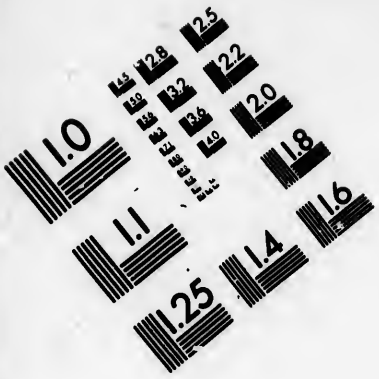

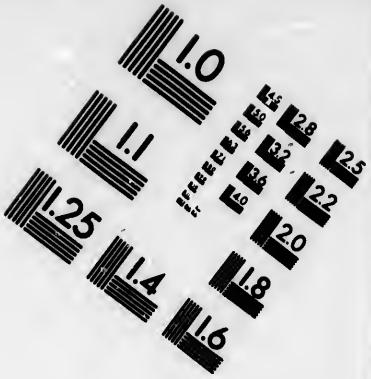

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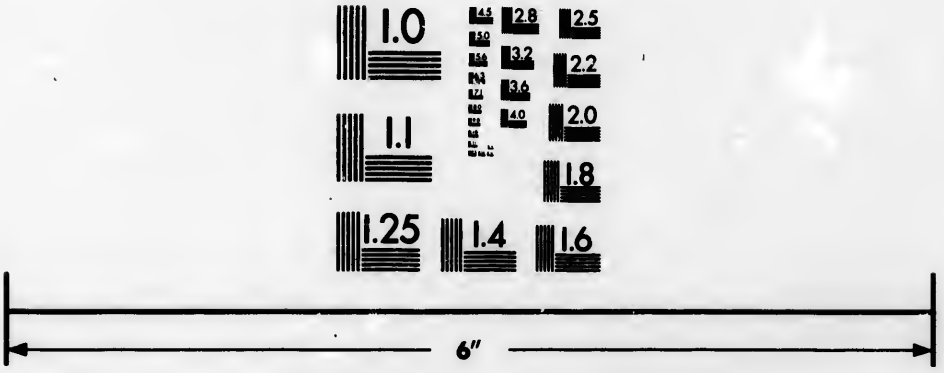

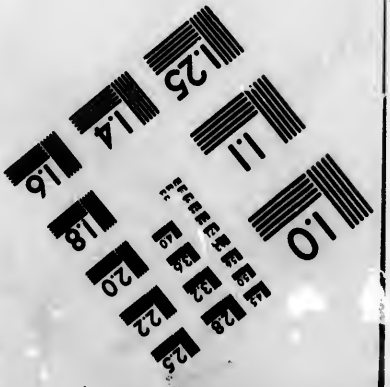

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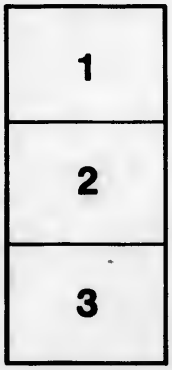

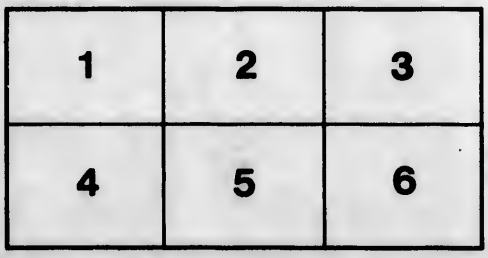

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THE TUTOR'S ASSISTANT,

BEING A

COMPENDIUM OF ARITHMETIC,

AND A

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 large 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; in which are set down *Rules* for the easy calculation of *Interest*, *Annuities*, and *Pensions* in *Arrears*, the *present worth* of *Annuities*, &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. The *Mensuration of Circles*, &c.

VI. A *Collection* of *Questions* set down promiscuously, for the greater Trial of the foregoing *Rules*.

VII. A general Table for the ready calculating the *Interest* of any Sum of Money, at any Rate per Cent. likewise *Rents*, *Salaries*, &c.

TO WHICH IS ADDED,

AN APPENDIX

ON CIRCULATING DECIMALS.

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 therein.

This Work having been perused by several eminent Mathematicians *and* Accomptants, *is recommended as the best* Compendium *hitherto published, for the Use of* Schools, *or for* Private Persons.

BY FRANCIS WALKINGAME,

WRITING-MASTER AND ACCOMPTANT.

FROM THE FIFTY-FIRST LONDON EDITION.

MONTREAL:

PRINTED BY NAHUM MOWER, 91, ST. PAUL STEET.

1818.

ARITHMETICAL TABLES

NUMERATION.

C. Millions							
X. Millions							
Millions							
C. Thousand							
X. Thousand							
Thousands							
Hundreds							
Tens							
Units							

PENCE.

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

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

SHILLINGS.

s.		£.	s.
20	is	1	0
30	..	1	10
40	..	2	0
50	..	2	10
60	..	3	0
70	..	3	10
80	..	4	0
90	..	4	10
100	..	5	0

PRACTICE TABLES.

Of a Pound.

s.	d.	
10	0	$\frac{1}{2}$
6	8	$\frac{1}{3}$
5	0	$\frac{1}{4}$
4	0	$\frac{1}{5}$
3	4	$\frac{1}{6}$
2	6	$\frac{1}{8}$
2	0	$\frac{1}{10}$
1	8	$\frac{1}{12}$
1	0	$\frac{1}{20}$

Of a Shill.

6d.	$\frac{1}{2}$
4	$\frac{1}{3}$
3	$\frac{1}{4}$
2	$\frac{1}{6}$
$1\frac{1}{2}$	$\frac{1}{8}$
1	$\frac{1}{12}$

Of a Ton.

10 cwt.	$\frac{1}{2}$
5	$\frac{1}{4}$
4	$\frac{1}{5}$
$2\frac{1}{2}$	$\frac{1}{8}$
2	$\frac{1}{10}$

Of an Cw

qr.	lb.	
2 or	56	$\frac{1}{2}$
1 ..	28	$\frac{1}{4}$
	16	$\frac{1}{7}$
	14	$\frac{1}{8}$

Of a Quar

lb.		
14	...	$\frac{1}{2}$
7	...	$\frac{1}{4}$
4	...	$\frac{1}{7}$
$3\frac{1}{2}$	..	$\frac{1}{8}$

COINS.

	VALUE. £. s. d.	WEIGHT. dwt. gr.
A Moidore	1 7 6	6 22
Half ditto	0 13 6	3 11
A Guinea	1 1 0	5 9
Half ditto	0 10 6	2 16½
Eighteen Shilling	0 18 6	4 15
Half ditto	0 9 6	2 7½
A Pistole	0 17 6	4 8
Half ditto	0 8 6	2 4
A Mark	0 13 4	
An Angel	0 10 0	
A Noble	0 6 8	

Note. Each Grain of Gold is 2d. and each Pennywt. 4s

MONTREAL:

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1818.

TABLES OF WEIGHTS AND MEASURES.

TROY WEIGHT.

24 Grains make 1 Pennyweight.
20 Pennyweights 1 Ounce.
12 Ounces..... 1 Pound.

AVOIRDUPOISE WEIGHT.

16 Drams..... 1 Ounce.
16 Ounces..... 1 Pound.
28 Pounds..... 1 Quarter.
4 Quarters..... 1 Hundred weight
20 Hundred weight 1 Ton.

APOTHECARIES WEIGHT.

20 Grains..... 1 Scruple.
3 Scruples..... 1 Dram.
8 Drams..... 1 Ounce.
12 Ounces..... 1 Pound.

WOOL WEIGHT.

7 Pounds..... 1 Clove.
2 Cloves..... 1 Stone.
2 Stone..... 1 Tod.
6½ Tod..... 1 Wey.
2 Weys..... 1 Sack.
12 Sacks..... 1 Last.

WINE MEASURE.

4 Quarts..... 1 Gallon.
42 Gallons..... 1 Tierce.
63 Gallons..... 1 Hogshead.
84 Gallons..... 1 Puncheon.
126 Gallons..... 1 Pipe.
252 Gallons..... 1 Tun.

ALE AND BEER MEASURE.

4 Quarts..... 1 Gallon.
8 Gallons..... 1 Firkin of Ale.
9 Gallons..... 1 Firkin of Beer.
2 Firkins..... 1 Kilderkin.
2 Kilderkins..... 1 Barrel.
1½ Barrels..... 1 Hogsheads.
2 Barrels..... 1 Puncheon.
3 Barrels..... 1 Butt.

COALS.

3 Bushels..... 1 Sack.
36 Bushels..... 1 Chaldron.

HAY.

36 Pounds make 1 Truss of Straw.
56 Pounds..... 1 Ditto of Old Hay.
60 Pounds..... 1 Ditto of New Hay.
36 Trusses..... 1 Load.

LONG MEASURE.

12 Inches..... 1 Foot.
3 Feet..... 1 Yard.
5½ Yards..... 1 Pole.
40 Poles..... 1 Furlong.
8 Furlongs..... 1 Mile.

LAND MEASURE.

9 Feet..... 1 Yard.
30¼ Yards..... 1 Pole.
40 Poles..... 1 Rood.
4 Roods..... 1 Acre.

CLOTH MEASURE.

2¼ Inches..... 1 Nail.
4 Nails..... 1 Quarter.
3 Quarters..... 1 Flemish Ell.
4 Quarters..... 1 Yard.
5 Quarters..... 1 English Ell.
6 Quarters..... 1 French Ell.

TIME.

60 Seconds..... 1 Minute.
60 Minutes..... 1 Hour.
24 Hours..... 1 Day.
7 Days..... 1 Week.
4 Weeks..... 1 Month.
365 Days, 6 Hours 1 Year.

DRY MEASURE.

2 Quarts..... 1 Pottle.
2 Pottles..... 1 Gallon.
2 Gallons..... 1 Peck.
4 Pecks..... 1 Bushel.
2 Bushels..... 1 Strike.
8 Bushels..... 1 Quarter.
5 Quarters..... 1 Wey.
2 Weys..... 1 Last.

SOLID MEASURE.

1728 Inches..... 1 Solid Foot.
27 Feet..... 1 Yard or Load.

ADVERTISEMENT.

WALKINGAME's Assistant having been so long held in high and deserved estimation by the Public, it cannot be necessary for the Proprietors or Editor of the present edition (the 51st) to enter upon any discussion of its merits; were they inclined so to do, they should undoubtedly refer to the numerous republications of the work itself, as forming its most powerful recommendations. Nevertheless, it cannot have escaped the observation of those who are engaged in studying or teaching the higher branches of Arithmetic, that having hitherto contained no rules upon the management of Circulating Decimals, this work has not only been incomplete in regard to the Theory and Practice of Decimal Fractions, but also incorrect in many of the answers to the questions contained therein, from want of attention to the practice of Circulating Decimals in their solutions; an oversight which has been a frequent source of trouble and anxiety to every Teacher, when the Pupil has been working the examples in Decimal Interest, Purchase of Annuities, &c. since the approximations which have been hitherto uniformly substituted in the place of the true results, are insufficient for their solution,

when the same questions have again occurred under another rule, with other data. To remedy this inconvenience, and that nothing might be wanting in regard to the perfection of this new and enlarged Edition, an Appendix has been added on Circulating Decimals, the examples in Decimal Interest, &c. carefully wrought afresh, and their corrected answers inserted; the recurring Decimals pointed, and the errors incident to a work of this nature, which have crept into preceding editions, every where corrected; the whole forming, in its present improved state, the cheapest and most practical work on Arithmetic which has hitherto appeared.

As it would have been frequently inconvenient to have given the remainders to many examples in Decimal Interest, &c. in a decimal form, the repetend consisting of too great a number of places, a vulgar-fractional expression has been, therefore, introduced, and the Editor would recommend, in all instances where the repetend is found to consist of many places, the use of Vulgar Fractions in preference to Decimals, as the most ready mode of calculation.

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 sometime 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 those rules or questions he wants; which detains the others from making that progress they otherwise might had they a proper book 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 follow:

"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 there- "fore say, *That some boys, lazily inclined, when they see an- "other 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; there- "fore, as different questions to different boys do not in the "least promote their improvement, so neither do the ques- "tions hinder it. Neither is it in the power of any master "(in the course of his buniness) how full of spirits soever he "be, to frame new questions at pleasure, in any Rule; but "the same questions will frequently occur in the same Rule, "notwithstanding his greatest care and and skill to the con- "trary.

"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 ignorance 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 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.

* Dilworth.

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 shewn, than by the customary mode of dotting. In Multiplication, I have shewn both the beauty and the use of that excellent Rule, in resolving most questions that occur in merchandizing; 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 Annuities, &c. and have not only shewn the use, but the method of making them. I have also added to this Edition, a new Rule for extracting the Cube Root, being a much shorter way than any that is already published; as likewise an Interest Table, calculated for the easier finding 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.

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VULGAR FRACTIONS.

PART III.

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DUODECIMALS.

PART V.

PART VI.

QUESTIONS.

APPENDIX.

ON CIRCULATING DECIMALS.

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=6, that is 8 lessened by 2 is equal to 6.
+*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.
$\overline{7-2}+5=10.$	Shews that the Difference between 2 and 7, added to 5, is equal to 10.
$9-\overline{2+5}=2$	Signifies that the Sum of 2 and 5, taken from 9, is equal to 2.
$10-\overline{3+6}=1.$	Over any number of quantities, denote that they must be taken together which are under it, thus 10 less the sum of 3 and 6 is equal to 1; without this character the preceding expression would be ambiguous, and might be read thus, 10 less 3 and 6 added to the difference, is equal to 1.
$\surd$	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 the Fourth Power, &c.
i. e.	*id est*, that is.

THE

TUTOR's ASSISTANT:

BEING A

COMPENDIUM OF ARITHMETIC.

PART I.

ARITHMETIC 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
			6	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, Units; 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: As the first period on the Left Hand is read thus, Nine hundred eighty-seven Millions; and so on for any of the rest.

THE APPLCATION.

Write down in proper figures the following Numbers:

Twenty-three.

Two hundred and fifty-four.

Three thousand, two hundred and four.

Twenty-five thousand, eight hundred and fifty-six.

One hundred, thirty-two thousand two hundred forty-five.

Four millions, nine hundred forty-one thousand, four hundred.

Twenty-seven millions, one hundred fifty-seven thousand, eight hundred thirty-two.

Seven hundred twenty-two millions, two hundred thirty-one thousand, five hundred and four.

Six hundred two millions, two hundred ten thousand, five hundred.

Write down in Words at Length the following Numbers:

35	2017	519007	5207054	65700047
59	5201	754058	2071909	900061057
172	20760	5900030	70054008	221900790

NOTATION BY ROMAN LETTERS.

I One	XI Eleven
II Two	XII Twelve
III Three	XIII Thirteen
IV Four	XIV Fourteen
V Five	XV Fifteen
VI Six	XVI Sixteen
VII Seven	XVII Seventeen
VIII Eight	XVIII Eeighteen
IX Nine	XIX Nineteen
X Ten	XX Twenty

XXX Thirty
XL Forty
L Fifty
LX Sixty
LXX Seventy
LXXX Eighty
XC Ninety
C Hundred
CC Two Hundred
CCC Three Hundred
CCCC Four hundred
D Five Hundred
DC Six Hundred
DCC Seven Hundred
DCCC Eight Hundred
DCCCC Nine Hundred
M One Thousand
MDCCCXIII One thousand eight hundred & thirteen.

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, at which set down the total amount.

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

Qrs.	*Months.*	£	*Years.*
275	1234	75245	271048
110	7098	37502	325476
473	3314	91474	107584
354	6732	32145	625608
271	2546	47258	754087
352	0709	21476	279736

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

Add 246,034, 298,765, 47,321, 58,653, 64,218, 5,376, 9,821, and 640 together, *Ans.* 730,828.

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

How many days are there in the twelve Calendar months? *Ans.* 365.

SUBTRACTION

TEACHETH to take a less sum from a greater, and shews 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 less Line together, and if the same as the greater, it is right.

From	271	4754	42087	452705	271508	3750205
Take	154	2723	34096	327616	152471	3150874
Rem.	117					
Proof.	271					

MULTIPLCATION

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 these 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 that stands in the Unit's Place of the Multiplier, and with it multiply the first Figure of 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.

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

Multiplicand	25104736	52471021	792543752
Multiplier	2	3	4
Product	50209472		
	27104107	231047	7092516	8725104
	5	6	7	8
	4215466	2701057	31040171	698854
	9	10	11	12

When the Multiplier is more than 12, and less than 2
multiply by the Unit Figure in the Multiplier, adding to t
Product the back Figure to that you multiplied.

5710592	5107252	7653210	92057165
13	14	15	16
6251721	9215324	2571341	3592104
17	18	19	20

When the Multiplier consists of several Figures, the
must be as many Products as there are Figures in the M
tiplier, observing to put the first Figure of every Prod
under that Figure you multiply by. Add the several P
ducts together, and their sum will be the total Product.

Multiply 271041071 by 5147.
Multiply 62310047 by 1608.
Multiply 170925164 by 7419.
Multiply 9500985742 by 61879.
Multiply 1701495868567 by 4708756.

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

Multiply 571204
By 27009

5140836
3998428
1142408

Product 15427648836

Multiply 7561240325 by 57002.
Multiply 562710934 by 590030.

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

Multiply 1379500
By 3400

55180
41385

4690300000

Multiply 7271000 by 52600.
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 the Product by the other will give the answer.

Multiply 771039 by 35, or 7 times 5.

7

5397273
5

26986365

Multiply 921563 by 32.
Multiply 715241 by 56.
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 shews 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 does not exceed 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.		
Divisor	(2)725107(	3)7210472(	4)7210416(
Quotient	3625531/2		
	2	5)7203287(	6)5231037(
Proof	725107		
	7)2532701(	8)2547325(	9)25047306

Divisor.	Dividend.	Quotent.
29	4172377	143875
	29	
	127	
	116	
	112	
	87	
	.253	
	232	
	.217	
	203	
	.147	
	145	
Rem.	.2	
		1294875.
		287750
		2 Rem.
		4172377 Proof.

Divide 7210473 by 37
Ans. 194877
Divide 42749467 by 347
Divide 734097143 by 5743
Divide 1610478407 by 5471
Divide 4973401891 by 5108
Divide 51704567874 by 4765
Divide 1745379894612374 by 3147946

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

100)254732|21(939 5721|00)7253472|16(1267
3|000)752473|729(2756 215|000)6325104|997(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 the Quotient by the other, it will give the Quotient required.

But as it sometimes happens that there is a Remainder in each of the Quotients, and neither of them the true one, they 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.

3210473 by 27	7210473 by 35	6251043 by 42	5761034 by 54
118906. 11 Rm.	206013. 18 Rm.	148834. 15 Rm.	106685. 44 Rm.

MONEY.

Marked.				Marked.
Farthing.	4	Farthings make	1 Penny	- *d.*
Halfpenny.	12	Pence —	1 Shilling	- *s.*
Three Farthings.	20	Shillings —	1 Pound	- *l.*

Farthings.

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

SHILLINGS.

s.		*l.*	*s.*
20	is	1	0
30	—	1	10
40	—	2	0
50	—	2	10
60	—	3	0
70	—	3	10
80	—	4	0
90	—	4	10
100	—	5	0
110	—	5	10
120	—	6	0
130	—	6	10

PENCE TABLE.

d.		*s.*	*d.*
20	is	1	8
24	—	2	0
30	—	2	6
36	—	3	0
40	—	3	4
48	—	4	0
50	—	4	2
60	—	5	0
70	—	5	10
72	—	6	0
80	—	6	8
84	—	7	0

d.		*s.*	*d.*
90	is	7	6
96	—	8	0
100	—	8	4
108	—	9	0
110	—	9	2
120	—	10	0
130	—	10	10
132	—	11	0
140	—	11	8
144	—	12	0
150	—	12	6
160	—	13	4

TROY WEIGHT.

			Marked.
24 Grains	make	1 Pennywight	*gr.* / *dwt.*
20 Pennyweights	—	1 Ounce	*oz.*
12 Ounces	—	1 Pound	*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 Gold, and 2 Carats of Copper, melted together. For Silver is 11 *oz.* 2 *dwts.* of fine Silver, and 18 *dwts.* of Copper.

25 *lb.* is a quarter of a 100 *lb.* 1 *cwt.*
20 *cwt.* 1 Ton of Gold or Silver.

AVOIRDUPOISE WEIGHT.

			Marked.
16 Drams	make	1 Ounce	*dr.* / *oz.*
16 Ounces	—	1 Pound	*lb.*
28 Pounds	—	1 Quarter	*qrs.*
4 Quarters or 112 *lb.*		1 Hundred Weight	*cwt.*
20 Hundred Weight		1 Ton	*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.		
A Firkin of Butter	56	A Stone of Iron Shot or Horseman's wt.	
Soap	64	Butchers Meat	
A Barrel of Anchovies	30	A Gallon of Train Oil.	
Soap	256	A Truss of Straw	
Raisins	112	New Hay	
A Puncheon of Prunes	1120	Old Hay	
A Fother of Lead, 19 *cwt.* 2 *qrs.*		36 Trusses a Load.	

CHEESE AND BUTTER.

A Clove or Half Stone, 8 *lb.*

	lb.		*lb.*
Wey in Suffolk, 2 Cloves, or	256	A Wey in Essex, 42 Cloves, or.....	336

WOOL.

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

By this Weight is weighed any thing of a coarse or dross Nature; as all Grocery and Chandlery Wares, Bread, all Metals, but Silver and Gold.

Note. One Pound Avoirdupoise is equal to 14 *oz.* 11 *dwt.* 16 *grs.* ½ Troy.

APOTHECARIES WEIGHT.

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

Grains.

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

Note. The Apothecaries mix their Medicines by this Weight, but buy and sell their Commodities by Avoirdupoise 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.* *qrs.*
4 Quarters	—	1 Flemish Ell.....	*Fl. E.*
4 Quarters	—	1 Yard.....	*yd.*
5 Quarters	—	1 English Ell.....	*E. E.*
6 Quarters	—	1 French Ell.....	*F. E.*

Inches.
$2\frac{1}{4}$ = 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.* or *in.*
12 Inches	—	1 Foot		*feet.*
3 Feet	—	1 Yard		*yd.*
6 Feet	—	1 Fathom		*fth.*
$5\frac{1}{2}$ Yards	—	1 Rod, Pole, or Perch		*rod,*
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 = $16\frac{1}{2}$ = $5\frac{1}{2}$ = 1 Pole.
23760 = 17920 = 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 distance of Places, or any thing else that hath length only.

WINE MEASURE.

				Marked
2 Pints	make	1 Quart		*pts.* or *qt.*
4 Quarts	—	1 Gallon		*gal.*
10 Gallons	—	1 Anchor of Brandy		*anc.*
18 Gallons	—	1 Rundlet		*run.*
$31\frac{1}{2}$ Gallons	—	Half a Hogshead		$\frac{1}{2}$*hhd.*
42 Gallons	—	1 Tierce		*tierce.*
63 Gallons	—	1 Hogshead		*hhd.*
2 Hogsheads	—	1 Pipe or Butt		*P.* or *but.*
2 Pipes or 4 Hogsheads		1 Tun		*tun.*

Inches.
28$\frac{7}{8}$= 1 Pint.
57$\frac{3}{4}$= 2= 1 Quart.
231 = 8= 4= 1 Gallon.
702 = 336= 168= 42=1 Tierce.
553 = 504= 252= 63=1$\frac{1}{2}$=1 Hogshead.
404 = 672= 336= 84=2 =1$\frac{1}{3}$=1 Puncheon.
106 =1008= 504=126=3 =2 =1$\frac{1}{2}$=1 Pipe.
212 =2016=1008=252=6 =4 =3 =2=1 Tun.

All brandies, spirits, perry, cyder, mead, vinegar, honey, oil, are measured by this measure; as also milk, not by , but custom only.

ALE AND BEER MEASURE.

			Marked
Pints	make	1 Quart.....	*Pts.* *Qts.*
Quarts	—	1 Gallon.....	*Gal.*
Gallons	—	1 Firkin of Ale.....	*A.fir.*
Gallons	—	1 Firkin of Beer.....	*B.fir.*
Firkins	—	1 Kilderkin.....	*Kil.*
Firkins, or 2 Kilderkins		1 Barrel.....	*Bar.*
Barrel and $\frac{1}{2}$, or 54 Gal.		1 Hogshead of Beer....	*Hhd.*
Barrels	—	1 Puncheon.....	*Pun.*
Barrels, or 2 Hogsheads		1 Butt.....	*Butt.*

BEER.

bic Inches.
35$\frac{1}{4}$= 1 Pint.
70$\frac{1}{2}$= 2= 1 Quart.
282 = 8= 4= 1 Gallon.
538 = 72= 36= 9= 1 Firkin.
076 =144= 72= 18= 2=1 Kilderkin.
152 =288=144= 36= 4=2=1 Barrel.
228 =432=216= 54= 6=3=1$\frac{1}{2}$=1 Hogshead.
304 =576=288= 72= 8=4=2 =1 Puncheon.
456 =864=432=108=12=6=3 =2=1 Butt.

ALE.

bic Inches.
35$\frac{1}{4}$= 1 Pint.
70$\frac{1}{2}$= 2= 1 Quart.
282 = 8= 4= 1 Gallon.
256 = 64= 32= 8=1 Firkin.
512 =128= 64=16=2=1 Kilderkin.
024 =256=128=32=4=2=1 Barrel.
536 =384=192=18=6=3=1$\frac{1}{2}$=1 Hogshead.

In *London* they compute but 8 gallons to the firkin of and 32 to the barrel; but in all other parts of England ale, strong beer, and small, 34 gallons to the barrel, 8 gallons ½ 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.

			Ma
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 Bushes	—	1 Strike - - - - -	*str*
4 Bushels	—	1 Coomb - - - - -	*coo*
2 Coombs or 8 Bushels - - -		1 Quarter - - - -	*qr.*
4 Quarters	—	1 Chaldron - - - -	*ch.*
5 Quarters	—	1 Wey - - - - - -	*we*
2 Weys	—	1 Last - - - - - -	*las*

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 Coomb.
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 inches and ½ wide, and 8 i
es deep.

gallons to the firkin of al
other parts of England, fo
gallons to the barrel, an

eels is 42 gallons.
- - - - 32 gallons.
- - - - 4 or 5 gallons.
- - - - 8 gallons.

SURE.

	Marked
Quart - - - - -	*pts.* *qts.*
Pottle - - - - -	*pot.*
Gallon - - - - -	*gal.*
Peck - - - - - -	*pk.*
Bushel - - - - -	*bu.*
Strike - - - - -	*strike*
Coomb - - - - -	*coomb*
Quarter - - - -	*qr.*
Chaldron - - - -	*chal.*
Wey - - - - - -	*wey.*
Last - - - - - -	*last.*

make a Chaldron.

l,
trike.
1 Coomb.
2= 1 Quarter.
10= 5=1 Wey.
20=10=2=1 Last.

easure is 5 pecks.
21 chaldrons.
3 bushels.
12 sacks.
5 bushels.
40 bushels.
to all dry goods.
es and ½ wide, and 8 inc

TIME.

			Marked.
60 Seconds	make	1 Minute - - -	*sec.* *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. s.
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,*
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 or flooring.
272¼ Feet	—	1 Rod.
40 Rods	—	1 Rood.
4 Roods, or 160 rods, or 4840 yar.		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 leng and breadth; such as land, painting, plastering, floorin 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 Or, 50 Feet of hewn timber	}	is 1	Ton or Load.

108 solid feet, *i. e.* 12 feet in length, 3 feet in breadt and 3 deep, or, commonly 14 feet long, 3 feet 1 inch broa and 3 feet 1 inch deep, is a stack of wood.

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

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

ADDITION OF MONEY, WEIGHTS, AND MEASURES.

RULE. Add the first row or denomination togethe as, in integers, then divide the sum by as many of t same denomination as makes one of the next greater, settin down the remainder under the row added, and carry t quotient to the next superior denomination, continuing th same to the last, which add as in simple Addition.

MONEY.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	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	1½
5	15	4½	57	19	2¼	97	13	5¼	91	15	4¼
9	17	6¼	91	16	1	37	16	8¾	35	16	5¾
7	16	3	75	18	7¾	97	15	7	29	19	7¼
5	14	7¾	97	13	5	59	16	5½	91	17	3¼
39	6	7¼									

MONEY.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£	s.	d.
257..	1..	5½	525..	2..	4¼	21..	14..	7½	73..	2..	1½
734..	3..	7¾	179..	3..	5	75..	16..	0	25..	12..	7½
595..	5..	3	250..	4..	7¼	79..	2..	4¼	96..	13..	5¼
152..	14..	7½	975..	3..	5¼	57..	16..	5½	76..	17..	3
207..	5..	4	254..	5..	7	26..	13..	8¾	97..	14..	1
798..	16..	7¾	379..	4..	5¾	54..	2..	7	54..	11.	7¼
127..	4..	7¼	261..	17..	1¼	31..	1..	1½	27..	13..	5
525..	3..	5	379..	13..	5	75..	13..	1	16..	12..	9¼
271..	0..	5	257..	16..	7¾	39..	19..	6¼	9..	13..	3
524..	9..	1	184..	13..	5	97..	17..	3¾	13..	2..	7½
379..	4..	3¼	725..	2..	3¼	36..	13..	5	37..	19..	1
215..	5..	8¾	359..	6..	3	24..	16..	3¼	56..	19..	1¾

TROY WEIGHT.

oz.	*dwt.*	*gr.*	*lb.*	*oz.*	*dwt.*	*lb.*	*oz.*	*dwt.*	*gr.*
5..	11..	4	7..	1..	2	5..	2..	15..	22
7..	19..	21	3..	2..	17	3..	11..	17..	14
3..	15..	14	5..	1..	15	3..	7..	15..	19
7..	19..	22	7..	10..	11	9..	1..	13..	21
9..	18..	15	2..	7..	13	3..	9..	7..	23
8..	13..	12	3..	11..	16	5..	2..	15..	17

AVOIRDUPOISE WEIGHT.

lb.	*oz.*	*dr.*	*cwt.*	*qr.*	*lb.*	*t.*	*cwt.*	*qr.*	*lb.*
152..	13..	15	25..	1..	17	7..	17..	2..	12
272..	14..	10	72..	3..	26	5..	5..	3..	14
303..	15..	11	54..	1..	16	2..	4..	1..	17
255..	10..	4	24..	1..	16	3..	18..	2..	19
173..	6..	2	17..	0..	19	7..	9..	3..	20
625..	13..	13	55..	2..	16	8..	5..	1..	24

APOTHECARIES WEIGHT.

lb	℥	ʒ	℈
17..	10..	7..	1
9..	5..	2..	2
27..	11..	1..	2
9..	5..	6..	1
37..	10..	5..	2
49..	—..	7..	0

lb	℥	ʒ	℈	*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.

FE. qr. n.	*yd. qr. n.*	*EE. qr. n.*
127..2..1	135..3..3	272..2..1
15..1..3	70..2..2	152..1..2
237..0..2	95..3..0	79..0..1
52..1..3	176..1..3	156..2..0
376..2..1	26..0..1	79..3..1
197..1..3	279..2..1	154..2..1

LONG MEASURE.

yd. feet in. bar.	*lea. m. fur. p.*
225..1.. 9..1	72..2..1..19
171..0.. 3..2	27..1..7..22
52..2.. 3..2	35..2..5..31
397..0..10..1	79..0..6..12
154..2.. 7..2	51..1..6..17
137..1.. 4..1	72..0..5..21

LAND MEASURE.

a. r. p.	*a. r. p.*
726..1..31	1232..1..14
219..2..17	327..0..19
1455..3..14	131..2..15
879..1..21	1219..1..18
1195..2..14	459..2..17

WINE MEASURE.

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

T. hhds.	*gal.*	*qts.*
14	3	27 .. 2
19	2	56 .. 3
17	0	39 .. 2
75	2	16 .. 1
54	1	19 .. 2
97	3	54 .. 3

ALE AND BEER MEASURE.

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

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

hhd.	*gal.*	*qts.*
76	51	2
57	3	3
97	27	3
22	17	2
32	19	3
55	38	3

DRY MEASURE.

ch.	*bu.*	*pks.*
75	2	1
41	24	1
92	16	1
70	13	2
54	17	3
79	25	1

lasts.	*weys.*	*qts.*	*bu.*	*pks.*
38	1	4	5	3
47	1	3	6	2
62	0	2	4	4
45	1	4	3	3
78	1	1	2	2
29	1	3	6	2

TIME.

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

w.	*d.*	*h.*	*m.*	*sec.*
57	2	15	42	41
95	3	21	27	51
76	0	15	37	28
53	2	21	42	27
98	2	18	47	38

THE APPLICATION.

1. A man born in the year 1750, when will he be years of age? *Ans.* 1797.

2. A, B, C, D, went partners in the purchase of a quantity of goods; A laid out £7. half a guinea and a crow B 49*s.* C 54*s.* 6*d.* and D 87*d.* What was laid out in all? *Ans.* £13..6..3.

3. A man lent his friend at different times these seve sums, viz. £63, £25..15, £32..7, £15..14..10, and fo score and nineteen pounds, half a guinea and a shilli How much did he lend in all? *Ans.* £236..8..4.

4. What is the estate worth *per annum*, when the ta are 21 guineas, the neat income 8 score, £19..14? *Ans.* £201..15.

5. There are three numbers; the first 215, the seco 519, and the third as much as the other two. What is t sum of them all? *Ans.* 1468.

6. Bought a parcel of goods, for which I paid £54.. for packing 13*s.* 8*d.* carriage £1..5..4, and spent about bargain 14*s.* 3*d.* What do these goods stand me in? *Ans.* £57..10..3.

7. There are two numbers, the least whereof is 40, th difference 14, I desire to know what is the greater numb and the sum of both? *Ans.* 54 greater number, 94 sum.

8. A gentleman left his eldest daughter £1500 more th the youngest, and her fortune was 11 thousand, 11 hundr and £11. What was the eldest sister's fortune, and wh did the father leave them? *Ans.* Eldest sister's for £13611. Father left them £25722.

9. A nobleman, before he went out of town, was desir of paying all his tradesmen's bills, and upon enquiry he fou that he owed 82 guineas for rent; to his wine-merch £72.. 5..0; to his confectioner £12..13..4; to his dra £47..13..2; to his taylor £110..15..6; to his coachma £157..8..0; to his tallow-chandler £8..17..9; to his co chandler £170..6..8; to his brewer £52..17..0; to his b cher £122..11..5; to his baker £37..9..5; and to his s vants for wages £53..18. I desire to know what money had to raise in the whole, when we add to the above su £100 which he wished to take with him?

Ans. £1032..17..3.

10. A father was 24 years of age (allowing 13 months year, and 28 days to a month,) when his first child born; between the eldest and next born was 1 year, months, 14 days; between the second and third were 2 s, 1 month and 15 days; between the third and fourth 2 years, 10 months and 25 days; when the fourth 27 years, 9 months and 12 days old; how old was the er? *Ans.* 58 *years*, 7 *months*, 10 *days*.

. A banker's clerk having been out with bills, brings e an account, that A paid him £7..5..2. B 15..18..6½ 150..13..2¼. D £17..6..8. E 5 guineas, 2 crown pieces, lf crowns, and 4*s*. and 2*d*. F paid him only 20 groats, 76..15..9½. and H £121..12..4. I desire to know h the whole amounted to that he had to pay?

Ans. £396..7..6¼.

2. A nobleman had a service of plate, which consisted venty dishes, weighing 203 *oz*. 8 *dwt*.; 36 plates weigh- 408 *oz*. 9 *dwt*.; 5 dozen of spoons, weighing 112 *oz*. 8 ; 6 salts, and 6 pepper-boxes, weighing 71 *oz*. 7 *dwt*; es and forks, weighing 73 *oz*. 5 *dwts*.; two large cups, a ard and a mug, weighing 121 *oz*. 4 *dwts*.; a tea-kettle lamp, weighing 131 *oz*. 7 *dwts*.; together with sundry small articles, weighing 105 *oz*. 5 *dwts*. I desire to the weight of the whole?

Ans. 102 *lb*. 2 *oz*. 13 *dwts*.

3. A hop-merchant buys 5 bags of hops, of which the weighed 2 *cwt*. 3 *qrs*. 13 *lb*.; the second 2 *cwt*. 2 *qrs*. .; the third 2 *cwt*. 3 *qrs*. 5*lb*.; the fourth 2 *cwt*. 3 *qrs*. ; the fifth 2 *cwt*. 3 *qrs*. 15 *lb*. Besides these he pur- ed two pockets, each weighing 8¼ *lb*. I desire to know weight of the whole? *Ans*. 15 *cwt*. 2 *qrs*.

4. A of Vienna, owes to B of Liverpool, for goods re- d in January, the sum of £103..12..2; for goods re- d in February, £93..3..4; for goods received in March 1..17; for goods received in April £142..15..4; for s received in May £171..15..10; for goods received in £142..12..6; but the latter six months of the year, g to the falling off in the demands for the articles in h he dealt, amounted to the sum only of £205..7..2. I e to know the amount of the whole year's bill?

Ans. £981..3..4.

SUBTRACTION OF MONEY, WEIGHTS, A MEASURES.

RULE. Subtract as in Integers only when any o lower denominations are greater than the upper, row as many of that as make one of the next superior, ing it to the upper, from which take the less; set dow difference, and carry one to the next higher denomin for what you borrowed.

PROOF. As in Integers.

MONEY.

	£.	s.	d.
Borrowed	715 ..	2 ..	$7\frac{1}{4}$
Paid	476 ..	3 ..	$8\frac{1}{2}$
Remains to pay	238 ..	18 ..	$10\frac{3}{4}$
Proof	715 ..	2 ..	$7\frac{1}{4}$

£.	s.	d.
87 ..	2 ..	10
79 ..	3 ..	$7\frac{1}{4}$

£.	s.	d.
3 ..	15 ..	$1\frac{1}{2}$
1 ..	14 ..	7

£.	s.	d.
25 ..	2 ..	$5\frac{1}{4}$
17 ..	9 ..	$8\frac{1}{2}$

£.	s.	
37 ..	3 ..	
25 ..	5 ..	

£.	s.	d.
321 ..	17 ..	$1\frac{1}{2}$
257 ..	14 ..	7

£.	s.	d.
59 ..	15 ..	$3\frac{1}{4}$
36 ..	17 ..	2

£.	s.	d.
71 ..	2 ..	4
19 ..	13 ..	$7\frac{3}{4}$

£.	s.	
527 ..	3 ..	
139 ..	5 ..	

Borrowed	25107 ..	15 ..	7
	375 ..	5 ..	$5\frac{1}{4}$
Paid	259 ..	2 ..	$7\frac{1}{2}$
at	359 ..	13 ..	$4\frac{3}{4}$
different	523 ..	17 ..	3
times	274 ..	15 ..	$7\frac{1}{4}$
	325 ..	13 ..	5
Paid in all			
Remains to pay			

Lent	250156 ..	1 ..	
	271 ..	13 ..	
Received	359 ..	15 ..	
at	475 ..	13 ..	
several	527 ..	15 ..	
payments	272 ..	16 ..	
	150 ..	— ..	

TROY WEIGHT.

	lb.	oz.	dwt.	gr.	lb.	oz.	dwt.	gr.
Bought	52	1	7	2	7	2	2	7
Sold	39	0	15	7	5	7	1	5
Unsold								

AVOIRDUPOISE WEIGHT.

lb.	oz.	dr.	cwt.	qrs.	lb.	T.	cwt.	qrs.	lb.
35	10	5	35	1	21	21	1	2	7
29	12	7	25	1	10	9	1	3	5

APOTHECARIES WEIGHT.

lb	℥	ʒ	℈	lb	℥	ʒ	℈	gr.
5	2	1	0	9	7	2	1	13
2	5	2	1	5	7	3	1	18

CLOTH MEASURE.

EE.	qrs.	n.	yds.	qrs.	n.	EE.	qrs.	n.
35	2	2	71	1	2	35	2	1
17	2	1	3	2	1	14	3	2

LONG MEASURE.

yds.	ft.	in.	bar.	leag.	mi.	fur.	po.
107	2	10	1	147	2	6	29
78	2	11	2	58	2	7	33

LAND MEASURE.

a.	r.	p.	a.	r.	p.
175	1	27	325	2	1
59	0	27	279	3	5

WINE MEASURE.

hhd.	*gal*	*qts.*	*pi.*	*tun*	*hhd.*	*gal.*	*qts.*
47	47	2	1	42	2	37	2
28	59	3	0	17	3	49	3

ALE AND BEER MEASURE.

AB.	*fir.*	*gal.*	*BB.*	*fir.*	*gal.*	*hhd.*	*gal.*	*qts.*
25	1	2	37	2	1	27	27	1
21	1	5	25	1	7	12	50	2

DRY MEASURE.

qu.	*bu.*	*p.*	*qu.*	*bu.*	*p.*	*ch.*	*bu.*	*p.*
72	1	2	65	2	1	79	3	0
35	2	3	57	2	3	54	7	1

TIME.

yrs.	*mo.*	*we.*	*da.*	*ho.*	*min.*	*sec.*
79	8	2	4	34	42	45
23	9	3	5	19	53	47

THE APPLICATION.

1. A man born in the year 1723, what was his age in year 1781? *Ans.* 58.

2. What is the difference between the age of a man in 1716, and another born in 1766? *Ans.* 56.

3. A merchant had 5 debtors, A B. C. D. and E. w together owed him £1156. B. C. D. and E. owed £737; what was A's debt? *Ans.* £419.

4. When an estate of £300, *per annum* is reduced payment of taxes, to 12 score and £14 .. 6, what is the t *Ans.* £45 .. 14.

5. What is the difference between £9154, and th mount of £754, added to £305? *Ans.* 8095.

6. A horse in his furniture is worth £37 .. 5; out 14 guineas; how much does the price of the furniture eed that of the horse? *Ans.* £7 .. 17.

7. A merchant at his out-setting in trade, owed £750; had in cash, commodities, the stocks, and good debts, 2510..7; he cleared the first year by commerce £152..3..6 at is the neat balance at the 12 months end?

Ans. £12212..10..6.

8. A gentleman dying, left £45247 between two daugh-, the youngest was to have 15 thousand, 15 hundred, twice £15. Wha' was the eldest sister's fortune?

Ans. £28717.

9. A tradesman happening to fail in business, called all creditors together, and found he owed to A £53..7..6; B £105..10; to C £34..5..2; to D £28..16..5; to E 4..15..8; to F £112..9; and to G £143..12..9. His ditors found the value of his stock to be £212..6, and t he had owing to him in good book debts £112..8..3, ides £21..10..5, money in hand. As his creditors took his effects into their hands, I desire to know whether y were losers or gainers, and how much?

Ans. the Creditors lost £146..11..10.

10. My correspondent, at Seville, in Spain, sends me the owing account of money received at different sales for ds sent him by me, *viz.* Bees-wax to the value of 7..15..4; stockings £57..6..7; tobacco £125..11..6; lin-cloth £112..14..8; tin £115..10..5. My correspondent the same time informs me, that he has shipped, agreea-to my order, wines to the value of £250..15; fruit to value of £51..12..6; figs £19..17..6; oil £19..12..4; Spanish wool to the value of £115..15..6. I desire to w how the account stands between us, and who is the tor?

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

MULTIPLICATION

OF SEVERAL DENOMINATIONS.

ULE. Multiply the first Denomination by the quanti-ty given, dividing the product by as many of that as e one of the next, setting down the remainder, and the quotient to the next superior, after it is multiplied. the given quantity is above 12, multiply by any two bers, which multiplied together, will make the same ber; 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.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
35	12	7½	75	13	1½	62	5	4¼	57	2	4
		2			3			4			5
71	5	2½									

1. 18 yds. of cloth at 9*s.* 6*d.* *per* yard

9X2=18 — 9

4 .. 5 .. 6

2

8 .. 11 .. 0

2. 26lb. of tea, at £1 .. 2 *per* lb

8X3+2=26 — 9 .. 0

27 .. 0

Top line X 2 — 2 .. 5

29 .. 5

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

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

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

6. 37 yards of tabby, at 9*s.* 7*d. per* yard.
Facit £17..1

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

8. 43 dozen of candles, at 6*s.* 4*d. per* dozen.
Facit £13..1

9. 127lb. of bohea tea, at 12*s.* 3*d. per* lb.
Facit £77..1

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

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

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

When the given quantity consists of ½, ¼, divide the p by ½, ¼: when ¾ divide the price by ½, and that quo by ¼, which add to the product of the quantity given.

ISTANT

25½ ells

75½ ells

19½ ells

35½ ells

7¼ cwt.

6½ barr

35½ cw

151½ c

117¼ g

85¾ cw

29¼ lb.

17¼ ya

37½ ya

56¾ cw

96½ cw

45¾ lb

$25\frac{1}{2}$ ells of Holland, at 3*s*. $4\frac{1}{2}d$. *per* ell.

3 .. $4\frac{1}{2}$
5 — 5 X 5 = 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 .. $0\frac{3}{4}$ = $25\frac{1}{2}$

$75\frac{1}{2}$ ells of diaper, at 1*s*. 3*d*. *per* ell.
Facit £4 .. 14 .. $4\frac{1}{2}$

$19\frac{1}{2}$ ells of damask, at 4*s*. 3*d*. *per* ell.
Facit £4 .. 2 .. $10\frac{1}{2}$

$35\frac{1}{2}$ ells of dowlas, at 1*s*. 4*d*. *per* ell.
Facit £2 .. 7 .. 4

$7\frac{1}{4}$ cwt. of Malaga raisins, at £1 .. 1 .. 6 *per* cwt.
Facit 7 .. 15 .. $10\frac{1}{2}$

$6\frac{1}{2}$ barrels of herrings, at £3 .. 15 .. 7 *per* barrel.
Facit £24 .. 11 .. $3\frac{1}{2}$

$35\frac{1}{2}$ cwt. double refined sugar, at £4 .. 15 .. 6 *per* cwt.
Facit £169 .. 10 .. 3

$151\frac{1}{2}$ cwt. of tobacco, at £4 .. 17 .. 10 *per* cwt.
Facit £755 .. 15 .. 3

$117\frac{1}{4}$ gallons of arrack, at 12*s*. 6*d*. *per* gallon.
Facit £73 .. 5 .. $7\frac{1}{2}$

$85\frac{3}{4}$ cwt. of cheese, at £1 .. 7 .. 8 *per* cwt.
Facit £118 .. 12 .. 5

$29\frac{1}{4}$ lb. of fine Hyson tea, at £1 .. 3 .. 6 *per* lb.
Facit £34 .. 7 .. $4\frac{1}{2}$

$17\frac{1}{4}$ yards superfine scarlet drab, at £1 .. 3 .. 6 *per* yd.
Facit £20 .. 17 .. $1\frac{1}{2}$

$37\frac{1}{2}$ yards of rich brocaded silk, at 12*s*. 4*d*. *per* yard.
Facit £23 .. 2 .. 6

$56\frac{3}{4}$ cwt. of sugar, at £2 .. 18 .. 7 *per* cwt.
Facit £166 .. 4 .. $7\frac{1}{4}$

$96\frac{1}{2}$ cwt. of currants, at £2 .. 15 .. 6 *per* cwt.
Facit £267 .. 15 .. 9

$45\frac{3}{4}$ lb. Belladine silk, at 18*s*. 6*d*. *per* lb.
Facit £42 .. 6 .. $4\frac{1}{2}$

29. 87¼ bushels of wheat, 4*s.* 3*d. per* bushel.
Facit 18 .. 12 ..

30. 120¾ cwt. of hops, at £4 .. 7 .. 6 *per* cwt.
Facit £528 .. 5 ..

31. 407 yards of cloth, at 3*s.* 9½*d. per* yard.
Facit £77 .. 3 ..

32. 729 ells of cloth, at 7*s.* 7¼*d. per* ell.
Facit £277 .. 3 ..

33. 2068 yards of lace, at 9*s.* 5½*d. per* yard.
Facit £977 .. 19 ..

THE APPLICATION.

1. What sum of money must be divided amongst 18 m so that each man may receive £14 .. 6 .. 8½?
Ans. £258 .. 0 ..

2. A Privateer of 250 men took a prize, which amou to £125 .. 15 .. 6 to each man, what was the value of prize? *Ans.* £31443 .. 15 ..

3. What is the difference between six dozen dozen half a dozen dozen: and what is their sum and product
Ans. 792 *Diff.* *Sum* 936. *Product* 6220

4. What difference is there between twice eight fifty, and twice fifty eight, and what is their product?
Ans. 50 *Diff.* 7656 *Produc*

5. There are two numbers, the greater of them is times 45, and their difference 19 times 4; their sum product are required? *Ans.* 3254 *Sum* 2645685 *Produc*

6. The sum of two numbers is 360, the less of them 1 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, e 157 men, 207 battalions, each 560 men, how many effec soldiers, supposing that in seven hospitals there are sick? *Ans.* 144806

8. What sum did that gentleman receive in dowry his wife, whose fortune was her wedding suit: her petti having two rows of furbelows, each furbelow 87 quills, in each quill 21 guineas? *Ans.* £3836 .. 14 .. 0

9. A merchant had £19118 to begin trade with: f years together he cleared £1086 a year; the next 4 y he made good £2715 .. 10 .. 6 a year; but the last 3 y he was in trade, had the misfortune to lose, one year another, £475 .. 4 .. 6 a year; what was his real fortun 12 years end? *Ans.* £33984 .. 8 .. 6

0. In some parts of the kingdom they weigh their coals a machine, in the nature of a steel-yard, waggon and Three of these draughts together amount to 137 *cwt. rs.* 10 *lb.* and the tare or weight of the waggon 13 *cwt. r.* how many coals had the customer in 12 such draughts?

Ans. 391 *cwt.* 1 *qr.* 12 *lb.*

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

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

3. Admitting that I pay eight guineas and half-a-crown a quarter's rent, and am allowed quarterly 15*s.* for re- s, what does my apartment cost me annually, and how h in 7 years?

Ans. In one year £31 .. 2*s. in seven* £217 .. 14*s.*

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

Ans. £36 .. 12 .. 2

5. A gentleman at his decease left his widow £4560; to blic charaty he bequeathed £572..10; to each of his four ews £750 .. 10; to each of his four nieces £375..12..6; 0 poor housekeepers ten guineas each, and 150 guineas s executor. What sum must he have been possessed of e time of his death to answer all these legacies?

Ans. £10109 .. 10 .. 0.

6. Admit 20 to be the remainder of a division sum, 423 quotient, the divisor the sum of both, and 49 more. t was the number of the dividend? *Ans.* 195446.

EXAMPLES OF WEIGHTS AND MEASURES.

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

DIVISION

OF SEVERAL DENOMINATIONS.

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

PROOF. By Multiplication.

2)25 .. 2 .. 4(	3)37 .. 7 .. 7(	4)57 .. 5 .. 7	5)52 .. 7
12 .. 11 .. 2			

Divide £ 1407. 17*s.* 7*d.* by 243.
Divide £ 700791. 14*s.* 4*d.* by 1794.
Divide £ 490981. 3*s.* $7\frac{1}{2}$*d.* by 31715.
Divide £ 19743052. 5*s.* $7\frac{1}{2}$*d.* by 214723.

THE APPLICATION.

1. If a man spends £257 .. 2 .. 5 in 12 months time, is that *per* month? *Ans.* £21 .. 8 ..
2. The clothing of 35 charity boys came to £57 .. what is the expence of each? *Ans.* £1 .. 12 .
3. If I give £37 .. 6 .. $4\frac{3}{4}$ for nine pieces of cloth, did I give *per* piece? *Ans.* £4 .. 2 ..
4. If 20 cwt. of tobacco came to £27 .. 5 .. $4\frac{1}{2}$, at rate is that *per* cwt.? *Ans.* 1 .. 7
5. What is the value of 1 hogshead of beer, whe are sold for £154 .. 17 .. 10? *Ans.* £1 .. 5 ..
6. Bought 72 yards of cloth for £85 .. 6 .. 0, I de know at what rate *per* yard? *Ans.* £1 .. 3 ..
7. Gave £275 .. 3 .. 4 for 36 bales of cloth; what for 2 bales? *Ans.* £15 .. 5 ..
8. A prize of £7257 .. 3 .. 6 is to be equally amongst 500 sailors, what is each man's share? *Ans.* £14 .. 10 ..
9. There are 2545 bullocks to be divided among 50 I desire to know how many each man had, and the

10. A g rds, the
11. A for a lo £4000. d what
12. A uch did
13. An arly inc
14. Wh ise it to
15. Div . may h
16. If t ers, how
17. Wh ake the
18. Th e divide
19. An ered a c hole bei
20. M 2*s.* 8d.; What did
21. A d 12*cwt* oint of d. I d *Ans.*
22. D nd C, t ess than

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, join- for a lottery ticket of £10 value, which came up a prize £4000. I desire to know what each man contributed, and what each man's share came to ?

Ans. each contributed 8*s. each share* £160.

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

13. Another cleared £2805 in 7½ years, what was the yearly increase of his fortune ? *Ans.* £374.

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

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

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

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.* 12*s.*

20. My purse and money, said Dick to Harry, are worth 2*s.* 8d. ; but the money is worth seven times the purse. What did the purse contain ? *Ans.* 11*s.* 1*d.*

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

Ans. Lesser weight 5 *cwt.* 2 *qrs.* 15 *lb. Price* £53. 10*s.*
Greater weight 7 *cwt.* 1 *qr. Price* £61. 5*s.* 6*d.*

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.

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

BILLS OF PARCELS.

HOSIER'S.

Mr. John Thomas March 7, 180

Bought of Samuel Green,

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

£7 .. 12

MERCER'S.

Mr. Isaac Grant March 7, 1803

Bought of John Sims,

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

£62 .. 2

LINEN DRAPER'S.

Mr. Simon Surety 27th March, 1809.

Bought of Josiah Short,

		s.	d.	
Yards of cambric.....	at	12	6	*per* yard £
Yards of muslin.....	at	8	3	.....
Yards of printed linen	at	5	4	.....
Dozen of napkins.....	at	2	3	each.....
Ells of diaper.....	at	1	7	*per* ell.....
Ells of dowlas.....	at	1	$1\frac{1}{2}$	.....

£17 .. 4 .. $6\frac{1}{2}$

MILLINER'S.

Mrs. Bright April 25, 1809.

Bought of Lucy Brown,

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

£23 .. 14 .. 4

WOOLLEN DRAPER'S.

Mr. Thomas Sage April 7, 1809.

Bought of Ellis Smith,

		l.	s.	d.	
Yards of fine serge.....	at	0	3	9	*per* yd. £
Yards of drugget...	at	0	9	0	.....
Yds. of superfine scarlet	at	1	2	0	.....
Yards of black.....	at	0	18	0	....
Yards of shalloon.....	at	0	1	9	.....
Yards of drab.....	at	0	17	6	.....

£59 .. 5 .. 0

LEATHER-SELLER'S.

Mr. Giles Harris April 12, 180

Bought of Abel Smith,

		s.	d.		
27	Calf skins.....at	3	9	*per* skin	£
75	Sheep ditto.....at	1	7	.....	
36	Coloured ditto.....at	1	8	.....	
15	Buck ditto.....at	11	6	.....	
17	Russia hides.....at	10	7	each.....	
120	Lamb Skins.....at	1	$2\frac{1}{2}$	.....	

£38 .. 1

GROCER'S.

Mr. Richard Groves April 21, 180

Bought of Francis Elliot,

		s.	d.		
25	lb. of lump sugar.....at	0	$6\frac{1}{2}$	*per* lb.	£
2	loaves of double refined, weight 15lb. ....at	0	$11\frac{1}{2}$	.....	
14	lb. of rice.....at	0	3	.....	
28	lb. of Malaga raisins.....at	0	5	.....	
15	lb. of currants.....at	0	$5\frac{1}{2}$	.....	
7	lb. of black pepper.....at	1	$10\frac{1}{2}$	.....	

£3 .. 2

CHEESEMONGER'S.

Mr. Charles Cross April 23, 180

Bought of Samuel Grant,

		s.	d.		
8	lb. of Cambridge butter at	0	6	*per* lb.	£
17	lb. of new cheese.....at	0	4	.....	
$\frac{1}{2}$	Fir. of butter, wt. 28 lb. at	0	$5\frac{1}{2}$	.....	
5	Cheshire cheeses, wt. 127 lb. at	0	4	.....	
2	Warwickshire do. wt, 15 lb. at	0	3	.....	
12	lb. of cream cheese.....at	0	6	.....	

£3 .. 1

CORN CHANDLER'S

Mr. Abraham Doyley April 29, 1909.

Bought of Isaac Jones,

		s.	d.	
...s, 19 bushels	at	1 ..	'	*per* bushel...
...e, 18 bushels	at	3 ..	9½	
..., 7 quarters	at	25 ..	0	*per* quarter
...s, 15 lb	at	1 ..	5	*per* lb.....
..., 6 quarters	at	2 ..	4	*per* bushel...
...s, 12 bushels	at	4 ..	8	

£23 .. 7 .. 4

REDUCTION

...the bringing or reducing numbers of one denomination ...into other numbers of another denomination, retaining ...ame value, and is performed by multiplication and divi-...

...*rst*, All great names are brought into small by multi-...g with so many of the less as make one of the greater. ...*condly*, All small names are brought into great by di-...g with so many of the less as make one of the greater.

...BLE OF SUCH COINS AS ARE CURRENT IN ENGLAND.

	l.	*s.*	*d.*
Guinea	1 ..	1 ..	0
Half ditto	0 ..	10 ..	6
One third ditto	0 ..	7 ..	0
Crown	0 ..	5 ..	0
Half ditto	0 ..	2 ..	6
Shilling	0 ..	1 ..	0

...OTE. *There are several pieces which speak their own ...: such as six-pence, four-pence, three-pence, two-pence, ...y, half-penny, farthing*

In £ 8 how many shillings and pence?

20

160 *shillings.*
12

1920 *pence.*

2. In £ 12 how many shillings, pence, and farthing
Ans. 240*s* 2880*d.* 11520/
3. In 311520 farthings, how many pounds?
Ans. 324*l.* 10*s.*
4. How many farthings are there in 21 guineas?
Ans. 211
5. In £17 .. 5 .. 3¼ how many farthings? *Ans.* 165
6. In £25 .. 14 .. 1 how many shillings and pence?
Ans. 514*s.* 616
7. In 17940 pence, how many crowns? *Ans.* 2
8. In 15 crowns, how many shillings and six-pences
Ans. 75*s.* 150 *six-pen*
9. In 57 half crowns, how many pence and farthing
Ans. 1710*d.* 6840 *farthin*
10. In 52 crowns, as many half-crowns, shillings, pence, how many farthings? *Ans.* 214
11. How many pence, shillings, and pounds, are in 17280 farthings? *Ans.* 4320*d.* 360*s.*
12. How many guineas in 21168 farthings?
Ans. 21 *guine*
13. In 16573 farthings, how many pounds,
Ans. 17*l.* 5*s.* 3
14. In 6169 pence, how many shillings and pounds
Ans. 514*s.* 25*l.* 14*s.*
15. In 6840 farthings, how many pence and half-cr
Ans. 1710*d.* 57 *half-crow*
16. In 21424 farthings, how many crowns, half-cr shillings, and pence, and of each an equal number?
Ans.
17. How many shillings, crowns, and pounds, in 60 eas? *Ans.* 1260*s.* 252 crowns, £
18. Reduce 76 moidores into shillings and pounds.
Facit 2052*s.* £102..
19. Reduce £ 102 .. 12 into shillings and moidores.
Facit 2052*s.* 76 moidor
20. How many shillings, half-crowns, and crowns there in £ 556, and each of an equal number?
Ans. 1308, *each, and* 2*s.* o
21. In 1308 half-crowns, as many crowns and shil how many pounds? *Ans.* £555 .. 18
22. Seven men brought £15 .. 10 each into the mi be changed for guineas, how many must they have in a
Ans. 103 *guineas,* 7*s.* o

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5*s.*—¼
, each t
remaind
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Ans. 66
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. If 103 guineas and seven shillings are to be divided ngst seven men, how many pounds sterling is that each?
Ans. £15..10..0.

. A certain person had 25 purses, and in each purse 12 eas, a crown, and a moidore, how many pounds sterling he in all? *Ans.* £355.

5. A gentleman, in his will, leaves £50. to the poor, ordered that ⅓ should be given to ancient men, each to 5*s.*—¼ to poor women, each to have 2*s.* 6*d.*—⅖ to poor , each to have 1*s.*—⅛ to poor girls, each to have 9*d.* and remainder to the person who distributed it. I demand many of each sort there were, and what the person distributed the money had for his pains?
Ans. 66 *men*, 100 *women*, 200 *boys*, 222 *girls*, £2..13..6. *to the person.*

TROY WEIGHT.

6. In 27 ounces of gold how many grains?
Ans. 12960.

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

8. In 3 *lb.* 10 *oz.* 7 *dwt.* 5 *gr.* how many grains?
Ans. 22253.

9. In 8 ingots of silver, each weighing 7 *lb.* 4 *oz.* 17 *dwt.* *rs.* how many ounces, pennyweights, and grains?
Ans. 711 *oz.* 14221 *dwt.* 341304 *gr.*

0. How many ingots of 7 *lb.* 4 *oz.* 17 *dwt.* 15 *gr.* each, here in 341304 grains? *Ans.* 8 *ingots.*

1. Bought 7 ingots of silver each containing 23 *lb.* 5 *oz.* *t.* how many grains? *Ans.* 945336.

2. A gentleman sent a tankard to his goldsmith, that hed 50 *oz.* 8 *dwt.* and ordered him to make it into ns, each to weigh 2 *oz.* 16 *dwt.* how many had he?
Ans. 18.

3. A gentleman delivered to a goldsmith 137 *oz.* 6 *dwt.* . of silver, and ordered him to make it into tankards of z. 15 *dwt.* 10 *gr.* each; spoons of 21 *oz.* 11 *dwt.* 13 *gr.* doz; salts of 3 *oz.* 10 *dwt.* each, and forks of 21 *oz.* *wt.* 13 *gr.* per doz.; and for every tankard to have one a dozen of spoons, and a dozen of forks, what is the ber of each he must have?
Ans. Two of each sort, 8 *oz.* 9 *dwt.* 9 *gr. over.*

AVOIRDUPOISE WEIGHT.

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

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

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

THINGS BOUGHT AND SOLD BY THE TALE.

12 Pieces or things make 1 Doz.
12 Dozen ..... 1 Groce
12 Groce, or 144 doz. 1 { Great 2 Reams ..... 1 Bu / Groce 1 Doz. of par. 12 Sk / 12 Skins ..... 1 R

24 Sheets make 1 Q
20 Quires ..... 1 R

31. In 14769 ounces, how many *cwt?*
Ans. 8 *cwt.* 0 *qr.* 27 *lb.* 1 *o*

35. Reduce 8 *cwt.* 0 *qr.* 27 *lb.* 1 *oz.* into quarters, pou and ounces. *Facit* 32 *qr.* 923 *lb.* 14769 *o*

36. Bought 32 bags of hops, each 2 *cwt.* 1 *qr.* 14 *lb.* another of 150 *lb.* how many *cwt.* in the whole?
Ans. 77 *cwt.* 1 *qr.* 10 *l*

37. In 34 ton, 17 *cwt.* 1 *qr.* 19 *lb.* how many pounds
Ans. 78111 *l*

38. In 547 great pounds, how many common pounds
Ans. 820 *lb.* 8 *o*

39. In 27 *cwt.* of raisins, how many parcels of 18 *lb.* e
Ans. 16

40. In 9 *cwt.* 2 *qr.* 14 *lb.* of indigo, how many pound
Ans. 1078 *l*

41. Bought 27 bags of hops, each 2 *cwt.* 1 *qr.* 15 *lb.* one bag of 137 *lb.* how many hundred is the whole?
Ans. 65 *cwt.* 2 *qr.* 10 *l*

42. How many pounds in 27 hogsheads of tobacco, weighing neat 8 *cwt.* $\frac{3}{4}$? *Ans.* 264

43. In 552 common pounds of silk, how many pounds? *Ans.* 3

44. How many parcels of sugar of 16 *lb.* 2 *oz.* are in 16 *cwt.* 1 *qr.* 15 *lb.* *Ans.* 113 *par.* 12 *lb.* 14 *oz.* ov

APOTHECARIES WEIGHT.

5. In 27 ℔. 7 ℥. 2 ʒ. 1 ℈. 2 *gr.* how many grains?
Ans. 159022.

6. How many ℔. ℥. ʒ. ℈. and *gr.* are there in 159022 ns? *Ans.* 27 ℔. 7 ℥. 2 ʒ. 1 ℈. 2 *gr.*

CLOTH MEASURE.

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

8. In 75 English ells, how many yards?
Ans. 93 *yards*, 3 *qr.*

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

0. In 24 pieces, each containing 32 Flemish ells, how y English ells? *Ans.* 460 *ells*, 4 *qr.*

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

2. Bought 27 pieces of English stuffs, each 27 ells, many yards? *Ans.* 911 *yards*, 1 *qr.*

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

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

LONG MEASURE.

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

6. In 7 miles, how many feet, inches, and barley corns?
Ans. 36960 *feet*, 443520 *inches*, 1330560 *barley corns.*

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

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

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

0. If from London to York be accounted 50 leagues, emand how many miles, yards, feet, inches, and barley ns? *Ans.* 150 *miles*, 264000 *yards*, 792000 *feet*, 9504000 *inches*, 28512000 *barley corns.*

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

62. How many barley corns will reach ronud the wo
which is 360 degrees, each degree 69½ miles.
Ans. 4755801600 *barley corn*

LAND MEASURE.

63. In 27 acres, how many roods and perches?
Ans. 108 *roods*, 4320 *perch*
64. In 4320 perches, how many acres? *Ans.* 27
65. A person having a piece of ground containing
acres, 1 pole, has a mind to dispose of 15 acres to A. I
sire to know how many perches he will have left.
Ans. 3521
66. There are 4 fields to be divided into shares of
perches each; the first field containing 5 acres; the sec
4 acres 2 poles; the third 7 acres 3 roods; and the fo
2 acres 1 rood; I desire to know how many shares are
tained therein? *Ans.* 40 *shares*, 42 *perches*

WINE MEASURE.

67. Bought 5 tun of Port wine, how many gallons
pints? *Ans.* 1260 *gallons*, 10080 *pints*
68. In 10080 pints, how many tuns? *Ans.* 5
69. In 5896 gallons of Canary, how many pipes
hogshead, and of each a like number?
Ans. 31 *of each*, 37 *gallons over*
70. A Gentleman ordered his butler to bottle off
a pipe of French wine into quarts, and the rest into pi
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. 1324
72. In 10 barrels of ale, how many gallons and quart
Ans. 320 *gal.* 1280 *q*
73. In 72 hogshead of beer, how many barrels?
Ans. 108
74. In 108 barrels of beer, how many hogsheads?
Ans. 72

DRY MEASURE.

5. In 120 quarters of wheat, how many bushels, pecks, ons, and quarts?
Ans. 960 *bushels*, 3840 *pecks*, 7680 *gallons*, 30720 *qts.*

6. In 30720 quarts of corn, how many quarters?
Ans. 120.

7. In 20 chaldrons of coals, how many pecks?
Ans. 2880.

8. In 273 lasts of corn, how many pecks?
Ans. 87360.

TIME.

9. In 72015 hours, how many weeks?
Ans. 428 *weeks*, 4 *days*, 15 *hours.*

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

1. Stowe writes, London was built 1108 years before r Saviour's birth, how many hours is it since to Christmas, 94? *Ans.* 25438932 *hours.*

2. From Nov. 17, 1738, to Sept. 12, 1739, how many ys? *Ans.* 299.

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

4. From July 18, 1723, to April 18, 1750, how many ars and days?
Ans. 26 *years*, 9770 ½ *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 to the first.

RULE. First state the question, that is, place the numbers such order, that the first and third be of one kind, and e second the same as the number required; then bring e first and third numbers into one name, and the second to the lowest term mentioned. Multiply the second and ird numbers together, and divide the product by the first,

the quotient will be the answer to the question in the s
denomination you left the second number in.

EXAMPLES.

1. If 1 *lb.* of sugar cost $4\frac{1}{2}$ *d*, what cost 54 *lb*

1 : $4\frac{1}{2}$: : 54
4 18

18 4)972 *Ans.* £ 1..0..3.

12)243

20*s* 3*d.*

2. If a gallon of beer cost 10*d.* what is that *per* barrel
Ans. £1..10..0

3. If a pair of shoes cost 4*s.* 6*d.* what will 12 do
come to? *Ans.* £32..8..0

4. If 1 yard of cloth cost 15*s.* 6*d.* what will 32 yards c
at the same rate? *Ans.* £24..16..0

5. If 32 yards of cloth cost £24..16..0. what is the va
of a yard? *Ans.* 15*s.* 6d

6. If I give £4..18..0. for 1 *cwt.* of sugar, at what r
did I buy it *per lb.*? *Ans.* $10\frac{1}{2}d$

7. If I buy 20 pieces of cloth, each 20 ells, for 12*s.*
per ell, what is the value of the whole? *Ans.* £25

8. What will 25 *cwt.* 3 *qrs.* 14 *lb.* of tobacco come to
$15\frac{1}{4}d.$ *per lb.*? *Ans.* £187..3..3

9. Bought 27 yards $\frac{1}{4}$ of muslin, at 6*s.* $9\frac{1}{2}d.$ *per* y
what does it amount to? *Ans.* £9..5..0$\frac{3}{4}$ 2 rem

10. Bought 17 *cwt* 1 *qr.* 14 *lb.* of iron, at $3\frac{1}{4}d.$ *per*
what does it come to? *Ans.* £26..7..0

11. If coffee is sold for $5\frac{1}{2}d.$ *per* ounce, what must
given for 2 *cwt*? *Ans.* £82..2..8

12. How many yards of cloth may be bought
£21..11..$1\frac{1}{2}$, when $3\frac{1}{2}$ cost £2..14..3?
Ans. 27 *yards*, 3 *qrs.* 1 *nail.* 84 rem

13. If 1 *cwt.* of Cheshire cheese cost £1..14..8. w
must I give for $3\frac{1}{2}$ *lb.*? *Ans.* 1*s.* 1*d*

14. Bought 1 *cwt.* 24 *lb.* 8 *oz.* of old lead, at 9*s. per c*
what does it come to? *Ans.* 10*s.* $11\frac{1}{4}d.$ 112 rem

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

6. 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.*

7. If 504 Flemish ells, 2 quarters, cost £283..17..6. at what rate must I give for 14 yards? *Ans.* £10..10.

8. Gave £1..1..8. for 3 *lb.* of coffee, what must be given for 29 *lb.* 4 *oz.*? *Ans.* £10..11..3.

9. If 1 English ell, 2 quarters, cost 4*s*. 7*d*. what will 7 yards $\frac{1}{2}$ cost at the same rate? *Ans.* £5..3..5$\frac{1}{47}$.

10. If 1 ounce of gold is worth £5..4..2. what is the worth of one grain? *Ans.* 2$\frac{1}{2}$*d*. 20 *rem.*

11. If 14 yards of broad cloth cost £9..12. what is the purchase of 75 yards? *Ans.* £51..8..6$\frac{3}{4}$. 6 *rem.*

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

13. If 1 *cwt.* cost £12..12..6. what must I give for 14 *cwt.* 1 *qr.* 6 *lb.*? *Ans.* £182..0..11$\frac{1}{2}$. 8 *rem.*

14. Bought 7 yards of cloth for 17*s*. 8*d*. what must be given for 5 pieces, each containing 27 yards $\frac{1}{2}$?
Ans. £17..7..0$\frac{1}{4}$. 2 *rem.*

15. If 7 *oz.* 1 *dwt.* of gold be worth £35. what is the value of 14 *lb.* 9 *oz.* 12 *dwts.* 16. *gr.* at the same rate?
Ans. £823..9. 3$\frac{3}{4}$. 552 *rem.*

16. A draper bought 420 yards of broad cloth, at the rate of 14*s*. 10$\frac{1}{4}$ *d*. *per* ell English, how much did he pay for the whole? *Ans.* £250..5.

17. A gentleman bought a wedge of gold, which weighed 1*b*. 3 *oz.* 8 *dwt.* for the sum of £514..4. at what rate did he pay for it *per* ounce? *Ans.* £3.

18. A grocer bought 4 hogsheads of sugar, each weighing 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.

19. A draper bought 8 packs of cloth, each containing 3 parcels, each parcel 10 pieces, and each piece 26 yards, which he gave after the rate of £4..16. for 6 yards; I desire to know what the 8 packs stood him in? *Ans.* £6656.

20. If 24 *lb.* of raisins cost 6*s*. 6*d*. what will 18 frails cost, each weighing neat 3 *qrs.* 18 *lb.*? *Ans.* £24..17..3.

31. If 1 ounce of silver be worth 5*s*. what is the pri 14 ingots, each weighing 7 *lb*. 5 *oz* 10 *dwt*.?

Ans. £313.

32. What is the price of a pack of wool weighing 2 1 *qr*. 19 *lb*. at 8*s*. 6*d*. *per* stone? *Ans.* £8..4. 6½. 10

33. Bought 59 *cwt*. 2 *qrs*. 24 *lb*. of tobacco, at £2..1 *per cwt*. what does it come to?

Ans. £171..3..7¼. 80 *re*

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

Ans. £2398..10. *value* 1½. 432 *rem. per*

35. If a pair of stockings cost 10 groats, how many d may I buy for £43..5.? *Ans.* 21 *doz*. 7½ *pa*

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

Ans. £7..15..4¼ 1 *re*

37. If an ounce of fine gold is sold for £3..10..0. come 7 ingots to, each weighing 3 *lb*. 7 *oz*. 14 *dwt* 21 *g* the same price?

Ans. £1071..14..

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

Ans. £158..18..

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

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

40. A gentleman hath an annuity of £896..17..0. *annum*, I desire to know how much he may spend daily at the year's end he may lay up 200 guineas, and give t poor quarterly 10 moidores? *Ans.* £1..14..8. 176 *re*

THE RULE OF THREE INVERSE.

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

ULE. Multiply the first and second terms together, and e the product by the third, the quotient will bear such ortion to the second as the first does to the third.

EXAMPLES.

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

8 : 12 :: 16 : 6

8

16)96(6 *days.*

If 54 men can build a house in 90 days, how many can do the same in 50 days? *Ans.* 97 *men*$\frac{1}{5}$.

If when a peck of wheat is sold for 2*s.* the penny loaf hs 8 *oz.* how much must it weigh when the peck is h but 1*s.* 6*d.*? *Ans.* 10 *oz.* 10*dr.*$\frac{2}{5}$

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

How many yards of 3 quarters wide, are equal in sure to 30 yards of 5 quarters wide? *Ans.* 50.

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

Ans. 16 *months.*

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

Ans. 1800 *lb.*

If 108 workmen finish a piece of work in 12 days, how y are sufficient to finish it in 3 days? *Ans.* 432.

An army besieging a town, in which were 1000 sol- s, with provisions for three months, how many soldiers arted, when the provision lasted them 6 months?

Ans. 500.

0. If £20. worth of wine is sufficient to serve an ordinary 00 men, when the tun is sold for £30. how many will 0. worth suffice, when the tun is sold but for £24.?

Ans. 125 *men.*

1. A courier makes a journey in 24 days, when the day ut 12 hours long, how many days will he be going the e journey, when the days are 16 hours long?

Ans. 18 *days.*

12. How much plush is sufficient for a cloak, whic in it 4 yards of 7 quarters wide of stuff for the lining plush being but 3 quarters wide? *Ans.* 9 *yard*

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

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

14. Borrowed of my friend £64. for 8 months, a hath occasion another time to borrow of me for 12 mo how much must I lend him to requite his former kin to me? *Ans.* £42..13

15. A regiment of soldiers consisting of 1000 men, have new coats, each coat to contain $2\frac{1}{2}$ yards of 5 quarters wide, and to be lined with shalloon of 3 qu wide; I demand how many yards of shalloon will line t

Ans. 4166 *ya. ds,* 2 *quarters,* 2 *nails,* 2 *r*

THE DOUBLE RULE OF THREE

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

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

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

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

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

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

PROOF. By two single rules of three.

EXAMPLES.

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

two single rules
hor. bu. hor. bu.
14 : 56 : : 20 : : 80
s bu. hor. bu.
16 : 80 : : 24 : 120

or in one stating, worked thus:
hor. day. bu.
14 : 16 : 56
20 : 24 : —

$$\frac{56 \times 20 \times 24}{14 \times 16} = 120$$

If 8 men in 14 [illegible] mow 112 acres of grass, how men must there be to mow 2000 acres in 10 days?

s.days.acres.days.
112:14::2000:250
s. men. days. men.
250 : 8 :: 10 : 200

men. days. acres.
8 : : 14 : 112
—: : 10 : 2000

$$\frac{8 \times 14 \times 2000}{112 \times 10} = 200$$

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

If a carrier receive £2..2..0. for the carriage of 3 *cwt.* miles, how much ought he to receive for the carriage of 3 *qrs.* 14 *lb.* for 50 miles? *Ans.* £1..16..9.

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

Ans. 15031.

If 40 acres of grass be mowed by 8 men in 7 days, how acres can be mowed by 24 men in 28 days?

Ans. 480.

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

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

If a regiment, consisting of 939 soldiers, consume 351 quarters of wheat in 168 days, how many soldiers will consume 1404 in 56 days? *Ans.* 11268.

In a family consisting of 7 persons, there are drank 2 kilderkins of beer in 12 days, how many kilderkins there be drank out by another family of 14 persons in days? *Ans* 2 *kil.* 12 *gal.*

If the carriage of 60 *cwt.* 20 miles cost £14..10..0. weight can I have carried 30 miles for £5..8..9. at the rate of carriage? *Ans.* 15 *cwt.*

12. If 2 horses eat 8 bushels of oats in 16 days, many horses will eat up 3000 quarters in 24 days?
Ans. 40

13. If £100. in 12 months gain £7. interest, what interest of £571. for 6 years? *Ans.* £239..16.

14. If I pay 10*s.* for the carriage of 2 tuns 6 miles, must I pay for the carriage of 12 tuns, 17 *cwt.* 17 mi
Ans. £9..2.

PRACTICE

IS so called from the general use thereof by all p concerned in trade and business.

All questions in this rule are performed by taking a or even parts, by which means many tedious redu 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.*	*rs.* *lb.*
10..0 is $\frac{1}{2}$	6 – $\frac{1}{2}$	10 is $\frac{1}{2}$	2 or 56 is
6..8 – $\frac{1}{3}$	4 – $\frac{1}{3}$	5 – $\frac{1}{4}$	1 – 28 –
5..0 – $\frac{1}{4}$	3 – $\frac{1}{4}$	4 – $\frac{1}{5}$	14 – –
4..0 – $\frac{1}{5}$	2 – $\frac{1}{6}$	$2\frac{1}{2}$ – $\frac{1}{8}$	
3..4 – $\frac{1}{6}$	$1\frac{1}{2}$ – $\frac{1}{8}$	2 – $\frac{1}{10}$	*Of a Quarter.*
2..6 – $\frac{1}{8}$	1 – $\frac{1}{12}$		14.....
2..0 – $\frac{1}{10}$			7.....
1..8 – $\frac{1}{12}$			4 .....
			$3\frac{1}{2}$.....

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

$\frac{1}{4}$ is $\frac{1}{4}$ 5704 *lb.* at $\frac{1}{3}$	7695 at $\frac{1}{2}$	6547 a
12)1426	*Facit* £16..0..7$\frac{1}{2}$	*Facit* £20.
2|0)11|8..10	5740 at $\frac{1}{2}$	4573 a
£5..18..10	*Facit* £11..19..2	*Facit* £14.

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

7547 at 1*d.*

)62|8..11

£31..8..11

3751 at 1*d.*$\frac{1}{4}$

312..7
78..1$\frac{3}{4}$

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

19..10..8$\frac{3}{4}$

325 at 1*d.*$\frac{1}{2}$
£339..10..7

45 at 1*d.*$\frac{3}{4}$
£45..12..0$\frac{1}{2}$

51 at 2*d.*
t £19..11..10

10 at 2*d.*$\frac{1}{4}$
£67..11..10$\frac{1}{2}$

10 at 2*d.*$\frac{1}{2}$
cit £28..4..7

250 at 2*d.*$\frac{3}{4}$
cit £37..4..9$\frac{1}{2}$

715 at 3*d.*
it £33..18..9

062 at 3*d.*$\frac{1}{4}$
it £95..12..7$\frac{1}{2}$

47 at 3*d.*$\frac{1}{2}$
it £31..6..2$\frac{1}{2}$

000 at 3*d.*$\frac{3}{4}$
it £109..7..6

3257 at 4*d.*
Facit £54..5..8

2056 at 4*d.*$\frac{1}{4}$
Facit £36..8..2

3752 at 4*d.*$\frac{1}{2}$
Facit £70..7..0

2107 at 4*d.*$\frac{3}{4}$
Facit £41..14..0$\frac{1}{4}$

3210 at 5*d.*
Facit £66..17..6

2715 at 5*d.*$\frac{1}{4}$
Facit £59..7..9$\frac{3}{4}$

3120 at 5*d.*$\frac{1}{2}$
Facit £71..10..0

7521 at 5*d.*$\frac{3}{4}$
Facit £180..3..9$\frac{3}{4}$

3271 at 6*d.*
Facit £81..15..6

7914 at 6*d.*$\frac{1}{4}$
Facit £206..1..10$\frac{1}{2}$

3250 at 6*d.*$\frac{1}{2}$
Facit £88..0..5

2708 at 6*d.*$\frac{3}{4}$
Facit £76..3..3

3271 at 7*d.*
Facit £95..8..1

3254 at 7*d.*$\frac{1}{4}$
Facit £98..5..11$\frac{1}{2}$

2701 at 7*d.*$\frac{1}{2}$
Facit £84..3..1$\frac{1}{2}$

3714 at 7*d.*$\frac{3}{4}$
Facit £119..18..7$\frac{1}{2}$

2710 at 8*d.*
Facit £90..6..8

3514 at 8*d.*$\frac{1}{4}$
Facit £120..15..10$\frac{1}{2}$

2759 at 8*d.*$\frac{1}{2}$
Facit £97..14..3$\frac{1}{2}$

9872 at 8*d.*$\frac{3}{4}$
Facit £359..18..4

5272 at 9*d.*
Facit £197..14..0

6325 at 9*d.*$\frac{1}{4}$
Facit £243..15..6$\frac{1}{4}$

7924 at 9*d.*$\frac{1}{2}$
Facit £313..13..2

2150 at 9*d.*$\frac{3}{4}$
Facit £87..6..10$\frac{1}{2}$

6325 at 10*d.*
Facit £263..10..10

5724 at 10*d.*$\frac{1}{4}$
Facit £244..9..3

6327 at 10*d.*$\frac{1}{4}$
Facit £270..4..3$\frac{3}{4}$

3254 at 10*d.*$\frac{1}{2}$
Facit £142..7..3

7291 at 10*d.*$\frac{3}{4}$
Facit £326..11..6$\frac{1}{4}$

3256 at 11*d.*
Facit £149..4..3

7254 at 11*d.*¼ *Facit* £340..0..7½	3754 at 11*d.*½ *Facit* £179..17..7	7972 at 11*d.*¾ *Facit* £390..5..

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

¼ ⅛2106 at 12*d.*¼ 43..10½ 2|0)214|9..10½ £107..9..10½	½ ¼3715 at 12*d.*½ 154..9½ 2|0)386|9..9½ £193..9..9½	2712 at 12*d.*¾ *Facit* £144..1.. 2107 at 1*s.* 1*d.* *Facit* £114..2..
3215 at 1*s.* 1*d.*¼ *Facit* £177..9..10¾	3725 at 1*s.* 5*d.* *Facit* £263..17..1	1004 at 1*s.* 8*d.* *Facit* £86..16..
2790 at 1*s.* 1*d.*½ *Facit* £156..18..9	7250 at 1*s.* 5*d.*¼ *Facit* £521..1..10½	2104 at 1*s.* 9*d.* *Facit* £184..2..
7904 at 1*s.* 1*d.*¾ *Facit* £452..16..8	2597 at 1*s.* 5*d.*½ *Facit* £189..7..3½	2571 at 1*s.* 9*d.*¼ *Facit* £227..12..
3750 at 1*s.* 2*d.* *Facit* £218..15..0	7210 at 1*s.* 5*d.*¾ *Facit* £533..4..9½	2104 at 1*s.* 9*d.*½ *Facit* £188..9..
3291 at 1*s.* 2*d.*¼ *Facit* £195..8..0¼	7524 at 1*s.* 6*d.* *Facit* £564..6..0	7506 at 1*s.* 9*d.*¾ *Facit* £680..4..
9254 at 1*s.* 2*d.*½ *Facit* £559..1.11	7103 at 1*s.* 6*d.*¼ *Facit* £540..2..5¾	1071 at 1*s.* 10*d.* *Facit* £98..3..6
7250 at 1*s.* 2*d.*¾ *Facit* £445..11..5½	3254 at 1*s.* 6*d.*½ *Facit* £450..16..7	5200 at 1*s.* 10*d.*½ *Facit* 382..0..8
7591 at 1*s.* 3*d.* *Facit* £474..8..9	7925 at 1*s.* 6*d.*¾ *Facit* £619..2..9¾	2117 at 1*s.* 10*d.*¾ *Facit* £198..9..4
6325 at 1*s.* 3*d.*¼ *Facit* £401..18..0¼	9271 at 1*s.* 7*d.* *Facit* £733..19..1	1007 at 1*s.* 10*d.* *Facit* £95..9..4
5271 at 1*s.* 2*d.*½ *Facit* £340..8..4½	7210 at 1*s.* 7*d.*¼ *Facit* £578..6..0½	5000 at 1*s.* 11*d.* *Facit* £479..3..

3254 at 1*s.* 3*d.* *Facit* £213..10..10½	2310 at 1*s.* 7*d.* *Facit* £187..13..9	2105 at 1*s.* 11*d.* *Facit* £203..18..5½
2915 at 1*s.* 4*d.* *Facit* £194..6..8	2504 at 1*s.* 7*d.* *Facit* £206..1..2	1006 at 1*s.* 11*d.* *Facit* £98..10..1
270 at 1*s.* 4*d.* *Facit* £221..8..1½	7152 at 1*s.* 8*d.* *Facit* £596..0..0	2705 at 1*s.* 11*d.* *Facit* £267..13..7½
059 at 1*s.* 4*d.* *Facit* £485..6..1½	2905 at 1*s.* 8*d.* *Facit* £215..2..2½	5000 at 1*s.* 11*d.* *Facit* £489..11..8
750 at 1*s.* 4*d.* *Facit* £191..18..6½	2104 at 1*s.* 8*d.* *Facit* £606..16..0	4000 at 1*s.* 11*d.* *Facit* £295..16..8

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

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

RULE 5. When the price consists of odd shillings, mul- y the given quantity by the price, and divide by 20, the duct will be the answer.

2703 at 1*s.* *Facit* £135..3..0	2715 at 7*s.* *Facit* £950..5..0	2150 at 15*s.* *Facit* £1612..10..0

3270 at 3*s.* 3 20)9810 £490..10..0	3214 at 9*s.* *Facit* £1446..6..0	3142 at 17 *Facit* £2670..
	2710 at 11*s.* *Facit* £1490..10..0	2150 at 19 *Facit* £2042..
3271 at 5*s.* *Facit* £817..15..0	3279 at 13*s.* *Facit* £2066..7..0	7157 at 19 *Facit* £6799

Note. *When the price is 5s. divide the quantity by 4 if any remains it is 5s.*

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

s.	*d.*			
6	8	$\frac{1}{3}$	2710 at 6*s.* 8*d.* *Facit* £903..6..8	7514 at 4*s.* *Facit* £1721.
			3150 at 3*s.* 4*d.* *Facit* £525..0..0	2517 at 5*s.* *Facit* £660..
			2715 at 2*s.* 6*d.* *Facit* £339..7..6	2547 at 7*s.* *Facit* £928..1
			7150 at 1*s.* 8*d.* *Facit* £595..16..8	3271 at 5*s.* *Facit* £943..
			3215 at 1*s.* 4*d.* *Facit* £214..6 .8	2103 at 15*s.* *Facit* £1616..
			7211 at 1*s.* 3*d.* *Facit* £450..13..9	7152 at 17*s.* *Facit* £6280.
s.	*d.*			2510 at 14*s.* *Facit* £1832..
3	2	$\frac{1}{6}$	2710 at 3*s.* 2*d.* 3 8130 451..8 858|1..8	3715 at 9*s.* *Facit* £1741.
				2572 at 13*s.* *Facit* £1752
			£429..1..8	7251 at 14*s.* *Facit* £5324.

3210 at 15*s.* 7*d.*¾	2710 at 19*s.* 2*d.*½
Facit £2511..3..1½	*Facit* £2602..14..7

RULE 7. 1*st.* When the price is pounds and shillings, ltiply the quantity by the pounds, and proceed with the lings if they are even, as in the 4th Rule; if odd, take aliquot parts, add them together, the sum will be the wer.

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

dly, When the price is pounds, shillings, pence, and hings, and the shillings and pence not the aliquot parts pound, reduce the pounds and shillings into shillings, tiply the quantity by the shillings, take parts for the rest, them together, and divide by 20.

ote, *When the given quantity is no more than three fig- proceed as in* Compound Multiplication.

⅓	7215 at £7..4..0	6	½	2710 at £2..3..7½	
	7			43	
	50505			116530	
	1443	1½	¼	1355	
	51948£			338..9	
			20	11822|3..9	
⅛	2104 at £5..3..0			£5911..3..9	
	5				
	10520			3215 at £1..17..0	
	263			*Facit* £5947..15..0	
	52..12				
	10835..12			2107 at £1..13..0	
				Facit £3476..11..0	
	2107 at £2..8..0			3215 at £4..6..8	
	Facit £5056..16..0			*Facit* £13931..13..4	
	7156 at £5..6..0			2154 at £7..1..3	
	Facit £37926..16..0			*Facit* £15212..12..6	

2701 at £2..3..4		142 at £1..15..2
Facit £5852..3..4		*Facit* £250..2..
2715 at £1..17..2½		95 at £15..17..
Facit £5051..0..7½		*Facit* £1494..7..
2157 at £3..15..2¼		37 at £1..19..5
Facit £8108..19..5¼		*Facit* £73..0..8
3210 at £1..18..6¾		2175 at £2..15..
Facit £6189..5..7½		*Facit* £6022..0..
2157 at £2..7..4½		2150 at £17..16..
Facit £5109..7..10½		*Facit* £38283..8..

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
		5	
		19.. 7.. 6	
		5	
lb.		96..17.. 6	
14	¼	1..18.. 9	
		9.. 8¼	
		99.. 5..11¼	

2. At £1..14..9. *per cwt.* what comes 17 *cwt.* 1 *qr.* 17 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..0½

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.. *per cwt.* what did I give for the whole?

Ans. £227..14..0

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

Tobacco at £3..17..10. the *cwt.* what is the value of wt. 15 *lb.*? *Ans.* £378..0..3.

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

Bought sugar at £3..14..6 the *cwt.* what did I give 5 *cwt.* 1 *qr.* 10 *lb*? *Ans.* £57..2..9.

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

oap at £3..11..6. the *cwt.* what is the value of 53 *cwt.* ? *Ans.* £190..0..4.

The Allowances usually made in this Weight are TARE, TRETT, *and* CLOFF.

ARE is an allowance made to the buyer for the weight he box, barrel, bag, &c. which contains the goods ght and is either

t so much per box, barrel, &c.

t so much per cent, or

t so much in the gross weight.

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

LOFF is an allowance of 2*lb.* to the citizens of London, very draft above 3*cwt.* on some sort of goods.

ROSS WEIGHT is the whole weight of any sort of ls, and that which contains it.

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

EAT is the pure weight, when all allowances are de- ted.

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

OTE. *To reduce pounds into gallons, multiply by* 2, *di- by* 15.

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

Ans. 37 *cwt.* 1 *qr.* 14 *lb.*

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

2. What is the neat weight of 25 hogsheads of toba weighing gross 163 *cwt.* 2 *qrs.* 15 *lb.* tare 100 *lb. per* h head? *Ans.* 141 *cwt.* 1 *qr.* 7 *l*

3. In 16 bags of pepper, each 85 *lb.* 4 *oz.* gross, tare bag 3 *lb.* 5 *oz.* how many pounds neat? *Ans.* 131

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

4. What is the neat weight of 5 hogsheads of toba weighing gross 75 *cwt.* 1 *qr.* 14 *lb.* tare in the whole 752 *Ans.* 68 *cwt.* 2 *qrs.* 18 *l*

5. In 75 barrels of figs, each 2 *qrs.* 27 *lb.* gross, tar 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 gross weight by the aliquot parts of a *cwt.* which subt from the gross, the 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, e 8 *cwt.* 2 *qrs.* 5 *lb.* tare at 14 *lb. per cwt.*?

	cwt.	*qr.*	*lb.*
	8 ..	2 ..	5
			9X2=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 *cwt.* 16 *lb.* how much neat weight?

Ans. 48 *cwt.* 0 *qr.* 24 *lb.*

What is the neat weight of 9 hogsheads of nutmegs, weighing gross 8 *cwt.* 3 *qrs.* 14 *lb.* tare 16 *lb. per cwt?*
Ans. 68 *cwt.* 1 *qr.* 24 *lb.*

ULE 4. When tret is allowed with tare, divide the ds suttle by 26, the quotient is the tret, which subtract the suttle, the remainder is neat.

In one butt of currants, weighing 12 *cwt.* 2 *qrs.* 24 *lb.*, tare 14 *lb. per cwt.* tret 4 *lb. per* 104 *lb.* how many ds neat?

12 .. 2 .. 24
4
50
28
14 = $\frac{1}{8}$ 1424 *gross.*
178 *tare.*
26) 1246 *suttle.*
47 *tret.*
1199 *neat.*

. In 7 *cwt.* 3 *qrs.* 27 *lb.* gross, tare 36 *lb.* tret 4 *lb. per lb.* how many pounds neat? *Ans.* 826 *lb.*

. 152 *cwt.* 1 *qr.* 3 *lb.* gross, tare 10 *lb. per cwt.* tret 4*lb.* 04 *lb.* how much neat weight? *Ans.* 133 *cwt.* 1 *qr.* 11 *lb.*

ULE 5. When cloff is allowed, multiply the *cwt.* suttle divide the product by 3, the quotient will be the pounds which subtract from the suttle, the remainder will be neat.

. What is the neat weight of 3 hogsheads of tobacco, hing 15 *cwt.* 3 *qrs.* 20 *lb.* gross, tare 7 *lb. per cwt.* tret *per* 104 *lb.* cloff 2 *lb.* for 3 *cwt.*? *Ans.* 14 *cwt.* 1 *qr.* 3 *lb.*

7 = $\frac{1}{10}$ 15 .. 3 .. 20 *gross.*
3 .. 27$\frac{1}{2}$ *tare.*
14 .. 3 .. 20$\frac{1}{2}$ *suttle.*
2 .. 8 *tret.*
14 .. 1 .. 12$\frac{1}{2}$ *suttle.*
9$\frac{1}{2}$ *cloff.*
14 .. 1 .. 3 neat.

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

Ans. 34 *cwt.* 2 *qrs.*

SIMPLE INTEREST

IS the PROFIT allowed in lending or forbearance sum of money, for a determined space of time.

The PRINCIPAL is the money lent for which Int to be received.

The RATE PER CENT, is a certain sum agreed tween the Borrower and the Lender, to be paid for £100. for the use of the principal 12 months.

The AMOUNT is the Principal and Interest add gether.

INTEREST is also applied to Commission, Brokage chasing of Stocks, and Insurance, and are calculated same rules.

To find the Interest of any Sum of Money for a Y

RULE 1. Multiply the Principal by the Rate *per cen* product, divided by 100, will give the interest require

For several Years.

2. Multiply the interest of one year by the num years given in the question, and the product will be th swer.

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

EXAMPLES.

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

5

18|75

20

15|00

Ans. £18..15

What is the interest of 268*l.* for one year at 4 *per cent.* *num?* *Ans.* £10 .. 14 .. $4\frac{3}{4}$.

What is the interest of £945 .. 10 .. 0. for a year at 4 *t. per annum?* *Ans.* £37 .. 16 .. $4\frac{3}{4}$.

What is the interest of £547 .. 15 .. 0. at 5 *per cent. per* for three years? *Ans.* £82 .. 3 .. 3.

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

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

y correspondent writes me word, that he has bought o the amount of £754 .. 16 .. 0. on my account, what s commission come to at $2\frac{1}{2}$ *per cent?* *Ans.* £18 .. 17 .. $4\frac{3}{4}$.

I allow my factor $3\frac{3}{4}$ *per cent.* for commission, what demand on the laying out £876 .. 5 .. 10? *Ans.* £32 .. 17 .. $2\frac{1}{2}$.

t $110\frac{1}{4}$ *per cent.* what is the purchase of £2054 .. 16 .. 0. ea Stock? *Ans.* £2265 .. 8 .. 4.

At $104\frac{3}{8}$ *per cent.* South-sea Annuities, what is the e of £1797 .. 15 .. 0? *Ans.* £1876 .. 6 .. $11\frac{3}{4}$.

t $96\frac{3}{4}$ *per cent.* what is the purchase of £577 .. 19 .. 0. nnuities? *Ans.* 559 .. 3 .. $3\frac{3}{4}$.

t $124\frac{5}{8}$ *per cent.* what is the purchase of £758 .. 17 .. ia Stock? *Ans.* 945 .. 15 .. $4\frac{1}{4}$.

BROKAGE

allowance to Brokers, for helping merchants or facpersons to buy or sell their goods.

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

I employ a broker to sell goods for me, to the value 5 .. 17 .. 6. what is the brokage at 4*s. per cent?*

25|75 .. 17 .. 6.
20

15|17
12

2|10

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

Ans. £5 .. 3 .. $0\frac{1}{4}$

Ans. £18..15

When a broker sells goods to the amount of 5 .. 10. what may he demand for brokage, if he is 5*s.* 6*d. per cent?* *Ans.* £19 .. 10 .. $9\frac{1}{4}$.

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

16. What is the interest of £547..2..4. for 5 years a half, at 4 *per cent. per annum?* *Ans.* £120 .. 7 .. 3

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

18. What is the interest of £479 .. 5 .. 0. for 5 years a quarter, at 5 *per cent. per annum?* *Ans.* £125 .. 16 .. 0

19. What is the interest of £576 .. 2 .. 7, for $7\frac{1}{4}$ years $4\frac{1}{2}$ *per cent. per annum?* *Ans.* £187 .. 19 .. 1

20. What is the interest of £279 .. 13 .. 8. at $5\frac{1}{4}$ *per per annum*, for $3\frac{1}{2}$ years? *Ans.* £51 .. 7 .. 1

When the Interest is required for any number of Wee

RULE. As 52 weeks are to the interest of the given for a year: so are the weeks given to the interest requ

21. What is the interest of £259 .. 13 .. 5. for 20 week 5 *per cent. per annum?* *Ans.* £4 .. 19 .. 10

22. What is the amount of £375 .. 6 .. 1. for 12 week $4\frac{1}{2}$ *per cent. per annum?* *Ans.* £379 .. 4 .. 0

When the Interest is for any number of Days.

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

23. At $5\frac{1}{2}$ *per cent. per annum*, what is the interes £985 .. 2 .. 7. for 5 years, 127 days? *Ans.* £289 .. 15 ..

24. What is the interest of £2726 .. 1 .. 4. at $4\frac{1}{2}$ *per per annum*, for 3 years, 154 days? *Ans.* £419 .. 15 ..

When the Amount, Time, and Rate per cent. *are give find the Principal.*

RULE. As the Amount of £100, at the rate and given: is to £100. :: so is the amount given: to the pr pal required.

25. What principal being put to interest will amou £402 .. 10 .. 0. in 5 years, at 3 *per cent. per annum?*

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

20 20

2300 8050

100

23|00)8050|00)£350 *Ans.*

6. What principal being put to interest for 9 years, will ount to £734..8..0 at 4 *per cent per annum?* *Ans.* £540.

7. What principal being put to interest for 7 years, at *er cent per annum*, will amount to £334..16..0?

Ans. £248.

en the principal Rate per cent. *and the amount are given, to find the time.*

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

8. In what time will £350 amount to £402..10..0. at *er cent. per annum?*

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

9. In what time will £540. amount to £734..8..0. at *er cent. per annum?* *Ans.* 9 *years.*

0. In what time will £248. amount to £334..16..0. at *er cent. per annum?* *Ans.* 7 *years.*

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

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

1. At what rate *per cent.* will £350 amount to 02..10..0. in 5 years time?

350 As £350 : £52..10 : : £100 : £15.

52..10..0. 20

1050
100

35\|0)105000\|0(300*s.* £15÷5=3 *per cent.*

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

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

COMPOUND INTEREST

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

RULE 1. Find the first year's interest, which add t principal: then find the interest of that sum, which a before, and so on for the number of years.

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

EXAMPLES.

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

500	500	525		
5	25	26..5		
25|00	525	1*st year.* 551..5	2*d year*	
	5	5		
			551..5..0	
26|25		27|56..5	27.11...3	
20		20		
			578..16..3	3*d year.*
5|00		11|25	500.. 0..0	*prin. sub.*
		12		
			£78..16..3=	*interest.*
		3|00		*for* 3 *ye*

2. What is the amount of £400. forborne $3\frac{1}{2}$ years *per cent. per annum.* compound interest?

Ans. £490..13..1

3. What will £650. amount to in 5 years, at 5 *per per annum,* compound interest? *Ans.* £829..11..

4. What is the amount of £550..10..0. for 3 years months, at 6 *per cent. per annum,* compound interest?

Ans. £675..6

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

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

Ans. £18..3.

What is the compound interest of £259..10..0. for 3 s, 9 months, and 10 days, at $4\frac{1}{2}$ *per cent. per annum?*
Ans. £46..19..$10\frac{1}{2}$.

REBATE OR DISCOUNT

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

ULE, As £100. with the interest for the time given: is at interest: : so is the sum given to the rebate re-ed.

ubtract the rebate from the given sum, and the remain- will be the present worth.

EXAMPLES.

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

$6m\frac{1}{2}6$ — 3 — 100 — 103

487..12
14.. 4

£473.. 8..0 *present worth.*

As 103 : 3 : : 487..12.

20 — 2060

20 — 9752 — 3

£. s.
206|0)2925|6(14..4. *rebate.*
206

865
824

416=4*s.*

What is the present payment of £357..10..0. which agreed to be paid nine months hence, at 5 *per cent. per* m? *Ans.* £344..11..7.

What is the discount of £275..10..0 for 7 months, at *cent per annum?* *Ans.* £7..16..$1\frac{3}{4}$.

Bought goods to the value of £109..10..0. to be paid months, what present money will discharge the same, m allowed 6 *per cent. per annum* discount?
Ans. £104..15..$8\frac{1}{4}$.

5. What is the present worth of £527..9.1.. payab months hence, at 4½ *per cent?* *Ans.* £514..13..10

6. What is the discount of £85..10, due September 8th, this being July the 4th, rebate at *5 per cent per ann* *Ans.* 15*s*..3

7. Sold goods for £875..5..6. to be paid 5 months he what is the present worth at 4½ *per cent.?* *Ans.* £859..3..3

8. What is the present worth of £500. payable in months, at *5 per cent. per annum?* *Ans.* £48

9. How much ready money can I receive for a note of due 15 months hence, at *5 per cent.* *Ans.* £70..11..9

10. What will be the present worth of £150. payab 3 four months, *i. e.* one-third at four months, one-third months, and one-third at 12 months, at *5 per cent.* disc *Ans.* £145..3..8

11. Sold goods to the value of £575..10. to be pa two 3 months, what must be discounted for present paym at *5 per cent.* *Ans.* £10..11..4

11. What is the present worth of £500. at 4 *per* £100. being to be paid down, and the rest at two 6 mon *Ans.* £488..7..8

EQUATION OF PAYMENTS

IS when several sums are due at different times to f mean time for paying the whole debt; to do which, is the common

RULE. Multiply each term by its time, and divide sum of the products by the whole debt, the quotient i counted the mean time.

EXAMPLES.

1. A owes B £200. whereof £40. is to be paid at months, £60. at 5 months, and £100. at 10 months what time may the whole debt be paid together, wi prejudice to either?

£.		m.	
40	X	3 =	120
60	X	5 =	300
100	X	10 =	1000
		2|00)	14|20

7 *months*, 1/10

2. B owes C £800. whereof £200. is to be paid at 3 nths, £100. at 4 months, £300. at 5 months, and £200. 6 months; but they agreeing to make but one payment 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 60. which was to have been paid as follows: £120. at nonths, £200. at 4 months, and the rest at 5 months; we afterwards agreed to have it paid at one mean time, time is demanded? *Ans.* 3 *months*, 13 *days.*

4. A merchant bought goods to the value of £500. to pay 00. at the end of 3 months, £150. at the end of 6 months, l £250, at the end of 12 months; but afterwards they eed to discharge the debt at one payment; at what time this payment made? *Ans.* 8 *months*, 11 *days.*

5. H is indebted to L a certain sum, which is to be paid 6 different payments, that is, $\frac{1}{4}$ at two months, $\frac{1}{8}$ at 3 nths, $\frac{1}{8}$ at 4 months, $\frac{1}{4}$ at 5 months, $\frac{1}{3}$ at 6 months, and rest at 7 months; but they agree that the whole shall be d 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 nths, $\frac{1}{4}$ at 6 months, and the rest at 9 months, what is the equated time of the whole payment?

Ans. 5 *months*, 7 *days.*

BARTER

S the exchanging one commodity for another, and informs the traders so to proportionate their goods, that ther may sustain loss.

RULE 1st. Find the value of that commodity whose quan- is given: then find what quantity of the other, at the e proposed, you may have for the same money.

2dly. When one has goods at a certain price, *ready mon-* but in bartering advances it to something more, find t the other ought to rate his goods at, in proportion to t advance, and then proceed as before.

EXAMPLES.

1. What quantity of chocolate at 4*s. per lb.* must be delivered in barter for 2 *cwt.* of tea at 9*s. per lb.*?

2 *cwt.*
112
224
9
4|2016 *the value of the tea.*
504 *lb. chocolate.*

2. A and B barter; A h 20 *cwt.* of prunes, at 4*d. lb.* ready money, but in b will have 5*d. per lb.* and B hops worth 32*s. per cwt.* re money; what ought B to his hops at in barter, and quantity must be given for 20 *cwt.* of prunes?

112 As 4 : 5 ::
20
s. 2240 4)
40 5
12 *cwt.qr.lb.*
48|0)1120|0(23..1..9$\frac{1}{4}\frac{6}{8}$ *Ans.*
96
160
144
16=1 *qr.* 9 *lb.* $\frac{1}{4}\frac{6}{8}$

3. How much tea at 9*s. per lb.* can I have in barter 4 *cwt.* 2 *qrs.* of chocolate, at 4*s. per lb.*? *Ans.* 2 *cw*

4. Two merchants barter; A hath 20 *cwt.* of chee 21*s.* 6*d. per cwt.* B hath 8 pieces of Irish cloth, at £ *per* piece; I desire to know who must receive the differe and how much? *Ans. B must receive of A* £8..

5. A and B barter; A hath 3½*lb.* of pepper at 13½*d. lb.* B hath ginger at 15¼*d. per lb.* how much ginger mus deliver in barter for the pepper? *Ans.* 3 *lb.* 1 *oz.*

6. How many dozen of candles, at 5*s.* 2*d. per* do must be delivered in barter for 3 *cwt.* 2 *qrs.* 16 *lb.* of ta at 37*s.* 4*d. per cwt.*? *Ans.* 26 *doz.* 3 *l*

7. A hath 608 yards of cloth, worth 14*s. per* yard, which B gives him £125..12. in ready money and 85 2 *qrs.* 24 *lb.* of bees wax. The question is, what d reckon his bees wax at *per cwt.*? *Ans.* £5..1

8. A and B barter; A hath 320 dozen of candles, a 6*d. per* dozen; for which B giveth him £30. in money,

rest in cotton, at 8*d. per lb.* I desire to know how much ton B gave A besides the money? *Ans.* 11 *cwt* 1 *qr.* . If B hath cotton at 1*s.* 2*d. per lb.* how much must he e A for 114 *lb.* of tobacco at 6*d. per lb.*?

Ans. 48 *lb.* $\frac{3}{7}$

0. C hath nutmegs worth 7*s.* 6*d. per lb.* ready money, in barter will have 8*s. per lb.* and D hath leaf tobacco th 9*d. per lb.* ready money, how much must D rate his acco at *per lb.* that his profit may be equivalent with). *Ans.* 9$\frac{1}{2}$*d* $\frac{11}{16}$.

PROFIT AND LOSS

S a rule that discovers what is got or lost in the buying or selling of goods, and instructs us to rise and fall the ce, so as to gain so much *per cent.* or otherwise.

The questions in this rule are performed by the Rule of ree.

EXAMPLES.

. If a yard of cloth is ght for 11*s.* and sold for . 6*d.* what is the gain *per* ?

As 11 : 1..6 :: 100

12 20

13 2000

18

11)36000

12)3272

20)272..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

1|00)19|44

20

8|80

12

9|60

4

2|40

12×5=60

12)19..8..9$\frac{1}{2}$

5|1..12..4$\frac{1}{4}$

6..5$\frac{3}{4}$

Ans. €s. 5$\frac{3}{4}$.

. If 1 *lb.* of tobacco cost 16*d.* and is sold for 20*d.* what he gain *per cent*? *Ans.* 25.

. If a parcel of cloth be sold for £560. and at £12 *per* . gain, what was the prime cost? *Ans.* £500.

. If a yard of cloth is bought for 13*s.* 4*d.* and sold again 16*s.* what is the gain *per cent*? *Ans.* 20.

6. If 112 *lb.* of iron cost 27*s* 6*d.* what must 1 *cwt.* be for to gain 15 *per cent?* *Ans.* £1. 11..7

7. If 375 yards of broad cloth be sold for £490. an *per cent.* profit, what did it cost per yard? *Ans.* £1..1.

8. Sold 1 *cwt.* of hops at £5..15. at the rate of 25 *cent.* profit, what would have been the gain *per cent.* if I sold them for £8. *per cwt.?* *Ans.* £48..2..11

9. If 90 ells of cambrick cost £60. how must I sell it yard to gain 18 *per cent?* *Ans.* 12*s* 7*d*

10. A plumber sold 10 fother of lead for £204..15. fother being 19 *cwt.* ½) and gained after the rate of £12 *per cent.* what did it cost him *per cwt.* *Ans.* 18*s.* 8

11. Bought 436 yards of cloth, at the rate of 8*s.* 6*d.* yard, and sold it for 10*s.* 4*d. per* yard, what was the ga the whole? *Ans.* £39..19..

12. Paid £69 for one ton of steel, which is retailed a *per lb.* what is the profit or loss by the sale of 14 tons? *Ans.* £182 *lo*

13. Bought 124 yards of linen for £32. how should same be retailed *per* yard to gain £15. *per cent?* *Ans.* 5*s.* 11*d.*$\frac{2}{13}$

14. Bought 249 yards of cloth, at 3*s.* 4*d. per* yard, tailed the same at 4*s.* 2*d. per* yard, what is the profit in whole, and how much *per cent?* *Ans.* £10..7..6. *profit, and 25 per ce*

FELLOWSHIP

IS when two or more join their stock and trade toge so to determine each person's particular share of gain or loss, in proportion to his principal in joint stoc

By this rule a bankrupt's estate may be divided among creditors; as also legacies may be adjusted when there 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 : : so is each man's share in stock : to his share of the or loss.

ROOF. Add all the shares together, and the sum will be al to the given gain or loss:—but the surest way is, as whole gain or loss : is to the whole stock : : so is each 's share of the gain or loss to his share in stock.

EXAMPLES.

. Two merchants trade together; A put in stock £20. B £40. they gained £50. what is each person's share reof?

20+40=60

As 60 : 50 : : 20 — As 60 : 50 : : 40 — 33.. 6..8 *B's share.*
20 — 40 — 16..13..4 *A's.*

6|0)100|0 — 6|0)200|0 — £50.. 0..0
£16..13..4 — £33..6..8.

. Three merchants trade together, A, B, and C; A put £20. B £30. and C £40. they gained £180. what is each n's part of the gain? *Ans. A* £40. *B* £60. *C* £80.

. A, B, and C, enter into partnership; A puts in £364. £482. and C £500, and they gained £867. what is each n'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.

. Four merchants, B, C, D, and E, make a stock; B put £227. C £349. D £115. and E £439. in trading they ned £428. I demand each merchant's share of the gain?
Ans. B £85..19..6¼—690. *C* £132..3..9—120.
D £43..11..1¾—250. *E* £166..5..6¼—70.

. Three persons, D, E, and F, join in company; D's k was £750. E's £460. and F's £500 and at the end of months they gained £684. what is each man's particular re of the gain? *Ans. D* £300. *E* £184. *and F* £200.

. A merchant is indebted to B £275..14..0. to C £304.. . to D £152. and to E £104..6..0. but upon his decease, estate is found to be worth but £675..15..0. how must it divided among his creditors?
Ans. B's £222..15..2—6584. *C's* £245..18. 1½—15750.
D's £122..16..2¾—12227. *and E's* £84..5..5—15620.

. Four persons trading together in a joint stock, of ch A has ⅓, B ¼, C ⅕, and D the remainder, and at the

end of six months they gain £100. what is each man's sh of the said gain?

Ans. A £33..6..8. *B* £25..0..0. *C* £20..0..0. *D* £21..13..4.

8. Two persons purchased an estate of £1700 *per an* freehold for £27,200. when money was at 6 *per cent.* in est, and 4*s. per* pound land tax, whereof D paid £15, and E the rest; some time after the interest of the m falling to 5 *per cent.* and 2*s. per* pound land tax, they the said estate for 24 years purchase. I desire to know person's share? *Ans D* £22,500. *E* £18,20

9. D, E, and F join their stocks in trade, the amoun their stock is £647, and are in proportion as 4, 6, and 8, to one another, and the amount of their gain is equal to stock, what is each man's stock and gain?

D's stock,	£143..15..6$\frac{3}{5}$	*gain,* £31..19..0$\frac{6}{7}$.
E's - -	215..13..4	47..18..6$\frac{4}{7}$.
F's - -	287..11..1$\frac{1}{8}$	63..18..0$\frac{5}{42}$.

10. D, E, and F join stocks in trade; the amount of t stocks was £100. D's gain £3. E's £5. and F's £8, w was each man's stock?

Ans. D's stock £18..15..0. *E's* £31..5..0. *and F's*

FELLOWSHIP WITH TIME.

RULE. As the sum of the product of each man's mo and time: is to the whole gain or loss : : so is each m 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. three months, and E £75. for four months, and they gai £70. What is each man's share of the gain?

Ans. D £20. E £50

40×3=120	As 420 : 70 : : 120	As 420 : 70 : :
75×4=300	120	300
420	42|0)840|0(20	42|0)2100|0(50

. Three merchants join in company; D puts in stock 5..14..0. for 3 months, E £169..18..3. for 5 months, and 59..14..10. for 11 months, they gained £364..18..0. what ach man's part of the gain?

Ans. D's £102..6..4—5008. *E's* £148..1..1½—482802. *and F's* £114..10..6¼—14707.

. Three merchants join in company for 18 months: D in 500*l.* and at 5 months end took out 200*l.*; at 10 ths end put in £300. and at the end of 14 months takes £130. E puts in £400. and at the end of 3 months 0. more; at 9 months he takes out £140. but puts in 0. at the end of 12 months; and withdraws £99. at the of 15 months. F put in £900. and at 6 months took £200; and at the end of 11 months put in £500. but es out that and £100. more at the end of 13 months. y gained £200. I desire to know each man's share of gain?

Ans. D £50..7..6—21720. *E* £62..12..5¼—29859, *and F* £87..0..0¼—14167.

. D, E, and F, hold a piece of ground in common, for ch they are to pay £36..10..6 D puts in 23 oxen 27 s; E 21 oxen 35 days; and F 16 oxen 23 days. What ach man to pay of the said rent?

Ans. D £13..3..1⅛—624. *E* £15..11..5—1683. *and F* £7..15..11—1136.

ALLIGATION.

ALLIGATION IS EITHER MEDIAL OR ALTERNATE.

ALLIGATION MEDIAL

S when the price and quantities of several simples are given to be mixed, to find the mean price of that mix-.

ULE. As the whole composition : is to its total value : : any part of the composition : to its mean price.

ROOF. Find the value of the whole mixture at the mean , and if it agrees with the total value of the several ntities at their respective prices, the work is right.

EXAMPLES.

1. A farmer mixed 20 bushels of wheat at 5*s.* *per* bu and 36 bushels of rye, at 3*s.* *per* bushel, with 40 bush barley, at 2*s.* *per* bushel. I desire to know the worth bushel of this mixture?

20 × 5 =	100	As 96 : 288 : : 1 : 3.
36 × 3 =	108	
40 × 2 =	80	
96	288	*Ans.* 3*s.*

2. A vintner mingles 15 gallons of Canary at 8s gallon, with 20 gallons at 7*s.* 4*d.* *per* gallon: 10 gallo sherry, at 6*s.* 8*d.* *per* gallon, and 24 gallons of white at 4*s.* *per* gallon. What is the worth of a gallon o mixture? *Ans.* 6*s.* 2½*d.*

3. A grocer mingled 4 *cwt.* of sugar, at 56*s.* *per* c *cwt.* at 43*s.* *per cwt.* and 5 *cwt.* at 37*s.* *per cwt.* I de the price of 2 *cwt.* of this mixture? *Ans.* £4..8.

4. A malster mingles 30 quarters of brown malt, a *per* quarter, with 46 quarters of pale, at 30*s.* *per* qu and 24 quarters of high-dried ditto, at 25*s.* *per* qu What is the value of 8 bushels of this mixture?

Ans. £1..8..2¼

5. If I mix 27 bushels of wheat, at 5*s.* 6*d.* *per* b with the same quantity of rye, at 4*s.* *per* bushel, a bushels of barley at 2*s.* 8*d.* *per* bushel, what is the wo a bushel of this mixture? *Ans.* 4*s.* 3¾*d.*

6. A vintner mixes 20 gallons of port, at 5*s.* 4*d.* *p* lon, with 12 gallons of white wine, at 5*s.* *per* gallon, 3 lons of Lisbon, at 6*s.* *per* gallon, and 20 gallons of tain, at 4*s.* 6*d.* *per* gallon. What is a gallon of this m worth? *Ans.* 5*s.* 3¾*d.*

7. A refiner having 12 *lb.* of silver bullion, of 6 *o* would melt it with 8 *lb.* of 7 *oz.* fine, and 10 *lb.* of 8 *o* required the fineness of 1 *lb.* of that mixture?

Ans. 6 *oz.* 18 *dwt.* 1

8. A tobacconist would mix 50 *lb.* of tobacco at 1 *lb.* with 30 *lb.* at 14*d.* *per lb.* 25 *lb.* at 22*d* *per lb.* an at 2*s.* *per lb.* What will 1 *lb.* of this mixture be wo

Ans. 16¾*d*

ALLIGATION ALTERNATIVE

Is when the price of several things are given, to find ch quantities of them to make a mixture, that may bear rice propounded.

In ordering the Rates and the given Price, observe,

1. Place them one under the other nd the propounded price of mean te at the left hand of them, thus

18—		2
20—	22	6
34—		4
28—		2

2. Link the several rates together, by 2, and 2, always serving to join a greater and a less than the mean:

3. Against each extreme place the difference of the ean and its yoke-fellow.

When the prices of the several simples and the mean rate e given without any quantity, to find how much of each sim- e is required to compose the mixture.

RULE. Take the difference between each price and the ean rate, and set them alternately, they will be the an- er required.

PROOF. By alligation medial.

EXAMPLES.

1. A vintner would mix four sorts of wine together, of 8*d.* 20*d.* 24*d.* and 28*d.* *per* quart, what quantity of each ust he have to sell the mixture at 22*d.* *per* quart?

Answer.		*Proof.*
18—	2 of 18*d.*	= 36*d.*
20—	6 of 20*d.*	=120
24—	4 of 24*d.*	= 96
28—	2 of 28*d.*	= 56
14		)308
		22*d.*

or thus,		*Proof.*
18—	6 of 18*d.*	=108*d.*
20—	2 of 20*d.*	= 40
24—	2 of 24*d.*	= 48
28—	4 of 28*d.*	=112
14		)308
		22*d.*

NOTE. *Questions in this Rule admit of a great Variety of nswers, according to the manner of linking them.*

2. A grocer would mix sugar at 4*d.* 6*d.* and 10*d.* *per lb.* as to sell the compound for 8*d per lb.* What quantity each must he take? *Ans.* 2*lb.* *at* 4*d.* 2*lb.* *at* 6*d.* *and lb. at* 10*d.*

3. I desire to know how much tea, at 16*s.* 14*s.* 9*s.* and 8*s. per lb.* will compose a mixture worth 10*s. per lb* ?
Ans. 1*lb.* *at* 16*s.* 2*lb.* *at* 14*s.* 6*lb.* *at* 9*s.* *and* 4*lb.* *at* 8*s.*

4. A farmer would mix as much barley at 3*s.* 6*d.* bushel, rye at 4*s.* *per* bushel, and oats at 2*s.* *per* bushel, as make a mixture worth 2*s.* 6*d.* *per* bushel. How much is t of each sort ? *Ans.* 6 *of barley*, 6 *of rye, and* 30 *of oat*

5. A grocer would mix raisins of the sun at 7*d.* *per* with Malagas at 6*d.* and Smyrnas at 4*d. per lb.* I desire know what quantity of each sort he must take to sell th at 5*d. per lb* ? *Ans.* 1*lb.* *of raisins of the sun,* 1*lb.* *Malagas, and* 3*lb.* *of Smyrna*

6. A tobacconist would mix tobacco at 2*s.* 1*s.* 6*d.* and 3*d. per lb.* so as the compound may bear a price of 1*s.* *per lb.* What quantity of each sort must he take?
Ans. 7*lb.* *at* 2*s.* 4*lb.* *at* 1*s.* 6*d.* *and* 4*lb.* *at* 1*s.*

ALTERNATION PARTIAL.

IS when the prices of all the simples, the quantity of one of them, and the mean rate, are given, to find several quantities of the rest in proportion to that given.

RULE. Take the difference between each price, and mean rate, as before. Then,

As the difference of that simple, whose quantity is gi is to the rest of the differences severally ; so is the quan given to the several quantities required.

EXAMPLES.

1. A tobacconist being determined to mix 20*lb.* of bacco at 15*d. per lb.* with others at 16*d. per lb.* 18*d. pe* and 22*d. per lb.* how many pounds of each sort must take to make one pound of that mixture worth 17*d.*

	Answer.		*Proof.*	
15——2		20*lb.* at 15*d.*=300*d.*	As 5 : 1 :: 2
17 16—| 18—|	1	4*lb.* at 16*d.*= 64*d.*	As 5 : 1 :: 2
	1	4*lb.* at 18*d.*= 72*d.*	As 5 : 2 :: 2
22——1		8*lb.* at 22*d.*=176*d.*	
=	—	—	

As 36*lb.* : 612*d.* :: 1*lb.* 17*d.*

2. A farmer would mix 20 bushels of wheat at 60*d.* *per* shel, with rye at 36*d.* barley at 24*d.* and oats at 18*d.* *per* shel. How much must he take of each sort, to make e composition worth 32*d.* *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 s. *per* gallon, with English at 7*s.* and spirits at 4*s.* *per* llon. What quantity of each sort must he take to afford for 8*s.* per gallon?

Ans. 40 *gallons French,* 32 *English, and* 32 *Spirits.*

4. A grocer would mix teas of 12*s.* 10*s.* and 6s. with 20 at 4*s.* *per lb.* How much of each sort must he take to ke the composition worth 8*s.* *per lb.*

Ans. 20*lb.* *at* 4*s.*. 10*lb.* *at* 6*s.* 10*lb.* *at* 10*s.* 20*lb.* *at* 12*s.*

5. A wine merchant is desirous of mixing 18 gallons of nary at 6*s.* 9*d.* *per* gallon, with Malaga at 7*s.* 6*d.* *per* llon; Sherry at 5*s.* *per* gallon; and white wine at 4*s.* 3*d.* gallon. How much of each sort must he take that the xture may be sold for 6*s.* *per* gallon?

Ans. 18 *gallons of Canary,* 31½ *of Malaga,* 13½ *of Sherry, and* 27 *of white wine.*

ALTERNATION TOTAL

s when the price of each simple, the quantities to be mpounded, and the mean rate are given, to find how ch of each sort will make that quantity.

RULE. Take the difference between each price, and the an rate as before. Then,

As the sum of the differences : is to each particular differ- e : : so is the quantity given : to the quantity required.

EXAMPLES.

. A grocer has four sorts of sugar, *viz.* 12*d.* 10*d.* 6*d.* 4*d.* *per lb.* and would make a composition of 144*lb.* th 8*d.* *per lb.* I desire to know what quantity of each must take?

	Answer.	*Proof.*	
12	4 :: 48 at 12*d.*	576	As 12 : 4 : 144 : 48
8 10	2 :: 24 at 10*d.*	240	As 12 : 2 : 144 : 24
6	2 :: 24 at 6*d.*	144	
4	4 :: 48 at 4*d.*	192	
	12 144	(1152(8*d.*	

2. A grocer having four sorts of tea, of 5*s.* 6*s.* 8*s.* and *per lb.* would have a composition of 87*lb.* worth 7*s.* *per* what quantity must there be of each?

Ans. 14½*lb.* *of* 5*s.* 29*lb.* *of* 6*s.* 29*lb.* *of* 8*s.* *and* 14½*lb.* *of*

3. A vintner had four sorts of wine, *viz.* white wine 4*s.* *per* gallon; Flemish at 6*s.* *per* gallon; Malaga at *per* gallon; and Canary at 10*s.* *per* gallon, would mak mixture of 60 gallons, to be worth 5*s.* *per* gallon. W quantity of each must he take?

Ans. 45 *gallons of white wine,* 5 *gallons of Flem* 5 *gallons of Malaga, and* 5 *gallons of Can*

4. A silversmith hath four sorts of gold, *viz.* of 24 ca fine, of 22, 20, and 15 carets fine, would mix as muc each sort together, so as to have 42*oz.* of 17 carets How much must he take of each?

Ans. 4 *of* 24, 4 *of* 22, 4 *of* 20, *and* 30 *of* 15 *carets*

5. A druggist having some drugs of 8*s.* 5*s.* and 4*s.* *pe* made them into 2 parcels; one of 28*lb.* at 6*s.* *per lb.* other of 42*lb.* at 7*s.* *per lb.* How much of each sort di take for each parcel?

Ans. 12*lb.* of 8*s.*	*Ans.* 30 of 8*s.*
8*lb.* of 5*s.*	6 of 5*s.*
8*lb.* of 4*s.*	6 of 4*s.*
28*lb.* at 6*s.* *per lb.*	42*lb.* at 7*s.* *per lb.*

POSITION, OR THE RULE OF FALSE,

IS a rule that by false or supposed numbers, tak pleasure, discovers the true one required. It is ed into two parts; SINGLE and DOUBLE.

SINGLE POSITION

Is, by using one supposed number, and working with it the true one, you find the real number required, by the lowing

RULE. As the total of the errors: is to the true total :: so the supposed number: to the true one required.

PROOF. Add the several parts of the sum together, and it agrees with the sum, it is right.

EXAMPLES.

1. A schoolmaster being asked how many scholars he d, said, if I had as many, half as many, and one quarter many more, I should have 88. How many had he?

Ans. 32.

ppose 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		88 *proof.*

2. A person having about him a certain number of Portgal pieces, said, if the third, fourth, and sixth of them re added together they would make 54. I desire to know w 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 e chaise to twice the price of the horse and harness. hat 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 ods, which would cost them £120. agreed among themves that B should have a third part more than A, and C fourth part more than B. I desire to know what each man ust pay? *Ans. A* £ 30. B £ 40. *and C* £ 50.

5. A person delivered to another a sum of money unown, to receive interest for the same, at 6 *per cent. per num*, simple interest, and at the end of ten years received principal and interest £300. What was the sum lent?

Ans. £187..10..0.

DOUBLE POSITION

Is, by making use of two supposed numbers, and if b
prove false (as it generally happens) they are, with th
errors, to be thus ordered:

RULE 1. Place each error against its respective positi
2. Multiply them cross ways.
3. If the errors are alike, *i. e.* both greater or both
than the given number, take their difference for a divi
and the difference of their product for a dividend. Bu
unlike, take their sum for a divisor, and the sum of t
product for a dividend, the quotient will be the answe

EXAMPLES.

1. A, B, and C, would divide £200 between them,
that B may have £6. more than A, and C £8. more t
B, how much must each have?

Suppose A had 40 — *Then suppose A had* 50
then B had 46 — *then B must have* 56
and C 54 — *and C* 64

140 *too little by* 60 — 170 *too little b*

sup. errors.
40 60
50 + 30

60
30
—
30 *divisor.*

3000 1200
1200
30)180(0
60 *Ans. for A.*

60 *A*
66 *B*
74 *C*
200 *proof.*

2. A man had 2 silver cups of unequal weight, h
one cover to both, of 5 *oz.* now if the cover is put o
lesser cup, it will double the weight of the geater
and set on the greater cup, it will be thrice as heavy
lesser cup. What is the weight of each cup?

Ans. 3 *ounces lesser,* 4 *great*

3. A gentleman bought a house with a garden,
horse in the stable, for £500. now he paid 4 times the
of the horse for the garden, and 5 times the price
garden for the house. What was the value of the h
garden and horse, separately?

Ans. Horse £20. *Garden* £80. *House* £4

4. Three persons discoursing concerning their ages; says H, I am 30 years of age; says K, I am as old as H, and $\frac{1}{5}$ 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 played 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 127 $\frac{1}{2}$, *E* 142 $\frac{1}{2}$, *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=4*s.* 6*d.* at par.

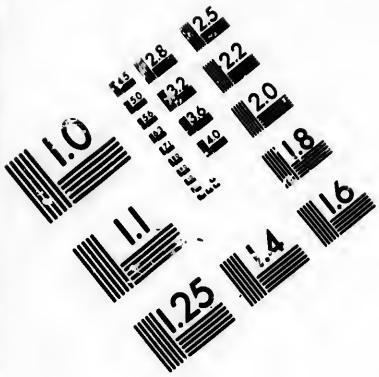
Note. 12 *deniers make* 1 *sol.*
20 *sols*.....1 *livre.*
3 *livres*.....1 *crown.*

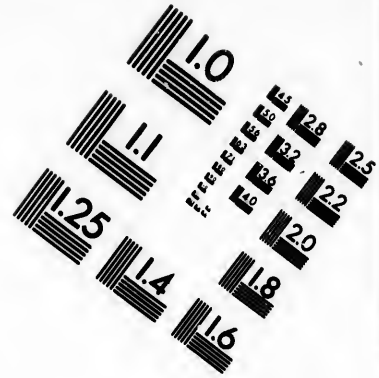
To change French into Sterling.

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 one crown:: so is the sterling sum: to the French required.





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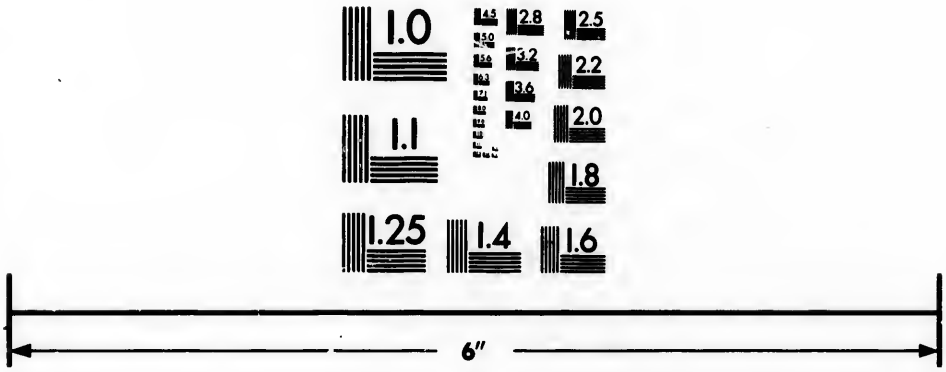

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EXAMPLES.

1. How many crowns must be paid at Paris, to receive in London £180. exchange at 4*s.* 6*d.* *per* crown?

d. *c.* £.
As 54 : 1 : : 180 :
2 10
crowns.
54)43200(800
432

2. How much sterling must be paid in London to receive in Paris 758 crowns, exchange 56*d.* *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 56*d.* *per* crown? *Ans.* 758.

4. Change 725 crowns, 17 sols, 7 deniers, at 54½*d.* per crown, into sterling, what is the sum?

Ans. £164..14..0¼ $\frac{21}{360}$

5. Change £164..14..0½. sterling, into French crowns exchange at 54½*d* *per* crown?

Ans. 725 *crowns*, 17 *sols.* 7 $\frac{41}{105}$ *deniers*

II. SPAIN.

They keep their accounts at Madrid, Cadiz, and Seville in dollars, rials, and maravedies, exchange by the piece of eight=4*s.* 6*d.* at par.

NOTE. 34 *maravedies make* 1 *rial.*
8 *rials*..... 1 *piaster, 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, a 56*d.* *per* piece, how much sterling is the sum, how much?

Ans. £594..6..

7. How many pieces of eight at 56*d.* each, will answer a bill of £594..6..0. sterling? *Ans.* £254

8. If I pay a bill here of £2500. what Spanish money must I draw my bill for at Madrid, exchange at 57½*d.* *per* piece of eight? *Ans.* 10434 *pieces of eight*, 6 *rials*, 8

III. ITALY.

They keep their accounts at Genoa and Leghorn, in li-
es, sols, and deniers, and exchange by the piece of eight,
dollars=4*s.* 6*d.* 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
change at Venice by ducats.

NOTE. 6 *solidi make* 1 *gross.*
24 *gross*..... 1 *ducat.*

RULE. The same as before.

9. How much sterling money may a person receive in
ondon, if he pays in Genoa 976 dollars, at 53*d. per* dollar?
Ans. £215..10..8.

10. A factor has sold goods at Florence, for 250 duca-
ons, at 54*d* each, what is the value in pounds sterling?
Ans. £56..5..0.

11. If 275 ducats at 4*s.* 5*d.* each, be remitted from Ve-
e to London, what is the value in pounds sterling?
Ans. £60..14..7.

12. A gentleman travelling would exchange £60..14..7.
rling for Venice ducats at 4*s.* 5*d.* each, how many must
receive? *Ans.* 275.

IV. PORTUGAL.

They keep their accounts at Oporto and Lisbon, in reas,
d exchange on the milrea=6*s.* 8½*d.* at par.

NOTE. 1000 *reas* make 1 *milrea.*

RULE. The same as with France.

EXAMPLES.

13. A gentleman being desirous to remit to his correspon-
nt in London 2750 milreas, exchange at 6*s.* 5*d. per* mil-
a, how much sterling will he be the creditor for in Lon-
n? *Ans.* £882..5..10.

14. A merchant in Oporto remits to London 4366 mil-
as, and 183 reas, at 5*s.* 5*d.* ½ exchange *per* milrea, how
uch sterling must be paid in London for this remittance?
Ans. £1193 .. 17 .. 6¾, 0375.

15. If I pay a bill in London of £1193..17..6¾,03 what must I draw for on my correspondent at Lisbon e change at 5*s*. 5*d*. ⅛ *per* milrea?

Ans. 4366 *milreas*, 183 *rea*

V. HOLLAND, FLANDERS, AND GERMANY.

They keep their accounts at Antwerp, Amsterdam, Br sels, Rotterdam, and Hamburgh; some in pounds, shillin and pe e, as in England; others in guilders, stivers, pennings; and exchange with us in our pound, at 33*s*. 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 1 pound:: so is the F mish sum: to the sterling required.

To change Sterling into Flemish.

RULE. As £1 sterling: is to the given rate:: so is sterling given: to the Flemish sought.

EXAMPLES.

16, Remitted from London to Amsterdam a bill £754..10. sterling, how many pounds Flemish is the s the exchange at 33*s*. 6*d*. Flemish *per* pound sterling?

Ans. £1263..15..9. *Flemish*

17. A merchant at Rotterdam remits £ ..15..9 mish to be paid in London, how much sterl money m he draw for, the exchange being at 33*s*. 6*d*. Flemish pound sterling? *Ans.* £754..10..

18. If I pay in London £852..12..6. sterling how m guilders must I draw for at Amsterdam, exchange a schel. 4½ groats Flemish *per* pound sterling?

Ans. 8792 *guild*. 13 *stiv*. 14½ *penning*

19. What must I draw for at London, if I pay at Ams

n 8792 guild. 13 stiv. 14½ pennings, exchange at 34 schel. 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. *e difference between one and the other is called* agio, *and is erally 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 ed:: so is the Bank given: to the current required.

To change Current Money into Bank.

RULE. As 100 with the agio added: is to 100 Bank. o is the current money given: to the Bank required.

0. Change 794 guilders, 15 stivers, current money, into k florins, agio $4\frac{3}{8}$ *per cent.*

Ans. 761 *guilders,* 8 *stivers,* $11\frac{14}{16}\frac{7}{7}$ *pennings.*

1. Change 761 guilders, 9 stivers Bank, into Current ney, agio $4\frac{3}{8}$ *per cent.*

Ans. 794 *guilders,* 15 *stivers,* $4\frac{3}{16}$ *pennings.*

VI. IRELAND.

2. A gentleman remits to Ireland £575..15. sterling, t will he receive there, the exchange being at 10 *per* ? *Ans.* £633..6..6.

3. What must be paid in London for a remittance o 3..6..6 Irish, exchange at 10 *per cent?*

Ans. 575..15.

MPARISON OF WEIGHTS AND MEASURES.

EXAMPLES.

If 50 Dutch pence be worth 65 French pence, how y Dutch pence are equal to 350 French pence?

Ans. $269\frac{15}{65}$.

If 12 yards at London make 8 ells at Paris, how many at Paris will make 64 yards at London? *Ans.* $42\frac{8}{12}$.

If 30*lb.* at London make 28*lb.* at Amsterdam, how y *lb.* at London will be equal to 350*lb.* at Amsterdam?

Ans. 375.

If 95*lb.* Flemish make 100*lb.* English, how many *lb.* lish are equal to 275 *lb.* Flemish? *Ans.* $289\frac{15}{95}$.

CONJOINED PROPORTION

IS when the coin, weight, or measures of several cou
are compared in the same question: or it is linking
ther a variety of proportions.

When it is required to find how many of the first s
coin, weight, or measure, mentioned in the question
equal to a given quantity of the last.

RULE. Place the numbers alternately, beginning
left hand, and let the last number stand on the left
then multiply the first row continually for a dividend
the second for a divisor.

PROOF. By as many single Rules of three as the qu
requires.

EXAMPLES.

1. If 20*lb.* at London make 23*lb.* at Antwerp, and
at Antwerp make 180*lb.* at Leghorn, how many *lb.* a
don are equal to 72*lb.* at Leghorn?

Left	*Right*	
20	23	$20 \times 155 \times 72 = 223200$
155	180	$23 \times 180 = 4140) 223200 (53$
72		

2. If 12*lb.* at London make 10*lb.* Amsterdam,
at Amsterdam 120*lb.* at Thoulouse, how many *lb.* a
don is equal to 40*lb.* at Thoulouse? *Ans.*

3. If 140 braces at Venice are equal to 156 braces
horn, and 7 braces at Leghorn equal to 4 ells Engli
many braces at Venice are equal to 16 ells English
Ans. 2

4. If 40*lb.* at London make 36*lb.* at Amsterda
90*lb.* at Amsterdam make 116*lb.* at Dantzick, how m
at London is equal to 130*lb.* at Dantzick?
Ans. 112

When it is required to find how many of the last
coin, weight, or measure, mentioned in the que
equal to the quantity of the first,

RULE. Place the numbers alternately, beginnin
left hand, and let the last number stand on the rig
then multiply the first row for a divisor, and th
for a dividend.

EXAMPLES.

5. If 12 *lb.* at London make 10 *lb.* at Amsterdam, 100 *lb.* Amsterdam, 120 *lb.* at Thoulouse, how many *lb.* at Thouse are equal to 40 *lb.* at London? *Ans.* 40 *lb.*

6. If 10 *lb.* at London make 36 *lb.* at Amsterdam, and *lb.* at Amsterdam 116 *lb.* at Dantzick, how many *lb.* at ntzick are equal to 122 *lb.* at London?

Ans. $141\frac{1272}{3600}$.

PROGRESSION

CONSISTS OF TWO PARTS,

ARITHMETICAL AND GEOMETRICAL.

ARITHMETICAL PROGRESSION

S when the rank of numbers increase or decrease regularly by the continual adding or subtracting of the equal bers: As 1, 2, 3. 4, 5, 6, are in Arithmetical Progresby the continual increasing or adding of one; 11, 9, 7, 1. by the continual decreasing or subtracting of two.

OTE. *When any even number of terms differ by Arithal Progression, the sum of the two* extremes *will be equal two* middle numbers, *or any two* means *equally distant the* extremes: as 2, 4. 6, 8, 10, 12, *where* 8+8, *o middle numbers are* =12+2=14, *the two extremes* +4, *the two means* =14.

hen the number of terms are odd, the double of the middle *will be equal to the* two extremes; *or of any* two means *y distant from the* middle term; *as* 1, 2, 3, 4, 5, *where uble of* 3=5+1=2+4=6.

Arithmetical Progression five things are to be observ-z.

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 the terms - - - - - - S.

three of which being given the other two may be found.

The first, second, and third terms given, to find the fi

RULE. Multiply the sum of the two extremes by half t number of terms, or multiply half the sum of the two tremes by the whole number of terms, the product is the tal of all the terms: *or thus,*

I. F. L. N. are given to find S.

$$\frac{N}{2}$$

$$F+L\times\frac{N}{2}=S.$$

EXAMPLES.

1. How many strokes does the hammer of a clock st in 12 hours?

$12+1=13$, *then* $13\times 6=78$.

2. A man buys 17 yards of cloth, and gave for the f yard 2*s.* and for the last 10*s.* what did the 17 yards amo to? *Ans.* £5..2..0

3. If 100 eggs were placed in a right line, exactly a y asund r from one another, and the first a yard from a b et, w at length of ground does that man go who gather these 100 eggs singly, returning with every egg to the b et o put it in? *Ans.* 5 *miles*, 1300 *yard*

The first second and third term given to find the fou

RULE. From the second subtract the first, the remain divided by the third less one, gives the fourth: *or thus*

II. 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 year and the eldest 32, they increase in Arithmetical Prog on; what was the common difference of their ages? *A*

$32-4=28$, *then* $28\div 8-1=$ *common differen*

5. A man is to travel from London to a certain pla 12 days, and to go but 3 miles the first, day increasing day by an equal excess, so that the last day's journey be 58 miles, what is the daily increase, and how many distant is that place from London? *Ans.* 5 *daily incr*

Therefore, as three miles is the first day's journey,

$3+5=8$ *the second day,*

$8+5=13$ *the third day, &c.*

The whore 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?

58—3=55. *then* 55÷5=11. 11+1=12 *the Ans.*

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 may 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 1, the product subtracted from the second gives the first: or thus,

IV. L. N. D. are given to find F.

$$L-\overline{D+N-1}=F.$$

EXAMPLES.

8. A man in 10 days went from London to a certain town the country, every day's journey increasing the former by and the last he went was 46 miles, what was 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 ny different numbers of shillings, every one exceeding 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 quotnt subtract half the produce of the fourth multiplied by third less 1 gives the first: or thus,

V. N. D. S. are given to find F.

$$\frac{S}{N}-\frac{D+N-1}{2}=F$$

EXAMPLE.

10. A man is to receive £360. at 12 several payments each to exceed the former by £4. and is willing to best the first payment on any one that can tell him what it What will that person have for his pains? *Ans.* £8.

$360 \div 12 = 30$, *then* $30 \overline{\frac{4 \times 12 - 1}{2}} = 8$ *the first payment.*

The first, third, and fourth given to find the second.

RULE. Subtract the fourth from the product of the thi multiplied by the fourth, that remainder added to the f gives the second: or thus,

VI. F. N. D. are given to find L.

$$N\,\overline{D - D} + F = L.$$

EXAMPLE.

11. What is the last number of an Arithmetical Prog sion, beginning at 6, and continuing by the increase o 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 some common ratio; that is, by the continual multi cation or division of some equal number: as 2, 4, 8, increase by the multiplier 2, and 16, 8, 4, 2, decrease, the divisor 2.

NOTE. *When any number of terms is continued in geo trical Progression, the product of the* two extremes *wil equal to any* two means, *equally distant from* the extrem *as* 2 : 4, 8, 16, 32, 64, *where* 64×2 *are* $= 4 \times 32$, $8 \times 16 = 128$.

When the number of terms are odd; *the* middle term *multiplied into itself will be equal to the* two extremes, *or any* two means, *equally distant from the* mean, *as* 2, 4, 8, 16, 32, *where* 2 × 32 = 4 × 16 = 8 × 8 = 64.

In Geometrical Progression the same five things are to be observed as are in Arithmetical.

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 readier 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.*

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* cypher.

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* cypher, *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 =
Geometrical proportion 4 × 32 = 128

Then the second 2 + 4 = 6
4 × 16 = 64

In any geometrical progression proceeding from uni the ratio being known, to find any remote term, witho producing all the intermediate terms.

RULE. Find what figure of the indices added toget would give the exponent of the term wanted; then m tiply the numbers standing under such exponent into e other, and it will given the term required.

Note. *When the* exponent 1 *stands over the* second te *the number of* exponent *must be* 1 less *than the number terms.*

EXAMPLES.

1. A man agrees for 12 peaches, to pay only the pr of the last, reckoning a farthing for the first, and a h penny for the second, &c. doubling the price to the l what must he give for them? *Ans.* £2..2..8

0, 1, 2, 3, 4, *Exponents.*
1, 2, 4, 8, 16, *No. of terms*

For 4+4+3=11, *No. of terms less,* 1

16=4
16=4
256=8
8=3
4)2048=11 *No. of*
12)512
20)42..8
£2..2..8

2. A country gentleman going to a fair to buy some o meets with a person who had 23; he demanded the p of them, was answered £16 a piece: the gentleman him £15 a piece, and he would buy all; the other tells it could not be taken; but if he would give what the ox would come to, at a farthing for the first and doub it to the last, he should have all. What was the pri the oxen? *Ans.* £4369..1..

In any geometrical progression not proceeding unity, the ratio beeu given, to find any remote term, out producing all the intermediate terms.

RULE. Proceed as in the last, only observe that product must be divided by the first term.

EXAMPLES.

3. A sum of money is to be divided among 8 persons, the first to have £20, the second £60, and so in triple proportion; what will the last have? *Ans.* £43740.

0, 1, 2, 3, $\frac{540\times540}{20}$=14580, *then* $\frac{14510\times60}{20}$

0, 60, 180, 540,

=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 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 portion? *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 quotent 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, 4*d.* for the third, *&c.* what did his wages amount to? *Ans.* £5825··8··5¼.

256×256=65536 *then* 65536×64=4194304

0, 1, 2, 3, 4, $\frac{4194304-1}{4-1}$=1398191, *then*

1, 4, 16, 64, 256.

+4+3=11. *No. of terms less* 1,

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.* £9651146816693..13..4.

7. A certain person married his daughter on New-year's day, and gave her husband 1*s.* towards her 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 treble proportion; I desire to know what he sold the lace for, 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 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 40 changes might be rung in 1 minute, and the year to contain 365 days, 6 hours?

$1\times2\times3\times4\times5\times6\times7\times8\times9\times10\times11\times12=479001600$ *changes, which* $\div10=47900160$ *minutes; and reduced, is* $=91$ *years, 3 weeks, 5 days,* 6 *hours.*

2. A young scholar coming into 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 $\frac{1}{2}$, $\frac{3}{4}$, &c.

The figure above the line is called the numerator, and the other one the denominator; which shews how many parts the unit is divided into; and the numerator shews how many of those parts are meant by the fraction.

There are four sorts of valgar fractions: *proper, improper, compound,* and *mixed, viz.*

1. A PROPER FRACTION is when the numerator is less than the denominator, as $\frac{2}{4}$, $\frac{3}{6}$, $\frac{7}{8}$, $\frac{9}{11}$, $\frac{101}{710}$, *&c.*

2. An IMPROPER FRACTION is when the numerator is equal to, or greater than the denominator, as $\frac{5}{3}$, $\frac{8}{4}$, $\frac{12}{12}$, &c.

3. A COMPOUND FRACTION is the fraction of a fraction, known by the word *of* as $\frac{1}{2}$, *of* $\frac{2}{3}$, *of* $\frac{7}{9}$, *of* $\frac{8}{11}$, *of* $\frac{9}{13}$, &c.

4. A MIXED NUMBER or FRACTION is composed of a whole number and fraction, $8\frac{3}{7}$, $17\frac{1}{2}$, $8\frac{71}{97}$, *&c.*

REDUCTION OF VULGAR FRACTIONS.

1. TO reduce fractions to a common denominator.

RULE. Multiply each numerator into all the denomi tors, except its own, for a new numerator; and all the nominators for a common denominator. Or,

2. Multiply the common denominator by the several gi numerators seperately, and divide their product by the se ral denominators, the quotient will be the new numerat

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.*

2X7 14 4X4 16, *then* 4X7 28 *den.*=$\frac{14}{28}$, *and*

2. Reduce $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{4}{5}$ to a common denominator.

Facit $\frac{32}{64}$, $\frac{48}{64}$, $\frac{40}{64}$

3. Reduce $\frac{1}{3}$, $\frac{4}{6}$, $\frac{6}{10}$, and $\frac{6}{9}$, to a common denominator

Facit $\frac{2940}{3360}$, $\frac{2240}{3360}$, $\frac{2016}{3360}$, $\frac{2330}{3360}$

4. Reduce $\frac{6}{10}$, $\frac{2}{4}$, $\frac{1}{7}$, $\frac{3}{6}$, to a common denominator.

Facit $\frac{1008}{1680}$, $\frac{840}{1680}$, $\frac{240}{1680}$, $\frac{840}{1680}$

5. Reduce $\frac{4}{6}$, $\frac{2}{3}$, $\frac{3}{7}$, and $\frac{1}{8}$ to a common denominator

Facit $\frac{672}{840}$, $\frac{560}{840}$, $\frac{360}{840}$, $\frac{105}{840}$

6. Reduce $\frac{4}{6}$, $\frac{5}{6}$, $\frac{2}{8}$, and $\frac{3}{5}$ to a common denominator

Facit $\frac{720}{2160}$, $\frac{1200}{2160}$, $\frac{540}{2160}$, $\frac{1296}{2160}$

2. To reduce a vulgar fraction to its lowest terms.

RULE. Find a common measure by dividing the lo term by the upper, and that divisor by the remainder foll ing, till nothing remain; the last divisor is the common m sure; then divide both parts of the fraction by the com measure, and the quotient will give the fraction requi

NOTE. *If the common measure happens to be one, the f tion is already in its lowest term; and when a fraction cyphers at the right hand, it may be abbreviated by cu them off, as* $\frac{3}{4}\frac{1}{0}\frac{0}{0}$.

EXAMPLES.

7. Reduce $\frac{24}{32}$ to its lowest terms.

24)32(1

—

com. measure 8)24(3

then 8)$\frac{24}{32}$)=$\frac{3}{4}$ *Facit.*

Reduce $\frac{30}{125}$ to its lowest terms. *Facit* $\frac{6}{25}$.
Reduce $\frac{202}{664}$ to its lowest terms. *Facit* $\frac{101}{332}$.
Reduce $\frac{192}{576}$ to its lowest terms. *Facit* $\frac{1}{3}$.
Reduce $\frac{825}{900}$ to its lowest terms. *Facit* $\frac{55}{60}$.
Reduce $\frac{5184}{6048}$ 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 the fraction, and to the product add the numerator for a numerator, which place over the denominator.

NOTE. *To express whole numbers fraction-ways, set* 1 *for denominator given.*

EXAMPLES.

13. Reduce $18\frac{5}{7}$ to an improper fraction. *Facit* $\frac{129}{7}$.
$18 \times 7 + 3 = 129$ *new numerator*, $= \frac{129}{7}$.
14. Reduce $56\frac{3}{23}$ to an improper fraction. *Facit* $\frac{1295}{23}$.
15. Reduce $183\frac{5}{21}$ to an improper fraction. *Facit* $\frac{3848}{21}$.
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 $\frac{1295}{23}$ to its proper terms. *Facit* $56\frac{7}{23}$.
21. Reduce $\frac{3848}{21}$ 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 term, by rule 2.

EXAMPLES.

25. Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{6}$ to a single fraction.

Facit $\begin{matrix}2\text{X}3\text{X}5 = 30\\ 3\text{X}5\text{X}8 = 120\end{matrix}$ *reduced to the lowest terms*=

26. Reduce $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{1}{1}\frac{1}{2}$ to a single fraction.

Facit $\frac{2}{7}\frac{2}{5}\frac{0}{6}=\frac{5}{1}$

27. Reduce $\frac{1}{1}\frac{1}{2}$ of $\frac{1}{1}\frac{3}{4}$ of $\frac{2}{2}\frac{1}{0}$ to a single fraction.

Facit $\frac{3}{4}\frac{0}{8}\frac{0}{7}\frac{3}{2}=\frac{1}{2}$

28. Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{1}\frac{0}{0}$ to a single fraction.

Facit $\frac{1}{2}\frac{3}{4}\frac{5}{6}=\frac{9}{1}$

29. Reduce $\frac{4}{5}$ of $\frac{6}{8}$ of $\frac{7}{9}$ to a single fraction.

Facit $\frac{1}{3}\frac{6}{6}\frac{8}{0}=\frac{7}{1}$

30. Reduce $\frac{2}{7}$ of $\frac{5}{6}$ of $\frac{8}{1}\frac{0}{0}$ to a single fraction.

Facit $\frac{8}{6}\frac{0}{3}\frac{0}{0}=\frac{3}{6}$

6. *To reduce fractions of one denomination to the fracti of another,* but greater, *retaining the same value.*

RULE. Reduce the given fraction to a compound o by comparing it with all the denominations between it, a that denomination which you would reduce it to; then duce 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 $\frac{1}{2}$ of $\frac{1}{2}\frac{0}{6}=\frac{1}{2}$

32. Reduce $\frac{1}{4}$ of a penny to the fraction of a pound.

Facit $\frac{1}{9}\frac{1}{6}$.

33. Reduce $\frac{4}{5}$ of a dwt. to the fraction of a lb. troy.

Facit $\frac{4}{1}\frac{4}{8}\frac{0}{0}$

34. Reduce $\frac{4}{7}$ of a lb. avoirdupoise to the fraction of a c

Facit $\frac{4}{7}\frac{4}{8}\frac{1}{6}$.

7. *To reduce fractions of one denomination to the fracti of another,* but less, *retaining the same value.*

RULE. Multiply the numerator by the parts contain in the several denominations between it, and that you wo reduce it to, for a new numerator, and place it over given denominator.

Reduce the new fraction to its lowest terms.

EXAMPLES.

5. Reduce $\frac{7}{1020}$ of a pound to the fraction of a penny.
Facit $\frac{7}{5}$.

$20 \times 12 = 1680$ $\frac{168}{1020}$ *reduced to its lowest term*—$\frac{7}{5}$.

6. Reduce $\frac{1}{560}$ of a pound to the fraction of a penny.
Facit $\frac{1}{4}$.

7. Reduce $\frac{4}{1200}$ of a pound troy, to the fraction of a ny-weight. *Facit* $\frac{4}{5}$.

8. Reduce $\frac{4}{784}$ of a *cwt.* to the fraction of a *lb.*
Facit $\frac{4}{7}$.

To reduce Fractions of one Denomination to another of the me Value, having the Numerator given of the required raction.

ULE. As the numerator of the given fraction : is to its minator : : so is the numerator of its intended fraction: s denominator.

EXAMPLES.

. Reduce $\frac{2}{3}$ to a fraction of the same value, whose nutor shall be 12. *As* 2 : 3 : : 12 : 18. *Facit* $\frac{12}{18}$.

. Reduce $\frac{2}{7}$ to a fraction of the same value, whose nutor shall be 25. *Facit* $\frac{25}{35}$.

. Reduce $\frac{5}{7}$ to a fraction of the same value, whose nutor shall be 47.

47
Facit——
$65\frac{4}{5}$

To reduce Fractions of one Denomination to another of the me Value, having the Denominator given of the Fractions quired.

LE. As the denominator of the given fraction : is to merator : : so is the denominator of the intended fraction to its numerator.

EXAMPLES.

Reduce $\frac{2}{3}$ to a fraction of the same value, whose denator shall be 18. *As* 3 : 2 : : 18 : 12. *Facit* $\frac{12}{18}$.

Reduce $\frac{5}{7}$ to a fraction of the same value, whose denator shall be 35. *Facit* $\frac{25}{35}$.

Reduce $\frac{5}{7}$ to a fraction of the same value whose denator shall be 65 $\frac{4}{5}$.

47
Facit——
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 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 $\frac{36\frac{2}{3}}{48}$ to a simple fraction. *Facit* $\frac{110}{144}=\frac{55}{72}$.

$36\times3+2=110$ *numerator.*
$48\times3\ \ =144$ *denominator.*

46. Reduce $\frac{23\frac{5}{7}}{38}$ to a simple fraction. *Facit* $\frac{166}{266}=\frac{83}{133}$.

When the denominator is the integral part, multiply 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 in the integer, and divide by the denominator.

EXAMPLES.

49. Reduce $\frac{3}{4}$ of a pound sterling to its proper quantity.
$3\times20=60\div4=15s.$ *Facit* 15*s.*

50. Reduce $\frac{2}{5}$ of a shilling to its proper quantity.
Facit 4*d.* 3 *qrs.*

51. Reduce $\frac{4}{7}$ of a pound avoirdupoise to its proper quantity. *Facit* 9 *oz.* 2 *dr.*

52. Reduce $\frac{7}{9}$ of an *cwt.* to its proper quantity.
Facit 3 *qrs.* 3 *lb.* 1 *oz* 12 *dr.*

53. Reduce $\frac{3}{8}$ of a pound troy to its proper quantity.
Facit 7 *oz.* 4 *dwt.*

54. Reduce $\frac{4}{5}$ of an ell English to its proper quantity.
Facit 2 *qrs.* 3 *nails* $\frac{1}{5}$.

55. Reduce $\frac{4}{5}$ of a mile to its proper quantity.
Facit 6 *furl.* 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 an 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 $\frac{9}{12}$ 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 ntioned for a numerator, under which set the integral t (reduced to the same term) for a denominator, and it l give the fraction required.

EXAMPLES.

61. Reduce 15s. to the fraction of a pound sterling.
Facit $\frac{15}{20}=\frac{3}{4}$ £.

62. Reduce $4\frac{3}{4}d.$ $\frac{1}{5}$ to the fraction of a shilling.
Facit $\frac{2}{5}$.

63. Reduce 9 *oz.* 2 *dr.* $\frac{2}{7}$ to the fraction of a *lb.* avoirdupse.
Facit $\frac{4}{7}$.

64. Reduce 3 *qrs.* 3 *lb.* 1 *oz.* 12 *dr.* $\frac{4}{9}$ to the fraction of *cwt.*
Facit $\frac{7}{9}$.

65. Reduce 7 *oz.* 4 *dwts.* to the fraction of a *lb.* troy.
Facit $\frac{3}{5}$.

66. Reduce 2 *qrs.* 3 nails $\frac{1}{9}$ to the fraction of an English
Facit $\frac{5}{9}$.

67. Reduce 6 furlongs 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 e.
Facit $\frac{6}{7}$.

70. Reduce 12 gallons to the fraction of a barrel of b
Facit

71. Reduce 15 bushels to the fraction of a chaldron coals. *Facit*

72. Reduce 2 weeks, 2 days, 19 hours, 12 minutes, the fraction of a month. *Facit*

ADDITION OF VULGAR FRACTIONS.

RULE. Ruduce the given fraction to a common nominator, then add all the numerators together, der which place the common denominator.

EXAMPLES.

1. Add $\frac{2}{3}$ and $\frac{4}{7}$ together. *Facit* $\frac{14}{21}+\frac{15}{21}=\frac{29}{21}=$
2. Add $\frac{3}{4}$, $\frac{2}{7}$, and $\frac{5}{6}$ together. *Facit* $1\ \frac{44}{168}$.
3. Add $\frac{1}{5}$, $4\frac{1}{3}$ and $\frac{2}{5}$ together. *Facit* $4\frac{7}{15}$.
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* $1\frac{1}{14}$.
6. Add $5\frac{2}{3}$, $6\frac{7}{8}$, and $4\frac{1}{2}$ together. *Facit* $17\frac{1}{24}$.

II. When the fractions are of several denominations, duce them to their proper quantities and add as befor

7. Add $\frac{3}{4}$ of a pound to $\frac{5}{6}$ of a shilling. *Facit* 15*s.*
8. Add $\frac{1}{2}$ of a penny to $\frac{2}{3}$ of a pound. *Facit* 13*s.*
9. Add $\frac{3}{4}$ of a pound troy to $\frac{1}{6}$ of an ounce.
Facit 9 *oz.* 3 *dwt.*
10. Add $\frac{4}{5}$ of a ton to $\frac{5}{6}$ of a *lb.*
Facit 16 *cwt.* 0 *qr.* 0 *lb.* 13*oz.* 5
11. Add $\frac{2}{3}$ of a chaldron to $\frac{3}{4}$ of a bushel.
Facit 24 *bushels,* 3 *pe*
12. Add $\frac{1}{3}$ of a yard to $\frac{2}{3}$ of an inch.
Facit 6 *inch.* 2 *bar*

SUBTRACTION OF VULGAR FRACTIONS.

RULE. Ruduce the given fractions to a comm nomin ator, then subtract the less numerator fro greater, and place the remainder over the common minator.

II. When the lower fraction is greater than the upper, ract the numerator of the lower fraction from the de- minator, and to that difference add the upper nume- or, carrying one to the unit's place of the lower whole mber.

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* $\frac{1}{2\,8}$.
2. From $\frac{5}{6}$ take $\frac{3}{5}$ of $\frac{5}{6}$.....*Facit* $\frac{1}{2}\frac{1}{4}$.
3. From 5 $\frac{2}{5}$ take $\frac{9}{10}$.....*Facit* $4\frac{2}{3}\frac{3}{0}$.
4. From $\frac{3}{4}\frac{8}{7}$ take $\frac{3}{5}$.....*Facit* $\frac{4}{2}\frac{0}{5}$.
5. From $\frac{1}{2}\frac{9}{0}$ take $\frac{1}{7}$ of $\frac{2}{5}$... ... .*Facit* $\frac{3}{4}\frac{5}{5}\frac{9}{0}$.
6. From 64 $\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$.....*Facit.* $63\frac{3}{4}$.

III. When the fractions are of several denominations re- ce 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* 14*s.* 3.*d*
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 *dr.* $\frac{2}{3}$.
11. From $\frac{2}{3}$ of a chaldron take $\frac{3}{4}$ of a bushel.
Facit 23 *bushels*, 1 *peck.*
12. From $\frac{1}{8}$ of a yard take $\frac{2}{3}$ of an inch. *Facit* 5 *in.* 1 *b. c.*

MULTIPLICATION OF VULGAR FRACTIONS.

RULE. Prepare the given numbers (if they require it) by the rules of Reduction; then multiply the nume- rors together for a new numerator, and the denomina- rs for a new denominator.

EXAMPLES.

1. Multiply $\frac{3}{4}$ by $\frac{5}{6}$ *Fa.* $3\times3=9$ *num.* $4\times5=20$ *den.* $\frac{9}{2\,0}$.
2. Multiply $\frac{7}{9}$ by $\frac{2}{3}$.....*Facit* $\frac{1}{2}\frac{4}{7}$.
3. Multiply 48 $\frac{3}{5}$ by 13 $\frac{5}{6}$..... .....*Facit* $672\frac{9}{3\,0}$.
4. Multiply $430\frac{6}{1\,0}$ by 18 $\frac{3}{7}$..... .....*Facit* $7935\frac{2}{7}\frac{4}{0}$.
5. Multiply $\frac{1}{2}\frac{6}{1}$ by $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$.....*Facit* $\frac{3}{2}\frac{6}{0}\frac{0}{4}=\frac{1}{4}\frac{6}{0}$.
6. Multiply $\frac{2}{1\,0}$ by $\frac{2}{3}$ of $\frac{3}{4}$ $\frac{5}{6}$.....*Facit* $\frac{3}{6}$.

7. Multiply $\frac{1}{4}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{1}{5}$.....*Facit* $\frac{1}{}$
8. Multiply $\frac{1}{4}$ of $\frac{1}{8}$ by $\frac{1}{7}$..... ....*Facit* $\frac{1}{}$
9. Multiply 5 $\frac{6}{7}$ by $\frac{1}{6}$.....*Facit* 4$\frac{}{}$
10. Multiply 24 by $\frac{2}{3}$.. .....*Facit* 16
11. Multiply $\frac{3}{4}$ of 9 by $\frac{7}{8}$..... .....*Facit* 5$\frac{}{}$
12. Multiply 9 $\frac{1}{2}$ by $\frac{2}{3}$ ..... *Facit* 3$\frac{}{}$

DIVISION OF VULGAR FRACTIONS.

RULE. Prepare the given numbers (if they requir by the rules of reduction, and divert the div then preceed as in Multiplication.

EXAMPLES.

1. Divide $\frac{9}{20}$ by $\frac{3}{5}$ $5\times 9=45$ *num.* $3\times 20=60$ *den.* $\frac{}{}$

2. Divide $\frac{14}{27}$ by $\frac{2}{3}$ *Facit* $\frac{7}{}$.
3. Divide 672 $\frac{9}{10}$ by 13 $\frac{5}{6}$ *Facit* 48$\frac{}{}$
4. Divide 7935 $\frac{24}{70}$ by 18 $\frac{3}{4}$ *Facit* 430
5. Divide $\frac{3}{8}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ *Facit* $\frac{9}{}$
6. Divide $\frac{2}{3}$ of 16 by $\frac{5}{7}$ of $\frac{}{}$ *Facit* 19$\frac{}{}$
7. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{}{}$ *Facit* $\frac{24}{}$=
8. Divide 9 $\frac{2}{12}$ by $\frac{1}{2}$ of 7 *Facit* 2$\frac{}{}$.
9. Divide $\frac{9}{10}$ by 4$\frac{1}{2}$ *Facit* $\frac{1}{}$.
10. Divide 16 by 24 *Facit* $\frac{2}{3}$.
11. Divide 5205 $\frac{2}{10}$ by $\frac{3}{5}$ of 91 *Facit* 71$\frac{1}{2}$.
12. Divide 3$\frac{1}{6}$ by 9$\frac{1}{2}$ *Facit* $\frac{1}{3}$.

THE SINGLE RULE OF THREE DIRECT,

VULGAR FRACTIONS.

RULE. Reduce the numbers as before directed i duction. State the question as in the Rule of in whole numbers, and invert the first term of the p tion, then multiply the three terms continually tog and the product will be the answer.

EXAMPLES.

1. If $\frac{3}{4}$ of a yard cost $\frac{5}{8}$ of a £. what will $\frac{9}{10}$ of a yard come to at that rate? *Ans.* $1\frac{13}{21}$=15*s.*

$\frac{3}{4}$ *yard* : $\frac{5}{8}$ £ –:: $\frac{9}{10}$ *yd.* $\frac{14}{21}$ £.

for 4×5× 9=180 *num.*
and 3×8×10=240 *den.* *or* $\frac{5}{8}$×$\frac{9}{10}$=$\frac{45}{80}$)$\frac{15}{20}$($\frac{15}{20}$

2. If $\frac{5}{6}$ of a yard cost $\frac{2}{3}$ £. what will $\frac{1}{12}$ of a yard cost? *Ans.* 1*s.* 8*d.*

3. If $\frac{3}{4}$ of a yard of lawn cost 7*s.* 3*d.* what will 10 yards $\frac{1}{2}$ cost? *Ans.* £4..19..10$\frac{12}{13}$.

4. If $\frac{7}{8}$ *lb.* cost $\frac{3}{4}$*s.* how many pounds will $\frac{3}{8}$ of 1*s.* buy? *Ans.* 1*lb.* $\frac{8}{21}$=$\frac{1}{2\frac{5}{7}}$.

5. If $\frac{3}{8}$ ell of Holland cost $\frac{1}{3}$ £. what will 12 ells $\frac{2}{3}$ cost at that rate? *Ans.* £7..0..8 $\frac{3}{4}$ $\frac{1}{21}$.

6. If $12\frac{1}{2}$ yards of cloth cost 15*s.* 9*d.* what will $48\frac{1}{4}$ cost at the same rate? *Ans.* £3..0..9$\frac{1}{2}$ $\frac{16}{1000}$.

7. If $\frac{9}{10}$ of of an *cwt.* cost 284*s.* what will 7 *cwt.* $\frac{1}{2}$ cost at the same rate? *Ans.* £118..6..8.

8. If 3 yards of broad cloth cost £2..$\frac{4}{5}$, what will 10 yards $\frac{2}{7}$ cost. *Ans.* £9..12.

9. If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of a £. what will $\frac{2}{5}$ of an ell English come to at the same rate? *Ans.* £2.

10. If 1 *lb.* of cochineal cost £1..5, what will 36 *lb.* $\frac{7}{10}$ come to? *Ans.* £4..17..6.

11. If 1 yard of broad cloth cost 15*s.*$\frac{5}{7}$, what will 4 pieces cost, each containing 27 yards $\frac{3}{7}$? *Ans.* £85..14..3$\frac{15}{47}$.

12. Bought 3 pieces $\frac{1}{2}$ of silk, each containing 24 ells $\frac{3}{8}$, at 6*s.*..0$\frac{3}{4}$ *per* ell, I desire to know what the whole quantity cost? *Ans.* £25..17..2$\frac{1}{4}$ $\frac{15}{16}$.

SINGLE RULE OF THREE INVERSE, IN VULGAR FRACTIONS.

EXAMPLES

IF 48 men can build a wall in 24 days $\frac{1}{4}$, how many men can do the same in 192 days? *Ans.* 6 *men* $\frac{48}{768}$.

2. If 25*s.* $\frac{2}{7}$ will pay for the carriage of 1 *cwt.* 145 miles, how far may 6 *cwt.* $\frac{1}{2}$ be carried for the same money? *Ans.* 22 *miles* $\frac{20}{36}$.

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 $\frac{1}{3}$ yard wide, to make another of the same bigness? *Ans.* $4\frac{7}{8}$ *yards.*

4 If 3 men can do a piece of work in 4 hours $\frac{1}{2}$, in ho many hours will 10 men do the same work ?

Ans. 1 *hour* $\frac{7}{8}$.

5. If a penny white loaf weigh 7 *oz.* when a bushel wheat cost 5*s.* 6*d.* what is the bushel worth when a pen white loaf weighs but $2\frac{1}{2}$ *oz.* ? *Ans.* 15*s.* 4*d.* $\frac{4}{7}$.

6. What quantity of shalloon that is $\frac{3}{4}$ yard wide w line $7\frac{1}{2}$ yards of cloth that is $1\frac{1}{2}$ yard wide? *Ans.* 15 *yds.*

DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

EXAMPLES.

IF a carrier receives £$2\frac{1}{10}$ for the carriage of 3 *cwt.* miles, how much ought he to receive for the carri of 7 *cwt.* 3 *qrs.* $\frac{1}{2}$ 50 miles ? *Ans.* £1..16..9.

2. If £100 in 12 months gain £6 interest, what p cipal will gain £$3\frac{3}{8}$ in 9 months? *Ans.* £75.

3. If 9 students spend £$10\frac{7}{9}$ in 18 days, how much 20 students spend in 30 days? *Ans.* £39..18..4$\frac{360}{1451}$

4. A man and his wife having laboured one day, ear 4*s.* $\frac{4}{5}$, how much must they have for 10 days $\frac{1}{2}$, when t two sons helped them? *Ans.* £4..17..1$\frac{1}{2}$

5. If £50 in 5 months gain £$2\frac{37}{144}$ what time £11 $\frac{1}{3}$ require to gain £$1\frac{1}{12}$? *Ans.* $10\frac{32}{121}$ *months*

6. If the carriage of 60 *cwt.* 20 miles cost £$14\frac{1}{2}$, w weight can I have carried 30 miles for £$5\frac{7}{16}$?

Ans. 15 *cwt.*

THE TUTOR's ASSISTANT.

PART III.

DICIMAL FRACTIONS.

IN Decimal Fractions the integer or whole thing, as one pound, one yard, one gallon, &c. is supposed to be divided into ten 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 cyphers as the numerator has places, therefore is never set down; the parts being only distinguished from the whole numbers 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, decimal parts decrease in a tenfold proportion to the right hand:

so that cyphers placed before decimal parts decrease th value, by removing them father from the comma, or un place; thus ,5 is 5 parts of ten, or $\frac{5}{10}$; ,05 is 5 parts 100, or $\frac{5}{100}$; ,005 is 5 parts of 1000, or $\frac{5}{1000}$; ,0005 5 parts of 10000, or $\frac{5}{10000}$. But cyphers, after deci parts, do not alter their value. For, 5, ,50 ,500, are each but $\frac{5}{10}$ of the unit.

A FINITE DECIMAL is that which ends at a certain nu ber of places; but an INFINITE is that which no where en

A RECURRING DECIMAL is that wherein one or m figures are continually repeated, as 2.75222.

And 52,275275275 is called a COMPOUND RECURRI DECIMAL.

Note, *a finite decimal may be considered as infinite, making cyphers to recur; for they do not alter the value the decimal.*

In all operations, if the result consists of several n reject them, and make the next superior place an unit mo thus for 26,25999 write 26,26.

In all circulating numbers, dash the last figure, as 86,54666.

ADDITION OF DECIMALS.

RULE. In setting down the proposed numbers to added, great care must be taken in placing ev figure directly underneath those of the same value, whet they be mixed numbers, or pure decimal parts; and to form which there must be a due regard had to the com or separating points, which ought always to stand in a rect line, one under, another, and to the right hand of t carefully place the decimal parts, according to their spective value; then add them as in whole numbers.

EXAMPLES.

1. Add 72,5+32,071+2,1574+371,4+2,75.
   Facit 480,878
2. Add 30,07+2,0071+59,432+07,1.
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+7,32.
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 ust be carefully observed, as in Addition.

EXAMPLES.

From ,2754 take ,2371	5. From 571 take 54,72
From 2,37 take 1,76	6. From 625 take 76,91
From 271 take 215,7	7. From 23,415 take ,3742
From 270,2 take 75,4075	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 nt hand, cut off as many places for decimals as there are both factors together; but if there should not be so many ces in the product, supply the defect with cyphers to left hand.

EXAMPLES.

Multiply ,2365 by ,2435	*Facit* ,05758775.
Multiply 2,071 by 2,27	7. Multiply 27,35 by 7,70071
Multiply 27,15 by 25,3	8. Multiply 57,21 by ,0075
Multiply 72347 by 23,15	9. Multiply ,007 by ,007
Multiply 17105 by ,3257	10. Multiply 20,15 by ,2705
Multiply 17105 by ,0237	11. Multiply ,907 by ,0025

When any number of decimals is to be multiplied by 10, , 1000, &c. it is only removing the separating point in multiplicand so many places towards the right-hand as re are cyphers in the multiplier; thus, ,578 × 10=5,78. 8 × 100=57,8. ,578 × 1000=578. 578 × 10000=5780.

CONTRACTED MUTIPLICATION OF DECIMALS.

RULE. Put the unit's place of the multiplier unde that place of the multiplicand that is intended to b kept in the product, then invert the order of all the othe figures, *i. e.* write them all the contrary way; then in mul tiplying begin at the figure in the multiplicand, which stan over the figure you are then multiplying with, and set do the first figures of each particular product directly one und the other, and have a due regard to the increase arisi from the figures on the right hand of that figure you b gin to multiply at in the multiplicand.

Note. *That in multiplying the figure left out every ti next the right-hand in the multiplicand, if the product be* 5, *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 b only four places of decimals in the product.

Facit 14169,2065

Contracted Way.	*Common Way.*
384,672158	384,672158
5438,63	36,8345
115401647	1923 360790
23080329	15386 88632
3077377	115401 6474
115402	3077377 264
15387	23080329 48
1923	115401647 4
14169,2065	14169,20650 38510

Facit ,1166

13. Multiply 3,141592 by 52,7438, and leave only places of decimals. *Facit* 165,6994.

14. Multiply 2,38645, by 8,2175, and leave only 4 pla of decimals. *Facit* 19,6107.

15. Multiply 375,13758 by 16,7324, and let there be o 1 place of decimals. *Facit* 6276,9

16. Multiply 375,13758 by 16,7324, and leave onl places of decimals. *Facit* 6276,9520

17. Multiply 395,3756 by ,75642, and let there be o 4 places of decimals. *Facit* 299,0699

DIVISION OF DECIMALS.

THIS Rule is also worked as in whole numbers; the the only difficulty is in valuing the quotient, which done by any of the following rules:

RULE 1. The first figure in the quotient is always of the ne value with that figure of the dividend, which answers stands over the place of unites in the divisor.

2. The quotient must always have so many decimal ces, as the dividend has more than the di visor.

Note 1. *If the divisor and dividend have both the same mber of decimal parts, the quotient will be a whole number.*

2. *If the dividend has not so many places of decimals as in the divisor, then so many cyphers must be annexed to dividend as will make them equal, and the quotient will n be a whole number.*

3. *But if, when the division is done, the quotient has no many figures as it should have places of decimals, then ny cyphers must be prefixed as there are places wanting.*

EXAMPLES.

Divide 85643,825 by 6,321. *Facit* 13549,09428 +.

Divide 48 by 144.	7. Divide 7382,54 by 6,4252.
Divide 217,75 by 65.	8. Divide ,0851648 by 423.
Divide 125 by ,1045.	9. Divide 267,15975 by 13,25
Divide 709 by 2,574.	10. Divide 72,1564 by 1347.
Divide 5,714 by 8275.	11. Divide 715 by 30,75.

When numbers are to be divided by 10, 100, 1000, 000, &c. it is performed by placing the separating point he dividend so many places towards the left hand, as re are cyphers in the divisor.

Thus, 5784 ÷ 10 = 578 $\frac{4}{10}$ 5784 ÷ 1000 = 5,784.
5784 ÷ 100 = 57,84 5784 ÷ 10000 = ,5784.

CONTRACTED DIVISION OF DECIMALS.

RULE. By the first rule find what is the value of t first figure in the quotient; then by knowing the fi figure's denomination, the decimal places may be reduc to any number, by taking as many of the left-hand figu of the dividend as will answer them; and in dividing o one figure of the divisor at each following operation.

Note. *That in multiplying every figure left out in the visor, you must carry* 1, *if it be* 5, *or upwards, to* 15; *if or upwards, to* 25, *carry* 2; *if* 25, *or upwards, to* 35, *ca* 3, &c.

EXAMPLES.

12. Divide 721,17562 by 2,257432, and let there be ly three places of decimals in the quotient.

Contracted.	*Common Way.*
2,257432)721,17562(319,467	2,257432)821,17562(319,
. 6772296	6772296
439460.	439460 2
225743.	225743 2
213717..	213717 00
203169..	203168 88
10548...	105548 120
9030...	9029 728
1518....	1518 3920
1354...,	1354 4592
164	163 9328
158	158 0202
6	5 9125

13. Divide 8,758615 by 5,2715167.
14. Divide 51717591 by 8,7586.
15. Divide 25,1367 by 217,35.
16. Divide 51,47549 by 123415.
17. Divide 70,23 by 7,9863.
18. Divide 27,184 by 3,712.

REDUCTION OF DECIMALS.

TO REDUCE A VULGAR FRACTION TO A DECIMAL.

RULE. Add cyphers 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 $\frac{11}{18}$ of $\frac{10}{13}$ to a decimal. *Facit* ,6043956+.

Note. *If the given parts be of several denominations they may be reduced either by so many distinct operations as there are different parts, or by the first reducing them into their lowest denominations, and then divide as before;* or,

2dly, *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 render pence, shillings, 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 up with the farthings contained in the remaining pence and farthings, always remembering to add* 1, *when it is or exceeds* 25. *But if the number of shillings be odd, the second place of decimals must be increased by* 5.

1. Reduce 5*s.* to the decimal of a £. *Facit* ,25.
2. Reduce 9*s.* to the decimal of a £. *Facit* ,45.
3. Reduce 16*s.* to the decimal of a £. *Facit* ,8.

10. Reduce 8s. 4d. to the decimal of a £.

Facit ,4166.

11. Reduce 16*s.* 7¾*d.* to the decimal of a £.

Facit ,8322916.

first.	*second*	*third.*	
16*s.* 7¾*d.*	4)3,00	2)16	7¾
12			4
	12)7,75	,832	
199			32
4	2|0)16,64583		
960)799(,8322916	,8322916		

12. Reduce 19*s.*5*d*½. 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.* avoirdupo

Facit ,046875

15. Reduce 2 *qrs.* 14 *lb.* to the decimal of an *cwt.*

Facit ,625

16. Reduce two furlongs to the decimal of a league.

Facit ,083

17. Reduce 2 quarts, 1 pint, to the decimal of a gall

Facit ,625

18. Reduce 4 gallons, 2 quarts of wine, to the dec of an hogshead. *Facit* ,071423

19. Reduce 2 gallons, 1 quart of beer, to the decim a barrel. *Facit* ,062

20. Reduce 52 days to the decimal of a year.

Facit ,14246.

To find the value of any Decimal Fraction *in the known parts of an* Integer.

RULE. Multiply the decimal given by the numb parts of the next interior denomination, cutting off th cimals from the product; then multiply the remaind the next inferior denomination; thus proceeding, til have brought in the least known parts of an Integer.

EXAMPLES.

21. What is the value of ,8322916 of a £. *Ans.* 16*s.* $d\frac{1}{2}$. +.

20

16,6458320

12

7,7499840

4

$\frac{1}{2}$,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.* avoirdupoise?
Ans. 12 *drams.*

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 *quarts*, 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	,02083
4	,016
3	,0125
2	,0083
1	,00416

Farthings.	Decimals.
3	,003125
2	,002083
1	,0010416

TABLE II.

ENG. COIN. 1 *sh.*

Long Meas. 1 *Foot*

the Integer.

Pence & Inches.	*Decimals.*
6	,5
5	,416
4	,3
3	,25
2	,16
1	,083

Farthings.	Decimals.
3	,0625
2	,0416
1	,02083

TABLE III.

TROY WEIGHT.

1 *lb.* the Integer.

Ounces the same as Pence in the last Table.

Penny-weight.	*Decimals.*
10	,0416
9	,0375
8	,03
7	,02916
6	,025
5	,02083
4	,016
3	,0125
2	,0083
1	,00416

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.

Penny weights the same as shillings in the first Table.

Grns.	*Decimals*
12	,025
11	,022916
10	,02083
9	,01875
8	,016
7	,01458
6	,0125
5	,01041
4	,0083
3	,00623
2	,00416
1	,00208

TABLE IV.

AVOIRDU. W

112*lb* the Integ

Qrs.	*Decim*
3	,75
2	,5
1	,25

Lbs.	*Decim*
14	,125
13	,116
12	,107
11	,098
10	,089
9	,080
8	,071
7	,062
6	,053
5	,044
4	,035
3	,026
2	,017
1	,008

Oz.	*Deci*
8	,00
7	,00

Decimal Tables of Coin, Weight, and Measure.

6	,003348
5	,002790
4	,002232
3	,001674
2	,001116
1	,000558

Oz.	Decimals
3	,000418
2	,000279
1	,000139

TABLE V.

AVOIRDUP. WT. 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 MEAS. Tun the Integ.

Gallons	Decimals
100	,396825
90	,357141
80	,317465
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	,000496

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.

MEASURE.

Liquid. Dry.

1 *Gallon*, 1 *Quarter*, Integer.

Pints.	Decim.	Bush.
4	,5	4
3	,375	3
2	,25	2
1	,125	1

Qt. pt.	Decim.	Peck.
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 VIII.

LONG MEASURE.

1 Mile the Integer.

Yards.	Decimals
1000	,568182
900	,511364
800	,454545
700	,397727
600	,340909

Decimal Tables of Coin, Weight. and Measure.

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*
9	,0000947
3	,0000474
1	,0000158

TABLE IX.

TIME.

1 Year the Integ.

Months the same as Pence in the second Table.

Days.	*Decimals.*
365	1,000000
300	,821918
200	,547945
100	,273972
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 Integ.

Hours.	*Decimals*
12	,5
11	,4583
10	,416
9	,375
8	,3
7	,2916
6	,25
5	,2083
4	,16
3	,125
2	,083
1	,0416

Min	*Decimals*
30	,02083
20	,013883
10	,006944
9	,00625
8	,005555
7	,004861
6	,004166
5	,003472
4	,002777
3	,002083
2	,001388
1	,000694

TABLE X.

CLOTH MEASURE.

1 Yard the Integ.

Qrs. the same as

Table 4.

Nails.	*Decima*
2	,125
1	,0625

TABLE XI.

LEAD WEIGHT.

A Fother the Inte

Hund.	*Decima*
10	,5128
9	,4615
8	,4102
7	,3589
6	,3076
5	,2564
4	,2051
3	,1538
2	,1025
1	,0512

Qrs.	*Decim*
2	,0256
1	,0128

Pounds.	*Decim*
14	,0064
13	,0059
12	,0054
11	,0050
10	,0045
9	,0041
8	,0036
7	,0032
6	,0027
5	,0022
4	,0018
3	,0013
2	,0009
1	,0004

THE RULE OF RHREE IN DECIMALS.

EXAMPLES.

1. 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. man? *Ans.* £688...10.

3. If 7¾ yards of cloth cost £2...12...9. what will 140½ rds of the same cost? *Ans.* £47...16...3,2 *qrs.*

4. If a chest of sugar, weighing 7 *cwt.* 2 *qrs.* 14 *lb.* cost 6..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* bacco for £3678..6..4. what will 1 *oz.* come to? *Ans.* 1*d.*

6. What will 326 *lb.* 1 *qr.* of tobacco come to, when 1½*lb.* sold for 3*s.* 6*d.* *Ans.* £38..1..3.

7. What is the worth of 19 *oz.* 3 *dwt.* 5 *gr.* of gold, at ..19. *per oz.*? *Ans.* £56..10..5..2,3 *qrs.*

8. What is the worth of 827¾ yards of painting, at 10½*d.* yard? *Ans.* £36..4..3..1,5 *qrs.*

9. If I lent my friend £34. for ⅝ of a year, how much ght he to lend me 1⅝ of a year to requite my kindness? *Ans.* £51.

10. If ⅔ of a yard of cloth, that is 2 yards ¼ broad, make garment, how much that is ⅘ of a yard wide will make same? *Ans.* 2,109375 *yards.*

11. If one ounce of silver costs 5*s.* 6*d.* what is the price of ankard that weighs 1 *lb.* 10 *oz.* 10 *dwt.* 4 *gr.*? *Ans.* £6..3..9 2,2. *qrs.*

12. If 1 *lb.* of tobacco cost 15*d.* what cost 3 hogsheads ighing together 15 *cwt* 1 *qr.* 19 *lb.*..? *Ans.* £107..18..9.

THE TUTO
d Measure.
ABLE X.
TH MEASURE
rd the Intege
s. the same a
Table 4.

s.	*Decima*
	,125
	,0625

ABLE XI.
EAD WEIGHT.
ther the Inte

d.	*Decima*
0	,5128
9	,4615
8	,4102
7	,3589
6	,3076
5	,2564
4	,2051
3	,1538
2	,1025
1	,0512

rs.	*Decim*
2	,0256
1	,0128

nds.	*Decim*
14	,0064
13	,0059
12	,0054
11	,0050
10	,0045
9	,0041
8	,0036
7	,0032
6	,0027
5	,0022
4	,0018
3	,0013
2	,0009
1	,0004

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..9..3 *qrs.*

14. Bought 6 chests of sugar, each 6 *cwt.* 3 *qrs.* at £ 16*s. per cwt.* what do they come to?

Ans. £113..8.

15. Bought a tankard for £10..12. at the rate of 5*s.* *per* ounce, what was the weight? *Ans.* 39 *oz.* 15 *dwt.*

16. Gave £187..3..3. for 25 *cwt.* 3 *qrs.* 14 *lb.* of tobacco. at what rate did I buy it *per lb.*? *Ans.* 15*d.* 2 *qrs.*

17. Bought. 29 *lb.* 4 *oz.* of coffee for £10..11..3. what the value of 3 *lb.*? *Ans.* £1..1..8.

18. If I gave 1*s.* 1*d.* for 3½*lb.* of cheese, what will be the value of 1 *cwt.*? *Ans.* £..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 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.	1.	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 imals together, make the number of decimals even by ing cyphers to them; so that there may be a point fall the unit's place of the whole number.

1. What is the square root of 3271,4007? *Ans.* 57,19+.
2. What is the square root of 4795,25731? *Ans.* 69,247+.
3. What is the square root of 4,372594? *Ans.* 2,091+.
4. What is the square root of 2,2710957? *Ans.* 1,50701+.
5. What is the square root of ,00032754? *Ans.* ,01809+.
6. What is the square root of 1,270054? *Ans.* 1,1269+.

o extract the Square Root *of a* VULGAR FRACTION.

ULE. Reduce the fraction to its lowest terms, then ex- t the square root of the numerator for a new numerator, the square root of the denominator, for a new denomi- or.

f the fraction be a surd (i. e.) *a number where a root can r be exactly found, reduce it to a decimal, and extract oot from it.*

EXAMPLES.

1. What is the square root of $\frac{2304}{5184}$? *Ans.* $\frac{2}{3}$.
2. What is the square root of $\frac{2704}{4225}$? *Ans.* $\frac{4}{5}$.
3. What is the square root of $\frac{9216}{12544}$? *Ans.* $\frac{4}{7}$.

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 $\frac{4}{5}\frac{7}{4}\frac{8}{9}$? *Ans.* ,933099+

To extract the Square Root *of a* Mixed Number.

Rule. 1. Reduce the fractional part of the mixed number to its lowest term, and then the mixed number to improper fraction.

2. Extract the root of the numerator and denomin for a new numerator and denominator.

If the mixed number given be a surd, reduce the fracti part to a decimal, annex it to the whole number, and ex the square root therefrom.

EXAMPLES.

19. What is the square root of $51\frac{2}{3}\frac{1}{5}$? *Ans.* 7
20. What is the square root of $27\frac{9}{1}\frac{}{6}$? *Ans.* 5
21. What is the square root of $9\frac{4}{4}\frac{3}{9}$? *Ans.* 3

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 num

Rule. The square root of the product of the given n bers is the mean proportional sought.

EXAMPLES.

27. What is the mean proportional between 3 and 1
Ans. $3\times12=36$ *then* $\sqrt{36}=6$ *the mean proportiona*
28. What is the mean proportional between 4276 and
Ans. 1897,4+

To find the side of a square equal in area to any give perficies.

Rule. The square root of the content of any give perficies, is the square equal sought.

EXAMPLES.

9. If the content of a given circle be 160, what is the of the square? *Ans.* 12,64911.

0. If the area of a circle is 750, what is the side of the are equal? *Ans.* 27,38612.

The Area of a Circle given to find the Diameter.

ULE. As 355 : 452, or, as 1 : 1,273239 : : so is the : to the square of the diameter :—or, multiply the re root of the area, by 1,12837, and the product will he diameter.

EXAMPLES.

1. What length of cord will be fit to tie to a cow's tail, other end fixed in the ground, to let her have liberty of ng an acre of grass and no more, supposing the cow tail to be 5 yards $\frac{1}{2}$? *Ans.* 6,136 *perches.*

Area of a Circle given to find the Periphery or Circumference.

ULE. As 113 : 1420, or, as 1 : 12,56637 : : the area he square of the periphery,—or, multiply the square of the area by 3,5449, and the product is the circumnce.

EXAMPLES.

2. When the area is 12, what is the circumference? *Ans.* 12,2798.

3. When the area is 160, what is the periphery? *Ans.* 44,889.

ny two sides of a right angled triangle given to find hird side.

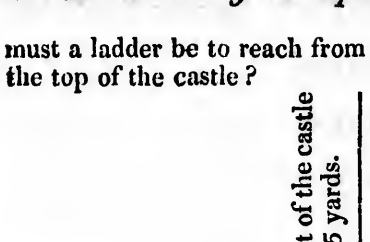
he Base and Perpendicular given to find the Hypothenuse.

ULE. The square root of the sum of the squares of the and perpendicular is the length of the hypothenuse.

EXAMPLES.

. The top of a castle from the ground is 45 yards high, surrounded with a ditch 60 yards broad; what length

must a ladder be to reach from the outside of the ditch the top of the castle? *Ans.* 75 *yard*



35 The wall of a town is 25 feet high, which is rounded by a moat of 30 feet in breadth: I desire to k the length of a ladder that will reach from the outside the moat to the top of the wall? *Ans.* 39,05 *fe*

The Hypothenuse and Perpendicular given to find the B

RULE. The square root of the difference of the square the hypothenuse and perpendicular is the length of the b

The Base and Hypothenuse given to find the Perpendicu

RULE. The square root of the difference of the square the hypothenuse and base is the hight of the perpendicu

N. B. *The two last Questions may be varied for Exam to the two last Propositions.*

Any number of men being given to form them int square battle, or to find the number of ranks and files.

RULE. The square root of the number of men given the number of men either in rank or file.

36. An army consisting of 351776 men, I desire to k how many rank and file. *Ans.*

37. A certain square pavement contains 48841 sq stones, all of the same size, I demand how many are tained in one of the sides? *Ans.* 22

EXTRACTION OF THE CUBE ROOT.

TO extract the Cube Root is to find out a num which being multiplied into itself, and then into product, produceth the given number.

RULE. 1. Point every third figure of the cube given, ginning at the unit's place; seek the greatest cube to

point, and subtract it therefrom; put the root in the tient, and bring down the figures in the next point to remainder for a RESOLVEND.

2. Find a DIVISOR by multiplying the square of the tient by 3. See how often it is contained in the resend, rejecting the units and tens, and put the answer he quotient.

3. To find the SUBTRAHEND. 1. Cube the last figure he quotient. 2. Multiply all the figures in the quotient , except the last, and that product by the square of the . 3. Multiply the devisor by the last figure. Add these ducts together, gives the subtrahend, which subtract n the resolvend; to the remainder bring down the next t, 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
6 4 = *cube of* 4

Divisor. ———
are of 4x3=48 (35252 *resolvend.*

216 = *cube of* 6.
432 = 4X3X *by square of* 6.
288 = *devisor* X *by* 6.

33336 *subtrahend.*

Divisor. ———
are of 46 X 3=6348) 1916847 *resolvend.*

27 = *cube of* 3.
1242 = 46X3X *by sqr. of* 3.
19044 = *divisor* X *by* 3.

1916847 *substrahend.*

What is the cube root of 389017 ?	*Ans.* 73.
What is the cube root of 5735339 ?	*Ans.* 179.
What is the cube root of 32461759 ?	*Ans.* 319.
What is the cube root of 84604519 ?	*Ans.* 439.
What is the cube root of 259694072 ?	*Ans.* 638.
What is the cube root of 48228544 ?	*Ans.* 364.

8. What is the cube root of 27054036008 ? *Ans.* 30
9. What is the cube root of 22069810125 ? *Ans.* 28
10. What is the cube root of 122615327232 ? *Ans.* 49
11. What is the cube root of 219365327791 ? *Ans.* 60
12. What is the cube root of 673373097125 ? *Ans.* 87

When the given number consists of a whole number and decimal together, make the number of decimals to consist of 3, 6, 9, &c. places by adding cyphers thereto, so that their whole may be a point fall on the unit's place of the whole number.

13. What is the cube root of 12,977875 ? *Ans.* 2,35
14. What is the cube root of 36155,027576 ? *Ans.* 33,0
15. What is the cube root of, 001906624 ? *Ans.* ,124.
16. What is the cube root of 33,230979637 ? *Ans.* 3,21
17. What is the cube root of 15926,972504 ? *Ans.* 25,1
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, extract the cube root of its numerator and denomina for a new numerator and denominator ; but if the frac be a surd, reduce it to a decimal, and then extract the from it.

EXAMPLES.

19. What is the cube root of $\frac{250}{686}$? *Ans.* $\frac{5}{7}$.
20. What is the cube root of $\frac{324}{1500}$? *Ans.* $\frac{3}{5}$.
21. What is the cube root of $\frac{1620}{5130}$? *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 t and then the mixed number to an improper fraction, ex the cube roots of the numerator and denominator new numerator and denominator ; but if the mixed ber given be a surd, reduce the fractional part to a mal, annex it to the whole number, and extract the therefrom

EXAMPLES.

What is the cube root of $12\frac{19}{27}$? *Ans.* $2\frac{1}{3}$.
What is the cube root of $31\frac{15}{343}$? *Ans.* $3\frac{1}{7}$.
What is the cube root of $405\frac{29}{125}$? *Ans.* $7\frac{3}{5}$.

SURDS.

What is the cube root of $7\frac{1}{2}$? *Ans.* 1,93+.
What is the cube root of $9\frac{1}{8}$? *Ans.* 2,092+.
What is the cube root of $8\frac{4}{7}$? *Ans.* 2,057+.

THE APPLICATION.

. If a cubical piece of timber, be 47 inches long, 47 es broad, and 47 inches deep, how many cubical inches it contain? *Ans.* 103823.

. There is a cellar dug, that is 12 feet every way, in th, breadth, and depth, how many solid feet of earth e taken out of it? *Ans.* 1728.

. There is a stone of cubic form, which contains 389017 l feet, what is the superficial contents of one of its s? *Ans.* 5329.

ween two Numbers given, to find two mean Proportionals

ULE. Divide the greater extreme by the less, and the e root of the quotient multiplied by the less extreme s the less mean; multiply the said cube root by the less n, and the product will be the greater mean propor- al.

EXAMPLES.

What are the two mean proportionals between 6 and ? *Ans.* 18 *and* 54.

What are the two mean proportionals between 4 and ? *Ans.* 12 *and* 36.

nd the Side of a Cube that shall be equal in Solidity to any iven Solid, as a Globe, Cylinder, Prism, Cone, &c.

ULE. The cube root of the solid contents of any solid given, is the side of the cube with equal solidity.

EXAMPLE.

If the solid content of a globe is 10648, what is the of a cube of equal solidity? *Ans.* 22.

The side of the Cube being given, to find the Side of the C that shall be double, treble, &c. in Quantity to the C given.

RULE. Cube the side given, and multiply it by 2, 3, the cube root of the product is the side sought.

EXAMPLE.

7. There is a cubical vessel, whose side is 12 inches, a it is required to find the side of another vessel, that is contain three times as much? *Ans.* 17,306

EXTRACTING OF THE BIQUADRATE ROOT.

TO extract the Biquadrate Root is to find out a numb which being involved four times into itself, will p duce the given number.

RULE. First extract the square root of the given nu ber, and then extract the square root of that square r and it will give the biquadrate root required.

EXAMPLES.

1. What is the biquadrate of 27? *Ans.* 531
2. What is the biquadrate of 76? *Ans.* 33362
3. What is the biquadrate of 275? *Ans.* 5719140
4. What is the biquadrate root of 531441? *Ans.*
5. What is the biquadrate root of 33362176? *Ans.*
6. What is the biquadrate root of 5719140625? *Ans.*

A GENERAL RULE FOR EXTRACTING T ROOTS OF ALL POWERS.

PREPARE the number given for extraction, pointing off from the unit's place as the root quired directs.

2. Find the first figure in the root by the table of po which subtract from the given number.

3. Bring down the first figure in the next point to remainder, and call it the dividend.

4. Involve the root into the next inferior power to hich is given, multiply it by the given power, and c the divisor.

5. Find a quotient figure by common division, and annex 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 is 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
 ---
 51 dividend.
 ---
 1369 subtrahend.
 ---
  4) 447 dividend.
 ---
 41376 subtrahend.
 =====
```

3 X 2=6 *divisor.*
37 X 37=1369 *subtrahend.*
37 X 2=74 *divisor.*
376 X 376=141376 *subtrahend.*

2. What is the cube root of 53157376?

```
531573(376
 27
 ---
 27)261 dividend.
 ---
 50653 subtrahend.
 ---
 4107)25043 dividend.
 ---
 53157376 subtrahend.
 ========
```

3 X 3 X 3=27 *divisor.*
37 X 37=50653 *subtrahend.*
37 X 57 X 3=4107 *divisor.*
376 X 376 X 376=53157376 *subtrahend.*

3. What is the biquadrate root 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 *per cent.*
I the Interest.
A the Amount.

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 100 : 3 :: 1 : ,03. *As* 100 : 3,5 :: 1,035

When the principle, Time, and Rate per cent. *are given to find the Interest.*

RULE. Multiply the principle, 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..0. for three 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..0. at 4 *per cent. per annum*, for 6 years? *Ans.* £131..8..11.2 *qrs.* ,08

3. What is the interest of £796..15..0. 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 2 years and at 3½ *per cent. per annum?* *Ans.* £34..15..6.3,55*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.—22.

6. What is the interest of £236..18..8. for 3 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 principle and number of days, it will give the answer.

INTEREST OF £1. FOR ONE DAY.

Per Cent.	*Decimals.*	*Per Cent.*	*Decimals.*
3	,00008219178	6⅓	,00017808219
3½	,00009589041	7	,00019178082
4	,00010958904	7⅓	,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 : ,0000958904 1, &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..0. for 154 days, at *5 per cent. per annum?* *Ans.* £7..13..11¼.

9. What is the interest of £725..15..0. for 74 days, at *per cent. per annum?* *Ans.* £5..17..8½.

10. What is the interest of £100. from the 1st of Jun 1775, to the 9th of March following, at 5 *per cent. pe annum?* *Ans.* £3..16..11¾.

11. *When* P, R, T, *are given to find* A.

RULE *prt* + *p* = A.

EXAMPLES.

11. What will £279..12..0. amount to in 7 years, at 4 *per cent. per annum?* *Ans.* £367..13..5.3,04 *qrs.*

279,6 × ,045 × 7 + 279,6 = 367,674.

12. What will £320..17..0. amount to in 5 years, at 3 *per cent. per annum?* *Ans.* £376..19..11. 2,8 *qrs.*

When there is any odd time given with the whole years, re duce the odd time into days, and work with the decimal par of a year which are equal to those days.

13. What will £926..12..0. amount to in 5 years ½, at *per cent. per annum?* *Ans.* £1130..9..0.1,92 *qrs.*

14. What will £273..18..0. amount to in 4 years, 17 days, at 3 *per cent. per annum?*

Ans. £310..14..1¾,35080064 *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 £367..13..5.3,04 *qrs.* in 7 years at 4½ *per cent. per annum*

Ans. ,045 × 7 + 1 = 1,315, *then* 367,674 ÷ 1,3 = £279..12..0.

16. What principal, being put to interest, will amount £376..19..11.2,8. in 5 years, at 3½ *per cent. per annum?*

Ans. £320..17..0.

17 What principle, being put to interest, will amount £1130..9..0. 1,92 *qrs.* in 5 years ½, at 4 *per cent. per annum?* *Ans.* £926..12..0.

18. What principal will amount to £310..14..1¾ 35080064 *qrs.* in 4 years, 175 days, at 3 *per cent, per ann?* *Ans.* £273..18..0.

7. *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..0. 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=,45, or 4½ *per cent*

20. At what rate *per cent* will £320..17..0. amount to 376..19..11. 2,8 *qrs.* in 5 years? *Ans.* 3½ *per cent.*

21. At what rate *per cent.* will £926..12..0. amount to 1130,.9..0. 1,92. *qrs.* in 5 years ½? *Ans.* 4 *per cent.*

22. At what rate *per cent.* will £273..18..0. amount to 310..14..1¼ ,35080064 *qrs.* in 4 years, 175 days?

Ans. 3 *per cent.*

7. *When* A, P, R, *are given, to find* T.

RULE. $\frac{a-p}{pr}=T.$

EXAMPLES.

3. In what time will £272..12..0. amount to £367..13..5 *qrs.* at 4½ *per cent.*? *Ans.* 367,674—279,6=88,074. 279,6 X ,045=12,5820, *then* 88,074÷12,5820=7 *years*

4. In what time will £320..17..0.amount to £376..19..11. *qrs.* at 3½ *per cent?* *Ans.* 5 *years.*

5. In what time will £926..12..0.amount to £1130..9..0. *qrs.* at 4 *per cent?* *Ans.* 5 *years*½.

6. In what time will £273..18..0.amount to £310..14..1¼ 0064 *qrs.* at 3 *per cent.?* *Ans.* 4 *years*, 175 *days.*

NUITIES, OR PENSIONS, &c. IN ARREARS.

nuities, or Pensions, &c.are said to be in arrears, when are payable or due, either yearly, half-yearly, or quar- 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.

RULE. $\frac{ttu-tu}{2} \times r : + tu = A$

EXAMPLES.

27. If a salary of £150. be forborn 5 years, at 5 *per cen* what would 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 forborn 7 years, wh will it amount to in that time at 6 *per cent.*? *Ans.* £206

29. There is a house let upon lease for 5 years ½ at £6 *per annum.* what will be the amount of the whole time, at *per cent.*? *Ans.* £363..8..3.

30. Suppose an annual pension of £28. remain unp for 8 years, what would it amount to at 5 *per cent.*?

Ans. £263..4..0.

NOTE. *When the annuities, &c. are to be paid half-year or quarterly, then*

For half yearly payment, *take half of the ratio, half of annuity, &c. and twice the number of years,—and,*

For quarterly payments, *take a fourth part of the ratio fourth part of the annuity, &c. and four times the number years, and work as before.*

EXAMPLES.

31. If a salary of £150. payable every half-year, rema unpaid for 5 years, what would it amount to in that tim 5 *per cent.*? *Ans.* £834..7..6

32. If a salary of £150. payable every quarter, was unpaid for 5 years, what would it amount to in that time 5 *per cent.*? *Ans.* £839..1..3

NOTE. *It may be observed by comparing these last exa ples, the amount of the half-yearly payments are more adv tageous than the yearly, and the quarterly more than half-yearly.*

II. When A, R, T, *are given to find* U.

RULE. $\frac{2a}{ttr-tr+2t} = U.$

EXAMPLES.

33. If a salary amounted to £825 in five years, at 5 *per cent.* what was the salary? *Ans.* £150.

$825 \times 2 = 1650$, $5 \times 5 \times ,05 - \times ,05 + 5 \times 2 = 11$ then $1650 + 11 = £150$.

34. If a house is to be let upon a lease for 5 years $\frac{1}{4}$, and the amount for that time be £363..8..3, at $4\frac{1}{2}$ *per cent.* what is the yearly rent? *Ans.* £60.

35. If a pension amounted to £2065 in 7 years, at 6 *per cent.* what is the pension? *Ans.* £250.

36. Suppose the amount of a pension be £263..4..0 in 8 years, at 5 *per cent.* what is 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, and at 5 *per cent.* be £834..7..6, what is the salary? *Ans.* £150.

38. If the amount of an annuity, payable quarterly, be £839..1..3 for 5 years, at 5 *per cent.* what is the annuity? *Ans.* £150.

III. *When* U, A, T, *are given to find* R.

RULE. $\frac{2a - 2\,ut}{utt - ut} = R$

EXAMPLES.

39. If a salary of £150. *per annum* amount to £325 in 5 years, what is the rate *per cent.*? *Ans.* 5 *per cent.*

$5 \times 2 - 150 \times 5 \times 2 = 150$ then $\frac{150}{150 \times 5 \times 5 - 150 \times 5} = ,05$

40. If a house be let upon lease for 5 years $\frac{1}{4}$, at £60 *per annum*, and the amount for that time be £363..8..3. what is the rate *per cent.*? *Ans.* $4\frac{1}{2}$ *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..0 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 *a dividend, and work with half the annuity, and double*

the number of years for a divisor; if quarterly, PRE
8 a—8 ut, *and work with a fourth of the annuity, and* OTE.
times the number of years.

43. If a salary of £150 *per annum*, payable half-ye When
amounts to £834..7..6. in 5 years, what is the rate
cent? *Ans.* 5 *per cen* tt

44. If an annuity of £150 *per annum*, payable quar ULE.
ly, amounts to £839..1..3 in 5 years, what is the rate 2t
cent? *Ans.* 5 *per cen*

IV. *When* U, A, R, *are given to find* T.

RULE. *First,* $\frac{2}{r} - \left| \right. = x$: *then* $\sqrt{\frac{2a}{ar} + \frac{xx}{4}} - \frac{x}{2} = T$.

45. In what time will a salary of £150 *per annu* 1. What
mount to £825 at 5 *per cent?* *Ans.* 5 *year* inue 5
e 5½ yea

$$\frac{2}{,05} - 1 = 39 \qquad \frac{82\overset{5}{\cancel{5}} \times 2}{150 \times ,05} = 220 \qquad \frac{30 \times 39}{4} = 380,25$$

$$\sqrt{220 + 380,25} = 24,5 - \frac{39}{2} = 5 \text{ years.}$$

46. If a house is let upon lease for a certain time 3. What
£60 *per annum*, and the amount to £363..8..3, at 4½ inue 7
cent. what time was it let for? *Ans.* 5½ *year* 4. What
47. If a pension of £250 *per annum*, being forbor ey, at 5
certain time, amounts to £2065, at 6 *per cent.* what ote. *By*
the time of forbearance? *Ans.* 7 *year* *the pres*
48. In what time will a yearly pension of £28 amou gcous t
£263..4..0, at 5 *per cent?* *Ans.* 8 *year* When

NOTE. *If the payments are half-yearly, take half* ULE.
ratio and half the annuity; if quarterly, one fourth of
ratio and one fourth of the annuity; and T *will be equ*
those half-yearly or quarterly payments.

49. If an annuity of £150 *per annum*, payable If the
yearly, amounts to £834..7..6, at 5 *per cent.* what time years a
the payment forborne? *Ans.* 5 *year*
50. If a yearly pension of £150, payable quart ×,05
amounts to £839..1..3. at 5 *per cent.* what was the tim
forbearance? *Ans.* 5 *year*

PRESENT WORTH OF ANNUITIES.

NOTE. P *represents the present worth;* U, T, R, *as before.*

When U, T, R, *are given, to find* P.

RULE. $\frac{ttr-tr+2t}{2tr+2} \times u = P.$

EXAMPLES.

1. What is the present worth of £150 *per annum*, to continue 5 years at 5 *per cent*? *Ans.* £660.

$\overline{5\times 5\times,05-5\times,05+5\times 2}=11$, $5\times,05\times 2+2=2,5$.
then $11\div 2,5\times 150=£660$.

2. 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 $\frac{15}{41}$.

3. What is the present worth of £250 *per annum*, to continue 7 years, at 6 *per cent*? *Ans.* £1454..4..6$\frac{6}{7}$.

4. 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*

5. What is the present worth of £150. payable quarterly, for 5 years, at 5 *per cent*? *Ans.* £671..5..0.

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.*

When P, T, R, *are given to find* U.

RULE. $\frac{tr+1}{ttr-tr+2t} \times 2p = U.$

EXAMPLE.

1. If the present worth of a salary be £660, to continue 10 years at 5 *per cent.* what was the salary? *Ans.* £150.

$\overline{5\times,05+1}=1,25=\overline{5\times 5\times,05-5\times,05+10}=11$.

then $\frac{1,25}{11}\times 660\times 2=150$.

57. There is a house let upon lease for $5\frac{1}{2}$ years to com I desire to know the yearly rent, when the present wor at $4\frac{1}{2}$ *per cent.* is £291..6..$3\frac{15}{409}$. *Ans* £60.

58. What annuity is that which for 7 years continuan at 6 *per cent.* produces, £1454..4..$6\frac{6}{11}$ present worth? *Ans.* £250.

59. What annuity is that which for 8 years continuan produces £188 for the present worth, at 5 *per cent.*? *Ans.* £28.

NOTE. *When the payments are half-yearly, take half ratio, twice the number of years, and multiply by* 4 p; *when quarterly, take one fourth of the ratio, four times number of years, and multiply by* 8 p.

60. There is an annuity payable half-yearly, for 5 y to come, what is the yearly rent, when the present wo at 5 *per cent.* is £667..10..0? *Ans.* £150

61. There is an annuity payable quarterly, for 5 year come, I desire to know the yearly income, when the p ent worth, at 5 *per cent.* is £671..5..0? *Ans.* £150

III. *When* U. P. T. *are given to find* R.

RULE. $\frac{ut-p\times 2}{2pt+ut-utt}=R.$

EXAMPLES.

62. At what rate *per cent.* will an annuity of £150 *annum*, to continue 5 years, produce the present wor £660? *Ans.* 5 *per ce*

$150\times 5-660\times 2=180,2\times 660\times 5+150\times 5-150\times 5$
$=3600$ *then* $180\div 3600=,05$ *per cent.*

63. If a yearly rent of £60 *per annum*, to continu years, produce £291..6..$3\frac{15}{409}$ for the present worth, is the rate *per cent*? *Ans.* $4\frac{1}{2}$ *per ce*

64. If an annuity of £250 *per annum*, to conti years, produce £1454..4..$6\frac{6}{11}$ for the present worth, w the rate *per cent*? *Ans.* 6 *per. ce*

65. If a pension of £23 *per annum*, to continue eight ears, produce £188 for the present worth, what is the rate *r cent?* *Ans. 5 per cent.*

NOTE. *When the annuities, or rents, &c. are to be paid lf yearly, or quarterly, then,*

For half-yearly payments, *take half of the annuity, &c. d twice the number of years, the quotent will be the ratio of lf 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 e ratio of the fourth part of the rate* per cent.

66. If an annuity of £150 *per annum*, payable half-year- having 5 years to come, is sold for £667..10..0, what is rate *per cent?* *Ans. 5 per cent.*

67. If an annuity of £150 *per annum*, paya[illegible] quarterly, ing 5 years to come, is sold for £671..5..[illegible], what is the e *per cent.?* *Ans. 6 per cent.*

IV. *When* U, P, R, *are given to find* T.

RULE. $\frac{2}{r}-\frac{2p}{u}-1=x$ *then* $\sqrt{\frac{2p}{ur}+\frac{xx}{4}}-\frac{x}{2}=T.$

EXAMPLES.

68. If an annuity of £150 *per annum*, produce £660 for present worth, at 5 *per cent.* what is the time of its con- ance? *Ans. 5 years.*

$\frac{660X2}{150}-1=30,2$ $\frac{660X2}{150X,05}=176$

$\frac{2X30,2}{4}=228,01$ *then* $\sqrt{228,01}+176=2,10$

$\frac{30,2}{2}=5$ *years.*

69. For what time may a salary of £60 be purchased for 1..6..3,$\frac{15}{190}$ at 4½ *per cent.?* *Ans.* 5½ *years.*

70. For how long time may £250 *per annum*, be pu
chased for £1454..4..6. $\frac{6}{71}$. at 6 *per cent.*? *Ans.* 7 *years.*

71. What time may a pension of £28 *per annum* be pu
chased for £188, at 5 *per cent.*? *Ans.* 8 *years.*

Note. *When the payments are half-yearly, then* U *will*
equal to the half annuity, &c. R. *half the ratio, and* T
number of payments; and

When the payments are quarterly, U *will be equal to*
fourth part of the annuity, &c. R *the fourth of the ratio, a*
T *the number of payments.*

72. If an annuity of £150 *per annum*, payable half-yea
ly, is sold for £667..10..0, at 5 *per cent.* I desire to kn
the number of payments and the time to come?

Ans. 10 *payments*, 5 *years.*

73. An annuity of £150 *per annum*, payable quarter
is sold for £671..5..0, at 5 *per cent.* what is the numb
of payments and time to come? *Ans.* 20 *payments*, 5 *yea*

ANNUITIES, &c. TAKEN IN REVERSION.

1. *To find the present Worth of an Annuity, &c. tak*
in Reversion.

RULE. 1. Find the present worth of $\frac{ttr-tr+2t}{2tr+2}$:Xu=
the yearly sum at the given rate and
for the time of its continuance, *thus:*

2. Change P into A, and find
what principal being put to interest $\frac{a}{tr+1}$=P.
will amount to A at the same rate,
and for the time to come before the
annuity, &c. commence, *thus:*

EXAMPLES.

74. What is the present worth of an annuity of £1
per annum, to continue 5 years, but not to commence till
end of 4 years, allowing 5 *per cent.* to the purchaser?

Ans. £550

$$\frac{5\times5\text{X},05-5\text{x},05\text{x}2\wedge5}{5\text{x},05\text{x}2+2}=4,4\text{X}1\text{5C}=\frac{\text{C60}}{4\text{X},05+1}=50$$

75. What is the present worth of a lease of £50 *per annum*, to continue 4 years, but is not to commence till the end of 5 years, allowing 4 *per cent.* to the purchaser?
Ans. £152..5..11 $\frac{2}{11}$.

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$\frac{1}{7}$.

77. A legacy of £40 being left for 6 years to a person of 5 years of age, but 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 $\frac{73}{101}$

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*,

$$\frac{tr+1}{ttr-tr+2t} : X2p = U.$$

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 is the yearly income? *Ans.* £150.

$$\overline{550X4X,05} + 550 = 660 \qquad \frac{5X,05+1.}{5X5X,05-5X,05+5X2}$$

$$113636 X 660 X 2 = £150.$$

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..5..11$\frac{1}{2}$. $\frac{2}{11}$, 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$\frac{1}{7}$, 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..13..11.$\frac{13}{16}$, allowing 5 *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.*?

$\frac{357,5}{,75 \times ,05 + 1}$ =£344,5783

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.*? £267..13..10$\frac{38}{247}$.

3. What is the present worth of £875..5..6 due 5 months hence, at 4$\frac{1}{2}$ *per cent.* *Ans.* £859..3..3$\frac{3}{4}$ $\frac{3}{16}$.

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$\frac{3}{17}$.

II. *When* P, T, R, *are given, to find* S.

RULE. $ptr+p$=S.

EXAMPLES.

5. If the prssent 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.

344,5783X,75X05+344,5783=£357..10.

6. A person owing a certain sum, payable 7 months hence, agrees with his 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..0.

7. A person receives £859..3..3$\frac{3}{4}$ $\frac{3}{16}$, for a sum of

ey due 5 months hence, allowing the debtor $4\frac{1}{2}$ *per cent.* or present payment, what was the sum due?

Ans. £875..5..6

8. A person paid £70..11..9 $\frac{3}{17}$ for a debt due 15 months ence, he being allowed 5 *per cent.* for the discount, how uch 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 9 months hence, produce £344..11..6 3,168 *qrs.* for present payment? *Ans.* 5 *per cent.*

$$\frac{357{,}5-344{,}5783}{344{,}5783\times{,}75}={,}05=5 \textit{ per cent.}$$

10. At what rate *per cent.* will £275..10, payable 7 months hence, produce £267..13..10 $\frac{33}{447}$ 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 $\frac{3}{8}\frac{5}{3}$ *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 $\frac{3}{17}$? *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 for 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.*

$$\frac{357{,}5-344{,}5783}{344{,}5783\times{,}05}={,}75=9 \textit{ months.}$$

14. The present worth of £275..10. due for a certain

time to come, is £267..13..10$\frac{31}{247}$, 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$\frac{1}{4}\frac{3}{3}$, 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$\frac{3}{17}$ for a debt of £75, allowing the person 5 *per cent.* for prompt paymnet, I desire to know when the debt would have been payable without the rebate? *Ans.* 1.5 *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 at three months, £60 at 6 months, and £100 at 9 months; at what time may the whole debt be paid together, rebate being made at 5 *per cent.*? *Ans.* 6 *months* 26 *days.*

$\frac{40}{1,0125}=39,5061$ $\frac{60}{1,025}=58,5365$ $\frac{100}{1,0375}=96,3855.$

then $200-39,5061+58,5365+96,3855=5,5719$

$\frac{5,5719}{194,4281\times,05}=,57315=6$ *months*, 26 *days.*

2. D owes F £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 : 105. As 100 :: 105,5 :: 1,055.

Table of the Amount of £1 for one Year.

Rates per cent.	*Amts. of* £1.	*Rates per cent.*	*Amts. of* £1.	*Rates per cent.*	*Amts. 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 shewing 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	3,02559
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	1,59384	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	3,92012	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 :: 1,05 *for the first year: then,* As 100 : 105 :: 1,05 : 1,10 *second year, &c.*

I. *When* P, T, R, *are given, to find* A.

RULE. $pXrt=A$.

EXAMPLES.

1. What will £225 amount to in 3 years time, at 5 *per cent. per annum?* *Ans.* 1,05X1,05X1,05=1,157625 *then* 1,157625x225=£260..9..3..3 *qrs.*

2. What will £200 amount to in 4 years, at 5 *per cent. per annum?* *Ans.* £243..2,025

3. What will £150 amount to in 5 years, at 4 *per cent. per annum?* *Ans.* £547..9..1C. 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?*

$1,05X1,05X1,05=1,152765\frac{260,465625}{1,157625}=£225.$

6. What principal being put to interest will amount to £243..2,025*s.* in 4 years, at 5 *per cent. per annum?*

Ans. £

7. What principal will amount to £547..9..10. 2,05 *qrs.* in 5 years, at 4 *per cent. per annum?*

Ans. £

8. What principal will amount to £619..8..2. 3,832 in 4 years, at 5½ *per cent?* *Ans.* £

III. *When* P, A, T, *are given to find* R.

RULE. $\frac{a}{p}=rt$, *which being extracted by the rules of Evolution (the time given in the question shewing the power,) will give* R.

EXAMPLES.

9. At what rate *per cent.* will £225 amount to £260..9..3. *qrs.* in 3 years? *Ans* 5 *per cent.*

$\frac{260,465625}{225}$ = 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. 2,025*s.* 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.

EXAMPLE.

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. 2,025*s.* at 5 *per cent.*? *Ans.* 4 *years.*

15. In what time will £ 50 amount to £547..9..10. 2,0538368 *qrs.* at 4 *per cent.*? *Ans.* 5 *years.*

11. In what time will £500 amount to £619..8..2. 3,8323 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 shewing the amount of £1, Annuity for any numb of Years under 31, at 5 and 6 per cent. per annum.

Years	*Rates.* 5	6	*Years.*	*Rates.* 5	6
1	1,00000	1,00000	16	23,65749	25,672 2
2	2,05000	2,06000	17	25,84036	28,21288
3	3,15250	3,18360	18	28,13238	30,90565
4	4,31012	4,37461	19	30,53900	33,75999
5	5,52563	5,63706	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	19,59863	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=3,1525 *third year's amount.*

I. *When* U, T, R, *are given to find* A.

RULE. $\frac{urt-u}{r-1}$=A, *or by the table thus:*

Multiply the amount of £1 for the number of years, a at the rate *per cent.* given in the question, by the annui pension, &c. and it will give the answer.

EXAMPLES.

17. What will an annuity of £50 *per annum*, paya yearly, amount to in 4 years, at 5 *per cent.*

Ans. 1,05×1,05×1,05×1,05×50=60,77531250

then $\frac{60,7753125-5}{1,05-1}$=£215..10..1. 2 *qrs. or,*

by the table thus, 4,31012×50=£215..10..1 1,76 *qrs.*

18. What will a pension of £45 *per annum*, pay yearly, amount to in 5 years, at 5 *per cent.?*

Ans £248..13..0 3,27 *qr*

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 $\frac{2264}{3906}$.

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..2¼. 235851424346112.

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. $\frac{215,50625\times 1,05-215,50625}{1,05\times 1,05\times 1,05\times 1,05-1}=$£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. $\frac{2264}{3906}$, at 6 *per cent.*? *Ans.* £40.

24. If the payment of an annuity being forborne 10 years, amount to £988..11..2¼ 235851424346112. at 6 *per cent*, what is the annuity? *Ans.* £75.

III. *When* U, A, R, *are given, to find* T.

RULE. $\frac{ar+a-a}{u}=rt$ *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. $\frac{215,50625\times 1,05+50-215,50625}{50}=1,21550625$

which being continually divided by R, *the number of the divisions will be* = 4 *years.*

26. In what time will £45 *per annum* amount to £248.,13..0 3,27 *qrs.* allowing 5 *per cent*, forbearance of payment? *Ans.* 5 *years.*

27. In what time will £40 *per annum* amount to £279..0..3.$\frac{22641}{3966625}$, at 6 *per cent.*? *Ans.* 6 *years.*

28. In what time will £75 *per annum* amount to £988..11..2¼. 235851424346112, allowing 6 *per cent.* for forbearance of payment? *Ans.* 10 *years.*

PRESENT WORTH OF ANNUITIES. PENSIONS, &c.

A Table shewing 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	0.95238 | 0.94339	16	10,83777 | 10,10539
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	5,78647 | 5,58238	22	13,16300 | 12,04158
8	6,46321 | 6,20979	23	13,48857 | 12,30338
9	7,10782 | 6,80169	24	13,7986 | 12,55035
10	7,72173 | 7,36008	25	14,09394 | 12,78365
11	8,30641 | 7,88687	26	14,37518 | 13,00316
12	8,86325 | 8,38384	27	14,64303 | 13,21053
13	9,39357 | 8,85268	28	14,89812 | 13,40616
14	9,89864 | 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 =.90703. *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* 1,85941=2,72324, *third year's present worth.*

I. *When* U, T, R, *are given, to find* P.

$$u\frac{\frac{u}{rt}}{r-1}$$

RULE. $\frac{\frac{u}{rt}}{r-1}$=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. £1 7..9..5..184*d.*

$\frac{30}{1,50363}$=19,9517. 30—19,9517=10,0483$\frac{10,0483}{1,06-1}$=167,4716. *By the table* 5,58238X30=167,4716.

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$\frac{3}{4}$ $\frac{1399301984837}{3782285030361}$.

31. What is the present worth of a salary of £35, to continue 7 years, at 6 *per cent.*?

Ans. £195..7..8 $\frac{144238301881}{352413341951711}$.

32. What is the yearly rent of £50, to continue 5 years, worth in ready money, at 5 *per cent.*?

Ans. £216..9..5. $2\frac{3529447867}{4084101}$ *qrs.*

II. *When* P, T, R, *are given to find* U.

RULE. $\frac{prt \text{ X } r-prt}{rt-1}$=U.

EXAMPLES.

33. If an annuity be purchased for £167..9..5..184*d.* to be continued 7 years, at 6 *per cent.* what is the annuity?

$\frac{167,4716 \text{ X } 1,50363 \text{ X } 1,06-167,4716 \text{ X } 1,50363}{1,50363-1}$=

30.

34. If the present payment of £258..10..6$\frac{3}{4}$. $\frac{1399301984837}{3782285030361}$ *qrs.* be made for a salary 8 years to come, at *per cent.* what is the salary? *Ans.* £40.

35. If the present payment of £195..7..8$\frac{144238301881}{352413341951711}$ be required for a pension for 7 years to come, at 6 *per* . what is the pension? *Ans.* £35.

36. If the present worth of an annuity, 5 years to come, £216..9..5. $2\frac{3529447867}{4084101}$ *qrs.* at 5 *per cent.* what is the uity? *Ans.* £50.

III. *When*, U, P, R, *are given, to find* T.

RULE. $\frac{u}{p\dagger u - pr} = rt$ *which being continually divided b* R, *till nothing remains, the numb of those divisions will be equal to* T

EXAMPLES.

37. How long may a lease of £30 yearly rent be had fo £167..9..5. ,184*d.* allowing 6 *per cent.* to the purchaser?

Ans. $\frac{30}{167{,}4716^{+}30 - 177{,}5198} = 1{,}50363$ *which being contin ually divided, th number of tho divisions will = to T = years.*

38. If £258..10..6. 3 $\frac{138}{378}\frac{93}{226}\frac{30}{350}\frac{12}{361}\frac{403}{361}$ *qrs.* is paid dow for a lease of £10 *per annum*, at 5 *per cent.* how long is th lease purchased for? *Ans.* 8 *years.*

39. If a house is let upon lease for £35 *per annu* and the lessee makes present payment of £195. 7. $\frac{144}{352}\frac{23}{14}\frac{8}{34}\frac{30}{19}\frac{18}{511}$ he being allowed 6 *per cent.* I demand ho long the lease is purchased for? *Ans.* 7 *years.*

40. For what time may a lease of £50 *per annum* be pu chased when present payment is made of £216,.9.. $2\frac{350}{405}\frac{47}{41}\frac{86}{01}$ at 5 *per cent.*? *Ans.* 5 *years.*

ANNUITIES, LEASES, &c. taken in REVERSIO

To find the present worth of Annuities, Leases, &c. taken Reversion.

RULE. Find the present worth of the annuity, &c. at the given rate, and for the time of its continuance; *thus*,

$$u\,\frac{\frac{u}{rt}}{\frac{}{r-1}} = \text{P}.$$

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.

$$\frac{a}{rt} = \text{P}.$$

EXAMPLES.

41. What is the present worth of a reversion of a lease of £40 *per annum*, to continue for 6 years, but not to commence till the end of two years, allowing 6 *per cent.* to the purchaser? *Ans.* £175..1..1. 2,048 *qrs.*

$\frac{40}{1,41852}$=28,1984, $\frac{40-28,1984}{1,06-1}$=196,1933. $\frac{199,6933}{1,1236}$ =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 $\frac{3525415048423}{16670880976201}$.

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 $\frac{41445673652803}{116759160847407}$ *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*, $prt=A$.

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*, $\frac{rt\times r-prt}{rt-1}=U$.

EXAMPLES.

44. What annuity to be entered upon 2 years hence, and then to continue 6 years, may be purchased for £175..1..1 2,058 *qrs.* at 6 *per cent.*?

Ans. 175,0563×1,1236=196,6933

Then $\frac{196,6933\times 1,41852\times 1,06-279,01337}{141852-1}$=£40

45. The present worth of a lease of an house i £299..18..2 $\frac{352541504842 2}{166790880978201}$ *d.* taken in the reversion fo 7 years, but not to commence till the end of 3 years, al lowing *5 per cent.* to the purchaser, what is the yearl rent? *Ans.* £60.

46. There is a lease of a house in being for 4 years, an the lessee being minded to take a lease in reversion 7 years to begin when the old lease shall be expired, paid dow £142..16..3. 1, $\frac{4144557365 2893}{1167591668474407}$ *qrs.* what was the yearl rent of the house, when the lessee was allowed *5 per cen* for present payment? *Ans.* £30.

Purchasing FREEHOLD *or* REAL ESTATES; *such as ar 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 *pe 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 continu for ever, worth, in present money, allowing 4 *per cent.* t the buyer? *Ans.* £3500.

49. If a freehold estate of £75 yearly rent was to b sold, what is the worth, allowing the buyer 6 *per cent.*? *Ans.* £1250.

II. *When* W, R, *are given, to find* U,

RULE. $\overline{w\times r-1}=U.$

EXAMPLES.

50. If a freehold estate is bought for £1000, and the a lowance of *5 per cent.* is made to the buyer, what is th yearly rent? *Ans.* 1,05—1=,05. *then* 1000×,05=£5

51. If an estate be sold for £3500, and 4 *per cent.* a lowed to the buyer, what is the yearly rent? *Ans.* £14

52. If a freehold estate is bought for £1250 present m ney, and an allowance of 6 *per cent.* made to the buyer f 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, hat 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 r £3500, what is the rate *per cent.* allowed?

Ans. 4 *per cent.*

55. If an estate of £75 *per annum* is sold for £1250, hat is the rate *per cent* allowed? *Ans.* 6 *per cent.*

Purchasing FREEHOLD ESTATE *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 eing put to interest will amount to A. at the me rate and for the time to come, before the tate commences, and that will be the worth f the estate in reversion; *thus*, $\frac{a}{rt}=P.$

EXAMPLES.

56. If a freehold estate of £50 *per annum*, to commence years hence, to be sold, what is it worth, allowing the urchaser 5 *per cent.* for present payment?

Ans. $\frac{50}{1{,}05-1}=1000.$ *then* $\frac{1000}{1{,}2155}=$£822..14..1. 2 *qrs.*+.

57. What is an estate of £200, to continue for ever, t not to commence till the end of 2 years, worth in ready oney, allowing the purchaser 4 *per cent.?*

Ans. £4622..15..7$\frac{1}{4}$. $\frac{139}{165}$.

58. What is an estate of £240 *per annum* worth in ready oney, to continue for ever, but not to commence till the d of 3 years, allowance being made at 6 *per cent.*

Ans. £3358..9..6. $2\frac{69741}{148877}$.

To find the Yearly rent of an Estate taken in Reversion.

RULE. Find the amount of the worth the estate, at the given rate and time fore it commences; *thus*, $wrt=A.$

Change A into W, and find what yearly nt being sold will produce U, at the me rate: *thus*, $\frac{wrXr-wr}{r}=U.$ hich will be the yearly rent required.

EXAMPLES.

59. If a freehold estate, to commence 4 years hence, i sold for £822..14..1 2 *qrs.* allowing the purchaser 5 *per cent.* what is the yearly income?

Ans. 822,70625×1,2155=1000.

then $\frac{1000\times 1{,}05\times 1{,}05-1050}{1{,}05}$ = £50.

60. A freehold estate is bought for £4622..15..7¼. which does not commence till the end of 2 years, the buye being allowed 4 *per cent.* for his money; I desire to kno the yearly income? *Ans.* £200.

61. There is a freehold estate sold for £3358..9.. $2\frac{68}{149}\frac{74}{877}$ *qrs.* but not to commence till the expiration o 3 years, allowing 6 *per cent.* for present payment; what i the yearly income? *Ans.* £240.

REBATE, OR DISCOUNT.

A *TABLE shewing the present worth of* £1 *due at the end of any number of years, to commence under* 31, *rebate at* 5 *and* 6 per cent.

Years.	5 *Rates.* 6	*Years.*	5 *Rates.* 6
1	,952381 ,943396	16	,458111 ,393647
2	,907030 ,889990	17	,436296 ,371364
3	,863838 ,839619	18	,415520 ,350343
4	,822702 ,792093	19	,395734 ,330513
5	,783526 ,747258	20	,376889 ,31180
6	,746215 ,704960	21	,358942 ,294155
7	,710682 ,665057	22	,341849 ,277505
8	,676839 ,627412	23	,325571 ,261797
9	,644609 ,591898	24	,310067 ,246978
10	,613913 ,558394	25	,295302 ,232998
11	,584679 ,526787	26	,281240 ,219810
12	,556837 ,496969	27	,267848 ,207368
13	,530321 ,468839	28	,255093 ,195630
14	,505068 ,442301	29	,242946 ,18 556
15	,481017 ,417265	30	,231377 ,174110

NOTE. *The above table is thus made,* 1÷1,05=,9523 *first year's present worth; and* ,952381÷1,05=,90703 *cond year; and* ,90703÷1,05=, 863838 *third year, &c.*

I. *When* S, T, R, *are given to find* P.

RULE. $\frac{s}{rt}=P.$

EXAMPLES.

1. What is the present worth of £315..12..4, 2*d.* payable years hence, at 6 *per cent.*?

Ans. 1,06×1,06×1,06×1,06=1,26247. *then*

	by the table
315,6175	315,6175
Ans. $\frac{315,6175}{1,26247}$=£250.	,792093
	249,9984124275

2. If £344..14..9 2,01940875 *qrs.* be payable in 7 years me, what is the present worth, rebate being made at 5 *r cent.*? *Ans.* £245.

3. There is a debt of £441..17..4. ,06464 *qrs.* which payable 4 years hence, but it is agreed to be paid in esent money; what sum must the creditor receive, re-te being made at 6 *per cent.*? *Ans.* £350.

II. *When* P, T, R, *are given, to find* S.

RULE. P×*rt*=S.

EXAMPLES.

4. If a sum of money due 4 years hence, produce £250 the present payment, rebate being made at 6 *per cent.* at was the sum first due?

Ans. £205 × 1,26247=£315..12..4 2*d.*

5. If £245 be received for a debt payable 7 years hence, d an allowance of 5 *per cent*, to the debtor for present yment, what was the debt?

An.. £344..14..9. 2,01940875.

6. There is a sum of money due at the expiration of 4 rs, but the creditor agrees to take £350 for present ment, allowing 6 *per cent.* what was the debt?

Ans. £441..17..4. ,06464.

III. *When* S, P, R, *are given, to find* T.

RULE. $\frac{s}{p}=rt$ *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 o £315..12..4. ,2*d.* rebate at 6 *per cent.* in what time wa the debt payable?

Ans. $\frac{315,6175}{250}$=1,26247 *which being continually divide those divisions will be equal* 4=*the number of years.*

8. A person receives £245 now for a debt £344..14..9. 2,01940875 *qrs.* rebate being made at 5 *p cent.* I demand in what time the debt was payable?

Ans. 7 *years.*

9. There is a debt of £441..17..4. ,06464. due at certain time to come, but 6 *per cent.* being allowed to t debtor for the present payment of £350, I desire to kn in what time the sum should have been made without a rebate? *Ans.* 4 *years.*

IV. *When* S, P, T, *are given, to find* R.

RULE. $\frac{s}{p}$=*rt* *which being extracted by the rules of traction (the time given in the questi shewing the power) will be equal to* R

EXAMPLES.

10 A debt of 315..12..4. ,2*d.* is due 4 years hen but it is agreed to take £250 now, what is the rate *cent.* that the rebate is made at?

Ans $\frac{315,6175}{250}$=1,26247; $\sqrt[4]{1,26247}$=1,06=6 *per*

11. The present worth of £344..14..9. 2,01940875 payable 7 years hence, is £245, at what rate *per cen* rebate made? *Ans.* 5 *per cen*

12. There is a debt of £441..17..4. ,0646. payabl 4 years time, but it is agreed to take £350 present ment, I desire to know at what rate *per cent.* reba made at? *Ans.* 6 *per ce*

THE TUTOR's ASSISTANT.

PART IV.

DUODECIMALS;

OR, WHAT IS GENERALLY CALLED

ROSS MULTIPLICATION AND SQUARING OF DIMENSIONS BY ARTIFICERS AND WORKMEN.

RULE FOR MULTIPLYING DUODECIMALLY.

UNDER the Multiplicand write the corresponding denominations of the Multiplier.

2. Multiply each term in the Multiplicand (beginning the lowest) by the feet in the Multiplier; write each ult under its respective term, observing to carry an unit every 12, from each lower denomination to its next erior.

3. In the same manner multiply the Multiplicand by the nes in the Multiplier, and write the result of each term place more to the right hand of those in the Multipli- d.

4. Work in the same manner with the seconds in the ltiplier, setting the result of each term two places to right hand of those in the Multiplicand, and so on for ds, fourths, &c.

EXAMPLES.

1. Multiply *f. in.* 7 . 9 by *f. in.* 3 . 6

Cross Multipli.	*Practice*	*Duodecimals.*	*Decimals.*
7 x 9	6½ 7 . 9	7 . 9	7.75
3 6	3 . 6	3 . 6	3,5
21.0.0=7x3	23 . 3	23 . 3 x3	3875
2.3.0=9x3	3 . 10.6	3 . 10.6x6	2325
3.6.6=7x6			
0.4.6=9x6	27 . 1 . 6	27 . 1 . 6	27125
27.1.6			

	f.in.		*f. in.*	*f. in.*
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* 11402.2.4.11.11.
18. Multiply	321.7.3	by	9.3.6.	*Facit* 2988.2.10.4.6.

THE APPLICATION.

Artificer's work is computed by different measures, viz.

1. Glazing and mason's flat-work by the foot.

2. Painting, plastering, paving, &c. by the yard.

3. Partitioning, flooring, roofing, tyling, &c. by the square of 100 feet.

4. Brick work, &c. by the rod, or 16 feet ½, whose square is 272¼.

MEASURING BY THE FOOT SQUARE.

As Glaziers and Masons 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 14*d. per* foot?

Duodecimals.		*feet in. pts.*	
7 . 10	*the*	233..0..6	at 14*d. per foot*
6 . 8	*heights*		
5 . 4	*added*	2*d.* $\frac{1}{6}$ 233	= 1*s.*
19 . 10		38..10	= 2*d.*
3	=*windows.*	$\frac{1}{2}$	= 6 *parts.*
59 . 6	*in a tier.*	2|0)27|1..10$\frac{1}{2}$.	
3 . 11	*in breadth.*	£13..11..10$\frac{1}{2}$	*Ans.*
178 . 6			
54 . 6 . 6			
233 . 0 . 6			

20. What is the worth of 8 squares of glass, each measuring 4 feet 10 inches long, and 2 feet 11 inches broad, at 1*d. per* foot? *Ans.* £1..18..9.

21. There is 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 2 feet 7 inches, and the breadth 1 foot 10 inches, at 6*s. per* foot? *Ans.* £3..1..5.

MEASURING BY THE YARD SQUARE.

As Paviours, Painters, Plasterers, and Joiners.

NOTE. *Divide the square foot by* 9, *and it will give the number of square yards.*

EXAMPLES.

23. A room is to be ceiled, whose length is 74 fee inches, and width 11 feet 6 inches, what will it come to 3*s.* 10½*d. per* yard? *Ans.* £18..10..

24. What will the paving of a court-yard come to, 4½*d. per* yard, the length being 58 feet 6 inches, breadth 54 feet 9 inches? *Ans.* £7..0..10

25. A room painted 97 feet 8 inches about, and 9 10 inches high, what does it come to at 2*s.* 8¾*d. per* ya *Ans.* £14..11..

26. What is the content of a piece of wainscotting yards square, that is 8 feet 3 inches long, and 6 feet 6 inc broad, and what will it come to at 6*s.* 7½*d. per* yard? *Ans.* £1..19..

27. What will the paving a court-yard come to at 3*s. per* yard, if the length be 27 feet 10 inches, and breadth 14 feet 9 inches? *Ans.* £7..4..

28. A person has paved a court-yard 42 feet 9 inche front, and 68 feet 6 inches in depth, and in this he la footway the depth of the court, of 5 feet 6 inche breadth; the footway is laid with purbeck Stone, at 3s *per* yard, and the rest with pebbles, at 3*s. per* yard, will the whole come to? *Ans.* £49..17..

29. What will the plastering a ceiling at 10*d. per* come to, supposing the length 21 feet 8 inches, and breadth 14 feet 10 inches? *Ans.* £1..9..

30. What will the wainscotting a room come to a *per* square yard, supposing the height of the room (t in the cornice and moulding) is 12 feet 6 inches, and compass 83 feet 8 inches, the three window shutters 7 feet 8 inches by 3 feet 6 inches, and the door 7 fe 3 feet 6 inches? The shutters and door being worke both sides, is reckoned work and half work?

Ans. £36..12..

MEASURING BY THE SQUARE OF 100 FE

As Flooring, Partitioning, Roofing, Tyling, &c

EXAMPLES.

31. In 173 feet 10 inches in length, and 10 feet 7 i in height of partitioning, how many squares?

Ans. 18 *squares*, 39 *feet*, 8 *inches*, 1

32. If a house of three stories, besides the ground floor, was to be floored at £6..10..0 *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, 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..3¼.

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 10*s.* 6*d. per* square? *Ans.* £12..12..11¾.

NOTE. *In tyling, roofing, and slating, it is customary to reckon the flat, and half of any 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 tyling of a barn cost, at 25*s.* 6*d. per* square; the length being 43 feet 10 inches, and breadth 27 feet 5 inches on the flat, the eve boards projecting 16 inches on each side? *Ans.* £24..9..5½.

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 the thickness of the wall is of; 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.*

37. How many square rods are there in a wall 62½ f long, 14 feet 8 inches high, and 2½ bricks thick?

Ans. 5 rods, 167 feet.

38. If the side walls of an house be 28 feet 10 inches length, and the height of the roof from the ground 55 f 8 inches, and the gable (or triangular part at top) to r 42 course of bricks, reckoning 4 course to a foot. N 20 feet high is 2½ bricks thick, 20 feet more, at 2 bric thick, 15 feet 8 inches more, at 1½ brick thick, and t gable at 1 brick thick, what will the whole work come at £5..16..0 *per* rod? *Ans.* £48..13..5½

Multiplying several figures by several, and the product to produced on the line only.

RULE. Multiply the units of the multiplicand by units of the multiplier, setting down the units of the p duct, and carry the tens; next multiply the tens in the m tiplicand by the units of the multiplier, to which add product of the units of the multiplicand multiplied by tens in the multiplier and the tens carried; then multi the hundreds in the multiplicand by the units of the mu plier, adding the product of the tens in the multiplic multiplied by the tens in the multiplier, and the units of multiplicand by the hundreds in the multiplier; and so p ceed till you have multiplied the multiplicand all throu by every figure in the multiplier.

EXAMPLES.

Multiply - - 35234	35234
by - - 52424	52423
1847107216	140936
	70468
	140936
	70468
	176170
	1847107216

EXPLANATION.

First. 4×4=16, that is 6 and carry 1, *Secondly.* 3×4 +1×2 and 1 that is carried is 21, set down 1 and carry 2. *Thirdly,* 2×4+3×2+4×4+2 carried=32; that is 2 and carry 3. *Fourthly,* 5×4+2×2+3×4+4×2+3 carried =47; set down 7 and carry 4. *Fifthly,* 3×4+5×2+2 ×4+3×2+4×5+4 carried=60; set down 0 and carry 6. *Sixthly,* 3×2+ ×4+2×2+3×5+6 carried = 51; set down 1 and carry 5. *Seventhly,* 3×4+5×2+2×5+5 carried=57, that is 7 and carry 3. *Eighthly,* 3×2+5×5 +3 carried=34; set down 4 and carry 3. *Lastly,* 3×5 +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.

THE MENSURATION OF CIRCLES, &c.

A CIRCLE is a plain figure, contained under one line which is called a circumference, unto which all lines drawn from a point in the middle of the figure, called the centre, and falling upon the circumference, are equal the one to the other. The circle contains more space than any plain figure of equal compass.

The proportion of the diameter of a circle to the circumference was never yet exactly found, notwithstanding many eminent and learned men have laboured very far therein among whom the excellent Van Ceulen has hitherto outdone all, in his having calculated the said proportion to thirty-six places of decimals, which are engraven upon his tomb-stone in St. Peter's church in Leyden.

Let it be required to find the area of a circle, whose diameter is an unit. By the proportion of Van Ceulen, if the diameter be one, the circumference will be 3.14159265, &c. of which 3.1416 is sufficient in most cases. Then the rule teaches, to multiply half the circumference, by half the diameter, and the product is the area: that is, multiply 1.570 by .5, (*viz.* half 3.1416 by half 1) and the product is ,785 which is the area of the circle, whose diameter is 1.

Again, if the area be required when the circumference is 1, first find what the diameter will be, thus: 3.1416: to 1 :: 1 to 318309, which is the diameter when the circumference is 1. Then multiply half .318309 by half 1, that is .159154 by 5, and the product is .079577, which is the area of a circle whose circumference is 1.

If the area be given to find the side of the square equal, you need but extract the square root of the area given, and it is done. So that the square root of .7854 is 8862, which is the side of a square equal when the diameter is 1. And if you extract the square root of .079577 it will be 2821, which is the side of the square equal to the circle whose circumference is 1.

If the side of a square within a circle be required, if you square the semi-diameter, and double that square, and out of that sum extract the square root, that shall be the side of the square, which may be inscribed in that circle: so if the diameter of the circle be 1, then the half is .5, which squared is .25, and this doubled is .5, whose square root is .7071, the side of the square inscribed.

From what has been here said, the ingenious scholar will easily perceive how all other proportional numbers are found, and may examine them at pleasure. We shall now proceed to the different problems.

Problem 1. Having the diameter and circumference to find the area.

Every circle is equal to a parallelogram, whose length is equal to half the circumference, and the breadth equal to half the diameter; therefore multiply the circumference by half the diameter, and the product is the area of the circle.

Thus, if the diameter of a circle, that is, the line drawn cross the circle through the centre, be 22.6; and if the circumference be 71, the half of 71 is 35.5, and the half of 22.6 is 11.3, which multiplied together, the product is 401.15, which is the area of the circle.

Problem 2. Having the diameter of a circle to find the circumference.

As 7 to 22, so is the diameter to the circumference. Or, as 113 to 355, so is the diameter to the circumference. Or, as 1 to 3.141593, so is the diameter to the circumference.

Let the diameter, as in the first problem, be 22.6. This multiplied by 22, and the product divided by 7, gives,

71.028 for the circumference; but the other two proportions are more exact, as appear by the following work.

3.141593	355
22.6	22.6
18849558	2130
6283186	710
6283186	710
71.0000018	113)80230.(71.
	113
	. . .

Problem 3. Having the circumference of a circle, to find the diameter.

As 1 is to .318309, so is the circumference to the diameter. Or, as 355 to 113, so is the circumference to the diameter. Or, as 22 to 7, so is the circumference to the diameter.

Let the circumference be 71, and then proceed with either of the three proportions, as follow:

318309	113	71
71	71	7
318309	113	22)497(22.59
2228163	791	57
22.599939	355)8023(22.6	130
	923	200
	2130	2
	. . .	

Thus, by the second proportion, the diameter is 22.6; but by the other two it falls something short.

Problem 4. Having the diameter of a circle, to find the area.

All circles are in proportion one to another, as the squares of their diameters, (by Euclid, lib. 12, prop. 2.) Now the area of a circle, whose diameter is 1, will be .785398, ac-

cording to Van Ceulen's proportion beforementioned; but for practice .7854 will be sufficient. Therefore, as 1 (the square of the diameter 1) is to .7854, so is 510,76 (the square of 22.6 the diameter of the given circle) to 41,15 the area of the given circle.

Problem 5. Having the circumference of a circle to find the area.

Because the diameters of circles are proportional to their circumferences; that is, as the diameter of one circle is to its circumference, so is the diameter of another circle to its circumference: therefore the areas of circles are to one another, as the squares of the circumferences. And if the circumference of a circle be 1, the area of that circle will be .07958; then the squre of 1 is 1, and the square of 71, (the circumference of the former circle) is 5041. Therefore it will be, as 1 : 07958 :: 5041 : 401,16278.

Problem 6. Having the diameter, to find the side of a square equal in area to that circle.

If the diameter of a circle be 1. the side of a square equal thereto will be .8862 Therefore as 1 : 8862 : : 22.6 (the diameter) : 20,02812, the side of the square.

Problem 7. By having the circumference, to find the side of the square equal thereto.

If the circumference of a circle be 1, the side of the square equal will be .2821. Therefore as 1 : 2821 : : 71 (the circumference) : 20,0291, the side of the square.

Problem 8. Having the diameter, to find the side of a square, which may be inscribed in that circle.

If the diameter of a circle be 1, the side of the square inscribed will be .7071. Therefore, as 1 : 7071 : : 22.6 : 15.98046, the side inscribed. Or, if you square the semidiameter, and double that square, the square root of the double square will be the side of the square inscribed.

Problem 9. Having the circumference to find the side of a square which may be inscribed.

If the circumference be 1, the side of the square inscribed will be .2251. Therefore, as 1 : 2251 : : 71 : 15.9821, the side of the square.

Problem 10. Having the area to find the diameter.

If the area of a circle be 1, the square of the diameter will be 1.2732. Therefore, as 1 : 1.2732 : : 401.15 : 510,744180, the square root of which is 22.599, the diameter.

Problem 11. Having the area, to find the circumference.

If the area of a circle be 1, the square of the circumference will be 12.56637. Therefore, as 1 : 12.56637 : : 401.15 : 5040.99932550, the square root of which is 70.9999.

Problem 12. Having the area, to find the side of a square inscribed.

If the area of a circle be 1, the area of a square inscribed within that circle will be .6366. Therefore, as 1 : 401.15 : : .6366 : 255.372090, the root of which is 15.980, the side of the square sought.

Problem 13. Having the side of a square, to find the diameter of the circumscribing circle.

If the side of a square be 1, the diameter of a circle that will circumscribe that square, will be 1.4142. Therefore, as : 1.4142 : : 15.98 : 22.598916, the diameter sought.

Problem 14. Having the side of a square to find the diameter of square equal to it.

If the side of a square be 1, the diameter of a circle equal to it will be 1.128. Therefore, as 1 : 1.128 : : 20.0291 : 22.5928248 the diameter required.

Problem 15. Having the side of a square to find the circumference of a circumscribing circle.

If the side of a square be 1, the circumference of a circle that will encompass that square will be 4.443. Therefore, as 1 : 4.443 : : 15.98 : 70.99914, the circumference required.

Problem 16. Having the side of a square, to find the circumference of a circle that will be equal to it.

If the side of a square be 1, the circumference of a circle that will be equal to it is 3.545 Then, as 1 : 3.545 : 20.0291 : 71.0031595, the circumference.

NOTE. *In several of the foregoing problems, where the diameter and circumference are required, the answers are not exactly the same as the diameter and circumference of the given circle, but are sometimes too much, and sometimes too little, as in the two last problems, where the answers in each should be 71, the one being too much, and the other too little. The reason of this is, the small defect that happens to be in the decimal fractions, they being sometimes too great, and sometimes too little; yet the defect is so small, that it is needless to calculate them to more exactness.*

Of the Semicircle.

To find the area of a semicircle, multiply the fourth part of the circumference of the whole circle by the semi-diameter

and the product will be the area. Suppose the diameter be 22,6 and the half circumference, or arch line, is 35,5. The half of it is 17.75, which multiplied by the semi-diameter 11.3, the product is 200.575, the area of the semi-circle.

Of the Quadrant.

To find the area of a quadrant, or the fourth part of a circle, multiply half the arch line of the quadrant, that is, the eighth part of the circumference of the whole circle (by the semi-diameter) and the product will be the area of the quadrant.

These are the rules commonly given for finding the area of a semi-circle and quadrant; or find the area of the whole circle, and then take half the area for the semi-circle, and the fourth part for the quadrant.

To find the Solidity of a Sphere or Globe.

A sphere or globe is a round solid body, every part of its surface being equally distant from a point within it, called its centre. To find its solidity, multiply the axis, or diameter, into the circumference, the product of which is the superficial content. This multiplied by a sixth part of the axis, the product is the solidity.

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PART VI.

A COLLECTION OF QUESTIONS.

1. WHAT is the value of 14 barrels of soap a 4½*d. per lb.* each barrel containing 254 *lb.*?
Ans. £66..13..6.

2. A and B trade together: A puts in £320 for months, B £460 for 3 months, and they gained £10 What must each man receive?
Ans. A £53..13..9$\frac{2}{9}\frac{7}{8}$, *and* B £46..6..2$\frac{2}{2}\frac{6}{9}\frac{6}{8}$.

3. How many yards of cloth, at 17*s.* 6*d. per* yard, ca I have for 13 *cwt.* 2 *qrs.* of wool at 14*d. per lb*?
Ans. 100 *yards*, 3 *qrs.*.. $\frac{1}{5}$.

4. If I buy 1000 ells of Flemish linen for £90, wh may I sell it *per* ell in London, to gain £10 by the whole
Ans. 3*s.* 4*d. per ell.*

5. A has 648 yards of cloth, at 14*s. per* yard, ready m ney, but in barter will have 16*s.* B has wine at £42 *p* tun, ready money: the question is, how much wine mu be given for the cloth, and what is the price of a tun wine in barter? *Ans.* £48 *the tun, and* 10 *tun* 3 *hhd* 12$\frac{3}{5}$ *gal. of wine must be given for the clot*

6. A Jeweller sold jewels to the value of £1200, which he received in part 876 French pistoles, at 16*s.* each, what sum remains unpaid? *Ans.* £177..6.

7. An oilman bought 417 *cwt.* 1 *qr.* 15 *lb.* gross weig of train oil, tare 20 *lb. per* 112 *lb.* how many neat gallo were there, allowing 7½ to a gallon? *Ans.* 5120 *gallons.*

8. If I buy a yard of cloth for 14*s.* 6*d.* and sell it for 1 *d.* what do I gain *per cent?* *Ans.* £15..10..4$\frac{3}{1}\frac{4}{7}\frac{4}{4}$.

9. Bought 27 bags of ginger, each weighing gross 84$\frac{3}{4}$ tar 1$\frac{3}{8}$*lb. per* bag, trett 4*lb. per* 104*lb.* what do they co to at 1$\frac{1}{2}$*d. per lb?* *Ans.* £76..13..2$\frac{1}{2}$.

10. If $\frac{4}{5}$ of an ounce cost $\frac{7}{8}$ of a shilling, what will $\frac{5}{6}$ of a *lb* cost? *Ans.* 17*s.* 6*d.*

11. If $\frac{3}{5}$ of a gallon cost $\frac{4}{9}$ of a £. what will $\frac{5}{6}$ of a tun cost? *Ans.* £105.

12. A gentleman spends one day with another £1..7..10½. and at the year's end layeth up £340, what is his yearly income? *Ans.* £148..14..1¼.

13. A has 13 fother of lead to send abroad, each being 19½ times 112. B has 39 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 7½ years, at simple interest? *Ans.* 5 *per cent.*

16. A hath 24 cows worth 72*s.* 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. There is a sum of £1000 to be divided among 3 men, in such 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 inches ½ long, and 2 feet 9 inches ¾ 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 two numbers is 187, their difference 34, the square of the product is required? *Ans.* 1707920929.

22. A butcher sends his man with £216 to a fair to buy cattle; oxen at £11, cows at 40*s.* colts at £1..5, and hogs at £1..15. *per* piece, 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 $36\frac{1}{8}\frac{3}{16}$?
Ans. $24\frac{1}{8}\frac{3}{16}$.

24 What number, multiplied by $\frac{3}{7}$, will produce $11\frac{9}{17}$.
Ans. $36\frac{4}{5}\frac{5}{1}$.

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. $2qrs.\frac{8}{1}\frac{8}{0}\frac{8}{5}$.

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 an *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 incle, at 8*s.* 8*d.* *per* gross?
Ans. $1386\frac{2}{3}$.

30. If I buy yarn for 9*d.* 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 9*d.* *per lb.* with 60*lb.* at 12*d* *per lb.* 40*lb.* at 18*d.* *per lb.* and with 12*lb.* at 2*s.* *per lb.* what is a *lb.* of this mixture worth?
Ans. 1*s.* $2\frac{1}{4}d.\frac{9}{1}\frac{9}{1}$.

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.

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 6*s.* *per* dozen ready money, but in barter will have 6*s.* 6*d.* *per* dozen; A hath cotton at 9*d.* *per lb.* ready money; I demand at what price the cotton must be at in barter; also how much cotton must be bartered for 100 dozen of candles?
Ans. the cotton at 9*d.* 3 *qrs, per lb. and* 7 *cwt.* 0 *qrs.* 16*lb. of cotton must be given for* 100 *dozen of candles.*

36. If a clerk's salary be £73 a year, what is that *per* day? *Ans.* 4*s.*

37. B hath an estate of £53 *per annum,* and payeth 5*s.* 10*d.* to the subsidy, what must C pay whose estate is worth £100 *per annum?* *Ans.* 11*s.* 0*d.*$\frac{4}{5}\frac{0}{3}$.

38. If I buy 100 yards of ribband, 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 shilling, whether do I get 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 $\frac{1}{8}$? *Ans.* $\frac{29}{40}$.

40. A farmer is willing to make a mixture of rye at 4*s.* a bushel, barley at 3s. and oats at 2*s.* how much must he take of each to sell it at 2*s.* 6*d.* 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 5*s.* 4*d.*?

Ans. 234.

43. A merry young fellow in a small 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 than 880 guineas left, which he found by computation was $\frac{3}{20}$ part of his money after the commission was bought; pray what was his fortune at first? *Ans.* £10450.

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 years $\frac{1}{2}$, at $4\frac{3}{4}$ *per cent.* simple interest? *Ans.* £1261..5.

46. Sold goods amounting to the value of £700 for two 4 months, what is the present worth, at 5 *per cent.* simple interest? *Ans.* £682..19..5$\frac{177}{481}$.

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.*

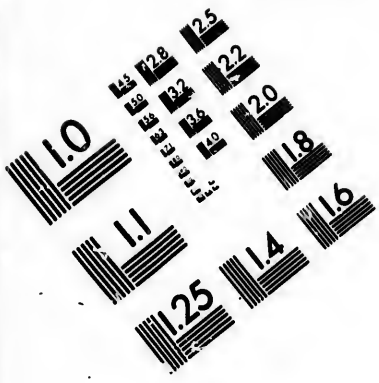
48. Hetty told her brother George, that though her fortune on her marriage took £19312 out of her family, it was but $\frac{3}{5}$ of two years rent, Heaven be praised! of his yearly income; pray what was that?

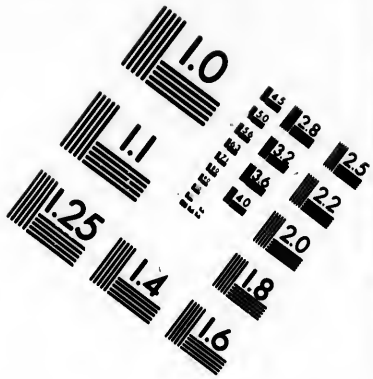
Ans. £16093. 6..8 *a year.*

49. A gentleman having 50*s.* to pay among his labourers for a day's work, would give to every boy 6*d.* to every woman 8*d.* and to every man 16*d.*; the number of boys, women, and men, was the same, I demand the number of each?

 Ans. 20 *of each.*

[redacted]





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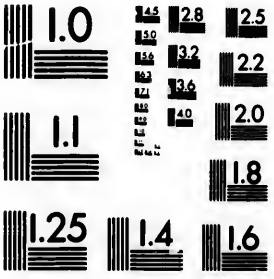

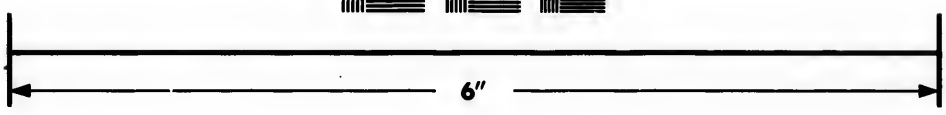

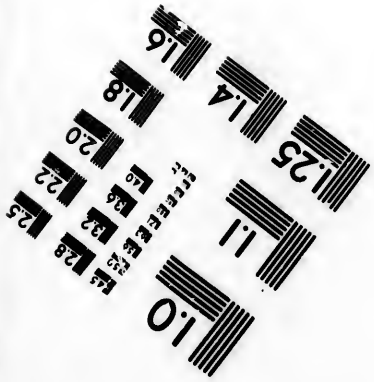

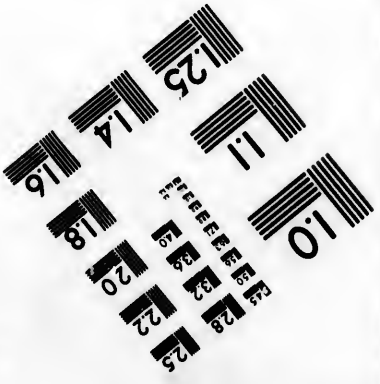

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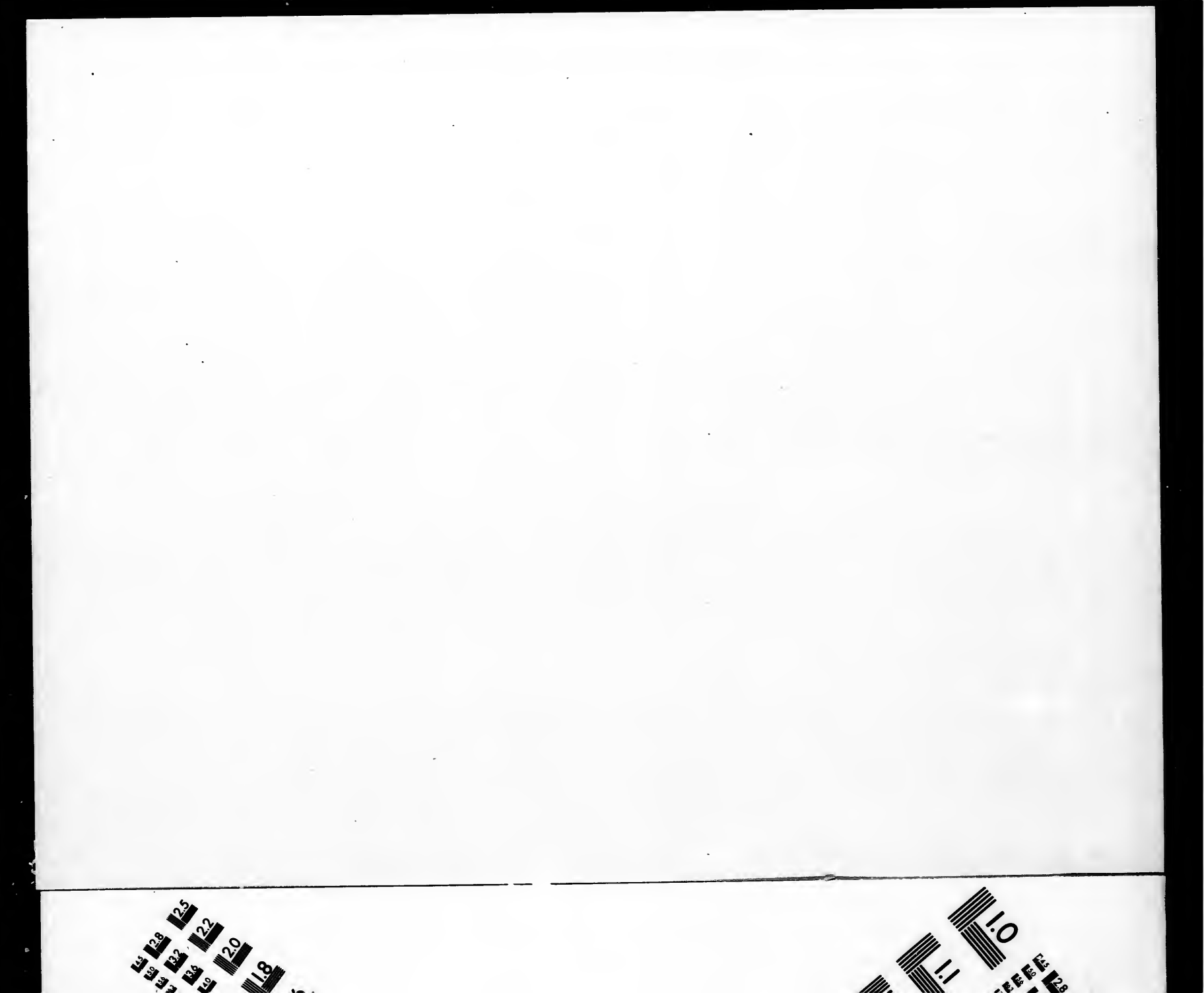

50. A stone that measures 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches deep, how many solid feet doth it contain? *Ans.* 41 *feet*, 3 *inches.*

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 22*s.* 6*d. per* month? *Ans.* £23040.

52. A traveller would change 500 French crowns at 4*s.* 6*d. per* crown, into sterling money, but he must pay a half-penny *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 2*s.* each, how many French pistoles, at 17*s.* 6*d. per* piece? *Ans.* $76\frac{2}{3}\frac{3}{5}$.

56. In 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 $\frac{1}{6}$, E $\frac{1}{7}$ part; divide this equitably among them, according to their father's intention.

Ans. A £$152\frac{3}{4}\frac{3}{5}\frac{3}{6}$, B £$114\frac{1}{4}\frac{7}{5}\frac{4}{6}$, C £$91\frac{2}{4}\frac{3}{5}\frac{1}{6}$,
D £$76\frac{1}{4}\frac{1}{5}\frac{6}{6}$, E £$65\frac{1}{4}\frac{0}{5}\frac{5}{6}$,

59. When first the marriage knot was ty'd
Between my wife and me,
My age did her's 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.

Quest. What was each of our ages when we married?

Ans. 45 *years the man*, 15 *the woman.*

60. If 12 oxen will eat $3\frac{1}{3}$ acres of grass in four weeks and 21 oxen will eat 10 acres in 9 weeks, how many oxen will eat 24 acres in 18 weeks, the grass being allowed to grow uniformly.

If $3\frac{1}{2}$ acres : 12 oxen : : 10 acres 36 oxen, which 10 acres will keep in 4 weeks.

Inversely, as 4 weeks : 36 oxen : : 9 weeks : 16 oxen, to be kept in 9 weeks.

The growth of the grass on 10 acres in 5 weeks, will be so much as alone would feed 5 oxen 9 weeks; that is, 21—16=5 oxen.

Inversely, as 9 weeks : 5 oxen : : 18 weeks : $2\frac{1}{2}$ oxen in 18 weeks. 18 weeks—4 weeks=14 weeks, 9 weeks—4 =5 weeks.

Inversely, As 14 weeks : $2\frac{1}{2}$ oxen : : 5 weeks : 7 oxen, 7 oxen+8 oxen=15 oxen, which 10 acres will keep or feed in 18 weeks. Lastly, As 10 acres : 15 oxen : : 24 acres : 36 oxen.

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. Mon.			Week.			Day.		
£.	£.	s.	d.	£.	s.	d.	£.	s.	d.
1		1	8			4½			¼
2		3	4			9			1¾
3		5	0		1	1¾			2
4		6	8		1	6½			2½
5		8	4		1	11			3¼
6		10	0		2	3¾			4
7		11	8		2	8¼			4½
8		13	4		3	1			5¼
9		15	0		3	5½			6
10		16	8		3	10¼			6½
20	1	13	4		7	8½		1	1¼
30	2	10	0		11	6¾		1	7¼
40	3	6	8		15	4½		2	2¼
50	4	3	4		19	2¾		2	9
60	5	0	0	1	3	0¼		3	5½
70	5	16	8	1	6	11		3	10
80	6	13	4	1	10	9½		4	4½
90	7	10	0	1	14	7¼		4	11¼
100	8	6	8	1	18	5½		5	5¾
200	16	3	4	3	16	11		10	11½
300	25	0	0	5	15	4½		16	2¼
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	8¼	2	3	10
900	75	0	0	17	6	1¾	2	9	3¾
1000	83	6	8	19	4	7¼	2	14	9¾
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	8	9
7000	583	6	8	134	12	3½	19	3	6½
8000	666	13	4	153	16	11	21	18	4¼
9000	750	0	0	173	1	6¼	24	13	1¾
10000	833	6	8	192	6	[illegible]	27	7	11¼
20000	1666	13	4	384	12	[illegible]	54	15	10½
30000	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 as when added will make the number remaining. And the several sums together will give the interest required.*

N. B. *For every* 10 *that is cut off in months, add* 2*d*; *for every* 10 *cut off in weeks, add an halfpenny; and for every* 40 *in the days,* 1 *farthing.*

Money for any
r cent.

Day. £.	s.	d.
		¼
		½
		¾
		1
		1¼
		1½
		1¾
		2
		2½
		3¼
		4
		4½
		5¼
		6
		6½
	1	1¼
1	7	3¾
2	2	¼
2	9	
3	3	½
3	10	
4	4	½
4	11	¼
5	5	¾
10	11	½
16	2	¼
1	1	11
1	7	4¾
1	12	10½
1	18	4¼
2	3	10
2	9	3¾
2	14	9½
5	9	7
8	4	4½
10	19	2
13	13	11½
16	8	9
19	3	6½
21	18	4¼
24	13	1¾
27	7	11¼
54	15	10½
82	3	10

ent. and the number
t off two figures on
m the table the sev-
added will make the
er will give the in-

2d; for every 10 cut
the days, 1 farthing.

EXAMPLES.

1. What is the interest of £2467..10..0 for 10 months, at 4 *per cent. per annum?*

2870..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..10..0 for 12 weeks, at 5 *per cent?*

2467..10	1000=19.. 4.. 7½
5	400= 7..13..10
12337..10	80= 1..10.. 9¼
12	50= 0.. 0.. 2½
1402|50..—	1480|50=28.. 9.. 5

3. What is the interest of £2467..10..0 for 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	7402|50=20..5.. 7

To find what an estate, from 1 to £60,000 *per annum*, will come to for 1 day.

Rule 1. Collect the annual rent or income from the table for 1 year, against which take the several sums for 1 day, add them together, 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 servant's 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 at 11 months, for 3 weeks, and for 6 days?

	For 11 *Months.*		*For* 3 *weeks.*
270	2000=166..13..4	270	800=15.. 7.. 8$\frac{1}{2}$
11	900= 75.. 0..0	3	10= 0.. 3..10
	70= 5..16..8		
2970		810	=15..11.. 6$\frac{1}{2}$
	2970=247..10		

	For 6 *days.*	*For the whole time.*	
270	1000=2..14.. 9$\frac{1}{2}$	247..10..0	
6	600=1..12..10$\frac{1}{2}$	15..11..6$\frac{1}{2}$	
	20=0.. 1.. 1	4.. 8..9	
1620			
	1620=4.. 8.. 9	267..10..3$\frac{3}{4}$	*Ans.*

A TABLE *shewing 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.	Apr.	May	June	July	Aug.	Sep.	Oct	Nov.	Dec.
Jan.	365	31	59	90	120	151	181	212	243	273	304	334
Feb.	334	365	28	59	89	120	150	181	212	242	273	303
Mar.	306	337	365	31	61	92	122	153	184	214	245	275
Apr.	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	91	122	153	183
July	184	215	243	274	304	335	365	31	62	92	123	153
Aug.	153	184	212	243	273	304	334	365	31	61	92	122
Sep.	122	153	181	212	242	273	303	334	365	30	61	91
Oct.	92	123	151	182	212	243	273	304	335	365	31	61
Nov.	61	92	120	151	181	212	242	273	304	334	365	30
Dec.	31	62	90	121	151	182	212	243	274	304	335	365

APPENDIX,

CIRCULATING DECIMALS.

DEFINITIONS.

1. WHEN the denominator of a vulgar fraction, is no aliquot part of its numerator, the latter being increased with any necessary number of cyphers, the decimal fraction equivalent thereto is called a repetend, or circulating decimal, from the continual repetition of a certain figure or series of figures, circulating alternately.

2. A single repetend is a decimal having one figure constantly repeating, as $\frac{1}{3}$=3333, &c. $\frac{2}{3}$=6666, &c. expressed by either drawing a stroke through the repeating figure, thus 3, or more neatly, by putting a dot over it, 3333=.666=6; by which contrivance the series is pointed out, and any repetition of the circulating figure rendered unnecessary.

3. A compound repetend consists of two or more figures circulating alternately, the first and last of which are distinguished as in single repetends thus, 636363=63. 2149621496=21496.

4. In a compound recurring decimal, either of the repeating figures may be made the first in the repetend, provided the new series be so far continued that it shall contain as many figures as the original repetend; thus 142857 may be expressed in either of the following way

1428571=1428571428=14285714285, &c.

So, likewise, the ries may be repeated any number of times before the repetend be supposed to begin, the figures between the first of the repetend and the decimal point being considered and treated as terminate numbers: the truth of this proposition may be proved by converting the above decimals into their least equivalent vulgar fractions, by Rule 2, when they will respectively be found equal to each other $= \frac{1}{7}$; hence is derived the method of making several repetends begin at the same distance from the decimal point, when they are then said to be similar.

EXAMPLE.

1,213, 4,012, and 24,92 are dissimilar, because the repetends begin at different distances from the decimal point, but expressed thus; 1,123, 4,01201, and 24,9292, they become similar.

NOTE. Terminate decimals may be considered and managed as repetends by the addition of cyphers.

5. Any circulating decimal may be transformed into another containing some multiple of the number of places in the original repetend.

EXAMPLE.

$$314 = 314314 = 314314314, \text{ \&c.}$$

If any number be compound repetends be continued till they are equal to the least common multiple of their several places, they will all necessarily end at the same place, and are then called counterminous. The examples following Def. 4. thus carried out, stand as follow: 1,21333333, 4,01201201, and 24,92929292. for the number of places in the several repetends being 1, 3, and 2, the least common multiple will be 6 by the 3d of the following Rules.

6. Similar and conterminous repetends are such as begin and end at the same place.

REDUCTION.

CASE I.

To reduce a pure repetend to its equivalent vulgar fraction.

RULE. LET the given decimal be made the numerator of the vulgar fraction, and its denominator as many nines as there are figures in the repetend. Reduce this fraction to its lowest terms, and it will give the answer required.

EXAMPLES.

1. Required the least equivalent vulgar fractions to $\dot{6}$ and $1\dot{3}\dot{5}$.

First. $\dot{6}=\frac{6}{9}=\frac{2}{3}$ and $1\dot{3}\dot{5}=1\frac{35}{99}=\frac{5}{37}$.

2. Required the least equivalent vulgar fractions to $14,\dot{9}216$, $4\dot{1}3$, and $\dot{0}09\dot{1}$.

3. Required the least equivalent vulgar fractions to $\dot{1}375$, $47\dot{0}02$, $\dot{0}12\dot{5}$, and $2743\dot{4}$.

CASE II.

To reduce a mixed repetend to a vulgar fraction.

RULE. From the given decimal subtract the terminate or finite part for a numerator, and for a denominator annex as many cyphers as there are terminate numbers to the right hand of the same number of nines as there are figures in the repetend. This fraction, divided by its greatest common measure, will give the required answer in its lowest terms.

EXAMPLES.

1. Required the least equivalent vulgar fractions to $,18\dot{7}$, and $,5\dot{9}25$, and $1,20\dot{9}$.

First. $,18\dot{7}=\frac{187-18}{900}=\frac{169}{900}=\frac{17}{90}$; $,027\dot{5}=\frac{2750-2}{99000}=\frac{2748}{99000}=\frac{229}{8250}$;

$,5\dot{9}25=\frac{5925-5}{9990}=\frac{5920}{9990}=\frac{16}{27}$;

Lastly. $1,20\dot{9}=\frac{1209-12}{990}=\frac{1197}{990}=\frac{133}{110}=1\frac{23}{110}$.

2. Required the least equivalent vulgar fractions to 11850, 74,048, 416, 142857, 3,518, 42175, and 12,875.

To find the least common multiple of several numbers.

1. If the numbers given be incommensurable, that is, if no number can be found which is an aliquot part of both the given numbers, the product of the said numbers will be the multiple required; thus, 2 and 5 being incommensurable, the multiple is $2 \times 5 = 10$.

If a number can be found which is an aliquot part of both, let either of them be divided by it; and this quotient multiplied into the remaining number, will give the multiple sought. Thus, if the numbers 4 and 6 be given, being commensurable by 2, either number divided by it, and the quotient multiplied by the other, the product 12 will be the multiple required. If the multiple of 3 or more numbers are required, proceed to find the least common multiple of any 2 of the said numbers, with this multiple and either of the remaining numbers, proceed as before, &c.: for instance, let the numbers given be 2, 3, 4, and 6, then will the multiple of 2 and 3 be 6, the multiple of 6 and 4 be 12, and the multiple of 12 and 6 be 12, the least common multiple of all the numbers 2, 3, 4, and 6, as required.

EXAMPLES.

1. The least common multiple of the numbers 2, 4, 5, and 7 is required. *Ans.* 140.

2. The least common multiple of the numbers 3, 7, 21, 4, and 8 is required.

ADDITION.

CASE I.

When the decimals contain single repetends.

RULE. MAKE them all similar and conterminous, then add as in common numbers, only the last, or right hand figure, or add as many units as there are nines in the sum of the row standing over it, and the figure, if not a cypher, will be a repetend

EXAMPLES.

29,166
6,347
2,030
,333
1,700

39,597

Add 4,727083; 2,583; ,002083; 9,02916; 4,03125; and 17,035756 together. *Ans.* 37,408673.

2. Add ,083; 12,5; ,7,60806; ,75; and 4,00613 together.

3. Add 74,617; 40,013; 1,25, ,6 and 027 together.

4. Add 41,3; ,10086; ,27; 4,62; and 9,6 together.

CASE II.

When the decimals contain compound repetends,

RULE. Make them similar and conterminous, and add, as in common numbers, with this difference, to the sum of the right hand repetend, or first row of figures, add as many units as must be carried by the common rule of addition to the next row of figures beyond the left-hand repetends or place where all the repetends begin together. The figures under the left and right-hand row of repetends will be the first and last of the repetend of the sum.

EXAMPLES.

Add ,6; ,027; ,73; 5,125; and ,127647 together.

Dissimilar,	*Made similar.*	*Similar and Conterminous.*
,6	,6666	,666666666
,027	,0277	,027777777
,73	,73737	,737373737
5,125	5,1250	5,125000000
,127647	,127647127	,127647127
	Ans.	6,684465309

2. Add 162,162; 134,09; 2,93; 97,26; 3,769230, 99,083; 1,5; and ,314 together. *Ans.* 501,62651077.

3. Add ,29543; ,104; ,37; ,4065826; and ,4731 together. *Ans.* 1,6530109431099.

4. Add ,7045 and ,7954 together. *Ans.* 1,5.

Add ,21613+50,063+00025+1,3+,703.

Add 1,135067+21+17+,305+,6+,05.

Add 2,93726+1,2+1,0003+,712+3076.

SUBTRACTION.

RULE. MAKE the decimals, whether they contain single or compound repetends, similar and conterminous, as in Addition: then subtract as in whole numbers with this difference, when the repetend of the number to be subtracted is greater than the repetend of the subtrahend, the right-hand figure of the remainder must be one less than it would be in common numbers.

EXAMPLES.

1. From 39,2178 take 17,68.

39,2178178
17,6868686

21,5309491

From 1,2 take 1,00723

1,20000
1,01723

,18276

3. From. 10,0413 take ,264. *Ans.* 9,7766948.
4. From 9,17386 take 4,20013.
5. From 1, take ,3.
6. From 4,0123 take 2,703.
7. From 14,047 take 12,36.

MULTIPLICATION.

CASE I.

When the multiplicand contains a single repetend, the multiplier being terminate numbers.

RULE. PROCEED as in whole numbers, only observing to increase the product of the right-hand figure of the multiplicand with each of the several figures in the multiplier, in every line by as many units as there are nines contained therein; make the several products conterminous, and add them together by Case I. the right-hand figures of the sum will be a circulate or a cypher.

EXAMPLES.

1. 21,6813	2. 16,146
6	40,82
130,0380	32293
	1291733
	64586666
	659,10693

3. Multiply 91,6467 by 426,8.
4. Multiply 40613,52 by 2,0068.

CASE II.

When the multiplicand contains a compound repetend, and the multiplier consists of terminate numbers.

RULE. Increase the products of the right-hand circulate arising from the multiplication of the several figures of the multiplier, with as many units as are carried from the product of the left-hand circulate to the product of the next figure to the left hand, then multiply as in common numbers, observing each product as well as the sum of the products contains a repetend of the same number of figures as the repetend of the multiplicand make the several pro-

ducts conterminous, as in the last case, and add them together by Case II. in Addition.

EXAMPLES.

1. ,9437 × 7 = 6,6062

2. 3,246 × 28,6 = 19478 + 259717 + 649292 = 92,8488

3. Multiply 5,1637 by 2,84. *Ans.* 14,665089.
4. Multiply 56,0042941 by 461,2. *Ans.* 25829,18045872.
5. Multiply 8,42543 by 1004,8.
6. Multiply 37,603 by 91,62.

CASE III.

When the multiplier has a single repetend.

RULE. Multiply by the repetend, as in common numbers, unless the multiplicand contain a single or compound repetend, in which case, increase the product by the preceding rules, divide the repetend product by nine, and continue the division till it terminate or end in a single or compound repetend, proceed with the remaining figures as usual; in adding the several products together, the repetend product must be considered as containing the same number of figures as before the division.

EXAMPLES.

1. 21,64
2,3

9)6492

7213
4328

Ans. 50,493

2. 14,013
,146

9)84080

93422
560533
1401333

2,055288

3. 2,912
8,46

9)17477

194194.....194
1165165.....165
23303303.....303

24,662662.....662, &c.

4. Multiply 14861,6 by 40,73.
5. Multiply ,419637 by 15,7.
6. Multiply 21464,3 by 12,6.

CASE IV.

When the multiplier contains a compound repetend.

RULE. If the multiplier contains finite numbers let them first be subtracted from it for a new multiplier; if it be a pure repetend it undergoes no alteration. Then multiply as in whole numbers if the multiplicand be terminate numbers; if it contain a single repetend by Case I. and if a compound repetend, by Case II. Lastly, add the total product to itself in the following manner:—Set the left-hand figure of it so many places forward, or to the right hand, as exceeds the number of places in the repetend of the multiplier by one, the remaining figures in order after it; repeat this addition till the product last added fall beyond the first, and if the multiplicand consists of terminate

numbers, the repetend of the product will consist of the same number of places as that of the multiplier; should there be repetends in the multiplicand, the repetend of the product will be most readily determined by continuing and repeating the first product.

EXAMPLES.

1. 11,7505
326

705030
235010
352515

38306630
38306630
38306630

3,83449749, &c. by repeating the additions, the series will be readily seen.

2. Multiply 225,6 by ,1225.

1225
1
1224

225,6
,1224
9026
45133
451333
2256666
2762160
2762
2
27,6492 *Ans.*

3. Mult. 8,594 by 12,581

125
12456

8,594
12,456
51567
429729
3437837
17189189
859459545
107054270270
1070542702
10705427
107054
1070
10
108,13562658 *Ans.*

4. Multiply 49,273 by 6,14902.
5. Multiply 7,0046 by 00413.
6. Multiply 4,12643 by 5,1273.
7. Multiply 9,24685 by 46.
8. Multiply ,012643 by 24,3721.

DIVISION.

CASE I.

When the dividend contains a single or compound repetend, the divisor being terminate numbers.

RULE. PROCEED as in terminate numbers, only observing to bring down instead of cyphers the repeating figure, or if it be a compound repetend, the repeating figures in their proper order.

EXAMPLES.

1. 8)146,158̇3̇3̇3̇ 2. 12)96,31̇7̇31̇7̇, &c.

18,2697916̇ 8,026443109776̇

3. 32,6)167,4151̇9̇(5,1̇3̇5̇4̇
1630

441
326

1155
978

1771
1630

1419
1304

115 *ad infinitum.*

4. Divide 461,17527̇ by 7.
5. Divide 51,64328̇ by 11.
6. Divide ,41̇4̇ by ,3048.
7. Divide 24,61̇4̇368 by 8,4461.
8. Divide 4,1̇4̇ by 8,64.

CASE. II.

When the divisor contains either a single or compound repetend, the dividend being terminate numbers.

RULE. Annex to the right hand of the dividend as many cyphers as there are places in the repetend of the divisor, for a subtrahend, from which subtract the dividend, the re-

mainder will be a new dividend, with which proceed as in terminate numbers. Should there be any terminate numbers in the divisor, they must be first subtracted from it, but if the divisor be a pure repetend it undergoes no alteration, but is to be used in all respects as terminate numbers.

EXAMPLES.

1. Divide 12,487 by 8.

124870
12487

8)112383

1,4047875 *Ans.*

2. Divide 428,364 by 2,43.

243 428,3640
24 428364

2,19) 385,5276(176,04 terminate.
219

1665
1533

1322
1314

876
876

3. Divide 3 by ,462.

3000
3

462)2997

6,4870129

4. Divide 214,160 by 1,476.
5. Divide 921,4 by 83.
6. Divide 1000 by 516.
7. Divide 754,03 by 7

CASE III.

When there are either single or compound repetends in the divisor and dividend.

RULE. Should the divisor and dividend be both pure repetends, and each containing the same number of places, proceed as in common division, and continue the quotient by bringing down cyphers till it either terminate, repeat, or is sufficiently exact. If the divisor and dividend are pure repetends, but dissimilar, not consisting of the same number of places in each, make them conterminous and proceed as above.

If the divisor and dividend be dissimilar mixed repetends, make them similar and conterminous, and subtract the terminate numbers from each for a new divisor and dividend, which proceed as above.

EXAMPLES.

1. Divide $\dot{4}\dot{7}$ by $\dot{2}\dot{6}$ *Quotient.* ,$1\dot{8}076\dot{9}23\dot{.}$

2. Divide 27,$6\dot{4}9\dot{2}$ by 225,$\dot{6}$.

27,6492		225,$6\dot{6}6\dot{6}$	
276		2256	
225441)27,62160	*New dividend.*	2254410	*New divis.*
,1225	*Quotient.*		

3. Divide 8,$6\dot{8}3\dot{6}3$ by 3,$5\dot{3}7\dot{.}$

3,$53\dot{7}7\dot{7}$		8,$6\dot{8}3\dot{6}3$	
3537		8683	
3,5024		8,$\dot{5}96\dot{8}$	
		2,$4\dot{5}$	*quotient.*

4. Divide 4,$1\dot{9}3\dot{}$ by ,$14\dot{1}7\dot{.}$

,$14\dot{1}71717$		4,$19\dot{3}19\dot{3}19$	
14		419	
,14171703)		4193189	
		29,588†	

5. Divide 108,1356265 by 12,581.

12,5818181	108,1356265
125	1081
12,5818056	108,1355184

8,594 *Quotient.*

6. Divide ,01783116449 by 1,003,

100300300300	01783116449
100	01
100300300200)	01783116448

,017 *Quotient*

7. Divide 1,831 by ,042.

	18318318
	18
,0424242)	18318300
	43,17889†

8. Divide 406,3 by 1,61456.
9. Divide 914,00014 by 417.
10. Divide 3201,40338 by 73,2586.
11. Divide 13,5169533 by 4,297.
12. Divide 46,0431712 by ,42168.

N. B. *If the Student should be at any loss respecting the certainty of his operations in the Rules of Multiplication and Division, he will find considerable advantage in turning the repetends into their equivalent vulgar fractions, and proceeding with them by the rules of vulgar fractions.*

FINIS.

265
081

184

594 *Quotient.*

16449
01

16448

,017 *Quotient*

ss respecting the
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