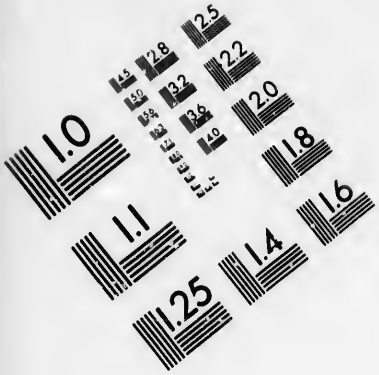

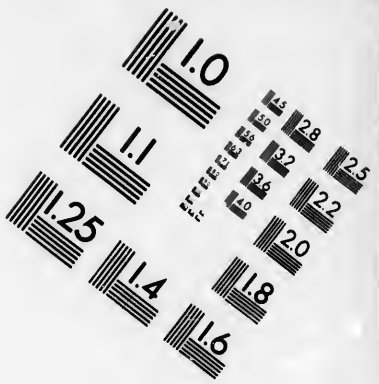

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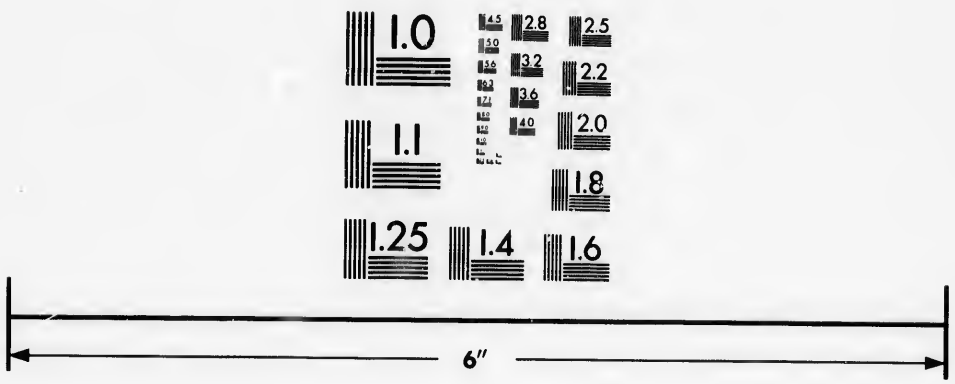

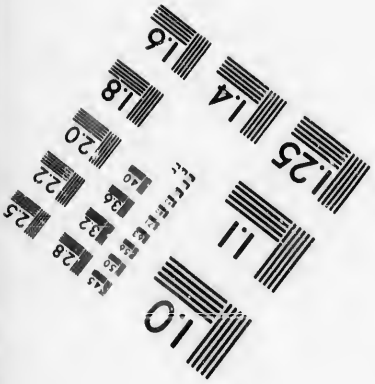

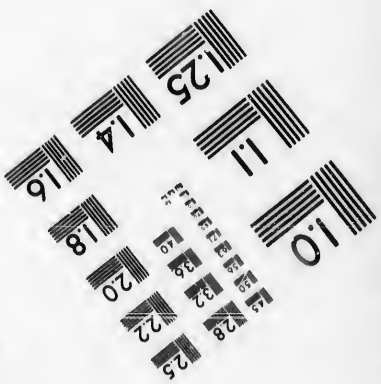

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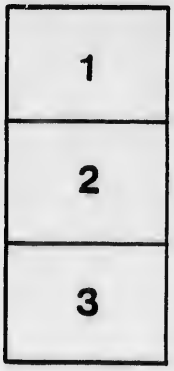

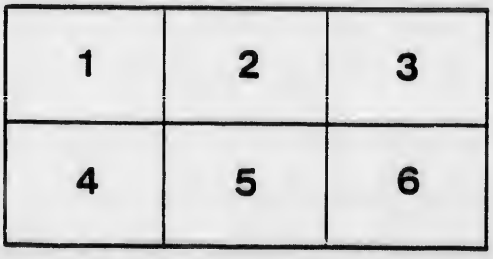

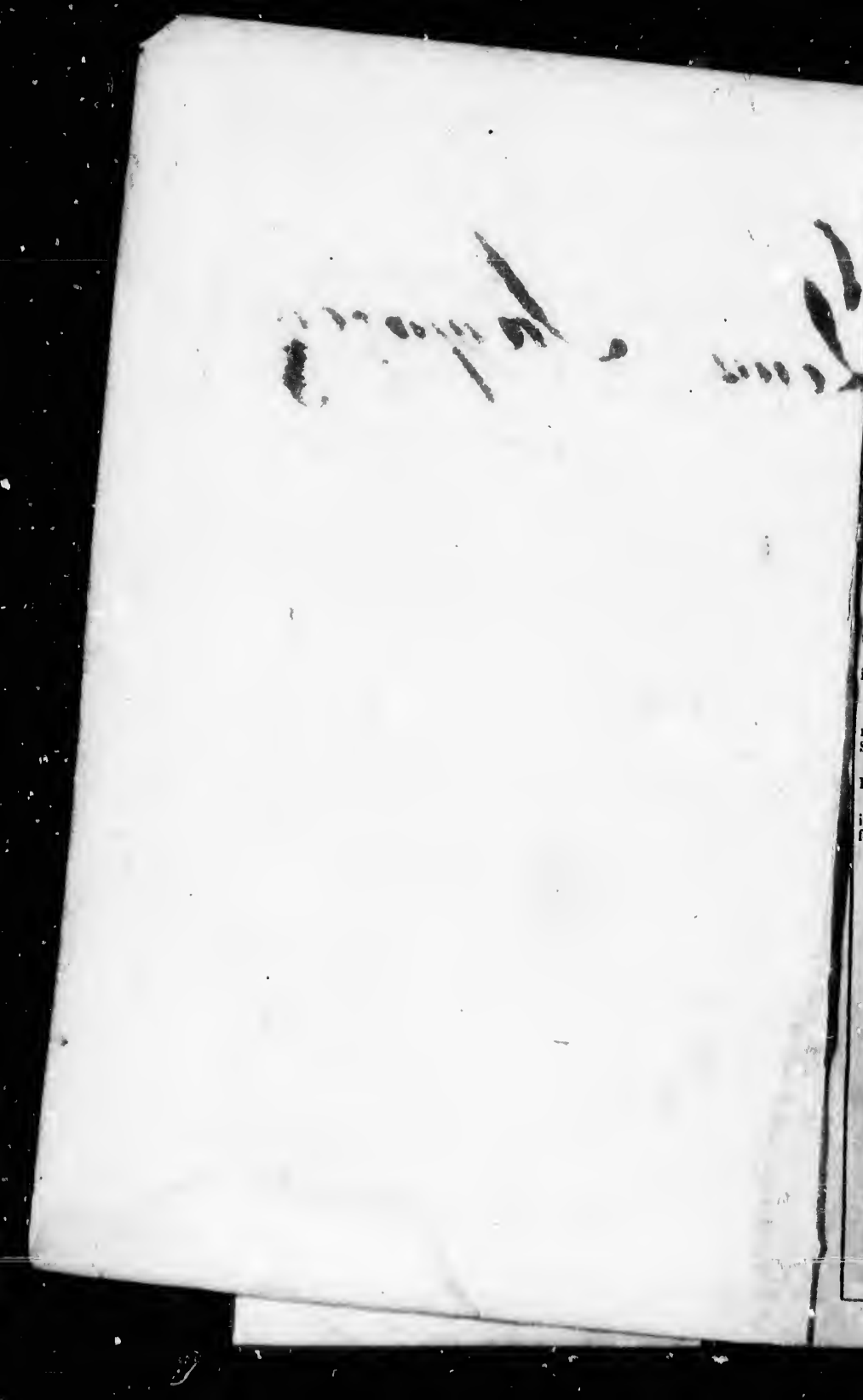

THE

TUTOR'S ASSISTANT;

BEING A

COMPENDIUM OF ARITHMETIC,

AND

COMPLETE QUESTION-BOOK;

CONTAINING,

I. Arithmetic in whole numbers; being a brief explanation of all its Rules, in a new and more concise method than any hitherto published; with an Application to each Rule, consisting of a great variety of questions in real Business, with their answers annexed.

II. Vulgar Fractions, which are treated with a great deal of plainness and perspicuity.

III. Decimals, with the extraction of the Square, Cube, and Biquadrate Roots, after a very plain and familiar manner; to which are added, Rules for the easy calculation of Interest, Annuities, and Pensions, in arrears, &c., either by Simple or Compound Interest.

IV. Duodecimals, or Multiplication of Feet and Inches, with Examples applied to measuring and working by Multiplication, Practice, and Decimals.

V. A Collection of Questions, promiscuously arranged, for the exercise of the scholar in the foregoing rules.

TO WHICH ARE ADDED,

A new and very short method of extracting the Cube Root, and a General Table for readily calculating the Interest of any sum of money, at any rate per cent.; Rents, Salaries, &c.

The whole being adapted either as a Question-Book for the use of Schools, or as a Remembrancer and Instructor to such as have some knowledge of Accounts.

This Work having been perused by several eminent Mathematicians and Accountants, is recommended as the best Compendium hitherto published, for the use of Schools, or for private persons.

BY FRANCIS WALKINGAME,

WRITING-MASTER AND ACCOUNTANT.

TO WHICH IS ADDED,

A COMPENDIUM OF BOOK-KEEPING,

BY ISAAC FISHER.

NEW-YORK:

PUBLISHED BY

D. & J. SADLIER & CO., 164 WILLIAM-STREET.

BOSTON:—128 FEDERAL STREET.

AND 179 NOTRE-DAME STREET, MONTREAL: C. E.

1855.

PREFACE.

THE public, no doubt, will be surprised to find there is another attempt made to publish a book of ARITHMETIC, when there are such numbers already extant on the same subject, and several of them that have so lately made their appearance in the world; but I flatter myself, that the following reasons which induced me to compile it, the method, and the conciseness of the rules, which are laid down in so plain and familiar a manner, will have some weight towards its having a favourable reception.

Having some time ago drawn up a set of rules and proper questions, with their answers annexed, for the use of my own school, and divided them into several books, as well for more ease to myself, as the readier improvement of my scholars, I found them by experience, of infinite use; for when a master takes upon him that laborious, (though unnecessary,) method of writing out the rules and questions in the children's books, he must either be toiling and slaving himself after the fatigue of the school is over, to get ready the books for the next day, or else must lose that time which would be much better spent in instructing and opening the minds of his pupils. There was, however, still an inconvenience which hindered them from giving me the satisfaction I at first expected; *i. e.* where there are several boys in a class, some one or other must wait till the boy who first has the book, finishes the writing out of those rules or questions he wants, which detains the others from making that progress they otherwise might, had they a proper book of rules and examples for each; to remedy which, I was prompted to compile one in order to have it printed, that might not only be of use to my own school, but to such others as would have their scholars make a quick progress. It will also be of great use to such gentlemen as

have acquired some knowledge of numbers at school to make them the more perfect; likewise to such as have completed themselves therein, it will prove, after an impartial perusal, on account of its great variety and brevity, a most agreeable and entertaining exercise-book. I shall not presume to say any thing more in favour of this work, but beg leave to refer the unprejudiced reader to the remark of a certain author,* concerning compositions of this nature. His words are as follows:—

"And now, after all, it is possible that some who like best to tread the old beaten path, and to sweat at their business, when they may do it with pleasure, may start an objection, against the use of this well-intended Assistant, because the course of arithmetic is always the same; and therefore say, that some boys lazily inclined, when they see another at work upon the same question, will be apt to make his operation pass for their own. But these little forgeries are soon detected by the diligence of the tutor: therefore, as different questions to different boys do not in the least promote their improvement, so neither do the questions hinder it. Neither is it in the power of any master (in the course of his business) how full of spirits soever he be, to frame new questions at pleasure in any rule: but the same question will frequently occur in the same rule, notwithstanding his greatest care and skill to the contrary.

"It may also be further objected, that to teach by a printed book is an argument of ignorance and incapacity; which is no less trifling than the former. He, indeed, (if any such there be,) who is afraid his scholars will improve too fast, will, undoubtedly, decry this method: but that master's igorance can never be brought in question, who can begin and end it readily; and, most certainly, that scholar's non-improvement can be as little questioned, who makes a much greater progress by this, than by the common method.

To enter into a long detail of every rule, would tire the reader, and swell the preface to an unusual length; I shall, therefore, only give a general idea of the method of proceeding, and leave the rest to speak for itself; which I hope the kind reader will find to answer the title, and the recommendation given it. As to the

* Dilworth.

rules, they follow in the same manner as the table of contents specifies, and in much the same order as they are generally taught in schools. I have gone through the four fundamental rules in Integers first, before those of the several denominations; in order that they being well understood, the latter will be performed with much more ease and dispatch, according to the rules shown, then by the customary method of dotting. In multiplication I have shown both the beauty and use of that excellent rule, in resolving most questions that occur in merchandising; and have prefixed before Reduction, several Bills of Parcels, which are applicable to real business. In working Interest by Decimals, I have added tables to the rules, for the readier calculating of Annuities, &c. and have not only shown the use, but the method of making them: as likewise an Interest Table, calculated for the easier finding of the Interest of any sum of money at any rate per cent. by Multiplication and Addition only; it is also useful in calculating Rates, Incomes, and Servants' Wages, for any number of months, weeks, or days; and I may venture to say, I have gone through the whole with so much plainness and perspicuity, that there is none better extant.

I have nothing further to add, but a return of my sincere thanks to all those gentlemen, schoolmasters, and others, whose kind approbation and encouragement have now established the use of this book in almost every school of eminence throughout the kingdom: but I think my gratitude more especially due to those who have favoured me with their remarks; though I must still beg of every candid and judicious reader, that if he should, by chance, find a transposition of a letter, or a false figure, to excuse it; for, notwithstanding there has been great care taken in correcting, yet errors of the press will inevitably creep in; and some may also have slipped my observation; in either of which cases the admonition of a good-natured reader will be very acceptable to his much obliged, and most obedient humble servant,

F. WALKINGAME.

ARITHMETICAL TABLES.

NUMERATION.

Units	1	X. of Thousands	12,345
Tens	12	C. of Thousands	123,456
Hundreds	123	Millions	1,234,567
Thousands	1,234	X. of Millions	12,345,678

MULTIPLICATION.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144
13	26	39	52	65	78	91	104	117	130	143	156
14	28	42	56	70	84	98	112	126	140	154	168
15	30	45	60	75	90	105	120	135	150	165	180
16	32	48	64	80	96	112	128	144	160	176	192
17	34	51	68	85	102	119	136	153	170	187	204
18	36	54	72	90	108	126	144	162	180	198	216
19	38	57	76	95	114	133	152	171	190	209	228
20	40	60	80	100	120	140	160	180	200	220	240

NOTE.—This Table may be applied to Division by reversing it; as the 2s in 4 are 2, and 2s in 6 are 3, &c.

TABLES OF MONEY.

PENCE.				SHILLINGS.				POUNDS.			
20d.	are	1s.	8d	80d,	are	6s.	8d.	20s,	are	£1	0s.
24	..	2	0	84	..	7	0	30	..	1	10
30	..	2	6	90	..	7	6	40	..	2	0
36	..	3	0	96	..	8	0	50	..	2	10
40	..	3	4	100	..	8	4	60	..	3	0
48	..	4	0	108	..	9	0	70	..	3	10
50	..	4	2	110	..	9	2	80	..	4	0
60	..	5	0	120	..	10	0	90	..	4	10
70	..	5	10	130	..	10	10	100	..	5	0
72	..	6	0	140	..	11	8	110	..	5	10

SHILLINGS.			
120s.	are	£6	0s.
130	..	6	10
140	..	7	0
150	..	7	10
160	..	8	0
170	..	8	10
180	..	9	0
190	..	9	10
200	..	10	0
210	..	10	10

PRACTICE TABLES.

OF A POUND.

10s.	0d.	is 1	half
6	8	1	third
5	0	1	fourth
4	0	1	fifth
3	4	1	sixth
2	6	1	eighth
2	0	1	tenth
1	8	1	twelfth
1	8	1	twentieth
0	8	1	thirtieth
0	6	1	fortieth

OF A SHILLING.

6d.	is	1	half
4		1	third
3		1	fourth
2		1	sixth
1½		1	eighth
1		1	twelfth

OF A TON.

10	cwt.	1	half
5		1	fourth
4		1	fifth
2½		1	eighth
2		1	tenth

OF A CWT.

qrs.	lb.		
2	or 56	is 1	half
1	28	1	fourth
0	16	1	seventh
0	14	1	eighth

OF A QUARTER.

14lbs.	1	half
7	1	fourth
4	1	seventh
3½	1	eighth

CUSTOMARY WEIGHT OF GOODS.

A Firkin of Butter is	56 lbs.	A Stone of Glass	5 lbs.
A Firkin of Soap	64	A Stone of Iron or Shot	14
A Barrel of Soap	256	A Barrel of Anchovies	30
A Barrel of Butter	224	A Barrel of Pot Ashes	200
A Barrel of Candles	120	A Seam of Glass, 24 Stone, or	120
A Faggot of Steel	120		

TABLES OF WEIGHTS AND MEASURES.

TROY WEIGHT.

24	gr.	make 1	dwt.
20	dwt.	1	ounce
12	oz.	1	pound

APOTHECARIES'

20	gr.	make 1	scruple.
3	scr.	1	dram.
8	dr.	1	ounce
12	oz.	1	pound

AVOIRDUPOIS.

16	dr.	make 1	oz.
16	oz.	1	lb.
14	lb.	1	stone
28	lb.	1	quarter
4	qrs.	1	cwt.
20	cwt.	1	ton,

WOOL WEIGHT.

7	lbs.	make 1	clove
2	cloves	1	stone
2	stone	1	tod
6½	tods	1	wey
2	weys	1	sack
12	sacks	1	last

CLOTH MEASURE.

2¼	inch	make 1	nail
4	nails	1	quar.
3	quar.	1	Fl. ell
4	quar.	1	yard
5	quar.	1	En. ell
6	quar.	1	Fr. ell

SOLID MEASURE.

1728	in.	make 1	sol. ft.
27	feet	1	yard

LAND MEASURE.

9	feet	make 1	yard
30	yards	1	pole
40	poles	1	rood
4	roods	1	acre

LONG MEASURE.

3	bar. corn	1	inch
12	inches	1	foot
3	feet	1	yard
6	feet	1	fathom
5½	yards	1	pole
40	poles	1	furlong
8	fur.	1	mile
3	miles	1	league
69½	miles	1	degree

OLD STANDARD.				ALE AND BEER.	NEW STANDARD.			
Gals.	Q.	P.	Gills.		Gals.	Q.	P.	Gills.
0	0	0	3.93	4 gills make 1 pint	0	0	1	0.07
0	0	1	3.86	2 pints.....1 quart	0	1	0	0.13
0	3	1	3.46	4 quarts....1 gal.	1	0	0	0.54
8	3	0	3.17	9 gallons....1 fir.	9	0	1	0.91
17	2	1	2.34	2 firkins....1 kild.	18	1	0	1.82
35	1	1	0.69	2 kilderkins.1 bar.	36	2	0	3.64
53	0	0	3.03	1½ barrel.....1 hhd	54	3	1	1.45
70	3	0	1.38	2 barrels....1 pun.	73	0	1	3.27
106	0	1	2.06	3 barrels....1 butt	109	3	0	2.91
				WINE MEASURE.				
0	1	0	1.60	2 pints...1 quart	0	0	1	2.36
1	0	1	2.41	4 quarts...1 gallon	0	3	0	2.65
12	0	0	0.10	10 gallons..1 anker	8	1	0	2.58
21	2	0	3.28	18 gallons..1 runlet	14	3	1	3.87
50	1	1	1.22	42 gallons..1 tierce	34	3	1	3.70
75	2	0	3.83	63 gallons..1 hogshead	52	1	1	3.55
100	3	0	2.44	84 gallons..1 puncheon	69	3	1	3.40
151	0	1	3.66	2 hhds...1 pipe	104	3	1	3.11
302	1	1	3.33	2 pipes...1 tun	209	3	1	2.22
				DRY MEASURE.				
B.	P.	G.	Q.	P. Gills.	B.	P.	G.	Q. P. Gills.
0	0	0	1	0 0.25	2 pints make 1 quart	0	0	0 0 1 3.75
0	0	1	0	0 1.01	4 quarts.....1 gallon	0	0	0 3 1 3.02
0	1	0	0	0 2.02	2 gallons.....1 peck	0	0	1 3 1 2.04
1	0	0	1	0 0.07	4 pecks.....1 bushel	0	3	1 3 0 0.17
2	0	0	2	0 0.14	2 bushels....1 strike	1	3	1 2 0 0.35
4	0	1	0	0 0.28	4 bushels....1 sack	3	0	1 0 0 0.70
8	1	0	0	0 0.56	8 bushels....1 quarter	7	3	0 0 0 1.40
33	0	0	0	0 2.24	4 quarters...1 chald.	31	0	0 0 1 1.65
82	2	0	0	1 1.63	10 quarters...1 last	77	2	0 1 1 2.13
					COAL MEASURE.			
3	0	0	3	0 0.21	3 bushels..1 sack	2	3	1 1 0 0.52
37	0	1	0	0 2.52	36 bushels..1 chaldron	34	3	1 0 1 2.34

TANDARD.

Q.	P.	Gills.
	1	0.07
	0	0.13
	0	0.54
	1	0.91
	0	1.82
	0	3.64
	1	1.45
	1	3.27
	0	2.91
	1	2.36
	0	2.65
	0	2.58
	1	3.87
	1	3.70
	1	3.55
	1	3.40
	1	3.11
	1	2.22

Q.	P.	Gills.
0	1	3.75
3	1	3.02
3	1	2.04
3	0	0.17
2	0	0.35
0	0	0.70
0	0	1.40
0	1	1.65
	1	2.13
	0	0.52
0	1	2.34

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EXPLANATION OF THE CHARACTERS MADE USE OF IN THIS COMPENDIUM.

=Equal.	The Sign of Equality; as, 4 qrs. = 1 cwt. signifies that 4 qrs. are equal to 1 cwt.
—Minus, or Less.	The Sign of Subtraction; as, 8—2, that is, 8 lessened by 2 is
+Plus, or More.	The Sign of Addition; as, 4+4=8, that is, 4 added to 4 more, is equal to 8.
×Multiplied by.	The Sign of Multiplication; as, 4×6=24, that is, 4 multiplied by 6 is equal to 24.
÷Divided by.	The Sign of Division; as, 8÷2=4, that is, 8 divided by 2 is equal to 4.
$\frac{2357}{63}$	Numbers placed like a fraction do likewise denote Division; the upper number being the dividend, and the lower the divisor.
: : So is.	The Sign of Proportion; as, 2 : 4 : : 8 : 16, that is, as 2 is to 4, so is 8 to 16.
7—2+5=10.	Shows that the difference between 2 and 7 added to 5, is equal to 10.
9—2+5=2.	Signifies that the sum of 2 and 5 taken from 9, is equal to 2.
$\surd$	Prefixed to any number, signifies the Square Root of that number is required.
$\surd^3$	Signifies the Cube, or Third Power.
$\surd^4$	Denotes the Biquadrate, or Fourth Power, &c.
i. e.	id est, that is.

THE

TUTOR'S ASSISTANT;

BEING

A COMPENDIUM OF ARITHMETIC.

PART I.

ARITMETIC IN WHOLE NUMBERS.

THE INTRODUCTION.

ARITHMETIC is the Art or Science of computing by Numbers, and has five principal or fundamental Rules, upon which all its operations depend, viz:—

NOTATION, or NUMERATION ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION.

NUMERATION

Teacheth the different value of Figures by their different Places, and to read and write any Sum or number.

THE TABLE.

C. Millions.	X. Millions.	Millions.	C. Thousands.	X. Thousands.	Thousands.	Hundreds.	Tens.	Units.
9	8	7	. 6	5	4	. 3	2	1
9	0	0	. 0	0	0	. 0	0	0
	8	0	. 0	0	0	. 0	0	0
		7	. 0	0	0	. 0	0	0
				0	0	. 0	0	0
				5	0	. 0	0	0
					4	. 0	0	0
						3	0	0
							2	0
								1

RULE. There are three periods; the first on the right hand, Uits; the second, Thousands; and the third, Millions; each consisting of three Figures, or Places. Reckon the first Figure of each from the left hand as so many Hundreds, the next as Tens, and the third as so many single ones of what is written over them: thus, the first Period on the left hand is read, Nine Hundred and Eighty-seven Millions; and so on for any of the rest.

THE APPLICATION.

Write down in proper Figures the following Numbers.

(1) Twenty-three.
(2) Two Hundred and Fifty-four.
(3) Three Thousand, Two Hundred and Four.
(4) Twenty-five Thousand, Eight Hundred and Fifty-six.
(5) One Hundred and Thirty-two Thousand, Two Hundred and Forty-five.
(6) Four Millions, Nine Hundred and Forty-one Thousand, Four Hundred.
(7) Twenty-seven Millions, One Hundred and Fifty-seven Thousand, Eight Hundred and Thirty-two.
(8) Seven Hundred and Twenty-two Millions, Two Hundred and Thirty-one Thousand, Five Hundred and Four.
(9) Six Hundred and Two Millions, Two Hundred and Ten Thousand, Five Hundred.

Write down in Words at length the following Numbers.

(1) 35	(4) 2017	(7) 519007	(10) 5207054
(2) 59	(5) 5201	(8) 754058	(11) 2071909
(3) 172	(6) 20766	(9) 5900030	(12) 70054008

(13) 65700047 (14) 900061057 (15) 221900790

Notation by Roman Letters.

I One.	IX Nine.
II Two.	X Ten.
III Three.	XI Eleven.
IV Four.	XII Twelve.
V Five.	XIII Thirteen.
VI Six.	XIV Fourteen.
VII Seven.	XV Fifteen.
VIII Eight.	XVI Sixteen.

XVII	Seventeen.	CCC	Three Hundred.
XVIII	Eighteen.	CCCC	Four Hundred.
XIX	Nineteen.	D	Five Hundred.
XX	Twenty.	DC	Six Hundred.
XXX	Thirty.	DCC	Seven Hundred.
XL	Forty.	DCCC	Eight Hundred.
L	Fifty.	DCCCC	Nine Hundred.
LX	Sixty.	M	One Thousand.
LXX	Seventy.	MDCCCXII.	One Thousand Eight Hundred and Twelve.
LXXX	Eighty.		
XC	Ninety.	MDCCCXXXVII	One Thousand Eight Hundred and Thirty Seven.
C	Hundred.		
CC	Two Hundred		

INTEGERS.

ADDITION

Teacheth to add two or more Sums together, to make one whole or total Sum.

Rule. There must be due regard had in placing the Figures one under the other, *i. e.* Units under Units, Tens under Tens, &c.; then beginning with the first row of Units, add them up to the top; when done, set down the Units, and carry the Tens to the next, and so on; continuing to the last row, under which set down the Total amount.

Proof. Begin at the top of the Sum, and reckon the Figures downwards, the same as you add them up, and, if the same as the first, the Sum is supposed to be right.

Qrs.	Months.	£	Years
(1) 275	(2) 1234	(3) 75245	(4) 271048
110	7098	37502	325476
473	3314	91474	107584
354	6732	32145	625608
271	2546	47258	754087
352	6709	21476	279736

(5) What is the sum of 43, 401, 9747, 3464, 2263, 314, 974? *Ans.* 17206.

(6) Add 246034, 298765, 47321, 58653, 64218, 5376, 9821, and 640 together. *Ans.* 730828.

(7) If you give A. £56, B. £104, C. £274, D. £391, and E. £703, how much is given all? *Ans.* 1528.

(8) How many days are in the twelve Calendar Months? *Ans.* 365.

SUBTRACTION

Teacheth to take a less Number from a greater, and shows the remainder or difference.

Rule. This being the reverse of Addition, you must borrow here (if it require) what you stopped at there, always remembering to pay it to the next.

Proof. Add the remainder and the less Line together, and if the same as the greater, it is right.

	(1)	(2)	(3)	(4)	(5)	(6)
From	271	4754	42087	452705	271508	3750215
Take	154	2725	34096	327616	152471	3150874
Rem.	117					
Proof	271					

MULTIPLICATION

Teacheth how to increase the greater of two Numbers given as often as there are Units in the less; and compendiously performs the office of many additions.

To this Rule belong three principal Members, viz.

1. The Multiplicand, or Number to be multiplied.
2. The Multiplier, or Number by which you multiply.
3. The Product, or Number produced by multiplying.

Rule. Begin with that Figure which stands in the Unit's place of the Multiplier, and with it multiply the first figure in the Unit's place of the Multiplicand. Set down the Units, and carry the Tens in mind, till you have multiplied the next Figure in the Multiplicand by the same Figure in the Multiplier; to the product of which add the Tens you kept in mind, setting down the Units, and proceed as before, till the whole line is multiplied.

PROOF. By casting out the Nines; or make the former Multiplicand the Multiplier, and the Multiplier the Multiplicand; and if the Product of this operation be the same as before, the work is right.

MULTIPLICATION TABLE.

	1	2	3	4	5	6	7	8	9	10	11	12
1		2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

	(1)	(2)	(3)
Multiplicand	25104736	52471021	7925437521
Multiplier	2	3	4
Product	50209472		

	(4)	(5)	(6)
	27104107	231047	7092516
	5	6	7

	(7)	(8)	(9)
	3725104	4215466	2701057
	8	9	10

	(10)
	31040171
	11

When the Multiplier is more than 12, and less than 20, multiply by the Unit Figure in the Multiplier, adding to the Product the back Figure to that you multiplied.

(11) 5710592 × 13

(12) 5107252 × 14

(13) 7653210 × 15

(14) 92057165 × 16

(15) 6251721 × 17

(16) 9215324 × 18

(17) 2571341 × 19

(18) 3592104 × 20

When the Multiplier consists of several Figures, there must be as many products as there are Figures in the Multiplier, observing to put the first figure of every Product under that Figure you multiply by. Add the several Products together, and their Sum will be the total Product.

(19) Multiply 271041071 by 5147.
(20) Multiply 62310047 by 1668.
(21) Multiply 1709251 4 by 7419.
(22) Multiply 9500985742 by 61879.
(23) Multiply 1701495868567 by 4768756.

When Ciphers are placed between the significant Figures in the Multiplier, they may be omitted; but great care must be taken that the next Figure must be put one place more to the left hand, *i. e.* under the Figure you multiply by.

(24) Multiply 571204
By 27009

5140836
3998428
1142408

Product 15427648836

(25) Multiply 7561240325 by 57002.
(26) Multiply 562710934 by 590030.

When there are Ciphers at the end of the Multiplicand or Multiplier, they may be omitted, by only multiplying by the rest of the Figures, and setting down on the right hand of the total Product as many Ciphers as were omitted.

(27) Multiply 1379500
3400

55180
41385

4690300000

(28) Multiply 7271000 by 52600.
(29) Multiply 74837000 by 975000.

When the Multiplier is a composite Number, *i. e.* if any two Figures being multiplied together, will make that Number, then multiply by one of those figures, and that Product being multiplied by the other will give the answer.

(30) Multiply 771039 by 35, or 7 times 5.
$7 \times 5 = 25$

5397273
5

26986365

(31) Multiply 921563 by 32.
(32) Multiply 715241 by 56.
(33) Multiply 7984956 by 144.

DIVISION

Teacheth to find how often one Number is contained in another; or, to divide any Number into what parts you please.

In this Rule there are three numbers real, and a fourth accidental: viz.

1. The Dividend, or Number to be divided:
2. The Divisor, or Number by which you divide:
3. The Quotient, or Number that shows how often the Divisor is contained in the Dividend:
4. Or accidental Number, is what remains when the work is finished, and is of the same name as the Dividend.

Rule. When the Divisor is less than 12, find how often it is contained in the first Figure of the Dividend; set it down under the Figure you divided, and carry the Overplus (if any) to the next in the Dividend, as so many Tens; then find how often the Divisor is contained therein, set it down, and continue the same

till you have gone through the Line; but when the Divisor is more than 12, multiply it by the Quotient Figure; the Product subtract from the Dividend, and to the Remainder bring down the next Figure in the Dividend and proceed as before, till the Figures are all brought down.

PROOF. Multiply the Divisor and Quotient together, adding the Remainder, (if any,) and the Product will be the same as the Dividend.

Dividend. Rem.

(1). Divisor 2)725107(1

Quotient 362553

2

Proof 725107

(2) 3)7210472(

(3) 4)7210416(

(4) 5)7203287(

(5) 6)5231037(

(6) 7)2532701(

(7) 8)2547325(

(8) 9)25047306(

Divisor. Dividend. Quotient.

(9) 29)4172377(143875

29 29

127 1294875

116 287750

2 rem.

112

87 4172377 Proof.

253

232

217

203

147

145

Rem. 2

(10) Divide 7210473 by 37.

Ans. $194877\frac{24}{37}$

(11) Divide 42749467 by 347.

(12) Divide 734097143 by 5743.

(13) Divide 1610478407 by 54716.

(14) Divide 4973401891 by 510834.

(15) Divide 51704567874 by 4765043.

(16) Divide 17453798946123741 by 31479461.

When there are Ciphers at the end of the Divisor, they may be cut off, and as many places from off the Dividend, but they must be annexed to the Remainder at last.

(19) 271|00)254732|21(939
(20) 373|000)7524731729(2017

(15) 5721|00)7253472|16(1267
(20) 215|000|63251041997(
29419

When the Divisor is a composite number, *i. e.* if any two Figures, being multiplied together, will make that number, then, by dividing the Dividend by one of those Figures, and that Quotient by the other, it will give the Quotient required. But as it sometimes happens, that there is a Remainder to each of the Quotients, and neither of them the true one, it may be found by this

RULE. Multiply the first Divisor into the last Remainder, to that Product add the first Remainder, which will give the true one.

(21)	(22)	(23)	(24)
Div. 3210473 by 27.	7210473 by 35.	6251043 by 42.	5761034 by 54.
118906 11 rem.	206013 18 rem.	148834 15 rem.	106685 44 rem.

MONEY.

Marked

¼ Farthing	4 Farthings make 1	Penny.....*d.*
½ Halfpenny	12 Pence 1	Shilling....*s.*
¾ Three Farthings	20 Shillings 1	Pound.....£

Farthings			
4	=	1	Penny
48	=	12 = 1	Shilling
960	=	240 = 20 = 1	Pound.

SHILLINGS.			PENCE TABLE.					
s.	£	*s.*	*d.*	*s.*	*d.*	*d.*	*s.*	*d.*
20 ..	1 :	0	20 ..	1 :	8	90 ..	7 :	6
30 ..	1 :	10	24 ..	2 :	0	96 ..	8 :	0
40 ..	2 :	0	30 ..	2 :	6	100 ..	8 :	4
50 ..	2 :	10	36 ..	3 :	0	108 ..	9 :	0
60 ..	3 :	0	40 ..	3 :	4	110 ..	9 :	2
70 ..	3 :	10	48 ..	4 :	0	120 ..	10 :	0
80 ..	4 :	0	50 ..	4 :	2	130 ..	10 :	10
90 ..	4 :	10	60 ..	5 :	0	132 ..	11 :	0
100 ..	5 :	0	70 ..	5 :	10	140 ..	11 :	8
110 ..	5 :	10	72 ..	6 :	0	144 ..	12 :	0
120 ..	6 :	0	80 ..	6 :	8	150 ..	12 :	6
130 ..	6 :	10	84 ..	7 :	0	160 ..	13 :	4

TROY WEIGHT.

			Marked
24 Grains	make	1 Pennyweight	gr.
20 Pennyweights		1 Ounce	dwt.
12 Ounces		1 Pound	oz.
			lb.

Grains			
24	=	1	Pennyweight
480	= 20	= 1	Ounce
5760	= 240	= 12	= 1 Pound

By this Weight are weighed Gold, Silver, Jewels, Electuaries and all Liquors.

N. B. The Standard for Gold Coin is 22 Carats of fine Gold, and 2 Carats of Copper, melted together. For Silver, is 11 oz. 2 dwts. of fine Silver, and 10 dwts. of Copper.

25 lb. is a quarter of 100 lb. 1 cwt.

20 cwt. 1 Ton of Gold or Silver.

AVOIRDUPOIS WEIGHT.

			Marked
16 Drams	make	1 Ounce	dr.
16 Ounces		1 Pound	oz.
28 Pounds		1 Quarter	lb.
4 Quarters or 112 lb.		1 Hundred Weight	qr.
20 Hundred Weight		1 Ton	cwt.
			ton.

Drams				
16	=	1	Ounce	
256	= 16	= 1	Pound	
7168	= 448	= 28	= 1	Quarter
28672	= 1792	= 112	= 4	= 1 Hundred Weight
573440	= 35840	= 2240	= 80	= 20 = 1 Ton.

There are several other Denominations in this Weight that are used in some particular Goods, viz.

	lb.		lb.
A Firkin of Butter	56	A Stone of Iron, Shot or Horseman's wt.	14
Soap	64	Butcher's Meat	8
A Barrel of Anchovies	30	A Gallon of Train Oil	7½
Soap	256	A Truss of Straw	56
Raisins	112	New Hay	60
A Puncheon of Prunes	1120	Old Hay	56
A Fodder of Lead 19 cwt. 2 qrs.		36 Trusses a Load.	

Cheese and Butter.

A clove or Half Stone, 8 lb.

A Wey in Suffolk, 32 Cloves, or	lb. 256	A Wey is Essex. 32 Cloves, or	lb. 336

Wool.

	lb.		lb.
A Clove	7	A Wey is 6 Tods and 1 Stone, or	182
A Stone	14	A Sack is 2 Weys, or	364
A Tod	28	A Last is 12 Sacks, or	4368

By this Weight is weighed anything of a coarse or drossy nature; as all Grocery and Chandlery Wares; Bread, and all Metals but Silver and Gold.

Note. One Pound Avoirdupois is equal to 14 oz. 11 dwts. 15½ grs. Troy.

APOTHECARIES' WEIGHT.

				Marked
20 Grains	make	1	Scruple	℈
3 Scruples		1	Drain	ʒ
8 Drams		1	Ounce	℥
12 Ounces		1	Pound	lb.

Grains
20 = 1 Scruple
60 = 3 = 1 Dram
480 = 24 = 8 = 1 Ounce
5760 = 288 = 96 = 12 = 1 Pound.

Note. The Apothecaries mix their Medicines by this Rule, but buy and sell their commodities by Avoirdupois Weight.

The Apothecaries' Pound and Ounce, and the Pound and Ounce Troy, are the same, only differently divided and subdivided.

CLOTH MEASURE.

				Marked
4 Nails	make	1	Quarter of a Yard	n. qr.
3 Quarters		1	Flemish Ell	Fl. E.
4 Quarters		1	Yard	yd.
5 Quarters		1	English Ell	E. E.
6 Quarters		1	French Ell	Fr. E

Inches
2¼ = 1 Nail
9 = 4 = 1 Quarter
36 = 16 = 4 = 1 Yard
27 = 12 = 3 = 1 Flemish Ell
45 = 20 = 5 = 1 English Ell
54 = 24 = 6 = 1 French Ell.

LONG MEASURE.

			Marked
3 Barley Corns....make	1 Inch		bar. c. in.
12 Inches	1 Foot		feet.
3 Feet	1 Yard		yd.
6 Feet	1 Fathom		fth.
5½ Yards	1 Rod, Pole or Perch		rod, p
40 Poles	1 Furlong		fur.
8 Furlongs	1 Mile		mile.
3 Miles	1 League		lea.
60 Miles	1 Degree		deg.

Barley Corns
3 = 1 Inch
36 = 12 = 1 Foot
108 = 36 = 3 = 1 Yard
594 = 198 = 16½ = 5½ = 1 Pole
23760 = 7920 = 660 = 220 = 40 = 1 Furlong
190080 = 63360 = 5280 = 1760 = 320 = 8 = 1 Mile.

N. B. A Degree is 69 Miles, 4 Furlongs, nearly, though commonly reckoned but 60 Miles.

This Measure is used to measure Distances of Places, or any thing else that hath length only.

WINE MEASURE.

			Marked
2 Pints.....make	1 Quart		pts. qts.
4 Quarts	1 Gallon		gal.
10 Gallons	1 Anker of Brandy		ank.
18 Gallons	1 Runlet		run.
31½ Gallons	Half an Hogshead		½ hhd.
42 Gallons	1 Tierce		tier.
63 Gallons	1 Hogshead		hhd.
2 Hogsheads	1 Pipe or Butt		P or B.
2 Pipes or 4 Hogsheads	1 Tun		t.

Inches*

28⅞	=	1	Pint				
57¾	=	2	=	1	Quart		
231	=	8	=	4	=	1	Gallon
9702	=	336	=	168	=	42	= 1 Tierce
14553	=	504	=	252	=	63	= 1½ = 1 Hogshead
19404	=	672	=	336	=	84	= 2 = 1½ = 1 Puncheon
29106	=	1008	=	504	=	126	= 3 = 2 = 1½ = 1 Pipe
58212	=	2016	=	1008	=	252	= 6 = 4 = 3 = 2 = 1 Tun

All Brandies, Spirits, Perry, Cider, Mead, Vinegar, Honey, and Oil, are measured by this measure; as also Milk, not by law, but custom only.

ALE AND BEER MEASURE.

			Marked.
2 Pints	make	1 Quart	pts. qts.
4 Quarts		1 Gallon	gal.
8 Gallons		1 Firkin of Ale	A. fir
9 Gallons		1 Firkin of Beer	B. fir.
2 Firkins		1 Kilderkin	kil.
4 Firkins, or 2 Kilderkins		1 Barrel	bar.
1½ Barrel, or 54 Gallons		1 Hogshead of Beer	hhd.
2 Barrels		1 Puncheon	pun.
3 Barrels, or 2 Hogsheads		1 Butt	butt.

BEER.

Cubic Inches

35¼	=	1	Pint				
70½	=	2	=	1	Quart		
282	=	8	=	4	=	1	Gallon
2538	=	72	=	36	=	9	= 1 Firkin
5076	=	144	=	72	=	18	= 2 = 1 Kilderkin
10152	=	288	=	144	=	36	= 4 = 2 = 1 Barrel
15228	=	432	=	216	=	54	= 6 = 3 = 1½ = 1 Hogshead
20304	=	576	=	288	=	72	= 8 = 4 = 2 = 1½ = 1 Puncheon
30456	=	864	=	432	=	108	= 12 = 6 = 3 = 2 = 1½ = 1 Butt

ALE.

Cubic Inches

35¼	=	1	Pint				
70½	=	2	=	1	Quart		
282	=	8	=	4	=	1	Gallon
2256	=	64	=	32	=	8	= 1 Firkin
4512	=	128	=	64	=	16	= 2 = 1 Kilderkin
9024	=	256	=	128	=	32	= 4 = 2 = 1 Barrel
13536	=	384	=	192	=	48	= 6 = 3 = 1½ = 1 Hogshead.

* By a late Act of Parliament, the capacities of the Wine, the Ale and Beer, and the Dry Measures, have been reduced to one Standard. For an accurate comparison of these Measures, with the old standard Measures, the Student is referred to the Table of the "*Imperial Measures*," at the beginning of the work.

In London they compute but 8 gallons to the firkin of Ale, and 32 to the barrel; but in all other parts of England, for ale, strong beer and small, 34 gallons to the barrel, and $8\frac{1}{2}$ gallons to the firkin.

N. B.—A barrel of salmon, or eels, is 42 gallons.
A barrel of herrings,.....32 gallons.
A keg of sturgeon..... 4 or 5 gallons.
A firkin of soap..... 8 gallons.

DRY MEASURE.

				Marked
2 Pints	make	1	Quart	pts. qts.
2 Quarts		1	Pottle	pot.
2 Pottles		1	Gallon	gal
2 Gallons		1	Peck	pk.
4 Pecks		1	Bushel	bu.
2 Bushels		1	Strike	strike
4 Bushels		1	Coom	coom.
2 Cooms, or 8 Bushels		1	Quarter	qr.
4 Quarters		1	Chaldron	chal.
5 Quarters		1	Wey	wey.
2 Weys		1	Last	last.

In London, 36 bushels make a chaldron.

Solid Inches
$268\frac{4}{5}$= 1 Gallon
$537\frac{3}{5}$= 2= 1 Peck
$2150\frac{2}{5}$= 8= 4= 1 Bushel
$4300\frac{4}{5}$= 16= 8= 2= 1 Strike
$8601\frac{3}{5}$= 32= 16= 4= 2= 1 Coom
$17203\frac{1}{5}$= 64= 32= 8= 4= 2= 1 Quarter
86016 =320=160=40=20=10= 5=1 Wey
172032 =640=320=80=40=20=10=2=1 Last.

The Bushel in Water Measure is 5 Pecks.

A score of coals.....is.....21 chaldrons.
A sack of coals..... 3 bushels.
A chaldron of coals.....12 sacks.
A load of corn..... 5 bushels.
A cart of ditto.....40 bushels.
This measure is applied to all dry goods.
The standard bushel is $18\frac{1}{2}$ inches wide, and 8 inches deep.

TIME.

				Marked
60 Seconds	make	1 Minute		″ m.
60 Minutes		1 Hour		hour.
24 Hours		1 Day		day.
7 Days		1 Week		week.
4 Weeks		1 Month		mo.
13 Months, 1 day, 6 hours		1 Julian Year		yr.

Seconds

60 = 1 Minute
3600 = 60 = 1 Hour
86400 = 1440 = 24 = 1 Day
604800 = 10080 = 168 = 7 = 1 Week
2419200 = 40320 = 672 = 28 = 4 = 1 Month.

d. h. w. d. h.
31557600 = 525960 = 8766 = 365 : 6 = 52 : 1 : 6 = 1 Julian Year.

d. h. m. ″
31556937 = 525948 = 8765 = 365 : 5 : 48 : 57 = 1 Solar Year.

To know the days in each month, observe,

Thirty days hath September,
April, June, and November,
February hath twenty-eight alone,
And all the rest have thirty and one;
Except in Leap-Year, and then's the time
February's days are twenty and nine.

SQUARE MEASURE.

144	Inches	make	1 Foot.
9	Feet		1 Yard.
100	Feet		1 Square of flooring
272¼	Feet		1 Rod.
40	Rods		1 Rood.
4	Roods, or 160 Rods, or 4840 yards		1 Acre of land.
640	Acres		1 Square Mile.
30	Acres		1 Yard of land.
100	Acres		1 Hide of land.

Inches						
144 =	1 Foot					
1296 =	9 =	1 Yard				
39204 =	272¼ =	30¼ =	1 Pole			
1568160 =	10890 =	1210 =	40 =	1 Rood		
6272640 =	43560 =	4840 =	160 =	4 =	1 Acre.	

By this measure are measured all things that have length and breadth; such as land, painting, plastering, flooring, thatching, plumbing, glazing, &c.

SOLID MEASURE.

1728 Inches.....make.....1 Solid Foot,
27 Feet.....1 Yard, or load of earth.
40 Feet of round timber, } ....is....1 Ton or Load.
Or, 50 Feet of hewn timber, }

108 Solid Feet, *i. e.* 12 feet in length, 3 feet in breadth, and 3 deep, or, commonly, 14 feet long, 3 feet 1 inch broad, and 3 feet 1 inch deep, is a stack of wood.

128 Solid Feet, *i. e.* 8 feet long, 4 feet broad, and 4 feet deep, is a cord of wood.

By this measure are measured all things that have length, breadth, and depth.

ADDITION OF MONEY, WEIGHTS, AND MEASURES.

Rule. Add the first row or denomination together, as in Integers, then divide the Sum by as many of the same denomination as make one of the next greater, setting down the Remainder under the row added, and carry the Quotient to the next superior denomination, continuing the same to the last, which add as in simple Addition.

MONEY.

(1) £	s.	d.	(2) £	s.	d.	(3) £	s.	d.	(4) £	s.	d.
2	13	5½	27	7	2	35	17	3	75	3	7
7	9	4¼	34	14	7¼	59	14	7½	54	17	1
5	15	4½	57	19	2¼	97	13	5¼	91	15	4¼
9	17	6¼	91	16	1	37	16	8¼	35	16	5¼
7	16	3	75	18	7¼	97	15	7	29	19	7¾
5	14	7¾	97	13	5	59	16	5½	91	17	3¼
39	6	7¼									

MONEY.

(5)

£	s.	d.
257	1	5¼
734	3	7¾
595	5	3
159	14	7½
207	5	4
798	16	7¼

(6)

£	s.	d.
525	2	4¼
179	3	5
250	4	7¾
975	3	5¼
254	5	7
379	4	5¾

(7)

£	s.	d.
21	14	7¼
75	16	0
79	2	4¼
57	16	5½
26	13	8¾
54	2	7

(8)

£	s.	d.
73	2	1½
25	12	7
96	13	5½
76	17	3¼
97	14	1½
54	11	7¼

(9)

£	s.	d.
127	4	7½
525	3	5
271	0	5
524	9	1
379	4	3½
215	5	8¾

(10)

£	s.	d.
261	17	1¼
379	13	5
257	16	7¾
184	13	5
725	2	3¼
359	6	5

(11)

£	s.	d.
31	1	1½
75	13	1
39	19	7¼
97	17	3¾
36	13	5
24	16	3¼

(12)

£	s.	d.
27	13	5¼
16	12	9½
9	13	¾
15	2	7½
37	19	1
56	19	1¾

TROY WEIGHT.

(1)

oz.	dwt.	gr.
5	11	4
7	19	21
3	15	14
7	19	22
9	18	15
8	13	12

(2)

lb.	oz.	dwt.
7	1	2
3	2	17
5	1	15
7	10	11
2	7	13
3	11	16

(3)

lb.	oz.	dwt.	gr.
5	2	15	22
3	11	17	14
3	7	15	19
9	1	13	21
3	9	7	23
5	2	15	17

AVOIRDUPOIS WEIGHT.

(1)

lb.	oz.	dr.
152	15	15
272	14	10
303	15	11
255	10	4
173	6	2
635	13	13

(2)

cwt.	qrs.	lb.
25	1	17
72	3	26
54	1	16
24	1	16
17	0	19
55	2	16

(3)

t.	cwt.	qrs.	lb.
7	17	2	12
5	5	3	14
2	4	1	17
3	18	2	19
7	9	3	20
8	5	1	24

APOTHECARIES' WEIGHT.

(1)

lb.	oz.	dr.	scr.
17	10	7	1
9	5	2	2
27	11	1	2
9	5	6	1
37	10	5	2
49	0	7	0

(2)

lb.	oz.	dr.	scr.	gr.
7	2	1	0	12
3	1	7	1	17
9	10	2	0	14
7	5	7	1	15
3	9	5	2	13
7	1	4	1	18

CLOTH MEASURE.

(1)

Fl.E.	qr.	n.
127	2	1
15	1	3
237	0	2
52	1	3
376	2	1
197	1	3

(2)

yd.	qr.	n.
135	3	3
70	2	2
95	3	0
176	1	3
26	0	1
279	2	1

(3)

E.E.	qr.	n.
272	2	1
152	1	2
79	0	1
156	2	0
79	3	1
154	2	1

LONG MEASURE.

(1)

yd.	feet	in.	bar.
225	1	9	1
171	0	3	2
52	2	3	2
397	0	10	1
154	2	7	2
137	1	4	1

(2)

lea.	m.	fur.	po
72	2	1	19
27	1	7	22
35	2	5	31
79	0	6	12
51	1	6	17
72	0	5	21

LAND MEASURE.

(1)

a.	r.	p.
726	1	31
219	2	17
1455	3	14
879	1	21
1195	2	14

(2)

a.	r.	p.
1232	1	14
327	0	19
131	2	15
1219	1	18
459	2	17

WINE MEASURE.

(1)

hhds.	gals	qts.
31	57	1
97	18	2
76	13	1
55	46	2
87	38	3
55	17	1

(2)

t.	hhds.	gals.	qts.
14	3	27	2
19	2	56	3
17	0	39	3
79	2	16	1
54	1	19	2
97	3	54	3

ALE AND BEER MEASURE.

(1)

A.B.	fir.	gal.
25	2	7
17	3	5
96	2	6
75	1	4
96	3	7
75	0	5

(2)

B.B.	fir.	gal.
37	2	8
54	1	7
97	3	8
78	2	5
47	0	7
35	2	5

(3)

hhds.	gals.	qts
76	51	2
57	3	3
97	27	3
22	17	2
32	19	3
55	38	3

DRY MEASURE.

(1)

ch.	bu.	pks.
75	2	1
41	24	1
29	16	1
70	13	2
54	17	3
79	25	1

(2)

last.	wey.	q.	bu.	p
38	1	4	5	3
47	1	3	6	2
62	0	2	4	3
45	1	4	3	3
78	1	1	2	2
29	1	3	6	2

TIME.

(1)

w.	d.	h.
71	3	11
51	2	9
76	0	21
95	3	21
79	1	15

(2)

w.	d.	h.	m.	"
57	2	15	42	41
65	3	21	27	51
76	0	15	37	29
53	2	21	42	27
98	2	18	47	38

THE APPLICATION.

1. A man was born in the year 1750, when will he be 47 years of age?

Ans. 1797.

2. A, B, C, and D, went partners in the purchase of a quantity of goods; A laid out £7, half-a-guinea, and a crown; B, 49s.; C, 54s. 6d.; and D, 87d. What was laid out in all?

Ans. £13 : 6 : 3.

3. A man lent his friend, at different times, these several sums, viz. £63, £25 : 15, £32 : 7, £15 : 14 : 10, and four score and nineteen pounds, half-a-guinea, and a shilling. How much did he lend in all?

Ans. £236 : 8 : 4.

4. What is the estate worth per annum, when the taxes are 21 guineas, the neat income 8 score, £19 : 14?

Ans. £201 : 15.

5. There are three numbers; the first is 215, the second 519, and the third is as much as the other two. What is the sum of them all?

Ans. 1468.

6. Bought a parcel of goods, for which I paid £54 : 17, for packing 13s. 8d., carriage £1 : 5 : 4, and spent about the bargain 14s. 3d. What do these goods stand me in?

Ans. £57 : 10 : 3.

7. There are two numbers, the least whereof is 40, their difference 14. I desire to know what is the greater number, and the sum of both?

Ans. 54 greater number, 94 sum.

8. A gentleman left his elder daughter £1500 more than the younger, and her fortune was 11 thousand, 11 hundred and £11. What was the elder sister's fortune, and what did the father leave them?

Ans. Eldest sister's fortune, £13611.
Father left them £25722.

9. A nobleman, before he went out of town, was desirous of paying all his tradesmen's bills, and upon inquiry, he found that he owed 82 guineas for rent; to his wine merchant, £72 : 5 : 0; to his confectioner, £12 : 13 : 4; to his draper, £47 : 13 : 2; to his tailor, £110 : 15 : 6; to his coach-maker, £157 : 8 : 0; to his tallow-chandler, £8 : 17 : 9; to his corn-chandler, £170 : 6 : 8; to his brewer, £52 : 17 : 0; to his butcher, £122 : 11 : 5; to his baker, £37 : 9 : 5; and to his servants, for wages, £53 : 18 : 0. I desire to know what money he had to raise in the whole, when he added to the above sums. £100, which he wished to take with him?

Ans. £1032 : 17 : 3.

10. A father was 24 years of age (allowing 13 months to a year, and 28 days to a month) when his first child was born; between the eldest and next born was 1 year, 11 months, 14 days; between the second and third were 2 years, 1 month, and 15 days; between the third and fourth were 2 years, 10 months, and 25 days; when the fourth was 27 years, 9 months, and 12 days old, how old was the father?

Ans. 58 years, 7 months, 10 days.

11. A banker's clerk having been out with bills, brings home an account, that A paid him £7 : 5 : 2, B £15 : 18 : 6½, C £150 : 13 : 2¼, D £17 : 6 : 8, E 5 guineas, 2 crown pieces, 4 half-crowns, and 4s. 2d., F paid him only twenty groats, G £76 : 15 : 9½, and H £121 : 12 : 4d. I desire to know how much the whole amounted to, that he had to pay?

Ans. £396 : 7 : 6¼.

12. A nobleman had a service of plate, which consisted of twenty dishes, weighing 203 oz. 8 dwts.; thirty-six plates, weighing 408 oz. 9 dwts.; five dozen of spoons, weighing 112 oz. 8 dwts.; six salts, and six pepper boxes, weighing 71 oz. 7 dwts.; knives and forks, weighing 73 oz. 5 dwts.; two large cups, a tankard, and a mug, weighing 121 oz. 4 dwts.; a tea-kettle and lamp, weighing 131 oz. 7 dwts.; together with sundry other small articles, weighing 105 oz. 5 dwts. I desire to know the weight of the whole?

Ans. 102 lb. 2 oz. 13 dwts.

13. A hop-merchant buys five bags of hops, of which the first weighed 2 cwt. 3 qrs. 13 lb.; the second, 2 cwt. 2 qrs. 11 lb.; the third, 2 cwt. 3 qrs. 5 lb.; the fourth, 2 cwt. 3 qrs. 12 lb.; the fifth, 2 cwt. 3 qrs. 15 lb. Besides these, he purchased two pockets, each weighing 84 lb. I desire to know the weight of the whole?

Ans. 15 cwt. 2 qrs.

14. A, of Vienna, owes to B, of Liverpool, for goods received in January, the sum of £103 : 12 : 2; for goods received in February, £93 : 3 : 4; for goods received in March, £121 : 17 : for goods received in April, £142 : 15 : 4; for goods received in May, £171 : 15 : 10; for goods received in June, £142 : 12 : 6; but the latter six months of the year, owing to the falling off in the demands for the articles in which he dealt, the amount was only £205 : 7 : 2. I desire to know the amount of the whole year's bill?

Ans. £981 : 3 : 4.

SUBTRACTION OF MONEY, WEIGHTS & MEASURES.

RULE. Subtract as in Integers; only when any of the lower denominations are greater than the upper, borrow as many of that as make one of the next superior, adding it to the upper, from which take the lower; set down the difference, and carry 1 to the next higher denomination from what you borrowed.

PROOF. As in Integers.

MONEY.

(1)

	£	s.	d.
Borrowed	715	2	7¼
Paid	476	3	8½
Remains to pay	238	18	10¾
Proof	715	2	7¼

(2)

	£	s.	d.
Lent	316	3	5½
Received	218	2	1¾

(3)

£	s.	d.
87	2	10
79	3	7½

(4)

£	s.	d.
3	15	1½
1	14	7

(5)

£	s.	d.
25	2	5¼
17	9	8½

(6)

£	s.	d.
37	3	4¼
25	5	2¾

(7)

£	s.	d.
321	17	1½
257	14	7

(8)

£	s.	d.
59	15	3¼
36	17	2

(9)

£	s.	d.
71	2	4
19	13	7¾

(10)

£	s.	d.
527	3	5¼
139	5	7½

(11)

	£	s.	d.
Borrowed	25107	15	7
	375	5	5¼
Paid	259	2	7½
at	359	13	4¾
different	523	17	3
times	274	15	7¼
	325	13	5
Paid in all			
Remains to pay			

(12)

	£	s.	d.
Lent	250156	1	6
	271	13	7¼
Received	359	15	3
at	475	13	9¾
several	527	15	3¼
payments	272	16	5
	150	0	0

TROY WEIGHT.

		lb.	oz.	dwt.	gr.
(1)	Bought	52	1	7	2
	Sold	39	0	15	7
	Unsold				

	lb.	oz.	dwt	gr.
(2)	7	2	2	7
	5	7	1	5

AVOIRDUPOIS WEIGHT.

	lb.	oz.	dr.
(1)	35	10	5
	29	12	7

	cwt.	qrs.	lb.
(2)	35	1	21
	25	1	10

	t.	cwt.	qrs.	lb
(3)	21	1	2	7
	9	1	3	5

APOTHECARIES WEIGHT.

	lb.	oz.	dr.	scr.
(1)	5	2	1	0
	2	5	2	1

	lb.	oz.	dr.	scr.	gr
(2)	9	7	2	1	1
	5	7	3	1	1

CLOTH MEASURE.

	Fl.E.	qr.	n.
(1)	35	2	2
	17	2	1

	yd.	qr.	n.
(2)	71	1	2
	3	2	1

	E.E.	qr.	n.
(3)	35	2	1
	14	3	2

LONG MEASURE.

	yds.	ft.	in.	bar.
(1)	107	2	10	1
	78	2	11	2

	lea.	mi.	fur.	po.
(2)	147	2	6	29
	58	2	7	33

LAND MEASURE.

	a.	r.	p
(1)	175	1	27
	59	0	27

	a	r.	p
(2)	325	2	1
	279	3	5

WINE MEASURE.

(1)

hhd.	gal.	ts.	pt.
47	47	2	1
28	59	3	0

(2)

tun.	hhd.	gal.	qt.
42	2	37	2
17	3	49	3

ALE AND BEER MEASURE.

(1)

A.B.	fir.	gal.
25	1	2
21	1	5

(2)

B.B.	fir.	gal.
37	2	1
25	1	7

(3)

hhd.	gal.	qt.
27	27	1
12	50	2

DRY MEASURE.

(1)

qu.	bu.	p.
72	1	2
35	2	3

(2)

qu.	bu.	p.
65	2	1
57	2	3

(3)

ch.	bu.	p
79	3	0
54	7	1

TIME.

(1)

yrs.	mo.	w.	ds.
79	8	2	4
23	9	3	5

(2)

hc.	min.	"
24	42	45
19	53	47

THE APPLICATION.

1. A man was born in the year 1723, what was his age in the year 1781?

Ans. 58.

2. What is the difference between the age of a man born in 1710, and another born in 1766?

Ans. 56.

3. A Merchant had five debtors, A, B, C, D, and E, who together owed him £1156; B, C, D, and E, owed him £737. What was A's debt?

Ans. £419.

4. When an estate of £3000 per annum, is reduced, on the paying of taxes to 12 score and £14 : 6. What is the tax?

Ans. £45 : 14.

5. What is the difference between £9154, and the amount of £754 added to £305?

Ans. £8095.

6. A horse in his furniture is worth £37 : 5; out of it, 14 guineas; how much does the price of the furniture exceed that of the horse?

Ans. £7 : 17.

7. A merchant at his out-setting in trade, owed £750; he had in cash, commodities, the stocks, and good debts, £12510 : 7; he cleared, the first year, by commerce, £452 : 3 : 6; what is the neat balance at the twelve months' end?

Ans. £12212 : 10 : 6.

8. A gentleman dying, left £45247 between two daughters, the younger who was to have 15 thousand, 15 hundred, and twice £15. What was the elder sister's fortune?

Ans. £28717.

9. A tradesman happening to fail in business, called all his creditors together, and found he owed to A, £63 : 7 : 6; to B, £105 : 10; to C, £34 : 5 : 2; to D, £28 : 16 : 5; to E, £14 : 15 : 8; to F, £112 : 9; and to G, £143 : 12 : 9. His creditors found the value of his stock to be £212 : 6, and that he had owing to him, in good book debts, £112 : 8 : 3, besides £21 : 10 : 5 money in hand. As his creditors took all his effects into their hands, I desire to know whether they were losers or gainers, and how much?

Ans. The creditors lost £146 : 11 : 10.

10. My correspondent at Seville, in Spain, sends me the following account of money received, at different sales, for goods sent him by me, viz: Beeswax, to the value of £37 : 15 : 4; stockings, £37 : 6 : 7; tobacco, £125: 11 : 6; linen cloth, £112 : 14 : 8; tin, £115 : 10 : 5. My correspondent, at the same time, informs me, that he has shipped, agreeably to my order, wines to the value of £250 : 15; fruit to the value of £51 : 12 : 6; figs, £19 : 17 : 6; oil, £19 : 12 : 4; and Spanish wool, to the value of £115 : 15 : 6. I desire to know how the account stands between us, and who is the debtor?

Ans. Due to my Spanish correspondent, £28 : 14 : 4.

MULTIPLICATION OF SEVERAL DENOMINATIONS.

RULE.—Multiply the first Denomination by the quantity given, divide the product by as many of that as make one of the next, set down the remainder, and add the quotient to the next superior, after it is multiplied.

If the given quantity is above 12, multiply by any two numbers, which multiplied together will make the same number; but if no two numbers multiplied together will make the exact number, then multiply the top line by as many as is wanting, adding it to the last product.

PROOF. By Division.

(1) £	s.	d.
35 :	12 :	7¼
		2
71 :	5 :	2½

(2) £	s.	d.
75 :	13 :	1½
		3

(3) £	s.	d.
62 :	5 :	4¼
		4

(4) £	s.	d.
57 :	2 :	4¼
		5

1. 18 yards of cloth, at 9s. 6d. per yard.

9×2=18

		9
4 :	5 :	6
		2
8 :	11 :	0

2. 26 lb. of tea, at £1 : 2 : 6 per lb.

8×3× =26

		8
9 :	0 :	0
		3
27 :	0 :	0
Top line ×2=	2 :	5 : 0
29 :	5 :	0

3. 21 ells of Holland, at 7s. 8½d. per ell.
Facit, £8 : 1 : 10½.

4. 35 firkins of butter, at 15s. 3½d. per firkin.
Facit, £26 : 15 : 2½.

5. 75 lb. of nutmegs, at 7s. 2¾d. per lb.
Facit, £27 : 2 : 2¼.

6. 37 yards of tabby, at 9s. 7d. per yard.
Facit, £17 : 14 : 7.

7. 97 cwt. of cheese, at £1 : 5 : 3 per cwt.
Facit, £122 : 9 : 3.

8. 43 dozen of candles, at 6s. 4d. per dozen.
Facit, £13 : 12 : 4.

9. 127 lb. of Bohea tea, at 12s. 3d. per lb.
Facit, £77 : 15 : 9.

10. 135 gallons of rum, at 7s. 5d. per gallon.
Facit, £50 : 1 : 3.

11. 74 ells of diaper, at 1s. 4½d. per ell.
Facit, £5 : 1 : 9.

12. 6 dozen pair of gloves, at 1s. 10d. per pair.
Facit, £6 : 12.

When the given quantity consists of ¼, ½, or ¾.

RULE. Divide the given price (or the price of one) by 4 for ¼, by 2 for ½, and for ¾, first divide by 2 for ½, then divide that quotient by 2 for ¼, add them to the product, and their sum will be the answer required.

13. $25\frac{1}{2}$ ells of holland, at 3 : $4\frac{1}{2}$d. per ell.

5 $\quad 5\times5=25$

16 : $10\frac{1}{2}$

5

4 : 4 : $4\frac{1}{2}=25$

0 : 1 : $8\frac{1}{4}=\frac{1}{2}$

4 : 6 : $0\frac{3}{4}=25\frac{1}{2}$

14. $75\frac{1}{2}$ ells of diaper, at 1s. 3d. per ell.

Facit, £4 : 14 : $4\frac{1}{2}$.

15. $19\frac{1}{2}$ ells of damask, at 4s. 3d. per ell.

Facit, £4 : 2 : $10\frac{1}{2}$.

16. $35\frac{1}{2}$ ells of dowlas, at 1s. 4d. per ell.

Facit, £2 : 7 : 4.

17. $7\frac{1}{4}$ cwt. of Malaga raisins, at £1 : 1 : 6 per cwt.

Facit, £7 : 15 : $10\frac{1}{2}$.

18. $6\frac{1}{2}$ barrels of herrings, at £3 : 15 : 7 per barrel.

Facit, £24 : 11 : $3\frac{1}{2}$.

19. $35\frac{1}{2}$ cwt. doubled refined sugar, at £4 : 15 : 6 per cwt.

Facit, £169 : 10 : 3.

20. $154\frac{1}{2}$ cwt. of tobacco, at £4 : 17 : 10 per cwt.

Facit, £755 : 15 : 3.

21. $117\frac{1}{4}$ gallons of arrack, at 12s. 6d. per gallon.

Facit, £73 : 5 : $7\frac{1}{2}$.

22. $85\frac{3}{4}$ cwt. of cheese, at £1 : 7 : 8 per cwt.

Facit, £118 : 12 : 5.

23. $29\frac{1}{4}$ lb. of fine hyson tea, at £1 : 3 : 6 per lb.

Facit, £34 : 7 : $4\frac{1}{2}$.

24. $17\frac{3}{4}$ yards of superfine scarlet drab, at £1 : 3 : 6 per yard.

Facit, £20 : 17 : $1\frac{1}{2}$.

25. $37\frac{1}{2}$ yards of rich brocaded silk, at 12s. 4d. per yard.

Facit, £23 : 2 : 6.

26. $56\frac{3}{4}$ cwt. of sugar, at £2 : 18 : 7 per cwt.

Facit, £166 : 4 : $7\frac{1}{4}$.

27. $96\frac{1}{2}$ cwt. of currants, at £2 : 15 : 6 per cwt.

Facit, £267 : 15 : 9.

28. $45\frac{3}{4}$ lb. of Belladine silk, at 18s. 6d. per lb.

Facit, £42 : 6 : $4\frac{1}{2}$.

29. $87\frac{3}{4}$ bushels of wheat, at 4s. 3d. per bushel.

Facit, £18 : 12 : $11\frac{1}{4}$.

30. 120¾ cwt. of hops, at £4 : 7 : 6 per cwt.

Facit, £528 : 5 : 7½.

31. 407 yards of cloth, at 3s. 9½d. per yard.

Facit, £77 : 3 : 2½.

32. 729 ells of cloth, at 7s. 7¼d. per ell.

Facit, £277 : 3 : 5¼.

33. 2068 yards of lace, at 9s. 5½d. per yard.

Facit, £977 : 19 : 10.

THE APPLICATION.

1. What sum of money must be divided amongst 18 men, so that each man may receive £14 : 6 : 8½?

Ans. £258 : 0 : 9.

2. A privateer of 250 men took a prize, which amounted to £125 : 15 : 6 to each man; what was the value of the prize?

Ans. £31443 : 15 : 0.

3. What is the difference between six dozen dozen, and half a dozen dozen; and what is their sum and product?

Ans. 792 diff. Sum 936, Product 62208.

4. What difference is there between twice eight and fifty, and twice fifty-eight, and what is their product?

Ans. 50 diff. 7656 Product.

5. There are two numbers, the greater of them is 37 times 45, and their difference 19 times 4; their sum and product are required?

Ans. 3254 Sum, 2645685 Product.

6. The sum of two numbers is 360, the less of them 144; what is their product and the square of their difference?

Ans. 31104 Product, 5184 Square of their difference.

7. In an army consisting of 187 squadrons of horse, each 157 men, and 207 battalions, each 560 men, how many effective soldiers, supposing that in 7 hospitals there are 473 sick?

Ans. 144806.

8. What sum did that gentleman receive in dowry with his wife, whose fortune was her wedding suit; her petticoat having two rows of furbelows, each furbelow 87 quills, and in each quill 21 guineas?

Ans. £3836 : 14 : 0.

9. A merchant had £19118 to begin trade with; for 5 years together he cleared £1086 a year; the next 4 years he made good £2715 : 10 : 6 a year; but the last 3 years he was in trade, he had the misfortune to lose, one year with another, £475 : 4 : 6 a year; what was his real fortune at 12 years' end?

Ans. £33984 : 8 : 6.

10. In some parts of the kingdom, they weigh their coals by a machine in the nature of a steel-yard, waggon and all. Three of these draughts together amount to 137 cwt. 2 qrs. 10 lb., and the tare or weight of the waggon is 13 cwt. 1 qr.; how many coals had the customer in 12 such draughts?

Ans. 391 cwt. 1 qr. 12 lb.

11. A certain gentleman lays up every year £294 : 12 : 6, and spends daily £1 : 12 : 6. I desire to know what is his annual income? *Ans.* £887 : 15 : 0.

12. A tradesman gave his daughter, as a marriage portion, a scrutoire, in which there were twelve drawers, in each drawer were six divisions, in each division there were £50, four crown pieces, and eight half-crown pieces; how much had she to her fortune? *Ans.* £3744.

13. Admitting that I pay eight guineas and half-a-crown for a quarter's rent, and am allowed quarterly 15s. for repairs, what does my apartment cost me annually, and how much in seven years? *Ans.* In 1 year, £31 : 2. In 7, £217 : 14.

14. A robbery being committed on the highway, an assessment was made on a neighbouring Hundred for the sum of £386 : 15 : 6, of which four parishes paid each £37 : 14 : 2, four hamlets £31 : 4 : 2 each, and the four townships £18 : 12 : 6 each; how much was the deficiency? *Ans.* £36 : 12 : 2.

15. A gentleman, at his decease, left his widow £4560; to a public charity he bequeathed £572 : 10; to each of his four nephews, £750 : 10; to each of his four nieces, £375 : 12 : 6; to thirty poor housekeepers, ten guineas each, and 150 guineas to his executor. What sum must he have been possessed of at the time of his death, to answer all these legacies?

Ans. £10109 : 10 : 0.

16. Admit 20 to be the remainder of a division sum, 423 the quotient, the divisor the sum of both, and 19 more, what was the number of the dividend? *Ans.* 195446.

EXAMPLES OF WEIGHTS AND MEASURES.

(1) Multiply 9 lb. 10 oz. 15 dwts. 19 grs. by 9.
(2) Multiply 23 tons, 9 cwt. 3 qrs. 18 lb. by 7.
(3) Multiply 107 yards, 3 qrs. 2 nails, by 10.
(4) Multiply 33 ale bar. 2 firk. 3 gal. by 11.
(5) Multiply 27 beer bar. 2 firk. 4 gal. 3 qts. by 12.
(6) Multiply 110 miles, 6 fur. 26 poles, by 12.

DIVISION OF SEVERAL DENOMINATIONS.

RULE. Divide the first Denomination on the left hand, and if any remains, multiply it by as many of the next less as make one of that, which add to the next, and divide as before.

PROOF. By Multiplication.

(1)

£	s.	d.
2)25 :	2 :	4(
12 :	11 :	2

(2)

£	s.	d.
3)37 :	7 :	7(

(3)

£	s.	d.
4)57 :	5 :	7(

(4)

£	s.	d.
5)52 :	7 :	0(

(5) Divide £1407 : 17 : 7 by 243.
(6) Divide £700791 : 14 : 4 by 1794.
(7) Divide £490981 : 3 : $7\frac{1}{2}$ by 31715,
(8) Divide £19743052 : 5 : $7\frac{1}{2}$ by 214723.

THE APPLICATION.

1. If a man spends £257 : 2 : 5 in twelve months' time, what is that per month?
Ans. £21 : 8 : $6\frac{1}{4}$.

2. The clothing of 35 charity boys came to £57 : 3 : 4, what is the expense of each?
Ans. £1 : 12 : 8.

3. If I gave £37 : 6 : $4\frac{3}{4}$ for nine pieces of cloth, what did I give per piece?
Ans. £4 : 2 : 11.

4. If 20 cwt. of tobacco came to £27 : 5 : $4\frac{1}{2}$, at what rate is that per cwt.?
Ans. £1 : 7 : 3.

5. What is the value of one hogshead of beer, when 120 are sold for £154 : 17 : 10?
Ans. £1 : 5 : $9\frac{3}{4}$.

6. Bought 72 yards of cloth for £85 : 6 : 0. I desire to know at what rate per yard?
Ans. £1 : 3 : $8\frac{1}{4}$.

7. Gave £275 : 3 : 4 for 36 bales of cloth, what is that for 2 bales?
Ans. £15 : 5 : $8\frac{3}{4}$.

8. A prize of £7257 : 3 : 6 is to be equally divided amongst 500 sailors, what is each man's share?
Ans. £14 : 10 : $3\frac{1}{4}$.

9. There are 2545 bullocks to be divided amongst 509 men, I desire to know how many each man had, and the value of each man's share, supposing every bullock worth £9 : 14 : 6.
Ans. 5 bullocks each man, £48 : 12 : 6 each share.

10. A gentleman has a garden walled in, containing 9625 yards, the breadth was 35 yards, what was the length?

Ans. 275.

11. A club in London, consisting of 25 gentlemen, joined for a lottery ticket of £10 value, which came up a prize of £4000. I desire to know what each man contributed, and what each man's share came to?

Ans. Each contributed 8s., each share £160.

12. A trader cleared £1156, equally, in 17 years, how much did he lay by in a year? *Ans.* £68.

13. Another cleared £2805 in 7½ years, what was his yearly increase of fortune?

Ans. £374.

14. What number added to the 43d part of 4429, will raise it to 240? *Ans.* 137.

15. Divide 20s. between A, B, and C, in such sort that A may have 2s. less than B, and C 2s. more than B?

Ans. A 4s. 8d., B 6s. 8d., C. 8s. 8d.

16. If there are 1000 men to a regiment, and but 50 officers how many private men are there to one officer?

Ans. 19.

17. What number is that, which multiplied by 7847, will make the product 3013248? *Ans.* 384.

18. The quotient is 1083, the divisor 28604, what was the dividend if the remainder came out 1788?

Ans. 30979920.

19. An army, consisting of 20,000 men, took and plundered a city of £12,000. What was each man's share, the whole being equally divided among them?

Ans. 12s.

20. My purse and money, said Dick to Harry, are worth 12s. 8d., but the money is worth seven times the purse. What did the purse contain? *Ans.* 11s. 1d.

21. A merchant bought two lots of tobacco, which weighed 12 cwt. 3 qrs. 15 lb., for £114 : 15 : 6. Their difference in point of weight, was 1 cwt. 2 qrs. 13 lb., and of price, £7 : 15 6. I desire to know their respective weights and value?

Ans. Less weight, 5 cwt. 2 qrs. 15 lb. Price, £53 : 10.
Greater weight, 7 cwt. 1 qr. Price, £61 : 5 : 6.

22. Divide 1000 crowns in such a manner between A, B, and C, that A may receive 129 more than B, and B 178 less than C.

Ans. A 360, B 231, C 409.

EXAMPLES OF WEIGHTS AND MEASURES.

1. Divide 83 lb. 5 oz. 10 dwts. 17 gr. by 8.
2. Divide 29 tons, 17 cwt. 0 qrs. 18 lb. by 9.
3. Divide 114 yards, 3 qrs. 2 nails, by 10.
4. Divide 1017 miles, 6 fur. 38 poles, by 11.
5. Divide 2019 acres, 3 roods, 29 poles, by 26.
6. Divide 117 years, 7 months, 3 weeks, 5 days, 11 hours, 27 minutes, by 37.

BILLS OF PARCELS.

HOSIERS'.

(1) Mr. John Thomas,
Bought of Samuel Green. May 1, 18

		s.	d.		
8	Pair of worsted stockings	at...	4 : 6	per pair	£
5	Pair of thread ditto		3 : 2		
3	Pair of black silk ditto		14 : 0		
6	Pair of milled hose		4 : 2		
4	Pair of cotton ditto		7 : 6		
2	Yards of fine flannel		1 : 8	per yard	
					£7 : 12 : 2

MERCERS'.

(2) Mr. Isaac Grant,
Bought of John Sims, May 3, 18

		s.	d.		
15	Yards of satin	at...	9 : 6	per yard	£
18	Yards of flowered silk		17 : 4		
12	Yards of rich brocade		19 : 8		
16	Yards of sarsenet		3 : 2		
13	Yards of Genoa velvet		27 : 6		
23	Yards of lutestring		6 : 3		
					£62 : 2 : 5

LINEN DRAPERS'.

(3) Mr. Simon Surety,
Bought of Josiah Short. June 4, 18

			s.	d.		
4	Yards of cambric	at	12	6	per yard	£
12	Yards of muslin		8	3		
15	Yards of printed linen		5	4		
2	Dozen of napkins		2	3	each	
14	Ells of diaper		1	7	per ell	
85	Ells of dowlas		1	1½		

£17 : 4 : 6½

MILLINERS'.

(4) Mrs. Bright,
Bought of Lucy Brown. June 14, 18

			£	s.	d.		
18	Yards of fine lace	at	0	12	3	per yard	£
5	Pair of fine kid gloves		0	2	2	per pair	
12	Fans of French mounts		0	3	6	each	
2	Fine lace tippets		3	3	0		
4	Dozen Irish lamb		0	1	3	per pair	
6	Sets of knots		0	2	6	per set	

£22 : 4 : 4

WOOLLEN DRAPERS'.

(5) Mr. Thomas Sage,
Bought of Ellis Smith. June 20, 18

			£	s.	d.		
17	Yards of fine serge	at	0	3	9	per yard	£
18	Yards of drugget		0	9	0		
15	Yards of superfine scarlet		1	2	0		
16	Yards of black		0	18	0		
25	Yards of shalloon		0	1	9		
17	Yards of drab		0	17	6		

£59 : 5 : 0

LEATHER-SELLERS'.

(°) Mr. Giles Harris,

Bought of Abel Smith.

July 1, 18

		s.	d.		
27	Calf Skins	at...	3 : 9	per skin	£
75	Sheep ditto		1 : 7		
36	Coloured ditto		1 : 8		
15	Buck ditto		11 : 6		
17	Russia Hides		10 : 7		
120	Lamb Skins		1 : 2½		

£38 : 17 : 5

GROCERS'.

(') Mr. Richard Groves,

Bought of Francis Elliot.

July 5, 18

		s.	d.		
25	lb. of lump sugar	at...	0 :	6¼	per lb. £
2	loaves of double refined, weight 15 lb.		0 :	11½	
14	lb. of rice				
28	lb. of Malaga raisins		0 :	3	
15	lb. of currants		0 :	5	
7	lb. of black pepper		1 :	10	

£3 : 2 . 3¼

CHEESEMONGERS'.

(°) Mr. Charles Cross,

Bought of Samuel Grant,

July 6, 18

		s.	d.		
8	lb. of Cambridge butter	at...	0 :	6	per lb. £
17	lb. of new cheese		0 :	4	
½	Fir. of butter, wt. 28 lb.		0 :	5½	
5	Cheshire cheeses, 127 lb.		0 :	4	
2	Warwickshire ditto, 15 lb.		0 :	3	
12	lb. of cream cheese		0 :	6	

£3 : 14 : 5

CORN-CHANDLERS'.

(*) Mr. Abraham Doyley,
Bought of Isaac Jones. July 20, 18

		d.	
Tares, 19 bushels	at.	1 : 10	per bushel £
Pease, 18 bushels		3 : 9½	.....
Malt, 7 quarters		25 : 0	per quarter
Hops, 15 lb.		1 : 5	per lb....
Oats, 6 qrs		2 : 4	per bushel
Beans, 12 bushels		4 : 8	.....

£23 : 7 : 4

REDUCTION

pp pp

Is the bringing or reducing numbers of one denomination into other numbers of another denomination, retaining the same value, and is performed by multiplication and division.

First, All great names are brought into small, by multiplying with so many of the less as make one of the greater.

Secondly, All small names are brought into great, by dividing with so many of the less as make one of the greater.

A TABLE OF SUCH COINS AS ARE CURRENT IN ENGLAND.

	£	s.	d.
Guinea	1 :	1 :	0
Half ditto	0 :	10 :	6
Sovereign	1 :	0 :	0
Half ditto	0 :	10 :	0
Crown	0 :	5 :	0
Half ditto	0 :	2 :	6
Shilling	0 :	1 :	0

NOTE. There are several pieces which speak their own value; such as sixpence, fourpence, threepence, twopence, penny, halfpenny, farthing.

1. In £8, how many shillings and pence?

20

160 shillings.
12

1920

2. In £12, how many shillings, pence, and farthings?
Ans. 240s. 2880d. 11520 far.

3. In 311520 farthings, how many pounds?
Ans. £324 : 10.

4. How many farthings are there in 21 guineas?
Ans. 21168.

5. In £17 : 5 : 3¼, how many farthings? *Ans.* 16573.

6. In £25 : 14 : 1, how many shillings and pence?
Ans. 514s. 6169d.

7. In 17940 pence, how many crowns? *Ans.* 299.

8. In 15 crowns, how many shillings and sixpences?
Ans. 75s. 150 sixpences.

9. In 57 half-crowns, how many pence and farthings?
Ans. 1710d. 6840 farthings.

10. In 52 crowns, as many half-crowns, shillings, and pence, how many farthings? *Ans.* 21424.

11. How many pence, shillings, and pounds, are there in 17280 farthings? *Ans.* 4320d. 360s. £18.

12. How many guineas in 21168 farthings?
Ans. 21 guineas.

13. In 16573 farthings, how many pounds?
Ans. £17 : 5 : 3¼.

14. In 6169 pence, how many shillings and pounds?
Ans. 514s. £25 : 14 : 1.

15. In 6840 farthings, how many pence and half-crowns?
Ans. 1710d. 57 half-crowns.

16. In 21424 farthings, how many crowns, half-crowns, shillings, and pence, and of each an equal number? *Ans.* 52.

17. How many shillings, crowns, and pounds, in 60 guineas?
Ans. 1260s. 252 crowns, £63.

18. Reduce 76 moidores into shillings and pounds?
Ans. 2052s. £102 : 12.

19. Reduce £102 : 12 into shillings and moidores?
Ans. 2052s. 76 moidores.

20. How many shillings, half-crowns, and crowns, are there in £556, and of each an equal number?
Ans. 1308 each, and 2s. over.

21. In 1308 half-crowns, as many crowns and shillings, how many pounds? *Ans.* £555 : 18.

22. Seven men brought £15 : 10 each into the mint, to be exchanged for guineas, how many must they have in all?
Ans. 103 guineas, 7s. over.

23. If 103 guineas and seven shillings are to be divided amongst seven men, how many pounds sterling is that each?

Ans. £15 : 10.

24. A certain person had 25 purses, and in each purse 12 guineas, a crown, and a moidore, how many pounds sterling had he in all?

Ans. £355.

25. A gentleman, in his will, left £50 to the poor, and ordered that $\frac{1}{3}$ should be given to ancient men, each to have 5s.—$\frac{1}{4}$ to poor women, each to have 2s. 6d.—$\frac{1}{5}$ to poor boys, each to have 1s.—$\frac{1}{6}$ to poor girls, each to have 9d. and the remainder to the person who distributed it. I demand how many of each sort there were, and what the person who distributed the money had for his trouble?

Ans. 66 men, 100 women, 200 boys, 222 girls, £2 : 13 : 6 for the person's trouble.

TROY WEIGHT.

26. In 27 ounces of gold, how many grains?

Ans. 12960.

27. In 12960 grains of gold, how many ounces?

Ans. 27.

28. In 3 lb. 10 oz. 7 dwts. 5 gr. how many grains?

Ans. 22253.

29. In 8 ingots of silver, each weighing 7 lb. 4 oz. 17 dwts. 15 gr. how many ounces, pennyweights, and grains?

Ans. 711 oz. 14221 dwts. 341304 gr.

30. How many ingots, of 7 lb. 4 oz. 17 dwts. 15 gr. each, are there in 341304 grains? *Ans.* 8 ingots.

31. Bought 7 ingots of silver, each containing 23 lb. 5 oz. 7 dwts. how many grains? *Ans.* 945336.

32. A gentleman sent a tankard to his goldsmith, that weighed 50 oz. 8 dwts. and ordered him to make it into spoons, each to weigh 2 oz. 16 dwts. how many had he?

Ans. 18.

33. A gentleman delivered to a goldsmith 137 oz. 6 dwts. 9 gr. of silver, and ordered him to make it into tankards of 17 oz. 15 dwts. 10 gr. each; spoons of 21 oz. 11 dwts. 13 gr. per doz. salts of 3 oz. 10 dwts. each; and forks of 21 oz. 11 dwts. 13 gr. per doz. and for every tankard to have one salt, a dozen of spoons, and a dozen of forks; what is the number of each he must have?

Ans. 2 of each sort, 8 oz. 9 dwts. 9 gr. over.

AVOIRDUPOIS WEIGHT.

NOTE.—There are several sorts of silk which are weighed by a great pound of 24 oz. others by the common pound of 16 oz.; therefore,

To bring great pounds into common, multiply by 3, and divide by 2 or add one half

To bring small pounds into great, multiply by 2, and divide by 3, or subtract one third.

Things bought and sold by the Tale.

12 Pieces or things make 1 Dozen
12 Dozen.....1 Gross.
12 Gross, or 144 doz.....1 Great Gross.
24 Sheets.....1 Quire.
20 Quires.....1 Ream.
2 Reams.....1 Bundle.
1 Dozen of Parchment.12 Skins.
12 Skins.....1 Roll.

34. In 14769 ounces how many cwt.?

Ans. 8 cwt. 0 qr. 27 lb. 1 oz.

35. Reduce 8 cwt. 0 qrs. 27 lb. 1 oz. into quarters, pounds, and ounces.

Ans. 32 qrs. 923 lb. 14769 oz.

36. Bought 32 bags of hops, each 2 cwt. 1 qr. 14 lb. and another of 150 lb. how many cwt. in the whole?

Ans. 77 cwt. 1 qr. 10 lb.

37. In 34 ton, 17 cwt. 1 qr. 19 lb. how many pounds?

Ans. 78111 lb.

38. In 547 great pounds, how many common pounds?

Ans. 820 lb. 8 oz.

39. In 27 cwt. of raisins how many parcels of 18 lb. each?

Ans. 168.

40. In 9 cwt. 2 qrs. 14 lb. of indigo, how many pounds?

Ans. 1078 lb.

41. Bought 27 bags of hops, each 2 cwt. 1 qr. 15 lb. and one bag of 137 lb., how many cwt. in the whole?

Ans. 65 cwt. 2 qrs. 10 lb.

42. How many pounds in 27 hogsheads of tobacco, each weighing neat 8$\frac{1}{4}$ cwt.?

Ans. 26460

43. In 552 common pounds of silk, how many great pounds?

Ans. 368.

44. How many parcels of sugar of 16 lb. 2 oz. are there in 16 cwt. 1 qr. 15 lb.?

Ans. 113 parcels, and 12 lb. 14 oz. over.

APOTHECARIES' WEIGHT.

45. In 27 lo. 7 oz. 2 dr. 1 scr. how many grains?
Ans. 159020.

46. How many lb. oz. dr. scr. are there in 159020 grains?
Ans. 27 lb. 7 oz. 2 dr. 1 scr.

CLOTH MEASURE.

47. In 27 yards, how many nails? *Ans.* 432.

48. In 75 English ells, how many yards?
Ans. 93 yards, 3 qrs.

49. In 93¾ yards, how many English ells? *Ans.* 75.

50. In 24 pieces, each containing 32 Flemish ells, how many English ells? *Ans.* 460 English ells, 4 qrs.

51. In 17 pieces of cloth, each 27 Flemish ells, how many yards? *Ans.* 344 yards, 1 qr.

52. Bought 27 pieces of English stuff, each 27 ells, how many yards? *Ans.* 911 yards, 1 qr.

53. In 911¼ yards, how many English ells?
Ans. 729.

54. In 12 bales of cloth, each 25 pieces, each 15 English ells, how many yards? *Ans.* 5625.

LONG MEASURE.

55. In 57 miles, how many furlongs and poles?
Ans. 456 furlongs, 18240 poles.

56. In 7 miles, how many feet, inches, and barley-corns?
Ans. 36960 ft. 443520 in. 1330560 b. corns.

57. In 18240 poles, how many furlongs and miles?
Ans. 456 furlongs, 57 miles.

58. In 72 leagues, how many yards? *Ans.* 380160.

59. In 380160 yards, how many miles and leagues?
Ans. 216 miles, 72 leagues.

60. If from London to York be accounted 50 leagues, I demand how many miles, yards, feet, inches, and barley-corns?
Ans. 150 miles, 264000 yards, 792000 feet, 9504000 inches, 28512000 barley-corns.

61. How often will the wheel of a coach, that is 17 feet in circumference, turn in 100 miles?
Ans. 31058$\frac{14}{17}$ times round.

62. How many barley-corns will reach round the world, the circumference of which is 360 degrees, each degree 69 miles and a half?

Ans. 4755801600 barley-corns.

LAND MEASURE.

63. In 27 acres, how many roods and perches?

Ans. 108 roods, 4320 perches.

64. In 4320 perches, how many acres? *Ans.* 27.

65. A person having a piece of ground, containing 37 acres. 1 pole, has a mind to dispose of 15 acres to A. I desire to know how many perches he will have left?

Ans. 3521.

66. There are four fields to be divided into shares of 75 perches each; the first field containing 5 acres; the second, 4 acres, 2 poles; the third, 7 acres, 3 roods; and the fourth, 2 acres, 1 rood. I desire to know how many shares are contained therein?

Ans. 40 shares, 42 perches rem.

WINE MEASURE.

67. Bought 5 tuns of port wine, how many gallons and pints?

Ans. 1260 gallons, 10080 pints.

68. In 10080 pints, how many tuns? *Ans.* 5 tuns.

69. In 5896 gallons of Canary, how many pipes and hogsheads, and of each an equal number?

Ans. 31 of each, 37 gallons over.

70. A gentleman ordered his butler to bottle off $\frac{1}{2}$ of a pipe of French wine into quarts, and the rest into pints. I desire to know how many dozen of each he had?

Ans. 28 dozen of each.

ALE AND BEER MEASURE.

71. In 46 barrels of beer, how many pints.

Ans. 13248.

72. In 10 barrels of ale, how many gallons and quarts?

Ans. 320 gals. 1280 qts.

73. In 72 hogsheads of ale, how many barrels?

Ans. 108.

74. In 108 barrels of ale, how many hogsheads?

Ans. 72

DRY MEASURE.

75. In 120 quarters of wheat, how many bushels, pecks, gallons and quarts?

Ans. 960 bushels, 3840 pecks, 7680 gallons, 30720 qts.

76. In 30720 quarts of corn, how many quarters?

Ans. 120.

77. In 20 chaldrons of coals, how many pecks?

Ans. 2880.

78. In 273 lasts of corn, how many pecks?

Ans. 87360.

TIME.

79. In 72015 hours, how many weeks?

Ans. 428 weeks, 4 days, 15 hours.

80. How many days is it since the birth of our Saviour, to Christmas, 1794? *Ans.* 655258½.

81. Stowe writes, London was built 1108 years before our Saviour's birth, how many hours is it since to Christmas, 1794?

Ans. 25438932 hours.

82. From November 17, 1738, to September 12, 1739, how many days? *Ans.* 299.

83. From July 18, 1749, to December 27 of the same year, how many days? *Ans.* 162.

84. From July 18, 1723, to April 18, 1750, how many years and days? *Ans.* 26 years, 9770½ days, reckoning 365 days 6 hours a year.

THE SINGLE RULE OF THREE DIRECT.

Teacheth by three numbers given to find out a fourth, in such proportion to the third, as the second is to the first.

Rule. First state the question, that is, place the numbers in such order, that the first and third be of one kind, and the second the same as the number required; then bring the first and third numbers into one name, and the second into the lowest term mentioned. Multiply the second and third numbers together, and

divide the product by the first, and the quotient will be the answer to the question in the same denomination you left the second number in.

EXAMPLES.

1. If 1 lb. of sugar cost 4½d, what cost 54 lb?

$$1 : 4\tfrac{1}{2} :: 54$$

$$\begin{array}{rr} 4 & 18 \\ \hline 18 & 4)972 \\ & \hline & 12)243 \\ & \hline & 20\text{s. } 3\text{d.} \end{array}$$

Ans. £1 : 0 : 3.

2. If a gallon of beer cost 10d., what is that per barrel?
Ans. £1 : 10.

3. If a pair of shoes cost 4s. 6., what will 12 dozen come to?
Ans. £32 : 8.

4. If one yard of cloth cost 15s. 6d., what will 32 yards cost at the same rate?
Ans. £24 : 16.

5. If 32 yards of cloth cost £24 : 16, what is the value of a yard?
Ans. 15s. 6d.

6. If I give £4 : 18 for 1 cwt. of sugar, at what rate did I buy it per lb?
Ans. 10½d.

7. If I buy 20 pieces of cloth, each 20 ells, for 12s. 6d. per ell, what is the value of the whole?
Ans. £250.

8. What will 25 cwt. 3 qrs. 14 lb. of tobacco come to, at 15½d. per lb.?
Ans. £187 : 3 : 3.

9. Bought 27¼ yards of muslin, at 6s. 9½d. per yard, what does it amount to?
Ans. £9 : 5 : 0¾, 2 rem.

10. Bought 17 cwt. 1 qr. 14 lb. of iron, at 3¼ per lb. what does it come to?
Ans. £26 : 7 : 0½.

11. If coffee is sold for 5½d. per ounce, what must be given for 2 cwt.?
Ans. £82 : 2 : 8.

12. How many yards of cloth may be bought for £21 : 11 : 1½, when 3½ yards cost £2 : 14 : 3?
Ans. 27 yards, 3 qrs. 1 nail, 84 rem.

13. If 1 cwt. of Cheshire cheese cost £1 : 14 : 8, what must I give for 3½ lb.?
Ans. 1s. 1d.

14. Bought 1 cwt. 24 lb. 8 oz. of old lead, at 9s. per cwt., what does it come to?
Ans. 10s. 11½d. 112 rem.

15. If a gentleman's income is £500 a year, and he spends 19s. 4d. per day, how much does he lay by at the year's end? *Ans.* £147 : 3 : 4.

16. If I buy 14 yards of cloth for 10 guineas, how many Flemish ells can I buy for £283 : 17 : 6 at the same rate?

Ans. 504 Fl. ells, 2 qrs.

17. If 504 Flemish ells, 2 quarters, cost £283 : 17 : 6, at what rate did I pay for 14 yards?

Ans. 10s. 10d.

18. Gave £1 : 1 : 8 for 3 lb. of coffee, what must be given for 29 lb. 4 oz.?

Ans. £10 : 11 : 3.

19. If one English ell 2 qrs. cost 4s. 7d. what will 39½ yards cost at the same rate?

Ans. £5 : 3 : 5¼, 5 rem.

20. If one ounce of gold is worth £5 : 4 : 2, what is the worth of one grain? *Ans.* 2½d. 20 rem.

21. If 14 yards of broad cloth cost £9 : 12, what is the purchase of 75 yards? *Ans.* 51 : 8 : 6¾, 6 rem.

22. If 27 yards of Holland cost £5 : 12 : 6, how many ells English can I buy for £100? *Ans.* 384.

23. If 1 cwt. cost £12 : 12 : 6, what must I give for 14 cwt. 1 qr. 19 lb. *Ans.* £182 : 0 : 11½, 8 rem.

24. Bought 7 yards of cloth for 17s. 8d. what must be given for 5 pieces, each containing 27½ yards.

Ans. £17 : 7 : 0¼, 2 rem.

25. If 7 oz. 11 dwts. of gold be worth £35, what is the value of 14 lb. 9 oz. 12 dwt. 16 gr. at the same rate?

Ans. £823 : 9 : 3¾, 552 rem.

26. A draper bought 420 yards of broad cloth, at the rate of 14s. 10½d per ell English, how much did he pay for the whole?

Ans. 250 : 5.

27. A gentleman bought a wedge of gold, which weighed 14 lb. 2 oz 8 dwts. for the sum of £514 : 4, at what rate did he pay for it per oz.?

Ans. £3.

28. A grocer bought 4 hogsheads of sugar, each weighing neat 6 cwt. 2 qrs. 14 lb which cost him £2 : 8 : 6 per cwt.; what is the value of the 4 hogsheads?

Ans. £64 : 5 : 3.

29. A draper bought 8 packs of cloth, each containing 4 parcels, each parcel 10 pieces, and each piece 26 yards, and gave after the rate of £4 : 16 for 6 yards; I desire to know what the 8 packs stood him to?

Ans. £6656.

30. If 24 lb. of raisins cost 6s. 6d. what will 18 frails cost, each weighing neat 3 qrs. 18 lb.?

Ans. £24 : 17 : 3.

31. If 1 oz. of silver be worth 5s. what is the price of 14 ingots, each weighing 7 lb. 5 oz. 10 dwts.

Ans. £313 : 5.

32. What is the price of a pack of wool, weighing 2 cwt. 1 qr. 19 lb. at 8s. 6d. per stone?

Ans. £8 : 4 : 6¼, 10 rem.

33. Bought 59 cwt. 2 qrs. 24 lb. of tobacco, at £2 : 17 : 4 per cwt.; what does it come to? *Ans.* £171 : 3 : 7¼ 80 rem.

34. Bought 171 tons of lead, at £14 per ton; paid carriage and other incident charges, £4 : 10. I require the value of the lead, and what it stands me in per lb.?

Ans. £2398 : 10 value; 1½d. 432 rem. per lb.

35. If a pair of stockings cost 10 groats, how many dozen may I buy for £43 : 5?

Ans. 21 dozen, 7½ pair.

36. Bought 27 dozen 5 lb. of candles, after the rate of 17d. per 3 lb. what did they cost me?

Ans. £7 : 15 : 4¼, 1 rem.

37. If an ounce of fine gold is sold for £3 : 10, what come 7 ingots to, each weighing 3 lb. 7 oz. 14 dwts. 21 gr., at the same price?

Ans. £1071 : 14 : 5¼.

38. If my horse stands me in 9½d. per day keeping, what will be the charge of 11 horses for the year?

Ans. £158 : 18 : 6½.

39. A factor bought 86 pieces of stuff, which cost him £517 : 19 : 4, at 4s. 10d. per yard; I demand how many yards there were, and how many ells English in a piece?

Ans. 2143¼ yards, 56 rem. and 19 ells, 4 quarters, 2 nails, 64 rem. in a piece.

40. A gentleman hath an annuity of £896 : 17 per annum. I desire to know how much he may spend daily, that at the year's end he may lay up 200 guineas, and give to the poor quarterly 40 moidores?

Ans. £1 : 14 : 8, 44 rem.

THE RULE OF THREE INVERSE.

INVERSE PROPORTION is, when more requires less, and less requires more. More requires less, is when the third term is greater than the first, and requires the fourth term to be less than the second. And less requires more, is when the third term is less than the first, and requires the fourth term to be greater than the second.

RULE.—Multiply the first and second terms together, and divide the product by the third, the quotient will bear such proportion to the second as the first does to the third.

EXAMPLES.

1. If 8 men can do a piece of work in 12 days, how many days can 16 men perform the same in? *Ans.* 6 days.

8 . 12 . . 16 . 6
8

16)96(6 days.

2. If 54 men can build a house in 90 days, how many can do the same in 50 days?

Ans. 97$\frac{1}{5}$ men.

3. If, when a peck of wheat is sold for 2s., the penny loaf weighs 8 oz., how much must it weigh when the peck is worth but 1s. 6d.?

Ans. 10$\frac{2}{3}$ oz.

4. How many pieces of money, of 20s. value, are equal to 240 pieces of 12s. each? *Ans.* 144.

5. How many yards, of three quarters wide, are equal in measure to 30 yards, of 5 quarters wide? *Ans.* 50.

6. If I lend my friend £200 for 12 months, how long ought he to lend me £150, to requite my kindness?

Ans. 16 months.

7. If for 24s. I have 1200 lb. carried 36 miles, how many pounds can I have carried 24 miles for the same money?

Ans. 1800 lb.

8. If 108 workmen finish a piece of work in 12 days, how many are sufficient to finish it in 3 days?

Ans. 432.

9. An army besieging a town, in which were 1000 soldiers, with provisions for 3 months, how many soldiers departed, when the provisions lasted them 6 months?

Ans. 500.

10. If £20 worth of wine is sufficient to serve an ordinary of 100 men, when the tun is sold for £30, how many will £20 worth suffice, when the tun is sold but for £24?

Ans. 125.

11. A courier makes a journey in 24 days, when the day is but 12 hours long, how many days will he be going the same journey, when the day is 16 hours long?

Ans. 18 days.

12. How much plush is sufficient for a cloak, which has in it 4 yards, of 7 quarters wide, of stuff, for the lining, the plush being but 3 quarters wide?

Ans. 9⅓ yards.

13. If 14 pioneers make a trench in 18 days, how many days will 34 men take to do the same?

Ans. 7 days, 4 hours, 56 min. $\frac{8}{17}$, at 12 hours for a day.

14. Borrowed of my friend £64 for 8 months, and he had occasion another time to borrow of me for 12 months, how much must I lend him to requite his former kindness to me?

Ans. £42 : 13 : 4.

15. A regiment of soldiers, consisting of 1000 men, are to have new coats, each coat to contain 2½ yards of cloth, 5 quarters wide, and to be lined with shalloon of 3 quarters wide; I demand how many yards of shalloon will line them?

Ans. 4166 yards, 2 qrs. 2 nails, 2 rem.

THE DOUBLE RULE OF THREE,

Is so called because it is composed of 5 numbers given to find a 6th, which, if the proportion is direct, must bear such a proportion to the 4th and 5th, as the third bears to the 1st and 2d. But if inverse, the 6th number must bear such proportion to the 4th and 5th, as the 1st bears to the 2d and 3d. The three first terms are a supposition; the two last, a demand.

Rule 1. Let the principal cause of loss or gain, interest or decrease, action or passion, be put in the first place.

2. Let that which betokeneth time, distance of place, and the like, be in the second place, and the remaining one in the third.

3. Place the other two terms under their like in the supposition.

4. If the blank falls under the third term, multiply the first and second terms for a divisor, and the other three for a dividend. But,

5. If the blank falls under the first or second term, multiply the third and fourth terms for a divisor, and the other three for the dividend, and the quotient will be the answer.

Proof. By two single rules of three.

EXAMPLES.

1. If 14 horses eat 56 bushels of oats in 16 days, how many bushels will be sufficient for 20 horses for 24 days?

By two single rules.

	hor.	bu.	hor.	bu.
1. As	14	56 ..	20	80
	days	bu.	days.	bu.
2. As	16	80 ..	24	120

or in one stating, worked thus:

hor.	days	bu.	
14	16	56	$\frac{56\times20\times24}{14\times16}=120$
20	24	—	

2. If 8 men in 14 days can mow 112 acres of grass, how many men must there be to mow 2000 acres in 10 days?

	acres.	days.	acres.	days.
1. As	112	14 ..	2000	250
	days.	men.	days.	men.
2. As	250	8 ..	10	200

men		acres.	
8		112	$\frac{8\times14\times2000}{112\times10}=200$
—	10	2000	

3. If £100 in 12 months gain £6 interest, how much will £75 gain in 9 months. *Ans.* £3 : 7 : 6.

4. If a carrier receives £2 : 2 for the carriage of 3 cwt. 150 miles, how much ought he to receive for the carriage of 7 cwt. 3 qrs. 14 lb. for 50 miles? *Ans.* £1 : 16 : 9.

5. If a regiment of soldiers, consisting of 136 men, consume 351 quarters of wheat in 108 days, how many quarters of wheat will 11232 soldiers consume in 56 days?

Ans. 15031 qrs. 864 rem.

6. If 40 acres of grass be mowed by 8 men in 7 days, how many acres can be mowed by 24 men in 28 days? *Ans.* 480.

7. If 40s. will pay 8 men for 5 days' work, how much will pay 32 men for 24 days' work? *Ans.* £38 : 8.

8. If £100 in 12 months gain £6 interest, what principal will gain £3 : 7 : 6 in 9 months? *Ans.* £75.

9. If a regiment, consisting of 939 soldiers, consume 351 qrs. of wheat in a 168 days, how many soldiers will consume 1404 qrs. in 56 days?

Ans. 11268.

10. If a family consisting of 7 persons, drink out 2 kilderkins of beer in 12 days, how many kilderkins will another family of 14 persons drink out in 8 days? *Ans.* 2 kil. 12 gal.

11. If the carriage of 60 cwt. 20 miles, cost £14 : 10, what weight can I have carried 30 miles for £5 : 8 : 9, at the same rate of carriage?

Ans. 15 cwt.

12. If 2 horses eat 8 bushels of oats in 16 days, how many horses will eat up 3000 quarters in 24 days?

Ans. 4000.

13. If £100 in 12 months gain £7 interest, what is the interest of £571 for 6 years?

Ans. £239 : 16 : 4¼, 20 rem.

14. If I pay 10s. for the carriage of 2 tons 6 miles, what must I pay for the carriage of 12 tons, 17 cwt. 17 miles?

Ans. £9 : 2 : $0\frac{1}{2}$.

PRACTICE

Is so called from the general use thereof by all persons concerned in trade and business.

All questions in this rule are performed by taking aliquot, or even parts, by which means many tedious reductions are avoided; the table of which is as follows:—

Of a Pound.		Of a shilling.		Of a Ton.		Of a Hundred.	
s.	d.	d.		cwt.		qrs.	lb.
10	0 .. is ...	$\frac{1}{2}$	6 .. is ...	$\frac{1}{2}$	10 .. is ...	$\frac{1}{2}$	2 or 56 is $\frac{1}{2}$
6	8	$\frac{1}{3}$	4	$\frac{1}{3}$	5	$\frac{1}{4}$	1 or 28 ... $\frac{1}{4}$
5	0	$\frac{1}{4}$	3	$\frac{1}{4}$	4	$\frac{1}{5}$	14 ... $\frac{1}{8}$
4	0	$\frac{1}{5}$	2	$\frac{1}{6}$	$2\frac{1}{2}$	$\frac{1}{8}$	Of a Quarter.
3	4	$\frac{1}{6}$	$1\frac{1}{2}$	$\frac{1}{8}$	2	$\frac{1}{10}$	14 lb. ..... $\frac{1}{2}$
2	6	$\frac{1}{8}$	1	$\frac{1}{12}$			7 ..... $\frac{1}{4}$
2	0	$\frac{1}{10}$					4 ..... $\frac{1}{7}$
1	8	$\frac{1}{12}$					$3\frac{1}{2}$ ..... $\frac{1}{8}$

Rule 1. When the price is less than a penny, divide by the aliquot parts that are in a penny; then by 12 and 20, it will be the answer.

(1) $\frac{1}{4}$ is $\frac{1}{4}$)5704 lb. at $\frac{1}{4}$

12)1426

2|0)11|8 : 10

Facit, £5 : 18 : 10

(2) 7695 at $\frac{1}{2}$
Facit, £16 : 0 : $7\frac{1}{2}$

(3) 5470 at $\frac{1}{2}$
Facit, £11 : 7 : 11

(4) 6547 at $\frac{3}{4}$
Facit, £20 : 9 : $2\frac{1}{4}$

(5) 4573 at $\frac{3}{4}$
Facit, £14 : 5 : $9\frac{3}{4}$

Rule 2. When the price is less than a shilling, take the aliquot part or parts that are in a shilling, add them together, and divide by 20, as before.

(1) is $\frac{1}{12}$ 7547 at 1d.

2|0)62|8 : 11

Facit, £31 : 8 : 11.

(2) 1 is $\frac{1}{12}$ 3751 at $1\frac{1}{4}$d

$\frac{1}{4}$ is $\frac{1}{4}$ 312 : 7

78 : $1\frac{3}{4}$

2|0)39|0 : $8\frac{3}{4}$

Facit, £19 : 10 : $8\frac{3}{4}$.

(3) 54325 at $1\frac{1}{2}$d.
Facit, £339 : 10 : $7\frac{1}{2}$.

(4) 6254 at $1\frac{3}{4}$d.
Facit, £45 : 12 : $0\frac{1}{2}$.

(5) 2351 at 2d.
Facit, £19 : 11 : 10.

(6) 7210 at $2\frac{1}{4}$d.
Facit, £67 : 11 : $10\frac{1}{2}$.

(7) 2710 at $2\frac{1}{2}$d.
Facit, £28 : 4 : 7.

(8) 3250 at $2\frac{3}{4}$d.
Facit, £37 : 4 : $9\frac{1}{2}$.

(9) 2715 at 3d.
Facit, £33 : 18 : 9.

(10) 7062 at $3\frac{1}{4}$d.
Facit, £95 : 12 : $7\frac{1}{2}$.

(11) 2147 at $3\frac{1}{2}$d.
Facit, £31 : 6 : $2\frac{1}{2}$.

(12) 7000 at $3\frac{3}{4}$d.
Facit, £109 : 7 : 6.

(13) 3257 at 4d.
Facit, £54 : 5 : 8.

(14) 2056 at $4\frac{1}{4}$d.
Facit, £36 : 8 : 2.

(15) 3752 at $4\frac{1}{2}$d.
Facit, £70 : 7 : 0.

(16) 2107 at $4\frac{3}{4}$d.
Facit, £41 : 14 : $0\frac{1}{4}$.

(17) 3210 at 5d.
Facit, £66 : 17 : 6.

(18) 2715 at $5\frac{1}{4}$d.
Facit, £59 : 7 : $9\frac{3}{4}$.

(19) 3120 at $5\frac{1}{2}$d.
Facit, £71 : 10 : 0.

(20) 7521 at $5\frac{3}{4}$d.
Facit, £180 : 3 : $9\frac{3}{4}$.

(21) 3271 at 6d.
Facit, £81 : 15 : 6.

(22) 7914 at $6\frac{1}{4}$d.
Facit, £206 : 1 : $10\frac{1}{2}$.

(23) 3250 at $6\frac{1}{2}$d.
Facit, £88 : 0 : 5.

(24) 2708 at $6\frac{3}{4}$d.
Facit, £76 : 3 : 3.

(25) 3271 at 7d.
Facit, £95 : 8 : 1.

(26) 3254 at $7\frac{1}{4}$d.
Facit, £98 : 5 : $11\frac{1}{2}$.

(27) 2701 at $7\frac{1}{2}$d.
Facit, £84 : 8 : $1\frac{1}{2}$.

(28) 3714 at $7\frac{3}{4}$d.
Facit, £119 : 18 : $7\frac{1}{2}$.

(29) 2710 at 8d.
Facit, £90 : 6 : 8.

(30) 3514 at $8\frac{1}{4}$d.
Facit, £120 : 15 : $10\frac{1}{2}$.

(31) 2759 at $8\frac{1}{2}$d.
Facit, £97 : 14 : $3\frac{1}{2}$.

(32) 9872 at $8\frac{3}{4}$d.
Facit, £359 : 18 : 4.

(33) 5272 at 9d.
Facit, £197 : 14 : 0.

(34) 6325 at $9\frac{1}{4}$d.
Facit, £243 : 15 : $6\frac{1}{4}$.

(35) 7924 at $9\frac{1}{2}$d.
Facit, £313 : 13 : 2.

(36) 2150 at $9\frac{3}{4}$d.
Facit, £87 : 6 : $10\frac{1}{2}$.

(37) 6325 at 10d.
Facit, £263 : 10 : 10.

(38) 5724 at $10\frac{1}{4}$d.
Facit, £244 : 9 : 3.

(39) 6827 at $10\frac{1}{4}$d.
Facit, £270 : 4 : $3\frac{3}{4}$.

(40) 3254 at $10\frac{1}{2}$d.
Facit, £142 : 7 : 3.

(41) 7291 at $10\frac{3}{4}$d.
Facit, £326 : 11 : $6\frac{1}{4}$.

(42) 3256 at 11d.
Facit, £149 : 4 : 8.

(43) 7254 at 11¼d.
Facit, £340 : 0 : 7½.

(44) 3754 at 11½d.
Facit, £179 : 17 : 7.

(45) 7972 at 11¾d.
Facit, £390 : 5 : 11.

RULE 3. When the price is more than one shilling, and less than two, take the part or parts, with so much of the given price as is more than a shilling, which add to the given quantity, and divide by 20, it will give the answer.

(1) ¼ ⅛ 2106 at 12¼d.
43 : 10½

2|0)214|9 : 10½

Facit, £107 : 9 : 10½.

(2) ½ ¼ 3715 at 12½d.
154 : 9½

2|0)386|9 : 9½.

Facit, £193 : 9 : 9½.

(3) 2712 at 12¾d.
Facit, £144 : 1 : 6.

(4) 2107 at 1s. 1d.
Facit, £114 : 2 : 7.

(5) 3215 at 1s. 1¼d.
Facit, £177 : 9 : 10¾.

(6) 2790 at 1s. 1½d.
Facit, £156 : 18 : 9.

(7) 7904 at 1s. 1¾d.
Facit, £452 : 16 : 8.

(8) 3750 at 1s. 2d.
Facit, £218 : 15 : 0.

(9) 3291 at 1s. 2¼d.
Facit, £195 : 8 : 0¾.

(10) 9254 at 1s. 2½d.
Facit, £559 : 1 : 11.

(11) 7250 at 1s. 2¾d.
Facit, £445 : 11 : 5½.

(12) 7591 at 1s. 3d.
Facit, £474 : 8 : 9.

(13) 6325 at 1s. 3¼d.
Facit, £401 : 18 : 0¼.

(14) 5271 at 1s. 3½d.
Facit, £340 : 8 : 4½d.

(15) 3254 at 1s. 3¾d.
Facit, £213 : 10 : 10½.

(16) 2915 at 1s. 4d.
Facit, £194 : 6 : 8.

(17) 3270 at 1s. 4¼d.
Facit, £221 : 8 : 1½.

(18) 7059 at 1s. 4½d.
Facit, £485 : 6 : 1½.

(19) 2750 at 1s. 4¾d.
Facit, £191 : 18 : 6½.

(20) 3725 at 1s. 5d.
Facit, £263 : 17 : 1.

(21) 7250 at 1s. 5¼d.
Facit, £521 : 1 : 10½.

(22) 2597 at 1s. 5½d.
Facit, £189 : 7 : 3½.

(23) 7210 at 1s. 5¾d.
Facit, £533 : 4 : 9½.

(24) 7524 at 1s. 6d.
Facit, £564 : 6 : 0.

(25) 7103 at 1s. 6¼d.
Facit, £540 : 2 : 5¾.

(26) 3254 at 1s. 6½d.
Facit, £250 : 16 : 7.

(27) 7925 at 1s. 6¾d.
Facit, £619 : 2 : 9¾.

(28) 9271 at 1s. 7d.
Facit, £733 : 19 : 1.

(29) 7210 at 1s. 7¼d.
Facit, £578 : 6 : 0½.

(30) 2310 at 1s. 7½d.
Facit, £187 : 13 : 9.

(31) 2504 at 1s. 7¾d.
Facit, £206 : 1 : 2.

(32) 7152 at 1s. 8d.
Facit, £596 : 0 : 0.

(33) 2905 at 1s. 8¼d.
Facit, £245 : 2 : 2¼.

(34) 7104 at 1s. 8½d.
Facit, £606 : 16 : 0.

(35) 1004 at 1s. 8¾d. Facit, £86 : 16 : 1.	(40) 1071 at 1s. 10d. Facit, £98 : 3 : 6.	(45) 2105 at 1s. 11¼d. Facit, £203 : 18 : 5¼.
(36) 2104 at 1s. 9d. Facit, £184 : 2 : 0.	(41) 5200 at 1s. 10¼d Facit, £482 : 1 : 8.	(46) 1006 at 1s. 11½d. Facit, £98 : 10 : 1.
(37) 2571 at 1s. 9¼d. Facit, £227 : 12 : 9¾.	(42) 2117 at 1s. 10½d. Facit, £198 : 9 : 4½.	(47) 2705 at 1s. 11¾d. Facit, £267 : 13 : 7¾.
(38) 2104 at 1s. 9½d. Facit, £188 : 9 : 8.	(43) 1007 at 1s. 10¾. Facit, £95 : 9 : 1¼.	(48) 5000 at 1s. 11½d. Facit, £489 : 11 : 8.
(39) 7506 at 1s. 9¾d. Facit, £680 : 4 : 7½.	(44) 5000 at 1s. 11d. Facit, £479 : 3 : 4.	(49) 4000 at 1s. 11¾d. Facit, £395 : 16 : 8.

RULE 4. When the price consists of any even number of shillings under 20, multiply the given quantity by half the price, doubling the first figure of the product for shillings, and the rest of the product will be pounds.

(1) 2750 at 2s. Facit, £275 : 0 : 0.	(5) 2102 at 10s. Facit, £1051 : 0 : 0.	(9) 1075 at 16s. Facit, £860 : 0 : 0.
(2) 3254 at 4s. Facit, £650 : 16 : 0.	(6) 2101 at 12s. Facit, £1260 : 12 : 0.	(10) 1621 at 18s. Facit, £1458 : 18 : 0.
(3) 2710 at 6s. Facit, £813 : 0 : 0.	(7) 5271 at 14s. Facit, £3689 : 14 : 0.	NOTE. When the price is 10s. take half of the quantity, and if any remains, it is 10s.
(4) 1572 at 8s. Facit, £628 : 16 : 0.	(8) 3123 at 16s. Facit, £2498 : 8 : 0.	

RULE 5. When the price consists of odd shillings, multiply the given quantity by the price, and divide by 20, the quotient will be the answer.

(1) 2703 at 1s. Facit, £135 : 3 : 0.	(2) 3270 at 3s. 3 20)9810 Facit, £490 : 10 : 0.	(3) 3271 at 5s. Facit, £817 : 15 : 0.

(4) 2715 at 7s.
Facit, £950 : 5 : 0.

(5) 3214 at 9s.
Facit, £1446 : 6 : 0.

(6) 2710 at 11s.
Facit, £1490 : 10 : 0.

(7) 3179 at 13s.
Facit, £2066 : 7 : 0.

(8) 2150 at 15s.
Facit, £1612 : 10 : 0.

(9) 3142 at 17s.
Facit, £2670 : 14 : 0.

(10) 2150 at 19s.
Facit, £2042 : 10 : 0.

(11) 7157 at 19s.
Facit, £6799 : 3 : 0.

NOTE. When the price is 5s. divide the quantity by 4, and if any remain, it is 5s.

RULE 6. When the price is shillings and pence, and they the aliquot part of a pound, divide by the aliquot part, and it will give the answer at once; but if they are not an aliquot part, then multiply the quantity by the shillings, and take parts for the rest, add them together, and divide by 20.

s. d.
6 : 8 $\frac{1}{3}$ (1) 2710 at 6s. 8d.
Facit, £903 : 6 : 8.

(2) 3150 at 3s. 4d.
Facit, £525 : 0 : 0.

(3) 2715 at 2s. 6d.
Facit, £339 : 7 : 6.

(4) 7150 at 1s. 8d.
Facit, £595 : 16 : 8.

(5) 3215 at 1s. 4d.
Facit, £214 : 6 : 8.

(6) 7211 at 1s. 3d.
Facit, £450 : 13 : 9.

(7) 2710 at 3s. 2d.

d.
2 $\frac{1}{6}$ 3

8130
451 : 8

2|0 8581|1 : 8
Facit, £429 : 1 : 8.

(8) 7514 at 4s. 7d.
Facit, £1721 : 19 : 2.

(9) 2517 at 5s. 3d.
Facit, £660 : 14 : 3.

(10) 2547 at 7s. $3\frac{1}{2}$d.
Facit, £928 : 11 : $10\frac{1}{2}$.

(11) 3271 at 5s. $9\frac{1}{4}$d.
Facit, £943 : 16 : $4\frac{3}{4}$.

(12) 2103 at 15s. $4\frac{1}{2}$d.
Facit, £1616 : 13 : $7\frac{1}{2}$.

(13) 7152 at 17s, $6\frac{3}{4}$d.
Facit, £6280 : 7 : 0.

(14) 2510 at 14 : $7\frac{1}{4}$d.
Facit, £1832 : 16 : $5\frac{1}{2}$.

(15) 3715 at 9s. $4\frac{1}{2}$d.
Facit, £1741 : 8 : $1\frac{1}{2}$.

(16) 2572 at 13 : $7\frac{1}{2}$d.
Facit, £1752 : 3 : 6.

(17) 7251 at 14s. $8\frac{1}{4}$d.
Facit, £5324 : 19 : $0\frac{3}{4}$.

(18) 3210 at 15s. 7¾d.
Facit, £2511 . 3 . 1½.

(19) 2710 at 19s. 2½d.
Facit, £2602 . 14 . 7.

RULE 7. 1st, When the price is pounds and shillings, multiply the quantity by the pounds, and proceed with the shillings, if they are even, as the fourth rule; if odd, take the aliquot parts, add them together, the sum will be the answer.

2dly, When pounds, shillings, and pence, and the shillings and pence the aliquot parts of a pound, multiply the quantity by the pounds, and take parts for the rest.

3dly, When the price is pounds, shillings, pence, and farthings, and the shillings and pence are not the aliquot parts of a pound reduce the pounds and shillings into shillings, multiply the quantity by the shillings, take parts for the rest, add them together, and divide by 20.

NOTE. When the given quantity consists of no more than three figures, proceed as in Compound Multiplication.

4 | ⅕ | (1) 7215 at £7 . 4 . 0.
7
50505
1443
£51948

s. d.
2 : 6 | ⅛ | (2) 2104 at £5 . 3 . 0
5
10520
263
52 . 12
£10835 . 12

6 | ⅕ | (3) 2107 at £2 . 8 . 0.
Facit, £5056 . 16 . 0.

(4) 7156 at £5 . 6 . 0.
Facit, £37926 . 16 . 0.

6 | ½ | (5) 2710 at £2 . 3 . 7½.
43
116530
1½ | ¼ | 1355
338 . 9
2|0 | 11822|3 . 9
Facit, £5911 . 3 . 9.

(6) 3215 at £1 . 17 . 0.
Facit, £5947 . 15 . 0.

(7) 2107 at £1 . 13 . 0.
Facit, £3476 . 11 . 0.

(8) 3215 at £4 . 6 . 8.
Facit, £13931 . 13 . 4.

(9) 2154 at £7 . 1 . 3.
Facit. £15212 . 12 . 6.

(10) 2701 at £2 . 3 . 4.
Facit, £5852 . 3 . 4.

(11) 2715 at £1.17.2½.
Facit, £5051 . 0 . 7½.

(12) 2157 at £3.15.2¼.
Facit, £8108 . 19 . 5¼.

(13) 3210 at £1.18.6¾.
Facit, £6189 . 5 . 7½.

(14) 2157 at £2 . 7 . 4½.
Facit, £5109 . 7 . 10½.

(15) 142 at £1 . 15 . 2¼.
Facit, £250 . 2 . 6½.

(16) 95 at £15 . 14 . 7¼.
Facit, £1494 . 7 . 4¾.

(17) 37 at £1 . 19 . 5¾.
Facit, £73 . 0 . 8¾.

(18) 2175 at £2.15.4½.
Facit, £6022 . 0 . 7½.

(19) 2150at£17.16.1½.
Facit, £38283 . 8 . 9.

RULE 8. When the price and quantity given are of several denominations, multiply the price by the integers, and take parts with the parts of the integers for the rest.

1. At £3 . 17 . 6 per cwt., what is the value of 25 cwt. 2 qrs. 14 lb. of tobacco?

2	½	£3.17. 6
		5×5=25.
		19. 7. 6
		5
lb.		96.17. 6
14	¼	1.18. 9
		9. 8¼
		99. 5.11¼

2. At £1 . 4 . 9 per cwt., what comes 17 cwt. 1 qr. 17 lb. of cheese to? *Ans.* £21 . 10 . 8.

3. Sold 85 cwt. 1 qr. 10 lb. of cheese, at £1 . 7 . 8 per cwt., what does it come to? *Ans.* £118 . 1 . 0¼.

4. Hops at £4 . 5 . 8 per cwt., what must be given for 72 cwt. 1 qr. 18 lb.? *Ans.* £310 . 3 . 2.

5. At £1 . 1 . 4 per cwt. what is the value of 27 cwt. 2 qrs. 15 lb. of Malaga raisins? *Ans.* £29 . 9 . 6¼.

6. Bought 78 cwt. 3 qrs. 12 lb. of currants, at £2 . 17 . 9 per cwt., what did I give for the whole? *Ans.* £227 . 14.

7. Sold 56 cwt. 1 qr. 17 lb. of sugar, at £2 : 15 : 9 the cwt., what does it come to? *Ans.* £157 : 4 : 4¼.

8. Tobacco at £3 : 17 : 10 the cwt., what is the worth of 97 cwt. 15 lb.? *Ans.* £378 : 0 : 3.

9. At £4 : 14 : 6 the cwt., what is the value of 37 cwt. 2 qrs. 13 lb. of double refined sugar? *Ans.* £177 : 14 : 8½.

10. Bought sugar at £3 : 14 : 6 the cwt., what did I give for 15 cwt. 1 qr. 10 lb.? *Ans.* £57 : 2 : 9.

11. At £4 : 15 : 4 the cwt., the value of 172 cwt. 3 qrs. 12 lb. of tobacco is required? *Ans.* £823 : 19 : 0¼.

12. Soap at £3 : 11 : 6 the cwt., what is the value of 53 cwt. 17 lb.? *Ans.* £190 : 0 : 4.

TARE AND TRET.

The allowances usually made in this Weight, are Tare, Tret, and Cloff.

Tare is an allowance made to the buyer for the weight of the box, barrel, bag, &c., which contains the goods bought, and is either

At so much per box, bag, barrel, &c.

At so much per cwt., or

At so much in the gross weight.

Tret is an allowance of 4 lb. in every 104 lb. for waste, dust, &c., made by the merchant to the buyer.

Cloff is an allowance of 2 lb. to the citizens of London, on every draught above 3 cwt. on some sort of goods.

Gross weight is the whole weight of any sort of goods, and that which contains it.

Suttle is when part of the allowance is deducted from the gross.

Neat is the pure weight, when all allowances are deducted.

Rule 1. When the tare is at so much per bag, barrel, &c., multiply the number of bags, barrels, &c. by the tare, and subtract the product from the gross, the remainder is neat.

NOTE. To reduce Pounds into Gallons, multiply by 2, and divide by 15.

1. In 7 frails of raisins, each weighing 5 cwt. 2 qrs. 5 lb. gross, tare at 23 lb. per frail, how much neat weight?

Ans. 37 cwt. 1 qr. 14 lb.

23 7 —— 4 28)161(5 140—— ——1 . 1 21 ——	5 . 2 . 5 7 —— 38 . 3 . 7=gross 1 . 1 . 21=tare —— 37 . 1 . 14=neat ——	or, 5 . 2 . 5 23 —— 5 . 1 . 10 7 —— 37 . 1 . 14 ——

2. What is the neat weight of 25 hogsheads of tobacco, weighing gross 163 cwt. 2 qrs. 15 lb., tare 100 lb. per hogshead?

Ans. 141 cwt. 1 qr. 7 lb.

3. In 16 bags of pepper, each 85 lb. 4 oz. gross, tare per bag, 3 lb. 5 oz. how many pounds neat? *Ans.* 1311.

RULE 2. When the tare is at so much in the whole gross weight, subtract the given tare from the gross, the remainder is neat.

4. What is the neat weight of 5 hogsheads of tobacco, weighing gross 75 cwt. 1 qr. 14 lb., tare in the whole 752 lb.?

Ans. 68 cwt. 2 qrs. 18 lb.

5. In 75 barrels of figs, each 2 qrs. 27 lb. gross, tare in the whole 597 lb. how much neat weight? *Ans.* 50 cwt. 1 qr.

RULE 3. When the tare is at so much per cwt., divide the gross weight by the aliquot parts of a cwt., which subtract from the gross, to remainder is neat.

NOTE. 7 lb. is $\frac{1}{16}$, 8 lb. is $\frac{1}{14}$, 14 lb. is $\frac{1}{8}$, 16 lb. is $\frac{1}{7}$.

6. What is the neat weight of 18 butts of currants, each 8 cwt. 2 qrs. 5 lb., tare at 14 lb. per cwt.?

8 . 2 . 5

$9 \times 2 = 18$

76 . 3 . 17

2

14=$\frac{1}{8}$ 153 . 3 . 6

19 . 0 . 25$\frac{1}{4}$

134 . 2 . 8$\frac{3}{4}$

7. In 25 barrels of figs, each 2 cwt. 1 qr. gross, tare per cwt. 16 lb., how much neat weight? *Ans.* 48 cwt. 0 qr. 24 lb.

8. What is the neat weight of 9 hogsheads of nutmegs, each weighing gross 8 cwt. 3 qrs. 14 lb., tare 16 lb. per cwt.

Ans. 68 cwt. 1 qr. 24 lb.

RULE 4. When tret is allowed with tare, divide the pounds suttle by 26, the quotient is the tret, which subtract from the suttle, the remainder is neat.

9. In 1 butt of currants, weighing 12 cwt. 2 qrs. 24 lb. gross, tare 14 lb. per cwt., tret 4 lb. per 104 lb., how many pounds neat?

12 . 2 . 24
4

50
28

14 = $\frac{1}{8}$ 1424 gross.
178 tare.

26)1246 suttle.
47 tret.

1199 neat.

10. In 7 cwt. 3 qrs. 27 lb. gross, tare 36 lb., tret 4 lb. per 104 lb., how many pounds neat?

Ans. 826 lb.

11. In 152 cwt. 1 qr. 3 lb. gross, tare 10 lb. per cwt., tret 4 lb. per 104 lb., how much neat weight?

Ans. 133 cwt. 1 qr. 12 lb.

RULE 5. When cloff is allowed, multiply the cwts. suttle by 2, divide the product by 3, the quotient will be the pounds cloff, which subtract from the suttle, the remainder will be neat.

12. What is the neat weight of 3 hogsheads of tobacco, weighing 15 cwt. 3 qrs. 20 lb. gross, tare 7 lb. per cwt., tret 4 lb. per 104 lb., cloff 2 lb. for 3 cwt.?

Ans. 14 cwt. 1 qr. 3 lb.

7=$\frac{1}{16}$ 15 . 3 . 20 gross.
3 . 27½ tare.

26)14 . 3 . 20½ suttle
3 . 8 tret.

14 . 1 . 12½ suttle.
9½ cloff.

14 . 1 . 3

13. In 7 hogsheads of tobacco, each weighing gross 5 cwt. 2 qrs. 7 lb., tare 8 lb. per cwt., tret 4 lb. per 104 lb., cloff 2 lb. per 3 cwt., how much neat weight?

Ans. 34 cwt. 2 qrs. 8 lb.

SIMPLE INTEREST,

Is the Profit allowed in lending or forbearance of any sum of money for a determined space of time.

The Principal is the money lent, for which interest is to be received.

The rate per cent. is a certain sum agreed on between the Borrower and the Lender, to be paid for every £100 for the use of the principal 12 months.

The Amount is the principal and interest added together.

Interest is also applied to Commission, Brokage, Purchasing of Stocks, and Insurance, and are calculated by the same rules.

To find the Interest of any Sum of Money for a Year.

RULE. 1 Multiply the Principal by the Rate per cent., that Product divided by 100, will give the interest required.

For several Years.

2. Multiply the interest of one year by the number of years given in the question, and the product will be the answer.

3. If there be parts of a year, as months, weeks and days, work for the months by the aliquot parts of a year, and for the weeks and days by the Rule of Three Direct.

EXAMPLES.

1 What is the interest of £375 for a year, at 5 per cent. per annum?

5

18175
20

15100 *Ans.* £18 . 15 . 0.

2 What is the interest of £268 for 1 year, at 4 per cent. per annum?

Ans. £10 . 14 . 4¾.

3 What is the interest of £945 . 10. for a year, at 4 per cent. per annum?

Ans. 37 . 16 . 4¾.

4. What is the interest of £547 . 15, at 5 per cent. per annum, for 3 years? *Ans.* £82 . 3 . 3.

5. What is the interest of £254 . 17 . 6, for 5 years, at 4 per cent. per annum? *Ans.* £50 . 19 . 6.

6. What is the interest of £556 . 13 . 4, at 5 per cent. per annum, for 5 years? *Ans.* £139 . 3 . 4.

7. My correspondent writes me word, that he has bought goods to the amount of £754 . 16 on my account, what does his commission come to at 2½ per cent.? *Ans.* £18 . 17 . 4¾.

8. If I allow my factor 3¾ per cent. for commission, what may he demand on the laying out £876 . 5 . 10? *Ans.* £32 . 17 . 2½.

9. At 110¼ per cent., what is the purchase of £2051 . 16. South Sea Stock? *Ans.* £2265 . 8 . 4.

10. At 104⅜ per cent. South Sea annuities, what is the purchase of 1797 . 14? *Ans.* £1876 . 6 . 11¾.

11. At 96¾ per cent., what is the purchase of £577 . 19, Bank annuities? *Ans.* £559 . 3 . 3¾.

12. At £124⅝ per cent., what is the purchase of £758 . 17 . 10, India Stock? £945 . 15 . 4¼.

BROKAGE,

Is an allowance to brokers, for helping merchants or factors to persons, to buy or sell them goods.

Rule. Divide the sum given by 100, and take parts from the quotient with the rate per cent.

13. If I employ a broker to sell goods for me, to the value of £2575 . 17 . 6, what is the brokage at 4s. per cent.?

25|75 . 17 . 6
20

15|17
12

2|10

4s.=$\frac{1}{5}$ 25 . 15 . 2

Ans. £5 . 3 . 0¼

14. When a broker sells goods to the amount of £7105 . 5 . 10, what may he demand for brokage, if he is allowed 5s. 6d. per cent.? *Ans.* £19 . 10 . 9¼.

15. If a broker is employed to buy a quantity of goods to the value of £975 . 6 . 4, what is the brokage, at 6s. 6d. per cent.? *Ans.* £3 . 3 . 4½.

16. What is the interest of £547 . 2 . 4, for 5½ years, at 4 per cent. per annum? *Ans.* £120 . 7 . 3½.

17. What is the interest of £257 . 5 . 1, at 4 per cent., for a year and three quarters? *Ans.* £18 . 0 . 1½.

18. What is the interest of £479 . 5 for 5¼ years, at 5 per cent. per annum? *Ans.* £125 . 16 . 0¼

19. What is the interest of £576 : 2 : 6 for 7¼ years, at 4½ p cent. per annum.

Ans. £187 : 19 : 2½.

20. What is the interest of £279 : 13 : 8 at 5¼ per cent. p annum, for 3½ years?

Ans. £51 : 7 : 10.

When the interest is required for any number of Weeks.

RULE. As 52 weeks are to the Interest of the given sum f a year, so are the weeks given for the interest required.

21. What is the interest of £259 : 13 : 5 for 20 weeks, at per cent. per annum?

Ans. £4 : 19 : 10¼.

22. What is the amount of £375 : 6 : 1 for 12 weeks, at 4 per cent. per annum?

Ans. £379 : 4 : 0¼.

When the Interest is for any number of days.

RULE. As 365 days are to the interest of the given sum for a year, so are the days given to the interest required.

23. At 5½ per cent. per annum, what is the interest of £985 2 . 7 for 5 years, 127 days?

Ans. £289 . 15 . 3.

24. What is the interest of £2726 . 1 . 4 at 4½ per cent. pe annum, for three years, 154 days?

Ans. £419 . 15 . 6¼.

When the Amount, Time, and Rate per cent. are given to find the Principal.

RULE. As the amount of £100 at the rate and time given : is to £100 : : so is the amount given : to the principal required.

25. What principal being put to interest, will amount to £402 . 10 in 5 years, at 3 per cent. per annum?

$3 \times 5 + 100 = £115 . 100 \quad . . 402 . 10$

$\begin{array}{r} 20 \\ \hline 2300 \end{array} \qquad \begin{array}{r} 20 \\ \hline 8050 \\ 100 \\ \hline \end{array}$

$23100)8050100(£350$ *Ans.*

26. What principal being put to interest for 9 years, will amount to £734 : 8, at 4 per cent. per annum?

Ans. £540.

27. What principal being put to interest for 7 years, at 5 per cent. per annum, will amount to £334 : 16?

Ans. £248.

When the principal, Rate per cent., and Amount are given, to find the Time.

RULE. As the interest of the principal for 1 year : is to 1 year : : so is the whole interest : to the time required.

28. In what time will £350 amount to £402 . 10, at 3 per cent. per annum?

350	As 10 . 10 : 1 : : 52 . 10 : 5		
3	20	20	
10|50	210	21|0)105|0(5 years.	*Ans.* 402 . 10
20		105	350 . 10
10|00			52 . 10

29. In what time will £540 amount to £734 : 8, at 4 per cent. per annum? *Ans.* 9 years.

30. In what time will £248 amount to £334 : 16, at 5 per cent. per annum? *Ans.* 7 years.

When the Principal, Amount, and Time, are given, to find the Rate per cent.

RULE. As the principal : is to the interest for the whole time : : so is £100 : to the interest for the same time. Divide that interest by the time, and the quotient will be the rate per cent.

31. At what rate per cent. will 350 amount to £402 : 10 in 5 years' time?

350	As 350 : 52 . 10 : : 100 : £15
52 . 10	20
	1050
	100

35\|0)105000(300s.=£15÷5=3 per cent.

32. At what rate per cent. will £248 amount to £334 : 16 in 7 years' time? *Ans.* 5 per cent.

33. At what rate per cent. will £540 amount to £734 : 8 in 9 years' time? *Ans.* 4 per cent.

COMPOUND INTEREST,

Is that which arises both from the principal and interest; that is, when the interest on money becomes due, and not paid, the same interest is allowed on that interest unpaid, as was on the principal before.

Rule 1. Find the first years' interest, which add to the principal; then find the interest of that sum, which add as before, and so on for the number of years.

2. Subtract the given sum from the last amount, and it will give the compound interest required.

EXAMPLES.

1. What is the compound interest of £500 forborne 3 years, at 5 per cent. per annum?

```
 500   500                525
   5    25                26 . . 5
 ----  ----               ------
25|00  525 = 1st year.    551 . . 5 = 2d year.
         5                    5
        ----              ------
        26|25             551 . . 5
          20            27|56 . . 5   27 . 11 . . 3
        ----              20          ------------
         5|00             ----        578 . 16 . . 3 = 3d year.
                          11|25       500        prin. sub
                            12        ------------
                          ----        78 . 16 . . 3 = inter. for 3 years.
                           3|00
```

2, What is the amount of £400 forborne $3\frac{1}{2}$ years, at 6 per cent. per annum, compound interest? *Ans.* £490 : 13 : $11\frac{1}{4}$.

3. What will £650 amount to in 5 years, at 5 per cent. per annum, compound interest? *Ans.* £829 : 11 : $7\frac{1}{2}$.

4. What is the amount of £550 : 10 for 3 years and 6 months, at 6 per cent. per annum, compound interest?

Ans. £675 : 6 : 5.

5. What is the compound interest of £764 for 4 years and 9 months, at 6 per cent. per annum? *Ans.* £243 : 18 : 8.

6. What is the compound interest of £57 : 10 : 6 for 5 years, 7 months, and 15 days, at 5 per cent. per annum?

Ans. £18 : 3 : $8\frac{1}{4}$.

7. What is the compound interest of £259 : 10 for 3 years, 9 months, and 10 days, at 4½ per cent. per annum?

Ans. £46 : 19 : 10½.

REBATE OR DISCOUNT,

Is the abating of so much money on a debt, to be received before it is due, as that money, if put to interest, would gain in the same time, and at the same rate. As £100 present money would discharge a debt of £105, to be paid a year to come, rebate being made at 5 per cent.

Rule. As £100 with the interest for the time given : is to that interest : : so is the sum given : to the rebate required.

Subtract the rebate from the given sum, and the remainder will be the present worth.

EXAMPLES.

1. What is the discount and present worth of £487 : 12 for 6 months, at 3 per cent. per annum?

6m=½6

3

100

103

487 : 12 principal.
14 : 4 rebate.

Ans. £473 : 8 present worth.

As 103 : 0 : : 487 : 12
20 20
2060 9752
3
£ s.
206|0)2925|6(14 . 4 rebate.
206
865
824
416=4s.

2. What is the present payment of £357 : 10, which was agreed to be paid 9 months hence, at 5 per cent. per annum?

Ans. £344 : 11 : 7.

3. What is the discount of £275 : 10 for 7 months, at 5 per cent. per annum? *Ans.* £7 : 16 : 1¾.

4. Bought goods to the value of £109 : 10, to be paid at nine months, what present money will discharge the same, if I am allowed 6 per cent. per annum discount?

Ans. £104 : 15 : 8½.

5. What is the present worth of £527 : 9 : 1, payable 7 months hence, at 4¼ per cent.? *Ans.* £514 : 13 : 10¾.

6. What is the discount of £85 : 10, due September the 8th, this being July the 4th, rebate at 5 per cent. per annum?

Ans. 15s. 3¾d.

7. Sold goods for £875 : 5 : 6, to be paid 5 months hence, what is the present worth at 4½ per cent.?

Ans. £859 : 3 : 4.

8. What is the present worth of £500, payable in 10 months, at 5 per cent. per annum? *Ans.* £480.

9. How much ready money can I receive for a note of £75, due 15 months hence, at 5 per cent.?

Ans. £70 : 11 : 9¼.

10. What will be the present worth of £150, payable at 3 four months, *i. e.* one third at four months, one third at 8 months, and one third at 12 months, at 5 per cent. discount?

Ans. £145 : 3 : 8½.

11. Sold goods to the value of £575 : 10, to be paid at 2 three months, what must be discounted for present payment, at 5 per cent.? *Ans.* £10 : 11 : 4¾.

12. What is the present worth of £500 at 4 per cent., £100 being to be paid down, and the rest at 2 six months?

Ans. £488 : 7 : 8½.

EQUATION OF PAYMENTS,

Is when several sums are due at different times, to find a mean time for paying the whole debt; to do which this is the common,

Rule. Multiply each term by its time, and divide the sum of the products by the whole debt, the quotient is accounted the mean time.

EXAMPLES.

1. A owes B £200, whereof £40 is to be paid at 3 months, £60 at 5 months, and £100 at 10 months; at what time may the whole debt be paid together, without prejudice to either?

£		m.		
40	×	3	=	120
60	×	5	=	300
100	×	10	=	1000

2|00)14|20

7 months $\frac{1}{10}$.

2. B owes C £800, whereof £200 is to be paid at 3 months, £100 at 4 months, £300 at 5 months, and £200 at 6 months; but they agreeing to make but one payment of the whole, I demand what time that must be?

Ans. 4 months, 18 days.

3. I bought of K a quantity of goods, to the value of £360, which was to have been paid as follows: £120 at 2 months, and £200 at 4 months, and the rest at 5 months; but they afterwards agreed to have it paid at one mean time; the time is demanded.

Ans. 3 months, 13 days.

4. A merchant bought goods to the value of £500, to pay £100 at the end of 3 months, £150 at the end of 6 months, and £250 at the end of 12 months; but afterwards they agreed to discharge the debt at one payment; at what time was this payment made?

Ans. 8 months, 12 days.

5. H is indebted to L a certain sum, which is to be paid at 6 different payments, that is, $\frac{1}{4}$ at 2 months, $\frac{1}{8}$ at 3 months, $\frac{1}{8}$ at 4 months, $\frac{1}{4}$ at 5 months, $\frac{1}{8}$ at 6 months, and the rest at 7 months; but they agree that the whole should be paid at one equated time: what is that time?

Ans. 4 months, 1 quarter.

6. A is indebted to B £120, whereof $\frac{1}{2}$ is to be paid at 3 months, $\frac{1}{4}$ at 6 months, and the rest at 9 months; what is the equated time of the whole payment?

Ans. 5 months, 7 days.

BARTER

Is the exchanging of one commodity for another, and informs the traders so to proportionate their goods, that neither may sustain loss.

Rule 1st. Find the value of that commodity whose quantity is given; then find what quantity of the other, at the rate proposed, you may have for the same money.

2dly. When one has goods at a certain price, ready money, but in bartering, advances it to something more, find what the other ought to rate his goods at, in proportion to that advance, and then proceed as before.

EXAMPLES.

1. What quantity of chocolate, at 4s. per lb. must be delivered in barter for 2 cwt., of tea, at 9s. per lb.?

2 cwt.,
112

224 lb.
9 price.

4)2016 the value of the tea.

504 lb. of chocolate.

2. A and B barter; A hath 20 cwt. of prunes, at 4d. per lb. ready money, but in barter will have 5d. per lb. and B. hath hops worth 32s. per cwt., ready money; what ought B. to rate his hops at in barter, and what quantity must be given for the 20 cwt., of prunes?

112
20

2240

cwt. qr. lb.
4810)112010(23 . 1 . 9$\frac{16}{48}$. *Ans.*
96

160
144

16=1 qr. 9 lb.$\frac{16}{48}$

As 4 : 5 : : 32
5

4)160

40s.

3. How much tea, at 9s. per lb. can I have in barter for 4 cwt., 2 qrs. of chocolate, at 4s. per lb.?

Ans. 2 cwt.

4. Two merchants barter; A hath 20 cwt. of cheese, at 21s. 6d. per cwt.; B hath 8 pieces of Irish cloth, at £3 . 14s. per piece: I desire to know who must receive the difference, and how much?

Ans. B. must receive of A £8. 2.

5. A and B barter; A hath 3½ lb. of pepper at 13½d. per lb.; B hath ginger at 15¼d. per lb.; how much ginger must he deliver in barter for the pepper?

Ans. 3 lb. 1 oz.$\frac{35}{61}$

6. How many dozen of candles, at 5s. 2d. per dozen, must be delivered in barter for three cwt. 2 qrs. 16 lb. of tallow, at 37s. 4d. per cwt.?

Ans. 26 dozen 3 lb. $\frac{54}{62}$

7 A hath 608 yards of cloth, worth 14s. per yard, for which B giveth him £125 . 12. in ready money, and 85 cwt. 2 qrs. 24 lb. of bees'-wax. The question is, what did B reckon his bees'-wax at per cwt.?

Ans. £3 . 10.

8. A and B barter; A hath 320 dozen of candles, at 4s. 6d. per dozen; for which B giveth him £30 in money, and the rest in cotton, at 8d. per lb.; I desire to know how much cotton B gave A besides the money?

Ans. 11 cwt. 1 qr.

9. If B hath cotton, at 1s. 2d. per lb., how much must he give A for 114 lb. of tobacco, at 6d. per lb.

Ans. 48 lb. $\frac{12}{14}$.

10. C hath nutmegs worth 7s. 6d. per lb. ready money, but in barter will have 8s. per lb.; and D hath leaf tobacco worth 9d. per lb. ready money; how much must D rate his tobacco at per lb. that his profit may be equivalent with C's?

Ans. 9½d. $\frac{36}{90}$.

PROFIT AND LOSS

Is a Rule that discovers what is got or lost in the buying or selling of goods, and instructs us to raise and lower the price, so as to gain so much per cent. or otherwise.

The questions in this Rule are performed by the Rule of Three.

EXAMPLES.

1. If a yard of cloth is bought for 11s. and sold for 12s. 6d. what is the gain per cent.?

As 11 : 1 : 6 : : 100

12 20

18 2000

18

12 . 6 11 . 0 11)36000

1 . 6 12)3272 $\frac{8}{11}$

210)2712 . 8

Ans. £13 . 12 . 8 $\frac{8}{11}$

2. If 60 ells of Holland cost £18 what must 1 ell be sold for to gain 8 per cent.?

As 100 : 18 : : 108

108

1100)19144

20

8180

12

9160

4

2140

Ans. 6s. 5½d

12×5=60

12)19 . 8 . 9½

5)1 . 12 . 4½

0 . 6 . 5½

3. If 1 lb. of tobacco cost 16d. and is sold for 20d. what is the gain per cent. ?

Ans. £25.

4. If a parcel of cloth be sold for £560, and at 12 per cent. gain, what was the prime cost ?

Ans £500.

5. If a yard of cloth is bought for 13s. 4d. and sold again for 16s. what is the gain per cent. ?

Ans. £20.

6. If 112 lb. of iron cost 27s. 6d., what must 1 cwt. be sold for to gain 15 per cent. ?

Ans. £1 . 11 . $7\frac{1}{2}$

7. If 375 yards of broad cloth be sold for £490, and 20 per cent. profit, what did it cost per yard ?

Ans. £1 . 1 . $9\frac{1}{4}$

8. Sold 1 cwt. of hops, for £6 . 15, at the rate of 25 per cent. profit, what would have been the gain per cent. if I had sold them for £8 per cwt. ?

Ans. £48 . 2 . $11\frac{1}{2}$.

9. If 90 ells of cambric cost £60, how much must I sell it per yard to gain 18 per cent. ?

Ans. 12s. 7d.

10. A plumber sold 10 fother of lead for £204 . 15, (the fother being $19\frac{1}{2}$ cwt.) and gained after the rate of £12 . 10 per cent. ; what did it cost him per cwt. ?

Ans. 18s. 8d.

11. Bought 436 yards of cloth, at the rate of 8s. 6d. per yard, and sold it for 10s. 4d. per yard ; what was the gain of the whole ?

Ans. £39 . 19 . 4.

12. Paid £69 for one ton of steel, which is retailed at 6d. per lb. ; what is the profit or loss by the sale of 15 tons.

Ans. £182 loss.

13. Bought 124 yards of linen, for £32 ; how should the same be retailed per yard to gain 15 per cent. ?

Ans. 5s. 11d. $\frac{23}{124}$.

14. Bought 249 yards of cloth, at 3s. 4d. per yard, retailed the same at 4s. 2d. per yard, what is the profit in the whole, and how much per cent. ?

Ans. £10 . 7 . 6 profit, and 25 per cent.

FELLOWSHIP

Is when two or more join their stock and trade together, so to determine each person's particular share of the gain or loss, in proportion to his principal in joint stock.

By this rule a bankrupt's estate may be divided amongst his creditors ; as also legacies may be adjusted when there is a deficiency of assets or effects.

FELLOWSHIP IS EITHER WITH OR WITHOUT TIME.

FELLOWSHIP WITHOUT TIME.

RULE. As the whole stock : is to the whole gain or loss : : s is each man's share in stock : to his share of the gain or loss.

PROOF. Add all the shares together, and the sum will be equal to the given gain or loss—but the surest way is, as the whole gain or loss : is to the whole stock : : so is each man's share of the gain or loss ; to his share in stock.

EXAMPLES

1. Two merchants trade together; A puts into stock £20, and B £40, they gained £50; what is each person's share thereof?

20+40=60

A 60 : 50 : : 20	As 60 : 50 : : 40	33 . 6 . 8, B's share.
20	40	16 . 13 . 4, A's share.
6|0)100|0	6|0)200|0	50 . 0 . 0 proof.
£16 . 13 . 4	£33 . 6 . 8	

2. Three merchants trade together, A, B, and C; A puts in £20, B £30, and C £40; they gained £180: what is each man's part of the gain?

Ans. A £40; B £60; C £80

3. A, B, and C, enter into partnership; A puts in £364, B £482, and C £500; and they gained £807; what is each man's share in proportion to his stock?

Ans. A £234 . 9 . 3¼—rem. 70; B £310 . 9 . 5—rem. 248; C £322 . 1 . 3½—rem. 1028.

4. Four merchants, B, C, D, and E make a stock; B puts in £227, C £349, D £115, and E £439; in trading they gained £428: I demand each merchant's share of the gain?

Ans. B £85 . 19 . 6¾—690; C £132 . 3 . 9—120; D. £43 . 11 . 1¾—250; E £166 . 5 . 6¼—70.

5. Three persons, D, E, and F, join in company; D's stock was £750, E's £460, and F's £500; and at the end of 12 months they gained £684: what is each man's particular share of the gain?

Ans. D £300, E £184, and F. £200.

6. A merchant is indebted to B £275 . 14, to C £304 . 7, to D £152, and to E £104 . 6; but upon his decease, his estate is found to be worth but £675 . 15: how must it be divided among his creditors?

Ans. B's share £222 . 15 . 2—6584; C's £245 . 18 . 1½—15750· D's £122 . 16 . 2¾—12227; and E's £84 . 5 . 5—15620.

7. Four persons trade together in a joint stock, of which A has ⅓, B ¼, C ⅕, and D ⅙; and at the end of 6 months they gain £100: what is each man's share of the said gain?

Ans. A £35 . 1 . 9—48; B £26 . 6 . 3¾—36; C £21 . 1 . 0½ —120; and D £17 . 10 . 10½—24.

8. Two persons purchased an estate of £1700 per annum, freehold, for £27,200, when money was at 6 per cent. interest, and 4s. per pound, land-tax; whereof D paid £15,000, and E the rest; sometime after, the interest of the money falling to 5 per cent. and 2s. per pound land-tax, they sell the said estate for 24 pears' purchase: I desire to know each person's share?

Ans. D £22,500; E £18 ?00.

9. D, E, and F, join their stocks in trade; the amount of their stocks is £647, and they are in proportion as 4, 6, and 8 are to one another, and the amount of the gain is equal to D's stock: what is each man's stock and gain?

Ans. D's stock £143 . 15 . $6\frac{12}{13}$ gain, 31 . 19 . $0\frac{16}{27}$.
E's..... 215 . 13 . 4 .... 47 . 18 . $6\frac{24}{27}$.
F's..... 287 . 11 . $1\frac{6}{13}$ .... 63 . 18 . $0\frac{15}{427}$.

10. D, E, and F, join stocks in trade; the amount of their stock was £100; D's gain £3, E's £5, and F's £8: what was each man's stock?

Ans. D's stock £18 . 15; E's £31 . 5; and F's £50.

FELLOWSHIP WITH TIME.

RULE. As the sum of the products of each man's money and time: is to the whole gain or loss: : so is each man's product: to his share of the gain or loss.

PROOF. As in fellowship without time.

EXAMPLES.

1. D and E enter into partnership; D puts in £40 for three months, and E £75 for four months; and they gained £70: what is each man's share of the gain?

Ans. D £20, E £50.

$40 \times 3 = 120$
$75 \times 4 = 300$
420

As 420 : 70 : : 120
120
42|0)840|0(20
840

As 420 : 70 : : 300
300
42|0)2100|0(50
2100

2. Three merchants join in company; D puts in stock £195 14, for three months, E £169 . 18 . 3, for 5 months, and F £59 . 14 . 10, for 11 months; they gained £364 . 18: what is each man's part of the gain?

Ans. D's £102 . 6 . 4—5008; E's £148 . 1 . $1\frac{1}{2}$—482802; and F's £114 . 10 . $6\frac{1}{4}$—14707

3. Three merchants join in company for 18 months; D put in £500, and at five months' end takes out £200; at ten months' end puts in £300, and at the end of 14 months takes out £130: E puts in £400, and at the end of 3 months £270 more; at 9 months he takes out £140, but puts in £100 at the end of 12 months, and withdraws £99 at the end of 15 months: F puts in £900, and at 6 months takes out £200; at the end of 11 months puts in £500, but takes out that and £100 more at the end of 13 months. They gained £200: I desire to know each man's share of the gain?

Ans. D £50 : 7 : 6—21720; E £62 : 12 : 5¼—29859; and F £87 : 0 : 0¼—14167.

4. D, E, and F, hold a piece of ground in common, for which they are to pay £36 : 10 : 6. D puts in 23 oxen 27 days; E 21 oxen 35 days; and F 16 oxen 23 days. What is each man to pay of the said rent?

Ans. D £13 : 3 : 1½—624; E £15 : 11 : 5—1688; and F £7 : 15 : 11—1136.

ALLIGATION

ALLIGATION IS EITHER MEDIAL OR ALTERNATE.

ALLIGATION MEDIAL

Is when the price and quantities of several simples are given to be mixed, to find the mean price of that mixture.

RULE. As the whole composition : is to its total value : : so is any part of the composition : to its mean price.

PROOF. Find the value of the whole mixture at the mean rate, and if it agrees with the total value of the several quantities at their respective prices, the work is right.

EXAMPLES.

1. A farmer mixed 20 bushels of wheat, at 5s. per bushel, and 36 bushels of rye, at 3s. per bushel, with 40 bushels of barley, at 2s. per bushel. I desire to know the worth of a bushel of this mixture.

$20\times5=100$
$36\times3=108$
$40\times2=80$

96 288

As 96 : 288 : : 1 : 3

Ans. 3s.

2. A vintner mingles 15 gallons of canary, at 8s. per gallon, with 20 gallons, at 7s. 4d. per gallon, 10 gallons of sherry, at 6s. 8d. per gallon, and 24 gallons of white wine, at 4s. per gallon. What is the worth of a gallon of this mixture?

Ans. 6s. $2\frac{1}{2}$d. $\frac{4}{6}\frac{6}{9}$.

3. A grocer mingled 4 cwt. of sugar, at 56s. per cwt. with 7 cwt. at 43s. per cwt. and 5 cwt. at 37s. per cwt. I demand the price of 2 cwt. of this mixture?

Ans. £4 . 8 . 9.

4. A malster mingles 30 quarters of brown malt, at 28s. per quarter, with 46 quarters of pale, at 30s. per quarter, and 24 quarters of high-dried ditto, at 25s. per quarter. What is the value of 8 bushels of this mixture?

Ans. £1 . 8 . $2\frac{1}{4}$d. $\frac{6}{10}$.

5. If I mix 27 bushels of wheat, at 5s. 6d. per bushel, with the same quantity of rye, at 4s. per bushel, and 14 bushels of barley at 2s. 8d. per bushel, what is the worth of a bushel of this mixture?

Ans. 4s. $3\frac{3}{4}$d. $\frac{2}{6}\frac{3}{9}$.

6. A vintner mixes 20 gallons of port at 5s. 4d. per gallon, with 12 gallons of white wine, at 5s. per gallon, 30 gallons of Lisbon, at 6s. per gallon, and 20 gallons of mountain, at 4s. 6d. per gallon. What is a gallon of this mixture worth?

Ans. 5s. $3\frac{3}{4}$d. $\frac{5}{8}\frac{0}{2}$.

7. A refiner having 12 lb. of silver bullion, of 6 oz. fine, would melt it with 8 lb. of 7 oz. fine, and 10 lb. of 8 oz. fine; required the fineness of 1 lb. of that mixture?

Ans. 6 oz. 18 dwts. 16 gr.

8. A tobacconist would mix 50 lb. of tobacco, at 11d. per lb. with 30 lb. at 14d. per lb., 25 lb. at 22d. per lb. and 37 lb. at 2s. per lb. What will 1 lb. of this mixture be worth?

Ans. $16\frac{3}{4}$d. $\frac{1}{1}\frac{1}{4}\frac{5}{2}$.

ALLIGATION ALTERNATE

Is when the price of several things are given, to find such quantities of them to make a mixture, that may bear a price propounded.

In ordering the rates and the given price, observe,

1. Place them one under the other, and the propounded price or mean rate at the left hand of them, thus,

18		2
22 20		6
24		4
28		2

2. Link the several rates together by 2 and 2, always observing to join a greater and a less than the mean.

3. Against each extreme place the difference of the mean and its yoke fellow.

When the prices of the several simples and the mean rate are given without any quantity, to find how much of each simple is required to compose the mixture.

RULE. Take the difference between each price and the mean rate, and set them alternately, they will be the answer required.

PROOF. By Alligation Medial.

EXAMPLES.

1. A vintner would mix four sorts of wine together, of 18d., 20d., 24d., and 28d. per quart, what quantity of each must he have, to sell the mixture at 22d. per quart?

Answer.

			Proof.
18	2 of 18d.	=	36d.
22 20	6 of 20d.	=	120
24	4 of 24d.	=	96
28	2 of 28d.	=	56
	14		)308
			22d.

or thus,

			Proof.
18	6 of 18d.	=	108d.
22 20	2 of 20d.	=	40
24	2 of 24d.	=	48
28	4 of 28d.	=	112
	14		)308
			22d.

NOTE. Questions in this rule admit of a great variety of answers, according to the manner of linking them.

2. A grocer would mix sugar at 4d., 6d., and 10d. per lb., so as to sell the compound for 8d. per lb.; what quantity of each must he take?

Ans. 2 lb. at 4d., 2 lb. at 6d., and 6 lb. at 10d.

3. I desire to know how much tea, at 16s., 14s., 9s., and 8s per lb., will compose a mixture worth 10s. per lb.?

Ans. 1 lb. at 16s., 2 lb. 14s., 6 lb. at 9s., and 4 lb. at 8s.

4. A farmer would mix as much barley at 3s. 6d. per bushel, rye at 4s. per bushel, and oats at 2s. per bushel, as to make a mixture worth 2s. 6d. per bushel. How much is that of each sort?

Ans. 6 bushels of barley, 6 of rye, and 30 of oats.

5. A grocer would mix raisins of the sun, at 7d. per lb., with Malagas at 6d., and Smyrnas at 4d. per lb.; I desire to know what quantity of each sort he must take to sell them at 5d. per lb.?

Ans. 1 lb. of raisins of the sun, 1 lb. of Malagas, and 3 lb. of Smyrnas.

6. A tobacconist would mix tobacco at 2s., 1s. 6d., and 1s. 3d. per lb., so as the compound may bear a price of 1s. 8d. per lb. What quantity of each sort must he take?

Ans. 7 lb. at 2s., 4 lb. at 1s. 6d., and 4 lb. at 1s. 3d.

ALLIGATION PARTIAL,

Is when the prices of all the simples, the quantity of but one of them, and the mean rate are given to find the several quantities of the rest in proportion to that given.

RULE. Take the difference between each price and the mean rate as before. Then,

As the difference of that simple whose quantity is given : to the rest of the differences severally : : so is the quantity given : to the several quantities required.

EXAMPLES.

1. A tobacconist being determined to mix 20 lb. of tobacco at 15d. per lb., with others at 16d. per lb., 18d. per lb., and 22d. per lb.; how many pounds of each sort must he take to make one pound of that mixture worth 17d.?

Answer.

15 ——— 5 20 lb. at 15d. = 300d. As 5 : 1 : : 20 : 4
17 16 ——— 1 4 lb. at 16d. = 64d. As 5 : 1 : : 20 : 4
18 ——— 1 4 lb. at 18d. = 72d. As 5 : 2 : : 20 : 8
22 ——— 2 8 lb. at 22d. = 176d.

Ans. 36 lb. Proof. 612d. : : 1 lb. 17d.

2. A farmer would mix 20 bushels of wheat at 60d. per bushel, with rye at 36d., barley at 24d., and oats at 18d. per bushel. How much must he take of each sort, to make the composition worth 32d. per bushel?

Ans. 20 bushels of wheat, 35 bushels of rye, 70 bushels of barley, and 10 bushels of oats.

3. A distiller would mix 40 gallons of French Brandy, at 12s. per gallon, with English at 7s., and spirits at 4s. per gallon. What quantity of each sort must he take to afford it for 8s. per gallon?

Ans. 40 gallons French, 32 English, and 32 spirits.

4. A grocer would mix teas at 12s., 10s., and 6s., with 20 lb. at 4s. per lb. How much of each sort must he take to make the composition worth 8s. per lb.?

Ans. 20 lb. at 4s., 10 lb. at 6s., 10 lb. at 10s., 20 lb. at 12s.

5. A wine merchant is desirous of mixing 18 gallons of Canary, at 6s. 9d. per gallon with Malaga, at 7s. 6d. per gallon, sherry at 5s. per gallon, and white wine at 4s. 3d. per gallon. How much of each sort must he take that the mixture may be sold for 6s. per gallon?

Ans. 18 gallons of Canary, 31½ of Malaga, 13½ of Sherry, and 27 of white wine.

ALLIGATION TOTAL

Is when the price of each simple, the quantity to be compounded, and the mean rate are given, to find how much of each sort will make that quantity.

RULE. Take the difference between each price, and the mean rate as before. Then,

As the sum of the differences : is to each particular difference : : so is the quantity given : to the quantity required.

EXAMPLES.

1. A grocer has four sorts of sugar, viz., at 12d., 10d., 6d., and 4d. per lb.; and would make a composition of 144 lb. worth 8d. per lb. I desire to know what quantity of each he must take?

Answer. Proof.

12 ——— 4 : 48 at 12d. 576 = As 12 : 4 : : 144 : 48
8 10 ——— 2 : 24 at 10d. 240 = As 12 : 2 : : 144 : 24
6 ——— 2 : 24 at 6d. 144 = As 12 : 2 : : 144 : 24
4 ——— 4 : 48 at 4d. 192 = As 12 : 4 : : 144 : 48

12 144)1152(8d.

2. A grocer having four sorts of tea, at 5s., 6s., 8s., and 9s. per lb., would have a composition of 87 lb., worth 7s. per lb. What quantity must there be of each?

Ans. 14½ lb. of 5s., 29 lb. of 6s., 29 lb. of 8s., and 14½ lb. of 9s.

3. A vintner having four sorts of wine, viz., white wine at 4s. per gallon; Flemish at 6s. per gallon; Malaga at 8s. per gallon; and Canary at 10s. per gallon; and would make a mixture of 60 gallons, to be worth 5s. per gallon. What quantity of each must he take?

Ans. 45 gallons of white wine, 5 gallons of Flemish, 5 gallons of Malaga, and 5 gallons of Canary.

4. A silversmith had four sorts of gold, viz., of 24 carats fine, of 22, 20, and 15 carats fine, and would mix as much of each sort together, so as to have 42 oz. of 17 carats fine. How much must he take of each?

Ans. 4 oz. of 24, 4 oz. of 22, 4 oz. of 20, and 30 oz. of 15 carats fine.

5. A druggist having some drugs of 8s., 5s., and 4s. per lb., made them into two parcels; one of 28 lb. at 6s. per lb., the other of 42 lb. at 7s. per lb. How much of each sort did he take for each parcel?

Ans. 12 lb. of 8s. 30 lb. of 8s.
8 lb. of 5s. 6 lb. of 5s.
8 lb. of 4s. 6 lb. of 4s.

28 lb. at 6s. per lb. 42 lb. at 7s. per lb.

POSITION, OR THE RULE OF FALSE,

Is a rule that by false or supposed numbers, taken at pleasure discovers the true one required. It is divided into two parts, SINGLE and DOUBLE.

SINGLE POSITION,

Is, by using one supposed number, and working with it as the true one, you find the real number required, by the following

RULE. As the total of the errors : is to the true total : : so is the supposed number : to the true one required.

PROOF. Add the several parts of the sum together, and if it agrees with the sum it is right.

EXAMPLES.

1. A schoolmaster being asked how many scholars he had, said, If I had as many, half as many, and one quarter as many more, I should have 88. How many had he? *Ans.* 32.

Suppose he had.. 40	As 110 : 88 : : 40	32
as many.... 40	40	32
half as many 20		16
¼ as many .. 10	11|0)352|0(32	8
110	33	88 proof.
	22	
	22	

2. A person having about him a certain number of Portugal pieces, said, If the third, fourth, and 6th of them were added together, they would make 54. I desire to know how many he had? *Ans.* 72.

3. A gentleman bought a chaise, horse, and harness, for £60, the horse came to twice the price of the harness, and the chaise to twice the price of the horse and harness. What did he give for each?

Ans. Horse £13 : 6 : 8, Harness £6 : 13 : 4, Chaise £40.

4. A, B and C, being determined to buy a quantity of goods which would cost them £120, agreed among themselves that B should have a third part more than A, and C a fourth part more than B. I desire to know what each man must pay?

Ans. A £30, B £40, C £50.

5. A person delivered to another a sum of money unknown, to receive interest for the same, at 6 per cent. per annum, simple interest, and at the end of 10 years received, for principal and interest, £300. What was the sum lent? *Ans.* £187 : 10.

DOUBLE POSITION,

Is by making use of two supposed numbers, and if both prove false, (as it generally happens) they are, with their errors, to be thus ordered:—

Rule 1. Place each error against its respective position.

2. Multiply them cross-ways.

3. If the errors are alike, *i. e.* both greater, or both less than the given number, take their difference for a divisor, and the difference of the products for a dividend. But if unlike, take their sum for a divisor, the sum of their products for a dividend, the quotient will be the answer.

EXAMPLES.

1. A, B, and C, would divide £200 between them, so that B may have £6 more than A, and C. £8 more than B; how much must each have?

Suppose A had 40
Then B had 46
and C 54

140 too little by 60.

Then suppose A had 50
then B must have 56
and C..... 64

170 too little by 30.

sup. errors.

40 × 60
50 × 30

3000 1200
1200

3|0)180|0
60 Ans. for A.

60
30

30 divisor.

60 A
66 B
74 C

200 proof.

2. A man had two silver cups of unequal weight, having one cover to both, of 5 oz., now if the cover is put on the less cup, it will double the weight of the greater cup; and set on the greater cup, it will be thrice as heavy as the less cup. What is the weight of each cup?

Ans. 3 ounces less, 4 greater.

3. A gentleman bought a house, with a garden, and a horse in the stable, for £500; now he paid 4 times the price of the horse for the garden, and 5 times the price of the garden for the house. What was the value of the house, garden, and horse, separately?

Ans. horse £20, garden £80, house £400.

4. Three persons discoursed concerning their ages: says H, I am 30 years of age; says K, I am as old as H and ¼ of L; and says L, I am as old as you both. What was the age of each person?

Ans. H 30, K 50, and L 80.

5. D, E, and F, playing at cards, staked 324 crowns; but disputing about the tricks, each man took as many as he could: D got a certain number; E as many as D, and 15 more; and F got a fifth part of both their sums added together. How many did each get?

Ans. D 127½, E 142½, and F 54.

6. A gentleman going into a garden, meets with some ladies, and says to them, Good morning to you 10 fair maids. Sir, you mistake, answered one of them, we are not 10; but if we were twice as many more as we are, we should be as many above 10 as we are now under. How many were they?

Ans. 5.

EXCHANGE

Is receiving money in one country for the same value paid in another.

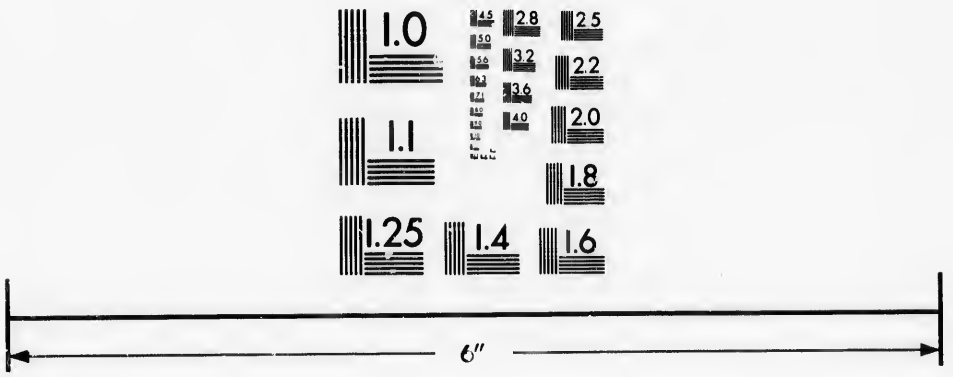
The par of exchange is always fixed and certain, it being the intrinsic value of foreign money, compared with sterling; but the course of exchange rises and falls upon various occasions.

I. FRANCE.

They keep their accounts at Paris, Lyons, and Rouen, in livres, sols, and deniers, and exchange by the crown=4s. 6d. at par.

NOTE. 12 deniers make 1 sol.
20 sols ..... 1 livre.
3 livres ..... 1 crown.

IMAGE EVALUATION
TEST TARGET (MT-3)



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To change French into Sterling.

RULE. As 1 crown : is to the given rate : : so is the French sum : to the sterling required.

To change Sterling into French.

RULE. As the rate of exchange : is to 1 crown : : so is the sterling sum : to the French required.

EXAMPLES.

1. How many crowns must be paid at Paris, to receive in London £180 exchanged at 4s. 6d. per crown?

d. *c.* *£*
As 54 : 1 : : 180 : 800.
240

54)43200(800 crowns.
432

2. How much sterling must be paid in London, to receive in Paris 758 crowns, exchanged at 56d. per crown?

Ans. £176 : 17 : 4.

3. A merchant in London remits £176 : 17 : 4, to his correspondent at Paris; what is the value in French crowns, at 56d. per crown?

Ans. 758.

4. Change 725 crowns, 17 sols, 7 deniers, at 54½d. per crown, into sterling, what is the sum? *Ans.* £164 : 14 : 0¼d. $\frac{312}{960}$.

5. Change £164 : 14 : 0½ sterling, into French crowns, exchange at 54½d. per crown?

Ans. 725 crowns, 17 sols, 7 $\frac{11}{109}$ deniers.

II. SPAIN.

They keep their accounts at Madrid, Cadiz and Seville, in dollars, rials, and maravedies, and exchange by the piece of eight =4s. 6d. at par.

NOTE. 34 maravedies make 1 rial.
8 rials..... 1 piastre or piece of eight.
10 rials..... 1 dollar.

RULE. As with France.

EXAMPLES.

6. A merchant at Cadiz remits to London 2547 pieces of eight, at 56d. per piece, how much sterling is the sum?

Ans. £594 : 6.

7. How many pieces of eight, at 56d. each, will answer a bill of £594 : 6, sterling? *Ans.* 2547.

8. If I pay a bill here of £2500, what Spanish money may I draw my bill for at Madrid, exchange at 57½d. per piece of eight?
Ans. 10434 pieces of eight, 6 rials, 8 mar. $\frac{2}{2}\frac{0}{3}$

III. ITALY.

They keep their accounts at Genoa and Leghorn, in livres, sols, and deniers, and exchange by the piece of eight, or dollar =4s. 6d. at par.

NOTE. 12 deniers make 1 sol.
20 sols.....1 livre
5 livres.....1 piece of eight at Genoa.
6 livres.....1 piece of eight at Leghorn.

N. B. The exchange at Florence is by ducatoons; the exchange at Venice by ducats.

NOTE. 6 solidi make 1 gross.
24 gross.....1 ducat

RULE. Same as before.

9. How much sterling money may a person receive in London, if he pays in Genoa 976 dollars, at 53d. per dollar? *Ans.* £215 . 10 . 8.

10. A factor has sold goods at Florence, for 250 ducatoons, at 54d. each; what is the value in pounds sterling? *Ans.* £56 . 5 . 0.

11. If 275 ducats, at 4s. 5d. each, be remitted from Venice to London; what is the value in pounds sterling? *Ans.* £60 . 14 . 7.

12. A gentleman travelling would exchange £60 . 14 . 7, sterling, for Venice ducats, at 4s. 5d. each; how many must he receive?
Ans. 275.

IV. PORTUGAL.

They keep their accounts at Oporto and Lisbon, in reas, and exchange by the milrea=6s. 8½d. at par.

NOTE. 1000 reas make 1 milrea.

RULE. The same as with France.

EXAMPLES

13. A gentleman being desirous to remit to his correspondent in London 2750 milreas, exchange at 6s. 5d. per milrea; how much sterling will he be the creditor for in London? *Ans.* £882 . 5 . 10.

14. A merchant at Oporto remits to London 4566 milreas, and 183 reas, at 5s. 5⅛d. exchange per milrea; how much sterling must be paid in London for this remittance? *Ans.* £1193 . 17 . 6¼, 0375.

15. If I pay a bill in London of £1193 . 17 . 6¼, 0375, what must I draw for on my correspondent in Lisbon, exchange at 5s. 5⅛d. per milrea?
Ans. 4366 milreas, 183 reas.

V. HOLLAND, FLANDERS, AND GERMANY.

They keep their accounts at Antwerp, Amsterdam, Brussels, Rotterdam, and Hamburgh, some in pounds, shillings, and pence, as in England; others in guilders, stivers, and pennings; and exchange with us in our pound, at 33s. 4d. Flemish, at par.

NOTE. 8 pennings make.....1 groat.
2 groats, or 16 pennings....1 stiver.
20 stivers.....1 guilder or florin.

ALSO,

12 groats, or 6 stivers make..1 schelling.
20 schellings, or 6 guilders...1 pound.

To change Flemish into Sterling.

RULE. As the given rate : is to one pound : : so is the Flemish sum : to the sterling required.

To change Sterling into Flemish.

RULE. As £1 sterling : is to the given rate : : so is the sterling given : to the Flemish sought.

EXAMPLES.

16. Remitted from London to Amsterdam, a bill of £754 . 10 . 0 sterling, how many pounds Flemish is the sum, the exchange, at 33s. 6d. Flemish, per pound sterling? *Ans.* £1263 . 15 . 9, Flemish.

17. A merchant in Rotterdam remits £1263 . 15 . 9, Flemish, to be paid in London, how much sterling money must he draw for, the exchange being at 33s. 6d. Flemish per pound sterling? *Ans.* £754 . 10.

18. If I pay in London £852 . 12 . 6, sterling, how many guilders must I draw for at Amsterdam, exchange at 34 schel. 4½ groats Flemish per pound sterling? *Ans.* 8792 guild. 13 stiv. 14½ pennings.

19. What must I draw for at London, if I pay in Amsterdam 8792 guild. 13 stiv. 14½ pennings, exchange at 34 schel. 4½ groats per pound sterling? *Ans.* 852 . 12 . 6.

To convert Bank Money into Current, and the contrary.

NOTE. The Bank Money is worth more than the Current. The difference between one and the other is called agio, and is generally from 3 to 6 per cent. in favour of the Bank.

To change Bank into Current Money.

RULE. As 100 guilders Bank : is to 100 with the agio added : : so is the Bank given : to the Current required.

To change Current Money into Bank.

RULE. As 100 with the agio is added : is to 100 Bank : : so is the Current money given : to the Bank required.

20. Change 794 guilders, 15 stivers, Current Money, into Bank florins agio $4\frac{3}{8}$ per cent.

Ans. 761 guilders, 8 stivers, $11\frac{14}{16}\frac{7}{7}$ pennings.

21. Change 761 guilders, 9 stivers Bank, into Current Money, agio $4\frac{3}{8}$ per cent.

Ans. 794 guilders, 15 stivers, $4\frac{3}{10}$ pennings.

VI. IRELAND.

22. A gentleman remits to Ireland £575 : 15, sterling, what will he receive there, the exchange being at 10 per cent.?

Ans. £633 : 6 : 6.

23. What must be paid in London for a remittance of £633 : 6 : 6, Irish, exchange at 10 per cent.? *Ans.* 575 : 15.

COMPARISON OF WEIGHTS AND MEASURES.

EXAMPLES.

. If 50 Dutch pence be worth 65 French pence, how many Dutch pence are equal to 350 French pence?

Ans. $269\frac{15}{65}$.

2. If 12 yards at London make 8 ells at Paris, how many ells at Paris will make 64 yards at London?

Ans. $42\frac{8}{12}$.

3. If 30 lb. at London make 28 lb. at Amsterdam, how many lb. at London will be equal to 350 lb. at Amsterdam?

Ans. 375.

4. If 95 lb. Flemish make 100 lb. English, how many lb. English are equal to 275 lb. Flemish.

Ans. $289\frac{15}{33}$.

CONJOINED PROPORTION,

Is when the coin, weights, or measures of several countries are compared in the same question; or, it is linking together a variety of proportions.

When it is required to find how many of the first sort of coin, weight, or measure, mentioned in the question, are equal to a given quantity of the last.

RULE. Place the numbers alternately, beginning at the left hand, and let the last number stand on the left hand; then multiply the first row continually for a dividend, and the second for a divisor.

PROOF. By as many single Rules of Three as the question requires.

EXAMPLES.

1. If 20 lb. at London make 23 lb. at Antwerp, and 155 lb. at Antwerp make 180 lb. at Leghorn, how many lb. at London are equal to 72 lb. at Leghorn?

Left.	Right.
20	23
155	180
72	

$20 \times 155 \times 72 = 223200$
$23 \times 180 = 4140) 223200 (53\frac{3}{4}\frac{7}{1}\frac{8}{4}$.

2. If 12 lb. at London make 10 lb. at Amsterdam, and 100 lb. at Amsterdam 120 lb. at Thoulouse, how many lb. at London are equal to 40lb. at Thoulouse?

Ans. 40 lb.

3. If 140 braces at Venice are equal to 156 braces at Leghorn, and 7 braces at Leghorn equal to 4 ells English, how many braces at Venice are equal to 16 ells English?

Ans. $25\frac{8}{6}\frac{0}{2}\frac{}{4}$.

4. If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam make 116 at Dantzick, how many lb. at London are equal to 130 lb. at Dantzick?

Ans. $112\frac{2}{4}\frac{8}{1}\frac{8}{7}\frac{}{6}$.

When it is required to find how many of the last sort of coin, weight, or measure, mentioned in the question, are equal to a quantity of the first.

RULE. Place the numbers alternately, beginning at the left hand, and let the last number stand on the right hand; then multiply the first row for a divisor, and the second for a dividend.

EXAMPLES.

5. If 12 lb. at London make 10 lb. at Amsterdam, and 100 lb. at Amsterdam 120 lb. at Thoulouse, how many lb. at Thoulouse are equal to 40 lb. at London? *Ans.* 40 lb.

6. If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam 116 lb. at Dantzick, how many lb. at Dantzick are equal to 122 lb. at London? *Ans.* $141\frac{18}{36}\frac{72}{00}$.

PROGRESSION

CONSISTS OF TWO PARTS

ARITHMETICAL AND GEOMETRICAL.

ARITHMETICAL PROGRESSION

Is when a rank of numbers increase or decrease regularly by the continual adding or subtracting of equal numbers; as 1, 2, 3, 4, 5, 6, are in Arithmetical Progression by the continual increasing or adding of one; 11, 9, 7, 5, 3, 1, by the continual decreasing or subtracting of two.

NOTE. When any even number of terms differ by Arithmetical Progression, the sum of the two extremes will be equal to the two middle numbers, or any two means equally distant from the extremes; as 2, 4, 6, 8, 10, 12, where 6+8, the two middle numbers, are=12+2, the two extremes, and=10+4 the two means=14.

When the number of terms are odd, the double of the middle term will be equal to the two extremes; or of any two means equally distant from the middle term; as 1, 2, 3, 4, 5, where the double number of 3=5+1=2+4=6.

In Arithmetical Progression five things are to be observed, viz.

1. The first term; better expressed thus, F.
2. The last term, ... L.
3. The number of terms, ... N.
4. The equal difference, ... D
5. The sum of all terms, ... S.

Any three of which being given, the other two may be found. The first, second, and third terms given, to find the fifth.

RULE. Multiply the sum of the two extremes by half the number of terms, or multipiy half the sum of the two extremes

by the whole number of terms, the product is the total of all the terms: or thus,

I. F L N are given to find S.

$$F+L\times\frac{N}{2}=S.$$

EXAMPLES.

1. How many strokes does the hammer of a clock strike in 12 hours?

$12+1=13$, then $13\times 6=78$.

2. A man bought 17 yards of cloth, and gave for the first yard 2s. and for the last 10s. what did the 17 yards amount to?

Ans. £5 . 2.

3. If 100 eggs were placed in a right line, exactly a yard asunder from one another, and the first a yard from a basket, what length of ground does that man go who gathers up these 100 eggs singly, and returns with every egg to the basket to put it in?

Ans. 5 miles, 1300 yards.

The first, second, and third terms given, to find the fourth.

Rule. From the second subtract the first, the remainder divided by the third less one, gives the fourth: or thus

F L N are given to find D.

$$\frac{L-F}{N-1}=D.$$

EXAMPLES.

4. A man had eight sons, the youngest was 4 years old, and the eldest 32, they increase in Arithmetical Progression, what was the common difference of their ages?

Ans. 4.

$32-4=28$, then $28\div 8=1+4$ common difference.

5. A man is to travel from London to a certain place in 12 days, and to go but 3 miles the first day, increasing every day by an equal excess, so that the last day's journey may be 58 miles,

what is the daily increase, and how many miles distant is that place from London? *Ans.* 5 daily increase.

Therefore, as three miles is the first day's journey,

3+5=8 the second day.
8+5=13 the third day, &c.
The whole distance is 366 miles.

The first, second, and fourth terms given, to find the third.

RULE. From the second subtract the first, the remainder divide by the fourth, and to the quotient add 1, gives the third; or thus,

III. F L D are given to find N.

$$\frac{L-F}{D}-+1=N.$$

EXAMPLES.

6. A person travelling into the country, went 3 miles the first day, and increased every day 5 miles, till at last he went 58 miles in one day; how many days did he travel? *Ans.* 12.

58—3=55÷5=11+1=12 the number of days.

7. A man being asked how many sons he had, said, that the youngest was 4 years old, and the oldest 32; and that he increased one in his family every 4 years, how many had he?

Ans. 8

The second, third, and fourth terms given to find the first.

RULE. Multiply the fourth by the third made less by one, the product subtracted from the second gives the first: or thus,

IV. L N D are given to find F.

L—D×N—1=F.

EXAMPLES.

8. A man in 10 days went from London to a certain town in the country, every day's journey increasing the former by 4, and the last he went was 46 miles, what the first?

Ans. 10 miles.

4×10—1=36, then 46—36=10, the first day's journey.

9. A man takes out of his pocket at 8 several times, so many different numbers of shillings, every one exceeding the former by 6, the last at 46; what was the first? *Ans.* 4.

The fourth, third, and fifth given, to find the first.

RULE. Divide the fifth by the third, and from the quotient subtract half the product of the fourth multiplied by the third less 1 gives the first: or thus,

V. N D S are given to find F.

$$\frac{S}{N} \; D \times N - 1 \; - F.$$

EXAMPLES.

10. A man is to receive £360 at 12 several payments, each to exceed the former by £4, and is willing to bestow the first payment on any one that can tell him what it is. What will that person have for his pains? *Ans.* £8.

$360 \div 12 = 30$, then $30 - \frac{4 \times 12 - 1}{2} = £8$ the first payment.

The first, third, and fourth, given to find the second.

RULE. Subtract the fourth from the product of the third, multiplied by the fourth, that remainder added to the first gives the second: or thus,

F N D are given to find L.

$ND - D + F = L$.

EXAMPLES.

11. What is the last number of an Arithmetical Progression, beginning at 6, and continuing by the increase of 8 to 20 places? *Ans.* 158.

$20 \times 8 - 8 = 152$, then $152 + 6 = 158$, the last number.

GEOMETRICAL PROGRESSION

Is the increasing or decreasing of any rank of numbers by some common ratio; that is, by the continual multiplication or division of some equal number: as 2, 4, 8, 16, increase by the multiplier 2, and 16, 8, 4, 2, decrease by the divisor 2.

NOTE. When any number of terms is continued in Geometrical Progression, the product of the two extremes will be equal to any two means, equally distant from the extremes: as 2, 4, 8, 16, 32, 64, where 64×2 are $= 4 \times 32$, and $8 \times 16 = 128$.

When the number of the terms are odd, the middle term multiplied into itself will be equal to the two extremes, or any two means equally distant from it, as 2, 4, 8, 16, 32, where $2 \times 32 = 4 \times 16 = 8 \times 8 = 64$.

In Geometrical Progression the same 5 things are to be observed as are in Arithmetical, viz.

1. The first term.
2. The last term.
3. The number of terms.
4. The equal difference or ratio.
5. The sum of all the terms.

NOTE. As the last term in a long series of numbers is very tedious to come at, by continual multiplication; therefore, for the reader finding it out, there is a series of numbers made use of in Arithmetical Proportion, called indices, beginning with an unit, whose common difference is one; whatever number of indices you make use of, set as many numbers (in such Geometrical Proportion, as is given in the question) under them.

As 1, 2, 3, 4, 5, 6, Indices.
2, 4, 8, 16, 32, 64, Numbers in Geometrical Proportion.

But if the first term in Geometrical Proportion be different from the ratio, the indices must begin with a cipher.

As 0, 1, 2, 3, 4, 5, 6, Indices.
1, 2, 4, 8, 16, 32, 64, Numbers in Geometrical Proportion.

When the Indices begin with a cipher, the sum of the indices made choice of must always be one less than the number of terms given in the question; for 1 in the indices is over the second term, and 2 over the third, &c.

Add any two of the indices together, and that sum will agree with the product of their respective terms.

As in the first table of Indices $2 + 5 = 7$
Geometrical Proportion ..... $4 \times 32 = 128$
Then the second $2 + 4 = 6$
$4 \times 16 = 64$

In any Geometrical Progression proceeding from unity, the ratio being known, to find any remote term, without producing all the intermediate terms.

RULE. Find what figures of the indices added together would give the exponent of the term wanted; then multiply the numbers standing under such exponents into each other, and it will give the term required.

NOTE. When the exponent 1 stands over the second term, the number of exponents must be one less than the number of terms.

EXAMPLES.

1. A man agrees for 12 peaches, to pay only the price of the last, reckoning a farthing for the first, and a halfpenny for the second, &c. doubling the price to the last; what must he give for them?

Ans. £2 . 2 . 8.

0, 1, 2, 3, 4, Exponents
1, 2, 4, 8, 16, No. of terms.

16=4
16=4
256=8
8=3

For 4+4+3=11, No. of terms less 1

4)2048=11 No. of far.

12)512

2|0)4|2 . 8

£2 . 2 . 8

2. A country gentleman going to a fair to buy some oxen, meets, with a person who had 23; he demanded the price of them, and was answered £16 a piece; the gentleman bids £15 a piece and he would buy all; the other tells him it could not be taken; but if he would give what the last ox would come to, at a farthing for the first, and doubling it to the last, he should have all. What was the price of the oxen?

Ans. £4360 . 1 . 4.

In any Geometrical Progression not proceeding from unity, the ratio being given, to find any remote term, without producing all the intermediate terms.

RULE. Proceed as in the last, only observe, that every product must be divided by the first term.

EXAMPLES.

3. A sum of money is to be divided among eight persons, the first to have £20, the next £60, and so in triple proportion; what will the last have? *Ans.* £43740.

$$\begin{array}{llll} 0, & 1, & 2, & 3, \\ 20, & 60, & 180, & 540, \end{array} \qquad \frac{540\times540}{20}=14580, \text{ then } \frac{14580\times60}{20}=43740$$

3+3+1=7, one less than the number of terms.

4. A gentleman dying, left nine sons, to whom and to his executors he bequeathed his estate in the manner following: To his executors £50, his youngest son was to have as much more as the executors, and each son to exceed the next younger by as much more; what was the eldest son's proportion?

Ans. £25600.

The first term, ratio, and number of terms given, to find the sum of all the terms.

RULE. Find the last term as before, then subtract the first from it, and divide the remainder by the ratio, less 1; to the quotient of which add the greater, gives the sum required.

EXAMPLES.

5. A servant skilled in numbers, agreed with a gentleman to serve him twelve months, provided he would give him a farthing for his first month's service, a penny for the second, and 4d. for the third, &c., what did his wages amount to?

Ans. £5825 . 8 . $5\frac{1}{4}$.

$$\begin{array}{ll} & 256\times256=65536, \text{ then } 65536\times64=4194304 \\ 0, 1, 2, 3, 4, & \\ 1, 4, 16, 64, 256, & \frac{4194304-1}{4-1}=1398101, \text{ then} \\ 4+4+3=11 & \text{No. of terms less } 1, 4-1 \end{array}$$

1398101+4194304=5592405 farthings.

6. A man bought a horse, and by agreement was to give a farthing for the first nail, three for the second, &c., there were four shoes, and in each shoe 8 nails; what was the worth of the horse?

Ans. £965114681693 . 13 . 4.

7. A certain person married his daughter on New-year's day, and gave her husband 1s. towards her marriage portion, promising to double it on the first day of every month for 1 year; what was her portion?

Ans. £204 . 15.

8. A laceman, well versed in numbers, agreed with a gentleman to sell him 22 yards of rich gold brocaded lace, for 2 pins the first yard, 6 pins the second, &c., in triple proportion; I desire to know what he sold the lace for, if the pins were valued at 100 for a farthing; also what the laceman got or lost by the sale thereof, supposing the lace stood him in £7 per yard.

Ans. The lace sold for £326886 . 0 . 9.
Gain £326732 . 0 . 9.

PERMUTATION

Is the changing or varying of the order of things.

RULE. Multiply all the given terms one into another, and the last product will be the number of changes required.

EXAMPLES.

1. How many changes may be rung upon 12 bells; and how long would they be ringing but once over, supposing 10 changes might be rung in 2 minutes, and the year to contain 365 days, 6 hours?

$1\times2\times3\times4\times5\times6\times7\times8\times9\times10\times11\times12=479001600$ changes, which $\div 10=47900160$ minutes; and, if reduced, is $=91$ years, 3 weeks, 5 days, 6 hours.

2. A young scholar coming to town for the convenience of a good library, demands of a gentleman with whom he lodged, what his diet would cost for a year, who told him £10, but the scholar not being certain what time he should stay, asked him what he must give him for so long as he should place his family, (consisting of 6 persons besides himself) in different positions, every day at dinner; the gentleman thinking it would not be long, tells him £5, to which the scholar agrees. What time did the scholar stay with the gentleman?

Ans. 5040 days.

THE

TUTOR'S ASSISTANT.

PART II.

VULGAR FRACTIONS.

A FRACTION is a part or parts of an unit, and written with two figures, with a line between them, as $\frac{1}{4}$, $\frac{5}{6}$, $\frac{3}{8}$, &c.

The figure above the line is called the numerator, and the under one the denominator; which shows how many parts the unit is divided into: and the numerator shows how many of those parts are meant by the fraction.

There are four sorts of vulgar fractions: proper, improper, compound, and mixed, viz.

1. A PROPER FRACTION is when the numerator is less than the denominator, as $\frac{2}{4}$, $\frac{3}{6}$, $\frac{7}{8}$, $\frac{10}{11}$, $\frac{101}{710}$, &c.

2. An IMPROPER FRACTION is when the numerator is equal to, or greater than the denominator, as $\frac{5}{3}$, $\frac{6}{4}$, $\frac{12}{12}$, $\frac{17}{12}$, &c.

3. A COMPOUND FRACTION is the fraction of a fraction, and known by the word of, as $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{7}{9}$ of $\frac{8}{17}$ of $\frac{9}{15}$, &c.

4. A MIXED NUMBER, or FRACTION, is composed of a whole number and fraction, as $8\frac{3}{7}$, $17\frac{1}{2}$, $87\frac{1}{97}$, &c.

REDUCTION OF VULGAR FRACTIONS.

1. To reduce fractions to a common denominator.

RULE. Multiply each numerator into all the denominators, except its own, for a numerator; and all the denominators, for a common denominator. Or,

2. Multiply the common denominator by the several given numerators, separately, and divide their product by the several denominators, the quotients will be the new numerators.

EXAMPLES.

1. Reduce $\frac{2}{4}$ and $\frac{4}{7}$ to a common denominator.

Facit, $\frac{14}{28}$ and $\frac{16}{28}$.

1st num. 2d num.

$2\times7=14$ $4\times4=16$, then $4\times7=28$ den.$=\frac{14}{28}$ and $\frac{16}{28}$.

2. Reduce $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{8}$, to a common denominator.

Facit, $\frac{32}{64}$, $\frac{48}{64}$, $\frac{40}{64}$.

3. Reduce $\frac{7}{8}$, $\frac{4}{6}$, $\frac{6}{10}$, and $\frac{6}{7}$, to a common denominator.

Facit, $\frac{2940}{3360}$, $\frac{2240}{3360}$, $\frac{2016}{3360}$, $\frac{2880}{3360}$.

4. Reduce $\frac{3}{10}$, $\frac{2}{4}$, $\frac{1}{7}$, and $\frac{3}{6}$, to a common denominator.

Facit, $\frac{1008}{1680}$, $\frac{840}{1680}$, $\frac{240}{1680}$, $\frac{840}{1680}$.

5. Reduce $\frac{4}{5}$, $\frac{2}{3}$, $\frac{3}{7}$, and $\frac{1}{8}$, to a common denominator.

Facit, $\frac{672}{840}$, $\frac{560}{840}$, $\frac{360}{840}$, $\frac{105}{840}$.

6. Reduce $\frac{2}{6}$, $\frac{5}{9}$, $\frac{2}{8}$, and $\frac{3}{5}$, to a common denominator.

Facit, $\frac{720}{2160}$, $\frac{1200}{2160}$, $\frac{540}{2160}$, $\frac{1206}{2160}$.

2. To reduce a vulgar fraction to its lowest terms.

RULE. Find a common measure by dividing the lower term by the upper, and that divisor by the remainder following, till nothing remain: the last divisor is the common measure; then divide both parts of the fraction by the common measure, and the quotient will give the fraction required.

NOTE. If the common measure happens to be one, the fraction is already in its lowest term: and when a fraction hath ciphers at the right hand, it may be abbreviated by cutting them off, as $\frac{3}{4}\frac{0}{0}$.

EXAMPLES.

7. Reduce $\frac{24}{32}$ to its lowest terms.

24)32(1
24
—

Com. measure, 8)24(3 Facit.

8. Reduce $\frac{360}{1225}$ to its lowest terms. Facit, $\frac{6}{25}$.
9. Reduce $\frac{2028}{6084}$ to its lowest terms. Facit, $\frac{52}{171}$.
10. Reduce $\frac{1922}{5766}$ to its lowest terms. Facit, $\frac{1}{3}$.
11. Reduce $\frac{2245}{4760}$ to its lowest terms. Facit, $\frac{55}{64}$.
12. Reduce $\frac{5119}{9112}$ to its lowest terms. Facit, $\frac{3}{4}$.

3. To reduce a mixed number to an improper fraction.

RULE. Multiply the whole number by the denominator of the fraction, and to the product add the numerator for a new numerator, which place over the denominator.

NOTE. To express a whole number fraction-ways set 1 for the denominator given.

EXAMPLES.

13. Reduce $18\frac{3}{7}$ to an improper fraction. Facit, $\frac{129}{7}$.

$18 \times 7 + 3 = 129$ new numerator $= \frac{129}{7}$.

14. Reduce $56\frac{13}{22}$ to an improper fraction. Facit, $\frac{1245}{22}$.
15. Reduce $183\frac{5}{21}$ to an improper fraction. Facit, $\frac{3843}{21}$.
16. Reduce $13\frac{4}{5}$ to an improper fraction. Facit, $\frac{69}{5}$.
17. Reduce $27\frac{2}{9}$ to an improper fraction. Facit, $\frac{245}{9}$.
18. Reduce $514\frac{5}{16}$ to an improper fraction. Facit, $\frac{8229}{16}$.

4. To reduce an improper fraction to its proper terms.

RULE. Divide the upper term by the lower.

EXAMPLES.

19. Reduce $\frac{129}{7}$ to its proper terms. Facit, $18\frac{3}{7}$.

$129 \div 7 = 18\frac{3}{7}$.

20. Reduce $\frac{1245}{22}$ to its proper terms. Facit, $56\frac{13}{22}$.
21. Reduce $\frac{3843}{21}$ to its proper terms. Facit, $183\frac{5}{21}$.
22. Reduce $\frac{69}{5}$ to its proper terms. Facit, $13\frac{4}{5}$.
23. Reduce $\frac{245}{9}$ to its proper terms. Facit, $27\frac{2}{9}$.
24. Reduce $\frac{8229}{16}$ to its proper terms. Facit, $514\frac{5}{16}$.

5. To reduce a compound fraction to a single one.

RULE. Multiply all the numerators for a new numerator, and all the denominators for a new denominator.

Reduce the new fraction to its lowest terms by Rule 2.

EXAMPLES.

25. Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a single fraction.

Facit, $\frac{2\times3\times5}{3\times5\times8} = \frac{30}{120}$ —reduced to the lowest term $= \frac{1}{4}$.

26. Reduce $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{11}{12}$ to a single fraction.

Facit, $\frac{220}{756} = \frac{55}{189}$.

27. Reduce $\frac{11}{12}$ of $\frac{13}{14}$ of $\frac{21}{29}$ to a single fraction.

Facit, $\frac{3003}{8072} = \frac{143}{352}$.

28. Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ to a single fraction.

Facit, $\frac{135}{240} = \frac{9}{16}$.

29. Reduce $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{7}{9}$ to a single fraction.

Facit, $\frac{168}{360} = \frac{7}{15}$.

30. Reduce $\frac{3}{7}$ of $\frac{5}{9}$ of $\frac{8}{10}$ to a single fraction.

Facit, $\frac{80}{630} = \frac{8}{63}$.

6. To reduce fractions of one denomination to the fraction of another, but greater, retaining the same value.

RULE. Reduce the given fraction to a compound one, by comparing it with all the denominations between it and that denomination which you would reduce it to; then reduce that compound fraction to a single one.

EXAMPLES.

31. Reduce $\frac{7}{8}$ of a penny to the fraction of a pound.

Facit, $\frac{7}{8}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{7}{1920}$.

32. Reduce $\frac{1}{4}$ of a penny to the fraction of a pound.

Facit, $\frac{1}{960}$.

33. Reduce $\frac{4}{5}$ of a dwt. to the fraction of a lb. troy.

Facit, $\frac{4}{1200}$.

34. Reduce $\frac{1}{7}$ of a lb. avoirdupois to the fraction of a cwt.

Facit, $\frac{1}{784}$.

7. To reduce fractions of one denomination to the fraction of another, but less, retaining the same value.

RULE. Multiply the numerator by the parts contained in the several denominations between it, and that you would reduce it to, for a new numerator, and place it over the given denominator.

EXAMPLES.

35. Reduce $\frac{7}{240}$ of a pound to the fraction of a penny.

Facit, $\frac{7}{8}$.

$7 \times 20 \times 12 = 1680$ $\frac{168}{1920}$ reduced to its lowest term $= \frac{7}{8}$.

36. Reduce $\frac{1}{960}$ of a pound to the fraction of a penny.

Facit, $\frac{1}{4}$.

37. Reduce $\frac{1}{1200}$ of a pound troy, to the fraction of a penny-weight.

Facit, $\frac{4}{5}$.

38. Reduce $\frac{4}{784}$ of a cwt. to the fraction of a lb.

Facit, $\frac{4}{7}$.

8. To reduce fractions of one denomination to another of the same value, having a numerator given of the required fraction.

RULE. As the numerator of the given fraction : is to its denominator : : so is the numerator of the intended fraction : to its denominator.

EXAMPLES.

39. Reduce $\frac{2}{3}$ to a fraction of the same value, whose numerator shall be 12. As 2 : 3 : : 12 : 18. Facit, $\frac{12}{18}$.

40. Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 25. Facit, $\frac{25}{35}$.

41. Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 47.

Facit, $\frac{47}{65\frac{4}{5}}$.

9. To reduce fractions of one denomination to another of the same value, having the denominator given of the fractions required.

RULE. As the denominator of the given fraction : is to its numerator : : so is the denominator of the intended fraction : to its numerator.

EXAMPLES.

42. Reduce $\frac{2}{3}$ to a fraction of the same value, whose denominator shall be 18. As 3 : 2 : : 18 : 12. Facit, $\frac{12}{18}$.

43. Reduce $\frac{5}{7}$ to a fraction of the same value, whose denominator shall be 35. Facit, $\frac{25}{35}$.

44. Reduce $\frac{5}{7}$ to a fraction of the same value, whose denominator shall be $65\frac{4}{5}$.

Facit, $\frac{47}{65\frac{4}{5}}$.

10. To reduce a mixed fraction to a single one.

RULE. When the numerator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new numerator; then multiply the denominator of the fraction by the denominator of the fractional part for a new denominator.

EXAMPLES.

45. Reduce $36\frac{2}{3}$—to a simple fraction. Facit, $\frac{110}{144}=\frac{55}{72}$.

$36\times3+2=110$ numerator.
$48\times3\quad=144$ denominator.

46. Reduce $23\frac{5}{7}$—to a simple fraction. Facit, $\frac{166}{266}=\frac{83}{133}$.

When the denominator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new denominator; then multiply the numerator of the fraction by the denominator of the fractional part for a new numerator.

EXAMPLES.

47. Reduce $\frac{47}{65\frac{4}{5}}$—to a simple fraction. Facit, $\frac{235}{329}=\frac{5}{7}$.

48. Reduce $\frac{19}{44\frac{1}{3}}$—to a simple fraction. Facit, $\frac{57}{133}=\frac{3}{7}$.

11. To find the proper quantity of a fraction in the known parts of an integer.

RULE. Multiply the numerator by the common parts of the integer, and divide by the denominator.

EXAMPLES.

49. Reduce $\frac{3}{4}$ of a pound sterling to its proper quantity.
$3\times20=60\div4=15$s. Facit, 15s.

50. Reduce $\frac{2}{5}$ of a shilling to its proper quantity.
Facit, 4d. $3\frac{1}{5}$ qrs.

51. Reduce $\frac{4}{7}$ of a pound avoirdupois to its proper quantity.
Facit, 9 oz. $2\frac{2}{7}$ dr.

52. Reduce $\frac{7}{9}$ of a cwt. to its proper quantity.
Facit, 3 qrs. 3 lb. 1 oz. $12\frac{4}{9}$ dr.

53. Reduce $\frac{3}{5}$ of a pound troy to its proper quantity.
Facit, 7 oz. 4 dwts.

54. Reduce $\frac{5}{9}$ of an ell English to its proper quantity.
Facit, 2 qrs. $3\frac{1}{9}$ nails.

55. Reduce $\frac{4}{5}$ of a mile to its proper quantity.
Facit, 6 fur. 16 poles.

56. Reduce $\frac{5}{8}$ of an acre to its proper quantity.
Facit, 2 roods, 20 poles.

57. Reduce $\frac{6}{7}$ of a hogshead of wine to its proper quantity.
Facit, 54 gallons.

58. Reduce $\frac{3}{9}$ of a barrel of beer to its proper quantity.
Facit, 12 gallons.

59. Reduce $\frac{5}{12}$ of a chaldron of coals to its proper quantity.
Facit, 15 bushels.

60. Reduce $\frac{3}{5}$ of a month to its proper time.
Facit, 2 weeks, 2 days, 19 hours, 12 minutes.

12. To reduce any given quantity to the fraction of any greater denomination, retaining the same value.

Rule. Reduce the given quantity to the lowest term mentioned for a numerator, under which set the integral part reduced to the same term, for a denominator, and it will give the fraction required.

EXAMPLES.

61. Reduce 15s. to the fraction of a pound sterling.
Facit, $\frac{15}{20} = \frac{3}{4}$£.

62. Reduce 4. $3\frac{1}{5}$ qrs. to the fraction of a shilling.
Facit, $\frac{2}{5}$.

63. Reduce 9 oz. $2\frac{2}{7}$ dr. to the fraction of a pound avoirdupois.
Facit, $\frac{4}{7}$.

64. Reduce 3 qrs. 3 lb. 1 oz. $12\frac{4}{9}$ dr. to the fraction of a cwt.
Facit, $\frac{7}{8}$.

65. Reduce 7 oz. 4 dwts. to the fraction of a pound troy.
Facit, $\frac{3}{5}$.

66. Reduce 2 qrs, $3\frac{1}{9}$ nails to the fraction of an English ell.
Facit, $\frac{5}{9}$.

67. Reduce 6 fur. 16 poles to the fraction of a mile.
Facit, $\frac{4}{5}$.

68. Reduce 2 roods 20 poles to the fraction of an acre.
Facit, $\frac{5}{8}$.

69. Reduce 54 gallons to the fraction of a hogshead of wine.
Facit, $\frac{6}{7}$.

70. Reduce 12 gallons to the fraction of a barrel of beer.
Facit, $\frac{1}{3}$.

71. Reduce fifteen bushels to the fraction of a chaldron of coal.
Facit, $\frac{5}{12}$.

72. Reduce 2 weeks, 2 days, 19 hours, 12 minutes, to the fraction of a month. Facit, $\frac{3}{5}$.

ADDITION OF VULGAR FRACTIONS.

RULE. Reduce the given fractions to a common denominator, then add all the numerators together, under which place the common denominator.

EXAMPLES.

1. Add $\frac{2}{3}$ and $\frac{5}{7}$ together. Facit, $\frac{14}{21}+\frac{15}{21}=\frac{29}{21}=1\frac{8}{21}$.
2. Add $\frac{3}{4}$, $\frac{2}{7}$ and $\frac{5}{6}$ together. Facit, $1\frac{146}{168}$.
3. Add $\frac{1}{5}$, $1\frac{1}{3}$ and $\frac{2}{5}$ together. Facit, $4\frac{70}{75}$.
4. Add $7\frac{2}{3}$ and $\frac{2}{5}$ together. Facit, $8\frac{1}{15}$.
5. Add $\frac{2}{7}$ and $\frac{2}{3}$ of $\frac{3}{4}$ together. Facit, $\frac{11}{14}$.
6. Add $5\frac{2}{3}$, $6\frac{7}{8}$ and $4\frac{1}{2}$ together. Facit. $17\frac{1}{24}$.

2. When the fractions are of several denominations, reduce them to their proper quantity, and add as before.

7. Add $\frac{3}{4}$ of a pound to $\frac{5}{6}$ of a shilling. Facit, 15s. 10d.
8. Add $\frac{1}{2}$ of a penny to $\frac{2}{3}$ of a pound. Facit, 13s. $4\frac{1}{2}$d.
9. Add $\frac{3}{4}$ of a pound troy to $\frac{1}{6}$ of an ounce.
Facit 9 oz. 3 dwts. 8 grs.
10. Add $\frac{4}{5}$ of a ton to $\frac{5}{6}$ of a lb.
Facit, 16 cwt. 0 qrs. 0 lb. 13 oz. $5\frac{1}{3}$ dr.
11. Add $\frac{2}{3}$ of a chaldron to $\frac{3}{4}$ of a bushel.
Facit, 24 bushels 3 pecks.
12. Add $\frac{1}{6}$ of a yard to $\frac{2}{3}$ of an inch.
Facit, 6 inch. 2 bar. corns.

SUBTRACTION OF VULGAR FRACTIONS.

RULE. Reduce the given fraction to a common denominator, then subtract the less numerator from the greater, and place the remainder over the common denominator.

2. When the lower fraction is greater than the upper, subtract the numerator of the lower fraction from the denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

EXAMPLES.

1. From $\frac{3}{4}$ take $\frac{5}{7}$. $3\times7=21$. $5\times4=20$. $21-20=1$ num. $4\times7=28$ den. Facit, $\frac{1}{28}$.
2. From $\frac{5}{6}$ take $\frac{3}{5}$ of $\frac{5}{8}$. Facit, $\frac{11}{24}$.
3. From $5\frac{2}{3}$ take $\frac{9}{10}$. Facit, $4\frac{23}{30}$.
4. From $\frac{3}{4}\frac{3}{7}$ take $\frac{3}{5}$. Facit, $\frac{49}{235}$.
5. From $\frac{1}{2}\frac{2}{0}$ take $\frac{1}{7}$ of $\frac{2}{3}$. Facit, $\frac{352}{420}$.
6. From $64\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$. Facit, $63\frac{3}{4}$.

3. When the fractions are of several denominations, reduce them to their proper quantities, and subtract as before.

7. From $\frac{3}{4}$ of a pound take $\frac{3}{4}$ of a shilling. Facit, 14s. 3d.
8. From $\frac{2}{3}$ of a shilling take $\frac{1}{2}$ of a penny. Facit, $7\frac{1}{2}$d.
9. From $\frac{3}{4}$ of a lb. troy take $\frac{1}{6}$ of an ounce.
Facit, 8 oz. 16 dwts. 16 grs.
10. From $\frac{4}{5}$ of a ton take $\frac{5}{6}$ of a lb.
Facit, 15 cwt. 3 qrs. 27 lb. 2 oz. $10\frac{2}{3}$ drs.
11. From $\frac{2}{3}$ of a chaldron, take $\frac{3}{4}$ of a bushel.
Facit, 23 bushels, 1 peck.
12. From $\frac{1}{6}$ of a yard, take $\frac{2}{3}$ of an inch.
Facit, 5 in. 1 b. corn.

MULTIPLICATION OF VULGAR FRACTIONS.

Rule. Prepare the given numbers (if they require it) by the rules of Reduction; then multiply all the numerators together for a new numerator, and all the denominators for a new denominator.

EXAMPLES.

1. Multiply $\frac{3}{4}$ by $\frac{3}{5}$.
Facit, $3\times3=9$ num. $4\times5=20$ den.—$\frac{9}{20}$.
2. Multiply $\frac{7}{9}$ by $\frac{2}{3}$. Facit, $\frac{14}{27}$.
3. Multiply $48\frac{3}{5}$ by $13\frac{5}{6}$. Facit, $672\frac{3}{30}$.
4. Multiply $430\frac{6}{10}$ by $18\frac{3}{7}$. Facit, $7935\frac{24}{70}$.
5. Multiply $\frac{1}{2}\frac{0}{1}$ by $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$. Facit, $\frac{60}{840}=\frac{1}{14}\frac{0}{0}$.
6. Multiply $\frac{9}{10}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$. Facit, $\frac{3}{8}$.

7. Multiply $\frac{3}{4}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{1}{6}$. Facit, $\frac{1}{9}$.
8. Multiply $\frac{1}{4}$ of $\frac{3}{8}$ by $\frac{5}{7}$. Facit, $\frac{15}{224}$.
9. Multiply $5\frac{6}{7}$ by $\frac{5}{6}$. Facit, $4\frac{37}{42}$.
10. Multiply 24 by $\frac{2}{6}$. Facit, 16.
11. Multiply $\frac{3}{4}$ of 9 by $\frac{7}{8}$. Facit, $5\frac{22}{32}$.
12. Multiply $9\frac{1}{2}$ by $\frac{2}{6}$. Facit, $3\frac{1}{6}$.

DIVISION OF VULGAR FRACTIONS.

RULE. Prepare the given numbers (if they require it) by the rules of Reduction, and invert the divisor, then proceed as in Multiplication.

EXAMPLES.

1. Divide $\frac{9}{20}$ by $\frac{3}{5}$.
   Facit, $5\times9=45$ num. $3\times20=60$ den.—$\frac{45}{60}=\frac{3}{4}$.
2. Divide $\frac{14}{27}$ by $\frac{2}{3}$. Facit, $\frac{7}{9}$.
3. Divide $672\frac{9}{30}$ by $13\frac{5}{6}$. Facit, $48\frac{3}{5}$.
4. Divide $7935\frac{24}{70}$ by $18\frac{3}{7}$. Facit, $430\frac{3}{5}$.
5. Divide $\frac{3}{8}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ Facit, $\frac{9}{10}$.
6. Divide $\frac{2}{3}$ of 16 by $\frac{5}{7}$ of $\frac{3}{4}$. Facis, $19\frac{41}{45}$.
7. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{4}$. Facit, $\frac{24}{36}=\frac{2}{3}$.
8. Divide $9\frac{2}{12}$ by $\frac{1}{2}$ of 7. Facit, $2\frac{13}{21}$.
9. Divide $\frac{9}{16}$ by $4\frac{1}{2}$. Facit, $\frac{1}{8}$.
10. Divide 16 by 24. Facit, $\frac{2}{3}$.
11. Divide $5205\frac{2}{10}$ by $\frac{4}{5}$ of 91. Facit, $71\frac{1}{4}$.
12. Divide $3\frac{1}{6}$ by $9\frac{1}{2}$. Facit, $\frac{1}{3}$.

THE SINGLE RULE OF THREE DIRECT, IN VULGAR FRACTIONS.

RULE. Reduce the numbers as before directed in Reduction. State the question as in the Rule of Three in whole numbers, and invert the first term in the proportion, then multiply the three terms continually together, and the product will be the answer.

EXAMPLES.

1. If $\frac{3}{4}$ of a yard cost $\frac{5}{6}$ of £1, what will $\frac{9}{10}$ of a yard come to at that rate? *Ans.* $\frac{1}{2}\frac{3}{4}$=15s.

yd. £ yd. £
As $\frac{3}{4}$: $\frac{5}{6}$ :: $\frac{9}{10}$: $\frac{1}{2}\frac{3}{4}$=15s.
for $4 \times 5 \times 9 = 180$ num.
and $3 \times 8 \times 10 = 240$ den. or $\frac{5}{8} \times \frac{9}{10} = \frac{4}{2}\frac{5}{0}$ $\frac{3}{4})\frac{4}{8}\frac{5}{0}(\frac{1}{2}\frac{5}{0}$£.

2. If $\frac{5}{6}$ of a yard cost $\frac{2}{3}$ of £1, what will $\frac{1}{1}\frac{1}{2}$ of a yard cost? *Ans.* 14s. 8d.

3. If $\frac{3}{4}$ of a yard of lawn cost 7s. 3d., what will $10\frac{1}{3}$ yards cost? *Ans.* £4 : 19 : $10\frac{1}{1}\frac{3}{8}$.

4. If $\frac{7}{8}$ lb. cost $\frac{3}{4}$s. how many pounds will $\frac{8}{9}$ of 1s. buy? *Ans.* 1 lb. $\frac{8}{2}\frac{8}{1}\frac{}{0} = \frac{1}{2}\frac{}{7}$.

5. If $\frac{2}{5}$ ell of Holland cost $\frac{1}{3}$ of £1, what will $12\frac{2}{3}$ ells cost at the same rate? *Ans.* £7 : 0 : $8\frac{3}{4}$ $\frac{1}{2}\frac{5}{7}$.

6. If $12\frac{1}{2}$ yards of cloth cost 15s. 9d., what will $48\frac{1}{4}$ cost at the same rate? *Ans.* £3 : 0 : $9\frac{1}{2}$ $\frac{1}{1}\frac{6}{0}\frac{}{0}$.

7. If $\frac{9}{10}$ of a cwt. cost 284s. what will $7\frac{1}{2}$ cwt. cost at the same rate? *Ans.* £118 : 6 : 8.

8. If 3 yards of broad cloth cost £$2\frac{4}{5}$, what will $10\frac{2}{7}$ yards cost? *Ans.* £9 : 12.

9. If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of £1, what will $\frac{3}{5}$ of an ell English come to at the same rate? *Ans.* £2.

10. If 1 lb. of cochineal cost £1 : 5, what will $36\frac{7}{10}$ lb. come to? *Ans.* £45 : 17 : 6.

11. If 1 yard of broad cloth cost $15\frac{5}{8}$s., what will 4 pieces cost, each containing $27\frac{3}{7}$ yards? *Ans.* £85 : 14 : $3\frac{1}{4}$ $\frac{4}{5}\frac{0}{6}$ or $\frac{5}{7}$.

12. Bought $3\frac{1}{2}$ pieces of silk, each containing $24\frac{3}{8}$ ells, at 6s. $9\frac{3}{4}$d. per ell. I desire to know what the whole quantity cost? *Ans.* £25 : 17 : $2\frac{1}{4}$ $\frac{1}{1}\frac{5}{6}$.

THE SINGLE RULE OF THREE INVERSE, IN VULGAR FRACTIONS.

EXAMPLES.

1. If 48 men can build a wall in $24\frac{1}{4}$ days, how many men can do the same in 192 days? *Ans.* $6\frac{4}{7}\frac{8}{8}$ men.

2. If $25\frac{2}{7}$s. will pay for the carriage of 1 cwt. $145\frac{1}{4}$ miles, how far may $6\frac{1}{2}$ cwt. be carried for the same money? *Ans.* $22\frac{9}{2}\frac{}{6}$ miles.

3. If $3\frac{1}{4}$ yards of cloth, that is $1\frac{1}{5}$ yard wide, be sufficient to make a cloak, how much must I have of that sort which is $\frac{4}{5}$ yard wide, to make another of the same bigness?

Ans. $4\frac{7}{8}$ yards.

4. If three men can do a piece of work in $4\frac{1}{2}$ hours, in how many hours will ten men do the same work?

Ans. $1\frac{7}{20}$ hour.

5. If a penny white loaf weighs 7 oz. when a bushel of wheat cost 5s. 6d., what is a bushel worth when a penny white loaf weighs but $2\frac{1}{2}$ oz.?

Ans. 15s. $4\frac{4}{5}$d.

6. What quantity of shalloon, that is $\frac{3}{4}$ yard wide, will line $7\frac{1}{2}$ yards of cloth, that is $1\frac{1}{2}$ yard wide?

Ans. 15 yards.

THE DOUBLE RULE OF THREE, IN VULGAR FRACTIONS.

EXAMPLES.

1. If a carrier receives $£2\frac{1}{10}$ for the carriage of 3 cwt. 150 miles, how much ought he to receive for the carriage of 7 cwt. $3\frac{1}{2}$ qrs. 50 miles?

Ans. £1 : 16 : 9.

2. If £100 in 12 months gain £6 interest, what principal will gain $£3\frac{3}{5}$ in 9 months?

Ans. £75.

3. If 9 students spend $£10\frac{7}{9}$ in 18 days, how much will 20 students spend in 30 days?

Ans. £39 : 18 : $4\frac{360}{1458}$.

4. A man and his wife having laboured one day, earned $4\frac{5}{8}$s. how much must they have for $10\frac{1}{2}$ days, when their two sons helped them?

Ans. 4 : 17 : $1\frac{1}{2}$.

5. If £50, in 5 months, gain $£2\frac{37}{144}$, what time will $£13\frac{1}{3}$ require to gain $£1\frac{1}{12}$?

Ans. 9 months.

6. If the carriage of 60 cwt. 20 miles cost $£14\frac{1}{2}$, what weight can I have carried 30 miles for $£5\frac{7}{16}$?

Ans. 15 cwt.

THE

TUTOR'S ASSISTANT.

PART III.

DECIMAL FRACTIONS.

In Decimal Fractions the integer or whole thing, as one pound, one yard, one gallon, &c. is supposed to be divided into 10 equal parts, and those parts into tenths, and so on without end.

So that the denominator of a decimal being always known to consist of an unit, with as many ciphers as the numerator has places, therefore is never set down; the parts being only distinguished from the whole members by a comma prefixed: thus ,5 which stands for $\frac{5}{10}$, ,25 for $\frac{25}{100}$, ,123 for $\frac{123}{1000}$.

But the different value of figures appears plainer by the following table.

Whole numbers.							*Decimal parts.*					
7	6	5	4	3	2	1	,2	3	4	5	6	7
Millions.	C. Thousands.	X. Thousands.	Thousands.	Hundreds.	Tens.	Units.	Parts of Tens.	Parts of Hundreds.	Parts of Thousands.	Parts of X. Thousands.	Parts of C. Thousands.	Parts of Millions.

From which it plainly appears, that as whole numbers increase in a ten-fold proportion to the left hand, so decimal parts decrease in a ten-fold proportion to the right hand; so that ciphers placed

before decimal parts decrease their value by removing them farther from the comma, or unit's place; thus, ,5 is 5 parts of 10, or $\frac{5}{10}$; ,05 is 5 parts of 100, or $\frac{5}{100}$; ,005 is 5 parts of 1000, or $\frac{5}{1000}$; ,0005 is 5 parts of 10000, or $\frac{5}{10000}$. But ciphers after decimal parts do not alter their value. For ,5, ,50, ,500, &c. are each but $\frac{5}{10}$ of the unit.

A FINITE DECIMAL is that which ends at a certain number of places, but an INFINITE is that which no where ends.

A RECURRING DECIMAL is that wherein one or more figures are continually repeated, as 2,75222.

And 52,275275275 is called a COMPOUND RECURRING DECIMAL.

NOTE. A finite decimal may be considered as infinite, by making ciphers to recur; for they do not alter the value of the decimal.

In all operations, if the result consists of several nines, reject them, and make the next superior place an unit more; thus, for 26,25999, write 26, 26.

In all circulating numbers, dash the last figure.

ADDITION OF DECIMALS.

RULE. In setting down the proposed numbers to be added, great care must be taken in placing every figure directly underneath those of the same value, whether they be mixed numbers, or pure decimal parts; and to perform which there must be a due regard had to the commas, or separating points, which ought always to stand in a direct line, one under another, and to the right hand of them carefully place the decimal parts according to their respective values; then add them as in whole numbers.

EXAMPLES.

1. Add 72,5+32,071+2,1574+371,4+2,75.

Facit, 480,8784.

2. Add 30,07+2,0071+59,432+7,1.
3. Add 3,5+47,25+927,01+2,0073+1,5.
4. Add 52,75+47,21+724+31,452+,3075.
5. Add 3275+27,514+1,005+725+7,82.
6. Add 27,5+52+3,2675+,5741+2720.

SUBTRACTION OF DECIMALS.

RULE. Subtraction of decimals differs but little from whole numbers, only in placing the numbers, which must be carefully observed, as in addition.

EXAMPLES.

1. From ,2754 take ,2371.
2. From 2,37 take 1,76.
3. From 271 take 215,7.
4. From 270,2 take 75,4075.
5. From 571 take 54,72.
6. From 625 take 76,91.
7. From 23,415 take ,3742.
8. From ,107 take ,0007

MULTIPLICATION OF DECIMALS.

RULE. Place the factors, and multiply them, as in whole numbers, and from the product towards the right hand, cut off as many places for decimals as there are in both factors together; but if there should not be so many places in the product, supply the defect with ciphers to the left hand.

EXAMPLES.

1. Multiply ,2365 by ,2435. Facit, ,05758775.
2. Multiply 2071 by 2,27.
3. Multiply 27,15 by 25,3.
4. Multiply 72347 by 23,15.
5. Multiply 17105 by ,3257.
6. Multiply 17105 by ,0237.
7. Multiply 27,35 by 7,70071.
8. Multiply 57,21 by ,0075.
9. Multiply ,007 by ,007.
10. Multiply 20,15 by ,2705.
11. Multiply ,907 by ,0025.

When any number of decimals is to be multiplied by 10, 100, 1000, &c., it is only removing the separating point in the multiplicand so many places towards the right hand as there are ciphers in the multiplier: thus, ,578×10=5,78. ,578×100=5,78; ,578×1000=578; and ,578×10000=5780.

CONTRACTED MULTIPLICATION OF DECIMALS.

RULE. Put the unit's place of the multiplier under that place of the multiplicand that is intended to be kept in the product, then invert the order of all the other figures, *i. e.* write them all the

contrary way; and in multiplying, begin at the figure in the multiplicand, which stands over the figure you are then multiplying with, and set down the first figure of each particular product directly one under the other, and have a due regard to the increase arising from the figures on the right hand of that figure you begin to multiply at in the multiplicand.

NOTE. That in multiplying the figure left out every time next the right hand in the multiplicand, and if the product be 5, or upwards, to 15, carry 1; if 15, or upwards, to 25, carry 2; and if 25, or upwards, to 35, carry 3, &c.

EXAMPLES.

12. Multiply 384,672158 by 36,8345, and let there be only four places of decimals in the product.

Contracted way.

384,672158
5438.63

115401647
23080329
3077377
115402
15387
1923

14169,2065

Common way.

384,672158
36,8345

1923 | 360790
15386 | 88632
115401 | 6474
3077377 | 264
23080329 | 48
115401647 | 4

14169,2066 | 038510

Facit, 14169,2065.

13. Multiply 3,141592 by 52,7438, and leave only four places of decimals. Facit, 165,6994.

14. Multiply 2,38645 by 8,2175, and leave only four places of decimals. Facit, 19,6107.

15. Multiply 375,13758 by 167324, and let there be only one place of decimals. Facit, 6276,9.

16. Multiply 375,13758 by 16,7324, and leave only four places of decimals. Facit, 6276,9520.

17. Multiply 395,3756 by ,75642, and let there be only four places of decimals. Facit, 299,0699.

DIVISION OF DECIMALS.

This Rule is also worked as in whole numbers; the only difficulty is in valuing the quotient, which is done by any of the following rules:

Rule 1. The first figure in the quotient is always of the same value with that figure of the dividend, which answers or stands over the place of units in the divisor.

2. The quotient must always have so many decimal places, as the dividend has more than the divisor.

Note 1. If the divisor and dividend have both the same number of decimal parts, the quotient will be a whole number.

2. If the dividend hath not so many places of decimals as are in the divisor, then so many ciphers must be annexed to the dividend as will make them equal, and the quotient will then be a whole number.

3. But if, when the division is done, the quotient has not so many figures as it should have places of decimals, then so many ciphers must be prefixed as there are places wanting.

EXAMPLES.

1. Divide 85643,825 by 6,321. Facit, 13549.

2. Divide 48 by 144
3. Divide 217,75 by 65.
4. Divide 125 by ,1045.
5. Divide 709 by 2,574.
6. Divide 5,714 by 8275.
7. Divide 7382,54 by 6,4252.
8. Divide ,0851648 by 423.
9. Divide 267,15975 by 13,25.
10. Divide 72,1564 by ,1347.
11. Divide 715 by ,3075.

When numbers are to be divided by 10, 100, 1000, 10,000, &c. it is performed by placing the separating point in the dividend so many places towards the left hand, as there are ciphers in the divisor.

Thus, $5784 \div 10 = 578,4$. $5784 \div 1000 = 5,784$.
$5784 \div 100 = 57,84$. $5784 \div 10,000 = ,5784$.

CONTRACTED DIVISION OF DECIMALS.

RULE. By the first rule find what is the value of the first figure in the quotient: then by knowing the first figure's denomination, the decimal places may be reduced to any number, by taking as many of the left hand figures of the dividend as will answer them; and in dividing, omit one figure of the divisor at each following operation.

NOTE. That in multiplying every figure left out in the divisor, you must carry 1, if it be 5 or upwards, to 15; if 15, or upwards, to 25, carry 2; if 25, or upwards, to 35, carry 3, &c.

EXAMPLES.

12. Divide 721,17562 by 2,257432, and let there be only three places of decimals in the quotient.

Contracted.

```
2,257432)721,17562(319,467
         6772296
         -------
          439460
          225743
          ------
          213717..
          203169..
          --------
           10548...
            9030...
            -----
            1518....
            1354....
            -------
             164
             158
             ---
               6
               -
```

Common way.

```
2,257432)721,17562(319,467
         6772296
         -------
          439460 | 2
          225743 | 2
          ------   -
          213717 | 00
          203168 | 88
          -------  --
           10548 | 120
            9029 | 728
            ----   ---
            1518 | 3920
            1354 | 4592
            ----   ----
             163 | 93280
             158 | 02024
             ---   -----
               5 | 91256
               -   -----
```

13. Divide 8,758615 by 5,2714167.
14. Divide 51717591 by 8,7586.
15. Divide 25,1367 by 217,35.
16. Divide 51,47542 by ,123415.
17. Divide 70,23 by 7,9863.
18. Divide 27,104 by 3,712.

REDUCTION OF DECIMALS.

To reduce a Vulgar Fraction to a Decimal.

RULE. Add ciphers to the numerator, and divide by the denominator, the quotient is the decimal fraction required.

EXAMPLES

1. Reduce $\frac{1}{4}$ ..... to a decimal.	4)1,00(25 Facit.
2. Reduce $\frac{1}{2}$ ..... to a decimal.	Facit, ,5.
3. Reduce $\frac{3}{4}$ ..... to a decimal.	Facit, ,75.
4. Reduce $\frac{3}{8}$ ..... to a decimal.	Facit, ,375.
5. Reduce $\frac{5}{26}$ ..... to a decimal.	Facit, ,1923076+.
6. Reduce $\frac{11}{14}$ of $\frac{10}{13}$. to a decimal.	Facit, ,6043956+.

NOTE. If the given parts are of several denominations, they may be reduced either by so many distinct operations as there are different parts, or by first reducing them into their lowest denomination, and then divide as before; or,

2ndly. Bring the lowest into decimals of the next superior denomination, and on the right hand of the decimal found, place the parts given of the next superior denomination; so proceeding till you bring out the decimal parts of the highest integer required, by still dividing the product by the next superior denominator; or,

3dly. To reduce shillings, pence, and farthings. If the number of shillings be even, take half for the first place of decimals, and let the second and third places be filled with the farthings contained in the remaining pence and farthings, always remembering to add 1, when the number is, or exceeds 25. But if the number of shillings be odd, the second place of decimals must be increased by 5.

7. Reduce 5s. to the decimal of a £.	Facit, ,25.
8. Reduce 9s. to the decimal of a £.	Facit, ,45.
9. Reduce 16s. to the decimal of a £.	Facit, ,8.

10. Reduce 8s. 4d. to the decimal of a £.

Facit, ,4166.

11. Reduce 16s. 7¾d. to the decimal of a £.

Facit, ,8322916.

first.	second.	third.	7¾d.
16s. 7¾d.	4)3,00	2)16	4
12			
199	12)7,75	,832	31
4	20)16,64583		
960)799(8322916	,8322916		

12. Reduce 19s. 5½d. to the decimal of a £.

Facit, 972916.

13. Reduce 12 grains to the decimal of a lb. troy.

Facit, ,002083.

14. Reduce 12 drams to the decimal of a lb. avoirdupois.

Facit, ,046875.

15. Reduce 2 qrs. 14 lb. to the decimal of a cwt.

Facit, ,625.

16. Reduce two furlongs to the decimal of a league.

Facit, ,0833.

17. Reduce 2 quarts, 1 pint, to the decimal of a gallon.

Facit, ,625.

18. Reduce 4 gallons, 2 quarts of wine, to the decimal of a hogshead. Facit, ,071428+.

19. Reduce 2 gallons, 1 quart of beer, to the decimal of a barrel. Facit, ,0625.

20. Reduce 52 days to the decimal of a year.

Facit, ,142465+.

To find the value of any Decimal Fraction in the known parts of an Integer.

Rule. Multiply the decimal given, by the number of parts of the next inferior denomination, cutting off the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding till you have brought in the least known parts of an integer.

EXAMPLES.

21. What is the value of ,8322916 of a lb.?

Ans. 16s. 7½d.+.

20

16,6458320
12

7,7499840
4

2,9999360

22. What is the value of ,002084 of a lb. troy?

Ans. 12,00384 gr.

23. What is the value of ,046875 of a lb. avoirdupois?

Ans. 12 dr.

24. What is the value of ,625 of a cwt.?

Ans. 2 qrs. 14 lb.

25. What is the value of ,625 of a gallon?

Ans. 2 qrs. 1 pint.

26. What is the value of ,071428 of a hogshead of wine?

Ans. 4 gallons 1 quart, ,999856.

27. What is the value of ,0625 of a barrel of beer?

Ans. 2 gallons 1 quart.

28. What is the value of ,142465 of a year?

Ans. 51,999725 days.

DECIMAL TABLES OF COIN, WEIGHT, AND MEASURE.

TABLE I.

ENGLISH COIN.

£ 1 the Integer.

Sh.	Dec.	Sh.	Dec.
19	,95	9	,45
18	,9	8	,4
17	,85	7	,35
16	,8	6	,3
15	,75	5	,25
14	,7	4	,2
13	,65	3	,15
12	,6	2	,1
11	,55	1	,05
10	,5		

Pence.	Decimals.
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Farth.	Decimals.
3	,003125
2	,0020833
1	,0010416

TABLE II.

ENGLISH COIN. 1 Sh.

Long Measure. 1 Foot. the Integer.

Pence & Inches.	Decimals.
6	,5
5	,416666
4	,333333
3	,25
2	,166666
1	,083333

Farth.	Decimals.
3	,0625
2	,041666
1	,020833

TABLE III.

TROY WEIGHT.

1 lb. the Integer.

Ounces the same as Pence in the last Table.

Dwts.	Decimals.
10	,041666
9	,0375
8	,033333
7	,029166
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Grains.	Decimals.
12	,002083
11	,001910
10	,001736
9	,001562
8	,001389
7	,001215
6	,001042
5	,000868
4	,000694
3	,000521
2	,000347
1	,000173

1 oz. the Integer.

Pennyweights the same as Shillings in the first Table.

Grains.	Decimals.
12	,052
11	,022916
10	,020833
9	,01875
8	,016666
7	,014583
6	,0125
5	,010416
4	,008333
3	,00625
2	,004166
1	,002083

TABLE IV.

AVOIR. WEIGHT.

112 lbs. the Integer.

Qrs.	Decimals.
3	,75
2	,5
1	,25

Pounds.	Decimals.
14	,125
13	,116071
12	,107143
11	,098214
10	,089286
9	,080357
8	,071428
7	,0625
6	,053571
5	,044643
4	,035714
3	,026786
2	,017857
1	,008928

Ounces.	Decimals.
8	,004464
7	,003906

DECIMAL TABLES OF COIN, WEIGHT, AND MEASURE.

6	,003348
5	,002790
4	,002232
3	,001674
2	,001116
1	,000558

¼ Oz.	Decimals.
3	,000418
2	,000279
1	,000139

TABLE V.

AVOIRDUPOIS WEIGHT.

1 lb. the Integer.

Ounces.	Decimals.
8	,5
7	,4375
6	,375
5	,3125
4	,25
3	,1875
2	,125
1	,0625

Drams.	Decimals.
8	,03125
7	,027343
6	,023437
5	,019531
4	,015625
3	,011718
2	,007812
1	,003906

TABLE VI.

LIQUID MEASURE

1 tun the Integer.

Gallons.	Decimals.
100	,396825
90	,357142
80	,317460
70	,27
60	,238095
50	,198412
40	,158730
30	,119047
20	,079365
10	,039682
9	,035714
8	,031746
7	,027
6	,023809
5	,019841
4	,015873
3	,011904
2	,007936
1	,003968

Pints.	Decimals.
4	,001984
3	,001488
2	,000992
1	,009496

A

Hogshead the

Integer.

Gallons.	Decimals.
30	,476190
20	,317460
10	,158730
9	,142857
8	,126984
7	,111111
6	,095238
5	,079365
4	,063492
3	,047619
2	,031746
1	,015873

Pints.	Decimals.
3	,005952
2	,003968
1	,001984

TABLE VII.

MEASURES.

Liquid. Dry.

1 Gal. 1 Qr.

Integer.

Pts.	Decimals.	Bush.
	,5	4
3	,375	3
2	,25	2
1	,125	1

Q. pt	Decimals.	Pck.
3	,09375	3
2	,0625	2
1	,03125	1

Decimals.	Q. Pks.
,0234375	3
,015625	2
,0078125	1

Decimals.	Pints.
,005859	3
,003906	2
,001953	1

TABLE VII..

LONG MEASURE.

1 Mile the Integer.

Yards.	Decimals.
1000	,568182
900	,511364
800	,454545
700	,397727
600	,340909

500	,284091
400	,227272
300	,170454
200	,113636
100	,056818
90	,051136
80	,045454
70	,039773
60	,034091
50	,028409
40	,022727
30	,017045
20	,011364
10	,005682
9	,005114
8	,004545
7	,003977
6	,003409
5	,002841
4	,002273
3	,001704
2	,001136
1	,000568

Feet.	Decimals.
2	,0003787
1	,0001894

Inches.	Decimals.
6	,0000947
3	,0000474
1	,0000158

TABLE IX.

TIME.

1 year the Integer.

Months the same as Pence in the second Table.

Days.	Decimals.
365	1,000000
300	,821918
200	,547945
100	,273973
90	,246575
80	,219178
70	,191781
60	,164383
50	,136986
40	,109589
30	,082192
20	,054794
10	,027397
9	,024657
8	,021918
7	,019178
6	,016438
5	,013698
4	,010959
3	,008219
2	,005479
1	,002739

1 day the Integer.

Hours.	Decimals.
12	,5
11	,458333
10	,416666
9	,375
8	,333333
7	,291666
6	,25
5	,208333
4	,166666
3	,125
2	,083333
1	,041666

Minutes.	Decimals.
30	,020833
20	,013888
10	,006944
9	,00625
8	,005555
7	,004861
6	,004166
5	,003472
4	,002777
3	,002083
2	,001389
1	,000664

TABLE X.

CLOTH MEASURE.

1 yard the Integer.

Quarters the same as Table 4.

Nails.	Decimals.
2	,125
1	,0625

TABLE XI.

LEAD WEIGHT.

A Foth. the Integer.

Hund.	Decimals.
10	,512820
9	,461538
8	,410256
7	,358974
6	,307692
5	,256410
4	,205128
3	,153846
2	,102564
1	,051282

Qrs.	Decimals.
2	,025641
1	,012820

Pounds.	Decimals.
14	,0064102
13	,0059523
12	,0054945
11	,0050366
10	,0045787
9	,0041208
8	,0036630
7	,0032051
6	,0027472
5	,0022893
4	,0018315
3	,0013736
2	,0009157
1	,0004578

THE RULE OF THREE IN DECIMALS.

EXAMPLES.

If 26½ yards cost £3 : 16 : 3, what will 32¼ yards come to?
Ans. £4 : 12 : 9½.

yds. £ yds.
26,5 : 3,8125 : : 32,25 :
32,25

26,5)122,953125(4,63974=£4 : 12 : 9½.

2. What will the pay of 540 men come to, at £1 : 5 : 6 per man? *Ans.* £688 : 10.

3. If 7¾ yards of cloth cost £2 : 12 : 9, what will 140½ yards of the same cost? *Ans.* £47 : 16 : 3 2,4 qrs.

4. If a chest of sugar, weighing 7 cwt. 2 qrs. 14 lb. cost £36 : 12 : 9, what will 2 cwt. 1 qr. 21 lb. of the same cost?
Ans. £11 : 14 : 2 3,5 qrs.

5. A grocer buys 24 ton 12 cwt. 2 qrs. 14 lb. 12 oz. of tobacco for £3678 : 6 : 4, what will 1 oz. come to? *Ans.* 1d.

6. What will 326¼ lb. of tobacco come to, when 1½ lb. is sold for 3s. 6d.? *Ans.* £38 : 1 : 3.

7. What is the worth of 19 oz. 3 dwts. 5 grs. of gold, at £2 : 19 per oz.? *Ans.* £56 : 10 : 5 2,99 qrs.

8. What is the worth of 827¾ yards of painting, at 10½d. per yard? *Ans.* £36 : 4 : 3 1,5 qrs.

9. If I lent my friend £34 for $\frac{5}{8}$ of a year, how much ought he to lend me $\frac{5}{12}$ of a year to requite my kindness? *Ans.* 51.

10. If ¾ of a yard of cloth, that is 2¼ yards broad, make a garment, how much that is ⅘ of a yard wide will make the same?
Ans. 2,109375 yards.

11. If 1 ounce of silver cost 5s. 6d., what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwts. 4 grs.?
Ans. £6 : 3 : 9 2,2 qrs.

12. If 1 lb. of tobacco cost 15d. what cost 3 hogsheads, weighing together 15 cwt. 1 qr. 19 lb.? *Ans.* £107 : 18 : 9.

13. If 1 cwt. of currants cost £2 : 9 : 6, what will 45 cwt. 3 qrs. 14 lb. cost at the same rate? *Ans.* £113 : 10 : 9¾.

14. Bought 6 chests of sugar, each 6 cwt. 3 qrs. at £2 : 16 per cwt., what do they come to? *Ans.* £113 : 8.

15. Bought a tankard for £10 : 12, at the rate of 5s. 4d. per ounce, what was the weight?

Ans. 39 oz. 15 dwts.

16. Gave £187 : 3 : 3, for 25 cwt. 3 qrs. 14 lb. of tobacco, at what rate did I buy it per lb.?

Ans. 1s. 3½d.

17. Bought 29 lb. 4 oz. of coffee, for £10 : 11 : 3, what is the value of 3 lb.? *Ans.* £1 : 1 : 8.

18. If I give 1s. 1d. for 3½ lb. cheese, what will be the value of 1 cwt.? *Ans.* £1 : 14 : 8.

EXTRACTION OF THE SQUARE ROOT.

Extracting the Square Root is to find out such a number as, being multiplied into itself, the product will be equal to the given number.

Rule. First, Point the given number, beginning at the unit's place, then proceed to the hundreds, and so upon every second figure throughout.

Secondly. Seek the greatest square number in the first point towards the left hand, placing the square number under the first point, and the root thereof in the quotient; subtract the square number from the first point, and to the remainder bring down the next point and call that the resolvend.

Thirdly. Double the quotient, and place it for a divisor on the left hand of the resolvend; seek how often the divisor is contained in the resolvend; (preserving always the unit's place) and put the answer in the quotient, and also on the right-hand side of the divisor; then multiply by the figure last put in the quotient, and subtract the product from the resolvend; bring down the next point to the remainder if there be any more) and proceed as before.

Roots.	1.	2.	3.	4.	5.	6.	7.	8	9.
Squares.		4.	9.	16.	25.	36.	49.	64.	81.

EXAMPLES.

1. What is the square root of 119025? *Ans.* 345.

```
 . . .
119025(345
  9
 ---
64)290
   256
 ----
685)3425
    3425
 ----
```

2. What is the square root of 106929? *Ans.* 327+.
3. What is the square root of 2268741? *Ans.* 1506,23+.
4. What is the square root of 7596796? *Ans.* 2756,228+
5. What is the square root of 36372961? *Ans.* 6031.
6. What is the square root of 22071204? *Ans.* 4698.

When the given number consists of a whole number and decimals together, make the number of decimals even, by adding ciphers to them; so that there may be a point fall on the unit's place of the whole number.

7. What is the square root of 3271,4007? *Ans.* 57,19+.
8. What is the square root of 4795,25731? *Ans.* 69,247+.
9. What is the square root of 4,372594? *Ans.* 2,091+.
10. What is the square root of 2,2710957? *Ans.* 1,50701+.
11. What is the square root of ,00032754? *Ans.* ,01809+.
12. What is the square root of 1,270059? *Ans.* 1,1269+

To extract the Square Root of a Vulgar Fraction.

RULE. Reduce the fraction to its lowest terms, then extract the square root of the numerator, for a new numerator, and the square root of the denominator, for a new denominator.

If the fraction be a surd (*i. e.*) a number where a root can never be exactly found, reduce it to a decimal, and extract the root from it.

EXAMPLES.

13. What is the square root of $\frac{23084}{51184}$? *Ans.* $\frac{2}{3}$.
14. What is the square root of $\frac{27084}{42225}$? *Ans.* $\frac{4}{5}$.
15. What is the square root of $\frac{9216}{12544}$? *Ans.* $\frac{6}{7}$.

SURDS.

16. What is the square root of $\frac{2}{3}\frac{7}{4}\frac{5}{1}$? *Ans.* ,89802+.
17. What is the square root of $\frac{3}{4}\frac{5}{7}\frac{7}{6}$? *Ans.* ,86602+.
18. What is the square root of $\frac{4}{5}\frac{7}{4}\frac{4}{9}$? *Ans.* ,93309+.

To extract the Square Root of a mixed number.

RULE. Reduce the fractional part of a mixed number to its lowest term, and then the mixed number to an improper fraction.

2. Extract the root of the numerator and denominator for a new numerator and denominator.

If the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the square root therefrom.

EXAMPLES.

19. What is the square root of $51\frac{2}{2}\frac{1}{5}$? *Ans.* $7\frac{1}{5}$.
20. What is the square root of $27\frac{9}{1}\frac{0}{6}$? *Ans.* $5\frac{1}{4}$.
21. What is the square root of $9\frac{4}{4}\frac{3}{9}$? *Ans.* $3\frac{1}{7}$.

SURDS.

22. What is the square root of $85\frac{1}{1}\frac{4}{5}$? *Ans.* 9,27+.
23. What is the square root of $8\frac{5}{7}$? *Ans.* 2,9519+.
24. What is the square root of $6\frac{2}{3}$? *Ans.* 2,5819+.

To find a mean proportional between any two given numbers.

RULE. The square root of the product of the given number is the mean proportional sought.

EXAMPLES.

5. What is the mean proportional between 3 and 12?
Ans. $3 \times 12 = 36$, then $\sqrt{36} = 6$ the mean proportional.
6. What is the mean proportional between 4276 and 842?
Ans. 1897,4+.

To find the side of a square equal in area to any given superficies.

RULE. The square root of the content of any given superficies is the side of the square equal sought.

EXAMPLES.

27. If the content of a given circle be 160, what is the side of the square equal? *Ans.* 12,64911.

28. If the area of a circle is 750, what is the side of the square equal? *Ans.* 27,38612.

The area of the circle given to find the Diameter.

RULE. As 355 : 452, or, as 1 : 1,273239 : : so is the area : to the square of the diameter;—or, multiply the square root of the area by 1,12837, and the product will be the diameter

EXAMPLES.

29. What length of cord will be fit to tie to a cow's tail, the other end fixed in the ground, to let her have liberty of eating an acre of grass, and no more, supposing the cow and tail to measure $5\frac{1}{2}$ yards? *Ans.* 6,136 perches.

The area of a circle given, to find the periphery, or circumference.

RULE. As 113 : 1420, or, as 1 : 12,56637 : : the area to the square of the periphery;—or, multiply the square root of the area by 3,5449, and the product is the circumference.

EXAMPLES.

30. When the area is 12, what is the circumference?
Ans. 12,279.

31. When the area is 160, what is the periphery?
Ans. 44,839.

Any two sides of a right-angled triangle given, to find the third side.

1. The base and perpendicular given to find the hypothenuse.

RULE. The square root of the sum of the squares of the base and perpendicular, is the length of the hypothenuse.

EXAMPLES.

32. The top of a castle from the ground is 45 yards high, and surrounded with a ditch 60 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle?

Ans. 75 yards.

33. The wall of a town is 25 feet high, which is surrounded by a moat of 30 feet in breadth: I desire to know the length of a ladder that will reach from the outside of the moat to the top of the wall?

Ans. 39,05 feet.

The hypothenuse and perpendicular given, to find the base.

RULE. The square root of the difference of the squares of the hypothenuse and perpendicular, is the length of the base.

The base and hypothenuse given, to find the perpendicular.

RULE. The square root of the difference of the squares of the hypothenuse and base, is the height of the perpendicular.

N. B. The two last questions may be varied for examples to the two last propositions.

Any number of men being given, to form them into a square battle, or to find the number of rank and file.

RULE. The square root of the number of men given, is the number of men either in rank or file.

34. An army consisting of 331776 men, I desire to know how many rank and file?

Ans. 576.

35. A certain square pavement contains 48841 square stones, all of the same size. I demand how many are contained in one of the sides?

Ans. 221.

EXTRACTION OF THE CUBE ROOT.

To extract the Cube Root is to find out one number, which being multiplied into itself, and then into that product, produceth the given number.

RULE. 1. Point every third figure of the cube given, beginning at the unit's place; seek the greatest cube to the first point, and subtract it therefrom; put the root in the quotient, and bring down the figures in the next point to the remainder, for a RESOLVEND.

2. Find a DIVISOR by multiplying the square of the quotient by 3. See how often it is contained in the resolvend, rejecting the units and tens, and put the answer in the quotient.

3. To find the SUBTRAHEND. 1. Cube the last figure in the quotient. 2. Multiply all the figures in the quotient by 3, except the last, and that product by the square of the last. 3. Multiply the divisor by the last figure. Add these products together, for the subtrahend, which subtract from the resolvend; to the remainder bring down the next point, and proceed as before.

ROOTS.	1.	2.	3.	4.	5.	6.	7.	8.	9.
CUBES.	1.	8.	27.	64.	125.	216.	343.	512.	729.

EXAMPLES.

1. What is the cube root of 99252847?

. . .
99252847(463
64 =cube of 4
Divisor———
Square of 4×3=48)35252 resolvend.

216=cube of 6.
432 =4×3×by square of 6.
288 =divisor×by 6.

33336 subtrahend.
Divisor———
Square of 46×3=6348)1916847 resolvend.

27=cube of 3.
1242 =46×3×by square of 3.
19044 =divisor×by 3.

1916847 subtrahend.

2. What is the cube root of 389017? *Ans.* 73.
3. What is the cube root of 5735339? *Ans.* 179.
4. What is the cube root of 32461759? *Ans.* 319.
5. What is the cube root of 84604519? *Ans.* 439.
6. What is the cube root of 259694072? *Ans.* 638.
7. What is the cube root of 48228544? *Ans.* 364.
8. What is the cube root of 27054036008? *Ans.* 3002.
9. What is the cube root of 22069810125? *Ans.* 2805.
10. What is the cube root of 122615327232? *Ans.* 4968.
11. What is the cube root of 219365327791? *Ans.* 6031.
12. What is the cube root of 673373097125? *Ans.* 8765.

When the given number consists of a whole number and decimals together, make the number of decimals to consist of 3, 6, 9, &c. places, by adding ciphers thereto, so that there may be a point fall on the unit's place of the whole number.

13. What is the cube root of 12,077875? *Ans.* 2,35.
14. What is the cube root of 36155,02756? *Ans.* 33,06+.
15. What is the cube root of ,001906624? *Ans.* ,124.
16. What is the cube root of 15926,972504? *Ans.* 3,215+.
17. What is the cube root of 15926,972504? *Ans.* 25,16+.
18. What is the cube root of ,053157376? *Ans.* ,376.

To extract the cube root of a vulgar fraction.

Rule. Reduce the fraction to its lowest terms, then extract the cube root of its numerator and denominator, for a new numerator and denominator; but if the fraction be a surd, reduce it to a decimal, and then extract the root from it?

EXAMPLES.

19. What is the cube root of $\frac{250}{686}$? *Ans.* $\frac{5}{7}$.
20. What is the cube root of $\frac{324}{1000}$? *Ans.* $\frac{3}{5}$.
21. What is the cube root of $\frac{1520}{5130}$? *Ans.* $\frac{2}{3}$.

SURDS.

22. What is the cube root of $\frac{4}{7}$? *Ans.* ,829+.
23. What is the cube root of $\frac{5}{9}$? *Ans.* ,822+.
24. What is the cube root of $\frac{2}{3}$? *Ans.* ,873+.

To extract the cube root of a mixed number.

Rule. Reduce the fractional part to its lowest terms, and then the mixed number to an improper fraction, extract the cube root of the numerator and denominator for a new numerator and deno-

minator; but if the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the root therefrom.

EXAMPLES.

25. What is the cube root of $12\frac{9}{27}$? *Ans.* $2\frac{1}{3}$
26. What is the cube root of $31\frac{15}{343}$? *Ans.* $3\frac{1}{7}$.
27 What is the cube root of $405\frac{28}{125}$? *Ans.* $7\frac{2}{5}$.

SURDS.

28. What is the cube root of $7\frac{1}{5}$? *Ans.* 1,93+.
29. What is the cube root of $9\frac{1}{6}$? *Ans.* 2,092+.
30. What is the cube root of $8\frac{5}{7}$? *Ans.* 2,057+.

THE APPLICATION.

1. If a cubical piece of timber be 47 inches long, 47 inches broad, and 47 inches deep, how many cubical inches doth it contain? *Ans.* 103823.

2. There is a cellar dug, that is 12 feet every way, in length, breadth, and depth; how many solid feet of earth were taken out of it? *Ans.* 1728.

3. There is a stone of a cubic form, which contains 389017 solid feet, what is the superficial content of one of its sides? *Ans.* 5329.

Between two numbers given, to find two mean proportionals.

RULE. Divide the greater extreme by the less, and the cube root of the quotient multiplied by the less extreme, gives the less mean; multiply the said cube root by the less mean, and the product will be the greater mean proportional.

EXAMPLES.

4. What are the two mean proportionals between 6 and 162? *Ans.* 18 and 54.

5. What are the two mean proportionals between 4 and 108? *Ans.* 12 and 36.

To find the side of a cube that shall be equal in solidity to any given solid, as a globe, cylinder, prism, cone, &c.

RULE. The cube root of the solid content of any solid body given, is the side of the cube of equal solidity.

EXAMPLES.

6. If the solid content of a globe is 10648, what is the side of a cube of equal solidity? *Ans.* 22.

The side of a cube being given, to find the side of a cube that shall be double, treble, &c. in quantity to the cube given.

RULE. Cube the side given, and multiply it by 2, 3, &c., the cube root of the product is the side sought.

EXAMPLES.

7. There is a cubical vessel, whose side is 12 inches, and it is required to find the side of another vessel, that is to contain three times as much? *Ans.* 17,306.

EXTRACTING OF THE BIQUADRATE ROOT.

To extract the Biquadrate Root, is to find out a number, which being involved four times into itself, will produce the given number.

RULE. First extract the square root of the given number, and then extract the square root of that square root, and it will give the biquadrate root required.

EXAMPLES.

1. What is the biquadrate of 27? *Ans.* 531441.
2. What is the biquadrate of 76? *Ans.* 33362176.
3. What is the biquadrate of 275? *Ans.* 5719140625.
4. What is the biquadrate root of 531441? *Ans.* 27.
5. What is the biquadrate root of 33362176? *Ans.* 76.
6. What is the biquadrate root of 5719140625? *Ans.* 275.

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

1. PREPARE the number given for extraction, by pointing off from the unit's place as the root required directs.

2. Find the first figure in the root, which subtract from the given number.

3. Bring down the first figure in the next point to the remainder, and call it the dividend.

4. Involve the root into the next inferior power to that which is given, multiply it by the given power, and call it the divisor.

5. Find a quotient figure by common division, and annex it to the root; then involve the whole root into the given power, and call that the subtrahend.

6. Subtract that number from as many points of the given power as are brought down, beginning at the lower place, and to the remainder bring down the first figure of the next point for a new dividend.

7. Find a new divisor, and proceed in all respects as before.

EXAMPLES.

1. What is the square root of 141376?

141376(376
9
—
6)51 dividend.
1369 subtrahend.
74)447 dividend.
141376 subtrahend.

3× 2=6 divisor.
37× 37=1369 subtrahend.
37× 2=74 divisor.
376×376=141376 subtrahend.

2. What is the cube root of 53157376?

53157376(376
27
27)261 dividend.
50653 subtrahend.
4107)25043 dividend.
53157376 subtrahend.

3× 3× 3=27 divisor.
37× 37× 37=50653 subtrahend.
37× 37× 3=4107 divisor.
376×376×376=53157376 subtrahend

3. What is the biquadrate of 19987173376?

19987173376(376
81

108)1188 dividend.

1874161 subtrahend.

202612)1245563 dividend.

19987173376 subtrahend.

3× 3× 3× 4=108 divisor.
37× 37× 37× 37=1874161 subtrahend.
37× 37× 37× 4=202612 divisor.
376×376×376×376=19987173376 subtrahend.

SIMPLE INTEREST.

There are five letters to be observed in Simple Interest, viz.

P. the Principal.
T. the Time.
R. the Ratio, or rate per cent.
I. the Interest.
A. the Amount.

A TABLE OF RATIOS

3	,03	5½	,055	8	,08
3½	,035	6	,06	8½	,085
4	,04	6½	,065	9	,09
4½	,045	7	,07	9½	,095
5	,05	7½	,075	10	,1

NOTE. The Ratio is the simple interest of £1 for one year, at the rate per cent. proposed, and is found thus

£ £ £
As 200 : 3 : : 1 : ,03 As 100 : 3,5 : : 1 : ,035.

When the principal, time, and rate per cent. are given, to find the interest.

RULE. Multiply the principal, time, and rate together, and it will give the interest required.

NOTE. The proposition and rule are better expressed thus:—

I. When P R T are given to find I.

RULE. prt=I.

NOTE. When two or more letters are put together like a word, they are to be multiplied one into another.

EXAMPLES.

1. What is the interest of £945 : 10, for 3 years, at 5 per cent. per annum. *Ans.* 945,5×,05×3=141,825, or £141 : 16 : 6.

2. What is the interest of £547 : 14, at 4 per cent. per annum, for 6 years? *Ans.* £131 : 8 : 11, 2 qrs. ,08.

3. What is the interest of £796 : 15, at 4½ per cent. per annum, for 5 years? *Ans.* 179 : 5 : 4 2 qrs.

4. What is the interest of £397 : 9 : 5, for 2½ years, at 3½ per cent. per annum? *Ans.* £34 : 15 : 6 3,5499 qrs.

5. What is the interest of £554 : 17 : 6, for 3 years, 8 months, at 4½ per cent. per annum? *Ans.* £91 : 11 : 1 ,2

6. What is the interest of £236 : 18 : 8, for three years, 8 months, at 5½ per cent. per annum? *Ans.* £47 : 15 : 7½, ,293.

When the interest is for any number of days only.

RULE Multiply the interest of £1 for a day, at the given rate, by the principal and number of days, it will give the answer.

INTEREST OF £1 FOR ONE DAY.

per cent.	Decimals.	per cent.	Decimals.
3	,00008219178	6½	,00017808219
3½	,00009589041	7	,00019178082
4	,00010958904	7½	,00020547945
4½	,00012328767	8	,00021917808
5	,00013698630	8½	,00023287671
5½	,00015068493	9	,00024657534
6	,00016438356	9½	,00026027397

NOTE. The above table is thus found:—

As 365 : ,03 : : 1 : ,00008219178. And as 365 : ,035 : : 1 : ,00009589041, &c.

EXAMPLES.

7. What is the interest of £240, for 120 days, at 4 per cent. per annum? *Ans.* ,00010958904 × 240 × 120 = £3 : 3 : 1¼.

8. What is the interest of £364 : 18, for 154 days, at 5 per cent. per annum? *Ans.* £7 : 13 : 11¼.

9. What is the interest of £725 : 15, for 74 days, at 4 per cent. per annum? *Ans.* £5 : 17 : 8½.

10. What is the interest of £100, from the 1st of June, 1775, to the 9th of March following, at 5 per cent. per annum? *Ans.* £3 : 16 : 11¾.

II. When P R T are given to find A.

RULE. prt + p = A.

EXAMPLES.

11. What will £279 : 12, amount to in 7 years, at 4½ per cent. per annum? *Ans.* £367 : 13 : 5 3,04 qrs.

279,6 × ,045 × 7 + 279,6 = 367,674.

12. What will £320 : 17, amount to in 5 years, at 3½ per cent. per annum? *Ans.* £376 : 19 : 11 2,8 qrs.

When there is any odd time given with the whole years, reduce the odd time into days, and work with the decimal parts of a year which are equal to those days.

13. What will £926 : 12, amount to in 5½ years, at 4 per cent. per annum? *Ans.* £1130 : 9 : 0¼ ,92 qrs.

14. What will £273 : 18, amount to in 4 years, 175 days, at 3 per cent. per annum? *Ans.* £310 : 14 : 1 3,35080064 qrs.

III. When A R T are given to find P.

RULE. $\frac{a}{rt + 1} = P.$

EXAMPLES.

15. What principal, being put to interest, will amount to £367 : 13 : 5 3,04 qrs. in 7 years, at 4½ per cent. per annum?

Ans. ,045 × 7 + 1 = 1,315 then 367,674 ÷ 1,315 = £279 : 12.

16. What principal, being put to interest, will amount to £376 : 19 : 11 2,8 in 5 years, at 3½ per cent. per annum?

Ans. £320 : 17.

17. What principal, being put to interest, will amount to £1130 : 9 : 0¼ ,92 qrs. in 5½ years, at 4 per cent. per annum?
Ans. £926 : 12.

18. What principal will amount to £310 : 14 : 1 3,35080064 qrs. in 4 years, 175 days, at 3 per cent. per annum?
Ans. £273 : 18.

IV. When A P T are given to find R.

RULE. $\frac{a-p}{pt.}=R.$

EXAMPLES.

19. At what rate per cent. will £279 : 12, amount to £367 : 13 : 5 3,04 qrs. in 7 years?
Ans. 367,674—279,6=88,074, 275,6×7=1957,2, then 88,074÷1957,2=,045 or 4½ per cent.

20. At what rate per cent. will £320 : 17, amount to £376 : 19 : 11 2,8 qrs. in 5 years? *Ans.* 3½ per cent.

21. At what rate per cent. will £926 : 12, amount to £1130 : 9 : 0¼ ,92 qrs. in 5½ years? *Ans.* 4 per cent.

22. At what rate per cent. will £273 : 18, amount to £310 : 14 : 1 3,35080064 qrs. in 4 years, 175 days?
Ans. 3 per cent.

V. When A P R are given to find T.

RULE. $\frac{a-p}{pr.}=T.$

EXAMPLES.

23. In what time will £279 : 12, amount to £367 : 13 : 5 3,04 qrs. at 4½ per cent.?
Ans. 367,674—279,6=88,074. 279,6× ,045=12,5820, then 88,074÷12,5820=7 years.

24. In what time will £320 : 17, amount to 376 : 19 : 11 2,8 qrs. at 3½ per cent.? *Ans.* 5 years.

25. In what time will £926 : 12, amount to £1130 : 9 : 0½ ,92 qrs. at 4 per cent.? *Ans.* 5½ years.

26. In what time will £273 : 18, amount to £310 : 14 : 1 3,35080064 qrs. at 3 per cent.? *Ans.* 4 years, 175 days.

ANNUITIES OR PENSIONS, &c. IN ARREARS.

Annuities or pensions, &c. are said to be in arrears, when they are payable or due, either yearly, half-yearly, or quarterly, and are unpaid for any number of payments.

NOTE. U represents the annuity, pension, or yearly rent, T R A as before.

I U R T are given to find A

$$\text{RULE.} \quad \frac{ttu-tu}{2} \times r : + tu = A.$$

EXAMPLES.

27. If a salary of £150 be forborne 5 years at 5 per cent. what will it amount to? *Ans.* £825.

$5\times5\times150-5\times150=3000$ then $\frac{3000}{2}\times,05+5\times150=£825.$

28. If £250 yearly pension be forborne 7 years, what will it amount to in that time at 6 per cent.? *Ans.* £2065.

29. There is a house let upon lease for $5\frac{1}{2}$ years, at £60 per annum, what will be the amount of the whole time at $4\frac{1}{2}$ per cent.? *Ans.* £363 : 8 : 3.

30. Suppose an annual pension of £28 remain unpaid for 8 years, what would it amount to at 5 per cent.?

Ans. £263 : 4.

NOTE. When the annuities, &c. are to be paid half-yearly or quarterly, then

For half-yearly payments, take half of the ratio, half of the annuity, &c., and twice the number of years—and

For quarterly payments, take a fourth part of the ratio, a fourth part of the annuity, &c., and four times the number of years, and work as before.

EXAMPLES.

31. If a salary of £150, payable every half-year, remains unpaid for 5 years, what will it amount to in that time at 5 per cent.? *Ans.* £834 : 7 : 6.

32. If a salary of £150, payable every quarter, was left unpaid for 5 years, what would it amount to in that time at 5 per cent.?

Ans. £839 : 1 : 3.

NOTE. It may be observed by comparing these last examples, the amount of the half-yearly payments are more advantageous than the yearly, and the quarterly more than the half-yearly.

II. When A R T are given to find U.

$$\text{RULE.} \quad \frac{2a}{ttr-tr+2t} = U.$$

33. If a salary amounted to £825 in five years, at 5 per cent. what was the salary? *Ans.* £150.

825×2=1650 5×5×,05—5×,05+5×2=11 then 1650 ÷ 11=£150.

34. If a house is to be let upon a lease for 5½ years, and the amount for that time is £363 : 8 : 3, at 4½ per cent. what is the yearly rent? *Ans.* £60.

35. If a pension amounted to £2065, in 7 years, at 6 per cent. what was the pension? *Ans.* 250.

36. Suppose the amount of a pension be £263 : 4 in 8 years, at 5 per cent. what was the pension? *Ans.* £28.

NOTE. When the payments are half-yearly, then take 4 a, and half of the ratio, and twice the number of years; and if quarterly, then take 8 a, one fourth of the ratio, and four times the number of years, and proceed as before.

37. If the amount of a salary, payable half-yearly, for 5 years, at 5 per cent. be £834 : 7 : 6, what was the salary? *Ans.* £150.

38. If the amount of an annuity, payable quarterly, be £839 : 1 : 3, for 5 years, at 6 per cent. what was the annuity?

Ans. £150.

III. When U A T are given to find R.

RULE. $\frac{2a-2ut}{utt-ut}=R.$

EXAMPLES.

39. If a salary of £150 per annum, amount to £825, in 5 years, what is the rate per cent.? *Ans.* 5 per cent.

825+2—150+5+2=150 then $\frac{150}{150\times5\times5-150\times5}=,05$

40. If a house be let upon a lease for 5½ years, at £60 per annum, and the amount for that time be £363 : 8 : 3, what is the rate per cent.? *Ans.* 4½ per cent.

41. If a pension of £250 per annum, amounts to £2065 in 7 years, what is the rate per cent.? *Ans.* 6 per cent.

42. Suppose the amount of a yearly pension of £28, be £263 : 4, in 8 years, what is the rate per cent.? *Ans.* 5 per cent.

NOTE. When the payments are half-yearly, take 4 a—4 ut for a dividend, and work with half the annuity, and double the number of years for a divisor; if quarterly, take 8 a—8 ut, and work with a fourth of the annuity, and four times the number of years.

43. If a salary of £150 per annum, payable half-yearly, amounts to £834 : 7 : 6, in 5 years, what is the rate per cent.?

Ans. 5 per cent.

44. If an annuity of £150 per annum, payable quarterly, amounts to £839 : 1 : 3, in 5 years, what is the rate per cent.?

Ans. 5 per cent.

IV. When U A R are given to find T.

RULE. First, $\frac{2}{r}-1=x$ then: $\sqrt{\frac{2a}{ur}+\frac{xx}{4}}-\frac{x}{2}=T.$

EXAMPLES.

45. In what time will a salary of £150 per annum, amount to £825, at 5 per cent.? *Ans.* 5 years.

$$\frac{2}{,05}-1=39 \qquad \frac{826\times 2}{150\times ,05}=220 \qquad \frac{39\times 39}{4}=380,25$$

$$\sqrt{220+380,25}=24,5-\frac{39}{2}=5 \text{ years.}$$

46. If a house is let upon a lease for a certain time, for £60 per annum, and amounts to £363 : 8 : 3, at $4\frac{1}{2}$ per cent., what time was it let for? *Ans.* $5\frac{1}{2}$ years.

47. If a pension of £250 per annum, being forborne a certain time, amounts to £2065, at 6 per cent., what was the time of forbearance? *Ans.* 7 years.

48. In what time will a yearly pension of £28, amount to £263 : 4, at 5 per cent.? *Ans.* 8 years.

NOTE. If the payments are half-yearly, take half the ratio, and half the annuity; if quarterly, one fourth of the ratio, and one fourth of the annuity; and T will be equal to those half-yearly or quarterly payments.

49. If an annuity of £150 per annum, payable half-yearly, amounts to £834 : 7 : 6, at 5 per cent., what time was the payment forborne? *Ans.* 5 years.

50. If a yearly pension of £150, payable quarterly, amounts to £839 : 1 : 3, at 5 per cent., what was the time of forbearance?
Ans. 5 years.

PRESENT WORTH OF ANNUITIES.

NOTE. P represents the present worth; U T R as before.

I. When U T R are given to find P.

RULE. $\frac{ttr-tr+2t}{2\,tr+2} : \times u = P.$

EXAMPLES.

51. What is the present worth of £150 per annum, to continue 5 years at 5 per cent.? *Ans.* £660.

$5\times5\times,05-5\times,05+5\times2=11,5\times,05\times2+2=2,5$ then $11\div 2,5\times150=$£660.

52. What is the yearly rent of a house of £60, to continue $5\frac{1}{2}$ years worth in ready money, at $4\frac{1}{2}$ per cent.?
Ans. £291 : 6 : 3.

53. What is the present worth of £250 per annum, to continue 7 years, at 6 per cent.? *Ans.* £1454 : 4 : 6.

54. What is a pension of £28 per annum, worth in ready money, at 5 per cent., for 8 years? *Ans.* £188.

NOTE. The same thing is to be observed as in the first rule of annuities in arrears, concerning half-yearly and quarterly payments.

55. What is the present worth of £150, payable quarterly, for 5 years, at 5 per cent.? *Ans.* £671 : 5.

NOTE. By comparing the last examples, it will be found that the present worth of half-yearly payments is more advantageous than yearly, and quarterly than half-yearly.

II. When P T R are given to find U.

RULE. $\frac{tr+1}{ttr-tr+2t} : \times 2p = U.$

EXAMPLES.

56. If the present worth of a salary be £660, to continue 5 years, at 5 cent., what is the salary? *Ans.* £150.

$$\overline{5 \times ,05 + 1} = 1,25 \quad \overline{5 \times 5 \times ,05} - \overline{5 \times ,05 + 10} = 11.$$

$$\frac{1,25}{11} \times 660 \times 2 = £150.$$

57. There is a house let upon lease for $5\frac{1}{2}$ years to come, I desire to know the yearly rent, when the present worth, at $4\frac{1}{2}$ per cent., is £291 : 6 : 3? *Ans.* £60.

58. What annuity is that which, for 7 years' continuance, at 6 per cent., produces £1454 : 4 : 6 present worth? *Ans.* £250.

59. What annuity is that which, for 8 years' continuance, produces £188 for the present worth, at 5 per cent.? *Ans.* £28.

NOTE. When the payments are half-yearly, take half the ratio, twice the number of years, and multiply by 4 p; and when quarterly, take one fourth of the ratio, and four times the number of years, and multiply by 8 p.

60. There is an annuity payable half-yearly, for 5 years to come, what is the yearly rent, when the present worth, at 5 per cent., is £667 : 10? *Ans.* £150.

61. There is an annuity payable quarterly, for 5 years to come, I desire to know the yearly income, when the present worth, at 5 per cent., is £671 : 5? *Ans.* £150.

III. When U P T are given to find R.

$$\text{RULE.} \quad \frac{\overline{ut - p} \times 2}{2pt + \overline{ut - ttu}} = R.$$

EXAMPLES.

62. At what rate per cent. will an annuity of £150 per annum, to continue 5 years, produce the present worth of £660?

Ans. 5 per cent.

$$\overline{150 \times 5 - 660} \times 2 = 180,2 \times \overline{\overline{660 \times 5 + 5 \times 150} - \overline{5 \times 5 \times 150}} = 3600$$

then $180 \div 3600 = ,05 = 5$ per cent.

63. If a yearly rent of £60 per annum, to continue $5\frac{1}{2}$ years, produces £291 : 6 : 3, for the present worth, what is the rate per cent.? *Ans.* $4\frac{1}{2}$ per cent.

64. If an annuity of £250 per annum, to continue 7 years, produces £1454 : 4 : 6, for the present worth, what is the rate per cent.? *Ans.* 6 per cent.

65. If a pension of £28 per annum, to continue 8 years, produces £188 for the present worth, what is the rate per cent.? *Ans.* 5 per cent.

NOTE. When the annuities, or rents, &c. are to be paid half-yearly, or quarterly, then

For half-yearly payments, take half of the annuity, &c. and twice the number of years, the quotient will be the ratio of half the rate per cent.—and

For quarterly payments, take a fourth part of the annuity, &c. and four times the number of years, the quotient will be the ratio of the fourth part of the rate per cent.

66. If an annuity of £150 per annum, payable half-yearly, having 5 years to come, is sold for £667 : 10, what is the rate per cent.? *Ans.* 5 per cent.

67. If an annuity of £150 per annum, payable quarterly, having 5 years to come, is sold for £671 : 5, what is the rate per cent.? *Ans.* 5 per cent.

IV. When U P R are given to find T.

RULE. $\frac{2}{r}\frac{2p}{n}-1=x$ then $\sqrt{\frac{2p}{ur}+\frac{xx}{4}}-\frac{x}{2}=T.$

EXAMPLES.

68. If an annuity of £150 per annum, produces £660 for the present worth, at 5 per cent., what is the time of its continuance? *Ans.* 5 years.

$$\frac{2}{,05}\frac{660\times 2}{150}-1=30,2 \qquad \frac{660\times 2}{150\times,05}=176$$

$$\frac{30,2\times 30,2}{4}=228,01 \text{ then } \sqrt{228,01}+176=20,1$$

$$20,1-\frac{30,2}{2}=5 \text{ years.}$$

69. For what time may a salary of £60 be purchased for £291 : 6 : 3 at 4½ per cent.? *Ans.* 5½ years.

70. For what time may £250 per annum, be purchased for £1454 : 4 : 6, at 6 per cent.? *Ans.* 7 years.

71. For what time may a pension of £28 per annum, be purchased for £188, at 5 per cent.? *Ans.* 8 years.

NOTE. When the payments are half-yearly, then U will be equal to half the annuity, &c. R half the ratio, and T the number of payments: and,

When the payments are quarterly, U will be equal to one fourth part of the annuity, &c. R the fourth of the ratio, and T the number of payments.

72. If an annuity of £150 per annum, payable half-yearly, is sold for £667 : 10, at 5 per cent., I desire to know the number of payments, and the time to come?

Ans. 10 payments, 5 years.

73. An annuity of £150 per annum, payable quarterly, is sold for £671 : 5, at 5 per cent., what is the number of payments, and time to come? *Ans.* 20 payments, 5 years.

ANNUITIES, &c. TAKEN IN REVERSION.

1. To find the present worth of an annuity, &c. taken in reversion.

RULE: Find the present worth of the yearly sum at the given rate and for the time of its continuance; thus,

$$\frac{ttr-tr+2t}{2tr+2} : \times u = P.$$

2. Change P into A, and find what principal, being put to interest, will amount to A at the same rate, and for the time to come before the annuity &c. commences; thus,

$$\frac{a}{tr+1} = P.$$

EXAMPLES.

74. What is the present worth of an annuity of £150 per annum, to continue 5 years, but not to commence till the end of 4 years, allowing 5 per cent. to the purchaser? *Ans.* £550.

$$\frac{\overline{5\times5\times,05}-\overline{5\times,05}+\overline{2\times5}}{\overline{5\times,05\times2+2}} = 4,4\times150 = 660$$

$$\frac{660}{4\times,05+1} = 550.$$

75. What is the present worth of a lease of £50 per annum, to continue 4 years, but which is not to commence till the end of 5 years, allowing 4 per cent. to the purchaser?

Ans. £152 : 5 : 11 3 qrs.

76. A person having the promise of a pension of £20 per annum, for 8 years, but not to commence till the end of 4 years, is willing to dispose of the same at 5 per cent., what will be the present worth? *Ans.* £111 : 18 : 1 ,14+.

77. A legacy of £40 per annum being left for 6 years, to a person of 15 years of age, but which is not to commence till he is 21; he, wanting money, is desirous of selling the same at 4 per cent., what is the present worth?

Ans. £171 : 13 : 11 ,07596.

2. To find the yearly income of an annuity, &c. in reversion.

RULE 1. Find the amount of the present worth at the given rate, and for the time before the reversion; thus,

$$ptr+p=A.$$

2. Change A into P, and find what annuity being sold, will produce P at the same rate, and for the time of its continuance; thus,

$$\frac{tr+1}{ttr-tr+2t} : \times 2p=U.$$

EXAMPLES.

78. A person having an annuity left him for 5 years, which does not commence till the end of 4 years, disposed of it for £550, allowing 5 per cent. to the purchaser, what was the yearly income? *Ans.* £150.

$$550 \times 4 \times ,05 + 550 = 660 \quad \frac{5 \times ,05 + 1,}{5 \times 5 \times ,05 - 5 \times ,05 + 5 \times 2} = ,113636 \times 660 \times 2 = £150.$$

79. There is a lease of a house taken for 4 years, but not to commence till the end of 5 years, the lessee would sell the same for £152 : 6, present payment, allowing 4 per cent. to the purchaser, what is the yearly rent? *Ans.* £50.

80. A person having the promise of a pension for 8 years, which does not commence till the end of 4 years, has disposed of the same for £111 : 18 : 1 ,14 present money, allowing 5 per cent. to the purchaser, what was the pension? *Ans.* £20.

81. There is a certain legacy left to a person of 15 years of age, which is to be continued for 6 years, but not to commence till he arrives at the age of 21; he, wanting a sum of money, sells it for £171 : 14, allowing 4 per cent. to the buyer, what was the annuity left him? *Ans.* £40.

REBATE OR DISCOUNT.

NOTE. S represents the Sum to be discounted.
P the Present worth.
T the Time.
R the Ratio.

I. When S T R are given to find P.

RULE. $\frac{s}{tr+1}=P.$

EXAMPLES.

1. What is the present worth of £357 : 10, to be paid 9 months hence, at 5 per cent.? *Ans.* £344 : 11 : $6\frac{3}{4}$,168.

2. What is the present worth of £275 : 10, due 7 months hence, at 5 per cent.? *Ans.* £267 : 13 : $10\frac{38}{247}$.

3. What is the present worth of £875 : 5 : 6, due at 5 months hence, at $4\frac{1}{2}$ per cent.? *Ans.* £859 : 3 : $3\frac{3}{4}$ $\frac{3}{16\,3}$.

4. How much ready money can I receive for a note of £75, due 15 months hence, at 5 per cent.?

Ans. £70 : 11 : 9 ,1764d.

II. When P T R are given to find S.

RULE. $ptr+p=S.$

EXAMPLES.

5. If the present worth of a sum of money, due 9 months hence, allowing 5 per cent., be £344 : 11 : 6 3,168 qrs., what was the sum first due? *Ans.* £357 : 10.

344,5783 × ,75 × ,05 + 344,5783 = £357 : 10.

6. A person owing a certain sum, payable 7 months hence, agrees with the creditor to pay him down £267 : 13 : $10\frac{38}{247}$, allowing 5 per cent. for present payment, what is the debt?

Ans. £275 : 10.

7. A person receives £859 : 3 : $3\frac{3}{4}$ $\frac{3}{16\,3}$ for a sum of money

due 5 months hence, allowing the debtor $4\frac{1}{2}$ per cent. for present payment, what was the sum due? *Ans.* £875 : 5 : 6.

8. A person paid £70 : 11 : 9 ,1764d. for a debt due 15 months hence, he being allowed 5 per cent. for the discount, how much was the debt? *Ans.* £75

III. When S P T are given to find R.

RULE. $\frac{s-p}{tp}=R.$

EXAMPLES.

9. At what rate per cent. will £357 : 10, payable months hence, produce £344 : 11 : 6 3,168 qrs. for present payment?

$$\frac{3575,-344,5783}{344,5783\times ,75}=,05=5 \text{ per cent.}$$

10. At what rate per cent. will £275 : 10, payable 7 months hence, produce £267 : 13 : $10\frac{3\,9}{2\,4\,0}$ for the present payment? *Ans.* 5 per cent.

11. At what rate per cent. will £875 : 5 : 6, payable 5 months hence, produce the present payment of £859 : 3 : $3\frac{3}{4}\ \frac{3}{16\,3}$? *Ans.* $4\frac{1}{2}$ per cent.

12. At what rate per cent. will £75, payable 15 months hence, produce the present payment of £70 : 11 : 9 ,1764d.? *Ans.* 5 per cent

IV. When S P R are given to find T.

RULE. $\frac{s-p}{rp}=T.$

EXAMPLES.

13. The present worth of £357 : 10, due at a certain time to come, is £344 : 11 : 6 3,168 qrs. at 5 per cent., in what time should the sum have been paid without any rebate? *Ans.* 9 months.

$$\frac{357,5-344,5783}{344,5783\times ,05}=,75=9 \text{ months.}$$

14. The present worth of £275 : 10, due at a certain time to

come, is £267 : 13 : $10\frac{36}{247}$, at 5 per cent., in what time should the sum have been paid without any rebate?

Ans. 7 months.

15. A person receives £859 : 3 : $3\frac{3}{4}$,0184, for £875 : 5 : 6, due at a certain time to come, allowing $4\frac{1}{2}$ per cent. discount, I desire to know in what time the debt should have been discharged without any rebate? *Ans.* 5 months.

16. I have received £70 : 11 : 9 ,1764d. for a debt of £75, allowing the person 5 per cent. for prompt payment, I desire to know when the debt would have been payable without the rebate?

Ans. 15 months.

EQUATION OF PAYMENTS.

To find the equated time for the payment of a sum of money due at several times.

RULE. Find the present worth of each payment for its respective time; thus, $\frac{s}{tr+1}=P$

Add all the present worths together, then, $s-p=D.$

and $\frac{d}{pr}=E$

EXAMPLES.

1. D owes E £200, whereof £40 is to be paid at three months, £60 at six months, and £100 at nine months; at what time may the whole debt be paid together, rebate being made at 5 per cent.?

Ans. 6 months, 26 days.

$$\frac{40}{1,0125}=39,5061 \qquad \frac{60}{1,025}=58,5365 \qquad \frac{100}{1,0375}=96,3855$$

then $200-39,5061+58,5365+96,3855=5,5719$

$$\frac{5,5719}{194,4281\times ,05.}=,57315=6 \text{ months, 26 days.}$$

2. D owes E £800, whereof £200 is to be paid in 3 months, £200 at 4 months, and £400 at 6 months; but they, agreeing to make but one payment of the whole, at the rate of 5 per cent. rebate, the true equated time is demanded?

Ans. 4 months, 22 days.

3. E owes F £1200, which is to be paid as follows: £200 down, £500 at the end of 10 months, and the rest at the end of 20 months; but they, agreeing to have one payment of the whole, rebate at 3 per cent., the true equated time is demanded?

Ans. 1 year, 11 days.

COMPOUND INTEREST.

The letters made use of in Compound Interest, are,

A the Amount.
P the Principal.
T the Time.
R the Amount of £1 for 1 year at any given rate; which is thus found:

As 100 : 105 : : 1 : 1,05. As 100 : 105,5 : : 1 : 1,055.

A Table of the amount of £1 for one year.

RATES PER CENT.	AMOUNTS OF £1.	RATES PER CENT.	AMOUNTS OF £1.	RATES PER CENT.	AMOUNTS OF £1
3	1,03	5½	1,055	8	1,08
3½	1,035	6	1,06	8½	1,085
4	1,04	6½	1,065	9	1,09
4½	1,045	7	1,07	9½	1,095
5	1,05	7½	1,075	10	1,1

Table showing the amount of £1 for any number of years under 31, at 5 and 6 per cent. per annum.

YEARS.	5 RATES. 6		YEARS.	5 RATES. 6	
1	1,05000	1,06000	16	2,18287	2,54035
2	1,10250	1,12360	17	2,29201	2,69277
3	1,15762	1,19101	18	2,40662	2,85434
4	1,21550	1,26247	19	2,52695	3,02560
5	1,27628	1,33822	20	2,65329	3,20713
6	1,34009	1,41852	21	2,78596	3,39956
7	1,40710	1,50363	22	2,92526	3,60353
8	1,47745	1,59385	23	3,07152	3,81975
9	1,55132	1,68948	24	3,22510	4,04893
10	1,62889	1,79084	25	3,38635	4,29187
11	1,71034	1,89829	26	3,55567	4,54938
12	1,79585	2,01219	27	3,73345	4,82234
13	1,88565	2,13292	28	3,92013	5,11168
14	1,97993	2,26090	29	4,11613	5,41838
15	2,07892	2,39655	30	4,32194	5,74349

NOTE. The preceding table is thus made—As 100 : 105 : : 1 · 1,05, for the first year; then, As 100 : 105 : : 1,05 : 1,1025, second year, &c.

I. When P T R are given to find A.

RULE. $p \times rt = A$.

EXAMPLES.

1. What will £225 amount to in 3 years' time, at 5 per cent. per annum?

Ans. $1,05 \times 1,05 \times 1,05 = 1,157625$, then $1,157625 \times 225 =$ £260 : 9 : 3 3 qrs.

2. What will £200 amount to in 4 years, at 5 per cent. per annum? *Ans.* £243 2,025s.

3. What will £450 amount to in 5 years, at 4 per cent. per annum? *Ans.* £547 : 9 : 10 2,0538368 qrs.

4. What will £500 amount to in 4 years, at 5½ per cent. per annum? *Ans.* £619 : 8 : 2 3,8323 qrs.

II. When A R T are given to find P.

RULE. $\frac{a}{rt} = P$

EXAMPLES.

5. What principal, being put to interest, will amount to £260 : 9 : 3 3 qrs. in 3 years, at 5 per cent. per annum?

$$1,05 \times 1,05 \times 1,05 = 1,157625 \frac{260,465625}{1,157625} = £225.$$

6. What principal, being put to interest, will amount to £243 2,025s. in 4 years, at 5 per cent. per annnm? *Ans.* £200.

7. What principa. will amount to £547 : 9 : 10 2,0538368 qrs. in 5 years, at 4 per cent. per annum? *Ans.* £450.

8 What principal will amount to £619 : 8 : 2 3,8323 qrs. in 4 years, at 5½ per cent. per annum? *Ans.* £500.

III. When P A T are given to find R.

RULE. $\frac{a}{p} = rt$ which being extracted by the rule of extraction, (the time given to the question showing the power) will give R.

EXAMPLES.

9. At what rate per cent. will £225 amount to £260 : 9 : 3,3 qrs. in 3 years? *Ans.* 5 per cent.

$$\frac{260,465325}{225}=1,157625,$$ the cube root of which (it being the 3d power)=1,05=5 per cent.

10. At what rate per cent. will £200 amount to £243 : 2,025s. in 4 years? *Ans.* 5 per cent.

11. At what rate per cent. will £450 amount to £547 : 9 : 10 2,0538368 qrs. in 5 years? *Ans.* 4 per cent.

12. At what rate per cent. will £500 amount to £619 : 8 : 2 3,8323 qrs. in 4 years? *Ans.* 5½ per cent.

IV. When P A R are given to find T.

RULE.—$\frac{a}{p}$=rt which being continually divided by R till nothing remains, the number of those divisions will be equal to T.

EXAMPLES.

13. In what time will £225 amount to £260 : 9 : 3 3 qrs. at 5 per cent.?

$$\frac{260,465625}{225}=1,157625\frac{1,157625}{1,05}=1,1025\frac{1,1025}{1,05}=1,05\frac{1,05}{1,05}$$

=1, the number of divisions being three times sought.

14. In what time will £200 amount to £243 2,025s. at 5 per cent.? *Ans.* 4 years.

15. In what time will £450 amount to £547 : 9 : 10 2,0538368 qrs. at 4 per cent.? *Ans.* 5 years.

16. In what time will £500 amount to £619 : 8 : 2 3,8323 qrs. at 5½ per cent.? *Ans.* 4 years.

ANNUITIES, OR PENSIONS, IN ARREARS.

NOTE. U represents the annuity, pension, or yearly rent A R T as before.

A Table showing the amount of £1 annually, for any number of years under 31, at 5 and 6 per cent. per annum.

YEARS.	5 RATES. 6		YEARS.	5 RATES. 6	
1	1,00000	1,00000	16	23,65749	35,67252
2	2,05000	2,06000	17	25,84036	28,21288
3	3,15250	3,18360	18	28,18238	30,90565
4	4,31012	4,37461	19	30,53900	33,75999
5	5,52563	5,63709	20	33,06595	36,78559
6	6,80191	6,97532	21	35,71925	39,99272
7	8,14200	8,39383	22	38,50521	43,39229
8	9,54910	9,89746	23	41,43047	46,99582
9	11,02656	11,49131	24	44,50199	50,81557
10	12,57789	13,18079	25	47,72709	54,86451
11	14,20678	14,97164	26	51,11345	59,15638
12	15,91712	16,86994	27	54,66912	63,70576
13	17,71298	18,88213	28	58,40258	68,52811
14	19,59868	21,01506	29	62,32271	73,63979
15	21,57856	23,27597	30	66,43884	79,05818

NOTE. The above table is made thus:—take the first year's amount, which is £1, multiply it by $1,05+1=2,05$ = second year's amount, which also multiply by $1,05+1=2,1525$ = third year's amount.

I. When U T R are given to find A.

RULE. $\frac{ur^t-u}{r-1}=A$, or by the table thus:

Multiply the amount of £1 for the number of years, and at the rate per cent. given in the question, by the annuity, pension, &c. and it will give the answer.

EXAMPLES.

17. What will an annuity of £50 per annum, payable yearly, amount to in 4 years, at 5 per cent.?

Ans. $1,05\times1,05\times1,05\times1,05\times50=60,77531250$

then $\frac{60,7753125-50}{1,05-1}=$ £215 : 10 : 1 2 qrs.; or,

by the table thus, $4,31012\times50=$ £215 : 10 : 1 1,76 qrs.

18. What will a pension of £45 per annum, payable yearly, amount to in 5 years, at 5 per cent.?

Ans. £248 : 13 : 0 3,27 qrs.

19. If a salary of £40 per annum, to be paid yearly, be forborne 6 years, at 6 per cent., what is the amount?

Ans. £279 : 0 : 3,05796096d.

20. If an annuity of £75 per annum, payable yearly, be omitted to be paid for 10 years, at 6 per cent., what is the amount?

Ans. £988 : 11 : 2,222d.

II. When A R T are given to find U.

RULE. $\frac{ar-a}{rt-1}=U.$

EXAMPLES.

21. What annuity, being forborne 4 years, will amount to £215 : 10 : 1 2 qrs. at 5 per cent.?

Ans. $\frac{215{,}50625\times1{,}05-215{,}50625}{1{,}05\times1{,}05\times1{,}05\times1{,}05-1}=$£50.

22. What pension, being forborne 5 years, will amount to £248 : 13 : 0 3,27 qrs. at 5 per cent.? *Ans.* 45.

23. What salary, being omitted to be paid 6 years, will amount to £279 : 0 : 3,05796096d. at 6 per cent.? *Ans.* £40.

24. If the payment of an annuity, being forborne 10 years, amount to £988 : 11 : 2,22d. at 6 per cent., what is the annuity?

Ans. £75.

III. When U A R are given to find T.

RULE. $\frac{ar+u-a}{u}=r^t$ which being continually divided by R till nothing remains, the number of those divisions will be equal to T.

EXAMPLES.

25. In what time will £50 per annum amount to £215 : 10 : 1 2 qrs. at 5 per cent. for non-payment?

Ans. $\frac{215{,}50625\times1{,}05+50-215{,}50625}{50}=1{,}21550625.$

which being continuallv divided by R, the number of the divisions will be=4 years.

26. In what time will £45 per annum amount to £248 : 13 327 qrs. allowing 5 per cent. for forbearance of payment?

Ans. 5 years.

27. In what time will £40 per annum amount to £279 : 0 : 3,05796096d. at 6 per cent. ? *Ans.* 6 years.

28. In what time will £75 per annum amount to £988 : 11 : 2,22d. allowing 6 per cent. for forbearance of payment ? *Ans.* 10 years.

PRESENT WORTH OF ANNUITIES, PENSIONS, &c.

A Table showing the present worth of £1 *annuity, for any number of years under* 31, *rebate at* 5 *and* 6 *per cent.*

YEARS.	5 RATES. 6		YEARS.	5 RATES. 6	
1	0,95238	0,94339	16	10,83777	10,10589
2	1,85941	1,83339	17	11,27406	10,47726
3	2,72324	2,67301	18	11,68958	10,82760
4	3,54595	3,46510	19	12,08532	11,15811
5	4,32947	4,21236	20	12,46221	11,46992
6	5,07569	4,91732	21	12,82115	11,76407
7	5,78637	5,58238	22	13,16300	12,01158
8	6,46321	6,20979	23	13,48857	12,30338
9	7,10752	6,80169	24	13,79864	12,55036
10	7,72173	7,36008	25	14,09391	12,78336
11	8,30641	7,88687	26	14,37518	13,00317
12	8,86325	8,38384	27	14,64303	13,21053
13	9,39357	8,85268	28	14,89812	13,40616
14	9,8986	9,29498	29	15,14107	13,59072
15	10,37965	9,71225	30	15,37245	13,76483

NOTE. The above table is thus made :—divide £1 by 1,05= ,95238, the present worth of the first year, which÷1,05=90753, added to the first year's present worth=1,85941, the second year's present worth ; then, 90703÷1,05, and the quotient added to 185941=2,72327, third year's present worth.

I. When U T R are given to find P.

$$\text{RULE.} \quad \frac{u - \frac{u}{r^t}}{r - 1} = P.$$

or by the table thus :

Multiply the present worth of £1 annuity for the time and rate per cent. given by the annuity, pension, &c., it will give the answer.

EXAMPLES.

29. What is the present worth of an annuity of £30 per annum, to continue 7 years, at 6 per cent.?

Ans. £167 : 9 : 5 ,184d.

$\frac{30}{1,50363}=19,9517$ $\qquad 30-19,9517=10,0483\frac{10,0483}{1,06-1}$

$=167,4716.$ By the table $5,58238\times 30=167,4714.$

30. What is the present worth of a pension of £40 per annum, to continue 8 years, at 5 per cent.?

Ans. £258 : 10 : 6 3,264 qrs.

31. What is the present worth of a salary of 35, to continue 7 years, at 6 per cent.? *Ans.* £195 : 7 : 7 3,968 qrs.

32. What is the yearly rent of £50, to continue 5 years, worth in ready money, at 5 per cent.? *Ans.* £216 : 9 : 5 2,56 qrs.

II. When P T R are given to find U.

RULE. $\frac{prt\times r-pr^t}{r^t-1}=U.$

EXAMPLES.

33. If an annuity be purchased for £167 : 9 : 5 184d. to be continued 7 years, at 6 per cent. what is the annuity?

Ans. $\frac{167,4716\times 1,50363\times 1,06-167,4716\times 1,50363}{1,50363-1}=£30.$

34. If the present payment of £258 : 10 : 6 3,264 qrs. be made for a salary of 8 years to come, at 5 per cent., what is the salary? *Ans.* £40.

35. If the present payment of £195 : 7 : 7 3,968 qrs. be required for a pension for 7 years to come, at 6 per cent., what is the pension? *Ans.* £35.

36. If the present worth of an annuity 5 years to come, be £216 : 9 : 5 2,56 qrs. at 5 per cent., what is the annuity? *Ans.* £50.

III. When U P R are given to find T.

RULE. $\frac{u}{p+u-pr}=r^t$ which being continually divided by R till nothing remains, the number of those divisions will be equal to T.

EXAMPLES.

37. How long may a lease of £30 yearly rent be had for £167 : 9 : 5 ,184d. allowing 6 per cent. to the purchaser?

$\frac{30}{167,4716+30-177,5198}=1,50363$ which being continually divided, the number of those divisions will be= to T=7 years.

38. If £258 : 10 : 6 3,264 qrs. is paid down for a lease of £40 per annum, at 5 per cent., how long is the lease purchased for?

Ans. 8 years.

39. If a house is let upon lease for £35 per annum, and the lessee makes present payment of £195 : 7 : 8, he being allowed 6 per cent., I demand how long the lease is purchased for?

Ans. 7 years.

40. For what time is a lease of £50 per annum, purchased when present payment is made of £216 : 9 : 5 2,56 qrs. at 5 per cent.?

Ans. 5 years.

ANNUITIES, LEASES, &c. TAKEN IN REVERSION.

To find the present worth of annuities, leases, &c. taken in reversion.

RULE. Find the present worth of the annuity, &c. at the given rate and for the time of its continuance: thus, $\frac{u-\frac{u}{r^t}}{r-1}=P.$

2. Change P into A, and find what principal being put to interest will amount to P at the same rate, and for the time to come before the annuity commences, which will be the present worth of the annuity, &c.: thus $\frac{a}{r^t}=P.$

EXAMPLES.

41. What is the present worth of a reversion of a lease of £40 per annum, to continue for six years, but not to commence till the end of 2 years, allowing 6 per cent. to the purchaser?

Ans. £175 : 1 : 1 2,048 qrs.

$$\frac{40}{1,41852}=28,1984 \qquad \frac{40-28,1984}{1,06-1}=196,6933 \qquad \frac{196,6933}{1,1236}$$

$$=175,0563.$$

42. What is the present worth of a reversion of a lease of £60 per annum, to continue 7 years, but not to commence till the end of 3 years, allowing 5 per cent. to the purchaser?

Ans. £299 : 18 : 2,8d.

43. There is a lease of a house at £30 per annum, which is yet in being for 4 years, and the lessee is desirous to take a lease in reversion for 7 years, to begin when the old lease shall be expired, what will be the present worth of the said lease in reversion, allowing 5 per cent. to the purchaser?

Ans. £142 : 16 : 3 2,688 qrs.

To find the yearly income of an annuity, &c. taken in reversion.

RULE. Find the amount of the present worth at the given rate, and for the time before the annuity commences: thus, $pr^t=A.$

Change A into P, and find what yearly rent being sold will produce P at the same rate, and for the time of its continuance, which will be the yearly sum required: thus, $\frac{pr^t \times r-prt.}{r^t-1}=U.$

EXAMPLES.

44. What annuity to be entered upon 2 years hence, and then to continue 6 years, may be purchased for £175 : 1 : 1 2,048 qrs. at 6 per cent.?

Ans. $175,0563 \times 1,1236=196,6933$

then $\frac{196,6933 \times 1,41852 \times 1,06-279,01337}{1,41852-1}=£40.$

45. The present worth of a lease of a house is £299 : 18 : 2 8d taken in reversion for 7 years, but not to commence till the end of 3 years, allowing 5 per cent. to the purchaser, what is the yearly rent? *Ans.* 60.

46. There is a lease of a house in being for 4 years, and the lessee being minded to take a lease in reversion for 7 years, to begin when the old lease shall be expired, paid down £142 : 16 : 3 2,688 qrs. what was the yearly rent of the house, when the lessee was allowed 5 per cent. for present payment? *Ans.* £30.

PURCHASING FREEHOLD OR REAL ESTATE, IN SUCH AS ARE BOUGHT TO CONTINUE FOR EVER.

I. When U R are given to find W.

RULE. $\frac{u}{r-1}=W.$

EXAMPLES.

47. What is the worth of a freehold estate of £50 per annum, allowing 5 per cent. to the buyer?

Ans. $\frac{50}{1,05-1}=£1000.$

48, What is an estate of £140 per annum, to continue for ever, worth in present money, allowing 4 per cent. to the buyer?

Ans. £3500.

49. If a freehold estate of £75 yearly rent was to be sold, what is the worth, allowing the buyer 6 per cent.?

Ans. £1250.

II. When W R are given to find U.

RULE. $w \times r-1=U.$

EXAMPLES.

50. If a freehold estate is bought for £1000, and the allowance of 5 per cent. is made to the buyer, what is the yearly rent?

Ans. 1,05—1=,05, then $1000 \times ,05 = £50.$

51. If an estate be sold for £3500, and 4 per cent. allowed to the buyer, what is the yearly rent? *Ans.* £140.

52. If a freehold estate is bought for £1250 present money, and an allowance of 6 per cent. made to the buyer for the same, what is the yearly rent? *Ans.* £75.

III. When W U are given to find R.

RULE. $\frac{w+u}{w}=R.$

EXAMPLES.

53. If an estate of £50 per annum be bought for £1000, what is the rate per cent.?

Ans. $\frac{1000+50}{1000}=1,05=5$ per cent.

54. If a freehold estate of £140 per annum be bought for £3500, what is the rate per cent. allowed? *Ans.* 4 per cent.

55. If an estate of £75 per annum is sold for £1250, what is the rate per cent. allowed? *Ans.* 6 per cent.

PURCHASING FREEHOLD ESTATES IN REVERSION.

To find the worth of a Freehold Estate in reversion:

RULE. Find the worth of the yearly rent, thus— $\frac{u}{r-1}=W$

Change W into A, and find what principal, being put to interest, will amount to A at the same rate, and for the time to come, before the estate commences, and that will be the worth of the estate in reversion, thus: $\frac{a}{r^t}=P$

EXAMPLES.

56. If a freehold estate of £50 per annum, to commence 4 years hence, is to be sold, what is it worth, allowing the purchaser 5 per cent. for the present payment?

Ans. $\frac{50}{1,05-1}=1000$, then $\frac{1000}{1,2155}=$£822 : 14 : 1½.

57. What is an estate of £200, to continue for ever, but not to commence till the end of 2 years, worth in ready money, allowing the purchaser 4 per cent.? *Ans.* £4622 : 15 : 7 ,44d.

58. What is an estate of £240 per annum worth in ready money, to continue for ever, but not to commence till the end of 3 years, allowance being made at 6 per cent.?

Ans. £3358 : 9 : 10 2,24 qrs.

To find the Yearly Rent of an Estate taken in reversion.

RULE. Find the amount of the worth of the estate, at the given rate, and time before it commences, thus: $wr^t = A$

Change A into W, and find what yearly rent being sold will produce U at the same rate, thus: $wr - w = U$, which will be the yearly rent required.

EXAMPLES.

59. If a freehold estate, to commence 4 years hence, is sold for $822 : 14 : 1\frac{1}{2}$, allowing the purchaser 5 per cent., what is the yearly income? *Ans.* $822{,}70625 \times 1{,}2155 = 1000$, then $1000 \times 1{,}05 - 1000 = £50$.

60. A freehold estate is bought for £4622 : 15 : 7 ,44d, which does not commence till the end of 2 years, the buyer being allowed 4 per cent. for his money. I desire to know the yearly income. *Ans.* £200.

61. There is a freehold estate sold for £3358 : 9 : 10 2,24 qrs., but not to commence till the expiration of 3 years, allowing 6 per cent. for present payment; what is the yearly income? *Ans.* 240.

REBATE OR DISCOUNT.

A Table showing the present worth of £1 due any number of years hence, under 31, rebate at 5 and 6 per cent.

YEARS.	5 RATES.	6	YEARS.	5 RATES.	6
1	,952381	,943396	16	,458111	,393646
2	,907030	,889996	17	,436296	,371364
3	,863838	,839619	18	,415520	,350343
4	,822702	,792093	19	,395734	,330513
5	,783526	,747258	20	,376889	,311804
6	,746215	,704960	21	,358942	,294155
7	,710682	,665057	22	,341849	,277505
8	,676839	,627412	23	,325571	,261797
9	,644609	,591898	24	,340068	,246978
10	,613913	,558394	25	,295302	,232998
11	,584679	,526787	26	,281240	,219810
12	,556837	,496969	27	,267848	,207368
13	,530321	,468839	28	,255093	,196630
14	,505068	,442301	29	,242946	,184556
15	,481017	,417265	30	,231377	,174110

NOTE.—The above table is thus made: $1 \div 1{,}05 = ,952381$, first year's present worth; and $,952381 \div 1{,}05 = ,90703$, second year; and $,90703 \div 1{,}05 = ,863838$ third year, &c.

I. When S T R are given to find P.

RULE.—$\frac{s}{r^t}$=P.

EXAMPLES.

1. What is the present worth of £315 : 12 : 4 ,2d, payable 4 years hence, at 6 per cent.?

Ans. 1,06×1,06×1,06×1,06=1,26247, then by the table.

$$\frac{315,6175}{1,26247}=£250 \qquad 315,6175 \times ,792093 = 249,9984124275$$

2. If £344 : 14 : 9 1,92 qrs. be payable in 7 years' time, what is the present worth, rebate being made at 5 per cent.?

Ans. £245.

3. There is a debt of £441 : 17 : 3 1,92 qrs., which is payable 4 years hence, but it is agreed to be paid in present money; what sum must the creditor receive, rebate being made at 6 per cent.?

Ans. £350.

II. When P T R are given to find S.

RULE. p×r^t=S.

EXAMPLES.

4. If a sum of money, due 4 years hence, produce £250 for the present payment, rebate being made at 6 per cent., what was the sum due?

Ans. £250×1,26247=£315 : 12 : 42d.

5. If £245 be received for a debt payable 7 years hence, and an allowance of 5 per cent. to the debtor for present payment, what was the debt? *Ans.* £344 : 14 : 9 1,92 qrs.

6. There is a sum of money due at the expiration of 4 years, but the creditor agrees to take £350 for present payment, allowing 6 per cent., what was the debt?

Ans. £441 : 17 : 3 1,92 qrs.

III. When S P R are given to find T.

RULE.—$\frac{s}{p}=r^t$ which being continually divided by R till nothing remains, the number of those divisions will be equal to T.

EXAMPLES.

7. The present payment of £250 is made for a debt of £315 : 12 : 4 ,2d., rebate at 6 per cent., in what time was the debt payable?

$$Ans.\ \frac{315{,}6175}{250}=1{,}26247$$

which being continually divided, those divisions will be equal to 4=the number of years.

8. A person receives £245 now, for a debt of £344 : 14 : 9 1,92 qrs., rebate being made at 5 per cent. I demand in what time the debt was payable? *Ans.* 7 years.

9. There is a debt of £441 : 17 : 3 1,92 qrs. due at a certain time to come, but 6 per cent. being allowed to the debtor for the present payment of £350, I desire to know in what time the sum should have been paid without any rebate?

Ans. 4 years.

IV. When S P T are given to find R.

$$\text{RULE.}\ \frac{s}{p}=r^t$$

which being extracted by the rules of extraction, (the time given in the question showing the power,) will be equal to R.

EXAMPLES.

10. A debt of £315 : 12 : 4,2d. is due 4 years hence, but it is agreed to take £250 now, what is the rate per cent. that the rebate is made at?

$$Ans.\ \frac{315{,}6175}{250}=1{,}26247 : \sqrt[4]{1{,}26247}=1{,}06=6 \text{ per cent.}$$

11. The present worth of £344 : 14 : 9 1,92 qrs., payable 7 years hence, is £245, at what rate per cent. is the rebate made?

Ans. 5 per cent.

12. There is a debt of £441 : 17 : 3 1,92 qrs., payable in 4 years time, but it is agreed to take £350 present payment. I desire to know at what rate per cent. the rebate is made at?

Ans. 6 per cent.

THE

TUTOR'S ASSISTANT.

PART IV.

DUODECIMALS,

OR, WHAT IS GENERALLY CALLED

Cross Multiplication, and Squaring of Dimensions by Artificers and Workmen.

RULE FOR MULTIPLYING DUODECIMALLY.

1. Under the multiplicand write the corresponding denominations of the multiplier.

2. Multiply each term in the multiplicand (beginning at the lowest) by the feet in the multiplier; write each result under its respective term, observing to carry an unit for every 12, from each lower denomination to its next superior.

3. In the same manner multiply the multiplicand by the primes in the multiplier, and write the result of each term one place more to the right hand of those in the multiplicand.

4. Work in the same manner with the seconds in the multiplier, setting the result of each term two places to the right hand of those in the multiplicand, and so on for thirds, fourths, &c.

EXAMPLES

f. in. f. in.

1. Multiply 7 . 9 by 3 . 6.

Cross Multiplication	Practice.	Duodecimals.	Decimals.
7 9 / 3×6	6½ 7 . 9	7 . 9	7,75
	3 . 6	2 . 6	3,5
21.0.0=7×3	23 . 3	23 . 3— ×3	3875
2.3.0=9×3	3 . 10 . 6	3 . 10 . 6×6	2325
3.6.0=7×6			
0.4.6=9×6	27 . 1 . 6	27 . 1 . 6	27,125
27.1.6			

	f.in.		f. in		f. in.pts.
2. Multiply	8.5	by	4. 7	Facit,	38. 6.11
3. Multiply	9.8	by	7. 6	Facit,	72. 6
4. Multiply	8.1	by	3. 5	Facit,	27. 7. 5
5. Multiply	7.6	by	5. 9	Facit,	43. 1. 6
6. Multiply	4.7	by	3.10	Facit,	17. 6.10,,,,,,
7. Multiply	7.5.9″	by	3. 5.3″	Facit,	25. 8. 6.2.3
8. Multiply	10.4.5	by	7. 8.6	Facit,	79.11. 0.6.6
9. Multiply	75.7	by	9. 8	Facit,	730. 7. 8
10. Multiply	97.8	by	8. 9	Facit,	854. 7.
11. Multiply	57.9	by	9. 5	Facit,	543. 9. 9
12. Multiply	75.9	by	17. 7	Facit,	1331.11. 3
13. Multiply	87.5	by	35. 8	Facit,	3117.10. 4
14. Multiply	179.3	by	38.10	Facit,	6960.10. 6
15. Multiply	259.2	by	48.11	Facit,	12677. 6.10
16. Multiply	257.9	by	39.11	Facit,	10288. 6. 3
17. Multiply	311.4.7	by	36. 7.5	Facit,	11402. 2. 4.11.1
18. Multiply	321.7.3	by	9. 3.6	Facit,	2988. 2.10.4.6

THE APPLICATION.

Artificers' work is computed by different measures, viz:—

1. Glazing, and masons' flat work, by the foot.

2. Painting, plastering, paving, &c. by the yard.

3. Partitioning, flooring, roofing, tiling, &c., by the square of 100 feet.

4. Brick work, &c. by the rod of 16½ feet, whose square is 272¼ feet.

Measuring by the Foot Square, as Glaziers' and Mason's' Flat Work.

EXAMPLES.

19. There is a house with 3 tier of windows, 3 in a tier—the height of the first tier 7 feet 10 inches, the second 6 feet 8 inches, and the third 5 feet 4 inches, the breadth of each is 3 feet 11 inches; what will the glazing come to, at 14d. per foot?

Duodecimals.

7 . 10 the
6 . 8 heights
5 . 4 added.

19 . 10
3=windows in a tier.

59 . 6
3 . 11 in breadth.

178 . 6
54 . 6 . 0

233 . 0 . 6

feet. in. pts.
233 . 0 . 6 at 14d. per ft.

2d.=$\frac{1}{6}$ 233 = 1s.
38 . 10 = 2d.
0 . 0$\frac{1}{2}$ = 6 parts.

2|0)27|1 . 10$\frac{1}{2}$

£13 . 11 . 10$\frac{1}{2}$ *Ans.*

20. What is the worth of 8 squares of glass, each measuring 4 feet 10 inches long, and 2 feet 11 inches broad, at 4$\frac{1}{2}$d per foot?

Ans. £1 : 18 : 9.

21. There are 8 windows to be glazed, each measures 1 foot 6 inches wide, and 3 feet in height, how much will they come to at 7$\frac{3}{4}$d. per foot?

Ans. £1 : 3 : 3.

22. What is the price of a marble slab, whose length is 5 feet 7 inches, and the breadth 1 foot 10 inches, at 6s. per foot?

Ans. £3 : 1 : 5.

Measuring by the Yard Square, as Paviers, Painters, Plasterers, and Joiners.

NOTE. Divide the square feet by 9, and it will give the number of square yards.

EXAMPLES.

23. A room is to be ceiled, whose length is 74 feet 9 inches, and width 11 feet 6 inches; what will it come to at 3s. 10½d. per yard?

Ans. £18 : 10 : 1.

24. What will the paving of a court-yard come to at 4¾d. per yard, the length being 58 feet 6 inches, and breadth 54 feet 9 inches?

Ans. £7 : 0 : 10.

25. A room was painted 97 feet 8 inches about, and 9 feet 10 inches high, what does it come to at 2s. 8¾d. per yard?

Ans. £14 : 11 : 1½.

26. What is the content of a piece of wainscoting in yards square, that is 8 feet 3 inches long, and 6 feet 6 inches broad, and what will it come to at 6s. 7½d. per yard?

Ans. Contents, yards 5.8.7.6; comes to £1 : 19 : 5.

27. What will the paving of a court-yard come to at 3s. 2d. per yard, if the length be 27 feet 10 inches, and the breadth 14 feet 9 inches?

Ans. £7 : 4 : 5.

28. A person has paved a court-yard 42 feet 9 inches in front, and 68 feet 6 inches in depth, and in this he laid a foot-way the depth of the court, of 5 feet 6 inches in breadth; the foot-way is laid with Purbeck stone, at 3s. 6d. per yard, and the rest with pebbles, at 3s. per yard; what will the whole come to?

Ans. £49 : 17.

29. What will the plastering of a ceiling, at 10d. per yard, come to, supposing the length 21 feet 8 inches, and the breadth 14 feet 10 inches?

Ans. £1 : 9 : 9.

30. What will the wainscoting of a room come to at 6s. per square yard, supposing the height of the room (taking in the cornice and moulding) is 12 feet 6 inches, and the compass 83 feet 8 inches, the three window shutters each 7 feet 8 inches by 3 feet 6 inches, and the door 7 feet by 3 feet 6 inches? The shutters and door being worked on both sides, are reckoned work and half work.

Ans. £36 : 12 : 2½.

Measuring by the Square of 100 *feet, as Flooring, Partitioning, Roofing, Tiling, &c.*

EXAMPLES

31. In 173 feet 10 inches in length, and 10 feet 7 inches in height of partitioning, how many squares?

Ans. 18 squares, 39 feet, 8 inches, 10 p.

32. If a house of three stories, besides the ground floor, was to be floored at £6 : 10 per square, and the house measured 20 feet 8 inches, by 16 feet 9 inches; there are 7 fire-places, whose measures are, two of 6 feet by 4 feet 6 inches each, two of 6 feet by 5 feet 4 inches each, and two of 5 feet 8 inches by 4 feet 8 inches each, and the seventh of 5 feet 2 inches by 4 feet, and the well hole for the stairs is 10 feet 6 inches by 8 feet 9 inches: what will the whole come to?

Ans. £53 : 13 : 3½.

33. If a house measures within the walls 52 feet 8 inches in length, and 30 feet 6 inches in breadth, and the roof be of a true pitch, what will it come to roofing at 10s. 6d. per square?

Ans. £12 : 12 : 11¾.

Note. In tiling, roofing, and slating, it is customary to reckon the flat and half of the building within the wall, to be the measure of the roof of that building, when the said roof is of a true pitch, *i. e.* when the rafters are ¾ of the breadth of the building; but if the roof is more or less than the true pitch, they measure from one side to the other with a rod or string.

34. What will the tiling of a barn cost, at 25s. 6d. per square; the length being 43 feet 10 inches, and breadth 27 feet 5 inches on the flat, the eave boards projecting 16 inches on each side?

Ans. £24 : 9 : 5¾.

Measuring by the Rod.

Note. Bricklayers always value their work at the rate of a brick and a half thick; and if the thickness of the wall is more or less, it must be reduced to that thickness by this.

RULE. Multiply the area of the wall by the number of half bricks in the thickness of the wall; the product divided by 3, gives the area.

EXAMPLES.

35. If the area of a wall be 4085 feet, and the thickness two bricks and a half, how many rods doth it contain?

Ans. 25 rods.

36. If a garden wall be 254 feet round, and 12 feet 7 inches high, and 3 bricks thick how many rods doth it contain?

Ans. 23 rods, 136 feet 7 in.

37. How many squared rods are there in a wall 62½ feet long, 14 feet 8 inches high, and 2½ bricks thick?

Ans. 5 rods, 166 feet 6 in.

38. If the side walls of a house be 28 feet 10 inches in length, and the height of the roof from the ground 55 feet 8 inches, and the gable (or triangular part at top) to rise 42 course of bricks, reckoning 4 course to a foot. Now, 20 feet high is 2½ bricks thick, 20 feet more at two bricks thick, 15 feet 8 inches more at 1½ brick thick, and the gable at 1 brick thick; what will the whole work come to at £5 16s. per rod?

Ans. £48 : 12 : 7.

Multiplying several figures by several, and the product to be produced in one line only.

RULE. Multiply the units of the multiplicand by the units of the multiplier, setting down the units of the product, and carry the tens; next multiply the tens in the multiplicand by the units of the multiplier, to which add the product of the units of the multiplicand multiplied by the tens in the multiplier, and the tens carried; then multiply the hundreds in the multiplicand by the units of the multiplier, adding the product of the tens in the multiplicand multiplied by the tens in the multiplier, and the units of the multiplicand by the hundreds in the multiplier; and so proceed till you have multiplied the multiplicand all through, by every figure of the multiplier.

EXAMPLES.

	Common way.
Multiply 35234	35234
by 52424	52424
Product, 1847107216	140936
	70468
	140936
	70468
	176170
	1847107216

EXPLANATIONS.

First, $4\times4=16$, that is 6 and carry one. Secondly, $3\times4+4\times2$, and 1 that is carried, is 21—set down 1 and carry 2 Thirdly, $2\times4+3\times2+4\times4+2$ carried$=32$, that is 2 and carry 3. Fourthly, $5\times4+2\times2+3\times4+4\times2+3$ carried $= 47$, set down 7 and carry 4. Fifthly, $3\times4+5\times2+2\times4+3\times2+4\times5+4$ carried$=60$, set down 0 and carry 6. Sixthly, $3\times2+5\times4+2\times2+3\times5+6$ carried $= 51$, set down 1 and carry 5. Seventhly, $3\times4+5\times2+2\times5+5$ carried$=37$, that is 7 and carry 3. Eighthly, $3\times2+5\times5+3$ carried$=34$, set down 4 and carry 3. Lastly, $3\times5+3$ carried$=18$, which being multiplied by the last figure in the multiplier, set the whole down, and the work is finished.

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PART V.

A COLLECTION OF QUESTIONS.

1. What is the value of 14 barrels of soap, at 4½d. per lb., each barrel containing 254 lb.? *Ans.* £66 : 13 : 6.

2. A and B trade together; A puts in £320 for 5 months, B £460 for 3 months, and they gained £100; what must each man receive? *Ans.* A £53 : 13 : $9\frac{2}{29}\frac{7}{8}$, and B £46 : 6 : $2\frac{2}{29}\frac{3}{8}$.

3. How many yards of cloth, at 17s. 6d. per yard, can I have for 13 cwt. 2 qrs. of wool, at 14d. per lb.?

Ans. 100 yards, $3\frac{1}{5}$ qrs.

4. If I buy 1000 ells of Flemish linen for £90, at what may I sell it per ell in London, to gain £10 by the whole?

Ans. 3s. 4d. per ell.

5. A has 648 yards of cloth, at 14s. per yard, ready money, but in barter will have 16s.; B has wine at £42 per tun, ready money: the question is, how much wine must be given for the cloth, and what is the price of a tun of wine in barter?

Ans. £48 the tun, and 10 tun, 3 hhds. $12\frac{3}{5}$ gals. of wine must be given for the cloth.

6. A jeweller sold jewels to the value of £1200, for which he received in part 876 French pistoles, at 16s. 6d. each; what sum remains unpaid? *Ans.* £477 : 6.

7. An oilman bought 417 cwt. 1 qr. 15 lb., gross weight, of train oil, tare 20 lb. per 112 lb., how many neat gallons were there, allowing 7½ lb. to a gallon? *Ans.* 5120 gallons.

8. If I buy a yard of cloth for 14s. 6d., and sell it for 16s. 9d., what do I gain per cent.? *Ans.* £15 : 10 : $4\frac{24}{174}$.

9. Bought 27 bags of ginger, each weighing gross $84\frac{3}{4}$ lb., tare at $1\frac{3}{8}$ lb. per bag, tret 4 lb. per 104 lb., what do they come to at $8\frac{1}{2}$d. per lb.? *Ans.* £76 : 13 : $1\frac{3}{16}$.

10. If $\frac{2}{3}$ of an ounce cost $\frac{7}{8}$ of a shilling, what will $\frac{5}{6}$ of a lb. cost? *Ans.* 17s. 6d.

11. If $\frac{5}{6}$ of a gallon cost $\frac{5}{8}$ of a pound, what will $\frac{5}{9}$ of a tun cost? *Ans.* £105.

12. A gentleman spends one day with another, £1 : 7 : $10\frac{1}{2}$, and at the year's end layeth up £340, what is his yearly income? *Ans.* £848 : 14 : $4\frac{1}{2}$.

13. A has 13 fother of lead to send abroad, each being $19\frac{1}{2}$ times 112 lb. B has 388 casks of tin, each 388 lb., how many ounces difference is there in the weight of these commodities? *Ans.* 212160 oz.

14. A captain and 160 sailors took a prize worth £1360, of which the captain had $\frac{1}{5}$ for his share, and the rest was equally divided among the sailors, what was each man's part? *Ans.* The captain had £272, and each sailor £6 : 16.

15. At what rate per cent. will £956 amount to £1314 : 10, in $7\frac{1}{2}$ years, at simple interest? *Ans.* 5 per cent.

16. A hath 24 cows, worth 72s. each, and B 7 horses, worth £13 a piece, how much will make good the difference, in case they interchange their said drove of cattle? *Ans.* £4 : 12.

17. A man dies and leaves £120 to be given to three persons, viz. A, B, C; to A a share unknown; B twice as much as A, and C as much as A and B; what was the share of each? *Ans.* A £20, B £40, and C £60.

18. £1000 is to be divided among three men, in such a manner, that if A has £3, B shall have £5, and C £8; how much must each man have? *Ans.* A £187 : 10, B £312 : 10, and C £500.

19. A piece of wainscot is 8 feet $6\frac{1}{2}$ inches long, and 2 feet $9\frac{3}{4}$ inches broad, what is the superficial content? *Ans.* 24 feet 0 : 3″ : 4 : 6.

20. If 360 men be in garrison, and have provisions for 6 months, but hearing of no relief at the end of 5 months, how many men must depart that the provisions may last so much the longer? *Ans.* 288 men.

21. The less of 2 numbers is 187, their difference 34, the square of their product is required? *Ans.* 1707920929.

22. A butcher sends his man with £216 to a fair to buy cattle; oxen at £11, cows at 40s., colts at £1 : 5, and hogs at £1 : 15 each, and of each a like number, how many of each sort did he buy? *Ans.* 13 of each sort, and £8 over.

23. What number added to $11\frac{5}{7}$ will produce $36\frac{3}{6}\frac{3}{1}\frac{7}{6}$? *Ans.* $24\frac{5}{6}\frac{1}{1}\frac{3}{6}$.

24. What number multiplied by $\frac{3}{7}$ will produce $11\frac{9}{17}$?
Ans. $26\frac{6}{51}$.

25. What is the value of 179 hogsheads of tobacco, each weighing 13 cwt. at £2 : 7 : 1 per cwt.? *Ans.* £5478 : 2 : 11.

26. My factor sends me word he has bought goods to the value of £500 : 13 : 6, upon my account, what will his commission come to at $3\frac{1}{2}$ per cent.? *Ans.* £17 : 10 : 5 2 qrs. $\frac{63}{100}$.

27. If $\frac{1}{3}$ of 6 be three, what will $\frac{1}{4}$ of 20 be? *Ans.* $7\frac{1}{2}$.

28. What is the decimal of 3 qrs. 14 lb. of a cwt.?
Ans. ,875

29. How many lb. of sugar at $4\frac{1}{2}$d. per lb. must be given in barter for 60 gross of inkle at 8s. 8d. per gross?
Ans. $1386\frac{2}{3}$ lb.

30. If I buy yarn for 9d. the lb. and sell it again for $13\frac{1}{2}$d. per lb., what is the gain per cent.? *Ans.* £50.

31. A tobacconist would mix 20 lb. of tobacco at 9d. per lb. with 60 lb. at 12d. per lb., 40 lb. at 18d. per lb., and with 12 lb. at 2s. per lb., what is a pound of this mixture worth?
Ans. 1s. $2\frac{4}{11}$d. $\frac{9}{11}$.

32. What is the difference between twice eight and twenty, and twice twenty-eight; as also, between twice five and fifty, and twice fifty-five? *Ans.* 20 and 50.

33. Whereas a noble and a mark just 15 yards did buy; how many ells of the same cloth for £50 had I? *Ans.* 600 ells.

34. A broker bought for his principal, in the year 1720, £400 capital stock in the South-Sea, at £650 per cent., and sold it again when it was worth but £130 per cent.; how much was lost in the whole? *Ans.* £2080.

35. C hath candles at 6s. per dozen, ready money, but in barter will have 6s. 6d. per dozen; D hath cotton at 9d. per lb. ready money. I demand what price the cotton must be at in barter; also, how much cotton must be bartered for 100 doz. of candles?
Ans. The cotton at 9d. 3 qrs. per lb., and 7 cwt. 0 qrs. 16 lb. of cotton must be given for 100 doz. candles.

36. If a clerk's salary be £73 a year, what is that per day?
Ans. 4s.

37. B hath an estate of £53 per annum, and payeth 5s. 10d. to the subsidy, what must C pay whose estate is worth £100 per annum?
Ans. 11s. 0d. $\frac{4}{53}$.

38. If I buy 100 yards of riband at 3 yards for a shilling, and 100 more at 2 yards for a shilling, and sell it at the rate of 5 yards for 2 shillings, whether do I gain or lose, and how much?

Ans. Lose 3s. 4d.

39. What number is that, from which if you take $\frac{3}{5}$, the remainder will be $\frac{1}{6}$? *Ans.* $\frac{2}{4}\frac{2}{0}$.

40. A farmer is willing to make a mixture of rye at 4s. a bushel, barley at 3s., and oats at 2s.; how much must he take of each to sell it at 2s. 6d. the bushel?

Ans. 6 of rye, 6 of barley, and 24 of oats.

41. If $\frac{3}{8}$ of a ship be worth £3740, what is the worth of the whole? *Ans.* £9973 : 6 : 8.

42. Bought a cask of wine for £62 : 8, how many gallons were in the same, when a gallon was valued at 5s. 4d.?

Ans. 234.

43. A merry young fellow in a short time got the better of $\frac{1}{5}$ of his fortune; by advice of his friends he gave £2200 for an exempt's place in the guards; his profusion continued till he had no more then 880 guineas left, which he found, by computation, was $\frac{3}{2\,0}$ part of his money after the commission was bought; pray what was his fortune at first? *Ans.* £10,450.

44. Four men have a sum of money to be divided amongst them in such a manner, that the first shall have $\frac{1}{3}$ of it, the second $\frac{1}{4}$, the third $\frac{1}{6}$, and the fourth the remainder, which is £28, what is the sum? *Ans.* £112.

45. What is the amount of £1000 for $5\frac{1}{2}$ years, at $4\frac{3}{4}$ per cent. simple interest? *Ans.* £1261 : 5.

46. Sold goods amounting to the value of £700 at two 4 months, what is the present worth, at 5 per cent. simple interest?

Ans. £682 : 19 : $5\frac{1}{4}$ $\frac{1\,7\,7}{1\,8\,9\,1}$.

47. A room 30 feet long, and 18 feet wide, is to be covered with painted cloth, how many yards of $\frac{3}{4}$ wide will cover it?

Ans. 80 yards.

48. Betty told her brother George, that though her fortune, on her marriage, took £19,312 out of her family, it was but $\frac{3}{5}$ of two years' rent, Heaven be praised! of his yearly income; pray what was that? *Ans.* £16,093 : 6 : 8 a year.

49. A gentleman having 50s. to pay among his labourers for a day's work, would give to every boy 6d., to every woman 8d. and to every man 16d.; the number of boys, women, and men was the same. I demand the number of each?

Ans. 20 of each

50. A stone that measures 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches deep, how many solid feet doth it contain? *Ans.* 41 feet 3 inches.

51. What does the whole pay of a man-of-war's crew, of 640 sailors, amount to for 32 months' service, each man's pay being 22s. 6d. per month? *Ans.* £23,040.

52. A traveller would change 500 French crowns, at 4s. 6d. per crown, into sterling money, but he must pay a halfpenny per crown for change; how much must he receive?

Ans. £111 : 9 : 2.

53. B and C traded together, and gained £100; B put in £640, C put in so much that he might receive £60 of the gain. I demand how much C put in? *Ans.* £960.

54. Of what principal sum did £20 interest arise in one year, at the rate of 5 per cent. per annum? *Ans.* £400.

55. In 672 Spanish guilders of 2s. each, how many French pistoles, at 17s. 6d. per piece? *Ans.* $76\frac{2}{3}\frac{8}{5}$.

56. From 7 cheeses, each weighing 1 cwt. 2 qrs. 5 lb., how many allowances for seamen may be cut, each weighing 5 oz. 7 drams? *Ans.* $3563\frac{3}{8}\frac{5}{7}$.

57. If 48 taken from 120 leaves 72, and 72 taken from 91 leaves 19, and 7 taken from thence leaves 12, what number is that, out of which when you have taken 48, 72, 19, and 7, leaves 12? *Ans.* 158.

58. A farmer ignorant of numbers, ordered £500 to be divided among his five sons, thus:—Give A, says he, $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$, D $\frac{1}{6}$, and E $\frac{1}{7}$ part; divide this equitably among them, according to their father's intention.

Ans. A £$152\frac{2}{4}\frac{3}{5}\frac{2}{9}$, B £$114\frac{1}{4}\frac{7}{5}\frac{4}{9}$, C £$91\frac{2}{4}\frac{3}{5}\frac{1}{9}$, D £$76\frac{1}{4}\frac{1}{5}\frac{6}{9}$, E £$65\frac{1}{4}\frac{6}{5}\frac{5}{9}$.

59

When first the marriage knot was tied
Between my wife and me,
My age did hers as far exceed,
As three times three does three;
But when ten years, and half ten years,
We man and wife had been,
Her age came then as near to mine,
As eight is to sixteen.

Ques. What was each of our ages when we were married?

Ans. 45 years the man, 15 the woman.

SUPPLEMENTAL QUESTIONS.

1. On goods that cost 412s. there was 25s. profit; how much should be sold to gain as much more? *Ans.* 462s.

2. The less of two numbers is 17, and after having subtracted 23 from the greater, the remainder is eight more than the less; what is the greater? *Ans.* 48.

3. After having successively subtracted from a number, 17, 29, 33, 58; the remainder is 91 more than the total of the sums subtracted; what is that number? *Ans.* 365.

4. Of three numbers, the first is 215, the second is 519, and the third is as much as the other two; what is the sum of the three numbers? *Ans.* 1468.

5. The greater of two numbers is 56 and the difference is 37; which is the less? *Ans.* 19.

6. A sister is 8 years younger than her brother who is 27 years of age; what will her age be when her brother will be 7 years older? *Ans.* 26 years.

7. If 27 be added to the sum of two numbers, the less of which is 21, their total will be 147; which is the greater? *Ans.* 99.

8. A man 47 years of age has a son 9 years old; what will the father's age be when the son will be the father's present age? *Ans.* 85.

9. After having added successively 17, 29, 33, and 54 to a number the total is 214; what is that number? *Ans.* 81.

10. The age of the father and son together is 60 years: and if 18 be taken from the father's age and added to the son's their age will be equal; what is the age of each? *Ans.* 48 and 12.

11. The greater of two numbers is four more than their difference and their sum is 27; determine the numbers? *Ans.* 23 and 4.

12. The smaller of two numbers is 160, and after subtracting 150 from one and 48 from the other, the remainder is 244; what is the greater? *Ans.* 282.

13. The less of two numbers is 37, and after taking 72 from one and adding 34 to the other their total is 145; what is the greater? *Ans.* 146.

14. What are the three numbers whose sum is 3291 and the greatest 1125 exceeds the smallest by 79? *Ans.* The smallest 1,046, the mean 1,120.

15. After dividing a certain sum between 26 persons each received 257s.; what was the sum? *Ans.* 6,682s.

16. From a certain sum 152 persons took $17 each, and there remained $13; what was the sum? *Ans.* $2597.

17. What is the number that being augmented by 56 and divided by 55, the quotient will be 2,854? *Ans.* 156,914.

18. What is the number that being divided by 27, gives a quotient equal to the product of 1,091 by 3? *Ans.* 88,371.

19. By selling 120 yards of cloth for 3,600s. there was 5s. profit per yard; what was the buying price? *Ans.* 3,000s.

20. I bought 150 yards of cloth for 3,750s. and sold them for 29s. the yard; what did I gain by the bargain? *Ans.* 600s.

21. What sum would be obtained, if, after having multiplied 250,540 by 10 this product should be repeated 2,458 times?
Ans. 6,158,273,200.

22. A man has $3000 revenue and spends $5 per day; what will he lay up at the end of 10 years? *Ans.* $11,750.

23. A class is composed of a certain number of scholars; if there were 8 more the number would be augmented $\frac{1}{5}$; how many scholars were there? *Ans.* 40.

24. The quarter of the 54th part of a number is 5,454; what is that number? *Ans.* 1,178,064.

25. On the sale of 150 yards of cloth for 29s. per yard, there were 600s. profit; what was the buying price? *Ans.* 3,750s.

26. What number being divided by 4 gives a quotient such that, after subtracting 9, the remainder will be 20? *Ans.* 116.

27. How many revolutions will the second-hand of a clock make in a year, the year being 365d. 5h. 48min.?
Ans. 525,948 rev.

28. A number is such that in taking 9 from its fourth part, the remainder is 91; what is the number? *Ans.* 400.

29. What is the number whose 17th part augmented 54, is equal to 602? *Ans.* 9,316.

30. What number added to the product of 185 by 27, gives 115 times 155 for total? *Ans.* 12.830.

31. The less of two numbers is 187, and their difference is 34 required the square of their product? *Ans.* 1,707,920,929.

32. What number must be added to the square of 125 to produce 20,000 for total? *Ans.* 4,375.

33. The sum of two numbers is 360, and the less is 144; required the result of their product by the square of their difference?
Ans. 161,243,136.

34. Two numbers are such, that the greater is 37 times 45, and their difference 19 times 4; required the two numbers, their difference, their sum and their product?

Ans. The two numbers are 1,665 and 1,589; diff. 76; sum 3,254; prod. 2,645,685.

35. The sums of two numbers is 4,517, and by adding 27 to double the square of 25 you will produce one of the numbers; what is the other? *Ans.* 3,240.

36. Determine the difference that exists between the fourth power of 13 and the triple square of 49? *Ans.* 21,358.

37. What is the sum of the cubes of two numbers, whose sum is 20 and the less number 9? *Ans.* 2,060.

38. There are two numbers, one is 39 and the other is 27 times greater; required their sum and the square of their difference?

Ans. Sum 1,092, square of their diff. 1,028,196.

39. What is the number that, being multiplied by 55, gives 156,970 for product? *Ans.* 2,854.

40. If 256 be multipled by an unknown number, the product will be 1792. *Ans.* 7.

41. By what number must 54 be multiplied to give 9,990? *Ans.* 185.

42. If you multiply a certain number by 7, you will augment it 1,548; required the number? *Ans.* 258.

43. The sum of two numbers is 13, and their product, divided by the less, is equal to the quarter of the same product; required the two numbers? *Ans.* 9 and 4.

44. The sum of two numbers is 2,458, and their difference is 154; what are the numbers? *Ans.* 1,152 and 1,306.

45. Required two numbers whose difference is 7, and sum 33? *Ans.* 20 and 13.

46. The difference between two nnmbers is 100, and after taking 150 from one and 48 from the other, there remains 244; required the two numbers? *Ans.* 271 and 171.

47. A son is 45 years younger than his father who is four times his age; what is the age of each? *Ans.* 60 and 15.

48. A father is six times as old as his son, and the sum of both their ages is 91; required their ages? *Ans.* 78 and 13.

49. The age of the father and son together is 80 years, and if the son's age was doubled, it would be 10 years more than his father's; what is each of their ages? *Ans.* 50 and 30.

50. Find two numbers whose sum is 108; and one the one-fifth of the other? *Ans.* 90 and 18.

51. 54 years is the age of the father and son together; and the father is 22 years older than the son; what is the age of each?

Ans. 38 and 16.

52. Two numbers are such that by adding 150 to the less, they are equal, and their sum is 2,400; what are the numbers?

Ans. Greater 1,275, less 1,125.

53. The sum of two numbers is 2,588 and to make them equal add 178 to the less; what are the numbers?

Ans. 1,383 and 1,205.

54. The sum and difference of two numbers are 150 and 100; what is their quotient? *Ans.* 5.

55. If I had as many more half dollars as I have, after spending 18, I would still have 194; how many have I? *Ans.* 106.

56. The sum of two numbers is 2,587, to make them equal subtract 178 from the greater and add 17 to the less; what are the numbers? *Ans.* 1,196 and 1,391.

57. The difference between two numbers is 10, and their quotient is three; what are the numbers? *Ans.* 5 and 15.

58. Required to divide 60 into three parts, so that the first may be 8 more than the second and 16 more than the third?

Ans. 28, 20 and 12.

59. The divisor and dividend together make 180 and their quotient is 11; determine the divisor and dividend?

Ans. 165 and 15.

60. The product of two numbers is 120, and if you add 4 to the less, the product will be 168; what are the two numbers?

Ans. 12 and 10.

61. The quotient of two numbers is 18, and their sum 1,121; find the numbers? *Ans.* 1,062 and 59.

62. Divide 256 into two such parts, that their quotient will be 31? *Ans.* 248 and 8.

63. The quotient of two numbers is 37 and their difference 684; determine the numbers? *Ans.* 703 and 19.

64. Divide a number into two such parts that their difference be 240 and their quotient 31? *Ans.* 248 and 8.

65. With 1,350 shillings I paid 75 labourers who worked during a week; how many would I pay with 1,836 shillings. *Ans.* 102.

66. If I had $350 more my stock would be tripled; what do I possess? *Ans.* $175.

67. The sum of two numbers is 4,545, and one of them is 4 times greater than the other; what are the numbers?

Ans. 3,636 and 909.

68. If you divide by one another two numbers whose sum is 5,939, the quotient will be 12 and the remainder 11; what are the two numbers? *Ans.* 456 and 5,483.

69. Divide 100 into two parts in such sort that the seventh part of the sextuple of one of the parts may equal 24; what are the parts? *Ans.* 28 and 72.

70. Divide the number 92 into 4 parts, in such sort that the first may be 10 more than the second, 18 more than the third, and 24 more than the fourth? *Ans.* 36, 26, 18, 12.

71. If I had three times more money than I have, and $245 more, I would have $2,045; what have I? *Ans.* $450.

72. If the money I have was multiplied by 8 and the product divided by 7, I would have $24. *Ans.* $21.

73. What number being added to the ninth part of 2,457 would give 2,731 for total? *Ans.* 2,458.

74. The product of two numbers is 144, and the sixth part of the product is equal to three times the less; what are the 2 numbers? *Ans.* 18 and 8.

75. I doubled a number and divided it by 4, then I multiplied it by 12, and the third of the result was 48; what is the number? *Ans.* 24.

76. One of the factors of a number is 37, and 5 times their product is 10,730; what is the other? *Ans.* 58.

77. The sum of two numbers is 374, and their quotient is 21; determine the numbers? *Ans.* 357 and 17.

78. What number multiplied by 12 will give the same product as 456 by 15? *Ans.* 570.

79. A person having 445 shillings per month to spend, subscribes for 3,150 shillings in effects, that he must pay out of his income; to what must he reduce his expenses to fulfil his engagement? *Ans.* 6 shillings per day.

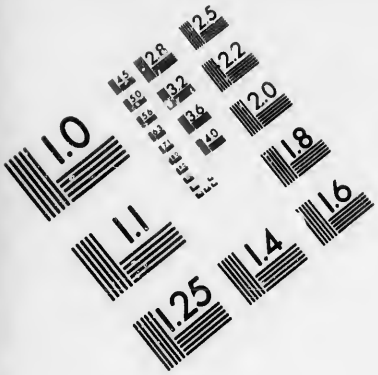
80. The total of three numbers is 131, the third is 89, and the second is quintuple the first; what are the numbers? *Ans.* 7 and 35.

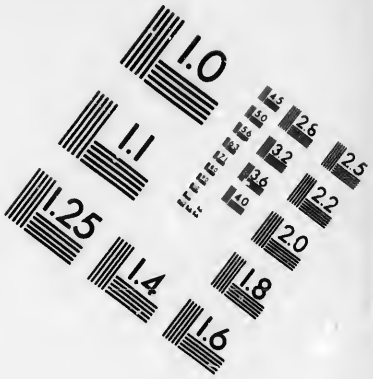
81. The less of two numbers is 7 more than their difference, and their sum is 41; what are the numbers? *Ans.* 16 and 25.

82. The less of two numbers is 12, and by tripling their sum, their difference is 51; what is the greater? *Ans.* 29.

83. Divide 20 into two parts in such sort that one part added to the quintuple of the other will make 84? *Ans.* 16 and 4.

84. A certain person wishing to buy some oranges, finds that in taking 24 he would have 7½d. over, and in taking 30 he would





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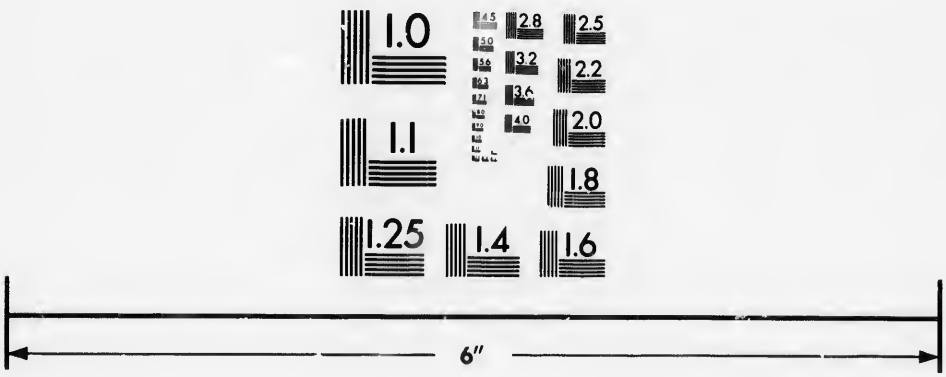

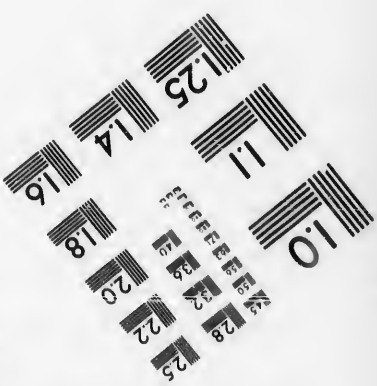

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want $10\frac{1}{2}$d. more; required the price of the oranges and the money the person had?

Ans. 3d. each orange; 6s. $7\frac{1}{2}$d. the money the person had.

85. The sum of two numbers is 450 and the less is equal to their difference; what are they? *Ans.* 150 and 300.

86. A father has six sons, there are 4 years difference between their ages, and the eldest is three times the age of the youngest; what is the age of each? *Ans.* 14, 18, 22 and 26 years.

87. Two gamblers play a game: the first has 54 shillings, the second 41. After the game, the first has four times as much money as his comrade; how much did the second lose?

Ans. 22 shillings.

88. Which is the greater of two numbers of which the less is three, and the sum added to the product is 39? *Ans.* 9.

89. Which are the two numbers whose difference is 6, and of which 3 times the less and 5 times the greater make 54?

Ans. 3 and 9.

90. What two numbers give 116 for sum, and for difference double the less? *Ans.* 29 and 87.

91. The sixth part of 9 times the sum that I have, divided by three and sextupled, gives a result such that its fifteenth part is 30; what is that sum? *Ans.* 150.

92. A gambler being asked how many pounds he had, answered: the quotient of 5 times their number, divided by 7, being multiplied by 13, gives a product equal to 65; how many had he?

Ans. £7.

93. The seventh part of a number, multiplied by 3, augmented 4, and divided by 13 gives 4 for quotient; what is that number?

Ans. 112.

94. If I add \$10 to four times the triple of six times the sum I have, I will have \$658; how many had I? *Ans.* \$9.

FRACTIONS.

95. The sum of two fractions is $\frac{3}{5}$ and their difference is $\frac{5}{11}$; what are the fractions? *Ans.* $\frac{4}{5}\frac{4}{5}$ and $\frac{2}{5}\frac{2}{5}$.

96. What is the number whose difference between its third and its fourth part is 16? *Ans.* 192.

97. What number will differ eight from its $\frac{1}{3}$ and its $\frac{1}{5}$?

Ans. 20.

98. With $3\frac{1}{2}$ more, the $\frac{3}{4}$ and the $\frac{7}{8}$ of a number would be equal; what is it? *Ans.* 28.

99. There is $12\frac{4}{45}$ difference between the fifth and the ninth part of a number; what is it? *Ans.* 136.

100. The sum of two numbers is 20, and after subtracting $\frac{1}{6}$ from one to add it to the other, they are equal; what are those numbers? *Ans.* 8 and 12.

101. Find a number whose $\frac{4}{5}$ will be equal to $\frac{1}{3}$ of 14?
Ans. $5\frac{5}{6}$.

102. There are two towers side by side, the first is equal to the $\frac{3}{7}$ of the other, which is 156 feet higher; what is the height of each? *Ans.* 273 and 117 feet.

103. The $\frac{3}{4}$ and $\frac{1}{6}$ of a ship are under water, and there remains 4 feet over water; what is its depth? *Ans.* 48 feet.

104. The $\frac{1}{3}$ and $\frac{1}{4}$ of a number make $17\frac{1}{2}$; what is it?
Ans. 30.

105. If you add the $\frac{3}{4}$ of a number to its half, the total will be 1; what is the number? *Ans.* $\frac{4}{5}$.

106. A number is such that if you add $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, of the same number, the total will be 12; find that number? *Ans.* $11\frac{1}{13}$.

107. Find a number whose $\frac{1}{3}$, $\frac{1}{5}$ and $\frac{2}{7}$ make $4\frac{1}{2}$?
Ans. $4\frac{137}{209}$.

108. Of two numbers one is $17\frac{1}{5}$, and their quotient is $\frac{7}{8}$; what is the other? *Ans.* $15\frac{1}{20}$.

109. The quarter of a number multiplied by $\frac{2}{3}$ is equal to $1\frac{1}{2}$; what is it? *Ans.* 8.

110. If the triple of $\frac{2}{5}$ be added to its third, the whole will be 115; what is it? *Ans.* 75.

111. After selling the $\frac{5}{9}$ of a piece of cloth there remains $\frac{1}{8}$ of the piece plus 6 yards; how many yards did it contain?
Ans. $18\frac{1}{2}\frac{8}{3}$ yds.

112. The $\frac{5}{7}$ plus $\frac{1}{3}$ of a number diminished 64 give for result the $\frac{2}{3}$ of the same number; what is the number? *Ans.* 168.

113. $\frac{1}{10}$ plus $\frac{1}{5}$ of a number augmented 3, give for result half of the same number; what is that number? *Ans.* 15.

114. The $\frac{3}{4}$ and $\frac{7}{8}$ of a number and twelve more make just double that number; what is it? *Ans.* 32.

115. If I had $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{2}{3}$ of what I have, I would have \$150 more; how many have I? *Ans.* \$360.

116. Some body said: if I had the $\frac{2}{3}$ and $\frac{1}{4}$ of the double of what I have, I would have \$5 more; how many had he?
Ans. \$6.

117. The $\frac{3}{4}$ plus $\frac{1}{10}$ of the sum I have, plus \$29, exceed that same sum by \$5; what is that sum? *Ans.* \$160.

118. A rod is divided in such sort that the $\frac{1}{3}$ is white, $\frac{1}{5}$ black, $\frac{2}{9}$ blue and the remaining 12 feet are red; what is the length of the rod?

Ans. $49\frac{1}{11}$ feet.

119. I bought a property, and paid by account the $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{8}{9}$ of the price, and I owe yet \$60,635; what did it cost?

Ans. \$109,143.

120. Divide 5 into two such parts that the quotient of greater by the less will be also 5?

Ans. $\frac{5}{6}$ and $4\frac{1}{6}$.

121. With the money I have I would pay $\frac{1}{3}$ of my debts; with \$1,000 more I would acquit myself entirely and have \$200 over; how much have I? How much do I owe?

Ans. \$400 and \$1,200.

122. The third of my money exceeds the $\frac{3}{10}$ by \$35; what do I possess?

Ans. \$1,050.

123. A number is such that in multiplying its fifth by its seventh, it is lessened one-fourth; what is it?

Ans. $26\frac{4}{7}$.

124. If you subtract $\frac{3}{7}$ from a number, 1964 will be the rem.; what is it?

Ans. 3,437.

125. The $\frac{3}{4}$ of $\frac{2}{3}$ of a number augmented $\frac{1}{2}$ of $\frac{5}{6}$ will make 11; what is it?

Ans. 12.

126. Determine a number whose $\frac{1}{2}$ of $\frac{3}{4}$ taken from the $\frac{2}{3}$ of its $\frac{4}{5}$ will give unity for remainder.

Ans. $6\frac{6}{19}$.

127. An article which cost 4,395 shillings was sold for two-third of five times what it cost; what was the gain?

Ans. 10,255 shillings.

128. Determine a number such that, if you multiply it by $\frac{3}{4}$ and divide the product by $4\frac{1}{2}$, the quotient will be 16?

Ans. 96.

129. The fifth part of the sum I have is equal to the same sum diminished \$20; what have I?

Ans. \$25.

130. What number must be added to the $\frac{3}{4}$ and the $\frac{7}{8}$ of 32 to give $67\frac{1}{3}$ for sum?

Ans. $15\frac{1}{3}$.

131. A certain person said: I have spent the $\frac{2}{3}$ of the $\frac{3}{4}$ of what I had, and I have yet \$10; how many had he?

Ans. \$20.

132. If I had \$30 more, I would pay my debts; \$20 less, I would pay but the $\frac{1}{3}$; how much money have I? How much do I owe?

Ans. \$45 and \$75.

133. What sum must be subtracted from the $\frac{5}{7}$ and the $\frac{1}{3}$ of 168 to reduce that number to its $\frac{2}{3}$?

Ans. 64.

134. The sum of two numbers is, 5,760, and their difference is equal to the third of the greater; what are the two numbers?

Ans. 3,456 and 2,304.

135. By what number must you multiply a sum to lessen it $\frac{3}{4}$?
Ans. $\frac{1}{4}$.

136. By what number must you divide a sum to render it once and a half greater? *Ans.* $\frac{2}{5}$.

137. Of three fractions the second is double the first, the third is $\frac{3}{4}$, and their sum is $\frac{7}{9}$; what are the two first fractions?
Ans. $\frac{1}{108}$ and $\frac{1}{54}$.

138. To double a number you must multiply its $\frac{2}{3}$ by its ninth part; what is it? *Ans.* 27.

139. The $\frac{2}{3}$ of one number is equal to the $\frac{4}{9}$ of another, and their difference is 6; determine those two numbers? *Ans.* 18 and 12.

140. The sum of two numbers is 4, and the quotient of the less by the greater is $\frac{5}{7}$; what are they? *Ans.* $2\frac{1}{3}$ and $1\frac{2}{3}$.

141. Divide 60 into two such parts that the $\frac{1}{7}$ of one may be equal to $\frac{1}{8}$ of the other? *Ans.* 32 and 28.

142. The father and son together are 70 years old, the age of the father multiplied by 3 is equal to the son's age multiplied by $7\frac{1}{2}$; what are the ages? *Ans.* 20 and 50.

143. A greyhound starts after a hare that is 82 leaps ahead; while the greyhound makes 9 leaps the hare makes 13, but 3 leaps of the greyhound are equal to 5 leaps of the hare; how many leaps must the greyhound make to catch the hare?
Ans. 369 leaps.

144. A watch marks 12, and both hands are together; required on what part of the dial they will next meet?
Ans. 1 o'clock $5\frac{5}{11}$ minutes.

145. It is just six o clock; when will the hands meet?
Ans. $32\frac{8}{11}$ minutes past 6.

146. It is just twelve; required how many times the hands shall meet from twelve till midnight, and at what o'clock each time?
Ans.

147. The $\frac{2}{3}$ and $\frac{1}{4}$ of a number make 39; what is that number?
Ans. 60.

148. A man can do a piece of work in $\frac{1}{4}$ day, his wife could do the same in $\frac{1}{3}$, and their son in $\frac{1}{2}$ day; what time would the three together take to do it? *Ans.* $\frac{1}{9}$ day.

149. A spring would fill a basin in 3 hours, another would fill it in 5 hours; if the two run together, required in what time they would fill it? *Ans.* $1\frac{7}{8}$ hour.

150. A pump would empty a ditch in $8\frac{1}{4}$ days, another would empty it in $7\frac{3}{5}$; if both work together, in what time will the ditch be dry? *Ans.* $3\frac{80}{151}$ days.

151. A set of workmen can build a wall 45 yards long in 6 days by working 9 hours per day; another set would build it in 8 days by working 7 hours per day: if both work together and work 8 hours a day, in how many days will the wall be built?

Ans. 27 hours $+\frac{54}{110}$, or 3 days 3 hours $+\frac{54}{110}$.

152 Two bands of reapers can reap a field: the first in 4 days, and the second in 5 days; if $\frac{1}{2}$ the first and $\frac{1}{3}$ of the second be employed, in what time will the field be reaped?

Ans. $5\frac{5}{23}$ days.

153. A cock gives 8 gallons of water in 7 minutes, another 5 gallons in 6 minutes; how many gallons do both give in one minute?

Ans. $1\frac{41}{42}$ gallons.

154. A person questioned about his age answered: the $\frac{2}{3}$ and the $\frac{1}{5}$ of my age plus 7 years, just make my age 3 years hence; what is his age?

Ans. 30 years.

155. The double of a sum augmented $\frac{1}{2}$, $\frac{1}{4}$ and $\frac{1}{6}$ of the same sum and \$5 more make \$75; what is that sum? *Ans.* \$24.

156. A water-spout would fill a basin in $\frac{1}{5}$ hour; another would do the same in $\frac{1}{8}$ hour; and a third in $\frac{1}{7}$ hour; in what time would the three running together fill it?

Ans. $\frac{1}{20}$ hour or 3 minutes.

157. I can do a piece of work in 4 days; my brother can do the same in 5 days; if we both work together, in what time will it be done?

Ans. $2\frac{2}{9}$ days.

158. A set of workmen can sink a well in 9 days, another can do it in 10 days, and a third in 12 days; now if I employ $\frac{1}{4}$ of the first band, $\frac{1}{3}$ of the second, and $\frac{1}{2}$ of the third, in what time will the well be dug out?

Ans. $9\frac{27}{37}$ da[illegible].

159. A basin has three cocks: two destined to fill it, and a third to empty it. The first cock would fill the basin alone in 4 hours, the second in three hours, and the third would empty it in 6 hours; now if the three be opened together, in what time will it be filled?

Ans. $2\frac{2}{5}$ hours.

160. A basin has three cocks: two to fill, and one to empty it. The first would fill it alone in 4 hours, the second in 5 hours, and the third would empty it in 2 hours. The basin being already full, the three cocks are opened together; in what time will it be empty?

Ans. 20 hours.

161. A workman can do a piece of work in $\frac{3}{4}$ day, another can do it in $\frac{5}{6}$ day; if the two work together, in what time will it be done?

Ans. $1\frac{1}{38}$ day.

162. A mother divides a certain number of sugar-plums between

her three daughters; the youngest receives the $\frac{2}{5}$ of the whole, the second $\frac{1}{3}$, and the third 12 for her part; how many were there, and what was the part of each?

Ans. Total 45; 12, 15, 18, respectively.

163. The $\frac{3}{5}$ and the $\frac{1}{3}$ of what I have in my purse, with \$10 more, would make \$6 more than I have; what does the purse contain? *Ans.* \$60.

164. The triple of a sum added to the $\frac{1}{3}$ and $\frac{1}{4}$ of the same sum, and \$5,000 more, would make \$22,200; what is that sum?

Ans. \$4,800.

165. The difference between the $\frac{3}{5}$ and the $\frac{5}{6}$ of a number is 12; what is that number? *Ans.* 216.

166. The total of the $\frac{2}{3}$ and the $\frac{3}{4}$ of a number, diminished the $\frac{1}{2}$ of the same number gives 14; what is the number?

Ans. 24.

167. Two cocks running together would fill a basin in 2 hours; one alone would fill it in 5: in what time would the other fill it if it were to run alone? *Ans.* $3\frac{1}{3}$ hours.

168. I spent the $\frac{2}{3}$ of what I had in my purse, and if I add \$44 to what remains, the sum it contained first will be augmented $\frac{1}{4}$; what did it contain? *Ans.* \$48.

169. One cock runs 11 gallons in 8 minutes, another runs 7 gallons in 5 minutes; which runs the most?

Ans. The second, by $\frac{1}{40}$ gal. per min.

170. A basin receives $45\frac{3}{4}$ gallons of water per hour by a cock, and leaks by a hole $37\frac{3}{5}$ gallons; how many gallons does it retain per hour? *Ans.* $7\frac{3}{20}$ gallons.

171. A certain person not recollecting what he paid for an article, only remembers that there were \$14 difference between the $\frac{3}{4}$ and the $\frac{2}{5}$ of the price; what is it? *Ans.* \$40.

172. The $\frac{6}{7}$ of a number diminished the $\frac{3}{5}$ of the same number gives 18 for rem.; what is that number? *Ans.* 70.

173. The sum of the $\frac{4}{5}$ and the $\frac{3}{10}$ of a number less one-half of the same number, gives 24; what is that number? *Ans.* 40.

174. Two workmen can do a piece of work in 3 hours, one alone can do it in 7 hours; in what time will the other do it alone?

Ans. $5\frac{1}{4}$ hours.

175. Three cocks running together would fill a basin in 4 hours; one of them would fill it alone in 10 hours, another would fill it in 12 hours; what time would the third running alone take to fill the basin? *Ans.* 15 hours.

176. The quarter of a field is sown with wheat, the $\frac{3}{7}$ with barley

and the remainder with oats. The portion sown with barley contains 10 acres more than that sown with wheat; required the extent of the whole field and that of each part?

Ans. Whole extent 56 acres; 14 wheat, 24 barley, 18 oats.

177. I have already sold the $\frac{4}{5}$ of a basket of eggs, and if I add 39 eggs to what remains, the primitive value of the basket will be augmented one-half, how many eggs were there in the basket?

Ans. 30.

178. A steam-loom weaves 5 yards of cloth in 3 hours, another 12 yds. in 7 hours; which has the greater power?

Ans. The latter weaves $\frac{1}{21}$ yd. per hour more than the former.

179. A ribbon was cut into 5 parts of $\frac{3}{8}$ yd. each; what was its length?

Ans. $1\frac{7}{8}$ yd.

180. A tradesman can do a piece of work in $5\frac{2}{3}$ days; in what time will he do the $\frac{7}{8}$ of the work?

Ans. $4\frac{2}{24}\frac{3}{4}$ days.

181. A ship sails at the rate of $16\frac{1}{2}$ miles an hour; how many miles will she sail in $3\frac{4}{7}$ hours?

Ans. $63\frac{9}{14}$ miles.

182. A weaver weaves 7 yards of linen in 8 hours; how many yards will he weave in $4\frac{5}{6}$ hours?

Ans. $4\frac{1}{4}\frac{1}{8}$ yds.

183. A man weaves 7 yards of linen in 8 hours; what time will he take to weave $4\frac{5}{6}$ yds.?

Ans. $5\frac{1}{21}$ hours.

184. If 5 gallons of wine be mixed with 7 gallons of water; required what quantity of water in $\frac{3}{4}$ gallon of the mixture?

Ans. $\frac{1}{4}\frac{5}{8}$ gallon of wine $\frac{2}{4}\frac{1}{8}$ of water.

185. If the $\frac{5}{6}$ of the $\frac{8}{9}$ of a number make 120, what is it?

Ans. 162.

186. A person being asked the time of day answered; it is the $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of 24 hours; what o'clock was it? *Ans.* 10 o'clock.

187. Divide a succession between three heirs in such sort that the first may have the $\frac{3}{7}$ of the whole, and the second the $\frac{2}{3}$ of the remainder; what is the part of each?

Ans. First $\frac{3}{7}$, second $\frac{8}{21}$, and the third $\frac{4}{21}$.

188. A sum of money was employed in four successive purchases. For the first purchase the $\frac{2}{5}$ of the sum was laid out; for the second, $\frac{1}{2}$ of the remainder; for the third, the $\frac{2}{3}$ of the second remainder; and finally, for the fourth the last remainder, which was $5; required the total sum, and the amount of each purchase?

Ans. Total $50; first $\frac{2}{5}$, second, $\frac{3}{15}$, third $\frac{2}{10}$, fourth $\frac{1}{10}$.

189. A certain person leaves to his nephew a fortune of $80,000, and orders the $\frac{1}{5}$ of $\frac{3}{4}$ of the succession to be given to a servant,

and to his nurse $\frac{1}{5}$ of $\frac{1}{2}$ of $\frac{1}{8}$ of the same succession; what is the portion of each?

Ans. Neph. \$73,000, servt. \$6,000, nurse \$1,000.

190. The $\frac{2}{3}$ of $\frac{4}{5}$ of the length of a garden is 48 yards; what is the length of it?

Ans. 90 yards.

191. Three robbers divide between themselves a sum of money that they had stolen; the first takes the $\frac{2}{5}$ of it, and the two others take each half of what remained; what part fell to each robber?

Ans. First $\frac{2}{5}$ of the sum, and the two others $\frac{3}{10}$ each.

192. A stage performs a journey in four days. The first day it travels the $\frac{1}{5}$ of the whole route; the second day it travels the $\frac{1}{3}$ of the remainder; the third day it travels the $\frac{1}{2}$ of the second remainder; and lastly, the fourth day it completes the journey, and goes 144 miles; required the length of the journey, and each day's travelling?

Ans. Length 540 miles; first day 108 miles, and each of the other days 144 miles.

193. A tradesman can finish a piece of work in $\frac{2}{3}$ of a day, another can do the same in $\frac{4}{5}$ day: 1st. What time will they take to do it together? 2d. What part of the work will be done by each? 3d. What will be the gain of each, if the whole be worth 4s. 7d.?

Ans. 1st., $\frac{4}{11}$ day; 2d., the 1st. $\frac{6}{11}$ of the work, the 2d. the $\frac{5}{11}$; 3d., the 1st. will have 2s. 6d., the 2d. 2s. 1d.

194. A little boy playing marbles augmented his number $\frac{1}{3}$ the first day; on the next day he augmented his last number $\frac{1}{4}$; finally, he plays a third day, and augments his last number $\frac{2}{5}$, and finds himself master of 63 marbles; how many had he when he began to play?

Ans. 27.

195. What number multiplied by $3\frac{3}{4}$ will give 1 for product?

Ans. $\frac{4}{15}$.

196. In 8 hours $5\frac{3}{3}$ yards are woven, in what time will 1 yard be woven?

Ans. $1\frac{7}{17}$.

197. A ship sails at the rate of $29\frac{2}{5}$ miles in $3\frac{2}{3}$ hours, what is that per hour?

Ans. $8\frac{1}{5}\frac{1}{5}$ miles per hour.

198. While a locomotive runs the whole route, a stage runs but the $\frac{2}{11}$ of it; how many times does the locomotive go quicker than the stage?

Ans. $5\frac{1}{2}$ times quicker.

199. A ship is victualled for 12 days only; and must be kept on sea during 18 days; to what must the daily rations of each man be reduced?

Ans. $\frac{2}{3}$ of one.

200. Four labourers work together and are paid equally. Now the first who worked the whole day received 4s. 2d. while the

second received but 3s. 4d., the third 2s. 6d., and the fourth 1s. 8d. Required what part of the day the three last labourers worked?

Ans. The second $\frac{1}{5}$ day, 3rd $\frac{3}{5}$, 4th $\frac{2}{5}$ day.

201. A spinning-wheel takes in $1\frac{1}{8}$ yard of thread every turn it makes; how many turns should it make to wind up $45\frac{3}{3}$ yards?

Ans. $40\frac{1}{2}\frac{6}{7}$ turns.

202. An omnibus takes $\frac{1}{2}$ hour to reach its destination, it stations $\frac{1}{5}$ hour, and takes $\frac{1}{3}$ hour to return to its starting place. Admitting that a trip is composed of going to and from the station; how many such trips will the omnibus perform from half-past seven in the morning till 10 o'clock at night?

Ans. $14\frac{1}{3\,1}$ trips.

203. A traveller having missed the stage, it is already 29 miles a-head of him. He then takes a calash that goes at the rate of 9 miles an hour, the stage travelling out $5\frac{1}{4}$ miles per hour. In what time will the calash overtake the stage?

Ans. 7 hours 44 minutes.

204. There is 29 miles distance between two towns. Two carriages start, one from each town and run towards each other, the first goes at the rate of 9 miles per hour, and the second $5\frac{1}{4}$ miles per hour; in what time will the carriages meet, and what will be the distance performed by each?

Ans. $2\frac{2}{5\,7}$ hours. One $18\frac{1}{5}\frac{3}{7}$ miles, other $10\frac{3}{5}\frac{9}{7}$ miles.

205. Two carriages travel at the rate of 9 miles and $5\frac{1}{4}$ miles respectively, start together from the same town to reach the neighbouring town distant 29 miles. In what time will the former arrive before the latter? *Ans.* $2\frac{5}{1}\frac{7}{8}\frac{7}{9}$ hours.

206. A saloon requires $8\frac{1}{2}$ pieces of wall-paper $\frac{2}{3}$ yard wide to line it. How many pieces $\frac{4}{9}$ yard wide would do the same?

Ans. $12\frac{3}{4}$.

207. A spring runs $8\frac{3}{4}$ gallons of water in 5 minutes; in what time will it run a gallon? *Ans.* $\frac{4}{7}$ minute.

208. A weaver weaves $9\frac{2}{5}$ yards of cloth in $2\frac{5}{6}$ days; how many yards does he weave per day? *Ans.* $3\frac{2}{8}\frac{7}{5}$.

209. I sold the $\frac{4}{7}$ of a piece of cloth and there remains yet 15 yards; what was the length of the piece?

Ans. 35 yards.

210. A bale of merchandise was sold for \$75; if it had been sold for \$9 more, the profit would have been just $\frac{2}{5}$ of the first cost; what did it cost? *Ans.* \$60.

211. The rail cars start from New York at noon and arrive at Philadelphia at 4 o'clock P. M. A stage started with the cars, and

went but the $\frac{3}{7}$ of the route: at what o'clock will the stage arrive at Philadelphia? A. M. *Ans.* Next day at 2 o'clock A. M.

212. While a horseman goes the $\frac{2}{9}$ of a journey a footman can only travel the $\frac{4}{15}$; how many times does the horseman go quicker than the footman? *Ans.* $3\frac{1}{3}$ times quicker.

213. What time will two water-spouts take to fill a basin that holds 508 gallons, if one runs $5\frac{3}{4}$ gallons per minute, and the other $4\frac{5}{6}$ gallons. *Ans.* 48 minutes.

214. A garrison has provisions for 9 days only, and must hold out for 12 days: to what fraction must the daily rations of each man be reduced? *Ans.* to $\frac{3}{4}$ of usual.

215. A watch is now regular, gets out of order and advances $5\frac{1}{2}$ minutes in a day; in how many days will it again mark the exact time? *Ans.* $130\frac{10}{11}$ days.

216. Three writers equally clever can write 40 pages each per day; now if the first write but 30 pages, the second 25, and the third 20: required during what portion of the day each worked?

Ans. 1st. $\frac{3}{4}$, 2nd. $\frac{5}{8}$, 3rd $\frac{1}{2}$ day.

217. If a bucket takes $1\frac{1}{3}$ minute to reach the bottom of a well and remains $\frac{1}{4}$ minute below, then $1\frac{2}{3}$ minute ascending, how many buckets of water may be drawn in 250 minutes.

Ans. 72 buckets.

218. Two couriers start at the same time at a distance of $92\frac{1}{4}$ miles apart, to meet each other and travel; the first 7 miles an hour, the second $13\frac{1}{2}$ miles an hour: in what time will they meet, and what will be the distance travelled by each?

Ans. In $4\frac{1}{2}$ hours. The first travelled $31\frac{1}{2}$ miles, the second $60\frac{3}{4}$ miles.

219. A fox that makes $2\frac{1}{3}$ leaps in a second is already $30\frac{3}{4}$ leaps a-head, when a dog that makes $4\frac{1}{2}$ leaps in a second starts after him. In what time will the dog overtake the fox?

Ans. $14\frac{5}{26}$ seconds.

220. Two couriers start at the same time from the same place for a neighbouring town distant $92\frac{1}{4}$ miles, the first travels $13\frac{1}{2}$ miles an hour, the second 7 idem: how many hours will the first arrive before the second? *Ans.* $6\frac{2}{8}\frac{2}{4}$ hours.

221. A courier goes 24 miles in 2 hours. Three hours after his departure another starts and goes 72 miles in 5 hours, in how many hours will the latter overtake the former?

Ans. 15 hours.

222. With $13\frac{2}{3}$ yards of old silk $\frac{3}{4}$ wide I can line a vestment: how many yards $\frac{4}{5}$ wide will do the same? *Ans.* $12\frac{1}{16}$ yards.

223. There is a levy of $800 to be taken of three villages in proportion to their inhabitants, in the first there are 240, second 510, third 450 inhabitants: what share of the impost will each have to pay? *Ans.* 1st. $160, 2nd. $340, 4th. $300.

224. An uncle on his death-bed bequeathes to his three nephews a fortune of $67,500 in proportion to their age. The first is 30, the second 25, the third 20 years of age: required what will fall to each? *Ans.* 1st. $27,000, 2nd. $22,500, 3rd. $18,000.

225. Divide the number 1,028 into three parts so that they be between themselves as the three fractions, $\frac{2}{3}$, $\frac{7}{8}$, $\frac{3}{5}$?

Ans. 320, 420, 288.

226. Divide $450 between three persons so that the second may have the $\frac{3}{4}$ of the first, and the third the $\frac{2}{7}$ of what the two first have together? *Ans.* $200, $150, $100.

227. Divide 100 shillings between two persons, and give the second the $\frac{2}{3}$ of the first? *Ans.* 60, 40 shillings.

228. Divide $180 between two persons, and give the second $\frac{1}{4}$ of the first's part more than the first? *Ans.* $80, $100.

229. Divide $\frac{3}{5}$ into two parts so that they be between themselves as 4 and 7? *Ans.* $\frac{1}{5}\frac{2}{5}$, $\frac{2}{5}\frac{1}{5}$.

230. The power of one machine is to that of another as 6 is to 7, while one makes 48 yards of work: how many will the other make? *Ans.* 56 yards.

231. Distribute $582 between 3 persons so that the part of the first be to the second as $\frac{1}{2}$ is to $\frac{3}{4}$, and that the part of the second be to that of the third as $\frac{2}{3}$ is to $\frac{3}{7}$? *Ans.* $168, $252, $162.

232. What is the superficies of a rectangular garden, being 40 yards long by 30 yards in breadth? *Ans.* 1,200 yards.

233. What is the area of a meadow in the form a triangle of 60 yards of base and 48 in height? *Ans.* 1,440 yards.

234. What is the area of a yard forming a trapezium one of whose sides is 34 yards and the other 56, its height being 25 yards? *Ans.* 1,125 yards.

235. What is the area of a rhombus, whose base is $44\frac{7}{10}$ and height $38\frac{2}{5}$ yards? *Ans.* $1,716\frac{12}{25}$ yards.

236. What is the superficies of a pillar 17 yards high and 7 yards in circumference? *Ans.* 119 yards.

237. The circumference of a cone is 12 yards, and the distance from the summit to the base is 6 yards; what would the painting of it cost at 3 shillings the square yard?

Ans. 108 shillings.

A Table for finding the Interest of any sum of Money for any number of months, weeks, or days, at any rate per cent.

Year.	*Calen. Month.*			*Week.*			*Day.*		
£	£	*s.*	*d.*	£	*s.*	*d.*	£	*s*	*d.*
1	0	1	8	0	0	4½	0		0½
2	0	3	4	0	0	9	0	0	1¼
3	0	5	0	0	1	1¾	0	0	2
4	0	6	8	0	1	6	0	0	2½
5	0	8	4	0	1	11	0	0	3¼
6	0	10	0	0	2	3¾	0	0	4
7	0	11	8	0	2	8¼	0	0	4½
8	0	13	4	0	3	1	0	0	5¼
9	0	15	0	0	3	5½	0	0	6
10	0	16	8	0	3	10¼	0	0	6½
20	1	13	4	0	7	8¼	0	1	1¼
30	2	10	0	0	11	6½	0	1	7¾
40	3	6	8	0	15	4½	0	2	2¼
50	4	3	4	0	19	2¾	0	2	9
60	5	0	0	1	3	1	0	3	3½
70	5	16	8	1	6	11	0	3	10
80	6	13	4	1	10	9¼	0	4	4½
90	7	10	0	1	14	7¼	0	4	11¼
100	8	6	8	1	18	5½	0	5	5¾
200	16	13	4	3	16	11	0	10	11½
300	25	0	0	5	15	4½	0	16	5¼
400	33	6	8	7	13	10	1	1	11
500	41	13	4	9	12	3½	1	7	4¾
600	50	0	0	11	10	9	1	12	10½
700	58	6	8	13	9	2¾	1	18	4¼
800	66	13	4	15	7	8½	2	3	10
900	75	0	0	17	6	1¾	2	9	3¾
1000	83	6	8	19	4	7¼	2	14	9½
2000	166	13	4	38	9	2¾	5	9	7
3000	250	0	0	57	13	10	8	4	4½
4000	333	6	8	76	18	5½	10	19	2
5000	416	13	4	96	3	0¾	13	13	11½
6000	500	0	0	115	7	8¼	16	18	9
7000	583	6	8	134	12	3½	19	3	6¾
8000	666	13	4	153	16	11	21	18	4¼
9000	50	0	0	173	1	6¼	24	13	1¾
10,000	833	6	8	192	6	1¾	27	7	11¼
20,000	1666	13	4	384	12	3½	54	15	10½
30,000	2500	0	0	576	18	5½	82	3	10

RULE. Multiply the principal by the rate per cent., and the number of months, weeks, or days, which are required, cut off two figures on the right hand side of the product, and collect from the table the several sums against the different numbers, which when added, will make the number remaining. Add the several sums together, and it will give the interest required.

N. B. For every 10 that is cut off in months, add twopence; for every 10 cut off in weeks, add a half-penny; and for every 40 in the days, 1 farthing.

EXAMPLES.

1. What is the interest of £2467 10s. for 10 months, at 4 per cent. per annum?

2467 : 10	900=75 : 0 : 0
4	80= 6 : 13 : 4
9870 : 0	7= 0 : 11 : 8
10	987=82 : 5 : 0
987|00	

2. What is the interest of £2467 10s. for 12 weeks, at 5 per cent.?

2467 : 10	1000=19 : 4 : 7¼
5	400= 7 : 13 : 10
12337 : 10	80= 1 : 10 : 9¼
12	50= 0 : 0 : 2½
1480|50 : 0	1480|50=28 : 9 : 5

3. What is the interest of £2467 10s., 50 days, at 6 per cent.?

2467 : 10	7000=19 : 3 : 6½
6	400= 1 : 1 : 11
14805 : 0	2= 0 : 0 : 1¼
50	50= 0 : 0 : 0¼
7402|50 : 0	7402|50=20 : 5 : 7

To find what an Estate, from one to £60,000 per annum will come to for one day.

RULE 1. Collect the annual rent or income from the table for 1 year, against which take the several sums for one day, add them together, and it will give the answer.

An estate of £376 per annum, what is that per day?

300=0 : 16 : 5¼
70=0 : 3 : 10
6=0 : 0 : 4

376=1 : 0 : 7¼

To find the amount of any income, salary, or servants' wages, for any number of months, weeks, or days.

RULE. Multiply the yearly income or salary by the number of months, weeks, or days, and collect the product from the table.

What will £270 per annum come to for 11 months, for 3 weeks, and for 6 days?

For 11 months,

270 × 11 = 2970

2000=166 : 13 : 4
900= 75 : 0 : 0
70= 5 : 16 : 8

2970=247 : 10 : 0

For 3 weeks.

270 × 3 = 810

800=15 : 7 : 8¼
10= 0 : 3 : 10¼

= 15 : 11 : 6½

For 6 days.

270 × 6 = 1620

1000=2 : 14 : 9½
600=1 : 12 : 10½
20=0 : 1 : 1¼

1620=4 : 8 : 9¼

For the whole time.

247 : 10 : 0
15 : 11 : 6½
4 : 8 : 9¼

267 : 10 : 3¾

A Table showing the number of days from any day in the month to the same day in any other month, through the year.

FROM	TO											
	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
January . .	365	31	59	90	120	151	181	212	243	273	304	334
February .	334	365	28	59	89	120	150	181	212	242	273	303
March . .	306	337	365	31	61	92	122	153	184	214	245	275
April	275	306	334	365	30	61	91	122	153	183	214	244
May	245	276	304	335	365	31	61	92	123	153	184	214
June	214	245	273	304	334	365	30	61	92	122	153	183
July	184	215	243	274	304	335	365	31	62	92	123	153
August . . .	153	184	212	243	273	304	335	365	31	61	92	122
September	122	153	181	212	242	273	303	334	365	30	61	91
October . .	92	123	151	182	212	243	273	304	335	365	31	61
November .	61	92	120	151	181	212	242	273	304	334	365	30
December .	31	62	90	121	151	182	212	243	242	304	335	365

A COMPENDIUM OF BOOK-KEEPING.

BY SINGLE ENTRY.

BOOK-KEEPING is the art of recording the transactions of persons in business so as to exibit a state of their affairs in a concise and satisfactory manner.

Books may be kept either by *Single* or by *Double Entry*, but *Single Entry* is the method chiefly used in retail business.

The books found most expedient in Single Entry, are the *Day-Book*, the *Cash-Book*, the *Ledger*, and the *Bill-Book*.

The Day-Book begins with an account of the trader's property, debts, &c.; and are entered in the order of their occurrence, the daily transactions of goods bought and sold.

The Cash-Book is a register of all money transactions. On the left-hand page, *Cash* is made *Debtor* to all sums received; and on the right, *Cash* is made *Creditor* by all sums paid.

The Ledger collects together the scattered accounts in the Day-Book and Cash-Book, and places the Debtors and Creditors upon opposite pages of the same folio; and a reference is made to the folio of the books from which the respective accounts are extracted, by figures placed in a column against the sums. References are also made in the Day-Book and Cash-Book, to the folios in the Ledger, where the amounts are collected. This process is called *posting*, and the following general rule should be remembered by the learner, when engaged in transferring the register of mercantile proceedings from the previous books to the Ledger:

The person from whom you purchase goods, or from whom you receive money, is *Creditor;* and, on the contrary, the person to whom you sell goods, or to whom you pay money, is *Debtor*.

In the Bill-Book are inserted the particulars of all *Bills of Exchange;* and it is sometimes found expedient to keep for this purpose two books, into one of which are copied *Bills Receivable*, or such as come into the tradesman's possession, and are drawn upon some other person; in the other book are entered *Bills Payable*, which are those that are drawn upon and accepted by the tradesman himself.

DAY BOOK. (folio 1.)

Folio of Ledger.	January 1st, 1837.	£	s.	d.
1	I commenced business with a capital of Five Hundred Pounds in Cash	500	0	0
	2d.			
	*Bennett and Sons, London,** Cr.			
	By 2 hhds. of sugar			
	cwt. qr. lb. cwt. qr. lb.			
	13 1 4 1 2 0			
	12 3 16 1 1 6			
	gross wt. 26 0 20			
	tare 2 3 6			
	neat wt. 23 1 14 at 63s. per cwt.	73	12	7
	2 chests of tea			
	cwt. qr. lb. lb.			
	1 0 15 25			
	1 0 12 25			
	2 0 27			
	1 22			
	1 3 5 at 6s. per lb.	60	6	0
1		133	18	7
	3d.			
	Hall and Scott, Liverpool, Cr.			
	By soap, 1 cwt. at 68s.....	3	8	0
	candles, 10 dozen at 7s. 9d.....	3	17	6
1		7	5	6
	6th.			
	Ward, William Dr.			
	To 1 cwt. of sugar, at 70s.....	3	10	0
	14 lbs. of tea, at 8s.....	5	12	0
	¼ cwt. of soap, at 74s.....	0	18	6
1		10	0	6
	6th.			
	Cooper, William Dr.			
	To 1 sugar hogshead.....	0	6	6
2				

* The student may be directed to fill up this and similar blanks in this book and the Ledger with the names of places familiar to him

DAY BOOK. (folio 2.)

		£	s.	d.
	January 9th. 1837.			
	Johnson, Richard Dr.			
	To 2 dozen of candles, at 8s. 3d.....	0	16	6
	½ cwt. of soap, at 74s.....	1	17	0
	½ cwt. of sugar, at 70s.....	1	15	0
2		4	8	6
	10th.			
	Ward, William Dr.			
	To sugar, 1 cask			
	cwt. qrs. lb.			
	gross wt. 5 2 10 cask.....	0	5	0
	tare 2 10			
	neat 5 0 0 at 68s.....	17	0	0
1		17	5	0
	12th.			
	Smith, John Dr.			
	To 14 lb. of sugar.....	0	9	0
	12 lb. of candles.....	0	8	6
	7 lb. of soap.....	0	4	9
	1 lb. of tea.....	0	8	3
2		1	10	6
	14th.			
	Hall and Scott, Liverpool, Cr.			
	By 2 cwt. soap, at 68s.....	6	16	0
1				
	17th.			
	Newton, John Dr.			
	To 21 lb. of soap, at 74s. per cwt....	0	13	10
	2 dozen of candles, at 8s. 3d.....	0	16	6
2		1	10	4
	19th.			
	Smith, John Dr.			
	To 14 lb. of sugar.....	0	9	0
	½ lb. of tea.....	0	4	2
2		0	13	2
	21st.			
	Smith, John Dr.			
	To 28 lb. of sugar.....	0	18	0
	12 lb. of candles.....	0	8	3
2		1	6	3

DAY BOOK (folio 3.)

		£	s	d.
	January, 23d., 1837.			
	Yates & Lane, Bradford, Cr.			
2	By 4 pieces of superfine cloth, each 36 yards, at 24s. per yard...	172	16	0
	23d.			
	Edwards, Benj. Manchester, Cr.			
3	By 2 pieces of calico, each 24 yards, at 1s. per yard	2	8	0
	23d.			
	Smith, John Dr.			
2	To 14 lb. of soap.....	0	9	6
	24th.			
	Johnson, Richard Dr.			
	To 2 dozen of candles, at 8s. 3d.....	0	16	6
	1 cwt. of soap, at 74s.....	3	14	0
	1½ cwt. of sugar, at 70s.....	5	5	0
2		9	15	6
	24th.			
	Smith, John Dr.			
2	To 1 lb. of tea.....	0	8	3
	26th.			
	Mason, Edward Dr.			
	To 3 pieces of superfine cloth, each 36 yards, at 27s. per yard....	145	16	0
	2 pieces of calico, each 24 yards, at 1s. 2d. per yard..	2	16	0
3		148	12	0
	27th.			
	Parker, Thomas Dr.			
3	To 1 piece of superfine cloth, 36 yards, at 28s...	50	8	0
	31st.			
	Bills Payable, Cr.			
3	By Yates & Lane's Bill at 2 months, due April 2.	172	16	0
	Inventory, January 31, 1837.			
	cwt. qr. lb.			
	Raw sugar, 14 3 14 at 63s.....	46	17	1
	Tea, 1 2 16½ at 6s. per lb.....	55	7	0
	Soap, 0 3 14 at 68s.....	2	19	6
	Candles, 2 dozen, at 7s. 9d.....	0	15	6
3		105	19	1

(Folio 1.)

CASH BOOK.

(Folio 1.)

1837	*Dr.* CASH.		£	*s.d.*
Jan. 1.	To cash for amount of capital.....	1	500	0 0
6	William Cooper	2	0	6 6
	Bernard & Co., Bill on Banks & Co.. London, due March 6	1	133	18 0
10	William Ward, Bill at 2 months...	1	27	5 6
14	Richard Johnson, Cash, (abated 6d).	2	4	8 0
21	John Smith, Cash, (abated 5d)....	2	3	9 6
23	John Newton, on account	2	0	15 0
30	Edward Mason, Bill at 6 weeks ...	3	150	0 0
31	Thomas Parker, Cash on account..	3	10	0 0
	My acceptance at 2 months brought from the Bill-book.....folio	1	172	16 0
			1002	18 6

1837	CASH *Cr.*		£	*s.d.*
Jan. 2.	By Bernard & Co., Cash	1	480	0 0
6	Bennett & Sons, London, Bill at 2 months, dated January 4, (abated 7d).....	1	133	18 0
10	A sugar cask		0	5 0
	Bernard and Co., W. Ward's Bill, due March 13	1	27	5 6
16	Hall & Scott, Cash, (abated 1s. 6d).	1	14	0 0
23	Benjamin Edwards, Cash	3	2	8 0
30	Postage of a letter.....		0	1 6
	Edward Mason, Cash out of Bill ..	3	1	8 0
31	Yates & Lane, my acceptance	2	172	16 0
	Balance on hand, Bill due, March 16		150	0 0
	Cash		20	16 6
			1002	18 6

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(folio 1.) **LEDGER.** (folio.)

1837.	*Dr.* STOCK.		£	s.	d.	1837.	STOCK *Cr.*		£	s.	d.
Jan. 31	To balance account	3	423	7	11	Jan. 1	By amount of Capital	1	500	0	0
	Amount of inventory	3	105	19	1		Balance, being the profit on the transactions of this month		29	7	0
			529	7	0				529	7	0
1837.	*Dr. Barnard & Co.*					1837.	*Bankers,* * *Cr.*				
Jan. 2	To Cash	1	480	0	0	Jan. 6	By Bill due March 6	1	133	18	0
10	Bill due March 13	1	27	5	6		Commission		1	5	0
	Interest		2	7	7		Balance	3	374	10	1
			509	13	1				509	13	1
1837.	*Dr. Bennett & Sons.*					1837.	*London,* *Cr.*				
Jan. 6	To bill	1	133	18	0	Jan. 2	By Goods	1	133	18	7
	Abated		0	0	7						
			133	18	7						
1837.	*Dr. Hall & Scott.*					1837.	*Liverpool,* *Cr.*				
Jan. 16	To Cash	1	14	0	0	Jan. 3	By Goods	1	7	5	6
	Abated		0	1	6	14	Ditto	2	6	16	6
			14	1	6				14	1	6
1837.	*Dr. William Ward.*					1837.	*Cr.*				
Jan. 6	To Goods	1	10	0	6	Jan. 10	By Bill at 2 months	1	27	5	6
10	Ditto	2	17	5	0						
			27	5	6						

* See Note, page 201.

(folio 2.) **LEDGER.** (folio 2.)

1836,	*Dr. William Cooper*		£	s.	d.	1837.	*Cr.*		£	s.	d
Jan. 7	To goods	1	0	6	6	Jan. 6	By Cash	1	0	6	6

10	Ditto	2	17	5	0				
			27	5	6				

* See Note, page 201.

1836, Jan. 7	*Dr. William Cooper* To goods	1	£ 0	s. 6	d. 6	1837. Jan. 6	*Cr.* By Cash	1	£ 0	s. 6	d 6
1836. Jan. 7	*Dr. Richard Johnson* To goods	2	4	8	6	1837. Jan. 14	*Cr.* By Cash Abated	1	4 0	8 0	0 6
									4	8	6
Jan. 24	ditto	3	9	15	6		Balance	3	9	15	6
1837. Jan. 12	*Dr. John Smith* To goods	2	1	10	6	1837. Jan. 21	*Cr.* By Cash Abated		3 0	9 0	6 5
19	ditto	2	0	13	2				3	9	11
21	ditto	2	1	6	3						
			3	9	11						
23	ditto	3	0	9	6						
24	ditto	3	0	8	3						
			0	17	9		Balance	3	0	17	9
1837. Jan. 17	*Dr. John Newton* To goods	2	1	10	4	1837. Jan, 23	*Cr.* By Cash Balance	1 3	0 0	15 15	0 4
									1	10	4
1837. Jan. 31	*Dr. Yates and Lane* To Bill	1	172	16	6	1837. Jan. 23	*Bradford,* *Cr.* By Goods	3	172	16	0

1837.	*Dr. Benj. Edwards*		£	s.	d.
Jan. 23	To Cash	1	2	8	0
1837.	*Dr. Edward Mason*				
Jan. 26	To goods	3	148	12	0
30	Cash	1	1	8	0
			150	0	0
1837.	*Dr. Thomas Parker*				
Jan. 27	To goods	3	50	8	0
1837.	*Dr. Bills payable*				
	Balance	3	172	16	0

GENERAL.

1837.	*Dr. Balance*	£	s.	d.				
Jan. 31	To Bill due March 16	150	0	0	1			
	deduct discount	0	18	1		149	1	11
	To Cash				1	20	16	6
	Bernard & Co. owe				1	374	10	1
	Richard Johnson				2	9	15	6
	John Smith				2	0	17	9
	John Newton				3	0	15	4
	Thomas Parker				3	40	8	0
						596	5	1

1837.	*Manchester,* Cr.		£	s.	d.
Jan. 23	By goods	3	2	8	0
1839.	Cr.				
Jan. 30	By Bill	1	150	0	0
1837.	Cr.				
Jan. 21	By Cash	1	10	0	0
	Balance	3	40	8	0
			50	8	0
1837.	Cr.				
Jan. 31	By Yates & Lane's Bill	3	172	16	0

BALANCE.

Balance, Cr.	£	s.	d.				
By Bills pay'le, due Ap. 2,	172	16	0	3			
deduct discount	1	8	10		171	7	2
By 1 month's rent					1	10	0
Stock				1	423	7	11
					596	5	1

Thomas Parker	2...	3	40	8	0				
			596	5	1				596	5	1