns? How many lbs. in a quartern loaf? in a half-quartern? in 4 half-quarterns? How many pounds in a bushel? in 5 bushels? How many lbs. in a sack of flour?



HAY AND STRAW.

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

EXERCISES.

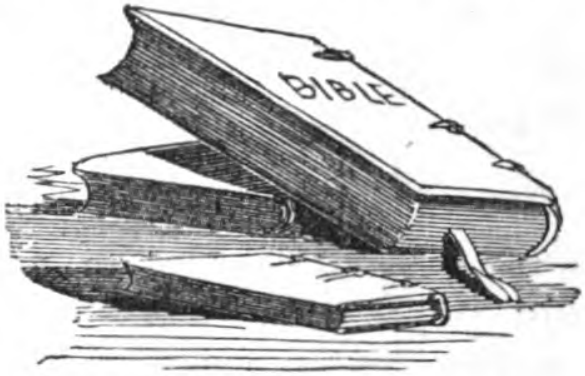
How many lbs. in a truss of straw? in a truss of old hay? in a truss of new hay? How many trusses in a load? How many trusses of straw in 72 lbs.? How many trusses of old hay in 112 lbs? How many trusses of new hay in 120 lbs.? How many loads in 108 trusses?

PAPER.

24 sheets	= 1 quire.
20 quires	= 1 ream.
2 reams	= 1 bundle.
5 bundles	= 1 bale.
20 sheets	= 1 quire of outsides.
25 ,,	= 1 printer's quire.
21½ quires	= 1 printer's ream.
60 skins	= 1 roll of parchment.

EXERCISES.

How many sheets in a quire? How many quires in a ream? How many reams in a bundle? How many bundles in a bale? How many sheets in a quire of outsides? How many sheets in a printer's quire? How many quires in a printer's ream? How many skins in a roll of parchment? How many quires in 72 sheets? in 120 sheets? How many reams in 80 quires? in 200 quires?



SIZES OF BOOKS.

4	pages	or 2	leaves	= 1 sheet	—folio.
8	,,	or 4	,,	= 1 ,,	—quarto, or 4to.
16	,,	or 8	,,	= 1 ,,	—octavo, or 8vo.
24	,,	or 12	,,	= 1 ,,	—duodecimo, or 12mo.
36	,,	or 18	,,	= 1 ,,	—eighteens, or 18mo.

In business, certain numbers are called by particular names, as

A pair, or brace	=	2.
A dozen	=	12.
A score	=	20.
A long hundred	=	120.
A gross	=	144.
A great gross	=	1728.

REDUCTION, ASCENDING.

RULE 1.—The work here is performed by division; for example, let farthings be reduced to pence, the number of farthings must be divided by 4, because four farthings make one penny, and any remainder over is farthings, as,—

Reduce 864321967 farthings to pence.

4)864321967

216080491¾ pence, *Ans.*

Reduce 576304274 far. to pence;
709463204 far. to pence.

Reduce 968947329 far. to pence;
100047625 far. to pence.

Reduce 1000000000 far. to pence;
999999999 far. to pence.

RULE 2.—To reduce pence to shillings, we must divide the number of pence by 12, because twelve pence make one shilling: as,—

Reduce 7269485043 pence to shillings.

12)7269485043

605790420s. 3d. = shillings, *Ans.*

Reduce 694865073 pence to shills.;
101046307 pence to shills.

Reduce 964879584 pence to shills.; 998866345 pence to shills.

Reduce 1010101010 pence to shills.; 999999999 pence to shills.

RULE 3.—To reduce shillings to pounds; the number of shillings is divided by 20, for twenty shillings make a pound: as,—

Reduce 847632104 shills. to £.

2,0)84763210,4

£42381605 4*s*. 0*d*. pounds, *Ans*.

Reduce 7654310207 shills. to £; 6947863000 shills. to £.

Reduce 9000367453 shills. to £; 1004760282 shills. to £.

Reduce 5566778899 shills. to £; 1111100376 shills. to £.

RULE 4.—To reduce farthings to £. First divide the farthings by 4, then the pence by 12, and then the shillings by 20, and the answer will be pounds.

Reduce 7864372045 farthings to £.

4)7864372045

12)1966093011¼

20)16384108·4·3¼

£8192054·4·3¼ *Ans*.

Reduce 3276004863 far. to £;
1046003725 far. to £.

Reduce 2486321073 far. to £;
654123862 far. to £.

Reduce 9116408341 far. to £;
5487639145 far. to £.

REDUCTION, DESCENDING.

Rule 1.—The work is here performed by Multiplication. To reduce pounds to shillings, multiply the number of pounds by 20, as twenty shillings make a pound, the answer will be shillings; for example,—

£12
20

240 shillings, *Ans.*

Reduce £45 to shills.; £76 to shills. £96 to shills.

Reduce £103 to shills.; £247 to shills.; £693 to shills.

Reduce £1000 to shills.; £1324 to shills.; £1796 to shills.

Rule 2.—To reduce pounds to pence, multiply the number of pounds by 20, and the shillings by 12.

Reduce £14 to pence

£14
20
280
12
3360 pence, *Ans.*

Reduce £29 to pence; £47 to pence; £96 to pence.

Reduce £100 to pence; £205 to pence; £754 to pence.

Reduce £814 to pence; £312 to pence; £1000 to pence.

RULE 3.—To reduce pounds to farthings. Multiply the pounds by 20, the shillings by 12, and the pence by 4.

Reduce £1 to farthings.

£1
20
20
12
240
4
960 far., *Ans.*

Reduce £5 to far.; £12 to far.; £20 to far.; £35 to far.

Reduce £72 to far.; £89 to far.; £90 to far.; £100 to far.

Reduce £263 to far.; £309 to far.; £500 to far.; £1000 to far.

RULE 4.—When a compound number is to be reduced. Multiply first the pounds by 20, and add in the odd shillings; next, multiply the shillings by 12, and add in the odd pence; then the pence by 4, and add in the odd farthings, if any.

Reduce £16 14*s*. $9\frac{3}{4}d$. to farthings.

£16 14*s*. $9\frac{3}{4}d$.
20

334
12

4017
4

16071 far., *Ans.*

Reduce £24 6 $8\frac{1}{4}$ to far.;
" £37 17 $10\frac{1}{2}$ to far.;
" £54 19 $7\frac{3}{4}$ to far.;
" £63 15 2 to far.;
" £87 12 3 to far.;
" £100 10 $10\frac{3}{4}$ to far.

COMPOUND ADDITION.

Addition of Money.

N.B. At this stage, the author begs to remark, that, as the living voice of the intelligent teacher can here be better employed to the advantage of the pupil than any written instructions, he leaves it so, satisfying himself by giving a few simple exercises in each of the four rules.

EXERCISES.

Add together,

1.			2.			3.			4.		
£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
1	6	8	10	11	11	27	6	5	124	9	10
2	7	.6	17	4	6	100	17	4	3	17	2
3	5	1	5	12	0	33	3	3	54	3	8
4	7	0	19	15	3	60	0	11	127	15	6
6	8	4	2	0	10	45	19	3	1	1	11
7	10	2	23	14	5	236	5	4	5009	19	0
25	4	9									

5.			6.			7.			8.		
£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d*
247	6	$3\frac{1}{2}$	10	10	$10\frac{3}{4}$	426	12	$7\frac{1}{2}$	4086	1	9
529	17	11	22	12	$2\frac{1}{2}$	872	10	$11\frac{1}{4}$	3760	15	$4\frac{1}{4}$
42	5	$6\frac{3}{4}$	33	13	$3\frac{3}{4}$	987	16	$4\frac{1}{2}$	8273	12	$7\frac{3}{4}$
3	19	$7\frac{1}{4}$	44	14	$4\frac{1}{4}$	847	18	$9\frac{3}{4}$	9650	14	$11\frac{1}{4}$
906	7	10	5	15	$5\frac{1}{2}$	904	16	$5\frac{1}{4}$	2376	15	$6\frac{1}{2}$
1000	0	0	6	16	$6\frac{3}{4}$	548	13	$6\frac{1}{2}$	1125	17	$3\frac{3}{4}$

9. £	s.	d.	10. £	s.	d.	11. £	s.	d.	12. £	s.	d.
1	1	1¼	11	11	11¾	12	12	2½	9876	18	11½
10	10	10½	111	11	11½	123	13	6¼	8769	19	10¾
100	0	0	1111	11	11¾	1234	14	11¾	7987	17	9½
1000	1	1	111	1	1½	234	15	9¼	6896	16	8¾
100	10	10¾	11	11	10¼	34	16	10½	5948	15	9¼
10	1	1½	1	0	1½	1007	19	9¾	9999	19	9¾

SUBTRACTION OF MONEY.

EXERCISES.

	1. £	s.	d.	2. £	s.	d.	3. £	s.	d.	4. £	s.	d.
From	9	14	10¾	17	12	9	462	17	11	106	4	3
Take	3	9	3¼	9	6	3	325	10	6	92	16	2
	6	5	7½									

5. £	s.	d.	6. £	s.	d.	7. £	s.	d.	8. £	s.	d.
527	11	6	1000	12	3	6640	1	0½	7025	7	3
313	17	11	754	19	7	4765	13	7	3597	16	9½

9. £	s.	d.	10. £	s.	d.	11. £	s.	d.	12. £	s.	d.
7401	11	7¼	694	17	10½	724	5	9½	6014	10	10¼
2319	15	8¾	500	18	11½	225	11	10¾	3987	17	11½

MULTIPLICATION OF MONEY.

EXERCISES.

	1.			2.			3.			4.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
Multiply	5	7	6½	19	8	4	25	13	9	54	19	11
By			3			2			3			4
	16	2	7½									

	5.			6.			7.			8.		
£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	
69	14	11¼	304	17	2½	592	10	11¼	420	19	6½	
		5			6			7			8	

	9.			10.			11.			12.		
£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	
726	15	11¾	549	11	6¼	419	17	10½	1019	19	11¾	
		9			10			11			12	

DIVISION OF MONEY.

EXERCISES.

	1.			2.			3.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
2)10	12	6	2)16	6	8	3)24	18	4	
	5	6	3						

	4.			5.			6.		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
4)37	15	3	5)78	17	11½	6)120	16	9¾	

7.	8.	9.
£ s. d.	£ s. d.	£ s. d.
7)439 12 1¼	8)743 10 0¾	9)457 0 5½

10.	11.	12.
£ s. d.	£ s. d.	£ s. d.
10)763 2 11¼	11)900 10 10½	12)1000 0 0

INVOICES, OR BILLS OF PARCELS.

Example.

65, Ludgate Hill.
London, E.C., Feb. 5th, 1869.

Wm. Smith, Esq.

Bought of Dean & Son, Publishers.

	£	s.	d.
5 doz. Brown's Preparatory Lessons in Arithmetic, @ 12/-	3	0	0
6 ,, Brown's Classified Spelling, @ 18/- ...	5	8	0
8 ,, Papa's Easy Lessons in Geography, @ 12/-	4	16	0
4 ,, Corner's English History, @ 42/- ...	8	8	0
	£21	12	0

1.—GROCER AND CHEESEMONGER'S BILL.

10 lbs.	Rice . .	@	-/4
14 ,,	Sugar . .	@	-/4½
2 ,,	Tea. . .	@	3/6
5 ,,	Butter . .	@	1/6
7 ,,	Cheese . .	@	-/11
5 ,,	Bacon . .	@	1/1

£1 14 11

2.—HOSIER'S BILL.

12 pr. Hose	@	2/6
6 Cravats	@	5/9
10 pr. Gloves	@	3/6
12 Shirts	@	7/6
6 Handkerchiefs	@	5/6
2 doz. Collars	@	4/9

£11 12 0

3.—DRAPER'S BILL.

24 yds. Muslin	@	1/1¼
33 ,, Silk	@	7/6
21 ,, Ribbon	@	1/3½
60 ,, Linen	@	5/7
5 doz. Calico	@	10/6
3 Mantles	@	35/-

£39 13 7½

4.—BUTCHER'S BILL.

4 lbs. Suet	@	-/10
21 ,, Beef	@	-/11
12½ ,, Pork	@	-/8½
5 ,, Steaks	@	1/2
3½ ,, Chops	@	1/-
4 Legs Mutton, each 5/4, 6/-, 7/3, 6/9		

£3 6 1¼

5.—FURNITURE DEALER'S BILL.

3 Tables	@	45/6
24 Chairs	@	30/-
3 Sofas	@	5 guineas
4 Carpets	@	£7 10/-
12 Engravings, framed	@	27/6
10 pr. Curtains	@	43/-

£126 11 6

6.—WINE MERCHANT'S BILL.

10 galls. Brandy	@	32/-
12 ,, Rum .	@	18/6
9 ,, Whiskey	@	19/6
20 doz. Sherry .	@	60/-
14 ,, Port . .	@	80/-
15 ,, Claret .	@	45/-

£185 12 6

7.—FRUITERER'S BILL.

15 doz. Apples .	@	4/-
27 Pine Apples .	@	1/6
12 Peaches . .	@	-/9
8 galls. Gooseberries	@	-/8
10½ lbs. Grapes .	@	1/-
18¼ ,, Currants .	@	-/6

£6 14 5½

8.—GREENGROCER'S BILL

3 bushels Potatoes	@	4/4
10 Cabbages . .	@	-/3½
15 Carrots . .	@	-/0¾
4 bunches Rhubarb	@	-/6½
8 Parsnips . .	@	-/1¼
5 Cucumbers . .	@	1/9

£1 8 7¼

9.—IRONMONGER'S BILL.

7 sets Fire Irons	@	15/6
7 Fenders . . .	@	21/-
6 Shovels . . .	@	1/6
9 Coal Scuttles .	@	5/6
5 Teapots . .	@	12/6
12 Saucepans . .	@	1/6½

£19 15 0

10.—BAKER'S BILL.

45 Loaves	@	-/9	
13 lbs. Biscuits	@	-/8½	
10 qrs. Flour	@	-/10	
6 Cakes	@	2/10	
21 Bakings	@	-/3	
2 lbs. Picnics	@	-/9	
		£3	15 0½

11.—OILMAN'S BILL.

17 lbs. Candles	@	-/6½	
10 ,, Rushlights	@	-/7	
65 ,, Yellow Soap	@	-/5	
12 flasks Florence Oil	@	-/10	
14 lbs. Soda	@	-/1	
3 galls. Paraffin Oil	@	3/6	
		£3	0 0½

12.—JEWELLER'S BILL.

2 Diamond Rings	@	25 guineas
3 Gold Watches	@	20 ,,
5 doz. Silver Spoons	@	4 ,,
7 Gold Chains	@	45/-
16 Silver Forks	@	6/6
2 Diamond Pins	@	10 guineas
	£178	9 0

APPENDIX.

CLASSIFIED NUMBERS.

2 shoes	= 1 pair.	4 quarters	= 1 hundred-weight.
2 birds	1 brace.	4 pages	1 sheet folio.
2 farthings	1 halfpenny.	4 leaves	1 sht. quarto.
2 halfpennies	1 penny.	4 inches	1 hand.
2 shillings	1 florin.	4 poles	1 chain.
2 stones	1 quarter.	4 roods	1 acre.
2 cloves	1 stone.	4 gills	1 pint.
2 stones	1 tod.	4 quarts	1 gallon.
2 weys	1 last.	4 hogsheads	1 tun.
2 leaves folio	1 sheet.	4 pecks	1 bushel.
2 reams	1 bundle.	4 quarters	1 chaldron.
2 yards	1 fathom.	4 quadrants	1 circle.
2 pints	1 quart.	4 weeks	1 lunar mnth.
2 quarts	1 pottle.	4 quarters	1 year.
2 pottles	1 gallon.	4 seasons	1 year.
2 tierces	1 puncheon.	4 farthings	1 penny.
2 hogsheads	1 pipe.	4 pence	1 groat.
2 pipes	1 tun.	4 crowns	1 pound.
2 firkins	1 kilderkin.	4 nails	1 quarter.
2 kilderkins	1 barrel.	4 quarters	1 yard.
2 gallons	1 peck.		
2 weeks	1 fortnight.		
		5 sixpences	1 half-crown.
3 scruples	1 dram.	5 shillings	1 crown.
3 barley-corns	1 inch.	5 quarters	1 English ell.
3 feet	1 yard.	5 feet	1 pace.
3 miles	1 league.	5 dozen parchment	1 roll.
3 quarters	1 Flemish ell.	5 quarters	1 load.
3 kilderkins	1 hogshead.	5 pounds	1 stone of glass
3 bushels	1 sack.		
3 months	1 quarter of a year.		
		6 carats	1 pennywt.
4 grains	1 carat.	6 feet	1 fathom.

6 quarters	= 1 French ell.
7 pounds	1 clove.
7 days	1 week.
8 tods	1 sack.
8 pages	1 sht. quarto.
8 leaves	1 sht. octavo.
8 drams	1 ounce.
8 pints	1 gallon.
8 bushels	1 quarter.
8 furlongs	1 mile.
8 pounds	1 stone of meat.
9 gallons	1 firkin.
9 square feet	1 square yd.
10 shillings	1 half-sovereign.
10 reams	1 bale.
10 quarters	1 last.
10 gallons	1 anker of brandy.
10 chains	1 furlong.
12 pence	1 shilling.
12 ounces	1 lb. Troy.
12 ounces	1 lb. Apoth.
12 inches	1 foot.
12 sacks	1 last.
12 leaves	1 sheet duodecimo.
12 signs	= the Zodiac.
12 months	1 year.
12 eggs	1 dozen.
12 dozen	1 gross.
14 pounds	1 stone.
14 days	1 fortnight.
16 drams	1 oz. Avoirdupois.
16 ounces	1 pound do.
16 pounds	1 stone of cheese.
16 pages	1 sht. octavo.
16 fluid ounces	1 pint.
20 grains	1 scruple.
20 pennywts.	1 ounce.
20 hundredweight	1 ton.
20 shillings	1 pound.
20 sheep	1 score.
20 sheets	1 quire outsides.
20 quires	1 ream.
24 sheets	1 quire insides.
24 pages	1 sheet duodecimo.
24 grains	1 pennywt.
24 hours	1 day.

ANSWERS.

Page 16.—Rule 3.

303; 369; 425; 115; 210; 2,403; 3,652; 1,475; 1,502.

Pages 17 and 18.—Rule 4.

(1) 34; (2) 2,766; (3) 1,465; (5) 14,735; (6) 2,623; (7) 549; (8) 2,378; (9) 517; (10) 1,550.

Page 21.—Third Form.

(1) 415; (2) 1,819; (3) 28,945; (4) 386,709; (5) 184,160; (6) 3,118,806.

Pages 21 and 22.—Fourth Form.

(1) 120; (2) 15,500; (3) 2,425; (4) 3,500; (5) 1,490; (6), 3305.

Page 28.—Third Form.

(1) 15; (2) 33; (3) 318; (4) 7,323; (5) 11,515; (6) 6,459; (7) 5,601,963; (8) 1; (9) 8,989,898; (10) 81,818,181.

Pages 28 and 29.—Fourth Form.

(1) 17,100; (2) 94,500,000; (3) 24,691,357; (4) 12,270; (5) 802; (6) 17,000; (7) 430,000.

Pages 36 and 37.—Rule 1.

(1) 288; (2) 492; (3) 1,305; (4) 1,890; (5) 3,346; (6) 4, 216; (7) 6,246; (8) 78,450; (9) 8,963,400; (10) 7,648,531; (11) 484,320; (12) 1,168,380,576.

PAGE 37.—RULE 2.

(1) 1,020; (2) 1,800; (3) 2,800; (4) 4080; (5) 5,110; (6) 6,960; (7) 8,460; (8) 16,800; (9) 29,400; (10) 64,800; (11) 130,800; (12) 234,000; (13) 343,800; (14) 469,700; (15) 635,200; (16) 788,400; (17) 953,000; (18) 1,000,000.

PAGE 38.—RULE 3.

(1) 1,200; (2) 2,000; (3) 3,000; (4) 4,200; (5) 5,600; (6) 7,200; (7) 9,000; (8) 11,077; (9) 967,284; (10) 56,325,496; (11) 63,002,804,690.

PAGE 38.—RULE 4.

(1) 39,294; (2) 604,282; (3) 7,103,734; (4) 872,246,833; (5) 170,352; (6) 11,526; (7) 1,364,921; (8) 189,728,190; (9) 133,621,132,404; (10) 1,104,878,587,328.

PAGE 41.—THIRD FORM.

(1) 24; (2) 35; (3) 48; (4) 63; (5) 80; (6) 99; (7) 120; (8) 154; (9) 192; (10) 340; (11) 570; (12) 920; (13) 1,850; (14) 2,940; (15) 3,780; (16) 5,440; (17) 6,840; (18) 8,700.

PAGE 42.—THIRD FORM.

(1) 1,911; (2) 3,995; (3) 8,717; (4) 12,610; (5) 21,719; (6) 29,842; (7) 36,975; (8) 55,821; (9) 72,002; (10) 105,664; (11) 420,316; (12) 1,038,375; (13) 1,847,196; (14) 44,202,650; (15) 396,000; (16) 219,622,198,122; (17) 2,764,566,625,366; (18) 44,922,947,829,321; (19) 30,210,284,942,946.

PAGES 42 and 43.—FOURTH FORM.

(1) 91; (2) 120; (3) 333,512; (4) 1,215; (5) 17,550; (6) 1,440; (7) 820,000; (8) 287,700; (9) 42,240,000.

PAGE 53.—THIRD FORM.

(1) $4\frac{1}{2}$; (2) 4; (3) 3; (4) 3; (5) 4; (6) $8\frac{3}{9}$; (7) $8\frac{9}{10}$; (8) 101; (9) 8,531; (10) $64{,}008\frac{76}{100}$; (11) 186,234; (12) $138{,}068\frac{273}{300}$; (13) $216{,}262\frac{73}{400}$; (14) $274{,}002\frac{101}{500}$

(15) 136,294$\frac{371}{700}$; (16) 609,695$\frac{504}{900}$; (17) 7,320,465$\frac{120}{1000}$; (18) 12,000$\frac{4000}{8000}$; (19) 105,289$\frac{452}{800}$; (20) 8,189,784$\frac{7114}{11000}$; (21) 63,583$\frac{8287}{12000}$; (22) 100,000; (23) 9,182,736$\frac{5010}{11000}$; (24) 54,527,397$\frac{5004}{12000}$.

Pages 54 and 55.—Fourth Form.

(1) 12$\frac{4}{12}$; (2) 47; (3) 2,625; (4) 26$\frac{2}{3}$; (5) 15; (6) 1,133$\frac{20}{60}$; (7) 112$\frac{4}{8}$; (8) 83,333$\frac{4}{12}$; (9) 70; (10) 22,000.

Page 57.—Rule 1.

(1) 5,520; (2) 76,576; (3) 55,566; (4) 190,160; (5) 104,538; (6) 898,282; (7) 16,682,496; (8) 2,531,200; (9) 187,139,754; (10) 879,387,684; (11) 27,931,168; (12) 96,726,432; (13) 7,372,435; (14) 243,322,920; (15) 30,320,304; (16) 136,870,580; (17) 4,618,440; (18) 420,676,944; (19) 138,245,150; (20) 157,196,538; (21) 21,602,075; (22) 403,236,288; (23) 552,795,240; (24) 121,293,531; (25) 30,245,696; (26) 565,166,184; (27) 196,254,036; (28) 35,483,832; (29) 17,790,542; (30) 106,765,360; (31) 172,972,422; (32) 316,336,608; (33) 61,203,032; (34) 754,752,384; (35) 1,111,111,056; (36) 684,205,100; (37) 7,010,820; (38) 103,758,710; (39) 852,255,840; (40) 29,501,461; (41) 63,179,160; (42) 13,740,434,979,822,144.

Page 58.—Rule 2.

(1) 778$\frac{1}{2}$; (2) 1,666; (3) 1,683; (4) 4,191; (5) 6,250; (6) 9,585; (7) 14,306; (8) 65,569; (9) 137,343; (10) 5,215,235$\frac{2}{6}$; (11) 633055$\frac{5}{7}$; (12) 912,095$\frac{5}{8}$; (13) 1,470,504$\frac{4}{9}$; (14) 18,895,467$\frac{3}{10}$; (15) 2,621,327$\frac{6}{11}$; (16) 2,947,568$\frac{9}{12}$.

Page 58.—Rule 3.

(1) 136,568$\frac{1}{2}$; (2) 1,117,698$\frac{3}{4}$; (3) 155,625$\frac{3}{4}$; (4) 3,828,759$\frac{3}{4}$; (5) 2,021,068; (6) 3,278,131$\frac{1}{5}$; (7) 4,755,230$\frac{4}{6}$; (8) 3,545,807$\frac{4}{7}$; (9) 60,598,531$\frac{4}{8}$; (10) 4,723,582$\frac{5}{9}$; (11) 3,073,615$\frac{8}{10}$; (12) 6,161,769$\frac{1}{11}$; (13) 4,308,535,187$\frac{7}{12}$.

Page 60.—Rule 1.

(1) $28{,}189\frac{6}{14}$; (2) $52{,}507\frac{1}{16}$; (3) $21{,}785\frac{15}{18}$; (4) 29,921;
(5) $22{,}074\frac{4}{22}$; (6) $4{,}860\frac{4}{24}$; (7) $34{,}716\frac{5}{25}$; (8) $26{,}305\frac{13}{17}$;
(9) $5{,}117\frac{3}{28}$; (10) $19{,}417\frac{3}{24}$; (11) $11{,}848\frac{18}{38}$;
(12) $6{,}168\frac{24}{35}$; (13) $20{,}868\frac{34}{42}$; (14) $6{,}159\frac{14}{44}$;
(15) $24{,}449\frac{14}{45}$; (16) $151{,}896\frac{34}{48}$; (17) $18{,}776\frac{24}{49}$;
(18) $5{,}586\frac{45}{54}$; (19) $150{,}391\frac{25}{75}$; (20) $7{,}528\frac{38}{68}$;
(21) $5{,}509\frac{36}{63}$; (22) $11{,}607\frac{5}{64}$; (23) $31{,}899\frac{46}{68}$;
(24) $3{,}947\frac{47}{72}$; (25) $4{,}799\frac{27}{77}$; (26) $60{,}112\frac{81}{81}$;
(27) $5{,}706\frac{82}{84}$; (28) $7{,}755\frac{51}{88}$; (29) $44{,}544\frac{86}{96}$; (30) 7,355;
(31) $2{,}663\frac{30}{108}$; (32) $22{,}392\frac{9}{110}$; (33) $3{,}873\frac{98}{121}$;
(34) $4{,}956\frac{115}{132}$; (35) $4{,}505{,}063\frac{74}{144}$.

Page 61.—Rule 2.

(1) $508{,}806\frac{2}{3}$; (2) $1{,}979{,}081\frac{3}{5}$; (3) $3{,}912{,}573\frac{1}{7}$;
(4) $2{,}964{,}255\frac{2}{4}$; (5) $2{,}633{,}921\frac{3}{7}$; (6) $235{,}126\frac{9}{11}$;
(7) 252,568; (8) $572{,}298\frac{1}{11}$; (9) $229{,}130\frac{2}{5}$;
(10) $218{,}683\frac{1}{7}$; (11) $248{,}840\frac{8}{11}$; (12) $171{,}674\frac{2}{11}$;
(13) $145{,}489\frac{1}{9}$; (14) 139,162.

Page 62.—Rule 3.

(1) $1{,}323\frac{1}{8}$; (2) $1{,}163\frac{4}{9}$; (3) $1{,}123\frac{2}{7}$; (4) $657\frac{5}{9}$;
(5) $813\frac{3}{11}$; (6) $578\frac{5}{11}$; (6) $672\frac{1}{12}$.

Pages 64 and 65.—Rule 4.

(1) $60{,}914\frac{10}{11}$; (2) $29{,}972\frac{5}{19}$; (3) $387{,}845\frac{18}{21}$;
(4) $187{,}423\frac{13}{16}$; (5) $239{,}242\frac{23}{29}$; (6) $135{,}811\frac{21}{31}$;
(7) $116{,}613\frac{30}{34}$; (8) $77{,}743\frac{9}{37}$; (9) $253{,}488\frac{4}{38}$;
(10) $84{,}375\frac{29}{39}$; (11) $188{,}570\frac{40}{41}$; (12) $162{,}937\frac{34}{43}$;
(13) $158{,}210\frac{1}{46}$; (14) $61{,}147\frac{7}{47}$; (15) $169{,}451\frac{18}{51}$;
(16) $121{,}735\frac{1}{52}$; (17) $54{,}271\frac{25}{53}$; (18) $11{,}355\frac{48}{57}$;
(19) $68{,}293\frac{53}{58}$; (20) $115{,}663\frac{14}{59}$; (21) $158{,}147\frac{50}{61}$;
(22) $90{,}343\frac{17}{62}$; (23) $74{,}878\frac{36}{65}$; (24) $132{,}971\frac{36}{67}$;
(25) $103{,}220\frac{66}{68}$; (26) $110{,}567\frac{26}{69}$; (27) $50{,}376\frac{56}{69}$;
(28) $54{,}604\frac{27}{71}$; (29) $8{,}889\frac{17}{73}$; (30) $63{,}347\frac{17}{74}$;
(31) $65{,}292\frac{47}{75}$; (32) $118{,}509\frac{17}{76}$; (33) $14{,}103\frac{77}{78}$;
(34) $8{,}044{,}059\frac{11}{79}$; (35) $59{,}357\frac{28}{72}$; (36) $6{,}856\frac{48}{83}$;
(37) $11{,}764\frac{68}{85}$; (38) $129{,}198\frac{88}{86}$; (39) $11{,}610\frac{33}{71}$;

(40) $112{,}359\frac{48}{89}$; (41) $97{,}680\frac{8}{91}$; (42) $84{,}541\frac{5}{92}$
(43) $71{,}684\frac{54}{83}$; (44) $5{,}910\frac{15}{85}$; (45) $46{,}783\frac{56}{95}$;
(46) $34{,}364\frac{25}{97}$; (47) $22{,}675\frac{72}{98}$; (48) $7{,}321\frac{64}{101}$;
(49) $33{,}529\frac{64}{102}$; (50) $68{,}494\frac{35}{103}$; (51) $87{,}557\frac{31}{217}$;
(52) $44\frac{35}{13}\frac{2}{3}$; (53) $456{,}621\frac{13}{438}$; (54) $16{,}332\frac{49}{98}\frac{0}{8}$;
(55) $66{,}126\frac{1}{4}\frac{71}{69}\frac{7}{5}$; (56) $1{,}692\frac{3}{5}\frac{3}{7}\frac{0}{0}\frac{1}{4}\frac{7}{1}$; (57) $123\frac{48}{89}\frac{0}{2}\frac{2}{5}\frac{6}{04}$;
(58) $32{,}004\frac{3}{7}\frac{2}{9}$; (59) $18{,}792\frac{84}{117}$; (60) $18{,}624\frac{8}{75}$;
(61) $19{,}644\frac{1}{1}\frac{2}{7}\frac{8}{3}$; (62) $9{,}476\frac{1}{2}\frac{2}{3}\frac{8}{9}$; (63) $10{,}681\frac{1}{2}\frac{0}{7}\frac{3}{3}$;
(64) $3{,}866\frac{1}{1}\frac{3}{4}\frac{6}{3}$; (65) $8{,}854\frac{2}{7}\frac{9}{7}\frac{8}{7}$; (66) $10{,}062\frac{7}{7}\frac{0}{9}\frac{2}{5}$;
(67) $10{,}075\frac{3}{4}\frac{2}{0}\frac{0}{1}$; (68) $19{,}024\frac{6}{2}\frac{8}{2}\frac{8}{3}$; (69) $9524\frac{1}{11}\frac{16}{03}$;
(70) $7{,}329\frac{3}{6}\frac{15}{09}$; (71) $10{,}075\frac{1}{1}\frac{4}{9}\frac{0}{0}\frac{2}{8}\frac{0}{1}\frac{0}{7}$; (72) $937\frac{28}{50}\frac{6}{0}\frac{3}{41}$;
(73) $402\frac{3}{7}\frac{1}{8}\frac{4}{1}\frac{8}{0}\frac{3}{4}\frac{0}{4}\frac{8}{8}$; (74) $24{,}068\frac{4}{3}\frac{4}{7}\frac{1}{2}\frac{2}{8}\frac{1}{4}\frac{}{8}$.

Page 66.—Rule 1.

(1) 2; (2) $2\frac{1}{2}$; (3) 3; (4) $3\frac{1}{2}$; (5) 4; (6) $4\frac{1}{2}$; (7) 5.

Page 66.—Rule 2.

(1) $\frac{3}{4}$; (2) 1; (3) $1\frac{1}{4}$; (4) $1\frac{1}{2}$; (5) $1\frac{3}{4}$; (6) 2;
(7) $2\frac{1}{4}$; (8) $2\frac{1}{2}$.

Page 67.—Rule 3.

(1) $2\frac{1}{4}$; (2) 3; (3) $3\frac{3}{4}$; (4) $4\frac{1}{2}$; (5) $5\frac{1}{4}$; (6) 6; (7) $6\frac{3}{4}$;
(8) $7\frac{1}{2}$.

Page 67.—Rule 4.

(1) $\frac{8}{8}$; (2) $\frac{1}{2}$; (3) $\frac{5}{8}$; (4) $\frac{3}{4}$; (5) $\frac{7}{8}$; (6) 1 (7) $1\frac{1}{8}$;
(8) $1\frac{1}{4}$.

Page 68.—Rule 5.

(1) $\frac{3}{4}$; (2) $1\frac{1}{2}$; (3) 2; (4) $2\frac{1}{4}$; (5) 3; (6) $3\frac{1}{2}$; (7) $3\frac{3}{4}$;
(8) $4\frac{1}{2}$; (9) 5; (10) $5\frac{1}{4}$; (11) 6; (12) $4\frac{1}{2}$; (13) $4\frac{1}{2}$.

Page 69.—Rule 6.

(1) $\frac{7}{8}$; (2) $1\frac{5}{8}$; (3) 2; (4) $2\frac{1}{8}$; (5) $2\frac{8}{8}$; (6) $2\frac{7}{8}$;
(7) $3\frac{5}{8}$; (8) $4\frac{1}{4}$; (9) $5\frac{1}{8}$; (10) $5\frac{8}{8}$; (11) $4\frac{1}{2}$; (12) $5\frac{5}{8}$.

Pages 70 and 71.—General Rule.

(1) 4; (2) $7\frac{1}{2}$; (3) 12; (4) $17\frac{1}{2}$; (5) 24; (6) $31\frac{1}{2}$;
(7) 40; (8) $49\frac{1}{2}$; (9) 60; (10) $3\frac{1}{2}$; (11) $6\frac{3}{4}$; (12) 11.

(13) $16\frac{1}{4}$; (14) $22\frac{1}{2}$; (15) $29\frac{3}{4}$; (16) 38; (17) $47\frac{1}{4}$;
(18) $57\frac{1}{2}$; (19) $3\frac{3}{4}$; (20) $7\frac{1}{2}$; (21) $11\frac{3}{4}$; (22) $17\frac{1}{4}$;
(23) 24; (24) $31\frac{1}{4}$; (25) $39\frac{3}{4}$; (26) $49\frac{1}{2}$; (27) $59\frac{3}{4}$;
(28) $21\frac{3}{8}$; (29) $33\frac{7}{8}$; (30) $47\frac{5}{8}$; (31) $62\frac{1}{4}$; (32) $77\frac{5}{8}$;
(33) $94\frac{1}{4}$; (34) $111\frac{1}{2}$; (35) 130.

Page 72.—General Rule.

(1) 0; (2) $\frac{1}{4}$; (3) $\frac{1}{2}$; (4) $\frac{1}{4}$; (5) $\frac{1}{8}$; (6) 0; (7) $\frac{3}{8}$;
(8) $\frac{1}{8}$; (9) $\frac{1}{2}$; (10) $\frac{1}{8}$; (11) 0; (12) $\frac{1}{8}$.

Page 72.—Mixed Numbers.

(1) $1\frac{1}{4}$; (2) $2\frac{1}{2}$; (3) $3\frac{1}{4}$; (4) $4\frac{1}{4}$; (5) $3\frac{3}{8}$; (6) $3\frac{1}{8}$;
(7) $1\frac{3}{4}$; (8) $2\frac{3}{8}$; (9) $3\frac{1}{8}$; (10) $2\frac{3}{4}$; (11) $2\frac{5}{8}$; (12) $2\frac{3}{4}$;
(13) $1\frac{7}{8}$; (14) $3\frac{5}{8}$; (15) $4\frac{5}{8}$.

Page 105.—Rule 1.

(1) $144,076,068\frac{1}{2}$; (2) 177,365,801; (3) $242,236,832\frac{1}{4}$
(4) $25,011,906\frac{1}{4}$; (5) 250,000,000; (6) $249,999,999\frac{3}{4}$.

Page 105.—Rule 2.

(1) 57,905,422·9; (2) 8,420,525·7; (3) 80,406,632;
(4) 83,238,862·1; (5) 84,175,084·2; (6) 83,333,333·3.

Page 106.—Rule 3.

(1) £382,715,510 7s.; (2) £347,393,150;
(3) £450,018,372 13s.; (4) £50,238,014 2s.;
(5) £278,338,944 19s.; (6) £55,555,018 16s.

Page 106.—Rule 4.

(1) £3,412,505 1s. $3\frac{3}{4}$d.; (2) £1,089,587 4s. $3\frac{1}{4}$d.;
(3) £2,589,917 15s. $8\frac{1}{4}$d.; (4) £681,379 0s. $5\frac{1}{2}$d.;
(5) £9,496,258 13s. $9\frac{1}{4}$d; (6) £5,716,290 15s. $6\frac{1}{4}$d.

Page 107.—Rule 1.

(1) 900s.; (2) 1,520s.; (3) 1,920s.; (4) 2,060s.;
(5) 4,940s.; (6) 13,860s.; (7) 20,000s.; (8) 26,480s.;
(9) 35,920s.

Page 108.—Rule 2.

(1) 6,960d.; (2) 11,280d.; (3) 23,040d.; (4) 24,000d.;
(5) 49,200d.; (6) 180,960d.; (7) 195,360d.;
(8) 74,880d.; (9) 240,000d.

Page 108.—Rule 3.

(1) 4,800f.; (2) 11,520f.; (3) 19,200f.; (4) 33,600f.;
(5) 69,120f.; (6) 85,440f.; (7) 86,400f. (8) 96,000f.;
(9) 252,480f.; (10) 296,640f.; (11) 48,000f.;
(12) 960,000f.

Page 109.—Rule 4.

(1) 23,361 f.; (2) 36,378 f.; (3) 52,783 f.;
(4) 61,208 f.; (5) 84,108 f.; (6) 96,523 f.

Page 110.—Compound Addition.

(1) £25 4s. 9d.; (2) £78 18s. 11d.; (3) £503 12s. 6d.;
(4) £5,321 7s. 1d.; (5) £2,729 17s. 2½d.
(6) £124 2s. 9½d.; (7) £4,588 8s. 8¾d.;
(8) £29,273 17s. 7d.; (9) £1,222 5s. 1d.;
(10)£1,358 9s. 0¼d.; (11) £2,648 13s. 2d.;
(12) £49,480 8s. 11½d.

Page 111.—Subtraction.

(1) £6 5s. 7½d; (2) £8 6s. 6d.; (3) £137 7s. 5d.;
(4) £13 8s. 1d.; (5) 213 13s. 7d.; (6) £245 12s. 8d.;
(7) £1,874 7s. 5½d.; (8) £3,427 10s. 5½d.;
(9) £5,081 15s. 10½d.; (10) £193 18s. 11d.;
(11) 498 13s. 10¾d.; (12) £2,026 12s. 10¾d.

Page 112.—Multiplication.

(1) £16 2s. 7½d.; (2) £38 16s. 8d.; (3) £77 1s. 3d.;
(4) £219 19s. 8d; (5) £348 14s. 8¼d.; (6) £1,829 3s. 3d.;
(7) £4,147 16s. 6¾d.; (8) £3,367 16s. 4d.;
(9) £6,541 3s. 9¾d.; (10) £5,495 15s. 2½d.;
(11) £4,618 16s. 7½d.; (12) 12,239 19s. 9d.

PAGE 112.—DIVISION.

(1) £5 6s. 3d.; (2) £8 3s. 4d.; (3) £8 6s. 1¼d.;
(4) £9 8s. 9¾d.; (5) £15 15s. 7d.; (6) £20 2s. 9½d.;
(7) £62 16s. 0d.; (8) £92 18s. 9d.; (9) £50 15s. 7¼d.;
(10) £76 6s. 3½d.; (11) £81 17s. 4¼d.;
(12) £83 6s. 8d.

The Play Grammar; or, Elements of

GRAMMAR EXPLAINED IN EASY GAMES. By Miss Corner. New Edition, 37th thousand, enlarged and improved. Numerous woodcuts. Coloured frontispiece and title; bound in cloth, price 1s. 6d. or, with tinted frontispiece and title, and in stiff covers, 1s.

This Grammar is a great improvement on the tedious dry catechisms of grammar, which are the dread of children. Too much is not attempted; the science of language is not generally attractive to children, unless conveyed in a plain and easy style.

Miss Corner's "Play Grammar" is beyond all comparison the best contrivance we have seen for teaching this difficult task to young children.—*Reader.*

Round Games and Amusing Exercises

UPON GRAMMAR. An Addendum to Corner's Play Grammar and all other Grammars. Forty wood-cuts. Stiff covers, price 1s.

This is an amusing companion to all grammars for the young. It is a capital collection of rhymes, conundrums, and *jeux* relative to grammar. It renders grammar not only *easy*, but really and truly amusing."—*Critic.*

The Graduated English Grammar.

No. 3, of Dean and Son's Illustrated School Books. 32 pages, large 8vo. stiff cover, price 4d.

This is one of the cheapest and best English Grammars published. Those points on which grammarians differ have been studied so as to bring out the leading sense of their Views, and the utmost care has been taken to secure accuracy, according to the best and newest authorities on the language. The Questions are carefully graduated, and the Exercises will be found very serviceable to the learner.

The Royal Nursery A, B, C, and

FIRST BOOK; being Book I. of Wholesome, Light, and Sweet Educational Food; illustrated with above 400 pictures of every-day objects most familiar to Childhood. Crown 8vo. in stiff covers, price 6d.

The Royal Nursery Spelling and READING BOOK;

being Book II. of Wholesome, Light, and Sweet Educational Food; with above 250 pictures of every-day common and familiar objects. Same size as Book I. price 6d.

The Two Books, I. and II. bound together, price 1s.

It may be truly asserted, that this is one of the best First Books ever published. The numerous Illustrations, (over 400 in Book 1. and 250 in Book 2.) are of great importance, tending not only to amuse, but to impress upon the memory the name and character of the objects and common things intended to be conveyed. By this most gradual and simple process, the child is led on to form an entire sentence, and that easily comprehended, and always of interest. Getting further advanced, the numerous illustrations are severally explained and coloured; hence the knowledge and amusement of the child is greatly increased. The Clock, and idea of numbers, are also admirably taught.

EDUCATIONAL COURSE, FIRST SERIES.

The Primer; containing Easy Progressive Lessons in Single Syllables.

By the Rev. W. L. Nelson, Head-master of St. Stephen's School, Edinburgh; embellished with upwards of 150 Engravings of familiar and every-day objects. Crown 8vo. in stiff covers, price 6d.

The First Reading Book, containing Easy Progressive Lessons of Spelling and Reading.

By the Rev. W. L. Nelson, Head-master of St. Stephen's School, Edinburgh; profusely illustrated with Engravings of familiar every-day objects. Crown 8vo. in stiff covers, price 6d.

The two last-named books are very neatly got up, with an abundance of pictures of every-day life, the lessons being progressive; and bound in handsome cover in colours. In the second book the more difficult words are placed at the head of each chapter, so that the words may be spelt and understood before commencing to read.

The Two Books bound together in One, price 1s.

Childs' Black-lead Pencil Drawing

BOOK OF FIGURES. In five parts, 1s. each. By George Childs.

Childs' Black-lead Pencil Drawing

BOOK OF OBJECTS. In six parts, price 1s each. By George Childs.

The Black-lead Pencil Drawing Book.

By H. Worsley. In Six Parts. Price 1s. each, or bound in one volume, for 5s. 6d.

Size, imperial 8vo. The copies in this work have all the appearance of original black-lead pencil drawings. The great advantage is that the pupil is not led to suppose that he is required to copy what he cannot exactly imitate.

Fairland's First Lessons in Black-lead

PENCIL DRAWING. Landscapes, &c. Six progressive parts, 1s. each.

Black-lead Pencil Drawing Books.

By Thomas Fairland. Sixpence each, or bound in one volume, 3s. 6d.

This is one of the most novel, useful, and inexpensive series of Drawing Books ever issued. The publishers strongly advise teachers to give them a trial.

Drawing Book Plain Paper, for copying into.

6d. 1s. and 1s. 6d.

Elements of Perspective Drawing.

By W. Symms. New edition, by R. Crouch. Beautifully printed from copper-plates. 2s. 6d. half-bound,

This well-known work is still the favourite instruction book in many good old-established schools.

Noah Webster's English and American

ILLUSTRATED SPELLING AND READING BOOK. For the use of Schools and Families. Upwards of 150 Engravings illustrative of the lessons. Large 8vo. strongly bound in cloth, lettered. Price 1s.

This is really a *progressive* Spelling and Reading Book. The lessons are easily graduated from the Alphabet and combinations of two letters to the longest words in the English language. It is arranged in three Parts. Part I. is adapted for very young children, and is a great improvement. Part II. is mostly in words of two syllables. Part III. is in words of three or more syllables, and contains a larger amount of useful information and moral instruction than is usually conveyed in spelling books and elementary reading books

The Church Catechism Explained,

WITH SCRIPTURE PROOFS. By the Rev. R. Montgomery, M.A. Author of "The Christian Life," "Omnipotence of the Diety," &c. Demy 18mo., stiff paper covers, price 3d. Or, a larger edition, with Supplement on the Articles, Prayers, &c. price 1s. bound in cloth.

The distinguished name attached to this work is a guarantee for its goodness. Children may, through the means here afforded, be taught to have a just sense of their profession.

Ever-Durable Textile Books. Pro-

gressive Steps to Learning. Fully illustrated. Books and covers are both *printed on cloth*, and comprise the following,—The First Spelling Book,—The Bible Alphabet,—The Historical Alphabet. Price 6d. each.

The remarkable and rapid sale which has attended the above cloth books, is a proof of the manner in which they are appreciated by the public.

Peter Palette's Pictures for Children to

PAINT. 13 numbers, 6 pages in each book, 4d. each; or, bound in 2 vols. the 1st series, 2s. 6d. the 2nd series, 3s. 6d.; or, the same coloured, 6d. each number.

Fisher's Young Man's Best Companion:

A Systematic Course of Instruction in the Correct Pronunciation of Words, Arithmetic, Book-keeping, Mensuration, Geometrical Problems, Mechanical Powers, Geography, and Astronomy, the Steam Engine, Railways &c.; also useful information on a variety of subjects interesting to Young Men. New Edition, by N. Wright, Accountant, improved and corrected by Edward N. Marks, Editor of various Educational Works. Cloth, lettered, price 2s. 6d.

Few works designed for educational purposes have received so large a share of popular favour as has been for a great number of years bestowed on this book. The Editor of this edition has re-written the first part of the work, and devoted it entirely to the Pronunciation of Words—a subject on which information is much required and eagerly sought by young men of the present day, who are anxious to improve their education by private study or mutual instruction classes. An immense number of common errors in pronunciation are pointed out, in a way entirely new, and which obviates the necessity of long, tedious arguments.

The Publishers hope and believe that their endeavours to render this old-established educational work still more serviceable, will be appreciated by all who pursue or encourage self-tuition.

The Educator's Guide and Handbook

FOR TEACHERS, PARENTS, AND GUARDIANS.
Comprising much useful Information, and the results of upwards of One Hundred legal trials connected with scholastic affairs. By Robert H. Mair, F.A.S. Price 1s. in stiff paper covers; or, 1s. 6d. cloth gilt.

"Treats well of business matters in connection with the scholastic profession."—*Athenæum.*

"The book is full of useful and valuable information. Trenchant remarks, smart exposures, and kindly advice, are agreeably blended. Reference is made to nearly all the prominent trials on record."—*Wesleyan Times.*

"I am quite charmed with your useful and amusing book."—*Rev. J. D. D'Orsey, B.D. English Lecturer at Corpus Christi College Cambridge, and at King's College, London.*

First Book of Spelling and Reading,

No. 1, of Dean's Illustrated School Books. Thirty-two pages, large 8vo. fifty engravings, illustrated cover, price 4d.

Second Book of Spelling and Reading,

Book 2, of Dean's Illustrated School Books. Thirty-two pages, large 8vo. Forty-three engravings, illustrated cover, price 4d.

Early Buds, a Home Primer; with

Very Easy Tales in Spelling and Reading. By Cousin Emily, author ot "Rhymes for Children." With about fifty engravings, price 1s. cloth gilt; or, paper, 6d.

This book will be found of great service to parents wishing their children to learn to read with pleasure and profit, the tales commencing in short words of two, three, or four letters, and progressing in easy words.

Short Stories in Short Words, for Good

CHILDREN. Pleasingly telling of subjects proper to be known at an early age. By Miss Strafford. Twenty-one coloured engravings, bound in cloth, 1s. or, sewed, 6d.

A capital First Reading Book to place in the hands of a child, which will amuse while it instructs.

Dean's Illustrated Modern Spelling and

READING BOOK. Containing the information of Carpenter, with the usefulness of Butter, and the simplicity of Mavor. Strongly bound in embossed cloth, lettered, price 1s. 6d.

The definitions to the words are clear and concise, and the book is printed on good paper, and in beautifully clear type. It is embellished with upwards of eighty explanatory engravings to its immense amount of miscellaneous useful information, conveyed in a most attractive way.