Εο2α20

# ARITHMETICAL TABLES.

## NUMERATION TABLE.

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

### SHILLINGS TABLE.

| s. | | £. s |
|---|---|---|
| 20 .. | — .. | 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 |

## 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 |
| 90 | — | 7 6 |
| 96 | — | 8 0 |
| 100 | — | 8 4 |
| 108 | — | 9 0 |
| 110 | — | 9 2 |
| 120 | — | 10 0 |
| 120 | — | 10 10 |
| 132 | — | 11 0 |
| 140 | — | 11 8 |
| 144 | — | 12 0 |
| 150 | — | 12 6 |
| 160 | — | 13 4 |
| 170 | — | 14 2 |
| 180 | — | 15 0 |

## SILVER COINS.

| | VALUE. | WEIGHT. |
|---|---|---|
| | s. d. | dwt. gr. |
| Crown .......... | 5 0 | 18 4½ |
| Half-crown .... | 2 6 | 9 2 |
| Shilling ....... | 1 0 | 3 15 |
| Sixpence........ | 0 6 | 1 19½ |

### MONEY.

4 Farthings make .. 1 Penny
12 Pence ........... 1 Shilling
20 Shillings ......... 1 Pound.

### MULTIPLICATION TABLE.

| 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 |

## GOLD COINS.

| | VALUE. | WEIGHT. |
|---|---|---|
| | £ s. d | dwt. gr. |
| A Moidore ...... | 1 7 0 | 6 22 |
| Half ditto ...... | 0 13 6 | 3 11 |
| A Guinea ...... | 1 1 0 | 5 9½ |
| Half Ditto .... | 0 10 6 | 2 16½ |
| A Sovereign .... | 1 0 0 | 5 3¾ |
| Half Ditto ...... | 0 10 0 | 2 13⅜ |
| A Pistole ....... | 0 17 0 | 4 8 |
| Half Ditto ..... | 0 8 6 | 2 4 |
| A Mark.......... | 0 13 4 | *Note*—Each |
| An Angel ... .... | 0 10 0 | Grain of Gold |
| A Noble ........ | 0 6 8 | is 2d and each Pennyweight 4s. |

## PRACTICE TABLES.

| Of a Pound. | | Of a Shill. | | Of a Cwt. | |
|---|---|---|---|---|---|
| 10/ | · ½ | 6d. .. | · ⅟₂₄ | qr. lb. | |
| 6/8 | · ⅓ | 4 .. | · ⅟₃₆ | 2 or 56.½ | |
| 5/ | · ¼ | 3 .. | · ⅟₄₈ | 1 .. 28.¼ | |
| 4/ | · ⅕ | 2 .. | · ⅟₇₂ | 16.⅟₇ | |
| 3/4 | · ⅙ | 1¼ .. | · ⅟₁₂ | 14.⅟₈ | |
| 2/6 | · ⅛ | 1 .. | · ⅟₁₂ | | |
| 2/ | · ⅟₁₀ | | | Of a Ton. | Of a Quar. |
| 1/8 | · ⅟₁₂ | 10 cwt | ½ lb. | | |
| 1/ | · ⅟₂₀ | 5 .. | ¼ | 14 ... ¼ | |
| 8d. | · ⅟₃₀ | 4 .. | ⅕ | 7 ... ⅛ | |
| 6d. | · ⅟₄₀ | 2½ .. | ⅛ | 4 ... ⅟₁₆ | |
| 4d. | · ⅟₆₀ | 2 .. | ⅟₁₀ | 3½... ¼ | |
| 3d. | · ⅟₈₀ | | | | |

# TABLES OF WEIGHTS AND MEASURES.

## TROY WEIGHT.

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

*Note*—The Troy Pound is the standard at the Mint ; and for Jewellers and Apothecaries.
The division of the Ounce into 8 Drams, the Dram into 3 Scruples, and the Scruple into 20 Grains, is not acknowledged in the Act.

## AVOIRDUPOIS WEIGHT.

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

## WOOL WEIGHT.

7 Pounds ...... 1 Clove
2 Cloves ...... 1 Stone
2 Stones ...... 1 Tod
6¼ Tods ...... 1 Wey
2 Weys ....... 1 Sack
12 Sacks....... 1 Last

## WINE MEASURE.

2 Pints .. .... 1 Quart
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
9 Gallons ..... 1 Firkin
2 Firkins .... 1 Kilderkin
2 Kilderkins .. 1 Barrel
1½ Barrel ..... 1 Hogshead
2 Barrels...... 1 Puncheon
3 Barrels...... 1 Butt

## COALS.

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

Coals are now sold by Avoirdupois Weight within 12 miles of London ; beyond that distance by the above admeasurement.

## 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 Parts or *primes* 1 Inch
12 Inches ...... 1 Foot
3 Feet ...... 1 Yard
5¼ Yards ...... 1 Pole
40 Poles ....... 1 Furlong
8 Furlongs ... 1 Mile
60 Miles .... ... 1 Degree

## 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.

# WALKINGAME

## MODERNIZED AND IMPROVED.

### 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 *Compound Interest*, and *Annuities*.

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.

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 Accountants, is recommended as the best Compendium hitherto published, for the Use of Schools, or for Private Persons.*

### By FRANCIS WALKINGAME.

#### TO WHICH ARE ADDED

## TABLES OF THE NEW WEIGHTS AND MEASURES;

### AN APPENDIX,

On *Repeating and Circulating Decimals, with their Application,*

#### AND OTHER IMPROVEMENTS,

### By JOHN FRASER,

#### ACCOUNTANT, &c.

### NEW EDITION.

### LONDON

# THE
# EDITOR'S PREFACE.

THE utility of the general plan of WALKINGAME's TUTOR's AS-SISTANT is fully evinced by the numerous editions which have issued, and still are issuing, from the London, York, and Derby presses.

The attention of former Editors however has been almost exclu-sively directed to the correction of the press, without adverting to the fact, that several parts of the Tutor's Assistant have become obsolete in consequence of the alterations and improvements in mer-cantile computations since the Work in question was written.

The design of the present Editor was to incorporate with the original Work, such alterations as were necessary to make it accord with the practice of the present period ; and these have been sub-mitted to several Teachers and professional Accountants, and have received their approbation.

The following are the principal improvements which have been made in this impression. The Tables of Weights and Measures are modelled agreeably to the new Act for uniformity in these, through-out the British empire : and in *Reduction*, rules are given for re-ducing the old measures to the new standards, and *vice versâ*.

Instead of blending *Commission, Brokerage*, and *Stockjobbing*, under the head of INTEREST, these rules have been treated of sepa-rately: and to Interest two Cases have been added, for computing interest on *Debts paid by Instalments*, and on *Accounts Current*.

Profit and Loss, and Partnership, are divided into separate cases, to which rules are added, illustrated by examples taken from real business: and the article on *Exchange*, being obsolete, is written anew, including the recent alterations in the exchanges of *Holland, France*, and *Italy*.

As compound interest is always allowed on *Annuities, Rever-sions*, &c. the computations on these by simple interest, being of no use in the practice of business, are suppressed, to make room for *Insurance, Bankers' Discount*, and other useful matter · and the

defect complained of in the former editions, by curtailing the *Collection of Promiscuous Questions*, in PART VI., is supplied by extending them to their original number.

The APPENDIX on *Circulating Decimals,* which appeared in the London editions of Walkingame, is set aside, and a new one inserted ; in which Interminate Decimals are distinguished into *Repeaters* and *Circulates,* to avoid the complexity or confusion which arises from treating of them promiscuously.  To this Appendix is sub joined a series of Exercises as a practical application.

To conclude—The whole work has been so revised, corrected, and improved, that the Editor trusts it will secure to the publishers a decided preference to this *modernized edition of Walkingame's Tutor's Assistant.*

*October* 18*th.* 1826

# PREFACE.

The Public, no doubt, will be surprised to find there is another attempt made to publish a book of ARITH-METIC, 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 expe rience, 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 incon-venience which hindered them from giving me the satis-faction 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 of Rules and Examples for each   to remedy

which I was prompted to compile one, in order to have
it printed, that might not only be of use to my own
School, but to such others as would have their Scholars
make a quick progress. It will also be of great use to
such Gentlemen as have acquired some knowledge of
numbers at School, to make them the more perfect;
likewise to such as have completed themselves therein,
it will prove, after an impartial perusal, on account of its
great variety and brevity, a most agreeable and entertain-
ing 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 au·
thor,* 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 As-
sistant, because the course of ARITHMETIC is always the
same ; and therefore say, *That some boys, lazily inclined,
when they see another at work upon the same Question,
will be apt to make his operation pass for their own.*
But these little forgeries are soon detected by the dili-
gence of the TUTOR ; therefore, as different questions to
different boys do not in the least promote their improve-
ment, so neither do the questions hinder it. Neither is
is it in the power of any Master, (in the course of his bu-
siness,) how full of spirits soever he be, to frame new
questions at pleasure, in any Rule ; but the same ques-
tions will frequently occur in the same Rule, notwith-
standing his greatest care and skill to the contrary.

" It may also be further objected, *That to teach by a
printed book is an argument of ignorance and incapacity :*
which is no less trifling than the former. He, indeed, (if
any such there be,) who is afraid his scholars will improve

---

* Dilworth

" 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 gene-
rally taught in Schools.  I have gone through the four
fundamental Rules in Integers first, before those of the
Several Denominations , in order that they being well un-
derstood, the latter will be performed with much more
ease and despatch, according to the Rules shown, than
by the customary method of dotting.  In Multiplication,
I have shown both the beauty and use of that excellent
Rule, in resolving most questions that occur in merchan-
dizing; 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 shown 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 ⅌ Cent. by Multiplication
and Addition only: it is also useful in calculating Rents,
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.

# CONTENTS.

## PART I.

## ARITHMETIC IN WHOLE NUMBERS.

## PART II.

## VULGAR FRACTIONS.

# 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.

$\times$ *Multiplied by*  The sign of Multiplication; as, $4 \times 6 = 24$, that is, 4 multiplied by 6 is equal to 24.

$\div$ *Divided by.*  The sign of Division; as, $8 \div 2 = 4$, that is, 8 divided by 2 is equal to 4.

      *Note.*—Numbers placed like a fraction do likewise denote Division; the upper number being the Dividend, and the lower the Divisor : thus $\frac{112}{14} = 8$.

$\cdot$ *To* : *So is.*  The sign of Proportion; as $2 : 4 :: 8 : 16$, that is, as 2 is to 4, so is 8 to 16

$\overline{7 - 2} + 5 = 10.$  Shows 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

$\sqrt{}$  Signifies the Square Root.

$\sqrt[3]{}$  Signifies the Cube Root.

$\sqrt[4]{}$  Denotes the Biquadrate Root.

$i. e$  *id est*, that is.

# THE
# TUTOR'S ASSISTANT:

### BEING A

# COMPENDIUM OF ARITHMETIC.

## PART I.
### *ARITHMETIC IN WHOLE NUMBERS*

## THE INTRODUCTION.

ARITHMETIC is the science which treats of number. The *theory* of arithmetic explains the properties of numbers; and the *practice* applies them to the performance of calculations.

The principal or fundamental Rules upon which all its operations depend, are the five following, *viz.*

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

## NUMERATION.

NUMERATION teaches the value of figures by their different places, and to read and write any sum or number.

### THE TABLE.

| Millions, | Millions, | Millions. | Thousan | Thousan | ands. | undreds. | ens. | nits. |
|---|---|---|---|---|---|---|---|---|
| 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 |
|   |   |   |   |   |   | 0 | 0 | 0 |
|   |   |   |   |   |   | 3 | 0 | 0 |
|   |   |   |   |   |   |   | 2 | 0 |
|   |   |   |   |   |   |   |   | 1 |

B

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 *units* or 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 APPLICATION.

I. *Write down in* FIGURES *the following Numbers:*

1. Twenty-three.
2. Two hundred and fifty-four.
3. Three thousand, two hundred and four.
4. Twenty-five thousand, eight hundred and fifty-six
5. One hundred, thirty-two thousand, two hundred forty-five.
6. Eight hundred thousand, seven hundred and six.
7. Four millions, nine hundred forty-one thousand, four hundred.
8. Twenty-seven millions, one hundred fifty-seven thousand, eight hundred thirty-two.
9. Seven hundred twenty-two millions, two hundred thirty-one thousand, five hundred and four.
10. Six hundred two millions, two hundred ten thousand, five hundred.

II. *Write down in* WORDS *at length the following Numbers.*

| | | | | |
|---|---|---|---|---|
| 35 | 2017 | 519007 | 5207054 | 65700047 |
| 59 | 5201 | 754058 | 2071909 | 900061057 |
| 172 | 20760 | 5900030 | 70054008 | 221900790 |
| 909 | 90900 | 6507005 | 81306909 | 987654321 |

### NOTATION BY ROMAN LETTERS.

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

| | |
|---|---|
| XV Fifteen | C Hundred |
| XVI Sixteen | CC Two hundred |
| XVII Seventeen | CCC Three hundred |
| XVIII Eighteen | CCCC Four hundred |
| XIX Nineteen | D Five hundred |
| XX Twenty | DC Six hundred |
| XXX Thirty | DCC Seven hundred |
| XL Forty | DCCC Eight hundred |
| L Fifty | DCCCC Nine hundred |
| LX Sixty | M One thousand |
| LXX Seventy | MDCCCXXVI One thou |
| LXXX Eighty | sand eight hundred and |
| XC Ninety | twenty-six. |

## ADDITION OF INTEGERS.

ADDITION teaches to add two or more sums together, to make one whole or total sum.

RULE.—Place the figures one under the other, so that units may stand 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.

| Pounds. | Guineas. | Sovereigns. | Crowns. | Cwts |
|---|---|---|---|---|
| 98 | 876 | 1234 | 65432 | 9090 |
| 97 | 765 | 2345 | 5432 | 9905 |
| 76 | 654 | 3456 | 76543 | 8154 |
| 65 | 543 | 4567 | 8765 | 7063 |
| 54 | 432 | 5678 | 87654 | 6846 |
| 43 | 321 | 6789 | 7305 | 5378 |
| 32 | 210 | 987 | 3650 | 3910 |

### APPLICATION.

1. What is the sum of 43, 401, 9747, 3464, 2263, 314, and 974 pounds. · *Ans.* £17206

2. Add 246,034, 298,765, 47,32   58,653, 64,218, 5,376, 9,821, and 640 pounds together.          *Ans.* £730,828.

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

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

# SUBTRACTION OF INTEGERS.

Subtraction teaches to take a less number from a greater, and shows the remainder, or difference.

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

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

| From | 271 | 4754 | 42087 | 452705 | 271508 | 3750215 |
|------|-----|------|-------|--------|--------|---------|
| Take | 154 | 2725 | 34096 | 327616 | 152471 | 3150874 |
| Rem. | 117 |      |       |        |        |         |
| Proof. | 271 |    |       |        |        |         |

### APPLICATION.

1. From 90 thousand and ninety, subtract 12345.
          *Ans.* 77745.

2. What is the difference between 73029 and 87091 pounds?
          *Ans.* 14062 pounds.

3. His present Majesty is 64 years of age : in what year was he born?          *Ans.* In 1762.

4. The union of the two crowns of England and Scotland took place when James I. ascended the English throne in 1603 : how long is it since?          *Ans.* 223 years.

# MULTIPLICATION OF INTEGERS.

Multiplication teaches how to increase the two numbers when the one is to be reckoned as many times as there are units in the other; 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.

I. *When the multiplier does not exceed* 12.

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.—Cast the 9's out of both multiplicand and multiplier, and multiply the remainders together ; what remains after casting the 9's out of their product, will be equal to what remains after casting the 9's out of the total product.

Or, multiply the multiplier by the multiplicand, and the product will be the same as formerly.

MULTIPLICATION TABLE.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 is | 4 | | 6 is | 24 | | 7 is | 49 | | | |
| | 3 — | 6 | | 7 — | 28 | | 8 — | 56 | | | |
| | 4 — | 8 | | 8 — | 32 | | 9 — | 63 | | | |
| | 5 — | 10 | 4 times | 9 — | 36 | 7 times | 10 — | 70 | | | |
| | 6 — | 12 | | 10 — | 40 | | 11 — | 77 | | | |
| 2 times | 7 — | 14 | | 11 — | 44 | | 12 — | 84 | | | |
| | 8 — | 16 | | 12 — | 48 | | 8 — | 64 | | | |
| | 9 — | 18 | | 5 — | 25 | | 9 — | 72 | | | |
| | 10 — | 20 | | 6 — | 30 | 8 times | 10 — | 80 | | | |
| | 11 — | 22 | | 7 — | 35 | | 11 — | 88 | | | |
| | 12 — | 24 | 5 times | 8 — | 40 | | 12 — | 96 | | | |
| | 3 — | 9 | | 9 — | 45 | | 9 — | 81 | | | |
| | 4 — | 12 | | 10 — | 50 | | 10 — | 90 | | | |
| | 5 — | 15 | | 11 — | 55 | 9 times | 11 — | 99 | | | |
| | 6 — | 18 | | 12 — | 60 | | 12 — | 108 | | | |
| 3 times | 7 — | 21 | | 6 — | 36 | | 10 — | 100 | | | |
| | 8 — | 24 | | 7 — | 42 | 10 times | 11 — | 110 | | | |
| | 9 — | 27 | | 8 — | 48 | | 12 — | 120 | | | |
| | 10 — | 30 | 6 times | 9 — | 54 | | 11 — | 121 | | | |
| | 11 — | 33 | | 10 — | 60 | 11 times | 12 — | 132 | | | |
| | 12 — | 36 | | 11 — | 66 | | | | | | |
| 4 times | 4 — | 16 | | 12 — | 72 | 12 times | 12 — | 144 | | | |
| | 5 — | 20 | | | | | 13 — | 156 | | | |

| Multiplicand | 25104736 | 52471021 | 7925437521 |
|---|---|---|---|
| Multiplier | 2 | 3 | 4 |
| Product | 50209472 | | |

| 27104107 | 231047 | 7092516 | 3725104 |
|---|---|---|---|
| 5 | 6 | 7 | 8 |

| 4215466 | 2701057 | 31040171 | 698854 |
|---|---|---|---|
| 9 | 10 | 11 | 12 |

**II.** *When the multiplier is more than* 12, *and less than* **20**, multiply by the unit figure in the multiplier, adding to the product the back figure to that you multiplied.

| 5710592 | 5107252 | 7653210 | 92057165 |
|---|---|---|---|
| 13 | 14 | 15 | 16 |

| 6251721 | 9215324 | 2571341 | 3592104 |
|---|---|---|---|
| 17 | 18 | 19 | 20 |

**III.** *When the multiplier consists of several figures*, multiply by each figure separately, observing to put the first figure of every product under that figure you multiply by. Add the several products together, and their sum will be the total product.

|  | *Mult.* | 87654 |
|---|---|---|
| 3 | *By* | 73 |
| 1 × 3 | | 262962 |
| 3 | | 613578 |
| | | 6398742 |

1. *Mult.* 987542 by 65.
2. ——— 81234567 by 98.
3. ——— 7309563 by 321.
4. ——— 3657354 by 654.
5. ——— 5975326 by 987.
6. ——— 9108765 by 1826.
7. ——— 271041071 by 5147.
8. ——— 62310047 by 1608.
9. ——— 170925164 by 7419
10. ——— 9500985742 by 61879.
11. ——— 1701495868567 by 47

**IV.** *When ciphers are placed between the significant figures in the multiplier,* they may be omitted ; but great care must be taken that the next figure must be put one place more to the left hand ; *i. e.* under the figure you multiply by

| | |
|---|---|
| *Mult.* 571204 | 1. *Mult.* 94165 by 403. |
| *By* 27009 | 2. —— 473054 by 706. |
| 5140836 | 3. —— 180567 by 1207. |
| 3998428 | 4. —— 765083 by 9008. |
| 1142408 | 5. —— 376509 by 1809. |
| *Product* 15427648836 | 6. —— 890675 by 7005. |
| | 7. —— 7561240325 by 57002. |
| | 8. —— 562710934 by 590030. |

**V.** *When there are ciphers at the end of the multiplicand or multiplier,* they may be omitted, by only multiplying by the rest of the figures, and setting down on the right hand of the total product as many ciphers as were omitted.

| | |
|---|---|
| *Mult.* 1379500 | 1. *Mult.* 8073950 by 900. |
| *By* 3400 | 2. —— 6476545 by 1200. |
| 55180 | 3. —— 7987630 by 7300. |
| 41385 | 4. —— 2710900 by 1820. |
| 4690300000 | 5. —— 657500 by 8400. |
| | 6. —— 7396390 by 11200. |
| | 7. —— 7271000 by 52600 |
| | 8. —— 74837000 by 975000. |

**VI.** *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.

*Mult.* 771039 by 35 ; or 5 times 7 = 35.

| | | |
|---|---|---|
| 5 | or | 771039 |
| 3855195 | | 7 |
| 7 | | 5397273 |
| *Product* 26986365 | | 5 |
| | | 26986365 *as before.* |

1. *Mult.* 7654891 by 24.  |  4. *Mult.* 3657384 by 72
2. —— 9087654 by 36.  |  5. —— 5463725 by 96.
3. —— 6789105 by 56.  |  6. —— 7984956 by 144

## DIVISION OF INTEGERS.

DIVISION teaches 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 always three numbers, and sometimes a fourth, or remainder, *viz.*

1. The *dividend*, or number to be divided.

2. The *divisor*, or number by which you divide.

3. The *quotient*, or number that shows how often the divisor is contained in the dividend.

4. The *remainder* is what is over when the work is finished, and is of the same name as the dividend.

RULE.—*When the divisor does not exceed* 12, fird 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.

PROOF.—Multiply the divisor and quotient together, adding the remainder, (if any,) and the product will be the same as the dividend.

Or, cast the 9's out of the divisor and quotient, and multiply the remainders together ; what remains after casting the 9's out of the product, and adding the remainder, (if any,) will be equal to what remains, after casting the 9's out of the dividend.

|  | Dividend. Rem. | | |
|---|---|---|---|
| Divisor | 2)725107—1 | 3)7210472 | 4)7210416 |
| Quotient | 362553½ | | |
|  | 2 | | |
| Proof | 725107 | 5)7203287 | 6)5231037 |
|  | 7)2532701 | 8)2547325 | 9)25047306 |

II. *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, and proceed as before, till the figures are all brought down

Divide **6173** by **25.**

| Divi-sor. | Divi-dend. | Quo-tient. |
|---|---|---|
| 25 ) | 6173 | ( 246 |

Proof by casting out the 9's.

```
25 ) 6173 ( 246
      50      25 × by divisor.        dividend.
      ───     ────                       8
      117     1230              divisor 7 × 3 quotient.
      100     492
      ───
      178  add 23 rem.                    rem.
      150     6173 Proof by Multiplication.
```

1. *Divide* 615433 by 13.    *Ans.* 47341.
2. — 7360320 by 21.    — 350491$\frac{9}{21}$.*
3. — 651083 by 32.    — 20346$\frac{11}{32}$.
4. — 1165467 by 43.    — 27103$\frac{38}{43}$.
5. — 1310530 by 65.    — 20162.
6. — 2614765 by 87.    — 30054$\frac{67}{87}$.
7. — 9267566 by 98.    — 94567.
8. *Divide* 876543 by 123.   12. *Divide* 2655492840 by 9009.
9. — 1815483 by 321.  13. — 7842603 by 3205.
10. — 6753210 by 654.  14. — 1554584788 by 2197.
11. — 10867495 by 987.  15. — 60706194584 by 96328.

III. *When there are ciphers at the end of the divisor,* they may be cut off, and as many places from off the dividend, but must be annexed to the remainder at last.

1. *Divide* 2547321 by 7100.

    *Thus* 71|00) 25473|21 (358$\frac{421}{7100}$ *Ans.*

2. *Divide* 752473729 by 273000.   *Ans.*   2756$\frac{73729}{273000}$.
3. — 725347216 by 572100.   — 1267$\frac{394416}{572100}$.
4. — 6325104997 by 215000.   — 29419$\frac{104997}{215000}$.

IV. *When the divisor is a composite number,* i. e. if any two figures, being multiplied together, will make that number, divide the dividend by one of those figures, and that quotient by the other, which will give the quotient required. But as it sometimes happens that there is a remainder to each of the quotients, and neither of them the true one, it may be found by the following

---

* When there is a remainder, place the divisor under it, with a line between them, and write the fraction thus formed at the end of the *quotient.*

Rule. Multiply the first divisor into the last remainder, to that product add the first remainder, which will give the true one.

|   | 1. | 2. | 3. | 4. |
|---|---|---|---|---|
| Div. | 3210473 by 27 | 7210473 by 35 | 6251043 by 42 | 5761034 by 54 |
|   | 118906. 11 Rm. | 206013. 18 Rm. | 148834. 15 Rm. | 106685. 44 Rm. |

## TABLES OF MONEY AND WEIGHTS.

### STERLING MONEY.

#### TABLE.

| 2 Farthings | make | 1 Halfpenny. | |
|---|---|---|---|
| 4 Farthings | —— | 1 Penny. | marked *d.* |
| 12 Pence | —— | 1 Shilling. | —— *s.* |
| 20 Shillings | —— | 1 Pound. | —— *£.* |

Farthings.
2 =    1 Halfpenny.
4 =    2 =    1 Penny.
48 =   24 =   12 =   1 Shilling.
960 = 480 = 240 = 20 = 1 Pound.

### SHILLINGS AND PENCE TABLES.

| Shillings | £. s. | Pence | s. d. | Pence | s. d. |
|---|---|---|---|---|---|
| 20 | equal 1 , — | 20 | equal 1/8 | 90 | equal 7/6 |
| 30 | .... 1 , 10 | 24 | .... 2/ | 96 | .... 8/ |
| 40 | .... 2 , — | 30 | .... 2/6 | 100 | .... 8/4 |
| 50 | .... 2 , 10 | 36 | .... 3/ | 108 | .... 9/ |
| 60 | .... 3 , — | 40 | .... 3/4 | 110 | .. . 9/2 |
| 70 | .... 3 , 10 | 48 | .... 4/ | 120 | .... 10/ |
| 80 | .... 4 , — | 50 | .... 4/2 | 130 | .... 10/10 |
| 90 | .... 4 , 10 | 60 | .... 5/ | 132 | .... 11/ |
| 100 | .... 5 , — | 70 | .... 5/10 | 140 | .... 11/8 |
| 110 | .... 5 , 10 | 72 | .... 6/ | 144 | .... 12/ |
| 120 | .... 6 , — | 80 | .... 6/8 | 150 | .... 12/6 |
| 130 | .... 6 , 10 | 84 | .... 7/ | 160 | .... 13/4 |

## TROY WEIGHT.

The Troy pound is the standard at the Mint, and for jewellers and apothecaries. This weight is used also for experiments in natural philosophy, and ascertaining the strength of spirits.

| 24 Grains (grs.) | make | 1 Pennyweight. | dwts. |
|---|---|---|---|
| 20 Pennyweights | —— | 1 Ounce. | oz. |
| 12 Ounces | —— | 1 Pound. | lb. |

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

The standard gold coin in this kingdom contains 22 parts of pure gold, 1 of fine silver, and 1 of copper. A pound of standard gold is coined into $44\frac{1}{2}$ guineas, and therefore the value of an ounce Troy of standard gold, at the Mint price, is £3 , 17 , $10\frac{1}{2}$.

A pound of silver of standard coin contains 11 oz. 2 dwt. of pure silver, and 18 dwts. of alloy or copper. It was formerly coined into 62 shillings; but since 1816, it is coined into 66 shillings. The current price of bullion varies like that of other commodities, according to the scarcity or demand.

*Note.*—25 lb. is a quarter of an Cwt., 100 lb. 1 Cwt., and 20 Cwt. 1 Ton of gold or silver.

## AVOIRDUPOIS WEIGHT.

This weight is now to be used for every purpose, except those mentioned in Troy weight.

| 16 Drams (dr.) | make | 1 Ounce. | oz. |
|---|---|---|---|
| 16 Ounces | —— | 1 Pound. | lb. |
| 14 Pounds | —— | 1 Stone. | st. |
| 28 lbs. or 2 stones | —— | 1 Quarter. | qr. |
| 4 qrs. or 112 lb. | —— | 1 Hundred wt. | cwt. |
| 20 Hundred weight | —— | 1 Ton. | T. |

### The Lesser Weight.

Grains.
    $27\frac{11}{32}$ =   1 Dram.
    $437\frac{1}{2}$ =  16 = 1 Ounce.
  7000 = 256 = 16 = 1 Pound.

### The Greater Weight.

Pounds.
    28 =   1 Quarter.
   112 =  4 = 1 Cwt.
 2240 = 80 = 4 = 1 Ton.

*Note.*—As the pound Troy contains 5760 grains, and the lb. Avoirdupois 7000, if these numbers be divided by (40) their common measure, it will be found that,

    1 Pound Avoirdupois is =  14 oz. 11dwts. 16 grs. Troy.
    1 Pound Troy         =  13 oz. $2\frac{1}{2}$ drams Avoir.
or, 144 lbs. Avoirdupois    = 175 lbs. Troy.

There are several denominations in this weight which are used in some particular kinds of goods, *viz.*

| | | |
|---|---|---|
| 64 lb. of Soap . . . . . . . . . . 1 Firkin. | *fir.* |
| 30 lb. Anchovies . . . . . . . . 1 Barrel. | *bar.* |
| 112 lb. Gunpowder . . . . . . 1 Barrel. | — |
| 112 lb. Raisins . . . . . . . . . . 1 Barrel. | — |
| 1120 lb. or 10 cwt. Prunes . . 1 Puncheon | *pun.* |
| 9 lb. Train Oil . . . . . . . . 1 Gallon.* | *gal.* |
| 8 lb. Vinegar . . . . . . . . . . 1 Gallon. | — |
| 36 lb. Straw . . . . . . . . . . 1 Truss. | *tr.* |
| 60 lb. new Hay . . . . . . . 1 Truss. | — |
| 56 lb. old Hay . . . . . . . . . 1 Truss. | — |
| 36 Trusses Hay or Straw  1 Load. | *lo.* |
| 7 lb. of Salt . . . . . . . . . . 1 Gallon. | *gal.* |
| 56 lb or 8 gallons . . . . . . 1 Bushel. | *bus.* |

### CHEESE AND BUTTER

| | | |
|---|---|---|
| 8 Pounds . . . . . . . . . . . . . . . 1 Clove. | *cl.* |
| 32 Cloves, or 256 lb. . . . . . . 1 Wey in Essex. | *wy.* |
| 42 Cloves, or 336 lb. . . . . . . 1 Wey in Suffolk. | — |
| 56 Pounds . . . . . . . . . . . . . . . 1 Firkin of butter. | *fkn.* |

* Of the new Imperial measure.

# WOOL.

14 Pounds make 1 Legal stone.
2 st. or 28 lbs. —— 1 Tod.

**ALSO,**

16 Pounds        1 Customary stone.
15 Stones, or 8 tods    1 Pack of 240 lbs.

*Note.*—In purchasing wool from the grower, 28 lb. make a legal tod; but woolstaplers, in their transactions with each other and with manufacturers, allow 30 lb. to the tod, and 8 tods to the pack.

# WEIGHT OF A FOTHER OF LEAD

### *At sundry Places.*

| | | | |
|---|---|---|---|
| At London | 19½ Cwt. | At Newcastle | 21 Cwt. |
| Leith | 20 Cwt. | Chester | 21 Cwt. 1qr. 20lb. |
| Hull | 20 Cwt. 3 qr. 16 lb. | Stockton | 22 Cwt. |

# CLOTH MEASURE.

THE *Yard* regulates all measures, whether lineal, superficial, or solid.

**TABLE.**

| | | | | |
|---|---|---|---|---|
| 4 Nails *(na.)* | make | 1 Qr. of a yard. | *qr.* |
| 4 Quarters | —— | 1 Yard. | *yd.* |
| 5 Quarters | —— | 1 English ell. | *E. E.* |
| *Note.* 3 Quarters | —— | 1 Flemish ell. | *Fl. E.* |

Inches.

2¼ = 1 Nail.
9 = 4 = 1 Quarter.
36 = 16 = 4 = 1 Yard.
45 = 20 = 5 = 1 English ell.
27 = 12 = 3 = 1 Flemish ell.

This measure for all kinds of woollen, linen, and muslin cloths, wrought silks, ribands, tape, &c.

## LONG, OR LINEAL MEASURE.

THIS measure respects length only, and is used in taking the distance from one place to another.

| 12 | Lines, or parts | make | 1 Inch. | *in.* |
|----|-----------------|------|---------|-------|
| 12 | Inches | —— | 1 Foot. | *ft.* |
| 3 | Feet | —— | 1 Yard. | *yd.* |
| 2 | Yards, or 6 feet | —— | 1 Fathom. | *fath.* |
| 5½ | Yards | —— | 1 Pole or Rod. | *po.* |
| 40 | Poles | —— | 1 Furlong. | *fur.* |
| 8 | Furlongs | —— | 1 Mile. | *mi.* |
| 3 | Miles | —— | 1 League of sea. | *lea.* |
| 69½ | Miles | —— | 1 Degree of latitude and of | |

longitude on the equator.

Inches.

$$12 = 1 \text{ Foot.}$$
$$36 = 3 = 1 \text{ Yard.}$$
$$198 = 16\tfrac{1}{2} = 5\tfrac{1}{2} = 1 \text{ Pole.}$$
$$7920 = 660 = 220 = 40 = 1 \text{ Furlong.}$$
$$63360 = 5280 = 1760 = 320 = 8 = 1 \text{ Mile.}$$

*Note.*—The length of 3 barley-corns was formerly reckoned an inch: but a barley-corn is no measure.

## MEASURES OF CAPACITY.

THE old measures for liquids and dry goods are abolished, and the new IMPERIAL GALLON to be used for both. This gallon contains 277.2738 cubic inches, or 277¼ inches *nearly.*

## WINE AND SPIRIT MEASURE.

### TABLE.

| 2 Quarterns, or gills | make | 1 Halfpint. | |
|-----------------------|------|-------------|------|
| 2 Halfpints, or 4 gills | —— | 1 Pint. | *pi.* |
| 2 Pints | —— | 1 Quart. | *qt.* |
| 4 Quarts, or 8 pints | —— | 1 Gallon. | *gal.* |
| 63 Gallons | ·· — | 1 Hogshead. | *hhd.* |
| 2 Hhds. or 126 gals. | —— | 1 Pipe. | *pi.* |
| 2 Pipes, or 252 gals. | —— | 1 Tun | *tun* |

Cubic Inches.

$34\frac{2}{3} =$      1 Pint.
$69\frac{1}{3} =$      2 =      1 Quart.
$277\frac{1}{4} =$      8 =      4 =   1 Gallon.
$17468\frac{1}{4} =$   504 =   252 =   63 = 1 Hogshead.
$34936\frac{1}{2} =$ 1008 =   504 = 126 = 2 = 1 Pipe.
$69873$   = 2016 = 1008 = 252 = 4 = 2 = 1 Tun.

*Note.*—1. A *puncheon* of spirits is 84 gallons by the Excise tables; but a cask of rum, which contains from 90 to 120 gallons, is usually called by that name.

2. A pipe, or butt of Malaga is 126 gallons, as in the table; but the pipe of foreign wines varies from 110 to 140 gallons.

3. The old wine gallon contained only 231 cubic inches; and therefore 6 gallons of wine or spirits of old measure are equal to 5 of new or imperial measure.

## ALE AND BEER MEASURE.

### TABLE.

| 2 Pints (*pts.*) | make | 1 Quart. | *qt.* |
|---|---|---|---|
| 4 Quarts, or 8 pints | —— | 1 Gallon. | *gal.* |
| 9 Gallons | —— | 1 Firkin. | *fir.* |
| 2 Firkins, or 18 gals. | —— | 1 Kilderkin. | *kild.* |
| 2 Kilderkins, or 36 gals. | —— | 1 Barrel. | *bar.* |
| 54 Gallons | —— | 1 Hogshead. | *hhd.* |
| 2 Hhds. or 108 gals. | —— | 1 Butt. | *butt.* |

Cubic Inches.

$34\frac{2}{3} =$      1 Pint.
$69\frac{1}{3} =$      2 =      1 Quart.
$277\frac{1}{4} =$      8 =      4 =   1 Gallon.
$2495\frac{1}{2} =$   72 =   36 =      9 =   1 Firkin.
$4991$   = 144 =   72 =   18 =   2 = 1 Kilderkin.
$9982$   = 288 = 144 =   36 =   4 = 2 = 1 Barrel.
$14973$   = 432 = 216 =   54 =   6 = 3 = $1\frac{1}{2}$ = 1 Hhd.
$29946$   = 864 = 432 = 108 = 18 = 6 = 3   = 2 = 1 Butt

*Note.*—1. The old beer gallon contained 282 cubic inches and the new imperial gallon $277\frac{1}{4}$ inches; 59 ale or beer gallons old measure were equal to 60 gallons of new measure.

2. As 63 gals. make a hhd. of wine or spirits, and 54 a hhd. of ale or beer, 6 hhds. of wine are equal to 7 hhds. of beer.

## CORN, OR DRY MEASURE.

### TABLE.

| | | | | |
|---|---|---|---|---|
| 2 Pints *(pts.)* | make | 1 Quart. | | *qt.* |
| 4 Quarts, or 8 pints | —— | 1 Gallon. | | *gal.* |
| 2 Gallons, or 8 quarts | —— | 1 Peck. | | *pe.* |
| 4 Pecks, or 8 gallons | —— | 1 Bushel. | | *bush.* |
| 8 Bushels, or 32 pecks | —— | 1 Quarter. | | *qr.* |
| 5 Quarters, or 40 bushels | —— | 1 Wey or load. | | *W.* |
| 2 Weys, or 10 quarters | —— | 1 Last. | | *la.* |

Cubic Inches.

$$34\tfrac{1}{2} = 1 \text{ Pint.}$$
$$69\tfrac{1}{4} = 2 = 1 \text{ Quart.}$$
$$277\tfrac{1}{4} = 8 = 4 = 1 \text{ Gallon.}$$
$$554\tfrac{1}{2} = 16 = 8 = 2 = 1 \text{ Peck.}$$
$$2218\tfrac{4}{10} = 64 = 32 = 8 = 4 = 1 \text{ Bushel.}$$
$$17745\tfrac{1}{4} = 512 = 256 = 64 = 32 = 8 = 1 \text{ Quarter.}$$
$$88727\tfrac{1}{2} = 2560 = 1280 = 320 = 160 = 40 = 5 = 1 \text{ Wey.}$$
$$177455 = 5120 = 2560 = 640 = 320 = 80 = 10 = 2 = 1 \text{ Last.}$$

*Note.*—1. The old Winchester bushel, which was the standard for England, contained 2150$\frac{4}{5}$ cubic inches, and the gallon 268$\frac{4}{5}$ inches and the proportion of that bushel to the new imperial measure is, 33 to 32 nearly, that is, 32 pecks, bushels, or quarters of new measure are equal to 33 of Winchester measure.

2. All goods measured by the new bushel, which are not heaped, are to be stricken by a straight roller.

## HEAPED MEASURE.

The bushel here is the same as in Corn Measure. It is a vessel of a circular form, 19$\frac{1}{2}$ inches in diameter, and 8$\frac{1}{4}$ inches deep.

Upon this measure the goods are to be heaped in the form of a cone, at least 6 inches high, and the outside of the bushel is to be the extremity of the base.

| | | |
|---|---|---|
| 3 Bushels of Coals | make | 1 Sack. |
| 12 Sacks or 36 Bushels | —— | 1 Chaldron. |
| 21 Chaldrons | —— | 1 Score. |

This measure is used for coals, culm, lime, fish, potatoes, or fruit, and all other goods sold by heaped measure.

## SQUARE, OR SUPERFICIAL MEASURE.

This measure respects both length and breadth, and is used by artificers in computing the contents of their work.

### TABLE.

| 144 Square Inches | make | 1 Sq. Foot. |
|---|---|---|
| 9 Square Feet | —— | 1 Sq. Yard. |
| 30¼ Square Yards | —— | 1 Sq. Pole or Perch. |
| 40 Poles | —— | 1 Rood. |
| 4 Roods | —— | 1 Acre. |

*Note.*—1. In carpentry, 100 superficial feet make a square of flooring.

2. The square rod is 16½ feet in length, and consequently contains 272¼ : but 272 is generally reckoned exact enough in practice.

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

The chain called Gunter's is used in measuring land. It is 4 poles, or 22 yards, or 66 feet, in length, and divided into 100 equal parts or links, each link being $7\frac{92}{100}$ inches. The square chain is equal to 484 square yards, or one-tenth of an

## CUBIC, OR SOLID MEASURE.

This measure includes length, breadth, and thickness or depth. It is used in measuring stones, timber, and all artificers' works computed by their solid contents

### TABLE.

| 1728 Solid Inches | make 1 Cubic Foot. |
|---|---|
| 27 Solid Feet | —— 1 Cubic Yard. |
| 40 Feet of rough Timber ⎫ or, 50 Feet of hewn Timber ⎭ | ——. 1 Ton or Load. |
| 42 Cubic Feet | —— 1 Ton of Shipping. |

## TIME.

| | |
|---|---|
| 60 Seconds (″) | make 1 Minute. |
| 60 Minutes | —— 1 Hour. |
| 24 Hours | —— 1 Natural day. |
| 7 Days | —— 1 Week. |
| 4 Weeks, or 28 days | —— 1 Month. |
| 13 Months, or 52 weeks | —— 1 Year of 364 days. |
| 12 Calendar months | —— 1 Year of 365 days. |
| 365 Days 6 hours | —— 1 Julian year |
| 365 Days 5 ho. 48 m. 48″s. | —— 1 Solar year. |

Seconds.
```
     60=      1 Minute.
   3600=     60=    1 Hour.
  86400=   1440=   24=   1 Day.
 604800=  10080=  168=   7  = 1 Week.
2419200=  40320=  672=  28  = 4=1 Month.
31557600=525960=8766=365¼=52=1 Year of 365 d. 6 h
```

*To know the number of days in each month, observe:*

> *Thirty days have* September,
> April, June, *and* November,
> February has *twenty-eight*
> All the rest have *thirty and one;*
> Except in Leap Year, and then 's the time,
> February's days are *twenty and nine.*

*Note.*—As leap year usually happens every fourth year, divide the year by 4; if nothing remain it is leap year. Thus 1824, 1828, 1832, &c. being divisible by 4, without a remainder, are leap years.

### QUARTERLY TERMS FOR PAYMENT OF RENT, &c.

> March 25th, commonly called *Lady-day.*
> June 24th, *Midsummer.*
> September 29th, *Michaelmas*
> December 25th, *Christmas*

# ADDITION

## OF MONEY, WEIGHTS, AND MEASURES.

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

### STERLING MONEY.

| | | |
|---|---|---|
| £2 , 13 , 5¼ | £27 , 7 , 2 | £35 , 17 , 3 |
| 7 , 9 , 4¼ | 34 , 14 , 7¼ | 59 , 11 , 7½ |
| 5 , 15 , 4½ | 57 , 19 , 2¼ | 97 , 13 , 5¼ |
| 9 , 17 , 6¾ | 91 , 16 , 1 | 37 , 16 , 8¼ |
| 7 , 16 , 3 | 75 , 18 , 7¾ | 97 , 15 , 7 |
| 5 , 14 , 7¾ | 97 , 13 , 5 | 59 , 16 , 5½ |
| £39 , 6 , 7¼ | | |

| | | |
|---|---|---|
| £257 , 1 , 5½ | £525 , 2 , 4¼ | £21 , 14 , 7¼ |
| 734 , 3 , 7¼ | 179 , 3 , 5 | 75 , 16 , 0 |
| 595 , 5 , 3 | 250 , 4 , 7¼ | 79 , 2 , 4¼ |
| 152 , 14 , 7½ | 975 , 3 , 5¼ | 57 , 16 , 5½ |
| 207 , 5 , 4 | 254 , 5 , 7 | 26 , 13 , 8¼ |
| 798 , 16 , 7¼ | 379 , 4 , 5¼ | 54 , 2 , 7 |

| | | |
|---|---|---|
| £127 , 4 , 7½ | £261 , 17 , 1¼ | £31 , 1 , 1½ |
| 525 , 3 , 5 | 379 , 13 , 5 | 75 , 13 , 1 |
| 271 , 0 , 5 | 257 , 16 , 7¾ | 39 , 19 , 6¼ |
| 524 , 9 , 1 | 184 , 13 , 5 | 97 , 17 , 3¼ |
| 379 , 4 , 3½ | 725 , 2 , 3½ | 36 , 13 , 5 |
| 215 , 5 , 8¼ | 359 , 6 , 3 | 24 , 16 , 3¼ |

### TROY WEIGHT.

| Oz.dwt.gr. | Lb. oz. dwt.gr. | Lb.oz. dwt. |
|---|---|---|
| 5 , 11 , 4 | 7 , 1 , 2 , 22 | 54 , 2 , 15 |
| 7 , 19 , 21 | 3 , 2 , 17 , 19 | 31 , 11 , 17 |
| 3 , 15 , 14 | 5 , 1 , 15 , 14 | 35 , 7 , 15 |
| 7 , 19 , 22 | 7 , 10 , 11 , 21 | 29 , 1 , 13 |
| 9 , 18 , 15 | 2 , 7 , 13 , 23 | 43 , 9 , 7 |
| 8 , 13 , 12 | 3 , 11 , 16 , 17 | 54 , 2 , 15 |

### AVOIRDUPOIS WEIGHT.

| Lb. oz. dr. | Tons cwt. qr. lb. | Cwt. qr. lb. |
|---|---|---|
| 152 , 13 , 15 | 97 , 17 , 2 , 12 | 25 , 1 , 17 |
| 272 , 14 , 10 | 85 , 5 , 3 , 14 | 72 , 3 , 26 |
| 303 , 15 , 11 | 72 , 4 , 1 , 17 | 54 , 1 , 16 |
| 255 , 10 , 4 | 63 , 18 , 2 , 19 | 24 , 1 , 16 |
| 173 , 6 , 2 | 57 , 9 , 3 , 20 | 17 , 0 , 19 |
| 625 , 13 , 13 | 48 , 5 , 1 , 24 | 55 , 2 , 16 |

N. B. *Apothecaries weight* is the same as Troy, and of no use to be taught a boy; besides, the division of it is not mentioned in the Act.

### CLOTH MEASURE.

| F.E. qr. na. | Yds. qr. na. | E.E. qr. na. |
|---|---|---|
| 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. | Miles fur. poles. | Lea. m. fur. |
|---|---|---|
| 225 , 1 , 9 | 67 , 7 , 39 | 72 , 2 , 1 |
| 171 , 0 , 3 | 76 , 6 , 18 | 27 , 1 , 7 |
| 52 , 2 , 3 | 65 , 5 , 21 | 35 , 2 , 5 |
| 397 , 0 , 10 | 54 , 4 , 35 | 79 , 0 , 6 |
| 154 , 2 , 7 | 43 , 3 , 21 | 51 , 1 , 6 |
| 137 , 1 , 4 | 31 , 2 , 12 | 72 , 0 , 5 |

### LAND MEASURE.

| Ac. ro. per. | Ac. ro. per. | Ac. ro. per. |
|---|---|---|
| 726 , 1 , 31 | 98 , 3 , 39 | 1232 , 1 , 14 |
| 219 , 2 , 17 | 87 , 1 , 32 | 327 , 0 , 19 |
| 1455 , 3 , 14 | 76 , 2 , 27 | 131 , 2 , 15 |
| 879 , 1 , 21 | 65 , 0 , 21 | 1219 , 1 , 18 |
| 1195 , 2 , 14 | 54 , 1 , 15 | 459 , 2 , 17 |

### WINE MEASURE.

| Hhds. gal. qts | Gals. qts. pi. | Tuns hhds. gal. |
|---|---|---|
| 31 , 57 , 1 | 123 , 3 , 1 | 14 , 3 , 62 |
| 97 , 18 , 2 | 108 , 0 , 1 | 19 , 2 , 56 |
| 76 , 13 , 1 | 96 , 2 , 0 | 17 , 0 , 39 |
| 55 , 46 , 2 | 84 , 1 , 1 | 75 , 2 , 16 |
| 87 , 38 , 3 | 72 , 3 , 1 | 54 , 1 , 19 |
| 55 , 17 , 1 | 60 , 2 , 0 | 97 , 3 , 54 |

### ALE, OR BEER MEASURE.

| Gals. qt. pi. | Bar. fir. gal. | Hhds. gal. qts. |
|---|---|---|
| 25 , 2 , 1 | 37 , 2 , 8 | 76 , 53 , 2 |
| 17 , 3 , 0 | 54 , 1 , 7 | 57 , 48 , 3 |
| 96 , 2 , 1 | 97 , 3 , 8 | 97 , 36 , 3 |
| 75 , 1 , 0 | 78 , 2 , 5 | 22 , 50 , 2 |
| 96 , 3 , 1 | 47 , 0 , 7 | 32 , 45 , 3 |
| 75 , 0 , 1 | 35 , 2 , 5 | 55 , 18 , 3 |

### DRY MEASURE.

| Qrs bush.pe. | Loads qr. bus. | Lasts qr. bus |
|---|---|---|
| 169 , 7 , 3 | 132 , 4 , 7 | 89 , 9 , 6 |
| 156 , 6 , 2 | 108 , 3 , 6 | 78 , 8 , 3 |
| 144 , 5 , 1 | 84 , 2 , 5 | 65 , 7 , 5 |
| 132 , 4 , 0 | 67 , 1 , 4 | 56 , 6 , 4 |
| 120 , 3 , 2 | 56 , 0 , 3 | 49 , 5 , 2 |
| 96 , 2 , 3 | 48 , 4 , 2 | 36 , 4 , 7 |

### TIME.

| Hours min.sec. | Mo. we. da. | Years da. hours. |
|---|---|---|
| 96 , 59 , 45 | 19 , 3 , 6 | 76 , 292 , 23 |
| 84 , 48 , 56 | 17 , 2 , 5 | 65 , 219 , 18 |
| 72 , 36 , 42 | 15 , 1 , 4 | 54 , 146 , 21 |
| 60 , 24 , 38 | 12 , 0 , 3 | 43 , 73 , 12 |
| 48 , 45 , 24 | 9 , 3 , 2 | 32 , 39 , 15 |

#### THE APPLICATION

1. A man born in the year 1780, when will he be 47 years of age? *Ans.* 1827.

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

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

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

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

6. Bought a parcel of goods, for which I paid £54 , 17 for packing 13/8, carriage £1 , 5 , 4, and spent about the bargain 14/3. What do these goods stand me?
*Ans.* £57 , 10 , 3.

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

8. A gentleman left his eldest daughter £1500 more than the youngest, and her fortune was £12111. What was the eldest sister's fortune, and what did the father leave them?
      *Ans.* Eldest sister's fortune £13611.   Father left them £25722.

9. A nobleman, before he went out of town, was desirou. of paying all his tradesmen's bills, and upon inquiry finds. he owed 82 guineas for rent; to his wine-merchant £72, 5; confectioner £12, 13, 4; draper £47, 13, 2; tailor £110, 15, 6; coachmaker £157, 8; tallow-chandler £8, 17, 9; corn-chandler £170, 6, 8; brewer £52, 17, butcher £122, 11, 5; baker £37, 9, 5; and to his servants for wages £53, 18. How much money must he draw for to allow £100 for travelling expenses?
                            *Ans.* £1032, 17, 3.

10. A father was 24 years of age (allowing 13 months to a year, and 28 days to a month) when his first child was born; between the eldest and next born was 1 year, 11 months, 14 days; between the second and third were 2 years, 1 month, and 15 days; between the third and fourth were 2 years, 10 months, and 25 days; when the fourth was 27 years, 9 months, and 12 days old, how old was the father?
                       *Ans.* 58 years, 7 months, 10 days.

11. A merchant's clerk having been out with bills, brings home an account, that A paid him £7, 5, 2, B £15, 18, 6½, C £150, 13, 2¼, D £17, 6, 8, E 5 guineas, 2 crown pieces 4 half crowns, and 4/2, F paid him only 20 *groats, G £76, 15, 9½, and H £121, 12, 4. I desire to know how much did he receive?           *Ans.* £396, 7, 6¼

12. A nobleman had a service of plate, which consisted of twenty dishes, weighing 203 oz. 8 dwts.; 36 plates weighing 408 oz. 9 dwts.; 5 dozen of spoons, weighing 112 oz. 8 dwts.; 6 salts and 6 pepper-boxes, weighing 71 oz. 7 dwts.; knives and forks, weighing 73 oz. 5 dwts.; two large cups, a tankard, and a mug, weighing 121 oz. 4 dwts.; a tea-kettle and lamp, weighing 131 oz, 7 dwts.; together with sundry other small articles, weighing 105 oz. 5 dwts. I desire to know the weight of the whole?           *Ans.* 102 lb. 2 oz. 13 dwts

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

14. A of Vienna owes to B of Liverpool, for goods received in January, the sum of £103, 12, 2; February £93, 3, 4; March £121, 17; April £142, 15, 4; May £171, 15, 10; June £142, 12, 6; but the latter six months of the year, owing to the falling off in the demands for the articles in which he dealt, amounted to the sum only of £205, 7, 2. I desire to know the amount of the whole year's bill?                    *Ans.* £981, 3, 4

# SUBTRACTION
## OF MONEY, WEIGHTS, AND MEASURES.

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

**Proof.**—As in integers.

### STERLING MONEY.

Borrowed.... £715, 2, 7¼    Lent ..... ..£316, 3, 5½
Paid......... 476, 3, 8½    Received ...... 218, 2, 1¾
Remains to pay £238, 18, 10¾    To receive .... £98, 1, 3¾
          Proof.. 715, 2, 7¼

£87, 2, 10          £3, 15, 1¼          £25, 2, 5¼
 79, 3, 7¼           1, 14, 7            17, 9, 8½


£321, 17, 1½        £59, 15, 3¾         £71, 2, 4
 257, 14, 7          36, 17, 2           19, 13, 7¾

Borrowed £25107 , 15 , 7          Lent .. £250156 ,  1 , 6

Paid at different times.
$$\begin{cases} 375 , & 5 , 5 \\ 259 , & 2 , 7\frac{2}{3} \\ 359 , & 13 , 4\frac{2}{3} \\ 523 , & 17 , 3 \\ 274 , & 15 , 7\frac{1}{2} \\ 325 , & 13 , 5 \end{cases}$$

Received at several payments.
$$\begin{matrix} 359 , 15 , 3 \\ 475 , 13 , 9 \\ 527 , 15 , \\ 272 , 16 , 5 \\ 150 , & 0 , 0 \end{matrix}$$

Paid in all. . £          Rec. in all £

Still to pay  £          Still to rec. £


### TROY WEIGHT.

|        | Lb. oz. dwt. | Lb.oz.dwt.gr. | Oz. dwt. gr. |
|--------|--------------|---------------|--------------|
| Bought | 52 , 1 , 7   | 76 , 2 , 2 , 7 | 123 , 12 , 18 |
| Sold   | 39 , 0 , 15  | 67 , 7 , 1 , 5 | 34 , 15 , 21 |
| Unsold |              |               |              |


### AVOIRDUPOIS WEIGHT.

|      | Lb. oz. dr. | Cwt. qrs. lb. | Tons. Cwt. qrs |
|------|-------------|---------------|----------------|
| From | 67 , 10 , 5 | 135 , 1 , 21  | 321 , 10 , 2   |
| Sub. | 29 , 15 , 7 | 45 , 3 , 27   | 179 , 15 , 3   |


### CLOTH MEASURE.

|      | F.E. qrs. n. | Yds. qrs. n. | E.E. qrs. n. |
|------|--------------|--------------|--------------|
| From | 135 , 2 , 2  | 171 , 1 , 2  | 150 , 2 , 1  |
| Sub. | 67 , 2 , 3   | 103 , 2 , 1  | 89 , 3 , 2   |


### LONG MEASURE.

|      | Yds. ft. in. | Mil. fur. po. | Leag. mi. fur. |
|------|--------------|---------------|----------------|
| From | 107 , 1 , 10 | 670 , 3 , 25  | 147 , 2 , 5    |
| Sub. | 76 , 2 , 11  | 292 , 5 , 32  | 58 , 2 , 7     |

### LAND MEASURE.

| | Acres. ro. per. | Acres. ro. per | Acres. ro. per |
|---|---|---|---|
| From | 175 , 1 , 17 | 145 , 2 , 19 | 325 , 2 , 19 |
| Sub. | 59 , 0 , 27 | 56 , 0 , 27 | 179 , 3 , 25 |

### WINE MEASURE.

| | Hds. gal. qts. | Pipes. hds. gal. | Tun. hds. gal |
|---|---|---|---|
| From | 97 , 47 , 2 | 165 , 1 , 49 | 42 , 2 , 37 |
| Sub. | 78 , 59 , 3 | 76 , 0 , 61 | 17 , 3 , 49 |

### ALE, OR BEER MEASURE.

| | Gals. qt. pt. | Bar. fir. gal. | Hds. gal. qts. |
|---|---|---|---|
| From | 210 , 1 , 0 | 137 , 2 , 1 | 127 , 27 , 1 |
| Sub. | 109 , 3 , 1 | 28 , 1 , 7 | 72 , 50 , 2 |

### DRY MEASURE.

| | Qrs. bu. p. | Qrs. bu. p. | Last. qr. bus. |
|---|---|---|---|
| From | 172 , 1 , 2 | 165 , 0 , 1 | 120 , 3 , 3 |
| Sub. | 85 , 2 , 3 | 82 , 2 , 3 | 94 , 9 , 5 |

| | Yrs. mo. we. da. | Yrs. da. ho. | Ho. min. sec. |
|---|---|---|---|
| From | 173 , 8 , 2 , 4 | 1826 , 73 , 18 | 134 , 42 , 45 |
| Sub. | 96 , 9 , 3 , 5 | 937 , 219 , 21 | 49 , 53 , 47 |

### THE APPLICATION.

1. A man born in the year 1777, what is his age in the present year (1826)?          *Ans.* 49

2. What is the difference between the age of a person born in 1745, and another born in 1801?          *Ans.* 56

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

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

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

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

7. A merchant, at his outsetting in trade, owed £750 ; he had in cash, commodities, the stocks, and good debts £12510 ,7 ; he cleared the first year by commerce £452 , 3 , 6 · what is the net balance at the 12 months end ?
                                              *Ans.* £12212 , 10 , 6

8. A gentleman dying, left £45247 between two daughters, the youngest was to have 15 thousand, 15 hundred, and twice £15.   What was the eldest sister's fortune ?
                                              *Ans.* £28717.

9. A tradesman, on the 2d of January, paid his banker £76 , 15 , 9 ; on the 1st of March, £65 , 14 , 7.   In April he drew £39 , 12 , 6 ; and in May £36 , 18 , 4.   In July he put in £45 , 7 , 10 ; and in the same month drew £17 , 10 ; in September he drew 21 guineas, and in October £15 , 15 , 10. In November he put in £36 , 10 ; but in December he drew £65 , 12 , 11.   How does his account stand at the close of the year?           *Ans.*   Balance due to him, £26 , 17 , 7

10. A merchant, on balancing his books, finds he has in cash £950 , 11 , 8 ; bills to the amount of £730 , 15 , 7 , goods valued at £1542 , 17 , 9.   He owes in open accounts £567 , 18 , 9, and in accepted bills, £1085 , 10 , 11 : required his net stock.                     *Ans.* £1570 , 15 , 4.

11. A tradesman happening to fail in business, called a meeting of his creditors.   He owed to A £53 , 7 , 6 ; to B £105 , 10 ; to C £34 , 5 , 2 ; to D £28 , 16 , 5 ; to E £14 , 15 , 8 ; to F £112 , 9 ; and to G £143 , 12 , 9.   His creditors found the value of his stock to be £212 , 6, and that he had owing to him in good book debts £112 , 8 , 3 besides £21 , 10 , 5 money in hand.   How much will they lose ?                     *Ans.* £146 , 11 , 10

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

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

## MULTIPLICATION

### OF SEVERAL DENOMINATIONS.

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

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

PROOF.—By Division.

$$£75 , 13 , 1\tfrac{1}{2} \qquad £62 , 5 , 4\tfrac{1}{4} \qquad £57 , 2 , 4\tfrac{3}{4}$$
$$3 \qquad\qquad 4 \qquad\qquad 5$$

£71 , 5 , 2½

1. 18 yds. of cloth, at 9 , 6
  ℔ yard                    9
9 × 2 = 18          4 , 5 , 6
                          2
              *Ans.* £8 , 11 , 0

2. 26 lb. of tea, at £1 , 2 , 6
  ℔ lb.                     8
8 × 3 + 2 = 26    9 , 0 , 0
                          3
                  27 , 0 , 0
Top line × 2      2 , 5 , 0
        *Ans.* £29 , 5 , 0

  3. 21 Ells of Holland, at 7/8½ ............£ 8, 1, 10½.
  4. 35 Firkins of butter, at 15/3½ .........26, 15, 2½.
  5. 75 Lb. of nutmegs, at 7/2¾ .............27, 2, 2¼.
  6. 37 Yards of tabby, at 9/7 .............17, 14, 7.
  7. 97 Cwt. of cheese, at 25/3 ...........122, 9, 3.
  8. 43 Dozen of candles, at 6/4 ...........13, 12, 4.
  9. 127 Lb. of bohea, at 12/3 .............77, 15, 9.
10. 135 Gallons of rum, at 7/5 ...........50, 1, 3.
11. 74 Ells of diaper, at 1/4½ .............5, 1, 9.
12. 6 Dozen pair of gloves, at 1/10 ⅌ pair ....6, 12, 0.

When the given quantity consists of ½, or ¼, divide the price by 2, or 4; when ¾, divide the price by 2, and that quotient by 2, which to the product of the quantity given.

13. 25½ Ells of Holland, at 3/4½ per ell.

$$£0, \; 3, \; 4½$$
$$\underline{\phantom{£0, \; 3, \;} 5} \qquad 5 \times 5 = 25$$
$$0, 16, 10½$$

$$\overline{4, \; 4, \; 4½} = \text{price of 25 yards.}$$
$$0, \; 1, \; 8½ = \text{price of ½ yard.}$$

*Ans.* $\underline{\underline{£4, \; 6, \; 0½}}$ = price of 25½ yards.

14. 75½ Ells of diaper, at 1/3 .............£4, 14, 4½
15. 19½ Ells of damask, at 4/3 .............4, 2, 10½
16. 35¼ Ells of dowlas, at 1/4 .............2, 7, 0
17. 7¼ Cwt. of Malaga raisins, at 21/6 .. .....7, 15, 10½
18. 6½ Barrels of herrings, at 75/7 .........24, 11, 3½
19. 35½ Cwt. double refined sugar, at 95/6 ..169, 10, 3
20. 154½ Cwt. of tobacco, at 97/10 ........755, 15, 3
21. 117¼ Gallons of arrack, at 12/6.........73, 5, 7½
22. 85¼ Cwt. of cheese, at 27/8 ...........118, 12, 5
23. 29½ Lb. of fine Hyson tea, at 22/9........33, 5, 5½
24. 17¼ Yards of superfine scarlet, at 23/6 ....20, 17, 1½
25. 37½ Yards of brocaded silk, at 12/4 ......23, 2, 6
26. 56¼ Cwt. of sugar, at 58/7 ...........166, 4, 7¼
27. 96½ Cwt. of currants, at 55/6 .........267, 15, 9
28. 45¼ Lb. Belladine silk, at 18/6 .........42, 6, 4½
29. 87¼ Bushels of wheat, at 4/3 ........ ...18, 12, 11½

*Answers.*

30. 120¼ Cwt. of hops, at 87/6 .......... £528, 5, 7¼
31. 407 Yards of cloth, at 3/9¼ ............ 77, 3, 2½
32. 729 Ells of cloth, at 7/7¼ .............. 277, 3, 5¼
33. 2068 Yards of lace, at 9/5¼ ........... 977, 19, 10

## THE APPLICATION.

1. What sum of money must be divided amongst 18 men so that each man may receive £14, 6, 8¼ ?
                                    *Ans.* £258, 0, 9.

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

3. What is the difference between six dozen dozen and half a dozen dozen : and what is their sum and product?
                    *Ans.* 792 diff. 936 sum. 62208 product

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

5. There are two numbers, the greater of them is 37 times 45, and their difference 19 times 4. Required their sum and product?              *Ans.* 3254 sum. 2645685 product.

6. The sum of two numbers is 360, the less of them 144 ; what is their product and the square of their difference?
        *Ans.* 31104 product, 5184 square of their difference.

7. In an army consisting of 187 squadrons of horse, each 157 men, 207 battalions, each 560 men, how many effective soldiers, supposing that in seven hospitals there are 473 sick ?
                                    *Ans.* 144806.

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

9. A merchant had £19118 to begin trade with: for 5 years together he cleared £1086 a year; the next 4 years he made good £2715, 10, 6 a year; but the last 3 years he was in trade, had the misfortune to lose, one year with another, £475, 4, 6 a year: what was he worth at 12 years end ?                              *Ans.* £33984, 8, 6

10. In some parts of the kingdom they weigh their coals by a machine, in the nature of a steel-yard. Three of these draughts together amount to 137 Cwt. 2 qrs. 10 lb. and the

tare or weight of the waggon 13 Cwt. 1qr.: how many coals had the customer in 12 such draughts?

*Ans.* 319 Cwt. 1 qr. 12lb.

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

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

13. Admitting that I pay eight guineas and half a crown for a quarter's rent, and am allowed quarterly 15/ for repairs, what does my apartment cost me annually, and how much in 7 years?

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

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

*Ans.* £36, 12, 2.

15. A gentleman at his decease left his widow £4560; to a public charity he bequeathed £572, 10; to each of his four nephews £750, 10; to each of his four nieces £375, 12, 6; to 30 poor housekeepers ten guineas each, and 150 guineas to his executor. What sum must he have been possessed of at the time of his death to answer all these legacies?

*Ans.* £10109, 10.

16. Admit 20 to be the remainder of a division sum; 423 the quotient, the divisor the sum of both, and 19 more What was the number of the dividend? *Ans.* 1954

### *Examples of* WEIGHTS *and* MEASURES.

Multiply 9 Lb. 10 oz. 15 dwts. 19 gr. by 9.
Multiply 23 Tons, 19 cwt. 3 qrs. 18lb. by 7.
Multiply 107 Yards, 3 qrs. 2 nails, by 10.
Multiply 33 Hhds. 61 gals. 5 pints wine, by 11.
Multiply 27 Barrels beer, 2 firk. 4 gals. 3 qts. by 8.
Multiply 110 Miles, 6 fur. 26 poles, by 12.

# DIVISION

## OF SEVERAL DENOMINATIONS.

**Rule.** Divide the first denomination on the left hand ; and if any remains, multiply them by as many of the next less as make one of that, which add to the next, and divide as before.

**Proof.** By Multiplication.

| £. s. d. | £. s. d. | £. s. d. | £. s d. |
|---|---|---|---|
| 2)25 , 2 , 4 | 3)37 , 7 , 7 | 4)57 , 5 , 7 | 5)52 , 7 , 0 |
| 12,11,2 | | | |

Divide £1407 , 17 , 6 by 12, 13, 39, and 78.
Divide £70079 , 13 , 4 by 56, 112, 144, and 168.
Divide £490981 , 18 , 9 by 219, 292, 365, and 1728.
Divide £19743052 , 5 , 7½ by 810, 1260, and 7300.

### THE APPLICATION.

1. If a man spends £257,2,3 in 12 months time, what is that per month ?      *Ans.* £21,8,6¼.

2. The clothing of 35 charity boys came to £57,3,7 what is the expense of each ?      *Ans.* £1,12,8.

3. If I give £37 , 6 , 3 for nine pieces of cloth, what did I give per piece ?      *Ans.* £4,2,11.

4. If 20 Cwt. of tobacco came to £27,5,10, at what rate is that per Cwt. ?      *Ans.* £1,7,3¼.

5. What is the value of 1 hogshead of beer, when 120 are sold for £154,17,6 ?      *Ans.* £1,5,9¾.

6. Bought 72 yards of cloth for £85,5,6, I desire to know at what rate per yard ?      *Ans.* £1,3,8¼.

7. Gave £275,3,4 for 36 bales of cloth ; what is that for 2 bales ?      *Ans.* £15,5,8¼.

8. A prize of £7257,8,6 is to be equally divided amongst 500 sailors, what is each man's share ?      *Ans.* £14,10,3¼.

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

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

*Ans.* 275.

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

*Ans.* Each contributed 8/, each share £160.

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

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

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

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

*Ans.* A 4/8, B 6/8, C 8/8

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/.

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

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

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

22. Divide 1000 crowns in such a manner between A, B, and C, that A may receive 129 more than B, and B 178 less than C. *Ans.* A 360, B 231 C 409.

*Examples of* WEIGHTS *and* MEASURES.

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 hours, minutes, by 37, and 74.

## BILLS OF PARCELS.

### HOSIER'S.

*Mr. John Thomas,*                    *March 7th,* 1826

*BOUGHT of Samuel Green,*

8 Pair worsted stockings at 4/6.... £
5 Pair thread ditto...... at 3/2....
3 Pair black silk ditto .. at 14/....
6 Pair milled hose ...... at 4/2....
4 Pair cotton ditto...... at 7/6....
2 Yards fine flannel ....at 1/8....

### MERCER'S.

*Mr. Isaac Grant,*                    *March 10th,* 1826.

*BOUGHT of John Sims,*

15 Yards satin .......... at 9/6 ..£
18 Yards flowered silk ....at 17/4..
12 Yards rich brocade ....at 19/8 .
16 Yards sarcenet........ at 3/2 ..
13 Yards Genoa velvet....at 27/6..
23 Yards lutestring ......at 6/3 ..

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£ 62 , 2 , 5

## LINEN DRAPER'S

*Mr. Simon Surety,*                    *March 16th,* 1826.

### *BOUGHT of Josiah Short,*

  4 Yards cambric . . . . . . . . at 12/6 . . . £
 12 Yards muslin . . . . . . . . at 8/3 . . . .
 15 Yards printed linen. . . . at 5/4 . . . .
  2 Dozen napkins . . . . . . at 2/3 each
 14 Ells diaper . . . . . . . . . at 1/7 . . . .
 35 Ells dowlas . . . . . . . . . at 1/1½ . . . .


## MILLINER'S.

*Mrs. Bright,*                         *April 5th,* 1826

### *BOUGHT of Lucy Brown,*

 18 Yards fine lace . . . . . . at 12/3 . . . . £
  5 Pair fine kid gloves . . at 2/2 . . . .
 12 Fans French mounts . . at 3/6 . . . .
  2 Fine laced tippets . . . . at 63/ . . . .
  4 Dozen Irish lamb . . . . at 1/3 . . . .
  6 Sets of knots . . . . . . . . at 2/6 . . . .

£23 , 14 , 4


## WOOLLEN DRAPER'S.

*Mr. Thomas Sage,*                    *April 27th,* 1826.

### *BOUGHT of Ellis Smith,*

 17 Yards fine serge . . . . . . at 3/9 . . . . £
 18 Yards drugget . . . . . . . . at 9/ . . . .
 15 Yards superfine scarlet at 22/ . . . .
 16 Yards black . . . . . . . . . . at 18/ . . . .
 25 Yards shalloon . . . . . . . . at 1/9 . . . .
 17 Yards drab cloth . . . . . . at 17/6 . . . .

£59 , 5 , 0

## LEATHER SELLER'S.

Mr *George Harris*,                    *April 12th*, 1826.

### BOUGHT of *Abel Smith*,

```
 27  Calf skins. ........... at 3/9 .... £
 75  Sheep ditto .......... at 1/7 ....
 36  Coloured ditto ........ at 1/8 ....
 15  Buck ditto .......... at 11/6. ...
 17  Russia hides. ........ at 10/7. ...
120  Lamb skins ......... at 1/2½. ...
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                              £38 , 17 , 5
                              ==============

## GROCER'S

Mr *Richard Groves*,                  *April 21st*, 1826.

### BOUGHT of *Francis Elliot*,

```
25  lb. Moist sugar ....... at 6½d. .... £
 2  Loaves of double refin-⎫
      ed, weight 15 lb. .... ⎬ at 11½d.. ...
                            ⎭
14  lb. Rice ............. at 3d. ....
28  lb. Malaga raisins ..... at 5d. ....
15  lb. Currants. .......... at 5½d. ....
 7  lb. Black pepper. ..... at 1/10. ...
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## CHEESE MONGER'S.

Mr *Charles Cross*,                    *April 25th*, 1826.

### BOUGHT of *Samuel Grant*,

```
 8  lb. Cambridge butter.... at 6d. .... £
17  lb. New cheese ........ at 4d. ....
 ½  Fir. of butter, wt. 28 lb. ... at 5½d. ...
 5  Cheshire cheeses, wt. ⎫
      127 lb. .......... ⎬ at 4d. ....
                        ⎭
 2  Warwickshire do., wt.
      15 lb. ..........
12  lb. Cream cheese. ....... at 6d.
```

                              £3 , 14 , 7

## CORN CHANDLER'S.

*Mr. Abraham Doyley*                    *April 29th*, 1826.

### BOUGHT *of Isaac Jones,*

Tares, 19 bushels ...... at 1/10.. £
Pease, 18 bushels ...... at 3/9½..
Malt, 7 quarters........ at 25/ ..
Hops, 15 lb. .......... at 1/5 ..
Oats, 6 quarters........ at 18/8 .
Beans, 12 bushels...... at 4/8 ..

£23 , 7 , 4

## REDUCTION

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

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

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

*A* TABLE *of such* Coins *as are current in* ENGLAND.

|  |  |  | dwt. | grs. |
|---|---|---|---|---|
| Guinea ...... | 21/ | .. weight | 5, | 9. |
| Sovereign .... | 20/ | .... —— | 5, | 3. |
| Half Guinea .. | 10/6 | .. —— | 2, | 16. |
| Half Sovereign | 10/ | .. . —— | 2, | 13. |
| Seven shil. piece | 7/ | .... —— | 1, | 19. |
| Crown ...... | 5/ | .... —— | 18, | 4. |
| Half-crown.... | 2/6 | .... —— | 9, | 2. |
| Shilling ...... | 12 pence | —— | 3, | 15. |

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

A moidore is 27/; a mark 13/4; an angel 10/; a noble 6/8

1. In £8 how many shillings and pence?

|                          |                        |
|--------------------------|------------------------|
| 20                       | *Proof.*               |
| 160 shillings. *Ans.*    | 12˙1920 pence.         |
| 12                       | 20  160 shill.         |
| 1920 pence. *Ans.*       | £8                     |

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

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

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

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

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

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

8. In 15 crowns, how many shillings and six-pences?
            *Ans.* 75*s.* 150 six-pences.

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

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

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

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

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

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

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

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

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

18. Reduce 76 moidores into shillings and pounds.
            *Ans.* 2052*s.* £102, 12.

19 Reduce £102, 12 into shillings and moidores.
            *Ans.* 2052*s.* 76 moidores

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

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

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

23. If 103 guineas and seven shillings are to be divided amongst seven men; how many pounds sterling is that each?
*Ans.* £15 *,* 10.

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

25. A gentleman, in his will, leaves £50 to the poor, and ordered that ¼ should be given to ancient men, each to have 5*s*. : ¼ to poor women, each to have 2*s*. 6*d*. ; ¼ to poor boys, each to have 1*s*. ; ¼ to poor girls, each to have 9*d*. ; and the remainder to the person who distributed it. I demand how many of each sort there were, and what the person that distributed the money had for his trouble?

*Ans.* 66 men, 100 women, 200 boys, 222 girls, £2 *,* 13 *,* 6 to the person.

## TROY WEIGHT.

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

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

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

29. In 8 ingots of silver, each weighing 7 lb. 4 oz. 17 dwt. 15 grs. how many ounces, pennyweights, and grains?
*Ans.* 711 oz. 14221 dwt. 341304 gr.

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

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

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

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

*s.* Two of each sort; and 8 oz. 9 dwt. 9 gr. *over.*


## AVOIRDUPOIS WEIGHT.

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

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

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


*Things bought and sold by the Tale.*

| | | |
|---|---|---|
| 12 | Pieces, or things ... | 1 Doz. |
| 12 | Dozen. | Gross. |
| 12 | Gross, or 144 doz... | Great Gross. |
| 5 | Score ............ | Hundred. |
| 6 | Score ............ | Great Hundred. |
| 24 | Sheets ........... | Quire. |
| 20 | Quires ........... | Ream. |
| 2 | Reams........... | Bundle. |
| 12 | Skins of parchment . | 1 Roll. |

**34.** In 14769 ounces, how many hundred weight?
*Ans.* 8 Cwt. 27 lb. 1 oz.

**35.** Reduce 8 Cwt. 27 lb. 1 oz. into quarters, pounds, and ounces. *Ans.* 32 Qrs. 923 lb. 14769 oz.

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

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

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

**39.** In 27 Cwt. of raisins, how many parcels of 18 lb. each ?

*Ans.* 168

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

*Ans.* 1078 lb.

**41.** Bought 27 bags of hops, each 2 Cwt. 1 qr. 15 lb. and one bag of 137 lb. how many hundred is the whole?

*Ans.* 65 Cwt. 2 qr. 10 lb.

**42.** How many pounds in 27 hogsheads of tobacco, each weighing net 8¾ Cwt. ?      *Ans.* 26460.

**43.** In 552 common pounds of silk, how many great pounds?      *Ans.* 368.

**44.** How many parcels of sugar of 16 lb. 2 oz. are there in 16 Cwt. 1 qr. 15 lb ?     *Ans.* 113 par. and 12 lb. 14 oz. *over.*

**45.** In 4 hhds. of sugar, each weighing net 17 Cwt. 11 lb. how many lbs. ?      *Ans* 7660 lb.

**46.** The pressure of air upon a person of a moderate size, is said to be about 32400 lbs. ; required how many tons?

*Ans* 14 tons, 9 cwt. 1 qr. 4 lb.

## CLOTH MEASURE.

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

**48.** In 75 English ells, how many yards?

*Ans.* 93 yards, 3 qr.

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

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

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

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

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

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

## LONG MEASURE.

**55.** In 57 miles, how many furlongs and poles ?

*Ans.* 456 furlongs, 18240 poles.

**56.** In 7 miles, how many feet, inches, and barley-corns ?

*Ans.* 36960 feet, 443520 inches, 1330560 barley-corns.

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

456 furlongs, 57 miles.

58. In 72 leagues, how many yards?        *Ans.* 380160
59. In 380160 yards, how many miles and leagues?
    *Ans.* 216 miles, 72 leagues.
60. If from London to York be accounted 65 leagues, I demand how many miles, yards, feet, inches, and barley-corns?
    *Ans.* 195 miles, 343200 yards, 1029600 feet, 12355200 inches, 37065600 barley-corns.
61. How often will the wheel of a coach, that is 17 feet in circumference, turn in 100 miles?
    *Ans.* 31058 $\frac{14}{17}$ times round.
62. How many barley-corns will reach round the world, which is 360 degrees, each degree 69½ miles.
    *Ans.* 4755801600 barley-corns.

## LAND MEASURE.

63. In 27 acres, how many roods and perches?
    *Ans.* 108 roods, 4320 perches.
64. In 4320 perches, how many acres?        *Ans.* 27.
65. A person having a piece of ground containing 37 acres, 1 pole, has a mind to dispose of 15 acres to A; I require how many perches he will have left.        *Ans.* 3521.
66. There are 4 fields to be divided into shares of 75 perches each; the first field contains 5 acres; the second 4 acres 2 poles; the third 7 acres 3 roods; and the fourth 2 acres 1 rood.   How many shares are contained therein?
    *Ans.* 40 shares, 42 perches.

## WINE MEASURE.

67. Bought 5 tuns of Port wine : how many gallons and pints?        *Ans.* 1260 gallons, 10080 pints.
68. In 10080 pints, how many tuns?        *Ans.* 5.
69. In 5896 gallons of Canary, how many pipes and hogsheads, and of each a like number?
    *Ans.* 31 of each, 37 gallons over.
70. A gentleman ordered his butler to bottle off ¾ of a pipe of French wine into quarts, and the rest into pints: required how many dozen of each he had?
    *Ans* 28 dozen of each.

## ALE AND BEER MEASURE.

**71.** In 46 barrels of beer, how many pints ?　*Ans.* 13248.

**72.** In 19 barrels of ale, how many gallons and quarts ?
*Ans.* 684 gal. 2736 qt.

**73.** In 72 hogsheads of porter, how many barrels ?
*Ans.* 108.

**74.** In 108 barrels of beer, how many hogsheads ?
*Ans.* 72.

## DRY MEASURE.

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

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

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

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

## TIME.

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

**80.** How many days is it since the birth of our Saviour, to Christmas, 1825.　*Ans.* $666581\frac{1}{4}$.

**81.** Stowe writes, London was built 1108 years before our Saviour's birth, how many hours is it since to Christmas, 1825 ?
*Ans.* 25710678.

**82.** From Nov. 17th, 1824, to Sept. 12th, 1825, how many days ?　*Ans.* 299.

**83.** From July 18th, 1825, to December 27th, of the same year, how many days ?　*Ans.* 162.

**84.** From July 18th, 1799, to April 18th, 1826, how many years and days ?

*Ans.* 26 years, $9770\frac{1}{2}$ days, reckoning 365 days 6 hours a
year ; or 26 years, 9 months, 3 weeks 1 day, 6 hours.

## APPENDIX TO REDUCTION.

CONTAINING Rules and Examples for comparing the Old Measures with the new Imperial standards.

1. *To reduce the Old Wine or Spirit measure to the New gallon, and the contrary.*

RULE.—Multiply by 924, and divide by 1109 ; the quotient gives the Imperial gallons : or deduct $\frac{1}{5}$th.

Multiply by 1109, and divide by 924 ; the quotient gives the wine gallons Old measure : or add $\frac{1}{5}$th.

86. How many Imperial gallons in a pipe of wine Old measure.                              *Ans.* 105 galls.

87. In a cask of spirits containing 110 gallons measured by the Imperial gallon ; how many of the Old measure.
*Ans* 132 galls.

2. *To reduce the Old Ale or Beer gallon to the New, and the contrary.*

RULE.—Multiply by 1128, and divide by 1109 ; the quotient gives the New gallons : or add $\frac{1}{60}$th.

Multiply by 1109, and divide by 1128 ; the quotient gives the gallons of Old measure : or deduct $\frac{1}{60}$th.

88. How many Imperial gallons in 20 hogsheads of porter of Old measure ?                *Ans.* 1098$\frac{1}{2}$ gallons.

89. In 1098$\frac{1}{2}$ gallons of ale Imperial measure, how many gallons of the Old standard ?    *Ans.* 1080 gallons.

3. *To reduce Winchester measure to the Imperial standard, and the contrary.*

RULE.—Multiply by 1075, and divide by 1109 the quotient gives Imperial measure : or deduct $\frac{1}{37}$d.

Multiply by 1109, and divide by 1075 ; the quotient gives the old Winchester standard measure : or add $\frac{1}{34}$d part, or a peck to the quarter.

90. In 1320 Winchester bushels, how many of the Imperial bushels standard measure ?         *Ans.* 1280 bushels.

91. How many Winchester bushels are in 1280 Imperial bushels ?                         *Ans.* 1320 bushels.

92. How many quarters of barley of New measure are equal to 2160 bushels Winchester measure?

<div align="right">

*Ans* 261 qrs. 5¾ bushels.

</div>

<div align="center">

THE

## SINGLE RULE OF THREE DIRECT

</div>

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

Rule.—First state the question; that is, place the numbers in such order, that the first and third be of one kind, and the second the same as the number required: then bring the first and third numbers into one name, and the second into the lowest term mentioned. Multiply the second and third numbers together, and divide the product by the first; the quotient will be the answer to the question in the same denomination you left the second number in.

<div align="center">

EXAMPLES.

</div>

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

<div align="right">

*Ans.* £1 , 0 , 3.

</div>

```
   lb.    d.      lb.
    1  : 4½ : : 54       or        1 · 4½ : : 54
       4      18                              4½
      ──    ─────                          ─────
      18  4)972                             216
            ─────
          12)243
          ─────
     Ans. 20/3                       Ans. 20/3
```

2. If a gallon of beer cost 10d. what is that per barrel?
<div align="right">*Ans.* £1 , 10.</div>

3. If a pair of shoes cost 4/6, what will 12 dozen come to?
<div align="right">*Ans.* £32 , 8.</div>

4. If 1 yard of cloth cost 15/6, what will 32 yards cost at the same rate? <div align="right">*Ans.* £24 , 16.</div>

5. It 32 yards of cloth cost £24 , 16, what is the value of a yard? <div align="right">*Ans.* 15/6.</div>

6. If I give £4, 18 for 1 Cwt. of sugar, at what rate did I buy it ⅌ lb.?                              *Ans.* 10¼d.

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

8. What will 25 Cwt. 3 qrs. 14 lb. of tobacco come to at 15½d. ⅌ lb.?                    .    *Ans.* £187, 3, 3.

9. Bought 27¼ yards of muslin, at 6/9½ ⅌ yard, what does it amount to?          *Ans.* £9, 5, 0¾—2 *rem.*

10. Bought 17 Cwt. 1 qr. 14 lb. of iron, at 3¼d. ⅌ lb. what does it come to?        *Ans.* £26, 7, 0½.

11. If coffee is sold for 5½d. ⅌ ounce, what must be given for 2 Cwt.?                    *Ans.* £82, 2, 8

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

13. If 1 Cwt. of Cheshire cheese cost £1, 14, 8, what must I give for 3½ lb.?              *Ans.* 1/1.

14. Bought 1 Cwt. 24 lb. 8 oz. of old lead, at 9/4 ⅌ Cwt. what does it come to?          *Ans.* 11/4½.

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

16. If I buy 14 yards of cloth for 10 guineas, how many Flemish ells can I buy for £283, 17, 6, at the same rate?
                    *Ans.* 504 Fl. ells, 2 qrs.

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

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

19. If 1 English ell, 2 qrs. cost 4/7, what will 39½ yards cost at the same rate?        *Ans.* £5, 3, 5¼ ¼.

20. If 1 ounce of gold is worth £5, 4, 2, what is the worth of one grain?              *Ans.* 2½d.—20 *rem.*

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

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

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

24. Bought 7 yards of cloth for 17/8, what must be given for 5 pieces, each containing 27½ yards?
                    *Ans.* £17, 7, 0¼—2 *rem.*

25. If 7 oz. 11 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, 3¾ +

26. A draper bought 420 yards of broad cloth, at the rate of 14/10¾ ⅌ ell English, how much did he pay for the whole ?
*Ans.* £250, 5.

27. A gentleman bought a wedge of gold, which weighed 14 lb. 8 oz. 8 dwt. for the sum of £514, 4, at what rate did he pay for it ⅌ ounce ? *Ans.* £3.

28. A grocer bought 4 hogsheads of sugar, each weighing net 6 Cwt. 2 qrs. 14 lb. which cost him £2, 8, 6 ⅌ Cwt. what is the value of the 4 hogsheads ? *Ans.* £64, 5, 3.

29. A draper bought 8 packs of cloth, each containing 4 parcels, 10 pieces each, and each piece 26 yards, at the rate of £4, 16 for 6 yards; I desire to know what the 8 packs cost him ? *Ans.* £6656

30. If 24 lb. of raisins cost 6/6, what will 18 frails cost, each weighing net 3 qrs. 18 lb. ? *Ans.* £24, 17, 3.

31 If 1 ounce of silver be worth 5/, what is the price of 14 ingots, each weighing 7 lb. 5 oz. 10 dwt ?
*Ans.* £313, 5.

32. What is the price of a pack of wool weighing 2 Cwt 1 qr. 19 lb. at 8/6 ⅌ stone ? *Ans.* £8, 4, 6¼—10 rem

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

34. Bought 171 tons of lead, at £14 ⅌ ton, paid carriage and other incident charges £4, 10. I require the value of the lead, and what it stands me ⅌ lb. ?
*Ans.* £2398, 10 value, 1½d ⅌ lb.—432 rem.

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

36. Bought 27 dozen 5 lb. of candles, after the rate of 1/5 for 3 lb. what did they cost me ? *Ans.* £7, 15, 4¼ —1 rem.

37. If an ounce of fine gold is sold for £3, 10, what come ingots to, each weighing 3 lb. 7 oz. 14 dwt. 21 gr. at the same price ? *Ans.* £1071, 14, 5¼.

38. If my horse costs me 9½d. ⅌ day keeping, what will be the charge of 11 horses for the year ? *Ans.* £158, 18, 6½

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

*Ans.* 2143¼ yards, 14 rem. and 19 ells, 4 quarters, 2 nails in a piece—64 *rem.*

**40.** A gentleman has an annuity of £896, 17 ⅌ annum, I desire to know how much he may spend daily, that at the year's end he may lay up 200 guineas, and give to the poor quarterly 10 moidores?        *Ans.* £1, 14, 8—44 *rem.*

# THE RULE OF THREE INVERSE.

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

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

### EXAMPLES.

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

<div align="center">

men. days. men.

8 : 12 : : 16 · 6 days.

8

16)96(6 days. *Ans.*

96
</div>

**2.** If 54 men can build a house in 90 days, how many men can do the same in 50 days?        *Ans.* 97⅕ men.

**3.** If when a peck of wheat is sold for 2/ the penny loaf weighs 8 oz. how much must it weigh when the peck is worth but 1/6 ?        *Ans.* 10 oz. 10⅓ dr

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

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

6. If I lend my friend £200 for 12 months; how long ought he to lend me £150 to requite my kindness ?
*Ans.* 16 months.

7 If for 24/. I have 1200 lb. carried 36 miles; how many pounds can I have carried 24 miles for the same money ?
*Ans.* 1800 lb.

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

9. An army besieging a town, in which were 1000 soldiers, with provisions for three months; how many soldiers departed, when the provision lasted them 6 months ? *Ans.* 500.

10. If £20 worth of wine is sufficient to serve an ordinary of 100 men, when the tun is sold for £30 ; how many will £20 worth suffice, when the tun is sold but for £24 ?
*Ans.* 125 men.

11. A courier makes a journey in 24 days, when the day is but 12 hours long ; how many days will he be going the same journey, when the days are 16 hours long ? *Ans.* 18 days.

12. How much plush is sufficient for a cloak, which has in it 4 yards of 7 quarters wide of stuff for the lining ; the plush being but 3 quarters wide ? *Ans.* 9⅓ yards

13. If 14 pioneers make a trench in 18 days, of 12 hours, how many days will 32 men take to do the same ?
*Ans.* 7 days, 10 hours, 30 min.

14. Borrowed of my friend £64 for 8 months, and he hath occasion another time to borrow of me for 12 months ; how much must I lend him to requite his former kindness to me ? *Ans.* £42,13,4.

15. A regiment of soldiers, consisting of 1000 men, are to have new coats, each coat to contain 2½ yards of cloth, 5 quarters wide, and to be lined with shalloon of 3 quarters wide ; I demand how many yards of shalloon will line them ?
*Ans.* 4166 yards, 2 qrs. 2 nails—2 *rem.*

# THE DOUBLE RULE OF THREE

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

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

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

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

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

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

PROOF.—By two Single Rules of Three.

### EXAMPLES.

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

*By two single rules.* Or, *in one stating, worked thus:*

hor. bu. hor. bu.    hor.da.bu.
1. As 14 : 56 : : 20 : 80   14 : 16 : 56    $\dfrac{56 \times 20 \times 24}{14 \times 16} = 120 \ Ans.$
   days bu. hor. bu.   20 : 24 : —
2. As 16 : 80 : : 24 : 120

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

ac. da. ac. da.    me.da.ac.
1. As 12 : 14 : : 2000 : 250   8 : 14 : 112    $\dfrac{8 \times 14 \times 2000}{112 \times 10}$
   da.mem.da.mem.        
2. As 250 : 8 : : 10 : 200   — 10 : 2000    

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

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

5. If a regiment of soldiers, consisting of 136 men, consume 351 quarters of wheat in 108 days; how many quarters of wheat will 11232 soldiers consume in 56 days?
     *Ans.* 15031.

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

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

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

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

10. A family, consisting of 7 persons, drink 2 kilderkins of beer in 12 days; how many kilderkins will there be drank out by another family of 14 persons in 8 days?
     *Ans.* 2 kil. 12 gal.

11. If the carriage of 60 Cwt. 20 miles cost £14, 10; what weight can I have carried 30 miles for £5, 8, 9, at the same rate of carriage?      *Ans.* 15 Cwt.

12. If 2 horses eat 8 bushels of oats in 16 days; how many horses will eat up 3000 quarters in 24 days?      *Ans.* 4000.

13. If £100 in 12 months gain £7 interest; what is the interest of £571 for 6 years?      *Ans.* £239, 16, 4¾.

14. If I pay 10*l*. for the carriage of 2 tons for 6 miles; what must I pay for the carriage of 12 tons, 17 Cwt., 17 miles?
     *Ans.* £9, 2, 0¼.


# PRACTICE

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

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

| Of a Penny. | Of a Pound. | Of a Pound. |
|---|---|---|
| $\frac{1}{4}d.$ is $\frac{1}{4}$ | $1d.$ is $\frac{1}{240}$ | $1/.$ is $\frac{1}{20}$ |
| $\frac{1}{2}d.$ is $\frac{1}{2}$ | $1\frac{1}{2}d.$ is $\frac{1}{160}$ | $1/3$ is $\frac{1}{16}$ |
|  | $2d.$ is $\frac{1}{120}$ | $1/4$ is $\frac{1}{15}$ |
| **Of a Shilling.** | $3d.$ is $\frac{1}{80}$ | $1/8$ is $\frac{1}{12}$ |
| $1d.$ is $\frac{1}{12}$ | $3\frac{1}{2}d.$ is $\frac{1}{71}$ | $2/.$ is $\frac{1}{10}$ |
| $1\frac{1}{2}d.$ is $\frac{1}{8}$ | $4d.$ is $\frac{1}{60}$ | $2/6$ is $\frac{1}{8}$ |
| $2d.$ is $\frac{1}{6}$ | $5d.$ is $\frac{1}{48}$ | $3/4$ is $\frac{1}{6}$ |
| $3d.$ is $\frac{1}{4}$ | $6d.$ is $\frac{1}{40}$ | $4/.$ is $\frac{1}{5}$ |
| $4d.$ is $\frac{1}{3}$ | $7\frac{1}{2}d.$ is $\frac{1}{32}$ | $5/.$ is $\frac{1}{4}$ |
| $6d.$ is $\frac{1}{2}$ | $8d.$ is $\frac{1}{30}$ | $6/8$ is $\frac{1}{3}$ |
|  | $10d.$ is $\frac{1}{24}$ | $10/.$ is $\frac{1}{2}$ |

| Of a Ton. | Of a Cwt. | Of a Quarter. |
|---|---|---|
| 10 Cwt. is $\frac{1}{2}$ | 2 qrs. is $\frac{1}{2}$ | 14 lb. is $\frac{1}{2}$ |
| 5 — is $\frac{1}{4}$ | 1 — is $\frac{1}{4}$ | 7 — is $\frac{1}{4}$ |
| 4 — is $\frac{1}{5}$ | 16 lb. is $\frac{1}{7}$ | 4 — is $\frac{1}{7}$ |
| $2\frac{1}{2}$ — 's $\frac{1}{8}$ | 14 — is $\frac{1}{8}$ | $3\frac{1}{2}$ — is $\frac{1}{8}$ |
| 2 — is $\frac{1}{10}$ | 8 — is $\frac{1}{14}$ | 2 — is $\frac{1}{14}$ |
| 1 — is $\frac{1}{20}$ | 7 — is $\frac{1}{16}$ | 1 — is $\frac{1}{28}$ |

RULE 1.—*When the price is less than a Penny:* divide by the aliquot parts that are in a penny; then by 12 and 20, which will be the answer

|  |  |  |
|---|---|---|
| $\frac{1}{4}d.$ is $\frac{1}{4}$ \| $\overline{5704}$lb. at $\frac{1}{4}d.$ | 2.   7695 at $\frac{1}{2}d.$ | 4.   6547 at $\frac{3}{4}d.$ |
| 12 \| $\overline{1426}$ | *Ans.* £16,0,7$\frac{1}{2}$ | *Ans.* £20,9,2$\frac{1}{4}$ |
| 2\|0)$\overline{11}$\|8,10 | 3.   5740 at $\frac{1}{2}d.$ | 5.   4573 at $\frac{3}{4}d.$ |
| *Ans.* £5,18,10 | *Ans.* £11,19,2 | *Ans.* £14,5,9$\frac{3}{4}$ |

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

| ¼ ₁/₁₆ 2106 at 12¼d. | 16. 2915 at 1/4. | 33. 2905 at 1/8¼. |
| 43,10½ | Ans. £194,6,8 | Ans. £245,2,2¼ |

¼ ₁/₁₆ 2106 at 12¼d.
43,10½
2|0)214|9,10½
£107,9,10½

½ ₁/₁₄ 3715 at 12½d.
154,9½
2|0)386|9,9½
£193,9,9½

3. 2712 at 12¾d.
Ans. £144,1,6

4. 2107 at 1/1.
Ans. £114,2,7

5. 3215 at 1/1¼.
Ans. £177,9,10¾

6. 2790 at 1/1½.
Ans. £156,18,9

7. 7904 at 1/1¾.
Ans. £452,16,8

8 3750 at 1/2.
Ans. £218,15

9. 3291 at 1/2¼.
Ans. £195,8,0¾

10. 9254 at 1/2½.
Ans. £559,1,11

11. 7250 at 1/2¾.
Ans. £445,11,5½

12. 7591 at 1/3.
Ans. £474,8,9

13. 6325 at 1/3¼.
Ans. £401,18,0¼

14. 5271 at 1/3½.
Ans. £340,8,4¼

15. 3254 at 1/3¾.
Ans. £213,10,10½

16. 2915 at 1/4.
Ans. £194,6,8

17. 3270 at 1/4¼.
Ans. £221,8,1½

18. 7059 at 1/4½.
Ans. £485,6,1½

19. 2750 at 1/4¾.
Ans. £191,18,6½

20. 3725 at 1/5.
Ans. £263,17,1

21. 7250 at 1/5¼.
Ans. £521,1,10½

22. 2597 at 1/5½.
Ans. £189,7,3½

23. 7210 at 1/5¾.
Ans. £533,4,9½

24. 7524 at 1/6.
Ans. £564,6

25. 7103 at 1/6¼.
Ans. £540,2,5¾

26. 3254 at 1/6½.
Ans. £250,16,7

27. 7925 at 1/6¾.
Ans. £619,2,9¾

28. 9271 at 1/7.
Ans. £733,19,1

29. 7210 at 1/7¼.
Ans. £578,6,0½

30. 2310 at 1/7½.
Ans. £187,13,9

31. 2504 at 1/7¾.
Ans. £206,1,2

32. 7152 at 1/8.
Ans. £596

33. 2905 at 1/8¼.
Ans. £245,2,2¼

34. 7104 at 1/8½.
Ans. £606,16

35. 1004 at 1/8¾.
Ans. £86,16,1

36. 2104 at 1/9.
Ans. £184,2

37. 2571 at 1/9¼.
Ans. £227,12,9¾

38. 2104 at 1/9½.
Ans. £188,9,8

39. 7506 at 1/9¾.
Ans. £680,4,7½

40. 1071 at 1/10.
Ans. £98,3,6

41. 5200 at 1/10¼.
Ans. £482,1,8

42. 2117 at 1/10½.
Ans. £198,9,4½

43 1007 at 1/10¾.
Ans. £95,9,1¼

44. 5000 at 1/11.
Ans. £479,3,4

45. 2105 at 1/11¼.
Ans. £203,18,5¼

46. 1006 at 1/11½.
Ans. £98,10,1

47. 2705 at 1/11¾.
Ans. £267,13,7¾

48. 5000 at 1/11½.
Ans. £489,11,8

49. 4000 at 1/11¾.
Ans. £395,16,8

RULE 4.—*When the price consists of any even number of Shillings under* 20: multiply the given quantity by half the

price, doubling the first figure of the product for shillings and the rest of the product will be pounds.

| | | | |
|---|---|---|---|
| 1. | 2750 at 2/. Ans. £275 | 5. 2102 at 10/. Ans. £1051 | 9. 1075 at 16/. Ans. £860 |
| 2. | 3254 at 4/. Ans. £650,16 | 6. 2101 at 12/. Ans. £1260,12 | 10. 1621 at 18/. Ans. £1458,18 |
| 3. | 2710 at 6/. Ans. £813 | 7. 5271 at 14/. Ans. £3689,14 | *Note.*When the price is 10/. take half of |
| 4. | 1572 at 8/. Ans. £628,16 | 8. 3123 at 16/. Ans. £2498,8 | the quantity, and if any remains,it is 10/. |

RULE 5.—*When the price consists of odd Shillings:* multiply the given quantity by the price, and divide by 20, the product will be the answer.

| | | | |
|---|---|---|---|
| 1. | 2703 at 1/. Ans. £135,3 | 4. 2715 at 7/. Ans. £950,5 | 8. 2150 at 15/. Ans. £1612,10 |
| 2. | 3270 at 3/. <br> 3 <br> 2\|0)981\|0 <br> Ans. £490,10 | 5. 3214 at 9/. Ans. £1446,6 <br> 6. 2710 at 11/. Ans. £1490,10 | 9. 3142 at 17/. Ans. £2670,14 <br> 10. 2150 at 19/. Ans. £2042,10 |
| 3. | 3271 at 5/. Ans. £817,15 | 7 3179 at 13/. Ans. £2066,7 | 11. 7157 at 19/. Ans. £6799,3 |

*Note.*—When the price is 5/. divide the quantity by 4, and the remainder (if any) multiplied by 5 will be shillings.

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

| 6/8 | ¼ | 1. 2710 at 6/8. Ans. £903,6,8 | 4. 7150 at 1/8. Ans. £595,16,8 |
|---|---|---|---|
| | | 2. 3150 at 3/4. Ans. £525 | 5. 3215 at 1/4. Ans. £214,6,8 |
| | | 3. 2715 at 2/6. Ans. £339,7,6 | 6. 7211 at 1/3. Ans. £450,13,9 |

| 2d. | ¼ | 7. 2710 at 3/2. | 13. 7152 at 17/6¾. |
|---|---|---|---|
| | | 3 | Ans. £6280 , 7 |
| | | ———— | |
| | | 8130 | 14. 2510 at 14/7¼. |
| | | 451 , 8 | Ans. £1832 , 16 , 5½ |
| | 2\|0 | )858\|1 , 8 | 15. 3715 at 9/4½. |
| | | ———— | Ans. £1741 , 8 , 1½ |
| | | £429 , 1 , 8 | |
| | | | 16. 2572 at 13/7½. |
| | | 8. 7514 at 4/7. | Ans. £1752 , 3 , 6 |
| | | Ans. £1721 , 19 , 2 | |
| | | | 17. 7251 at 14/8¼. |
| | | 9. 2517 at 5/3. | Ans. £5324 , 19 , 0¾ |
| | | Ans. £660 , 14 , 3. | |
| | | | 18. 3210 at 15/7¾. |
| | | 10. 2547 at 7/3¼. | Ans. £2511 , 3 , 1½ |
| | | Ans. £928 , 11 , 10½ | |
| | | | 19. 2710 at 19/2½. |
| | | 11. 3271 at 5/9½. | Ans. £2602 , 14 , 7 |
| | | Ans. £947 , 4 , 6½ | |
| | | | 20. 1975 at 16/3¾. |
| | | 12. 2103 at 15/4½. | Ans. £1610 , 17 , 2¼ |
| | | Ans. £1616 , 13 , 7½ | |

RULE 7.—*When the price is Pounds and Shillings:* multiply the quantity by the pounds, and proceed with the shillings, if they are even, as in the 4th Rule; if odd, take the aliquot parts, add them together, the sum will be the answer.

*Note.*—1. When pounds, shillings, and pence, and the shillings and pence the aliquot parts of a pound, multiply the quantity by the pounds, and take parts for the rest.

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

*When the given quantity is no more than three figures* proceed as in Compound Multiplication.

| 4/. | .. 7215 at £7 , 4. | 2/. | ⊤₀ | 3. 2104 at £5 , 3. |
|---|---|---|---|---|
| | 7£ | | | 5£ |
| | ———— | | | ———— |
| | 50505 | | | 10520 |
| | 1443 | 1/. | ½ | 210 , 8 |
| | ———— | | | 105 , 4 |
| | £51948 *Ans.* | | | ———— |
| | | | | £10835 , 12 *Ans* |

|  |  |  |  |  |  |
|---|---|---|---|---|---|

3. 2107 at £2 , 8.
  Ans. £5056 , 16

4. 7156 at £5 , 6.
  Ans. £37926 , 16

*6d.* ½ 5. 2710 at £2 , 3 , 7½.
  43/.

  116530
  1355
  338 , 9

1½d. ¼ 2|0 11822|3 , 9
  £5911 , 3 , 9

6. 3215 at £1 , 17.
  Ans. £5947 , 15

7. 2107 at £1 , 13.
  Ans. £3476 , 11

8. 3215 at £4 , 6 , 8.
  Ans. £13931 , 13 , 4

9. 2154 at £7 , 1 , 3.
  Ans. £15212 , 12 , 6

10. 2701 at £2 , 3 , 4.
  Ans. £5852 , 3 , 4

11. 2715 at £1 , 17 , 2½
  Ans. £5051 , 0 , 7½

12. 2157 at £3 , 15 , 2¼.
  Ans. £8108 , 19 , 5¼

13. 3210 at £1 , 18 , 6¾.
  Ans. £6189 , 5 , 7½

14. 2157 at £2 , 7 , 4½.
  Ans. £5109 , 7 , 10½

15. 142 at £1 , 15 , 2¾.
  Ans. £250 , 2 , 6½

16. 95 at £15 , 14 , 7¼.
  Ans. £1494 , 7 , 4¾

17. 37 at £1 , 17 , 5¾.
  Ans. £73 , 0 , 8¾

18. 2175 at £2 , 15 , 4½.
  Ans. £6022 , 0 , 7½

19. 2150 at £17 , 16 , 1½.
  Ans. £38283 , 8 , 9

20. 999 at £9 , 19 , 11¾
  Ans. £9988 , 19 , 2¼

RULE 8.—*When the price and quantity given are of several denominations:* multiply the price by the integers, and take parts of the price for the lower denominations.

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

qrs.
  2      £3 , 17 , 6      5 × 5 = 25
        5

       19 , 7 , 6
        5

lb.    96 , 17 , 6   = 25 Cwt.
  14    1 , 18 , 9   =  2 qrs.
        0 , 9 , 8¼  = 14 lb.
       £99 , 5 , 11¼ *Answer.*

*Cwt.qrs.lb.*                    *Answers.*
2. What cost 13 , 1 , 7 of molasses at 32/4 .. £21 , 10 , 5¼
3. —— 18 , 2 , 8 pearl ashes at 45/6 .... 42 , 5

|          | *Cwt. qrs. lb.* | *Answers.* |
|---|---|---|

4. What cost 21 ₁ 3 ₁ 14 starch at 56/8 ...... £61 ₁ 19 ₁ 7

5. ——— 32 ₁ 1 ₁ 16 soap at 65/11 ...... 106 ₁ 15 ₁ 2¾

6. ——— 43 ₁ 2 ₁ 21 madder at 79/4 .... 173 ₁ 5 ₁10½

7. At £3 ₁ 14 ₁ 8 ℔ Cwt. ; what cost 17 Cwt. 1 qr. 11 lb. of cheese ?          *Ans.* £64 ₁ 15 ₁ 4.

8. Sold 85 Cwt. 1 qr. 10 lb. of butter at £4 ₁ 6 ₁ 4 ℔ Cwt. ; how much does it come to ?      *Ans.* £368 ₁ 7 ₁ 7½

9. Hops at £4 ₁ 5 ₁ 8 ℔ Cwt. ; what must be given for 72 Cwt. 1 qr. 18 lb. ?       *Ans.* £310 ₁ 3 ₁ 2.

10. What is the value of 27 Cwt. 2 qr. 15 lb. of Malaga raisins, at £2 ₁ 6 ₁ 8 ℔ Cwt. ?      *Ans.* £64 ₁ 9 ₁ 7.

11. Bought 78 Cwt. 3 qr. 12 lb. of Zante currants, at £2 ₁ 17 ₁ 9 ℔ Cwt. ; what is the amount of the bill ?
                *Ans.* £227 ₁14.

12. Sold 56 Cwt. 1 qr. 17 lb. of sugar, at £2 ₁15 ₁9 the Cwt. ; what does it come to ?      *Ans.* £157 ₁4 ₁4½.

13. Tobacco at £3 ₁17 ₁10 the Cwt. ; what is the value of 97 Cwt. 15 lb ?         *Ans.* £378 ₁0 ₁3.

14. At £4 ₁14 ₁6 the Cwt. ; what is the value of 37 Cwt. 2 qrs. 13 lb. of refined sugar ?     *Ans.* £177 ₁14 ₁8½.

15. Bought sugar at £3 ₁14 ₁6 the Cwt. ; what did I give for 15 Cwt. 1 qr. 10 lb. ?     *Ans.* £57 ₁2 ₁9.

16. At £4 ₁15 ₁4 the Cwt. ; find the value of 172 Cwt. 3 qrs. 12 lb. of Dutch madder.    *Ans.* £823 ₁19 ₁0¼.

17. Soap at £3 ₁11 ₁6 the Cwt. ; what is the value of 53 Cwt. 17 lb. ?       *Ans.* £190 ₁0 ₁4.

18. How much is the import duty on 45 Tons, 17 Cwt. 2 qrs. of Foreign iron, at £7 ₁18 ₁4 ℔ Ton? *Ans.* £363 ₁3 ₁6½.

*Allowances made on the Weight of Goods.*

### Tare, Tret, *and* Cloff.

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

At so much ℔ box, barrel, &c.

At so much ℔ Cwt. or ℔ 100 lb.

At so much in the gross weight.

Tret is an allowance of 4 lb. in every 104 lb., or $\frac{1}{26}$th for waste, dust, &c., made by the merchant to the buyer.

Cloff is an allowance of 2 lb. for every 3 Cwt., or $\frac{1}{168}$th part for waste on a few articles, but is now very seldom made.

Gross Weight is the whole weight of any sort of goods, and that of the package

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

Net Weight is what remains after all allowances are deducted, and is that at which the price is charged.

Rule 1.—*When the Tare is at so much ℔ bag, barrel, &c.:* multiply the number of bags, barrels, &c. by the tare, and subtract the product from the gross, the remainder is the net.

1. In 7 frails of raisins, each weighing 5 Cwt. 2 qrs. 5 lb. gross, tare at 23 lb. ℔ frail, how much net weight ?

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

|  | *Cwt. qr. lb.* |  | *Cwt. qr. lb.* |
|---|---|---|---|
| 23 lb. | 5 , 2 , 5 | Or, | 5 , 2 , 5 |
| 7 frails. | 7 | ℔ frail | 23 lb. |
| 28)161(5 qrs. | 38 , 3 , 7 = gross. | net | 5 , 1 , 10 |
| 140  1 , 1 | 1 , 1 , 21 = tare. | frails | 7 |
| 21    Cwt. | 37 , 1 , 14 net. | Cwt. | 37 , 1 , 14 |

2. What is the net weight of 25 hogsheads of tobacco, weighing gross 163 Cwt. 2 qrs. 15 lb. tare 100 lb. ℔ hogshead? *Ans.* 141 Cwt. 1 qr. 7 lb.

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

Rule 2.—*When the Tare is at so much in the whole gross weight :* subtract the given tare from the gross, the remainder is the net.

4. What is the net weight of 5 hogsheads of tobacco, weighing gross 75 Cwt. 1 qr. 14 lb. tare in the whole 752 lb. ? *Ans.* 68 Cwt. 2 qrs. 18 lb.

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

Rule 3.—*When the Tare is at so much ℔ Cwt. :* divide the weight by the aliquot parts of a Cwt. which subtract from the gross, the remainder is the net.

6. What is the net weight of 18 butts of currants, each 8 Cwt. 2 qrs. 5 lb. tare at 14 lb. ℔ Cwt.?

$$
\begin{array}{r}
Cwt.\ qr.\ lb. \\
8\ ,2\ ,\ 5 \\
9 \times 2 = 18 \\
76\ ,3\ ,17 \\
2 \\
14\ lb. =\ \tfrac{1}{4})\overline{153\ ,3\ ,\ 6} \\
19\ ,0\ ,25\tfrac{1}{2} \\
\end{array}
$$

*Ans* Cwt. $\overline{134\ ,2\ ,\ 8\tfrac{3}{4}}$ net weight.

7. In 25 barrels of figs, each 2 Cwt. 1 qr. gross, tare 16 lb. ℔ Cwt., how much net weight?      *Ans.* 48 Cwt. 24 lb.

8. What is the net weight of 9 hogsheads of nutmegs, each weighing gross 8 Cwt. 3 qrs. 14 lb. tare 16 lb ℔ Cwt.?
*Ans.* 68 Cwt. 1 qr. 24 lb.

**Rule 4.**—*When Tret is allowed with Tare:* divide the lbs. suttle by 26, the quotient is the tret, which subtract from the suttle, the remainder is the net.

9. In a cask of currants, weighing 12 Cwt. 2 qrs. 24 lb. gross, tare 14 lb. ℔ Cwt. tret 4 lb. ℔ 104 lb.; how many lbs. net?

| $Cwt.\ qr.\ lb.$ | Short way of reducing Cwts. |
|---|---|
| 12 ,2 ,24 | into lbs. by *Addition.* |
| 4 | 12 ,2 ,24 |
| 50 | 12 |
| 28 | 12 |
| 14 lb. = $\tfrac{1}{4}$)1424 gross. | 12,80 = 2 qr. 14 lbs. |
| 178 tare. | 1424 lbs. |
| $\tfrac{1}{16}$)1246 suttle. | |
| 47 tret. | |

*Ans.*   1199 lbs. net.

10. In 7 Cwt. 3 qrs. 27 lb. gross, tare 36 lb. tret 4 lb. ℔ 104 lb.; how many lbs. net?      *Ans.* 826 lb.

11. 152 Cwt. 1 qr. 3 lb. gross, tare 10 lb. ℔ Cwt. tret 4 lb. ℔ 104 lb.; how much net weight? *Ans.* 133 Cwt. 1 qr. 11 lb.

**Rule 5.**—*When Cloff is allowed:* multiply the Cwt. suttle by 2, divide the product by 3, the quotient will be the pounds cloff, which subtract from the suttle, the remainder gives the net.

12. What is the net weight of 3 hogsheads of tobacco

weighing 15 Cwt. 3 qrs. 20 lb. gross, tare 7 lb. ℔ Cwt. tret 4 lb. ℔ 104 lb. cloff 2 lb. for 3 Cwt. ? *Ans.* 14 Cwt. 1 qr. 3 lb

$$Cwt.\ qr.lb.$$
$$7\ \text{lb.} = \tfrac{1}{16})\overline{15,3,20}\quad \text{gross.}$$
$$3,27\tfrac{1}{2}\quad \text{tare.}$$
$$\tfrac{1}{16})\overline{14,3,20\tfrac{1}{2}}\quad \text{suttle.}$$
$$2,\ 8\quad \text{tret.}$$
$$\tfrac{1}{16}\,\tfrac{1}{4})\overline{14,1,12\tfrac{1}{2}}\quad \text{suttle.}$$
$$9\tfrac{1}{2}\quad \text{cloff.}$$
$$\textit{Ans.}\ \overline{14,1,\ 3}\quad \text{net weight.}$$

13. In 7 hogsheads Virginia tobacco, weighing each 5 Cwt. 2 qr. 7 lb. tare 8 lb. ℔ Cwt. and the usual tret and cloff, how many lbs. net ? *Ans.* 3780 lbs.

14. What is the net weight of 72 bales cotton, weighing 241 Cwt. 6 lb. draft 1 lb. ℔ bale, tare 4 lb. ℔ 100 lb. and the value at 1/3¾ ℔ lb. net ? *Ans.* net 230 Cwt. 3 qr. 5 lbs. value £1696,6,9¾.

15. Find the net weight and price of 9 casks madder, weighing 85 Cwt. 3 qr. 22 lb. draft 4 lb. ℔ cask, and tare 10 lb. ℔ Cwt. at 4 guineas ℔ Cwt. ?
*Ans.* 77 Cwt. 3 qr. 26 lb. net, price £327,10,6

# COMMISSION

Is an allowance of so much ℔ Cent. to a Factor or Agent, employed in buying or selling goods, or transacting business in general, for their employers.

RULE.—Multiply the sum by the rate ℔ Cent., and divide by 100. If a fraction is annexed to the rate, take a proportional part for it.

Or, which is often shorter: *Take aliquot parts of* 100 *for the rate.*

1. What is the Commission on £287,10, at 3½ ℔ Cent. ?

$\frac{1}{2}$ . . £287 , 10          *Or, by aliquot parts.*

          3$\frac{1}{2}$ rate.        $\frac{1}{100}$, $\frac{1}{40}$)287 , 10 , 0

          862 , 10              7 , 3 , 9 = 2$\frac{1}{2}$ ℙ Ct.

          143 , 15              2 , 17 , 6 = 1 ℙ Ct.

     £10,06 , 5        *Proof* £10 , 1 , 3

          20

          1,25

          12

          3,        *Ans.* £10 , 1 , 3

     ℙ *Cent.*                    ℙ *Cent.*

*Note.* For 1$\frac{1}{4}$ take $\frac{1}{80}$ of the sum. | For 3$\frac{1}{2}$ take $\frac{1}{10}$ of the sum.

     2  take $\frac{1}{50}$ of the sum. | 4  take $\frac{1}{25}$ of the sum.

     2$\frac{1}{2}$ take $\frac{1}{40}$ of the sum. | 5  take $\frac{1}{20}$ of the sum.

2. Find the Commission on £987 , 15, at 1$\frac{1}{4}$ ℙ Cent.

          *Ans.* £12 , 6 , 11$\frac{1}{4}$.

3. Find the Commission on £876 , 5, at 1$\frac{1}{2}$ ℙ Cent.

          *Ans.* £13 , 2 , 10$\frac{1}{2}$.

4. Find the Commission on £765 , 10 , 5, at 2 ℙ Cent.

          *Ans.* £15 , 6 , 2$\frac{1}{4}$.

5. Find the Commission on £654 , 12 , 6, at 2$\frac{1}{4}$ ℙ Cent.

          *Ans.* £14 , 14 , 7.

6. Find the Commission on £1276 , 15, at 2$\frac{1}{2}$ ℙ Cent.

          *Ans.* £31 , 18 , 4$\frac{1}{2}$.

7. Find the Commission on £1025 , 17 , 6, at 3$\frac{1}{2}$ ℙ Cent.

          *Ans.* £34 , 3 , 11.

8. Find the Commission on £903 , 6 , 8, at 3$\frac{1}{2}$ ℙ Cent.

          *Ans.* £31 , 12 , 4.

9. Find the Commission on £1368 , 18 , 4, at 3$\frac{3}{4}$ ℙ Cent.

          *Ans.* £51 , 6 , 8$\frac{1}{4}$.

10. Find the Commission on £997 , 14 , 2, at 4 and 5 ℙ Cent.

 *Ans.* At 4 ℙ Cent. £39 , 18 , 2, and £49 , 17 , 8$\frac{1}{2}$ at 5 ℙ Cent.


## BROKERAGE

   Is an allowance to a Broker, or person employed to settle
the prices and terms of purchases and sales of goods, nego-
tiate bills, or effect insurances, &c.

   RULE.—Divide the sum by 100; the quotient is to £1 ℙ
Cent., of which take aliquot parts for the given rate.

   11. What is the Brokerage on £2575 , 17 , 6, at 5/. or $\frac{1}{4}$ ℙ
Cent.?

25,75,17,6       5/..¼)25,15,2 = 1 ⅌ Cent.
     20            *Ans.* £6, 8,9½
  ─────
  15,17
    12
  ─────
  2,10

12. What is the Brokerage on £9125, at ⅛ ⅌ Cent.?
*Ans.* £11,8,1½.

13. What is the Brokerage on £7283,6,8, at ¼ ⅌ Cent.?
*Ans.* £18,4,2.

14. What is the Brokerage on £1826,15, at ⅓ ⅌ Cent.?
*Ans.* £6,1,9¼.

15. What is the Brokerage on £3650,18,4, at ½ ⅌ Cent.?
*Ans.* £18,5,1

16 What is the Brokerage on £2195,10, at ¾ ⅌ Cent.?
*Ans.* £16,9,4.

17. What is the Brokerage on £1987,5, at ⅞ ⅌ Cent.?
*Ans.* £17,7,9.

### *Promiscuous Questions.*

18. A broker procures sales for his employer to the amount of £2752,10; how much does his allowance come to at ½ ⅌ Cent.? *Ans.* £13,15,3.

19. A broker negotiates bills for A B to the amount of £36622,10, at 6/8 ⅌ £100; how much does his allowance come to? *Ans.* £122,1,6

20. An agent sold goods to the amount of £2520,16,8; how much will his commission come to at 2 ⅌ Cent.?
*Ans.* £50,8,4.

21. An agent purchases for his employer goods to the value of £937,10; how much is his commission at 3¼ ⅌ Cent.? *Ans.* £30,9,4½.

22. Sent my employer in Jamaica an account sales of sugar, which sold for £2750,18,9; commission 2½ ⅌ Cent.; brokerage ½ ⅌ Cent.; duty and charges £935,7,6: how much will the net proceeds of the sales come to?
*Ans.* £1733,0,8½.

## INSURANCE

Is a contract in which the *Underwriter* engages to repay the losses on specified property, sustained by the *Insured*, in consideration of a certain allowance ⅌ Cent., called the *Premium.*

*Note.*—The paper or parchment containing the contract is called the *Policy.*

Rule.—Calculate as in Commission, and when the rate is given in guineas ℔ *Cent.*, add $\frac{1}{70}$th part to the answer.

1. What should be paid for insuring £1250 at 1¼ guineas ℔ Cent. on goods from London to Leith, policy 32/6 ?

*Ans.* £18 , 0 , 7½.

2. Insured £6500 on house and goods, at the Union Fire Office, at 7/6 ℔ Cent., government duty 2/6 ℔ Cent.

*Ans.* £32 , 10.

3. How much should be paid for insuring £3900 on goods from London to Jamaica, at 3¾ guineas, policy 5/6 ℔ Cent. ?

*Ans.* £164 , 5 , 9.

## STOCKS.

The Stocks, or public funds, are debts of Government created by loans, for which interest is paid from revenues set apart for the purpose.

Rule.- -1. *To find the value of a given quantity of stock :* multiply the quantity by the rate or price, and divide by 100.

2. *To find the quantity of stock which can be purchased for a given sum :* multiply the value by 100, and divide by the rate or price.

*Note.*—Brokers are usually employed in transfers of *stock,* who charge ⅛ ℔ cent., or 2/6 on every £100 of *stock* bought or sold.

1. What is the cost of £800 stock, Three ℔ Cent. Consols, at 72¼ ℔ Cent. ; brokerage ⅛ ? *Ans.* £582.

2. Find the cost of £1250 Four ℔ Cents. at 79¼ ; brokerage ⅛ ℔ Cent. *Ans.* £992 , 3 , 9.

3. What quantity of Three ℔ Cent. Consols will £582 purchase at 72⅛ ; brokerage ⅛ ℔ Cent. ? *Ans.* £800.

4. What cost £185 stock in the Navy Five ℔ Cents. purchased at 95⅞ ; brokerage ⅛ ℔ Cent. ? *Ans.* £176 , 13 , 6.

5. What is the value of £1250 Bank stock at 175½ ℔ Cent. ?

*Ans.* £2193 , 15.

6. How much India stock can be purchased for £2583, at 215¼ ℔ Cent. ? *Ans.* £1200 stock.

7. What rate of interest has a person for his money in the South Sea stock at 71¼ ℔ Cent. ; the yearly dividends being 3¼ ℔ Cent. ? *Ans.* 4⅝ ℔ Cent.

## SIMPLE INTEREST.

INTEREST is the allowance given by the borrower to the lender for the use of his money. It is reckoned at a certain rate on every £100 for a year.

The money lent is called the *Principal*, and when the interest is added to it, the sum is called the *Amount.*

### CASE I.—*To find the Interest for Years.*

RULE.—Multiply the principal by rate ⅌ Cent.; the quotient divided by 100, gives the interest for *one year*, which multiply by the number of years.

### *Examples.*

1. What is the interest of £375 for three years, at 5 ⅌ Cent. ⅌ annum?

| £375 | then £18,15 = 1 year. |
|---|---|
| 5 rate. | 3 years. |
| 18,75 | £56,5 *Ans.* |
| 20 | |
| 15,00 | |

#### A SHORT RULE.

Multiply the rate and time together, and take aliquot parts of 100 for the product, considered as the rate ⅌ Cent.

2. Find the interest of £432,5 for 3¾ years, at 4 ⅌ Cent.

⅌ Ct. Yrs.          10 ⅌ Cent. = ₁₀) 432, 5,0

4 × 3¾ = 15 ⅌ Cent.  5 ditto    = ½  43, 4,6

                                  21,12,3

                         *Ans.* £64,16,9

*Note.*—When the product of the *Rate* and *Time* amounts

| To 10. take ₁₀ of the sum. | To 25. take ¼ of the sum. |
|---|---|
| 12½. take ⅛ | 33⅓. take ⅓ |
| 20. take ⅕ | 50. take ½ |

If the product is not any of these aliquot parts, it may easily be divided: thus for 15, in the above example, we take ₁₀ for 10 ⅌ Cent., and ½ of 10 for 5, and add them for 15: or we might have taken ⅛ for 12½, and ⅖ for 2½, which would also give 15.

3. Find the interest of £365,10,5 for 2 years, at 5 ⅌ Cent.                    *Ans.* £36,11 0½

4. What is the interest of £214,7,11 for 1 year, at 5 Cent.?                              *Ans.* £10,14,4¾

5. What is the interest of £945,10 for 1 year, at 4 Cent.?                               *Ans.* £37,16,4⅝

6. Find the interest of £456,11,8 for 2½ years, at 5 Cent.                                *Ans.* £57,1,5½.

7. Find the interest of £780,15,10 for 5 years, at 4 ℔ Cent.                               *Ans.* £156,3,2.

8. Find the interest of £654,12,6 for 5 years, at 5 ℔ Cent.                              *Ans.* £163,13,1⅟₄.

9. Find the interest of £576,18,9 for 8⅓ years, at 4 ℔ Cent.                              *Ans.* £192,6,3.

10. Find the interest of £395,7,10 for 12½ years, at 4 ℔ Cent.                          *Ans.* £197,13,11.

11. What is the interest of £547,15, at 5 ℔ Cent. for 3 years?                               *Ans.* £82,3,3.

12. What is the interest of £254,17,6 for 5 years, at 4 ℔ Cent.?                             *Ans.* £50,19,6.

13. What is the interest of £556,13,4, at 5 ℔ Cent. for 5 years?                              *Ans.* £139,3,4.

14. What is the interest of £547,2,6 for 5 years and a half, at 4 ℔ Cent. ?                     *Ans.* £120,7,4.

15. Required the interest of £257,5,10, at 4 ℔ Cent. for a year and three quarters.              *Ans.* £18,0,2¼.

16. Required the interest of £479,5 for 5 years and one quarter, at 5 ℔ Cent.                   *Ans.* £125,16,0¾.

17. Required the interest of £576,2,6 for 7¼ years, at 4½ ℔ Cent.                            *Ans.* £187,19,2¼.

18. Required the interest of £279,13,8, at 5¼ ℔ Cent. for 3 years and a half.                     *Ans.* £51,7,10.

19. Required the interest of £554,10 for 3 months, at 4 ℔ Cent.                              *Ans.* £5,10,10¾.

20. Required the interest of £737,10 for half a year, at 5 ℔ Cent.                              *Ans.* £18,8,9.

### CASE II.—*To find the Interest for Days.*

RULE.—1. Multiply the sum by the number of days, and divide the product by 365 for the interest in *Shillings*, or by 7300 for the interest in *Pounds at* 5 ℔ *Cent. ;* and for any other rate take a proportional part.

2. *For any rate* ℔ *Cent.;* Multiply by the days, and by *double the rate;* and divide by 73000

*Note.*—When the time is given in weeks,* reduce them to days, and proceed as above.

*Examples.*

**21. What is the interest of £240 for 120 days, at 4 ⅌ Cent.**

£240          *Method* 1
120 days.

365)28800(÷)78/11  interest at 5 ⅌ Cent.
2555  off 15/9¾      —    1    —
─────  ─────
3250   63/1¼  or £3,3,1¼ *Ans.*
2920  ═════
─────
3|0†)33|0
─────
*nearly.*

*Method* 2.
£240
120 da.
─────
28800
8 *double rate*
─────
730|00)2304|00(£3,3,1¼ as before
2190    ═════
─────
114
20
─────
2280
219
─────
9
12
─────
108
73
─────
35
4
─────
140
73
─────
67

* The calculation of interest, by allowing only 52 weeks to the year, is inaccurate, as 52¼ weeks make a year. It may also be remarked, that stating questions of this kind by the Rule of Three, would appear to the man of business, or practical accountant, truly ludicrous.

† After the shillings are obtained we may divide the remainder by 30, which is the $\frac{1}{12}$th part of the divisor (365.) This saves the trouble of multiplying by 12 and 4, for the *pence* and *farthings*.

22. Find the interest on £408,10 for 30 days, at 5 ⅌ Cent.                                   *Ans.* £1,13,6¾.

23. Find the interest on £657,5 for 36 days, at 5 ⅌ Cent.                                   *Ans.* £3,4,9¾.

24. Find the interest on £584,10 for 42 days, at 5 ⅌ Cent.                                   *Ans.* £3,7,3.

25. What is the interest on £510,12,6 for 56 days, at 4 ⅌ Cent.?                             *Ans.* £3,2,8.

26. What is the interest on £436,15 for 64 days, at 4 ⅌ Cent.?                               *Ans.* £3,1,3.

27. Required the interest on £291,17,6 for 72 days, at 3 ⅌ Cent.                             *Ans.* £1,14,6½.

28. Required the interest on £219,18 for 84 days, at 4½ ⅌ Cent.                              *Ans.* £2,5,6½.

29. Required the interest on £197,10 for 120 days, at 3½ ⅌ Cent.                             *Ans.* £2,5,5¼.

*Note.*—In finding the number of days, from one period to another, the day computed *from* is not reckoned, but the day computed *to* is included: and in leap years 29 days are reckoned in February.

30. What is the interest on £320 from 20th May till 11th July following, at 5 ⅌ Cent.?       *Ans.* £2,5,7.

31. How much interest is due on £400 lent at 4 ⅌ Cent., from 1st March till 1st June, 1825?  *Ans.* £4,0,8.

32. A person borrowed 500 guineas on the 4th March, 1824, which he repaid on the 28th July, 1825, with interest at 5 ⅌ Cent.: how much did he pay?       *Ans.* £561,15.

Case III.—*To find how much interest is due on a debt which has been paid by instalments.*

Rule.—Multiply the principal and the successive balances by the number of days between the times of payment: the sum of the quotients, divided by 7300, gives the interest at 5 ⅌ Cent.

### Examples.

33. On the 2d February I lent a person £350, which he repaid as follows: £80 on the 15th May, £150 on the 1st August, and £120 on the 11th November: how much interest is due to me, at 5 ⅌ Cent.?

                                    Days.    Products.
Feb.   2. Lent ...... £350 × 102  =  35700
May   15. Received...     80
                        ‾‾‾‾
                         270 × 78  =  21060
August 1. Received...    150
                        ‾‾‾‾
                         120 × 102 =  12240
Nov.  11. Rec. balance   120      73|00)690|00(£9,9 *Ans.*
                                          657
                                         ‾‾‾‾
                                           33
                                           20
                                         ‾‾‾‾
                                          660
                                          657
                                         ‾‾‾‾
                                            3

**34.** How much interest, at 5 ⅌ Cent., is due on a bill of
£170, payable on 12th August, 1825, of which £54 was paid
on the 18th September, £56 on 17th October, and the balance
on the 16th November?                *Ans.* £1,11,4½.

**35.** Borrowed £420 on Lady day, at 4 ⅌ Cent., which I
paid back as follows: at Midsummer £100, at Michaelmas
£160, and at Christmas £160: how much interest is due to
the lender.                          *Ans.* £9,2,3¾.

CASE IV.—*To calculate Interest on Accounts Current.**

RULE.—Find the interest, first of the sums on the *Dr. side*
of the account, and then, of those on the *Cr. side*, reckoning
the time from the day which the sums became due, to the
time to which the account is brought up.   Subtract the sum
of the interest on the one side from that of the other, and the
*difference* is the interest to be carried to the proper side of the
account current.

*Examples.*

36. Calculate the interest at ⅌ Cent. on the following Ac-
count Current up till 31st December, 1825.

*Dr.*     *Mr. J. Adams's Account Current with A. Bell.*     *Cr.*

| May. | 15 | To Balance .. | 182 | .. | .. | July. | 5 | By Cash .... | 198 | 10 |
| June. | 29 | To Bill *due* .. | 136 | 10 | .. | Oct. | 10 | By Cotton *due.* | 145 | 15 |
| Sept.. | 16 | To Goods *do.* . | 275 | 15 | .. | Nov. | 18 | By Rum *do.*. . . | 126 | .. |

* An Account Current is a statement of the mercantile transactions of
one person with another drawn out in the form of *Dr.* and *Cr*

### Calculation of the Interest
#### Dr. side.

```
May  15  to Dec. 31 is 230 da. on £182 , 0 is £5 , .4 , 8
June 29  to   do.   is 185 da.    136 , 10    3 , 9 , 2
Sept. 16 to   do.   is 106 da.    275 , 15    4 , 0 , 1
                                            ————————  13 , 3 , i
```

#### Cr. side.

```
July  5  to Dec. 31 is 179 da. on £198 , 10 is £4 , 17 , 4
Oct. 10  to   do.   is  82 da.    145 , 15    1 , 12 , 9
Nov. 18  to   do    is  43 da.    126 , 0     0 , 14 , 10
                                            ————————  7 , 4 , 11
```

*Ans.*      Interest due by J. Adams £5 , 19 , 0

*Note.*—It is obvious that when the Account is long, this method must be very tedious without the assistance of *tables,* from the number of calculations required in ascertaining the interest on every sum separately.—The operation performed by the following *Rule,* reduces the whole to one division.

Rule.—Add and subtract the sums on the *Dr.* and *Cr.* sides of the Account in the order of their dates they become due.  Multiply the several by the days, and if the balance be sometimes due to one party, and sometimes to the other, extend the products in different columns.  The difference of their sums, divided by 7300, gives the interest at 5 ℔ Cent.

### Calculation of the preceding Example.

```
May 15. To Bal. ... £182 , 0 × 45 =  8190
June29. To Bill. ...   136 , 10
                     ——————
                       318 , 10 ×  6 =  1911
July  5. By Cash ..   198 , 10
                     ——————
                       120 ,  0 × 73 =  8760
Sept.16. To Goods..   275 , 15
                     ——————
                       395 , 15 × 24 =  9498
Oct. 10. By Cotton..  145 , 15
                     ——————
                       250 ,  0 × 39 =  9750
Nov. 18. By Rum  ..   126 ,  0
Balance of Principal £124 ,  0 × 43 =  5332
                              73|00)434|41
```

           *Interest* as before .....  £5 , 19 *Ans*

Balance of the Account is .. £124, 0,0
Add the Interest. . . . . . . . . .    5,19,0
The sum due to A. Bell . . . . £129,19,0

37. What interest is due on the following current ac
count, at 4 ⅌ Cent.?

*Dr.*    *Mr. C. Davis's Account Current with Ed. Fox.*    *Cr*
1826.
Jan.   15 To Cash £160, 0,0|Mar. 22 By Cash £50, 0,0
March 12 To ditto .. 36, 0,0|May  16 By ditto .. 37, 0,0
June  23 To Goods.. 13, 4,6|June 15 By Goods 25,12,6
July  19 To ditto .. 26,13,4|  —  28 By ditto.. 32, 5,4
                        *Ans.* £2,14,2.

38. Required the balance, including interest at 5 ⅌ Cent.
to the 10th December, on the following Account.

*Dr.*    *Mr. J. Gale's Account Current with Henry Inglis.*    *Cr*
Feb. 11 To Balance £186,0,0   Mar. 24 By Coffee £167,0,0
 —  26 To Sugar ... 215,0,0   Apr.  6 By Cash .. 348,0,0
June 20 To Rum ... 415,0,0    Sep. 26 By Bill .. 200,0,0
                   *Ans.* Balance due Inglis £107,2,

# DISCOUNT OR REBATE

Is the allowance which ought to be deducted from a debt
due at a future period in consideration of receiving present
payment. The remainder, or *present value*, is the sum which,
at the rate of interest proposed, would amount to the debt,
upon the day when it is payable.

RULE.—As £100, *with its interest added for the given time,
is to that interest: so is the sum given, to the discount.*

Or, *As* £100, *with its interest, is to* 100: *so is the sum
given, to the present value.*

*Note.*—Or subtract the discount from the given sum; the
remainder gives the present value.

*Examples.*

1. What is the discount and present value of £487, 10, 8, due in 6 months, allowing 6 ℞ Cent. ℞ annum?

$$\underline{\phantom{00}100\phantom{00}}$$
$$3£ = 6 \text{ months' interest.}$$

*Ans.* 103 : 3 :: 487, 10, 8
$$\phantom{000000000000}3$$
$$103)\overline{1462, 12, 0}$$

Subtract ....  £14,  4, 0  the discount.
From ...... 487, 10, 8
Remains .. £473,  6, 8  the present value.

Or, As 103 : 100 :: £487, 10, 8 : £473,  6, 8
*Present Value.*

2. What is the present value of £357, 10, payable 9 months hence, discount at 5 ℞ Cent.?  *Ans.* £344, 11, 6¾.

3. How much present money will discharge a debt of £109, 10, due in 9 months, allowing 6 ℞ Cent. ℞ annum?  *Ans.* £104, 15, 8¼.

4. What is the discount on £312, at 5 ℞ Cent. for 292 days?  *Ans.* £12.

5. How much ready money is equivalent to £100 due at the end of 146 days' interest, at 4 ℞ Cent.?  *Ans.* £98, 0, 9¼.

6. What is the discount of £1050 for one year, at 5 ℞ Cent.?  *Ans.* £50.

7. What sum lent at 5 ℞ Cent. for a year would produce £1000?  *Ans.* £952, 7, 7⁴⁄₇.

8. What is the present worth of £150, payable, one-third at 4 months, one-third at 8 months, and the remaining third at 12 months, at 5 ℞ Cent. discount?  *Ans.* £145, 3, 8½.

9. Required the present value of £500 interest at 4 ℞ Cent., £100 to be paid down, and the rest at 6 and 12 months, in sums of £200 each.  *Ans.* £488, 7, 8½.

10. A person agrees to advance money on a bill of £510, due in 146 days, on being allowed interest at 5 ℞ Cent. on the sum he pays: how much discount should he take?  *Ans.* £10.

*Note.*—To find the TIME when the principal, interest, (or amount,) and rate ℞ Cent. are given.

RULE.—As the interest of the principal for one year, is to 1 year; so is the whole interest, to the *time* required.

11  In what time will £350 amount to £402, 10, at 5 ⅌ Cent.?        *The interest of £350 for one year is £17, 10 And the difference beween the principal and amount is £52, 10*

As £17, 10 : 1 year : £52  10
            2                    2
   ────                ──────────
    35               35)105(3 years *Ans.*
                         105
                         ───

12. In what time will £540 amount to £734, 8, at 4 ⅌ Cent.?                                         *Ans.* 9 years.
13. In what time will £350 amount to £413, at 3 ⅌ Cent.?                                          *Ans.* 6 years.
14. How long will £800 be in amounting to £830, at 5 ⅌ Cent. ⅌ annum?                        *Ans.* 9 months
15. How long will £500 be in amounting to £520, at the rate of 5 ⅌ Cent. ⅌ annum?                   *Ans.* 292 days

*Note.*—2. To find the RATE ⅌ Cent., when the principal interest, (or amount,) and time, are given.

RULE.—As the principal is to the interest for the whole time, so is £100 to the interest of the same time; then divide that interest by the time, and the quotient gives the *rate* ⅌ Cent.

16. At what rate of interest will £350 amount to £402, 1C in 3 years?

As £35,0 : £52, 10 :: 10,0
            1C
   ──────────────────
   35)525, 0  (£15 ÷ 3 yrs. = 5 ⅌ Cent. *Ans.*
      35
      ───
      175
      175
      ───

17. At what rate ⅌ Cent. will £540 amount to £734, 8 in 9 years?                                  *Ans.* 4 ⅌ Cent.
18. At what rate of simple interest will £350 amount to £413 in 6 years?              ·    *Ans.* 3 ⅌ Cent.
19. At what rate of interest ⅌ annum will £800 amount to £830 in 9 months?              ·    *Ans.* 5 ⅌ Cent.
20. At what rate ⅌ Cent. will £500 amount to £520 in 292 days?                                   *Ans.* 5 ⅌ Cent.

E

## BANKERS' DISCOUNT.

Bankers and others, who discount Bills, charge interest at 5 ⅌ Cent. on the sum of the bill for the time it has to run, by which they have more than 5 ⅌ Cent. on the money which they advance by the *interest* of the discount.

Rule.—1. Find how long the bill has to run; reckoning from the time it was discounted till it is due, (including the 3 days of grace.)

2. Then calculate the interest on the sum of the bill for that time, which is what bankers call the discount, which deduct, and the remainder is the *proceeds.*

### *Examples.*

1. What is the discount and proceeds of a bill for £219, dated 19th April, at 3 months, and discounted on Tuesday, the 23d May ?

A bill drawn 19th April, at 3 months, is due 19/22 July, and from 23d May to 22d July is 60 days.

```
    £219
        60 days to run.
365)13140(36/ discount.        Bill....£219,  0,0
    1095                            ┌ Discount    1,16,0
    ────                      Ans. ┤
    2190                            └ Proceeds £217,  4,0
    2190
```

2. What is the discount on a bill of £150, which has 60 days to run?                    *Ans.* £1, 4, 8.

3. Required the proceeds of a bill of £580, dated 11th April, at 4 months, and discounted on 16th May.
                                        *Ans.* £572, 17.

4. Find the proceeds of a bill of £390, drawn 11th September, at 4 months, and discounted on 17th October, commission ¼ ⅌ Cent.                    *Ans.* 384, 5, 5.

5. Discounted at my banker's the following bills: £146 for 50 days to run, £182, 10 for 60 days, and £365 for 91 days: how much do the proceeds amount to?        *Ans.* £686, 9,

# COMPOUND INTEREST

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

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

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

### *Examples.*

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

$$\frac{1}{20}|£500 \, , \quad 0 \, , 0 \; = \text{1st year's principal.}$$
add      25 , 0 , 0 = interest.

$$\frac{1}{20} \quad 525 \, , \quad 0 \, , 0 \; = \text{2d year's principal.}$$
add      26 , 5 , 0 = interest.

$$\frac{1}{20} \quad 551 \, , \quad 5 \, , 0 \; = \text{3d year's principal}$$
add      27 , 11 , 3 = interest.

£578 , 16 , 3 = amount in 3 years.
500 , 0 , 0    deduct the principal.

*Ans.*   £78 , 16 , 3 = Interest required.

*e.*—As the rate is 5 ⅌ Cent. we divide by 20, if it had been 4 ⅌ Cent. we would divide by $\frac{1}{25}$.

2. What is the amount of £400 forborne 3½ years, at 6 ⅌ Cent. ⅌ annum, compound interest?   *Ans.* £490 , 13 , 11¼.

3. What will £650 amount to in 5 years, at 5 ⅌ Cent. ⅌ annum, compound interest?   *Ans.* £829 , 11 , 7½.

4. What is the amount of £550 , 10 for 3 years and 6 months, at 4 ⅌ Cent. ⅌ annum, compound interest?
*Ans.* £631 , 12 , 5.

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

6. What is the compound interest of £57 , 10 , 6 for 5 years, 7 months, 15 days, at 5 ⅌ Cent ⅌ annum?
*Ans.* £18 , 3 , 8¼.

7. What is the compound interest of £259 ، 10 for 3 years, 8 months, and 10 days, at 4½ ⅌ Cent. ⅌ annum ?

*Ans.* £45 ، 17 ، 7.

## EQUATION OF PAYMENTS

**Is** the determination of the time at which a debt due at two or more times may be discharged at once, without disadvantage to either party.

*Common Rule.*—Multiply each payment by the time at which it is due, and divide the sum of the products by the amount of the debt : the quotient is the mean or equated time of payment.

### *Examples.*

1. A owes B £200 : of which £40 is due at 3 months, £60 at 5 months, and £100 at 10 months ; at what time may the whole be paid at once ?

$$
\begin{array}{r}
£40 \times 3 \text{ mo.} = 120 \\
60 \times 5 — = 300 \\
100 \times 10 — = 1000 \\
\hline
\text{whole debt } 2|00) \overline{14|20}
\end{array}
$$

*Ans.* $7\frac{1}{10}$ months ; or 7 months 3 days, allowing 30 days to the month.

2. I owe £96 as follows : £40 payable in 20 days, £36 in 30 days, and £20 in 50 days : required the equated time of payment ?        *Ans.* 30 days.

3. B owes C 800 : £200 payable at 3 months ; £100 at 4 months ; £300 at 5 months, and £200 at 6 months ; but they agreeing to make but one payment of the whole, I demand what time that must be ?        *Ans.* 4 months, 18 days.

4. Bought a quantity of goods to the value of £360, which was to have been paid as follows : £120 at 2 months ; £200 at 4 months ; and the rest at 5 months ; but it was afterwards agreed to have it paid at one mean time : required the time ?        *Ans.* 3 months, 13 days.

5. A merchant bought goods to the value of £500 ; to pay £100 at the end of 3 months, £150 at the end of 6 months, and £250 at the end of 12 months ; but it was afterwards agreed to discharge the debt at one payment : at what time should this payment be made ?        *Ans.* 8 months, 12 days

6. H is indebted to L a certain sum, which was to be paid in 6 different instalments: $\frac{1}{4}$ at 2 months; $\frac{1}{8}$ at 3 months; $\frac{1}{8}$ at 4 months; $\frac{1}{4}$ at 5 months; $\frac{1}{8}$ at 6 months; and the rest at 7 months; but they agree that the whole shall be paid at once: required the equated time? *Ans.* 4 months, 8 days.

7. A is indebted to B £120; of which $\frac{1}{2}$ is to be paid at 3 months, $\frac{1}{4}$ at 6 months, and the rest at 9 months; what is the equated time of the whole payment? *Ans.* 5 months, 8 days.

## BARTER

Is the exchanging one commodity for another, and informs the traders so to proportionate their goods, that neither may sustain loss.

Rule.—1. Find the value of that commodity whose quan·tity is given; then find what quantity of the other, at the rate proposed, you may have for the same money.

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

### *Examples.*

1. What quantity of cho-colate at 4/. ℔ lb. must be de-livered in barter for 2 Cwt. of tea at 9/.

    2 Cwt.
    112
    ──────
    224 lb.
      9

4)2016 the value of the tea.
  ──────
  504 lb. chocolate.

       Or,
       lb.
9/. : 224 :: 4/. *Inverse.*
     9
  4)2016
*Ans.* 504 lb

2. A and B barter; A has prunes, at 4d. ℔ lb. ready money, but in barter will have 5d. ℔ lb.; B has hops worth 32/. ℔ Cwt. ready money; what ought B to rate his hops at in barter, and what quantity must be given for 20 Cwt. of prunes?

         d.  d.
 112  As 4 : 5 :: 32/
  20          5
 ──────         ────
40/.  2240     4)160
12/.    5d.Cwt.qr. lb.  40/.
──────                ────
48|0)1120|0( 23 , 1 , 9¼ *Ans.*
    160
    144
    ────
    16 = 1 qr. 9 lb. $\frac{16}{48}$ or $\frac{1}{3}$

3. How much tea at 9/. ⅌ lb. can I have in barter for 4 Cwt. 2 qrs. of chocolate, at 4/. ⅌ lb.? *Ans.* 2 Cwt.

4. Two merchants barter; A has 20 Cwt. of cheese at 21/6 ⅌ Cwt. B hath 8 pieces of Irish cloth, at £3, 14 ⅌ piece; I desire to know who must receive the difference, and how much? *Ans.* B must receive of A £8, 2.

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

6. How many dozen of candles, at 5/2 ⅌ dozen, must be delivered in barter for 3 Cwt. 2 qr. 16 lb. of tallow at 37/4 ⅌ Cwt.? *Ans.* 26 doz. 3 lb. +.

7. A has 608 yards of cloth, worth 14/. ⅌ yard, for which B gives him £125, 12 in ready money and 85 Cwt. 2 qrs. 24 lb. of bees'-wax. The question is, what did B reckon his bees'-wax at ⅌ Cwt.? *Ans.* £3, 10.

8. A and B barter: A has 320 dozen of candles, at 4/6 ⅌ dozen; for which B gives him £30 in money, and the rest in cotton, at 8d. ⅌ lb.; I desire to know how much cotton B gave A besides the money? *Ans.* 11 Cwt. 1 qr

9. If B hath cotton at 1/2 ⅌ lb. how much must he give A for 114 lb. of tobacco at 6d. ⅌ lb.? *Ans.* 48⅘ lb.

10. C hath nutmegs worth 7/6 ⅌ lb. ready money, but in barter will have 8/4 ⅌ lb. and D hath leaf tobacco worth 9d. ⅌ lb. ready money, how much must D rate his tobacco at ⅌ lb. that his profit may be equivalent with C's?

*Ans.* 10d. ⅌ lb.

# PROFIT AND LOSS

Is a rule that discovers what is gained or lost in the buying or selling of goods, and instructs merchants to rise and fall the price, so as to gain so much ⅌ Cent. or otherwise.

As questions in this rule are frequently misunderstood, and consequently wrong solved, we shall divide them into four cases.

CASE I.—*To find the gain or loss ⅌ Cent.*—As the prime cost is to the sum gained or lost, so is 100 to the rate ⅌ Cent.

CASE II.—*To find the selling price.*—As 100 is to 100, with the proposed gain added to it or loss subtracted, so is the prime cost to the selling price.

### Examples.

1. If a yard of cloth cost 11*l.* and sold for 12/6, what is the gain ₱ Cent?

$$\begin{array}{r} 12/6 \\ 11 \\ \hline 11/. : \overline{1/6} :: £100 \\ 100 \\ \hline 11)150 \\ \hline \end{array}$$

*Ans.* £13 ₰ 12 ₰ 8₁ᵣⁱᵣ.
Or *about* 13⅚ ₱ Cent.

2. If 60 ells of Holland cost £18, what must I sell it for to gain 8 ₱ Cent?

$$\begin{array}{r} 10) \quad \overline{\phantom{0}3} \\ \hline \overline{6}/. \text{ prime cost.} \end{array}$$

As 100 : 108 : : 6/.
6

100)648

*Ans.* 6/5¾ ₱ yard.

CASE III.—*To find the prime cost.*—As 100, with the gain ₱ Cent. added to it or loss subtracted, is to 100, so is the selling price to the prime cost.

CASE IV.—*To find a proportional rate ₱ Cent. on an advanced price.*—As the price whose rate ₱ Cent. is given is to 100, with the gain added or loss subtracted, so is the given price to a fourth number, which, if greater than 100, the difference shows the gain, and if less, the loss ₱ Cent.

### Examples.

3. If a parcel of cloth be sold for £560, at 12 ₱ Cent. gain, what is the prime cost?

As 112 : 100 : : £560
560

112)56000(£500 *Ans.*
560

4. Sold hops for 50/. Cwt. at 25 ₱ Cent. profit, what would have been my gain ₱ Cent. at 70/. ₱ Cwt.?

As 5,0/. : 125 : : 7,0/.
7

5)575

175 − 100 = 75₱Ct.

5. If 1 lb. of tobacco cost 16*d.* and is sold for 20*d.*; what is the gain ₱ Cent.?          *Ans.* 25 ₱ Cent.

6. If a yard of cloth is bought for 13/4, and sold again for 16/.; what is the gain ₱ Cent.?          *Ans.* 20 ₱ Cent.

7. If 112 lb. of iron cost 27/6; what must 1 Cwt. be sold for to gain 15 ₱ Cent.?          *Ans.* £1 ₰ 11 ₰ 7¼.

8. If 375 yards of broad cloth be sold for £490, and 20 ⅌ Cent. profit, what did it cost ⅌ yard?  *Ans.* £1₇ 1₇ 9¼ +.

9. If 90 ells of cambric cost £60, how must I sell it ⅌ yard to gain 18 ⅌ Cent.?  *Ans.* 12/7 +.

10. A plumber sold 10 fother of lead for £204₇ 15, (the fother being 19½ Cwt.) and gained after the rate of £12₇ 10 ⅌ Cent. what did it cost him ⅌ Cwt.?  *Ans.* 18/8.

11. Bought 436 yards of cloth, at the rate of 8/6 ⅌ yard, and sold it for 10/4 ⅌ yard, what was the gain of the whole?
*Ans.* £39₇ 19₇ 4.

12. Paid £69 for one ton of steel, which was retailed at 6*d.* ⅌ lb., what is the profit or loss by the sale of 14 tons?
*Ans.* £182 loss.

13. Bought 124 yards of linen for £32; how should the same be retailed ⅌ yard to gain £15 ⅌ Cent.?
*Ans.* 5/11₇⁷₇

14. Bought 249 yards of cloth at 3/4 ⅌ yard, retailed the same at 4/2 ⅌ yard; what is the profit in the whole, and how much ⅌ Cent.?  *Ans.* £10₇ 7₇ 6 profit, and 25 ⅌ Cent.

15. A grocer sold coffee at 2/4 ⅌ lb. which cost 2/8, how much did he lose ⅌ Cent.?  *Ans.* 12½ ⅌ Cent.

16. How much must sugar be sold for which cost 56/. ⅌ Cwt. to yield a profit of 12½ ⅌ Cent.; and at how much ⅌ lb. to gain 2*d.* on the shilling?
*Ans.* 63/. ⅌ Cwt. and 7*d.* ⅌ lb.

17. By selling superfine cloth at 21/. a yard, I lose 15 ⅌ Cent.; but markets rising, I sold the rest of the piece at 28/. a yard.; whether do I gain or lose by the latter price, and how much ⅌ Cent.?  *Ans.* 13¼ ⅌ Cent. gain.

18. A tea dealer sells tea at 7/6 ⅌ lb. and gains 10 ⅌ Cent.; how much will he gain ⅌ Cent. should the price rise to 8/9; and how much will he lose if it falls to 6/. a lb.?
*Ans.* He gains 28½ ⅌ Cent., and loses 12 ⅌ Cent.

---

# PARTNERSHIP,

### OR, AS IT IS USUALLY CALLED,

# FELLOWSHIP,

Is when two or more persons join their stocks, and trade together, dividing their gain or loss according to the terms of their contract.

CASE I.—*When the Joint Stock is divided into a certain number of shares.*

First, divide the proceeds by the number of shares in the joint stock, and then multiply the quotient by the number of shares which each partner holds.

*Example* 1.—The joint stock of three merchants is divided into 12 shares, of which A holds 5, B 4, and C 3 shares · at the end of the year, their profits amount to £350 ; what is the share of each?

A .. 5 shares          12)£350 , 0 , 0

B .. 4 do.          29 , 3 , 4 × 3 × 4 × 5

C .. 3 do.          £87 , 10 , 0  C's share.

12 shares.     *Ans.* { £116 , 13 , 4  B's.
                            145 , 16 , 8  A's.

          £350 , 0 , 0  Proof.

CASE II.—*When each Partner is to share in proportion to his Stock.*

As the whole stock, is to the whole gain or loss; so is each person's share in the stock, to his share of the gain or loss.

*Example* 2.—Two merchants trade together; A put in £20, and B £40; they gained £50, what is each share?

          stock. gain.          £. s. d.

As  60 : 50 :: { 20£ : 16 , 13 , 4 = A's }
Or as 6 :  5 :: { 40  : 33 , 6 , 8 = B's }

                    £50 , 0 , 0

CASE III.—*When each Partner is to share in proportion to his Stock and the Time it was in trade.*

As the sum of the product of each person's stock and time, is to the whole gain or loss ; so is each person's product, to the share of the gain or loss.

*Example* 3.—Two persons lay out £1500 in trade ; A put in £900 for 12 months, and B £600 for 9 months; and their profits amount to £243 : required to divide them so that each may share in proportion to his stock, and the time it was in trade.

          £900 × 12 months = 10800
          600 × 9 ditto  =  5400
          Sum of the products 16200

            products.   gain.    prod.
         As 16200 : £243 :: 10800 ⎱ : £162 to A.
         Or as 2    ·    3 ::· 5400 ⎰ ·    81 to B.
                                   £243  Proof.

CASE IV.—*When each Partner is allowed only interest for the unequal times.*

Subtract amount of the interest of their several advances from the net profits; then divide the remainder by the number of partners: to which add the interest of their stocks.

*Example 4.*—If the partners in the question of last case were allowed only interest at 5 ℔ Cent. for the unequal times, how much of the profits belong to each?

            Profits on the business. . . . . . . . .   £243 , 0 , 0
    Interest on £900 for 12 months is £45 , 0 , 0
            on £600 for 9 months   . .  22 , 10 , 0
                                               ────────
                                                67 , 10 , 0
               To be equally divided . . . . . . . . £175 , 10 , 0
               ½ of which is . . . . . . . . . £87 , 15 , 0

A's share of gain £87 , 15 , 0      B's share of gain £87 , 15 , 0
Interest. . . . . . .   45 , 0 , 0   Interest. . . . . . .  22 , 10 , 0
    A draws   £132 , 15 , 0              B draws £110 , 5 , 0

5. Three merchants trade together; A puts in £20, B £30, and C £40; they gained £180: what is each man's share?                    *Ans.* A £40, B £60, C £80.

6. The profits of a Mercantile House amount to £10561 , 17 , 3; A holds 8 shares, B 7, C 4, and D 2 shares. Required the share of each partner?
*Ans.* A £4023 , 11 , 4; B £3520 , 12 , 5; C £2011 , 15 , 8; D £1005 , 17 , 10.

7. Three persons join in trade; D's stock was £750, E's £460, and F's £500; they gain the first year £684: what is each man's share?
            *Ans* D's £300, E's £184, and F's £200

8. Four partners engage to trade in company; A advanced £150, B £320, C £350, and D £500; at the end of two

years their net gain amounted to £730: how much is the share of each?

  *Ans.* A's share is £82,19,1$\frac{1}{11}$, B's £176,19,4$\frac{8}{11}$, C's £193,11,2$\frac{6}{11}$, and D's £276,10,3$\frac{7}{11}$.

9. A and B purchased an estate of £1700 $\text{φ}$ annum, free hold, for £27200; of which A paid £15000, and B the rest; sometime after, they sell the estate at 24 years' purchase: required each person's share?

  *Ans.* A's £22500, and B's £18300.

10. Two persons lay out £1500 in trade, in the proportion of 3 to 2; that is, A puts in £900, and B £600; A leaves his money in the concern for 9 months, and B does not want his for 12 months: what share of the profits, which amount to £229,10, belongs to each?

  *Ans.* A £121,10, B £108.

11. Three merchants pay money into a common stock, A pays £300, which lies for 12 months, B £250 for 8 months, and C £150 for 6 months; the profits amount to £97,10 required to divide them, so that each may have a share proportioned to his stock and the time it was in trade?

  *Ans.* A £54, B £30, C £13,10.

12. A began business with a capital of £1200, 3 months after he took in B as a partner, who advanced £1000, and 3 months after that, he admitted C, who put in £800; in 18 months from A's commencement, the business yielded a net profit of £782,10: required each partner's share, allowing only interest at 5 $\text{φ}$ Cent. on their unequal advances?

  *Ans.* A £286,13,4, B £259,3,4, C £236,13,4.

# ALLIGATION.

ALLIGATION IS EITHER MEDIAL OR ALTERNATE.

----

## ALLIGATION MEDIAL

Is when the price and quantities of several simples are given to be mixed, to find the mean or average price of that mixture.

Rule.—Divide the value of the whole composition by the whole quantity: the quotient gives the mean or average price of the mixture.

*Proof.*—Find the value of the whole mixture at the mean rate, and if it agrees with the total value of the several quantities at their respective prices, the work is right.

### Examples.

1. A farmer mixed 20 bushels of wheat at 5/. ℔ bushel, and 36 bushels of rye, at 3/. ℔ bushel, with 40 bushels of barley, at 2/. ℔ bushel. I desire to know the worth of a bushel of this mixture?

Bush. 20 × 5/. = 100/. value of the wheat.
      36 × 3/. = 108/. —— rye.
      40 × 2/. = 80/. —— barley.
     96         )288(3/. ℔ bushel *Ans.*

2. A vintner mingles 15 gallons of Canary at 8/. ℔ gallon, with 20 gallons at 7/4 ℔ gallon, 10 gallons of sherry, at 6/8 ℔ gallon, and 24 gallons of white wine, at 4/. ℔ gallon. What is the worth of a gallon of this mixture?

*Ans.* 6/2½ ⁴⁶⁄₆₉.

3. A grocer mingled 4 Cwt. of sugar, at 56/. ℔ Cwt. 7 Cwt. at 43/. ℔ Cwt. and 5 Cwt. at 37/. ℔ Cwt. I demand the price of 2 Cwt. of this mixture? *Ans.* £4‚8‚9.

4. A maltster mingles 30 quarters of brown malt, at 28/. ℔ quarter, with 46 quarters of pale, at 30/. ℔ quarter, and 24 quarters of high-dried ditto, at 25/. ℔ quarter: what is the value of 8 bushels of this mixture? *Ans.* 28/2½ ¾.

5. If I mix 27 bushels of wheat, at 5/6 ℔ bushel, with the same quantity of rye, at 4/. ℔ bushel, and 14 bushels of barley at 2/8 ℔ bushel: what is the worth of a bushel of this mixture? *Ans.* 4/3¾ ₁⁷₇.

6. A vintner mixes 20 gallons of port, at 5/4 ℔ gallon, with 12 gallons of white wine, at 5/. ℔ gallon, 30 gallons of Lisbon, at 6/. ℔ gallon, and 20 gallons of mountain, at 4/6 ℔ gallon: what is a gallon of this mixture worth?

*Ans.* 5/3¾ ⁴⁵⁄₄₁.

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

*Ans.* 6 oz. 18 dwt. 16 gr.

8. A tobacconist would mix 50 lb. of tobacco at 11*d*. ℔ lb. with 30 lb. at 14*d*. ℔ lb. 25 lb. at 22*d*. ℔ lb. and 37 lb. at 2/. ℔ lb.: what will 1 lb. of this mixture be worth?

*Ans.* 16¾*d*. ⁴⁸⁄₇₁

## ALLIGATION ALTERNATE

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

In ordering the rates and the given price, observe,

1. Place them one under the other, and the propounded price, or mean rate, at the left hand of them, thus,

$$
22\begin{cases}18\!-\!\!\!-\!\!\!\rceil & 2 \\ 20\!-\!\!\!-\!\!\! & 6 \\ 24\!-\! & 4 \\ 28\cdot & 2\end{cases}
$$

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

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

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

RULE.—Take the difference between each price and the mean rate, and set them alternately, they will be the answer required.

*Proof.*—By Alligation Medial.

### Examples.

1. A vintner would mix four sorts of wine together, of 18*d.* 20*d.* 24*d.* and 28*d.* ⅌ quart; what quantity of each must he take to sell the mixture at 22*d.* ⅌ quart?

| *Answer.* | *Proof.* | *Or thus,* | *Proof.* |
|-----------|----------|------------|----------|
| 18——⌐2 of 18*d.* = 36*d.* | | 18———6 of 18*d.* = 108*d.* | |
| 22 20—⌐ 6 of 20*d.* = 120 | | 22 20—⌐ 2 of 20*d.* = 40 | |
| 24—∣ 4 of 24*d.* = 96 | | 24—∣ 2 of 24*d.* = ·48 | |
| 28—∣ 2 of 28*d.* = 56 | | 28———4 of 28*d.* = 112 | |
| 14    14)308 | | 14    14)308 | |
| 22*d.* | | 22*d.* | |

*Note.*—Questions in this rule admit of a great variety of answers, according to the manner of linking them.

2. A grocer intends to mix sugar at 4*d*. 6*d*. and 10*d*. ℔ lb. so as to sell the compound for 8*d*. ℔ lb. what quantity of each must he take?  *Ans.*  2 lb. at 4*d*. 2 lb. at 6*d*. and 6 lb. at 10*d*.

3. How much tea, at 16/. 14/. 9/. and 8/. ℔ lb. will compose a mixture worth 10/. ℔ lb.?

*Ans.*  1 lb. at 16/. 2 lb. at 14/. 6 lb. at 9/. and 4 lb. at 8/.

4. A farmer would mix as much barley at 3/6 ℔ bushel, rye at 4/. ℔ bushel, and oats at 2/. ℔ bushel, as to make a mixture worth 2/6 ℔ bushel; how much is that of each sort?

*Ans.*  6 of barley, 6 of rye, and 30 of oats.

5. A grocer intends to mix raisins of the sun at 7*d*. ℔ lb. with Malagas at 6*d*. and Smyrnas at 4*d*. ℔ lb.: required what quantity of each sort he must take to sell them at 5*d*. ℔ lb.?          *Ans.*  1 lb. of raisins of the sun, 1 lb. of Malagas, and 3 lb. of Smyrnas.

6. A tobacconist would mix tobacco at 2/. 1/6, and 1/3, ℔ lb. so as the compound may bear a price of 1/8 ℔ lb.; what quantity of each sort must he take?

*Ans.*  7 lb. at 2/. 4 lb. at 1/6, and 4 lb. at 1/3

## ALLIGATION PARTIAL

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

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

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

### *Examples.*

1. A tobacconist intends to mix 20 lb. of tobacco at 15*d*. ℔ lb. with others at 16*d*. ℔ lb. 18*d*. ℔ lb. and 22*d*. ℔ lb.; how many pounds of each sort must he take to make one pound of that mixture worth 17*d*.?

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

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

**2.** A farmer would mix 20 bushels of wheat at 5/. ℔ bushel, with rye at 3/. barley at 2/. and oats at 1/6 ℔ bushel : how much must he take of each sort to make the composition worth 2/8 ℔ bushel?
*Ans.* 20 bushels of wheat, 35 busnels of rye, 70 bushels of barley, and 10 bushels of oats.

**3.** A distiller proposes to mix 40 gallons of French brandy, at 12/. ℔ gallon, with English at 7/. and spirits at 4/. ℔ gallon : what quantity of each sort must he take to afford it for 8/. ℔ gallon?
*Ans.* 40 gallons French, 32 English, and 32 spirits.

**4.** A grocer has teas at 12/. 10/. and 6/. with 20 lb. at 4/. ℔ lb. : how much of each sort must he take to make a composition worth 8/. ℔ lb.?
*Ans.* 20 lb. at 4/. 10 lb. at 6/. 10 lb. at 10/. 20 lb. at 12/.

**5.** A wine merchant is desirous of mixing 18 gallons of Canary at 6/9 ℔ gallon, with Malaga at 7/6, sherry at 5/. and white wine at 4/3 : how much of each sort must he take that the mixture may be sold for 6/. ℔ gallon?
*Ans.* 18 gallons of Canary ; 13½ of Malaga ; 13½ of sherry, and 27 of white wine.

## ALLIGATION TOTAL

Is when the price of each simple, the quantities to be compounded, and the mean rate are given, to find how much of each sort will make the quantity.

RULE.—Take the difference between each price, and the mean rate as before : then,

As the sum of the differences : is to each particular difference : : so is the quantity given : to the quantity required.

### *Examples.*

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

```
    12        4   48 at 12d. 576    As 12:4::144·48
   ₈10        2   24 at 10d. 240    As 12·2.·144  24
     6   ⌋  │ 2   24 at  6d. 144
     4      │ 4   48 at  4d. 192
          ─────  ─────
          1̅2̅ 1̅4̅4̅       )1152(8d
```

2. A grocer having four sorts of tea, of 5/. 6/. 8/. and 9/. ℔ lb. would have a composition of 87 lb. worth 7/. ℔ lb.: what quantity must there be of each?

*Ans.* 14½ lb. of 5/. 29 lb. of 6/. 29 lb. of 8/. and 14½ lb. of 9/.

3. A vintner had four sorts of wine, viz. white wine at 4/. ℔ gallon, Flemish at 6/. Malaga at 8/. and Canary at 10/. would make a mixture of 60 gallons, to be worth 5/. ℔ gallon · what quantity of each must he take?

*Ans.* 45 gallons of white wine, 5 gallons of Flemish, 5 gallons of Malaga, and 5 gallons of Canary.

4. A silversmith has four sorts of gold, viz. of 24 carats fine, of 22, 20, and 15 carats fine, would mix as much of each sort together, so as to have 42 oz. of 17 carats fine: how much must he take of each?

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

5. A druggist having some drugs of 8/. 5/. and 4/. ℔ lb. made them into 2 parcels, one of 28 lb. at 6/. ℔ lb. the other of 42 lb. at 7/. ℔ lb.: how much of each sort did he take for each parcel?

| | |
|---|---|
| *Ans.* 12 lb. of 8/. ℔ lb. | *Ans.* 30 lb. of 8/. ℔ lb. |
| 8 lb. of 5/. — | 6 lb. of 5/. — |
| 8 lb. of 4/. — | 6 lb. of 4/. — |
| 28 lb. at 6/. ℔ lb. | 42 lb. at 7/. ℔ lb. |

# POSITION;

### OR,

## THE RULE OF FALSE,

Is a rule that by false or supposed numbers, taken at pleasure, discovers the true one required. •It is divided into two parts, SINGLE and DOUBLE.

## SINGLE POSITION

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

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

*Proof.*—Add the several parts of the sum together, and if it agrees with the sum it is right

*Examples.*

1. A schoolmaster being asked how many scholars he had, said, if I had as many, half as many, and one quarter as many more, I should have 88 : how many had he?     *Ans.* 32.

| Suppose he had.40 | As 110 : 88 : : 40 | 32 |
| as many . . . . 40 | 40 | 32 |
| half as many . .20 | 11|0)352|0(32 | 16 |
| ¼ as many . . 10 | 33 | 8 |
| 110 | 22 | 88 proof. |
| | 22 | |

2. A person having about him a certain number of Portugal pieces, said, if the third, fourth, and sixth of them were added together they would make 54 : I desire to know how many he had?     *Ans.* 72

3. A gentleman bought a gig, horse, and harness, for £60, the horse came to twice the price of the harness, and the gig to twice the price of the horse and harness : what did he give for each?

*Ans.* horse £13 , 6 , 8, harness £6 , 13 , 4, gig £40.

4. A, B, and C, being determined to buy a quantity of goods, which would cost them £120 ; agreed among themselves that B should have a third part more than A, and C a fourth part more than B : I desire to know what each man must pay?     *Ans.* A £30, B £40, and C £50.

5. A person delivered to another a sum of money unknown, to receive interest for the same at 6 ⅌ Cent. ⅌ annum, simple interest, and at the end of ten years received for principal and interest £300 : what was the sum lent?

*Ans.* £187 , 10

## DOUBLE POSITION

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

RULE.—1. Place each error against its respective position.

2. Multiply them cross-wise.

3. If the errors are alike, i. e. both greater or both less than the given number, take their difference for a divisor, and the difference of their product for a dividend    But if unlike, take their sum for a divisor, and the sum of the products for a dividend ; the quotient will be the answer

### Examples.

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

| Suppose A had 40 | Then 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 by 30. |

sup. errors.

| 40 | 60 | | *Ans.* |
|---|---|---|---|
| 50 | × 30 | 60 | £60 A. |
| 3000 | 1200 | 30 | |
| 1200 | | 30 divisor. | 74 |
| 3|0)180|0 | | | £200 proof. |

60 *Ans.* for A.

2. A man had 2 silver cups of unequal weight, having one cover to both of 5 oz., now if the cover is put on the lesser cup, it will double the weight of the greater cup, and set on the greater cup, it will be thrice as heavy as the lesser cup : what is the weight of each cup? *Ans.* 3 oz. lesser, 4 greater.

3. A gentleman bought a house with a garden, and a horse in the stable, for £500, now he paid 4 times the price of the horse for the garden, and 5 times the price of the garden for the house. What was the value of the house, garden, and horse, separately? *Ans.* horse £20, garden £80, house £400.

4. Three persons discoursing concerning their ages ; says H, I am 30 years of age ; says K, I am as old as H, and ½ 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 127½, E 142½, and F 54.

6. A gentleman going into a garden meets with some ladies, and says to them, Good morning to you, 10 fair maids! Sir, you mistake, answered one of them, we are not 10 ; but

if we were twice as many more as we are, we should be as
many above 10 as we are now under: how many were they?

*Ans.* 5.

# EXCHANGE

TEACHES to compute how much money of one country is
equal to a certain sum of another, according to a given rate
of exchange.

The *Par of Exchange* is always fixed and certain, being
the intrinsic value of foreign money compared with sterling;
but the *Rate, or Course of Exchange,* rises or falls according
to the circumstances of trade.

Questions in this Rule are worked by Reduction, Rule of
Three, or Practice.

## I.—FRANCE.

At *Paris, Lyons, Bourdeaux,* &c. they keep Accounts in
livres, sous, and deniers, and also in francs and cents.

          12 Deniers   make   1 Sou, or Sol.
          20 Sous      ———    1 Livre, value 10*d.* sterling.
          3 Livres, or 60 Sous 1 Ecu of Exch. 2/6.

ALSO :

      10 Centimes    make     1 Decime.
      10 Decimes, or 100 Cents 1 Franc, value 10*d.* sterling.

Exchange with England at so many francs and centimes
for the pound sterling. *Par 25 francs ₩ £.*

### Examples.

1. **How much English money in 3918 livres 15 sous ex-**
change 23 livres 15 sous ₩ pound sterling?

```
 Liv.Sous. Liv.                      For Proof.
   23,15)3918,15      10 sous = ½ . . £165
   20       20                         23 liv.
  ───                                 ────
  475    )78375(£165 Ans.             495
         475                          330
         ───                     5 sous = ½ . . 82,10
         3087                                  41, 5
         2850                        Livres 3918,15 sous
         ────
         2375
         2375
```

2. Reduce £364,7,6 into French money; exchange 23 francs 50 centimes ⅌ £ sterling. *Ans.* 8562 francs 81 cents.

3. How much English money in 2545 francs 41 cents; exchange 24 francs 80 cents ⅌ £ sterling? *Ans.* £102,12,9.

4. In a million of francs how much sterling; exchange 24 francs 75 cents ⅌ pound sterling? *Ans.* £40404,0,9½+.

5. How many French crowns of exchange in £199,17,6? *Ans.* 1599.

## II.—SPAIN.

At *Madrid, Cadiz, Seville,* &c. they keep their Accounts in piastres, rials, and maravedies.

| | | |
|---|---|---|
| 34 Maravedies | make | 1 Rial. |
| 8 Rials | ——— | 1 Piastre, or Dollar. |
| 4 Piastres, or 32 Rials | | 1 Pistole of Exchange. |
| 375 Maravedies | -—— | 1 Ducat. |

Exchange with England is mostly negotiated by the piastre, also called the piece of eight. *Par* 39*d.* sterling dollar.

6. How much Sterling money in 3760 piastres; exchange 2/11 ⅌ piastre? *Ans.* £548,6,8.

7. How much Spanish money in £846,19,7 sterling; exchange 37½*d.* ⅌ piastre? *Ans* 5420 pias. 5 rials, 11 mar.+.

8. Find how much sterling in 6424 piastres, 2 rials, 17 maravedies; exchange 3/4 ⅌ piastre? *Ans.* £1070,14,4¼.

## III.--ITALY.

Leghorn keeps Accounts in piastres, or pezze, soldi, and denari.

| | |
|---|---|
| 12 Denari make 1 Soldi. | |
| 20 Soldi ——— 1 Piastre, or Dollar. | |

*Leghorn* computes its Exchanges in money like that of livres, sous, and deniers, of France.

*Genoa* also, and several other Italian Cities, compute in a similar manner.

*Venice* gives for the pound sterling a variable number of Italian *livres* and *cents*, similar to *francs,* and computes in the same manner.

*Naples* and *Sicily* exchange by the ducat of 100 grains,

and the computations are similar to those of France and Portugal.

9. Reduce 1580 piastres 15 soldi into English money; exchange 49*d*. sterling ℔ piastre.      *Ans.* £322, 14, 8¾.

10. How many dollars of Leghorn in £651, 16, 8; exchange 50*d*. ℔ dollar?      *Ans.* 3128 dollars 16 soldi.

11. In 9682 Italian livres, how much sterling; exchange 22 livres 80 cents ℔ £ sterling?      *Ans.* £424, 12, 11¼.

12. Find how much English money 3650 ducats, 60 grs. of Naples, will amount to, at 3/9 ℔ ducat. *Ans.* £684, 9, 9

## IV.—PORTUGAL.

At *Lisbon* and *Oporto* Accounts are kept in *milrees* and *rees*, distinguished by a mark set between them.

     400 Rees make 1 Crusado.
     1000 Rees —— 1 Milree.
     4800 Rees —— 1 Moidore.
     6400 Rees —— 1 Joannes.
        *Par* 5/7½ ℔ Milree.

13. How much Sterling money is equal to 2720 milrees 625 rees; exchange 5/4 ℔ milree?      *Ans.* £725, 10.

14. Required how much English money is equivalent to 1826 milrees 250 rees; exchange at 5/6 ℔ milree?
                        *Ans.* £502, 4, 4½.

15. How much money of Portugal is equal to £270 sterling; exchange at par?      *Ans.* 960 milrees.

16. Reduce 7580 crusados 310 rees into English money; exchange at 65*d*. ℔ milree.      *Ans.* £821, 5.

17. A person brings 1800 moidores from Portugal to England, where they are current at 27/.; how much will he gain or lose exchange at 5/4 ℔ milree?    *Ans.* He gains £126

## V.—HOLLAND.

At *Amsterdam, Rotterdam*, &c. Accounts are kept in guilders, stivers, and pennings; and also in pounds, shillings, and pence, *Flemish*.

   16   Pennings        make 1 Stiver (2*d*. *Flemish*.)
   20   Stivers, or 40 Pence —— 1 Guilder, or Florin.
   2½   Guilders           —— 1 Rix Dollar.
   6   Guilders            —— 1 Pound Flemish.

**ALSO:**

8 Pennings make 1 Groat, or Penny Flem.
12 Pence —— 1 Shilling.
20 Shillings —— 1 Pound.
        *Par* 36/1 Flem. ₩ *£* sterling.

### Examples.

18. Reduce 4066 guilders 8 stivers into Sterling **money**
exchange 34/8 Flemish ₩ *£* sterling.

*Guild.Stiv.*
As 34/8 : £1 : : 4066 , 8 : £391 *Ans*

Flem. 416 pence. )162656 pence.
        ——————
                £391

Or, *when the Exchange is given Guilders.*

| *Guild.Pen.* | | *For Proof.* |
|---|---|---|
| 34/8 = 10 , 8 )4066 , 8 | | ¼ )£391 |
| 20          20 | | stivers   10 , 8 |
| ———— | | ———— |
| Stivers 218   )81328 | | 3910 |
| *Ans.* £391 ster. | | 4 pen. = 78 , 4 |
| | | 4 pen. = 78 , 4 |
| | | Guilders 4066 , 8 |

*Note.*—There are two kinds of money in Holland, called
*Banco* and *Currency;* the bank money is worth more than
the latter; the difference is called agio, and generally runs
from 3 to 6 ₩ Cent. All Bills of Exchange are valued and
paid in banco.

To reduce *Banco* into *Currency*, and the contrary, say—
As 100 : to 100 with the agio added : : banco : *currency* required.
And 100 with the agio added : 100 : : currency : *banco* required.

19. Reduce 1625 guilders banco into currency; agio 3¼ ₩
Cent., and reverse the statement for proof.

*Ban. Cur.     Ban. Guild. St.Pen*
As 100 : 103¼ : : 1625 : 1677 , 16 , 4 *Answer*

*Cur.   Ban.     Cur.*
And 103¼ : 100 : : 1677 , 16 , 4 : 1625 *Proof.*

20. How much Dutch money in £850 sterling ; **exchange**
86/4 Flemish ₩ *£* sterling ?          *Ans.* 9265 guilders.

**21. Reduce £586, 10 into florins; exchange at 10 florins 8 stivers ℔ £ sterling.** *Ans.* 6099 florins 12 stivers.

**22. How much English money in 6099 guilders 12 stivers, exchange 34/8 Flemish ℔ £ sterling?** *Ans.* £586, 10.

**23. How much of a debt in banco will 3852 guilders 10 stivers compensate; agio 3½ ℔ Cent.?**
*Ans.* 3722 guilders 4 stivers, 7 pennings.

**24. Amsterdam owes London £1704, 5 sterling; how much Dutch money is equal thereto; exchange 10 florins, 6 stivers, 4 pennings, or 34/4½ Flemish ℔ £ sterling?**
*Ans.* 17575 guilders, 1 stiver, 9 pennings.

## VI.—GERMANY

At *Hamburgh, Bremen,* &c. Accounts are kept in *marks* and *shillings,* both banco and currency, and also in *pounds shillings,* and *pence,* Flemish.

|  |  |  |  |
|---|---|---|---|
| 12 | Phennings | make 1 | Shilling (2d. *Flem.*) |
| 16 | Shillings | —— 1 | Mark. |
| 2 | Marks | —— 1 | Dollar of *Exchang* |
| 3 | Marks | —— 1 | Rix Dollar. |

### ALSO:

| | | | |
|---|---|---|---|
| 6 | Phennings make 1 | Groat, or Penny | ⎫ |
| 12 | Pence —— 1 | Shilling | ⎬ *Flemish.* |
| 20 | Shillings, or ⎱ —— 1 | Pound | ⎭ |
| 7½ | Marks .... ⎰ | | |

By the estimate of merchants, the *Par* is from 34/7 to 34/10, varying according to the fluctuation of the *Agio.*

### *Examples.*

**25. How much Sterling money in 3280 marks banco; exchange 34/2 Flemish ℔ £ sterling?**

```
               Marks.        s.  d.
As   34/2  ·  £1 :: 3280    Or, 34/2 )3280 marks.
     12        ×   32d.       6       16
   ─────        ─────       ─────   ─────
   41,0 pence  41)104960    205  )52480 shil.
       Ans.    £256             £256 as before.
```

**26. How many marks banco in £512 sterling; exchange 34/2 Flemish ℔ £ sterling?** *Ans.* 6560 marks.

27. Reduce 6162 marks current into banco; agio 18½ ⅌ Cent.                              *Ans.* 5200 marks banco.

28. How much Sterling money in 4162 marks 5 shillings banco; exchange 33/10 ⅌ £ sterling?     *Ans.* £328, 1, 3¼

29. London draws on Hamburgh for £1093, 15 sterling; how many marks will pay the draft, exchange 34/9 ⅌ £ ster. ?
                    *Ans.* 14252 marks, 14 shillings, 10½ phen.


## VII.—IRELAND.

Accounts in IRELAND are kept in pounds, shillings, and pence, as in England.  The par is 8⅓ ⅌ Cent., that is £100 English is equal to £108, 6, 8 Irish

The Course of Exchange varies from 6 to 20 ⅌ Cent.

> A Shilling Sterling = 13 Pence Irish.
> A Pound        = 21/8.

*Note.*—To reduce British sterling into Irish at *par*, add $\frac{1}{12}$, and to reduce Irish at *par* into British, subtract $\frac{1}{13}$ from the Irish.

30. How much Irish sterling in £750, 12, 6 British; exchange at par or 8⅓ ⅌ Cent.?          *Ans.* £813, 3, 6½.

31. Reduce £1626, 7, 1 Irish into British sterling; exchange at par.                              *Ans.* £1501, 5.

32. How much Irish money is equivalent to £875, 13 sterling; exchange 12½ ⅌ Cent.?     *Ans.* £985, 2, 1¼.

33. What is the Sterling value of a prize of £5000 in the Irish lottery; exchange at par?     *Ans.* £4615, 7, 8$\frac{4}{13}$.


## COMPARISON OF WEIGHTS AND MEASURES.

### *Examples.*

1. If 50 Dutch pence be worth 65 French pence; how many Dutch pence are equal to 350 French pence?
                                  *Ans.* 269$\frac{3}{13}$.

2. If 12 yards at London make 8 ells at Paris; how many ells at Paris will make 64 yards at London?     *Ans.* 42⅔.

3. If 30 lb. at London make 28 lb. at Amsterdam; how many lb. at London will be equal to 350 lb. at Amsterdam?
                                  *Ans.* 375.

4. If 95 lb. Flemish make 100 lb. English; how many lb. English are equal to 275 lb Flemish.     *Ans.* 289$\frac{9}{19}$

# CONJOINED PROPORTION

**Is** when the coin, weight, or measures of several countries are compared in the same question: or it is linking together a variety of proportions.

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

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

*Proof.*—By as many single Rules of Three as the question requires.

## *Examples.*

1. If 20 lb. at London make 23 lb. at Antwerp, and 155 lb. at Antwerp make 180 lb. at Leghorn; how many lb. at London are equal to 72 lb. at Leghorn?

| *Left.* | *Right.* | |
|---|---|---|
| 20 | 23 | $20 \times 155 \times 72 = 223200$ |
| 155 | 180 | $23 \times 180 = 4140)223200(53\frac{178}{414}$ *Ans.* |
| 72 | | |

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

3. If 140 braces at Venice are equal to 156 braces at Leghorn, and 7 braces at Leghorn equal to 4 ells English; how many braces at Venice are equal to 16 ells English?

*Ans.* $26\frac{80}{156}$.

4. If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam make 116 lb. at Dantzick; how many lb. at London are equal to 130 lb. at Dantzick? *Ans.* $112\frac{288}{4176}$.

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

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

### Examples.

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

6. If 40 lb. at London make 36 lb. at Amsterdam, and 90 lb. at Amsterdam 116 lb. at Dantzick; how many lb. at Dantzick are equal to 122 lb. at London?　*Ans.* 141$\frac{1087}{1620}$.

# PROGRESSION

CONSISTS OF TWO PARTS,

## *ARITHMETICAL AND GEOMETRICAL*

## ARITHMETICAL PROGRESSION

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

*Note.*—When any even number of terms differ by Arithmetical Progression, the sum of the two extremes will be equal to the two middle numbers, or any two means equally distant from the extremes; as 2, 4, 6, 8, 10, 12, where $6+8$, the two middle numbers are $=12+2=14$, the two extremes $=10+4$, the two means $=14$.

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

In Arithmetical Progression five things are to be observed, viz.

1. The first term ; better expressed thus, **F**.
2. The last term . . . . . . . . . . . . . . . . . . . **L**.
3. The number of terms . . . . . . . . . . . . . **N**.
4. The equal difference . . . . . . . . . . . . . **D**.
5. The sum of all the terms . . . . . . . . . **S**.

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

The first, second, and third terms given, to find the fifth.

RULE.—Multiply the sum of the two extremes by half the number of terms; or multiply half the sum of the two extremes by the whole number of terms, the product is the total of all the terms : Or thus,

1.  F, L, N, are given to find S

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

### Examples.

1. How many strokes does the hammer of a clock strike in '2 hours?    $12 + 1 = 13$, then $13 \times 6 = 78$. *Ans.*

2. A man buys 17 yards of cloth, and gave for the first yard 2/. and for the last 10/. what did the 17 yards amount to ?
*Ans.* £5 , 2.

3. If 100 eggs were placed in a right line, exactly a yard asunder from one another, and the first a yard from a basket, what length of ground does that man go who gathers up these 100 eggs singly, returning with every egg to the basket to put it in?    *Ans.* 5 miles, 1300 yards

The first, second, and third terms given to find the fourth.

RULE.—From the second subtract the first, the remainder divided by the third, less 1, gives the fourth : Or thus,

2.  F, L, N, are given to find D.

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

### Examples.

4. A man had 8 sons, the youngest was 4 years old and the eldest 32, they increase in arithmetical progression ; what was the common difference of their ages?    *Ans.* 4.

$32 - 4 = 28$, then $28 \div \overline{8 - 1} = 4$ common difference.

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

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

$$3 + 5 = \quad 8 \text{ the second day,}$$
$$8 + 5 = 13 \text{ the third day, \&c.}$$

The whole distance is 366 miles; or thus,

$$58 + 3 = 61, \text{ then } 61 \times 6 = 366.$$

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,

3.   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 by 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, and + 1 = 12, number of days, *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 many had he ? *Ans.* 8.

The second, third, and fourth terms given to find the first.

RULE.—Multiply the fourth by the third made less by 1, the product subtracted from the second gives the first : Or thus,

4.   L, N, D, are given to find F.

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

*Examples.*

8. A man in 10 days went from London to a certain town in the country, every day's journey increasing the former by 4, and the last he went was 46 miles; what was the first ? *Ans.* 10 miles.
$4 \times \overline{10 - 1} = 36$, then 46 − 36 = 10 the first day's journey.

9. A man takes out of his pocket at 8 several times, so many different numbers of shillings, every one exceeding the former by 6, the last was 46, what was the first ? *Ans.* 4.

The fourth, third, and fifth given to find the first.

RULE.—Divide the fifth by the third, and from the quotient subtract half the product of the fourth multiplied by the third, less 1, gives the first : Or thus,

5   N, D, S, are given to find F

$$S \quad D \times \overline{N - 1} \quad _{- F}$$

### *Example.*

10. A man is to receive £360, at 12 several payments, each to exceed the former by £4, and is willing to bestow the first payment on any one that can tell him what it is ; what will that person receive ? *Ans.* £8.

$$360 \div 12 = 30, \text{ then } 30 - \frac{4 \times \overline{12-1}}{2} = 8, \text{ the first payment.}$$

The first, third, and fourth given to find the second.

Rule.—Subtract the fourth from the product of the third, multiplied by the fourth, that remainder added to the first gives the second : or thus,

6.   F, N, D, are given to find L.

   N D — D + F = L.

### *Example.*

11. What is the last number of an arithmetical progression, beginning at 6, and continuing by the increase of 8 to 20 places ? *Ans.* 158.

$$\overline{20 \times 8} - 8 = 152, \text{ then } 152 + 6 = 158 \text{ the last number.}$$

## GEOMETRICAL PROGRESSION

Is the increasing or decreasing of any rank of numbers by some common ratio ; that is, by the continual multiplication or division of some equal number : as 2, 4, 8, 16, increase by the multiplier 2 ; and 16, 8, 4, 2, decrease by the divisor 2.

*Note.*—When any number of terms is continued in Geometrical Progression, the product of the two extremes will be equal to any two means, equally distant from the extremes ; as 2 : 4, 8, 16, 32, 64, where 64 × 2 are = 4 × 32, and 8 × 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, viz.

    1. The first term.
    2. The last term.
    3. The number of terms.
    4. The equal difference, or ratio.
    5. The sum of all the terms.

*Note.*—As the last term in a long series of numbers is very tedious to come at, by continual multiplication; therefore, for 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.

As 1, 2, 3,  4,  5,  6. Indices.
    2, 4, 8, 16, 32 64. Numbers in geometrical proportion.

But if the first term in geometrical proportion be different from the ratio, the indices must begin with a cipher:

As 0, 1, 2,  3,  4,  5,  6. Indices.
    1, 2, 4,  8, 16, 32, 64. Numbers in geometrical proportion.

When the indices begin with a cipher, the sum of the indices made choice of, must always be one less than the number of terms given in the question; for 1 in the indices is over the second term, and 2 over the third, &c.

Add any two of the indices together, and that sum will agree with the product of their respective terms,

    As in the first table of indices $2 + 5 = 7$
    Geometrical proportion       $4 \times 32 = 128$

    Then the second           $2 + 4 = 6$
                          $4 \times 16 = 64$

In any Geometrical Progression proceeding from unity, the ratio being known to find any remote term, without producing all the intermediate terms.

*Rule.*—Find what figure of the indices added together would give the exponent of the term wanted; then multiply the numbers standing under such exponent into each other, and it will give the term required.

*Note.*—When the exponent 1 stands over the second term, the number of exponents must be 1 less than the number of terms.

### Examples.

1 A man agrees for 12 peaches, to pay only the price of

the last, reckoning a farthing for the first, and a half-penny for the second, &c. doubling the price to the last; what must he give for them?

$$
\begin{array}{r}
16 = 4 \\
16 = 4 \\
\hline
256 = 8 \\
8 = 3 \\
\end{array}
$$

0, 1, 2, 3, 4, Exponents.
1, 2, 4, 8, 16, No. of terms.
For $4 + 4 + 3 = 11$, No. of terms less 1.

$$
\begin{array}{r}
4)\overline{2048} = \overline{11} \text{ No. of} \\
12)\ \overline{512} \qquad \text{far.} \\
2|0)\ \overline{4|2}_{\prime}8 \\
\hline
\textit{Ans. } \pounds 2_{\prime}2_{\prime}8
\end{array}
$$

2. A country gentleman going to a fair to buy some oxen, meets with a person who had 23; he demanded the price of them, was answered £16 a head: the gentleman bids him £15 a head, and he would buy all; the other tells him it could not be taken; but if he would give what the last ox would come to, at a farthing for the first and doubling it to the last, he should have all; what was the price of the oxen?
*Ans.* £4369 ، 1 ، 4.

In any Geometrical Progression not proceeding from unity, the first term and the ratio being given, to find any remote term, without producing all the intermediate terms.

RULE.—Proceed as in the last, only observe that every product must be divided by the first term.

### *Examples.*

3. A sum of money is to be divided among 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, $\dfrac{540 \times 540}{20} = 14580,$ then $\dfrac{14510 \times 60}{20} = 43740$
20, 60, 180, 540,

$3 + 3 + 1 = 7$, 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 quotient of which add the greater, gives the sum required.

### Examples.

5. A servant skilled in numbers agreed with a gentleman to serve him twelve months, provided he would give him a farthing for his first month's service, a penny for the second, 4d. for the third, &c what did his wages amount to ?
$$Ans. \; £5825, 8, 5\frac{1}{4}$$

$256 \times 256 = 65536$ then $65536 \times 64 = 4194304.$

0,  1,  2,  3,  4,          $\dfrac{4194304 - 1}{4 - 1} = 1398101$, then

1,  4,  16,  64,  256.

$4 + 4 + 3 = 11.$ No. of terms less 1.
$$1398101 + 4194304 = 5592405 \text{ farthings.}$$

6. A man bought a horse, and by agreement was to give a farthing for the first nail, three for the second, &c. there were four shoes, and in each shoe 8 nails ; what was the worth of the horse ?                  $Ans. \; £965114681693, 13, 4.$

7. A certain person married his daughter on New-year's day, and gave her husband 1/. 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 brocade 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, if the pins were valued at 100 for a farthing ; also what the laceman got or lost by the sale thereof, supposing the lace stood him in £7 ⅌ yard ?
$$Ans \quad \text{The lace sold for } £326886, 0, 9.$$
$$\text{Gain } £326732, 0, 9.$$

# 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 10 changes might be rung in 1 minute, and the year to contain 365 days 6 hours?

$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600$ changes, which $\div 10 = 47900160$ minutes; and if 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.

### PART II.

## VULGAR FRACTIONS.

A FRACTION is a part or parts of an unit, and written with two figures, with a line between them as $\frac{1}{4}$, $\frac{2}{3}$, $\frac{3}{4}$, &c.

The figure above the line is called the numerator, and the under one the denominator; which shows how many parts the unit is divided into; and the numerator shows how many of those parts are meant by the fraction.

There are four sorts of vulgar fractions: *proper, improper, compound,* and *mixed,* viz.

1. A PROPER FRACTION is when the numerator is less than the denominator, as $\frac{2}{4}$, $\frac{3}{8}$, $\frac{1}{3}$, $\frac{9}{11}$, $\frac{10}{11}\frac{1}{3}$, &c.

2. An IMPROPER FRACTION is when the numerator is equal to, or greater than the denominator, as $\frac{5}{3}$, $\frac{5}{4}$, $1\frac{2}{3}$, $\frac{107}{21}$, &c.

3. A COMPOUND FRACTION is the fraction of a fraction, and known by the word *of*, as $\frac{1}{3}$ *of* $\frac{2}{3}$ *of* $\frac{1}{4}$ *of* $\frac{3}{7}$ *of* $\frac{9}{13}$, &c.

4. A MIXED NUMBER or FRACTION is composed of a whole number and fraction, $8\frac{3}{4}$, $17\frac{1}{2}$, $8\frac{7}{11}$, &c.

# REDUCTION
### OF
## VULGAR FRACTIONS.

### 1. *To reduce fractions to a common denominator.*

RULE.—Multiply each numerator into all the denominators, except its own, for a new numerator; and all the denominators for common denominator.   Or,

2. Multiply the common denominator by the several given numerators separately, and divide their product by the several denominators, the quotient will be the new numerators.

### *Examples.*

1. Reduce $\frac{2}{4}$ and $\frac{4}{7}$ to a common denominator.

*Ans.* $\frac{14}{28}$, and $\frac{16}{28}$.

1st num.            2d num.
$2 \times 7 = 14$,   $4 \times 4 = 16$, then $4 \times 7$, $28$ den. $= \frac{14}{28}$, and $\frac{16}{28}$.

2. Reduce $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{8}$ to a common denominator.

*Ans.* $\frac{32}{64}$, $\frac{48}{64}$, $\frac{40}{64}$.

3. Reduce $\frac{7}{8}$, $\frac{4}{5}$, $\frac{9}{10}$, and $\frac{6}{7}$, to a common denominator.

*Ans.* $\frac{2940}{3360}$, $\frac{2688}{3360}$, $\frac{3024}{3360}$, $\frac{2880}{3360}$.

4. Reduce $\frac{6}{10}$, $\frac{2}{4}$, $\frac{1}{4}$, $\frac{3}{8}$, to a common denominator.

*Ans* $\frac{1008}{1680}$, $\frac{840}{1680}$, $\frac{240}{1680}$, $\frac{840}{1680}$.

5. Reduce $\frac{5}{8}$, $\frac{3}{5}$, $\frac{3}{7}$, and $\frac{1}{8}$ to a common denominator.

*Ans.* $\frac{875}{840}$, $\frac{500}{840}$, $\frac{480}{840}$, $\frac{105}{840}$

6. Reduce $\frac{3}{8}$, $\frac{5}{9}$, $\frac{3}{8}$, and $\frac{1}{3}$ to a common denominator.

*Ans.* $\frac{780}{2160}$, $\frac{1200}{2160}$, $\frac{540}{2160}$, $\frac{1296}{2160}$.

### 2. *To reduce a vulgar fraction to its lowest terms.*

RULE.—Find a common measure by dividing the lower term by the upper, and that divisor by the remainder following, till nothing remain; the last divisor is the common measure; then divide both parts of the fraction by the common measure, and the quotient will give the fraction required.

*Note.*—If the common measure happens to be one, the fraction is already in its lowest term; and when a fraction has ciphers at the right hand, it may be abbreviated by cutting them off, as $\frac{320}{740}$.

*Examples.*

7. Reduce $\frac{24}{32}$ to its lowest terms.

$$24)32(1$$
$$\underline{24} \qquad \text{then } 8)\frac{24}{32}( = \frac{3}{4} \text{ } Ans.$$
com. measure $\overline{8)24(3}$
$$\underline{24}$$

8. Reduce $\frac{30}{125}$ to its lowest terms.       *Ans.* $\frac{6}{25}$
9. Reduce $\frac{385}{804}$ to its lowest terms.       *Ans.* $\frac{5}{111}$.
10. Reduce $\frac{192}{576}$ to its lowest terms.       *Ans.* $\frac{1}{3}$.
11. Reduce $\frac{833}{960}$ to its lowest terms.       *Ans.* $\frac{55}{64}$
12. Reduce $\frac{5184}{6912}$ to its lowest terms.       *Ans.* $\frac{3}{4}$.

**3.** *To reduce a mixed number to an improper fraction.*

RULE.—Multiply the whole number by the denominator of the fraction, and to the product add the numerator for a new numerator; which place over the denominator.

*Note.*—To express a whole number fraction-ways, set 1 for the denominator given.

*Examples.*

13. Reduce $18\frac{3}{7}$ to an improper fraction.       *Ans.* $\frac{129}{7}$

$$\overline{18 \times 7 + 3} = 129, \text{ new numerator.}$$

14. Reduce $56\frac{13}{22}$ to an improper fraction.       *Ans.* $\frac{1245}{22}$.
15. Reduce $183\frac{5}{21}$ to an improper fraction.       *Ans.* $\frac{3848}{21}$.
16. Reduce $13\frac{4}{5}$ to an improper fraction.       *Ans.* $\frac{69}{5}$.
17. Reduce $27\frac{2}{9}$ to an improper fraction.       *Ans.* $\frac{245}{9}$.
18. Reduce $514\frac{5}{16}$ to an improper fraction.       *Ans.* $\frac{8229}{16}$.

**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.       *Ans.* $18\frac{3}{7}$.

$$129 \div 7 = 18\frac{3}{7}$$

20. Reduce $\frac{1245}{22}$ to its proper terms.       *Ans.* $56\frac{13}{22}$.
21. Reduce $\frac{3848}{21}$ to its proper terms.       *Ans.* $183\frac{5}{21}$.
22. Reduce $\frac{69}{5}$ to its proper terms.       *Ans.* $13\frac{4}{5}$.
23. Reduce $\frac{245}{9}$ to its proper terms.       *Ans.* $27\frac{2}{9}$.
24. Reduce $\frac{8229}{16}$ to its proper terms.       *Ans.* $514\frac{5}{16}$.

5. *To reduce a compound fraction to a single one.*

RULE.—Multiply all the numerators for a new numerator, and all the denominators for a new denominator.

Reduce the new fraction to its lowest terms, by Rule 2.

### *Examples.*

25. **Reduce** $\frac{2}{3}$ **of** $\frac{3}{5}$ **of** $\frac{5}{8}$ **to a single fraction.**        *Ans.* $\frac{1}{4}$.

*Ans.*   $\dfrac{2 \times 3 \times 5 =}{3 \times 5 \times 8 =} \dfrac{30}{120}$*reduced to the lowest terms* $= \frac{1}{4}$

26. **Reduce** $\frac{5}{6}$ **of** $\frac{4}{4}$ **of** $\frac{11}{12}$ **to a single fraction.**

*Ans.* $\frac{220}{755} = \frac{55}{189}$.

27. **Reduce** $1\frac{1}{2}$ **of** $1\frac{3}{4}$ **of** $2\frac{1}{9}$ **to a single fraction.**

*Ans.* $\frac{3993}{4872} = \frac{131}{232}$.

28. **Reduce** $\frac{3}{4}$ **of** $\frac{5}{6}$ **of** $\frac{9}{10}$ **to a single fraction.**

*Ans.* $\frac{135}{240} = \frac{9}{16}$.

29. **Reduce** $\frac{4}{5}$ **cf** $\frac{6}{8}$ **of** $\frac{7}{9}$ **to a single fraction.**

*Ans.* $\frac{168}{360} = \frac{7}{15}$.

30. **Reduce** $\frac{2}{7}$ **of** $\frac{4}{9}$ **of** $\frac{8}{10}$ **to a single fraction.**

*Ans.* $\frac{80}{630} = \frac{8}{63}$.

6. *To reduce fractions of one denomination to the fraction of another,* but greater, *retaining the same value.*

RULE.—Reduce the given fraction to a compound one, by comparing it with all the denominations between it, and that denomination which you would reduce it to ; then reduce that compound fraction to a single one.

### *Examples.*

31. Reduce $\frac{1}{8}$ of a penny to the fraction of a pound.

*Ans.* $\frac{1}{8}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{7}{1920}$.

32. Reduce $\frac{1}{4}$ of a penny to the fraction of a pound.

*Ans.* $\frac{1}{960}$.

33. Reduce $\frac{4}{5}$ of a dwt. to the fraction of a lb. troy.

*Ans.* $\frac{4}{1200}$.

34. Reduce $\frac{4}{7}$ of a lb. avoirdupois to the fraction of a Cwt

*Ans.* $\frac{4}{784}$.

7. *To reduce fractions of one denomination to the fraction of another,* but less, *retaining the same value.*

RULE.—Multiply the numerator by the parts contained in the several denominations between it, and that you would reduce it to, for a new numerator ; and place it over the given denominator.

Reduce the new fraction to its lowest terms.

### Examples.

**35.** Reduce $\frac{7}{1920}$ of a pound to the fraction of a penny.

<div align="right">*Ans.* $\frac{7}{8}$.</div>

$7 \times 20 \times 12 = 1680 \ \frac{1680}{1920}$ *reduced to its lowest term* $= \frac{7}{8}$.

**36.** Reduce $\frac{1}{960}$ of a pound to the fraction of a penny.

<div align="right">*Ans.* $\frac{1}{4}$.</div>

**37.** Reduce $\frac{1}{300}$ of a lb. Troy to the fraction of a pennyweight.

<div align="right">*Ans.* $\frac{4}{5}$.</div>

**38.** Reduce $\frac{1}{196}$ of a Cwt. to the fraction of a lb.

<div align="right">*Ans.* $\frac{4}{7}$.</div>

**8.** *To reduce fractions of one denomination to another of the same value, having the numerator given of the required fraction.*

**RULE.**—As the numerator of the given fraction : is to its denominator :: so is the numerator of its intended fraction . to its denominator.

### Examples.

**39.** Reduce $\frac{2}{3}$ to a fraction of the same value, whose numerator shall be 12. As 2 : 3 :: 12 : 18. *Ans.* $\frac{12}{18}$.

**40.** Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 25. *Ans.* $\frac{25}{35}$.

**41.** Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 47.

<div align="right">47<br>*Ans.* $\overline{65\frac{4}{5}}$</div>

**9.** *To reduce fractions of one denomination to another of the same value, having the denominator given of the fraction required.*

**RULE.**—As the denominator of the given fraction : is to its numerator :: so is the denominator of the intended fraction : to its numerator.

### Examples.

**42.** Reduce $\frac{2}{3}$ to a fraction of the same value, whose denominator shall be 18. As 3 : 2 :: 18 : 12. *Ans.* $\frac{12}{18}$.

**43.** Reduce $\frac{5}{7}$ to a fraction of the same value, whose denominator shall be 35. *Ans.* $\frac{25}{35}$.

**44.** Reduce $\frac{5}{7}$ to a fraction of the same value, whose denominator shall be $65\frac{4}{5}$.

<div align="right">47<br>*Ans.* $\overline{65\frac{4}{5}}$</div>

10. *To reduce a mixed fraction to a single one.*

Rule.—1. When the numerator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new numerator; then multiply the denominator of the fraction by the denominator of the fractional part for a new denominator.

### Examples.

45. Reduce $\dfrac{36\frac{2}{3}}{48}$ to a simple fraction.     *Ans.* $\frac{110}{144} = \frac{55}{72}$

$$36 \times 3 + 2 = 110 \; numerator.$$
$$48 \times 3 \qquad = 144 \; denominator.$$

46. Reduce $\dfrac{23\frac{4}{7}}{38}$ to a simple fraction.     *Ans.* $\frac{165}{266} = \frac{85}{133}$.

2. When the denominator is the integral part, multiply it by the denominator of the fractional part, adding in the numerator of the fractional part for a new denominator; then multiply the numerator of the fraction by the denominator of the fractional part for a new numerator

### Examples.

47. Reduce $\dfrac{47}{65\frac{2}{3}}$ to a simple fraction.     *Ans.* $\frac{141}{197} = \frac{3}{7}$.

48. Reduce $\dfrac{19}{44\frac{1}{3}}$ to a simple fraction     *Ans.* $\frac{57}{133} = \frac{3}{7}$.

11. *To find the proper quantity of a fraction in the known parts of an integer.*

Rule.—Multiply the numerator by the common parts of the integer, and divide by the denominator.

### Examples.

49. Reduce $\frac{3}{4}$ of a pound sterling to its proper quantity.
$$3 \times 20 = 60 \div 4 = 15/. \; Ans.$$

50. Reduce $\frac{3}{8}$ of a shilling to its proper quantity.
*Ans.* $4\frac{3}{4}d.\,\frac{1}{2}.$

51. Reduce $\frac{4}{9}$ of a lb. Avoirdupois to its proper quantity.
*Ans.* 9 oz. $2\frac{4}{9}$ dr.

52 Reduce $\frac{1}{7}$ of a Cwt. to its proper quantity.
*Ans.* 3 qrs. 3 lb. 1 oz. $12\frac{4}{7}$ dr.

53. Reduce $\frac{3}{5}$ of a lb. Troy to its proper quantity.
*Ans.* 7 oz. 4 dwt.

54. Reduce $\frac{5}{9}$ of an ell English to its proper quantity.
*Ans.* 2 qrs. 3$\frac{1}{2}$ nails.

55. Reduce $\frac{4}{5}$ of a mile to its proper quantity.
*Ans.* 6 furl. 16 poles.

56. Reduce $\frac{5}{8}$ of an acre to its proper quantity.
*Ans.* 2 roods 20 poles.

57. Reduce $\frac{6}{7}$ of a hogshead of wine to its proper quantity.
*Ans.* 54 gallons.

58. Reduce $\frac{3}{4}$ of a barrel of beer to its proper quantity.
*Ans.* 27 gallons.

59. Reduce $\frac{5}{12}$ of a chaldron of coals to its proper quantity.
*Ans.* 15 bushels.

60. Reduce $\frac{3}{5}$ of a month to its proper time.
*Ans.* 2 weeks, 2 days, 19 hours, 12 minutes.

12. *To reduce any given quantity to the fraction of any greater denomination, retaining the same value.*

RULE.—Reduce the given quantity to the lowest term mentioned for a numerator; under which set the integral part (reduced to the same term) for a denominator, and it will give the fraction required.

## *Examples.*

61. Reduce 15/. to the fraction of a pound sterling
*Ans.* $\frac{15}{20} = \frac{3}{4}\pounds.$

62. Reduce 4$\frac{3}{4}$d. $\frac{1}{3}$ to the fraction of a shilling. *Ans.* $\frac{2}{5}$.

63. Reduce 9 oz. 2$\frac{2}{7}$ drams to the fraction of a lb. Avoirdupois. *Ans.* $\frac{4}{7}$.

64. Reduce 3 qrs. 3 lb. 1 oz. 12$\frac{1}{9}$ dr. to the fraction of a Cwt. *Ans.* $\frac{7}{10}$.

65. Reduce 7 oz. 4 dwts. to the fraction of a lb. Troy.
*Ans.* $\frac{3}{5}$.

66. Reduce 2 qrs. 3$\frac{1}{2}$ nails to the fraction of an English ell. *Ans.* $\frac{5}{9}$.

67. Reduce 6 furlongs 16 poles to the fraction of a mile.
*Ans.* $\frac{4}{5}$.

68. Reduce 2 roods 20 poles to the fraction of an acre.
*Ans.* $\frac{5}{8}$.

69. Reduce 54 gallons to the fraction of a hogshead of wine. *Ans.* $\frac{6}{7}$.

70. Reduce 27 gallons to the fraction of a barrel of beer.
*Ans.* $\frac{3}{4}$

71. Reduce 15 bushels to the fraction of a chaldron of coals.

*Ans.* $\frac{5}{18}$.

72. Reduce 2 weeks, 2 days, 19 hours, 12 minutes, to the fraction of a month.                         *Ans.* $\frac{3}{5}$.

# ADDITION

### OF

## VULGAR FRACTIONS.

RULE.—Reduce the given fractions to a common denominator, then add all the numerators together, under which place the common denominator.

### *Examples.*

1. Add $\frac{3}{3}$ and $\frac{5}{7}$ together.

*Thus,* $\left.\begin{array}{l}\frac{3}{3} \times 7 = \frac{14}{21} \\ \frac{5}{7} \times 3 = \frac{15}{21}\end{array}\right\}$ sum. $\frac{29}{21} = 1\frac{8}{21}$ *Ans.*

2. Add $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{5}{6}$ together. . . . . . . . *Ans.* $1\frac{16}{66}$.

3. Add $\frac{1}{5}$, $4\frac{1}{3}$, and $\frac{2}{5}$ together. . . . . . . . . . . . *Ans.* $4\frac{14}{15}$.

4. Add $7\frac{2}{3}$ and $\frac{4}{5}$ together. . . . . . . . . . . . . . . . *Ans.* $8\frac{7}{15}$.

5. Add $\frac{4}{5}$ and $\frac{2}{3}$ of $\frac{3}{4}$ together. . . . . . . . . . . . . . . *Ans.* $\frac{11}{4}$.

6. Add $5\frac{2}{3}$, $6\frac{7}{8}$, and $4\frac{1}{2}$ together . . . . . . . . . . . . *Ans.* $17\frac{1}{24}$.

2. When the fractions are of several denominations, reduce them to their proper quantities, and add as before.

7. Add $\frac{1}{4}$ of a pound to $\frac{2}{3}$ of a shilling. . . . . . . *Ans.* 15/10.

8. Add $\frac{1}{2}$ of a penny to $\frac{2}{3}$ of a pound. . . . . . . *Ans.* 13/4$\frac{1}{2}$.

9. Add $\frac{3}{4}$ of a lb. Troy to $\frac{1}{6}$ of an ounce.

*Ans.* 9 oz. 3 dwt. 8 gr.

10. Add $\frac{4}{5}$ of a ton to $\frac{5}{6}$ of a lb.

*Ans.* 16 Cwt. 13 oz. 5$\frac{1}{3}$ dr.

11. Add $\frac{2}{3}$ of a chaldron to $\frac{3}{4}$ of a bushel.

*Ans.* 24 bushels, 3 pecks.

12. Add $\frac{1}{6}$ of a yard to $\frac{2}{3}$ of an inch.    *Ans.* 6 in. 8 parts.

# SUBTRACTION

### OF

## VULGAR FRACTIONS.

RULE.—1. Reduce the given fractions to a common denominator, then subtract the less numerator from the greater, and place the remainder over the common denominator.

2. When the lower fraction is greater than the upper, subtract the numerator of the lower fraction from the denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

### Examples.

1. From $\frac{3}{4}$ take $\frac{5}{7}$.

$$\left.\begin{array}{l} \text{From } \frac{3}{4} \times 7 = \frac{21}{28} \\ \text{Take } \frac{5}{7} \times 4 = \frac{20}{28} \end{array}\right\} \text{diff. } \frac{1}{28} \text{ } Ans.$$

2. From $\frac{5}{6}$ take $\frac{3}{5}$ of $\frac{5}{8}$. . . . . . . . . . . . . . . . . . . . . . . .*Ans.* $\frac{11}{16}$.
3. From $5\frac{4}{5}$ take $\frac{9}{10}$. . . . . . . . . . . . . . . . . . . . . . . .*Ans.* $4\frac{23}{30}$.
4. From $\frac{38}{47}$ take $\frac{3}{5}$. . . . . . . . . . . . . . . . . . . . . . . .*Ans.* $\frac{49}{235}$.
5. From $\frac{18}{19}$ take $\frac{1}{2}$ of $\frac{2}{7}$. . . . . . . . . . . . . . . . . .*Ans.* $\frac{108}{133}$.
6. From $6\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{3}{4}$. . . . . . . . . . . . . . . . . .*Ans.* $63\frac{3}{4}$.

3. When the fractions are of several denominations, reduce them to their proper quantities, and subtract as before.

7. From $\frac{3}{4}$ of a pound take $\frac{3}{4}$ of a shilling. *Ans.* 14/3.
8. From $\frac{2}{3}$ of a shilling take $\frac{1}{2}$ of a penny. *Ans.* $7\frac{1}{2}d$.
9. From $\frac{3}{4}$ of a lb. Troy take $\frac{1}{6}$ of an ounce.

*Ans.* 8 oz. 16 dwts. 16 grs.

10. From $\frac{4}{5}$ of a ton take $\frac{5}{6}$ of a lb.

*Ans.* 15 Cwt. 3 qrs. 27 lb. 2 oz. $10\frac{4}{5}$ dr.

11. From $\frac{4}{5}$ of a chaldron take $\frac{3}{4}$ of a bushel.

*Ans.* 23 bushels, 1 peck.

12. From $\frac{1}{6}$ of a yard take $\frac{2}{3}$ of an inch.

*Ans.* 5 in. 4 parts.

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# MULTIPLICATION

### OF

# VULGAR FRACTIONS.

**Rule.**—Prepare the given numbers (if they require it) by the rules of Reduction; then multiply the numerators together for a new numerator, and the denominators for a new denominator.

### Examples.

1. Multiply $\frac{3}{4}$ by $\frac{3}{5}$.

*Thus,* $\frac{3}{4} \times \frac{3}{5} = \frac{9}{20}$ *Ans.*

2. Multiply $\frac{1}{7}$ by $\frac{3}{5}$. . . . . . . . . . . . . . . . . . . . . . . .*Ans.* $\frac{1}{2}\frac{4}{7}$.
3. Multiply $48\frac{3}{4}$ by $13\frac{3}{5}$. . . . . . . . . . . . . . . . . .*Ans.* $672\frac{9}{10}$.
4. Multiply $430\frac{3}{4}$ by $18\frac{3}{4}$. . . . . . . . . . . . . . . . .*Ans.* $7935\frac{11}{12}$

5. Multiply $\frac{1}{2}\frac{6}{7}$ by $\frac{2}{4}$ of $\frac{5}{7}$ of $\frac{4}{5}$ ............... *Ans.* $\frac{1}{4}\frac{6}{8}$
6. Multiply $\frac{9}{10}$ by $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ ................ *Ans.* $\frac{3}{4}$.
7. Multiply $\frac{3}{4}$ of $\frac{4}{3}$ by $\frac{3}{4}$ of $\frac{1}{3}$ ................. *Ans.* $\frac{4}{9}$
8. Multiply $\frac{1}{4}$ of $\frac{3}{6}$ by $\frac{5}{7}$. ................ *Ans.* $\frac{1}{2}\frac{5}{2}\frac{8}{4}$
9. Multiply $5\frac{6}{9}$ by $\frac{5}{8}$ ..................... *Ans.* $4\frac{1}{4}\frac{7}{2}$
10 Multiply 24 by $\frac{2}{3}$. ..................... *Ans.* 16
11. Multiply $\frac{3}{4}$ of 9 by $\frac{7}{8}$. ................ *Ans.* $5\frac{7}{3}\frac{2}{8}$.
12. Multiply $9\frac{1}{2}$ by $\frac{1}{3}$. ..................... *Ans.* $3\frac{1}{6}$.

## DIVISION
OF
### VULGAR FRACTIONS.

RULE.—Prepare the given numbers (if they require it) by the rules of Reduction ; and invert the divisor, then proceed as in Multiplication.

#### Examples.

1. Divide $\frac{9}{20}$ by $\frac{3}{5}$.
Thus, $\frac{9}{20} \times \frac{5}{3} = \frac{4}{6}\frac{5}{0}$ or $\frac{3}{4}$ *Ans.*

2. Divide $\frac{1}{2}\frac{4}{7}$ by $\frac{2}{3}$. ........................ *Ans.* $\frac{7}{6}$.
3. Divide $672\frac{9}{10}$ by $13\frac{5}{6}$. ................. *Ans.* $48\frac{3}{4}$.
4. Divide $7935\frac{1}{2}\frac{2}{3}$ by $18\frac{3}{4}$. ............... *Ans.* $430\frac{2}{3}$.
5. Divide $\frac{3}{4}$ by $\frac{3}{4}$ of $\frac{3}{4}$ of $\frac{5}{6}$ .................. *Ans.* $\frac{9}{70}$.
6. Divide $\frac{2}{3}$ of 16 by $\frac{5}{7}$ of $\frac{3}{4}$. ............... *Ans.* $19\frac{4}{4}\frac{1}{5}$.
7. Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{4}$. .... ......... *Ans.* $\frac{2}{3}\frac{4}{6}=\frac{2}{3}$
8. Divide $9\frac{1}{3}$ by $\frac{1}{3}$ of 7 ........ ........... *Ans.* $2\frac{1}{4}$
9. Divide $\frac{9}{16}$ by $4\frac{1}{2}$. ........................ *Ans.*
10. Divide 16 by 24. ........................ *Ans.*
11. Divide $5205\frac{1}{4}$ by $\frac{4}{7}$ of 91 ................ *Ans.* 71
12. Divide $3\frac{1}{6}$ by $9\frac{1}{2}$. ........................ *Ans.*

# THE SINGLE RULE OF THREE DIRECT,
IN
### VULGAR FRACTIONS.

RULE.—Reduce the numbers as before directed in Reduction   State the question as in the Rule of Three in whole numbers, and invert the first term of the proportion, then multiply the three terms continually together, and the product will be the answer

### Examples.

1. If $\frac{3}{4}$ of a yard cost $\frac{5}{8}$ of a £, what will $\frac{9}{10}$ of a yard come to at that rate?                    *Ans.* $\frac{18}{24}$ £ = 15/.

$$\frac{3}{4} \text{ yard} : \frac{5}{8} £ - : : \frac{9}{10} \text{ yard} : \frac{18}{24} £.$$

$$\frac{4}{3} \times \frac{5}{8} \times \frac{9}{10} = \frac{180}{240} = \frac{3}{4} £, \text{ or } 15/. \; Ans$$

2. If $\frac{5}{6}$ of a yard cost $\frac{2}{3}$ £; what will $\frac{1}{12}$ of a yard cost?
                                                    *Ans.* 14/8.

3. If $\frac{3}{4}$ of a yard of lawn cost 7/3; what will $10\frac{1}{4}$ yards cost?                     *Ans.* £4, 19, $10\frac{1}{2} - \frac{3}{4}$.

4. If $\frac{7}{8}$ lb. cost $\frac{2}{3}s$.; how many pounds will $\frac{3}{9}$ of 1/. buy?
                                                    *Ans.* $1\frac{1}{37}$ lb.

5. If $\frac{3}{4}$ ell of Holland cost £$\frac{1}{3}$; what will $12\frac{2}{3}$ ells cost at that rate?                     *Ans.* £7, 0, $8\frac{3}{4} - \frac{5}{9}$.

6. If $12\frac{1}{2}$ yards of cloth cost 15/9; what will $48\frac{1}{4}$ cost at the same rate?                     *Ans.* £3, 0, $9\frac{1}{2} - \frac{4}{25}$.

7. If $\frac{9}{10}$ of a Cwt. cost £$14\frac{1}{2}$; what will $7\frac{1}{2}$ Cwt. cost at the same rate?                     *Ans.* £118, 6, 8.

8. If 3 yards of broad cloth cos $£2\frac{1}{5}$; what will $10\frac{2}{7}$ yards cost?                     *Ans.* £9, 12.

9. If $\frac{1}{4}$ of a yard cost $\frac{2}{3}$ of a £; what will $\frac{2}{3}$ of an ell English come to at the same rate?                     *Ans.* £2.

10. If 1 lb. of cochineal cost £1, 5; what will $36\frac{7}{10}$ lb. come to?                     *Ans.* £45, 17, 6.

11. If 1 yard of broad cloth cost $15\frac{5}{8}/.$; what will 4 pieces cost, each containing $27\frac{1}{2}$ yards?      *Ans.* £85, 14, $3\frac{1}{4} - \frac{5}{7}$.

12. Bought $3\frac{1}{2}$ pieces of silk, each containing $24\frac{2}{3}$ ells at $6/0\frac{3}{4}$ ⅌ ell; I desire to know what the whole quantity cost?
                                                    *Ans.* £25, 17, $2\frac{1}{4} - \frac{15}{16}$.


# THE SINGLE RULE OF THREE INVERSE

#### IN

## VULGAR FRACTIONS.

### Examples.

1. If 48 men can build a wall in $24\frac{1}{2}$ days; how many men can do the same in 192 days?      *Ans.* $6\frac{1}{16}$ men.

2. If $25\frac{4}{7}/.$ will pay for the carriage of 1 Cwt. $145\frac{1}{4}$ miles; how far may $6\frac{1}{2}$ Cwt. be carried for the same money?
                                                    *Ans.* $22\frac{9}{26}$ miles.

3. If $3\frac{1}{4}$ yards of cloth, that is $1\frac{1}{5}$ yard wide, be sufficient

to make a cloak; how much must I have of that sort which is $\frac{3}{4}$ yard wide, to make another of the same bigness?

*Ans.* $4\frac{1}{8}$ yards.

4. If 3 men can do a piece of work in $4\frac{1}{2}$ hours; in how many hours will 10 men do the same work? *Ans.* $1\frac{7}{20}$ hour.

5. If a penny loaf weigh 7 oz. when a bushel of wheat cost 5/6; what is the bushel worth when the loaf weighs only $2\frac{1}{2}$ oz.? *Ans.* 15/4$\frac{4}{5}$.

6. What quantity of shalloon that is $\frac{3}{4}$ yard wide will line $7\frac{1}{2}$ yards of cloth that is $1\frac{1}{2}$ yard wide? *Ans.* 15 yards.

# THE DOUBLE RULE OF THREE

IN

## VULGAR FRACTIONS.

### *Examples.*

1. If a carrier receives £2$\frac{1}{10}$ for the carriage of 3 Cwt. 150 miles; how much ought he to receive for the carriage of 7 Cwt. 3$\frac{1}{2}$ qrs. 50 miles? *Ans.* £1,16,9.

2. If £100 in 12 months gain £6 interest; what principal will gain £3$\frac{3}{8}$ in 9 months? *Ans.* £75.

3. If 9 students spend £10$\frac{7}{9}$ in 18 days; how much will 20 students spend in 30 days? *Ans.* £39,18,4$\frac{20}{81}$.

4. A man and his wife having laboured one day, earned $4\frac{5}{8}$/.; how much must they have for 10$\frac{1}{2}$ days, when their two sons helped them? *Ans.* £4,17,1$\frac{1}{2}$.

5. If £50 in 5 months gain £2$\frac{57}{144}$; what time will £11$\frac{1}{4}$ require to gain £1$\frac{1}{12}$? *Ans.* 10$\frac{130}{221}$ months.

6. If the carriage of 60 Cwt. 20 miles cost £14$\frac{1}{2}$; what weight can I have carried 30 miles for £5$\frac{7}{16}$? *Ans.* 15 Cwt.

# PART III.

# DECIMAL FRACTIONS.

IN Decimal Fractions the integer or whole thing, as one pound, one yard, one gallon, &c. is supposed to be divided into 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 ciphers as the numerator has places, is therefore never set down; the parts being only distinguished from the whole numbers by a *point* or dot prefix-ed: 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.*

From which it plainly appears, that as whole numbers increase in a tenfold proportion to the left hand, decimal parts decrease in a tenfold proportion to the right hand: so that ciphers placed before decimal parts decrease their value, by removing them further from the *point*, or unit's place; thus .5 is 5 parts of ten, or $\frac{5}{10}$; .05 is 5 parts of 100, or $\frac{5}{100}$; .005 is 5 parts of 1000, or $\frac{5}{1000}$; .0005 is 5 parts of 10000, or $\frac{5}{10000}$. But ciphers, after decimal parts, do not alter their value. For, .5, .50, .500, &c. are each but $\frac{5}{10}$ of the unit.

## ADDITION OF DECIMALS.

Rule.—In setting down the numbers to be added, great care must be taken in placing every figure directly underneath those of the same value, whether they be integers or decimal parts; and to perform which there must be a due regard had to the decimal points, which ought always to stand in a direct line, one under another, and to the right hand of them carefully place the decimal parts, according to their respective values; then add them as in whole numbers.

*Examples.*

1. Add 72 5+32.071+2.1574+371.4+2.75

*Ans.* 480.8784

   2. Add 30.07+2.0071+59.4+3207.1
   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+3.2075+.5741+2720


## SUBTRACTION OF DECIMALS.

RULE.—Subtraction of Decimals differs but little from whole numbers, only in placing the numbers, which must be carefully observed, as in Addition.

### *Examples.*

| | | |
|---|---|---|
| 1. From .2754 take .2371 | 5. From 571 take 54.72 |
| 2. From 2.37 take 1.76 | 6. From 625 take 76.91 |
| 3. From 271 take 215.7 | 7. From 23.415 take .3742 |
| 4. From 270.2 take 76.4075 | 8. From .107 take .0007 |


## MULTIPLICATION OF DECIMALS.

RULE.—Multiply as in whole numbers, and from the product towards the right hand, cut off as many places for decimals as there are in both factors together; but if there should not be so many places in the product, supply the defect with ciphers to the left hand.

### *Examples.*

   1. Multiply .2365 by .2435.   *Ans.* .05758775

| | |
|---|---|
| 2. Multiply 2.071 by 2.27 | 7. Multiply 27.35 by 7.70071 |
| 3. Multiply 27.15 by 25.3 | 8. Multiply 5.721 by .0075 |
| 4. Multiply 79347 by 23.15 | 9. Multiply 2.07 by .007 |
| 5. Multiply 17105 by .3257 | 10. Multiply 20.15 by .2705 |
| 6. Multiply 17105 by .0237 | 11. Multiply .907 by .0025 |

When any number of decimals is to be multiplied by 10, 100, 1000, &c. it is only removing the separating point in the multiplicand so many places towards the right hand as there are ciphers in the multiplier; thus, .578×10=5.78. .578×100=57.8 .578×1000=578. .578×10000=5780.

## CONTRACTED MULTIPLICATION
## OF DECIMALS.

Rule.—Put the unit's place of the multiplier under that place of the multiplicand that is intended to be kept in the product, then invert the order of all the other figures, i. e write them all the contrary way; then in multiplying, begin at the figure in the multiplicand, which stands over the figure you are then multiplying with, and set down the first figure of each particular product directly one under the other, and have a due regard to the increase arising from the figures on the right hand of that figure you begin to multiply at in the multiplicand.

*Note.*—That in multiplying the figure left out every time next the right hand in the multiplicand, if the product be 5, or upwards, to 15, carry 1; if 15, or upwards, to 25, carry 2; and if 25, or upwards, to 35, carry 3, &c.

### *Examples.*

12. Multiply 384.672158 by 36.8345, and let there be only four places of decimals in the product.      *Ans.* 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 | 11540164: 4 |
| | |
| 14169.2065 | 14169.2066\|038510 |

13. Multiply 3.141592 by 52.7438, and leave only 4 places of decimals.                            *Ans.* 165.6994

14. Multiply 2.38645 by 8.2175, and leave only 4 places of decimals.                            *Ans.* 19.6107

15. Multiply 375.13758 by 16.7324, and let there be only 1 place of decimals.                            *Ans.* 6276.9

16. Multiply 375.13758 by 16.7324, and leave only 4 places of decimals.                            *Ans.* 6276.9520

17. Multiply 395.3756 by .75642, and let there be only 4 places of decimals.                            *Ans.* 299.0700

## DIVISION OF DECIMALS.

Tʜɪs rule is also worked as in whole numbers; the only difficulty is in valuing the quotient, which is done by any of the following rules:

Rᴜʟᴇ.—1. The first figure in the quotient is always of the same value with that figure of the dividend, which answers or stands over the place of units in the divisor.

2. The quotient must always have so many decimal places as the dividend has more than the divisor.

*Note.*—1. If the divisor and dividend have both the same number of decimal parts, the quotient will be a whole number.

2. If the dividend has not so many places of decimals as are in the divisor, then so many ciphers must be annexed to the dividend as will make them equal, and the quotient will then be a whole number.

3. But if, when the division is done, the quotient has not so many figures as it should have places of decimals, then so many ciphers must be prefixed as there are places wanting.

### *Examples.*

1. Divide 85643.825 by 6.321.  *Ans.* 13549.09428+.
2. Divide 48 by 1.44
3. Divide 217.75 by 65
4. Divide 125 by .1045
5. Divide .709 by 2.574
6. Divide 5.714 by 8275
7. Divide 7382.54 by 6.4252
8. Divide .0851648 by 423
9. Divide 267.15975 by 13.25
10. Divide 72.1564 by .1347
11. Divide 715 by 30.75

When numbers are to be divided by 10, 100, 1000, 10,000, &c. it is performed by placing the separating point in the dividend so many places towards the left hand, as there are ciphers in the divisor.

Thus, 5784 ÷ 10 = 578.4     |     5784 ÷ 1000 = 5.784
5784 ÷ 100 = 57.84     |     5784 ÷ 10000 = .5784

## CONTRACTED DIVISION OF DECIMALS.

Rᴜʟᴇ.—By the first rule find what is the value of the first figure in the quotient; then, by knowing the first figure's

denomination, the decimal places may be reduced to any number, by taking as many of the left-hand figures of the dividend as will answer them; and in dividing, omit one figure of the divisor at each step of the operation.

*Note.*—That in multiplying every figure left out in the divisor, you must carry 1, if it be 5, or upwards, to 15; if 15, or upwards, to 25, carry 2; if 25, or upwards, to 35, carry 3, &c.

### Examples.

12. Divide 721.17562 by 2.257432, and let there be only three places of decimals in the quotient.

| Contracted. | Common Way. |
|---|---|
| 2.257432)721.17562(319.467 | 2.257432)721.17562(319.467 |
| ......6772296 | 6772296 |
| 439460. | 439460 2 |
| 225743. | 225743 2 |
| 213717.. | 213717 00 |
| 203169.. | 203168 88 |
| 10548... | 10548 120 |
| 9030... | 9029 728 |
| 1518.... | 1518 3920 |
| 1354.... | 1354 4592 |
| 164..... | 163 93280 |
| 158..... | 158 02024 |
| 6 | 5 91256 |

13. Divide 8.758615 by 5.2714167
14. Divide 51717591 by 8.7586
15. Divide 25.1367 by 217.35
16. Divide 51.47542 by .123415
17. Divide 70.23 by 7.9863
18. Divide 27.104 by 3.712

## REDUCTION OF DECIMALS.

### 1.—*To reduce a vulgar fraction to a decimal*

Rule.—Add ciphers to the numerator, and divide by the denominator, the quotient is the decimal fraction required.

*Examples.*

1. Reduce ¼ ......to a decimal.    4)1.00(.25 *Ans.*
2. Reduce ½ ......to a decimal.    *Ans.* .5
3. Reduce ¾ ... ..to a decimal.    *Ans.* .75
4. Reduce ⅜ ......to a decimal.    *Ans.* .375
5. Reduce ₂⁵₆......to a decimal.    *Ans.* .1923076 +
6. Reduce 1¼ of ¹⁰⁄₁₃ to a decimal.    *Ans.* .6043956 +

2.—*To reduce lower denominations to decimals of higher.*

RULE.—Annex a cipher to the lower denomination, and divide it by as many as make one of the next higher. When there are several denominations begin at the lowest, and reduce them in their order.

*Examples.*

7. Red. 7/. to the dec. of £1.    8. Red. 16/7¾ to ditto.
    20)7.0                                4)3.0
    *Ans.*  .35                          12)7.75
                                         2.0)16.6458 +
      -                               *Ans.*   .83229 +

9. Reduce 5/. to the decimal of a £ .......... *Ans.* .25
10. Reduce 9/. to the decimal of a £.......... *Ans.* .45
11. Reduce 16/. to the decimal of a £.......... *Ans.* .8
12. Reduce 8/9 to the decimal of a £. ...... *Ans.* .4375
13. Reduce 19/10½ to the decimal of a £.... *Ans.* .99375
14. Reduce 12 grains to the decimal of a lb. Troy.
                                         *Ans.* .002083 +
15. Reduce 12 drams to the decimal of a lb. Avoirdupois.
                                         *Ans.* .046875
16. Reduce 2 qrs. 14 lb. to the decimal of a Cwt.
                                         *Ans.* .625
17. Reduce 2 furlongs to the decimal of a league.
                                         *Ans.* .0833 +
18. Reduce 2 quarts 1 pint to the decimal of a gallon.
                                         *Ans.* .625
19. Reduce 4 gallons 2 quarts of wine to the decimal of a hogshead.                    *Ans.* .071428+
20. Reduce 2 gallons 1 quart of beer to the decimal of a barrel.                        *Ans.* .0625
21. Reduce 52 days to the decimal of a year.
                                         *Ans.* .14247 ➔

*Note.*—When the decimal would run on to a great many places, it is sufficient in practice to extend it to three, four, or five places, according to the nature of the articles and the degree of accuracy required, and add 1 to the last decimal place, if the following figure would have been 5, or upwards. Thus the decimal of 8 qrs. 22 lb. is .946428571, &c. and therefore .94643 — is nearer to it than .94642 +.

Shillings, pence, and farthings, may be easily reduced to decimals of three places by the following rule : *Take half the shillings for the final decimal place; and the number of far things increased by* 1, *if it amount to* 24, *or upwards; by* 2, *if it amount to* 48, *or upwards; and by* 3, *if it amount to* 72, *or upwards, for the two next places*

22. Find the decimal of 13/7½.    *Ans.* .681.

Compute thus: The half 13 is 6, which is the first decimal place, and a shilling over, which, together with 7½d., makes 19½d., or 78 farthings, to which we add 3 by the rule, because it exceeds 72; and obtain 81 for the two next decimal places.

23. Find the decimal of 6/10¾ to three places.  *Ans.* .344.
24. Find the decimal of 12/3 to three places.  *Ans.* .612.
25. Find the decimal of 15/10½.    *Ans.* .793.
26. Find the decimal of 19/11.    *Ans.* .995.

**3.**—*To find the value of any decimal fraction in the known parts of an integer.*

RULE.—Multiply the given decimal by the number of parts of the next inferior denomination, cutting off the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding, till you have taken in the least known parts of an integer.

*Examples.*

27 What is the value of .8323 of a £?

$$
\begin{array}{r}
.8323 \\
20 \\
\hline
16.6460 \\
12 \\
\hline
7.752 \\
4 \\
\hline
\frac{3}{4}.008 \quad \textit{Ans. } 16/7\frac{3}{4}. \\
\hline\hline
\end{array}
$$

28. What is the value of .002084 of a lb. Troy?
<div align="right">*Ans.* 12 grains +.</div>

29. What is the value of .046875 of a lb. Avoirdupois?
<div align="right">*Ans.* 12 drams.</div>

30. What is the value of .625 of a Cwt.? *Ans.* 2 qrs. 14 lb.

31. What is the value of .625 of a gallon?
<div align="right">*Ans.* 2 quarts, 1 pint.</div>

32. What is the value of .07143 — of a hogshead of wine?
<div align="right">*Ans.* 4 gallons, 2 quarts +.</div>

33. What is the value of .0625 of a barrel of beer?
<div align="right">*Ans.* 2 gallons, 1 quart.</div>

34. What is the value of .14247—of a year? *Ans.* 52 days.

*Note.*—Decimals of sterling money of three places may easily be reduced to shillings, pence, and farthings, by the following rule : *Double the first decimal place, and, if the second be* 5, *or upwards, add* 1 *thereto for shillings. Then the second and third decimal places, or their excess above* 50, *will be farthings, abating* 1 *if they amount to* 25, *or upwards; and* 2 *if they amount to* 40.

35. Value .621 of £1 sterling. ............*Ans.* 12/5¼.

36. —— .839 of £1 sterling. ...........*Ans.* 16/9½.

37. —— .365 of £1 sterling. ..............*Ans.* 7/3¾.

In Ex. 34. we compute thus: Twice 6 is 12 ; and 21, divided by 4, quotes 5¼d. In Ex. 35. twice 8 is 16/. and because 39 exceeds 25, we abate 1, the remainder 38 is farthings, or 9½d. In Ex. 36. because the second decimal place exceeds 5, we add 1 to twice 3, which gives 7/. then 5 from the second place leaves 15, which are farthings, or 3¾d.

38. Find the value of .483 of a £.......... ..*Ans.* 9/8.

39. Find the value of .528 of a £...........*Ans.* 10/6¼.

40. Find the value of .992 of a £......... *Ans.* 19/10.

41. Find the value of .816 of a £ .........*Ans.* 16/4.

## Decimal TABLES of Coin, Weight, and Measure.

### TABLE I.

ENGLISH COIN.

£1 the Integer.

| Sh. | Dec. | Sh. | Dec. |
|---|---|---|---|
| 19 | .95 | 9 | .45 |
| 18 | .9 | 8 | .4 |
| 17 | .85 | 7 | .35 |
| 16 | .8 | 6 | .3 |
| 15 | .75 | 5 | .25 |
| 14 | .7 | 4 | .2 |
| 13 | .65 | 3 | .15 |
| 12 | .6 | 2 | .1 |
| 11 | .55 | 1 | .05 |
| 10 | .5 | | |

| Pence. | Decimals. |
|---|---|
| 6 | .025 |
| 5 | .020833 |
| 4 | .016666 |
| 3 | .0125 |
| 2 | .008333 |
| 1 | .004166 |

| Far. | Decimals. |
|---|---|
| 3 | .003125 |
| 2 | .0020833 |
| 1 | .0010416 |

### TABLE II.

ENG. COIN. 1 sh.

Long Meas. 1 Foot the Integer.

| Pence and Inches. | Decimals. |
|---|---|
| 6 | .5 |
| 5 | .416666 |
| 4 | .333333 |
| 3 | .25 |
| 2 | .166666 |
| 1 | .083333 |

| Far. | Decimals. |
|---|---|
| 3 | .0625 |
| 2 | .041666 |
| 1 | .020833 |

### TABLE III.

TROY WEIGHT.

1 lb. the Integer.

*Ounces the same as Pence in Table II.*

| Penny-weights. | Decimals. |
|---|---|
| 10 | .041666 |
| 9 | .0375 |
| 8 | .033333 |
| 7 | .029166 |
| 6 | .025 |
| 5 | .020833 |
| 4 | .016666 |
| 3 | .0125 |
| 2 | .008333 |
| 1 | .004166 |

| Grains. | Decimals. |
|---|---|
| 12 | .002083 |
| 11 | .001910 |
| 10 | .001736 |
| 9 | .001562 |
| 8 | .001389 |
| 7 | .001215 |
| 6 | .001042 |
| 5 | .000868 |
| 4 | .000694 |
| 3 | .000521 |
| 2 | .000347 |
| 1 | .000173 |

1 Oz. the Integer.
*Pennyweights the same as Shillings in Table I.*

| Grains. | Decimals. |
|---|---|
| 12 | .025 |
| 11 | .022916 |
| 10 | .020833 |
| 9 | .01875 |
| 8 | .016666 |
| 7 | 014583 |
| 6 | .0125 |
| 5 | .010416 |
| 4 | .008333 |
| 3 | .00625 |
| 2 | .004166 |
| 1 | .002083 |

### TABLE IV.

AVOIRDUP. WEIGHT.

112 lb. the Integer.

| Qrs. | Decimals. |
|---|---|
| 3 | .75 |
| 2 | .5 |
| 1 | .25 |

| Pounds. | Decimals. |
|---|---|
| 14 | .125 |
| 13 | .116071 |
| 12 | .107143 |
| 11 | .098214 |
| 10 | .089286 |
| 9 | .080357 |
| 8 | .071428 |
| 7 | .0625 |
| 6 | .053571 |
| 5 | .044643 |
| 4 | .035714 |
| 3 | .026786 |
| 2 | .017857 |
| 1 | .008928 |

| Ounces. | Decimals. |
|---|---|
| 8 | .004464 |
| 7 | .003906 |

| Decimal TABLES of Coin, Weight, and Measure. |
| --- |

| | |
| --- | --- |
| 6 | .003348 |
| 5 | .002790 |
| 4 | .002232 |
| 3 | .001674 |
| 2 | .001116 |
| 1 | .000558 |

| ¼ Oz. | Decimals. |
| --- | --- |
| 3 | .000418 |
| 2 | .000279 |
| 1 | .000139 |

### TABLE V.
AVOIRDUP. WEIGHT.
1 lb. the Integer.

| Ounces. | Decimals. |
| --- | --- |
| 8 | .5 |
| 7 | .4375 |
| 6 | .375 |
| 5 | .3125 |
| 4 | .25 |
| 3 | .1875 |
| 2 | .125 |
| 1 | .0625 |

| Drams. | Decimals. |
| --- | --- |
| 8 | .03125 |
| 7 | .027343 |
| 6 | .023437 |
| 5 | .019531 |
| 4 | .015625 |
| 3 | .011718 |
| 2 | .007812 |
| 1 | .003906 |

### TABLE VI.
LIQUID MEAS.
1 Tun the Integ.

| Gallons. | Decimals. |
| --- | --- |
| 100 | .396825 |
| 90 | .357141 |

| | |
| --- | --- |
| 80 | .317460 |
| 70 | .277777 |
| 60 | .238095 |
| 50 | .198412 |
| 40 | .158730 |
| 30 | .119047 |
| 20 | .079365 |
| 10 | .039682 |
| 9 | 035714 |
| 8 | .031746 |
| 7 | .027777 |
| 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.

| Pin. | Decim. | Bush. |
| --- | --- | --- |
| 4 | .5 | 4 |
| 3 | .375 | 3 |
| 2 | .25 | 2 |
| 1 | .125 | 1 |

| Q.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 |

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Decimal TABLES of Coin, Weight, and Measure.

| | | | | |
|---|---|---|---|---|
| 500 | .284091 | 80 | .219178 | **TABLE X.** |
| 400 | .227272 | 70 | .191781 | CLOTH MEASURE. |
| 300 | .170454 | 60 | .164383 | 1 Yard the Integer. |
| 200 | .113636 | 50 | .136986 | Qrs. the same as |
| 100 | .056818 | 40 | .109589 | Table IV. |
| 90 | .051136 | 30 | .082192 | |

| Nails. | Decimals. |
|---|---|
| 2 | .125 |
| 1 | .0625 |

**TABLE XI.**

LEAD WEIGHT.

A Fother of 19½Cwt. the Integer.

Main left column:

| | |
|---|---|
| 500 | .284091 |
| 400 | .227272 |
| 300 | .170454 |
| 200 | .113636 |
| 100 | .056818 |
| 90 | .051136 |
| 80 | .045454 |
| 70 | .039773 |
| 60 | .034091 |
| 50 | .028409 |
| 40 | .022727 |
| 30 | .017045 |
| 20 | .011364 |
| 10 | .005682 |
| 9 | .005114 |
| 8 | .004545 |
| 7 | .003977 |
| 6 | .003409 |
| 5 | .002841 |
| 4 | .002273 |
| 3 | .001704 |
| 2 | .001136 |
| 1 | .000568 |

| Feet. | Decimals. |
|---|---|
| 2 | .0003787 |
| 1 | .0001894 |

| Inches. | Decimals. |
|---|---|
| 6 | .0000947 |
| 3 | .0000474 |
| 1 | .0000158 |

**TABLE IX.**

TIME.

1 Year the Integer.

Months the same as Pence in Table II.

| Days. | Decimals. |
|---|---|
| 365 | 1.000000 |
| 300 | .821918 |
| 200 | .547945 |
| 100 | .273972 |
| 90 | .246575 |

Middle column:

| | |
|---|---|
| 80 | .219178 |
| 70 | .191781 |
| 60 | .164383 |
| 50 | .136986 |
| 40 | .109589 |
| 30 | .082192 |
| 20 | .054794 |
| 10 | .027397 |
| 9 | .024657 |
| 8 | .021918 |
| 7 | .019178 |
| 6 | .016438 |
| 5 | .013698 |
| 4 | .010959 |
| 3 | .008219 |
| 2 | .005479 |
| 1 | .002739 |

1 Day the Integer.

| Hours. | Decimals. |
|---|---|
| 12 | .5 |
| 11 | .458333 |
| 10 | .476666 |
| 9 | .375 |
| 8 | .333333 |
| 7 | .291666 |
| 6 | .25 |
| 5 | .208333 |
| 4 | .166666 |
| 3 | .125 |
| 2 | .083333 |
| 1 | .041666 |

| Min. | Decimals. |
|---|---|
| 30 | .020833 |
| 20 | .013888 |
| 10 | .006944 |
| 9 | .00625 |
| 8 | .005555 |
| 7 | .004861 |
| 6 | .004166 |
| 5 | .003472 |
| 4 | .002777 |
| 3 | .002083 |
| 2 | .001388 |
| 1 | .000694 |

Right column (TABLE XI):

| Cwt. | Decimals. |
|---|---|
| 10 | .512820 |
| 9 | .461538 |
| 8 | .410256 |
| 7 | .358974 |
| 6 | .307692 |
| 5 | .256410 |
| 4 | .205128 |
| 3 | .153846 |
| 2 | .102564 |
| 1 | .051282 |

| Qrs. | Decimals. |
|---|---|
| 2 | .025641 |
| 1 | .012820 |

| Pounds. | Decimals. |
|---|---|
| 14 | .0064102 |
| 13 | .0059523 |
| 12 | .0054945 |
| 11 | .0050366 |
| 10 | .0045787 |
| 9 | .0041208 |
| 8 | .0036630 |
| 7 | .0032051 |
| 6 | .0027472 |
| 5 | .0022893 |
| 4 | .0018315 |
| 3 | .0013736 |
| 2 | .0009157 |
| 1 | .0004578 |

# THE RULE OF THREE IN DECIMALS.

### *Examples.*

If 26½ yards cost £3,16,3, what will 32¼ yards come
to ?                                   *Ans.* £4,12,9½.

    **Yds.**      **£.**      **Yds.**
    26.5  :  3.8125  :  :  32.25
                  32.25
    ────────────────────────────
    26.5)122.953125(4.639* = £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 140¼
yards of the same cost ?        *Ans.* £47,16,8¼.

4. If a chest of sugar, weighing 7 Cwt. 2 qrs. 14 lb. cost
£36,12,9; what will 2 Cwt. 1 qr. 21 lb. cost ?

5. A chest of tea weighs 3 qrs. 21¾ lb. and cost £24,13,6;
what is the price of 3½ lb. at the same rate ?        *Ans.* 16/4.

6. What will 3 Cwt. 18 lb. of tobacco come to, when 1¼
lb. is sold for 3/6.                    *Ans.* £38,1,3.

7. What is the worth of 19 oz. 3 dwt. 5 gr. of gold, at
£2,19 ℔ oz.?                    *Ans.* £56,10,5,2¾.

8. What is the expense of 827¾ yards of painting, at 10½d.
℔ yard ?                    *Ans.* £36,4,3¼+.

9. If I lent my friend £34 for ⅝ of a year; how much
ought he to lend me ₅⁄₁₂ of a year to requite my kindness?
                                   *Ans.* £51.

10. If ¾ of a yard of cloth, that is 2¼ yards broad, make
a garment; how much cloth, ⅘ of a yard wide, will make
the same ?                    *Ans.* 2.109375 yards.

11. If 1 ounce of silver costs 5/6; what is the price of a
tankard that weighs 1 lb. 10 oz. 10 dwt. ?    *Ans.* £6,3,9.

12. If 1 lb. of tobacco cost 15¾d.; what cost 3 hogsheads,
weighing together 15 Cwt. 1 qr. 19 lb. ?   *Ans.* £113,6,8¼.

13. If 1 Cwt. of currants cost £2,9,6; what will 45 Cwt.
3 qrs. 14 lb. cost at the same rate ?    *Ans.* £113,10,9¾.

14. Bought 6 chests of sugar, each 6 Cwt. 3 qrs. at £2,16
℔ Cwt.; what do they come to ?          *Ans.* £113,8.

15. Bought a tankard for £10,12, at the rate of 5/4 ℔
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 ℔ lb. ?          *Ans.* 15½d.

─────────────────────────────────────

* Three places are sufficient for finding the value of a *decimal of* £1
sterling by inspection.—*Vide* Rule. p. 124.

17. Bought 29 lb. 4 oz. of coffee for £10,11,3; what is the value of 3 lb.? *Ans.* £1,1,8.

18. If I gave 1/1 for 3½ lb. of cheese, what will be the value of 1 Cwt.? *Ans.* £1,14,8.

# EXTRACTION OF THE SQUARE ROOT.

EXTRACTING the Square Root, is to find out such a number as being multiplied into itself, the product will be equal to the given number.

RULE.—*First.* Point the given number, beginning at the unit's place, then 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, (except 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 any) 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 root.        345 root.
3² = 9                          345
    64)290                     1725
       256                     1380
    685) 3425                  1035
         3425            Proof 119025
```

G 3

2. What is the square root of 106929 ?          *Ans.* 327.
3. What is the square root of 2268741 ?    *Ans.* 1506.23+.
4. What is the square root of 7596796 ? *Ans.* 2756.228+.
5. What is the square root of 36372961 ?          *Ans.* 6031.
6. What is the square root of 22071204 ?          *Ans.* 4698.

When the given number consists of a whole number, and decimals together, make the number of decimals even by adding ciphers to them ; so that there may be a point fall on the unit's place of the whole number.

7. What is the square root of 3271.4207 ?    *Ans.* 57.19+.
8. What is the square root of 4795.25731 ? *Ans.* 69.247+.
9. What is the square root of 4.372594?    *Ans.* 2.091+.
10. What is the square root of 2.2710957 ?

*Ans.* 1.50701+

11. What is the square root of .00032754?    *Ans.* .01809+.
12. What is the square root of 1.270054 ?    *Ans.* 1.1269+.

### To extract the square root of a vulgar fraction.

Rule.—Reduce the fraction to its lowest terms, then extract the square root of the numerator for a new numerator, and the square root of the denominator for a new denominator.

*Note.*—If the fraction be a surd, i. e. a number where a root can never be exactly found, reduce it to a decimal, and extract the root of it.

### Examples.

13. What is the square root of $\frac{2304}{3184}$? .......... *Ans.* $\frac{2}{3}$.
14. What is the square root of $\frac{2704}{4225}$? .......... *Ans.* $\frac{3}{4}$.
15. What is the square root of $\frac{9216}{12544}$?.......... *Ans.* $\frac{6}{7}$

### Surds.

16. What is the square root of $\frac{675}{841}$?    ...*Ans.* .89802+.
17. What is the square root of $\frac{357}{476}$ ?    ....*Ans.* .86602+.
18. What is the square root of $\frac{478}{549}$?...*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 an improper fraction.

2. Extract the roots of the numerator and denominator for a new numerator and denominator.

*Note.*—If the mixed number given be a surd; reduce the fractional part to a decimal: annex it to the whole number, and extract the square root thereof.

### Examples.

19. What is the square root of $51\frac{11}{25}$?......... *Ans.* $7\frac{1}{5}$.
20. What is the square root of $27\frac{9}{16}$?.......... *Ans.* $5\frac{1}{4}$.
21. What is the square root of $9\frac{43}{49}$? .......... *Ans.* $3\frac{1}{7}$

### Surds.

22. What is the square root of $85\frac{4}{7}$? ......*Ans.* 9.27 +
23. What is the square root of $8\frac{4}{7}$?......*Ans.* 2.9519 +
24. What is the square root of $6\frac{2}{3}$?......*Ans.* 2.5819 + .

### The Application.

1. How many square feet in the pavement of a square court yard, each side being 121 feet?     *Ans.* 14641 feet.

2. A solid square of men is to be extended into line, three deep; of what number of men will each line consist, if each side of the square contains 219 men?     *Ans.* 15987 men.

*To find a mean proportional between any two given numbers.*

RULE.—The square root of the product of the given numbers is the mean proportional sought.

### Examples.

3. What is the mean proportional between 3 and 12?
    *Ans.* $3 \times 12 = 36$ then $\sqrt{36} = 6$ *the mean proportional*

4. What is the mean proportional between 12 and 27?
     *Ans.* 18.

5. If a cheese be laid in an unequal balance, and weighs in the one scale 45 lb. and in the other only 40 lb.: required its true weight?     *Ans.* 42 lb. 7 oz.

*To find the side of a square, equal in area to any given super-ficies.*

RULE.—The square root of the content of any given superficies, is the square equal sought.

### Examples.

6. If the content of a given circle be 160: what is the side of the square? ⚓     *Ans.* 12.64911.

7. If the area of a circle is 750: what is the side of the square equal?     *Ans.* 27.38612.

8. A square field containing 6 acres, is to be enclosed with a hedge: what will be the length of each side?
     *Ans.* 511.123 + feet.

9. There are two circular walks in a gentleman's pleasure ground, the diameter of the one is 60 yards, and the other three times as large : what is its diameter?

*Ans.* 103.923 + yards.

10. A gentleman has two fields; the first measures 10 cres 38 poles, and the second, 6 acres, 3 roods, 12 poles : ne wants to exchange them with a square field of inferior land, but one-half larger: required the side of the square ?

*Ans.* 64 poles, *nearly*.

### The area of a circle given, to find the diameter.

RULE.—As 355 : 452, or, as 1 : 1.273239 : : so is the area : to the square of the diameter :—or, multiply the square root of the area, by 1.12837, and the product will be the diameter.

#### Example.

11. What length of cord will be necessary to tie to a cow's tail, the other end being fastened to the ground, to let her have liberty of eating just an acre of grass, supposing the cow and tail to be 5½ yards in length?

*Ans.* 6.136 + perches.

### The area of a circle given to find the periphery or circumference.

RULE.—As 113 : 1420, or, as 1 : 12.56637 : : the area to the square of the periphery,—or, multiply the square root of the area by 3.5449, and the product is the circumference.

#### Examples.

12. When the area is 12, what is the circumference?

*Ans.* 12.2798.

13. When the area is 160, what is the periphery?

*Ans.* 44.839.

### Any two sides of a right-angled triangle given to find the third side.
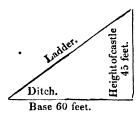
1. *The base and perpendicular given, to find the hypothenuse.*

RULE.—The square root of the sum of the squares of the base and perpendicular, is the length of the hypothenuse.

*Examples.*

14. The wall of a castle is 45 feet high, and surrounded with a ditch, 60 feet broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle?

*Ans.* 75 feet.



*Operation.*
$$45^2 = 2025$$
$$60^2 = 3600$$
$$\overline{\phantom{00}5625}(75 \text{ feet.}$$
$$7^2 = \overline{\phantom{00}49}$$
$$145)\overline{725}$$
$$\phantom{145)}725$$

15. The wall of a town is 25 feet high, which is surrounded by a moat of 30 feet in breadth: I desire to know the length of a ladder that will reach from the outside of the moat to the top of the wall? *Ans.* 39.05 + feet.

16. Two ships sail from the same port, one of them goes due east 50 leagues, and the other due north· how far are they then distant? *Ans.* 97.75 leagues.

*The hypothenuse and perpendicular given, to find the base.*

RULE.—The square root of the difference of the squares of the hypothenuse and perpendicular is the length of the base.

17. The wall of a castle, 45 feet high, is surrounded with a ditch; and a ladder 75 feet long will reach from the outside of the ditch to the top of the wall: what is the breadth of the ditch? *Ans.* 60 feet.

18. A ladder 40 feet long will reach a window 32 feet high on the one side of a street, and on the opposite side, another window 24 feet high: what is the breadth of the street?
*Ans.* 56 feet.

*The base and hypothenuse given, to find the perpendicular.*

RULE.—The square root of the difference of the squares of the hypothenuse and base is the height of the perpendicular.

19. The wall of a castle is surrounded with a ditch 60 feet broad, and it requires a ladder 75 feet long to reach from the outside of the ditch to the top of the wall: what is 'ts height? *Ans.* 45 feet

20. A line 27 yards long will exactly reach from the top of a fort, on the opposite bank of a river which is 23 yards broad: required the height of the wall.

*Ans.* 42 feet, 5 inches

*Any number of men being given, to form them into a square battalia, or to find the number of rank and file.*

RULE.—The square root of the number of men given, is the number of men either in rank or file.

21. An army consisting of 331776 men; I desire to know how many rank and file. *Ans.* 576.

22. A square pavement contains 39601 square stones, all of the same size; I demand how many are contained in one of the sides? *Ans.* 199

# EXTRACTION OF THE CUBE ROOT.

To extract the Cube Root is to find out a number, which being multiplied into itself, and then into that product, produceth the given number.

RULE.—1. Point every third figure of the Cube given, beginning at the unit's place; seek the greatest cube to the first point, and subtract it therefrom; put the root in the quotient, and bring down the figures in the next point to the remainder for a *Resolvend.*

2. Find a *Divisor* by multiplying the square of the quotient by 3. See how often it is contained in the resolvend, rejecting the units and tens, and put the answer in the quotient.

3. To find the *Subtrahend.* 1. Cube the last figure in the quotient. 2. Multiply all the figures in the quotient by 3, except the last, and that product by the square of the last. 3. Multiply the divisor by the last figure. Adding these products together, gives the subtrahend, which subtract from the resolvend; to the remainder bring down the next point, and proceed as before.

| Roots..... | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. |
|---|---|---|---|---|---|---|---|---|---|
| Cubes..... | 1 | 8 | 27. | 64. | 125. | 216. | 343. | 512. | 729. |

*Examples.*

1. What is the cube root of 99252847?

99252847. (463

     64 = cube of 4

Divisor  ̄ ̄ ̄ ̄ ̄

Square of 4 × 3 = 48(35252 resolvend.

        216 = cube of 6.

       432 = 4 × 3 × by square of 6.

       288 = divisor × by 6

     33336 subtrahend.

Divisor.  ̄ ̄ ̄ ̄ ̄

Square of 46 × 3 = 6348)1916847 resolvend.

        27 = cube of 3.

     1242 = 46 × 3 × by squ. of 3

   19044 = divisor × by 3.

   1916847 subtrahend.

2. What is the cube root of 389017?     *Ans.* 73
3. What is the cube root of 5735339?     *Ans.* 179
4. What is the cube root of 32461759?     *Ans.* 319
5. What is the cube root of 84604519?     *Ans.* 439
6. What is the cube root of 259694072?     *Ans.* 638
7. What is the cube root of 48228544?     *Ans.* 364
8. What is the cube root of 27054036008?     *Ans.* 3002.
9. What is the cube root of 22069810125?     *Ans.* 2805.
10. What is the cube root of 122615327232?     *Ans.* 4968.
11. What is the cube root of 219365327791?     *Ans.* 6031.
12. What is the cube root of 673373097125?     *Ans.* 8765.

When the given number consists of a whole number and decimal together, make the number of decimals to consist of 3, 6, 9, &c. places by adding ciphers thereto, so that a point may 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.* 33.06 +
15. What is the cube root of .001906624?     *Ans.* .124.
16. What is the cube root of 33.230979637? *Ans.* 3.215 +
17. What is the cube root of 15926.972504? *Ans.* 25.16 +
18. What is the cube root of .053157376?     *Ans.* .376.

*To extract the Cube Root of a Vulgar Fraction.*

Rule.—Reduce the fraction to its lowest terms; then ex-

tract the cube root of its numerator and denominator for a new numerator and denominator; but if the fraction be a *surd*, reduce it to a decimal, and then extract the root from it

### *Examples.*

| | |
|---|---|
| 19. What is the cube root of $\frac{258}{688}$ ? | *Ans.* $\frac{4}{8}$. |
| 20. What is the cube root of $\frac{334}{1500}$ ? | *Ans.* $\frac{3}{8}$. |
| 21. What is the cube root of $\frac{1530}{5120}$ ? | *Ans.* $\frac{7}{8}$. |

### Surds.

| | |
|---|---|
| 22. What is the cube root of $\frac{4}{7}$ ? | *Ans.* .829 +. |
| 23. What is the cube root of $\frac{5}{9}$ ? | *Ans.* .822 +. |
| 24. What is the cube root of $\frac{2}{3}$ ? | *Ans.* .873 +. |

*To extract the Cube Root of a mixed number.*

Rule.—Reduce the fractional part to its lowest terms, and then the mixed number to an improper fraction, extract the cube roots of the numerator and denominator for a new numerator and denominator; but if the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the root of it?

### *Examples.*

| | |
|---|---|
| 25. What is the cube root of $12\frac{19}{27}$ ? | *Ans.* $2\frac{1}{3}$. |
| 26. What is the cube root of $31\frac{15}{343}$ ? | *Ans.* $3\frac{1}{7}$. |
| 27. What is the cube root of $405\frac{48}{125}$ ? | *Ans.* $7\frac{2}{5}$. |

### Surds.

| | |
|---|---|
| 28. What is the cube root of $7\frac{1}{5}$ ? | *Ans.* 1.93 +. |
| 29. What is the cube root of $9\frac{1}{6}$ ? | *Ans.* 2.092 + |
| 30. What is the cube root of $8\frac{4}{7}$ ? | *Ans.* 2.057 +. |

### The Application.

1. How many cubical inches, in a cubical piece of timber, 47 inches long, 47 inches broad, and 47 inches deep?

*Ans.* 103823.

2. A cellar dug 12 feet every way, in length, breadth, and depth; how many solid feet of earth were taken out of it?

*Ans.* 1728.

3. A stone of cubic form contains 389017 solid feet; what is the superficial contents of one of its sides? *Ans.* 5329.

*To find two mean proportionals, between two numbers given.*

RULE.—Divide the greater extreme by the less, and the cube root of the quotient multiplied by the less extreme gives the less mean ; multiply the said cube root by the less mean, and the product will be the greater mean proportional.

### Examples.

4. What are the two mean proportionals between 6 and 162?                                                   *Ans.* 18 and 54.

5. What are the two mean proportionals between 4 and 108?                                                   *Ans.* 12 and 36.

*To find the side of a cube that shall be equal in solidity to any given solid, as a globe, cylinder, prism, cone, &c.*

RULE.—The cube root of the solid contents of any solid body given, is the side of the cube of equal solidity.

### Examples.

6. If the solid content of a globe be 10648; what is the side of a cube of equal solidity?             *Ans.* 22.

7. Required the side of a cubical vessel that will contain 8 gallons of liquor?                      *Ans.* 13 + inches.

8. What is the inside length of the sides of a bin in a cubical form, which is to contain 1000 bushels of barley, Imperial measure?                          *Ans.* 130.4 + inches.

*The side of the cube being given, to find the side of the cube that shall be either greater or less in quantity to the cube given.*

RULE.—Cube the side given; and enlarge or diminish it, in the proportion required: the cube root of that number, is the side sought.

### Examples.

9. The side of a cubical vessel is 12 inches; it is required to find the side of another vessel, that is to contain three times as much?                    *Ans.* $17\frac{3}{10}$ inches.

10. The side of a cubical cistern is 60 inches, and holds a certain quantity of water: what is the side of another, which is only one-third of the quantity?       *Ans* 41.5 + inches.

## EXTRACTING OF THE BIQUADRATE ROOT

To extract the Biquadrate Root is to find out a number, which being involved four times into itself, will produce the given number.

RULE.—First extract the square root of the given number, and then extract the square root of that square root, and it will give the biquadrate root required.

### Examples.

1. What is the biquadrate of 27?        *Ans.* 531441.
2. What is the biquadrate of 76?        *Ans.* 33362176.
3. What is the biquadrate of 275?        *Ans.* 5719140625.
4. What is the biquadrate root of 531441?        *Ans.* 27.
5. What is the biquadrate root of 33362176?        *Ans.* 76.
6. What is the biquadrate root of 5719140625?  *Ans.* 275.

A GENERAL RULE FOR

## EXTRACTING THE ROOTS OF ALL POWERS.

1. PREPARE the number given for extraction, by pointing off from the unit's place as the root required directs.

2. Find the first figure in the root by the table of powers which subtract from the given number.

3. Bring down the first figure in the next point to the remainder, and call it the dividend.

4. Involve the root into the next inferior power to that which is given; multiply it by the given power, and call it the divisor.

5. Find a quotient figure by common division, and annex it to the root; then involve the whole root into the given power, and call that the subtrahend.

6. Subtract that number from as many points of the given power, as are brought down, beginning at the lower place, and to the remainder bring down the first figure of the next point for a new dividend.

7. Find a new divisor, and proceed in all respects as before.

*Examples.*

1. What is the square root of 141376?

$\dot1\dot4\dot1\dot3\dot7\dot6$(376
9
6)$\overline{51}$    dividend.
$\overline{1369}$ subtrahend.
74) $\overline{.447}$ dividend.
$\overline{141376}$ subtrahend.

| | | | |
|---|---|---|---|
| 3 × | 2 = 6 | divisor. |
| 37 × 37 = 1369 | subtrahend. |
| 37 × 2 = 74 | divisor. |
| 376 × 376 = 141376 | subtrahend. |

3 ×    2 = 6    divisor.
37 ×  37 = 1369    subtrahend.
37 ×  2 = 74    divisor.
376 × 376 = 141376 subtrahend.

2. What is the cube root of 53157376?

$\dot5\dot3\dot1\dot5\dot7\dot3\dot7\dot6$(376
27
27)$\overline{261}$    dividend.
$\overline{50653}$    subtrahend.
4107)$\overline{25043}$    dividend.
$\overline{53157376}$ subtrahend.

3 ×   3 ×   3 = 27    divisor.
37 ×  37 ×  37 = 50653    subtrahend.
37 ×  57 ×   3 = 4107    divisor.
376 × 376 × 376 = 53157376 subtrahend.

3. What is the biquadrate root of 19987173376?

$19\dot9871\dot73\dot37\dot6$(376
81
108)$\overline{1188}$    dividend.
$\overline{1874161}$    subtrahend.
202612)$\overline{1245563}$    dividend.
$\overline{19987173376}$ 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

## COMPOUND INTEREST.

The following letters are made use of in Compound Interest

A, the amount.
P, the principal.
T, the time.
R, the amount of £1 for 1 year at any given rate,
which is thus found :

As 100 : 105 : : 1 : 1.05      As 100 : : 105.5 : : 1 : 1.055

TABLE of the Amount of £1 for One Year.

| Rates ⅌ Ct. | Amts. of £1. | Rates ⅌ Ct. | Amts. of £1. | Rates ⅌ Ct. | 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 |

A TABLE showing the Amount of £1 for any Number of Years under 31, at 5 and 6 ⅌ Cent. ⅌ 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 | 1.68947 | 24 | 3.22510 | 4.04893 |
| 10 | 1.62889 | 1.79084 | 25 | 3.38635 | 4.29187 |
| 11 | 1.71034 | 1.89829 | 26 | 3.55567 | 4.54938 |
| 12 | 1.79585 | 2.01219 | 27 | 3.73345 | 4.82234 |
| 13 | 1.88565 | 2.13292 | 28 | 3.92013 | 5 11168 |
| 14 | 1.97993 | 2.26090 | 29 | 4.11613 | 5.41838 |
| 15 | 2.07892 | 2.39655 | 30 | 4.32194 | 5.74349 |

*Note.*—The above Table is thus made: As 100 : 105 : 1 : 1.05 for the first year; then, As 100 : 105 : : 1.05 : 1.1025 second year, &c.

I. *When* P, T, R, *are given to find* A.

RULE. $p \times r^t = $ A.

### Examples,

1. What will £225 amount to in 3 years time, at 5 ₱ Cent. ₱ annum?     *Ans.* 1.05 × 1.05 × 1.05 = 1.157625, then 1.157625 × £225 = £260 , 9 , 3¾

2. What will £200 amount to in 4 years, at 5 ₱ Cent. ₱ annum?     *Ans.* £243 , 2.025.

3. What will £450 amount to in 5 years, at 4 ₱ Cent. ₱ annum?     *Ans.* £547 , 9 , 10½.

4. What will £500 amount to in 4 years, at 5½ ₱ Cent ₱ annum?     *Ans.* £619 , 8 , 2¾.

II. *When* A, R, T, *are given to find* P.

RULE. $\dfrac{a}{r^t} = $ P.

### Examples.

5. What principal being put to interest will amount to £260 , 9 , 3¾ in 3 years, at 5 ₱ Cent. ₱ annum?

$$1.05 \times 1.05 \times 1.05 = 1.157625 \frac{260.465625}{1.157625} = £225 \ Ans$$

6. What principal being put to interest will amount to £243 , 2 in 4 years, at 5 ₱ Cent. ₱ annum? *Ans.* £200.

7. What principal will amount to £547 , 9 , 10½ in 5 years, at 4 ₱ Cent. ₱ annum?     *Ans.* £450.

8. What principal will amount to £619 , 8 , 2¾ in 4 years, at 5½ ₱ Cent?     *Ans.* £500.

III. *When* P, A, T, *are given to find* R.

RULE. $\dfrac{a}{p} = r^t$, { which being extracted by the rules of extraction, (the time given in the question showing the power,) will give R.

### Examples.

9. At what rate ₱ Cent. will £225 amount to £260 , 9 , 3¾ in 3 years?     *Ans.* 5 ₱ Cent.

$$\frac{260.465625}{225} = 1.157625,$$ the cube root of which (it being the 3d power) = 1.05 = 5 ₱ Cent.

10. At what rate ₱ Cent. will £200 amount to £243 , 2 in 4 years?     *Ans.* 5 ₱ Cent.

11. At what rate ₱ Cent. wil £450 amount to £547 , 9 , 10½ in 5 years?     *Ans.* 4 ₱ Cent.

12. At what rate ⅌ Cent. will £500 amount to £619 ,8 ,3 in 4 years?                    *Ans.* 5½ ⅌ Cent.

IV. *When* P, A, R, *are given to find* T,

RULE    $\dfrac{a}{p} = r^t$, $\left\{\begin{array}{l}\text{which being continually divided by R}\\\text{till nothing remains, the number of those}\\\text{divisions will be equal to T.}\end{array}\right.$

*Examples.*

13. In what time will £225 amount to £260 ,9 ,3¾, at 5 ⅌ Cent.?                    *Ans.* 3 years

$$\frac{260.465625}{225} = 1.157625 \ \frac{1.157625}{1.05} = 1.1025 \ \frac{1.1025}{1.05} = 1.05 \ \frac{1.05}{1.05} = 1$$

the number of divisions being three times sought.

14. In what time will £200 amount to £243 ,2, at 5 ⅌ Cent?                    *Ans.* 4 years.

15. In what time will £450 amount to £547 ,9 ,10½, at 4 ⅌ Cent.?                    *Ans.* 5 years.

16. In what time will £500 amount to £619 ,8 ,3, at 5½ ⅌ Cent.?                    *Ans.* 4 years.

## ANNUITIES, OR PENSIONS,

### IN ARREARS.

*Note.*—U represents the annuity, pension, or yearly rent A, R, T, as before.

A TABLE showing the Amount of £1 Annuity for any number of Years under 31, at 5 and 6 ⅌ Cent. ⅌ annum.

| Years. | 5 | *Rates.* | 6 | Years. | 5 | *Rates.* | 6 |
|---|---|---|---|---|---|---|---|
| 1 | 1.00000 | | 1.00000 | 16 | 23.65749 | | 25.67252 |
| 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 | | 5.63709 | 20 | 33.06595 | | 36.78559 |
| 6 | 6.80191 | | 6.97532 | 21 | 35.71925 | | 39.99272 |
| 7 | 8.14200 | | 8.39383 | 22 | 38.50521 | | 43.39229 |
| 8 | 9.54910 | | 9.89746 | 23 | 41.43047 | | 46.99582 |
| 9 | 11.02656 | | 11.49131 | 24 | 44.50199 | | 50.81557 |
| 10 | 12.57789 | | 13.18079 | 25 | 47.72709 | | 54.86451 |
| 11 | 14.20678 | | 14.97164 | 26 | 51.11345 | | 59.15638 |
| 12 | 15.91712 | | 16.86994 | 27 | 54.66912 | | 63.70576 |
| 13 | 17.71298 | | 18.88213 | 28 | 58.40258 | | 68.52811 |
| 14 | 19 59863 | | 21.01506 | 29 | 62.32271 | | 73.63979 |
| 15 | 21.57856 | | 23.27597 | 30 | 66.43884 | | 79.05818 |

*Note.*--The preceding 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. $\dfrac{ur' - u}{r - 1}$ = A, or by the Table thus :

Multiply the amount of £1 for the number of years, and at the rate ₥ Cent. given in the question, by the annuity, pension, &c. and it will give the answer.

### *Examples.*

17. What will an annuity of £50 ₥ annum, payable yearly, amount to in 4 years, at 5 ₥ Cent.
*Ans.* 1.05 × 1.05 × 1.05 × 1.05 × £50 = 60.77531250

then $\dfrac{60.7753125 - 50}{1.05 - 1}$ = £215, 10, 1½, or,

by the Table thus, 4.31012 × £50 = £215, 10, 1¼

18. What will a pension of £45 ₥ annum, payable yearly, amount to in 5 years, at 5 ₥ Cent.? *Ans.* £248, 13, 0¾

19. If a salary of £40 ₥ annum, to be paid yearly, be for borne 6 years, at 6 ₥ Cent. what is the amount?
*Ans.* £279, 0, 3.

20. If an annuity of £75 ₥ annum, payable yearly, be omitted to be paid for 10 years, at 6 ₥ Cent. what is the amount? *Ans.* £988, 11, 2¼

II. *When* A, R, T, *are given to find* U.

Rule $\dfrac{ar - a}{r' - 1.}$ = U.

### *Examples.*

21. What annuity, being forborne 4 years, will amount to £215, 10, 1½ at 5 ₥ Cent.?

*Ans.* $\dfrac{\overline{215.50625 \times 1.05} - 215.50625}{1.05 \times 1.05 \times 1.05 \times 1.05 - 1}$ = £50.

22. What pension, being forborne 5 years, will amount to £248, 13, 1 at 5 ₥ Cent? *Ans.* £45.

23. What salary being omitted to be paid 6 years, will amount to £279, 0, 3, at 6 ₥ Cent.? *Ans.* £40.

24. If the payment of an annuity being forborne 10 years, amount to £988, 11, 2½, at 6 ₥ Cent. what is the annuity?
*Ans.* £75

III. *When* U, A, R, *are given to find* T.

RULE. $\dfrac{ar + u - a}{u} = r'$ $\begin{cases}\text{which being continually divided by} \\ \text{R, till nothing remains, the number} \\ \text{of those divisions will be equal to T}\end{cases}$

*Examples.*

25. In what time will £50 ⅌ annum amount to £215,10,1½, at 5 ⅌ Cent. for non-payment?

*Ans.* $\dfrac{\overline{215.50625} \times 1.05 + 50 - 215.50625}{50} = 1.21550625$

which being continually divided by R, the number of the divisions will be = 4 years.

26. In what time will £45 ⅌ annum amount to £248,13,1, allowing 5 ⅌ Cent. forbearance of payment?

*Ans.* 5 years.

27. In what time will £40 ⅌ annum amount to £279,0,3, at 6 ⅌ Cent.? *Ans.* 6 years.

28. In what time will £75 ⅌ annum amount to £988,11,2¼, allowing 6 ⅌ Cent. for forbearance of payment? *Ans.* 10 years.

## PRESENT WORTH
### OF ANNUITIES, PENSIONS, &c.

A TABLE showing the present worth of £1 Annuity for any Number of Years under 31, Rebate at 5 and 6 ⅌ Cent.

| Years. | 5 | Rates. 6 | Years. | 5 | Rates. 6 |
|---|---|---|---|---|---|
| 1 | 0.95238 | 0.94339 | 16 | 10.83777 | 10.10589 |
| 2 | 1.85941 | 1.83339 | 17 | 11.27406 | 10.47726 |
| 3 | 2.72324 | 2.67301 | 18 | 11.68958 | 10.82760 |
| 4 | 3.54595 | 3.46510 | 19 | 12.08532 | 11.15811 |
| 5 | 4.32947 | 4.21236 | 20 | 12.46221 | 11.46992 |
| 6 | 5.07569 | 4.91732 | 21 | 12.82115 | 11.76407 |
| 7 | 5.78637 | 5.58238 | 22 | 13.16300 | 12.04158 |
| 8 | 6.46321 | 6.20979 | 23 | 13.48857 | 12.30338 |
| 9 | 7.10782 | 6.80169 | 24 | 13.79864 | 12.55035 |
| 10 | 7.72173 | 7.36008 | 25 | 14.09394 | 12.78335 |
| 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 preceding 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.

Rule.  $u - \dfrac{\dfrac{u}{r^t}}{r-1} = \text{P}.$

or, by the Table, thus,

Multiply the present worth of £1 annuity for the time and
rate ⅌ Cent. given, by the annuity, pension, &c. it will give
the answer.

### Examples.

29. What is the present worth of an annuity of £30 ⅌
annum, to continue 7 years, at 6 ⅌ Cent.?

*Ans.* £167 , 9 , 5¼.

$\dfrac{30}{1.50363} = 19.9517.$  $30 - 19.9517 = 10.0483 \dfrac{10.0483}{1.06 - 1}$

$= £167.4716.$  By the Table 5.58238 × 30 = £167.4716.

30. What is the present worth of a pension of £40 ⅌
annum, to continue 8 years, at 5 ⅌ Cent.?

*Ans.* £258 , 10 , 6¼.

31. What is the present worth of a salary of £35, to con-
tinue 7 years, at 6 ⅌ Cent.?  *Ans.* £195 , 7 , 8

32. What is the yearly rent of £50, to continue 5 years,
worth in ready money, at 5 ⅌ Cent.?  *Ans.* £216 , 9 , 5½.

II.  *When* P, T, R, *are given to find* U

Rule.  $\dfrac{pr^t \times r - pr^t}{r^t - 1} = \text{U}.$

### Examples.

33. If an annuity be purchased for £167.4716, to be con
tinued 7 years, at 6 ⅌ Cent. what is the annuity?

$$\dfrac{167.4716 \times 1.50363 \times 1.06 - 167.4716 \times 1.50363}{1.50363 - 1} = £30$$

H

34. If the present payment of £258,10,6¼ be made for a salary 8 years to come, at 5 ⅌ Cent.; what is the salary?

*Ans.* £40.

35. If the present payment of £195,7,8 be required for a pension for 7 years to come, at 6 ⅌ Cent.; what is the pension?                                                    *Ans.* £35.

36. If the present worth of an annuity, 5 years to come, be £216,9,5½, at 5 ⅌ Cent.; what is the annuity?

*Ans.* £50.

III. *When* U, P, R, *are given to find* T.

RULE.   $\dfrac{u}{p+u-pr}=r^t$ $\begin{cases} \text{which being continually divided by} \\ \text{R, till nothing remains, the number} \\ \text{of those divisions will be equal to T.} \end{cases}$

*Examples.*

37. How long may a lease of £30 yearly rent, be had for £167.4716, allowing 6 ⅌ Cent. to the purchaser?

$$\frac{30}{167.4716+30-177.5198}-1.\underline{\phantom{0}0\phantom{0}}\quad \begin{cases} \text{which being con-} \\ \text{tinually divided,} \\ \text{the number of} \\ \text{those divisions} \\ \text{will be} = \text{to T} \\ = 7 \text{ years. } Ans. \end{cases}$$

38. If £258,10,6¼ is paid down for a lease of £40 ⅌ annum, at 5 ⅌ Cent.; how long is the lease purchased for?

*Ans.* 8 years.

39. If a house is let upon lease for £35 ⅌ annum, and the lessee makes present payment of £195,7,8, he being allowed 6 ⅌ Cent.; I demand how long the lease is purchased for?                                    *Ans.* 7 years.

40. For what time may a lease of £50 ⅌ annum be purchased, when present payment is made of £216,9,5½, at 5 ⅌ Cent.?                                              *Ans.* 5 years.

### ANNUITIES, LEASES, &c.

#### TAKEN IN REVERSION.

1. *To find the present worth of annuities, leases, &c. taken in reversion.*

RULE.—Find the present worth of the annuity, &c. at the given rate, and for the time of its continuance; thus,

$$u-\dfrac{\dfrac{u}{r^t}}{r-1}=P$$

2. Change **P** into **A**, and find what principal being put to interest will amount to **P** at the same rate, and for the time to come, before the annuity commences, which will be the present worth of the annuity, &c.

$$\frac{a}{r^t} = \mathbf{P.}$$

### *Examples.*

41. What is the present worth of a reversion of a lease of £40 ₩ annum, to continue for 6 years, but not to commence till the end of 2 years, allowing 6 ₩ Cent. to the purchaser?

*Ans.* £175, 1, 1¼.

$$\frac{40}{1.41852} = 28.1984. \quad \frac{40 - 28.1984}{1.06 - 1} = 196.6933. \quad \frac{196.6933}{1.1236}$$
$$= £175.0563.$$

42. What is the present worth of a reversion of a lease of £60 ₩ annum, to continue 7 years, but not to commence till the end of 3 years, allowing 5 ₩ Cent. to the purchaser?

*Ans.* £299, 18, 2¾.

43. There is a lease of a house at £30 ₩ 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 ₩ Cent. to the purchaser?

*Ans.* £142, 16, 3½.

### 2. *To find the yearly income of an annuity, &c. taken in reversion.*

Rule.—Find the amount of the present worth at the given rate, and for the time before the annuity commences; thus,

$$pr^t = \mathbf{A.}$$

Change A into P, and find what yearly rent being sold will produce P, at the same rate, and for the time of its continuance, which will be the yearly sum required? thus,

$$\frac{pr^t \times r - pr^t}{r^t - 1} = \mathbf{U.}$$

### *Examples.*

44. What annuity, to be entered upon 2 years hence, and then to continue 6 years, may be purchased for £175.0563, at 6 ₩ Cent.?

*Ans.* £40

$$40175.0563 \times 1.1236 = 196.6933$$

Then $\dfrac{196.6933 \times 1.41852 \times 1.06 - 279.01337}{1.41852 - 1} = £40.$

45. The present worth of a lease of a house is £299 , 18 , 3 taken in the reversion for 7 years, but not to commence till the end of 3 years, allowing 5 ₩ Cent. to the purchaser, what is the yearly rent?                              *Ans.* £60.

46. There is a lease of a house in being for 4 years, and the lessee being minded to take a lease in reversion 7 years, to begin when the old lease shall be expired, paid down £142 , 16 , 3½, what was the yearly rent of the house, when the lessee was allowed 5 ₩ Cent. for present payment?
*Ans.* £30

*Purchasing* FREEHOLD *or* REAL ESTATES ; *such as are bought to continue for ever.*

I. *When* U, R, *are given to find* W.

RULE.   $\dfrac{u}{r-1} = W.$

*Examples.*

47. What is the worth of a freehold estate of £50 ₩ annum, allowing 5 ₩ Cent. to the buyer?

$$\frac{50}{1.05 - 1} = £1000. \quad Ans.$$

48. What is an estate of £140 ₩ annum, to continue for ever, worth, in present money, allowing 4 ₩ Cent. to the buyer?                                        *Ans.* £3500.

49. If a freehold estate of £75 yearly rent was to be sold, what is the worth, allowing the buyer 6 ₩ Cent.
*Ans.* £1250.

II. *When* W, R, *are given to find* U.

RULE. $w \times \overline{r-1} = U.$

*Examples.*

50. If a freehold estate is bought for £1000, and the allowance of 5 ₩ Cent. is made to the buyer, what is the yearly rent?        $1.05 - 1 = .05.$ then $1000 \times .05 = £50.$ *Ans.*

51. If an estate be sold for £3500, and 4 ₩ Cent. allowed to the buyer, what is the yearly rent?        *Ans.* £140.

52. If a freehold estate is bought for £1250 present

money, and an allowance of 6 ⅌ Cent. made to the buyer for the same, what is the yearly rent? *Ans.* £75.

III. *When* W, U, *are given to find* R.

RULE. $\dfrac{w+u}{w} = R$

*Examples.*

53. If an estate of £50 ⅌ annum be bought for £1000, what is the rate ⅌ Cent. ? *Ans.* 5 ⅌ Cent.

$$\frac{1000+50}{1000}\,1.05 = 5 ⅌ \text{ Cent.}$$

54. If a freehold estate of £140 ⅌ annum be bought for £3500, what is the rate ⅌ Cent. allowed? *Ans.* 4 ⅌ Cent.

55. If an estate of £75 ⅌ annum is sold for £1250, what is the rate ⅌ Cent. allowed? *Ans.* 6 ⅌ Cent

### Purchasing FREEHOLD ESTATES *in* REVERSION.

1. *To find the worth of a Freehold Estate in reversion.*

RULE.—Find the worth of the yearly rent, thus, Change W into A, and find what principal $\dfrac{u}{r-1} = W.$ being put to interest will amount to A, at the same rate, and for the time to come, before the estate commences, and that will be the worth $\dfrac{a}{r^t} = P.$ of the estate in reversion; thus,

*Examples.*

56. If a freehold estate of £50 ⅌ annum, to commence 4 years hence, is to be sold, what is it worth, allowing the purchaser 5 ⅌ Cent. for present payment? *Ans.* £822, 14, 1½.

$$\frac{50}{1.05-1} = 1000. \text{ then } \frac{1000}{1.2155} = £822.70625$$

57. What is an estate of £200, to continue for ever, but not to commence till the end of 2 years, worth in ready money, allowing the purchaser 4 ⅌ Cent.?
*Ans.* £4622, 15, 7. +

58. What is an estate of £240 ⅌ annum worth in ready money, to continue for ever, but not to commence till the end of 3 years, allowance being made at 6 ⅌ Cent.
*Ans.* £3358, 9, 10½. +.

2. *To find the yearly rent of an Estate taken in reversion.*

RULE.—Find the amount of the worth of the estate, at the given rate and time before it commences; thus, *wrt* = A.

Change A into W, and find what yearly
rent being sold will produce U, at the
same rate; thus, $\dfrac{wr \times r - wr.}{r} = U.$
which will be the yearly rent required.

### Examples.

59. If a freehold estate, to commence 4 years hence, is sold
for £822.70625, allowing the purchaser 5 ⅌ Cent. what is
the yearly income?          *Ans.* £50

        First, £822.70625 × 1.2155 = 1000.

        then $\dfrac{1000 \times 1.05 \times 1.05 - 1050}{1.05}$ = £50.

60. A freehold estate is bought for £4622,15,7½, which
does not commence till the end of 2 years, the buyer being
allowed 4 ⅌ Cent. for his money; I desire to know the
yearly income?          *Ans.* £200.

61. There is a freehold estate sold for £3358,9,10½, but
not to commence till the expiration of 3 years, allowing 6 ⅌
Cent for present payment; what is the yearly income?

         *Ans.* £240.

## REBATE, OR DISCOUNT.

A Table showing the present worth of £1 due any number of
years, to commence under 31, rebate at 5 and 6 ⅌ Cent

| Years. | 5   *Rates.*   6 | | Years. | 5   *Rates.*   6 | |
|---|---|---|---|---|---|
| 1 | .952381 | .943396 | 16 | .458111 | .393647 |
| 2 | .907030 | .889996 | 17 | .436296 | .371364 |
| 3 | .863838 | .839619 | 18 | .415520 | .350343 |
| 4 | .822702 | .792093 | 19 | .395734 | .330513 |
| 5 | .783526 | .747258 | 20 | .376889 | .311804 |
| 6 | .746215 | .704960 | 21 | .358942 | .294155 |
| 7 | .710682 | .665057 | 22 | .341849 | .277505 |
| 8 | .676839 | .627412 | 23 | .325571 | .261797 |
| 9 | .644609 | .591898 | 24 | .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 | .184556 |
| 15 | .481017 | .417265 | 30 | .231377 | .174110 |

*Note.*—The preceding Table is thus made: $1 \div 1.05 = .952381$ first year's present worth; and $.952381 \div 1.05 = .90703$ second year; and $.90703 \div 1.05 = .863838$ third year, &c.

**I.** *When* S, T, R, *are given to find* P.

RULE. $\dfrac{s}{r^t} = $ P.

### Examples.

1. What is the present worth of £315.6175, payable 4 years hence, at 6 ⅌ Cent. *Ans.* £250

$1.06 \times 1.06 \times 1.06 \times 1.06 = 1.26247$, then by the Table

$\dfrac{315.6175}{1.26247} = £250.$

$$\begin{array}{r} 315.6175 \\ .792093 \\ \hline £249.9984124275 \end{array}$$

2. If £344 , 14 , 9½ be payable in 7 years time, what is the present worth, rebate being made at 5 ⅌ Cent. ? *Ans.* £245.

3. There is a debt of £441 , 17 , 4, which is payable 4 years hence, but it is agreed to be paid in present money ; what sum must the creditor receive, rebate being made at 6 ⅌ Cent. ? *Ans.* £350.

**II.** *When* P, T, R, *are given to find* S.

RULE. $p \times r^t = $ S.

### Examples.

4. If a sum of money, due 4 years hence, produce £250 for the present payment, rebate being made at 6 ⅌ Cent. what was the sum first due ?

$£250 \times 1.26247 = £315 , 12 , 4½$ *Ans*

5. If £245 be received for a debt payable 7 years hence, and an allowance of 5 ⅌ Cent. to the debtor for present payment, what was the debt ? *Ans.* £344 , 14 , 9½.

6. There is a sum of money due at the expiration of 4 years, but the creditor agrees to take £350 for present payment, allowing 6 ⅌ Cent. what was the debt ?
*Ans.* £441 , 17 , 4.

**III.** *When* S, P, R, *are given to find* T.

RULE. $\dfrac{s}{p} = r^t$, $\left\{\begin{array}{l} \text{which being continually divided by R,} \\ \text{till nothing remains, the number of those} \\ \text{divisions will be equal to T.}' \end{array}\right.$

### Examples.

7. The present payment of £250 is made for a debt of £315.6175, rebate at 6 ₱ Cent.: in what time was the debt payable?                                                   *Ans.* 4 years.

$$\frac{315.6175}{250} = 1.26247 \begin{cases} \text{which being continually divid-} \\ \text{ed, those divisions will be equal} \\ \text{to 4} = \text{the number of years.} \end{cases}$$

8. A person receives £245 now for a debt of £344 , 14 , 9½, rebate being made at 5 ₱ Cent. I demand in what time the debt was payable?                                         *Ans.* 7 years.

9. There is a debt of £441 , 17 , 4 due at a certain time to come, but 6 ₱ Cent. being allowed to the debtor for the present payment of £350, I desire to know in what time the sum should have been made without any rebate?    *Ans.* 4 years.

IV. *When* S, P, T, *are given to find* R.

RULE. $\dfrac{s}{p} = r'$, $\begin{cases} \text{which being extracted by the rules of ex} \\ \text{traction, (the time given in the question} \\ \text{showing the power,) will be equal to R.} \end{cases}$

### Examples.

10. A debt of £315.6175 is due 4 years hence, but it is agreed to take £250 now, what is the rate ₱ Cent. that the rebate is made at?                                         *Ans.* 6 ₱ Cent.

$$\frac{3.0775}{250} = 1.26247; \quad \sqrt[4]{1.26247} = 1.06 = 6 \ ₱ \text{ Cent.}$$

11. The present worth of £344 , 14 , 9½, payable 7 years hence, is £245, at what rate ₱ Cent. is rebate made?
                                                          *Ans.* 5 ₱ Cent.

12. There is a debt of £441 , 17 , 4, payable in 4 years time, but it is agreed to take £350 present payment; I desire to know at what rate ₱ Cent. rebate is made at?
                                                          *Ans.* 6 ₱ Cent.

# PART IV.

# DUODECIMALS;

OR, WHAT IS GENERALLY CALLED

## *CROSS MULTIPLICATION*

## SQUARING OF DIMENSIONS BY ARTIFICERS AND WORKMEN.

### Rule *for multiplying duodecimally.*

1. UNDER the multiplicand write the corresponding denominations of the multiplier.

2. Multiply each term in the multiplicand (beginning at the lowest) by the feet in the multiplier; write each result under its respective term, observing to carry an unit for every 12, from each lower denomination to its next superior.

3. In the same manner multiply the multiplicand by the primes in the multiplier, and write the result of each term one place more to the right hand of those in the multiplicand.

4. Work in the same manner with the seconds in the multiplier, setting the result of each term two places to the right hand of those in the multiplicand, and so on for thirds, fourths, &c.

### *Examples.*

1. Multiply 7 feet 9 inches by 3 feet 6 inches.

| Cross Mult. | Practice. | Duodecimals. | Decimals |
|---|---|---|---|
| $7 \times 9$ | $6 in. = \frac{1}{2}$ 7, 9 | 7, 9 | 7.75 |
| $3 \times 6$ | 3, 6 | 3, 6 | 3.5 |
| $21, 0, 0 = 7 \times 3$ | 23, 3 | 23, 3   ×3 | 3875 |
| $2, 3, 0 = 9 \times 3$ | 3, 10, 6 | 3, 10, 6 × 6 | 2325 |
| $3, 6, 0 = 7 \times 6$ | | | |
| $0, 4, 6 = 9 \times 6$ | 27, 1, 6 | 27, 1, 6 | 27.125 |

27, 1, 6

|   |   | *f.in.* |   | *f. in.* |   | *Ft. in. pls.* |
|---|---|---|---|---|---|---|
| 2. | Multiply | 8.5 | by | 4. 7. | *Ans.* | 38,6,11. |
| 3. | Multiply | 9.8 | by | 7. 6. | *Ans.* | 72,6. |
| 4. | Multiply | 8.1 | by | 3. 5. | *Ans.* | 27,7,5. |
| 5. | Multiply | 7.6 | by | 5. 9. | *Ans.* | 43,1,6. |
| 6. | Multiply | 4.7 | by | 3.10. | *Ans.* | 17,6,10. |
| 7. | Multiply | 7.5.9″ | by | 3.5.3″ | *Ans.* | 25,8,6,2‴,3⁗. |
| 8. | Multiply | 10.4.5. | by | 7.8.6. | *Ans.* | 79,11,0,6‴,6⁗. |
| 9. | Multiply | 75.7 | by | 9. 8. | *Ans.* | 730,7,8. |
| 10. | Multiply | 97.8 | by | 8. 9. | *Ans.* | 854,7. |
| 11. | Multiply | 57.9 | by | 9. 5. | *Ans.* | 543,9,9. |
| 12. | Multiply | 75.9 | by | 17. 7. | *Ans.* | 1331,11,3. |
| 13. | Multiply | 87.5 | by | 35. 8. | *Ans.* | 3117,10,4. |
| 14. | Multiply | 179.3 | by | 38.10. | *Ans.* | 6960,10,6. |
| 15. | Multiply | 259.2 | by | 48.11. | *Ans.* | 12677,6,10″. |
| 16. | Multiply | 257.9 | by | 39.11 | *Ans.* | 10288,6,3. |
| 17. | Multiply | 311.4.7 | by | 36.7.5. |   |   |

<div align="right">

*Ans.* 11402,2,4″,11‴,11⁗

</div>

| 18. | Multiply 321.7.3 by | 9.3.6. | *Ans.* 2988,2,10,4,6. |
|---|---|---|---|

### The Application.

Artificers' work is computed by different measures, *viz.*

1. Glazing and masons' flat-work by the *foot.*

2. Painting, plastering, paving, &c. by the *yard.*

3. Partitioning, flooring, roofing, tiling, &c. by the square of 100 superficial feet.

4. Brickwork, &c by the *rod,* or 16½ feet, whose square is 272¼ feet.

## I. MEASURING BY THE FOOT SQUARE,

### As Glaziers' and Masons' Flatwork.

#### 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.* ₱ foot?

*Duodecimals.*

| ft. in. | |
|---|---|
| 7 , 10 | ⎫ the |
| 6 , 8 | ⎬ heights |
| 5 , 4 | ⎭ added. |
| 19 , 10 | |
| | 3 windows. |
| 59 , 6 | in a tier. |
| 3 , 11 | in breadth. |
| 178 , 6 | |
| 54 , 6 , 6 | |
| 233 , 0 , 6 | |

$$ft.\ in.\ pts.$$

233 , 0 , 6  at 14d. ℔ foot.

$2d. = \frac{1}{6}$ | 233 | = 1s.
| 38 , 10 | = 2d.
| $\frac{1}{2}$ | = 6 parts.

2|0)27|1 , 10½

£13 , 11 , 10½ *Ans.*

20. What is the worth of 8 squares of glass, each measuring 4 feet 10 inches long, and 2 feet 11 inches broad, at $4\frac{1}{2}d.$ ℔ foot? *Ans.* £2 , 2 , 3½.

21. There are 8 windows to be glazed, each measures 1 foot 6 inches wide, and 3 feet in height; how much will they come to at $7\frac{3}{4}d.$ ℔ foot? *Ans.* £1 , 3 , 3.

22. What is the price of a marble slab, whose length is 5 feet 7 inches, and the breadth 1 foot 10 inches, at 6/. ℔ foot? *Ans.* £3 , 1 , 5

## II. MEASURING BY THE YARD SQUARE.

### *As Paviers, Painters, Plasterers, and Joiners.*

*Note.*—Divide the square feet by 9, and it will give the number of square yards.

### *Examples.*

23. A room is to be ceiled, whose length is 74 feet 9 inches, and width 11 feet 6 inches; what will it come to at $3/10\frac{1}{2}$ ℔ yard? *Ans.* £18 , 10 , 1¼.

24. What will the paving of a court-yard come to, at $4\frac{3}{4}d.$ ℔ yard, the length being 58 feet 6 inches, and breadth 54 feet 9 inches? *Ans.* £7 , 0 , 10¼.

25. A room painted 97 feet 8 inches about, and 9 feet 10 inches high; what does it come to at $2/8\frac{3}{4}$ ℔ yard?

*Ans.* £14 , 11 , 2¼

26. What is the content of a piece of wainscoting in yards square, that is 8 feet 3 inches long, and 6 feet 6 inches broad, and what will it come to at 6/7½ ⅌ yard?

*Ans.* £1,19,5½.

27. What will the paving a court-yard come to at 3/2 ⅌ yard, if the length be 27 feet 10 inches, and the breadth 14 feet 9 inches?

*Ans.* £7,4,5¼.

28. A person has paved a court-yard 42 feet 9 inches in front, and 68 feet 6 inches in depth, and in this he laid a foot-way the depth of the court, of 5 feet 6 inches in breadth; the footway is laid with purbeck stone, at 3/6 ⅌ yard, and the rest with pebbles, at 3/. ⅌ yard; what will the whole come to?

*Ans.* £49,17,0½.

29. What will the plastering a ceiling, at 10*d.* ⅌ yard, come to, supposing the length 21 feet 8 inches, and the breadth 14 feet 10 inches?

*Ans.* £1,9,9.

30. What will the wainscoting a room come to at 6/. ⅌ square yard, supposing the height of the room (taking in the cornice and moulding) is 12 feet 6 inches, and the compass 83 feet 8 inches, the three window shutters each 7 feet 8 inches by 3 feet 6 inches, and the door 7 feet by 3 feet 6 inches? The shutters and door being worked on both sides, is reckoned work and half work.

*Ans.* £36,12,2½.

## III. MEASURING BY THE SQUARE OF ONE HUNDRED FEET.

*As Flooring, Partitioning, Roofing, Tiling, &c.*

### Examples.

31. In 173 feet 10 inches in length, and 10 feet 7 inches in height of partitioning, how many squares?

*Ans.* 18 squares, 39 feet, 8 inches, 10 p.

32 If a house of three stories, besides the ground floor, was to be floored at £6,10 ⅌ 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 10/6 ₱ square? *Ans.* £12, 12, 11¾.

*Note.*—In tiling, roofing, and slating, it is customary to reckon the flat and half of any building within the walls, to be the measure of the roof of that building, when the said roof is of a true pitch, *i. e.* when the rafters are ¾ of the breadth of the building; but if the roof is more or less than the true pitch, they measure from one side to the other, with a rod or string.

34. What will the tiling of a barn cost, at 25/6 ₱ square; the length being 43 feet 10 inches, and breadth 27 feet 5 inches on the flat, the eave boards projecting 16 inches on each side? *Ans.* £24, 9, 5¾.

## IV. 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 be 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 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 does 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 does it contain? *Ans.* 23 rods, 130 feet, 7 in.

37. How many square rods are there in a wall 62½ feet long, 14 feet 8 inches high, and 2½ bricks thick? *Ans.* 5 rods, 166 feet, 6 in. +.

38. If the side walls of a house be 28 feet 10 inches in length, and the height of the roof from the ground 55 feet 8 inches, and the gable (or triangular part at the top) to rise 42 course of bricks, reckoning 4 course to a foot. Now, 20 feet high is 2½ bricks thick, 20 feet more at 2 bricks thick, 15 feet 8 inches more at 1½ brick thick, and the gable at 1 brick thick; what will the whole work come to at £5, 16 ₱ rod? *Ans.* £48, 12, 7 ¦ .

## 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 Culen has hitherto outdone all, in his having calculated the said proportion to thirty-six places of decimals, which are engraven upon his tombstone 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 Culen, if the diameter be 1, 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 1.5708 by .5, (*viz.* half 3.1416 by half 1) and the product is .7854, 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 semidiameter, 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 leisure. We shall now proceed to the different problems.

*Problem* 1. Having the diameter and the 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 half 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 : 22, so is the diameter to the circumference. Or, as 113 : 355, so is the diameter to the circumference. Or, as 1  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 appears by the following work:—

|  |  |
|---|---|
| 3.141593 | 355 |
| 22.6 | 22.6 |
| 18849558 | 2130 |
| 6283186 | 710 |
| 6283186 | 710 |
| 71.0000018 | 113)8023.0(71 |
|  | 791 |
|  | 113 |
|  | 113 |

*Problem* 3. Having the circumference of a circle, to find the diameter.

As 1 : .318309, so is the circumference to the diameter
Or, as 355 : 113, so is the circumference to the diameter
Or, as 22 : 7, so is the circumference to the diameter.

Let the circumference be 71, and then proceed with either
of the three proportions, as follows :

```
      318309              113                71
          71               71                 7
      ──────            ─────           ──────────────
      318309              113           22)497(22.59 +
     2228163              791                44
   ──────────          ─────                ──
   22.599939         355)8023(22.6           57
                        710                  44
                       ─────                ───
                        923                 130
                        710                 110
                       ─────                ───
                       2130                 200
                       2130                 198
```

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 are the
squares of their diameters, (by Euclid, lib. xii. 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 o.
22.6, the diameter of the given circle) to 401.15 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 cir-
cumference: therefore the areas of circles are to one another
as the squares of the circumferences. And if the circumfer-
ence of a circle be 1, the area of that circle will be .07958;
then the square of 1 is 1, and the square of 71 (the circum
ference 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 semi-diameter, 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 is 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 : 5040.9993255, 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 : 255.37209, the root of which is 15.98, 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 : 1.4142 : : 15.98 : 22.598916, the diameter sought.

*Problem 14.* Having the side of a square, to find the diameter of a 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 semidiameter, 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 semidiameter 11.3, the product is 200.575, the area of the semicircle.

## *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 semidiameter,) and the product will be the area of the quadrant.

These are the rules commonly given for finding the area of a semicircle and quadrant; or find the area of the whole circle, and then take half the area for the semicircle, 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 gives the solidity.

## PART VI.

## A COLLECTION OF PROMISCUOUS QUESTIONS

*To exercise the preceding Rules.*

1. WRITE down in figures the sum of eleven thousand, eleven hundred, and eleven? *Ans.* 12111.

2. How many yards of cloth, at 17/6 ⅌ yard, can I have for 13 Cwt. 2 qrs. of wool, at 15d. ⅌ lb. ? *Ans.* 108 *yards.*

3. If I buy 1000 ells of Flemish linen for £90; what may I sell it, ⅌ English ell, to gain £10 by the sales? *Ans.* 3/4

4. A gentleman spends, one day with another, £1,7,10½, and, at the year's end, lays up £340; what is his yearly income? *Ans.* £848,14,4½.

5. A has 18 fother of lead, each being 19½ times 112 lb. B has 39 casks of tin, each 388 lb.; how many ounces difference is there in the weight of these commodities?
*Ans.* 212160 *ounces.*

6. A captain and 160 sailors took a prize worth £1360; of which the captain had ⅓ of the whole, and the rest was equally divided among the sailors ; what was each man's share? *Ans. The captain had* £272, *and each sailor* £6, 16.

7. A has 12 cows, worth £7,4 each; and B 7 horses, at £13 each; how much will make good the difference, should they exchange cattle? *Ans. A pays* £4, 12.

8. The sum of £1000 is to be divided among 3 men, in such a manner, as that if A has £3, B shall have £5, and C £8 · how much will each have?
*Ans. A* £187, 10, *B* £312, 10, *and C* £500.

9 The less of two numbers is 187, and their difference 34· what is the square of their product? *Ans.* .1707920929.

10. A debt of £99 , 18 was discharged, with an equal number of half guineas, crowns, and half crowns: required the number? *Ans.* 111.

11. A butcher sends his man with £242 to a fair to buy cattle; oxen at £11, calves at 40/. colts at £3 , 5, and hogs at 35/. a piece, and of each an equal number: how many of each sort did he buy? *Ans.* 13 *of each, and* £8 *over.*

12. If a clerk's salary be £73 a year; what is that ℔ day? *Ans.* 4/.

13. B has an estate of £530 ℔ annum, and pays £2 , 18 , 4 to the subsidy: what must C pay whose estate is £150 a year? *Ans.* 16/6$\frac{6}{5}$$\frac{6}{3}$.

14. Bought a cask of wine for £62 , 8; how many gallons did it contain, the price being 10/8? *Ans.* 117 *gallons.*

15. A gentleman pays 50/. among his labourers for a day's work; and gives each boy 6d. each woman 8d. and to each man 1/4, and the number of each was the same: how many were there? *Ans.* 20 *of each.*

16. In 14 cheeses, each weighing, at an average, 3 qr. 2½ lb.: how many allowances for seamen may be cut, each 5 oz. 7 drams? *Ans.* 3563$\frac{3}{4}$$\frac{4}{5}$ *allowances.*

17. A jeweller sold jewels to the value of £1200, for which he received in part 876 French pistoles, at 16/6 each ; what sum remains unpaid? *Ans.* £477 , 6.

18. An oilman bought 9 casks of train oil, weighing gross 417 Cwt. 1 qr. 15 lb. tare 20 lb. ℔ Cwt. : how many gallons were there, allowing 9 lb. net to the Imperial gallon ? *Ans.* 4266$\frac{2}{3}$ *gallons.*

19. What is the difference between twice eight, and twenty, and twice twenty-eight: also, between twice five, and fifty, and twice fifty-five? *Ans.* 20, *and* 50.

20. What does the whole pay of a man of war's crew of 640 men amount to for 32 months' service, at 22/6 ℔ month for each man? *Ans.* £23040.

21. 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.

22. If 5 puncheons of rum be bottled off into gallons, quarts, and pints, and of each an equal number: how many will there be of each? *Ans.* 305, *and* 5 *pints over*

23. A mercer sells 21 yards of silk at 15/6, and 3 yards at 14/10, and, on receiving payment, allows 5 ⅌ Cent. for ready money: how much did he receive?

*Ans.* £17 , 11 , 6.

24. Two persons' ages when added make 140 years, 6 months, and when the one is subtracted from the other, the difference is 47 years, 9 months : how old is each?

*Ans. The younger is* 46 *yea.* 4½ *mo. ; the elder* 94 *yea.* 1½ *mo.*

25. I gave a hogshead of British gin, at 7/4 ⅌ gallon, in exchange for 56 gallons of rum : what does the rum stand me ⅌ gallon ? *Ans.* 8/3.

26. A tradesman fails for £10,000, and his net effects amount only to £6798 , 10 : how much will a creditor receive who has a claim of £790 , 18 against his estate ?

*Ans.* £537 , 13 , 10¼.

27. A bankrupt's estate paid 7/9 ⅌ pound, and his debts amounted to £14980 : how much did his creditors receive and lose? *Ans. They received* £5804 , 15, *lost* £9175 , 5.

28. A field containing 40 acres is to be divided between A and B; so that A's share may exceed B's by 4 acres, 2 roods, 20 perches: required each person's share?

*Ans. A* 22 *acres,* 1 *ro.* 10 *per.; and B* 17 *acres,* 2 *ro.* 30 *per.*

29. If ¼ of 6 be 3, what will ¼ of 20 be ? *Ans.* 7½.

30. Whereas a noble and a mark just 15 yards did buy;
How many ells of the same cloth for fifty pounds had I ?

*Ans.* 600.

31. If a garrison of 360 men 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.*

32. If I buy 100 yards of riband, at 3 yards for a shilling, and 100 more at 2 yards for a shilling, and sell it at the rate of 5 yards for 2 shillings whether do I gain or lose?

*Ans. Lose* 3/4.

33. Bought 27 bags of ginger, each weighing gross 84¾ lb. tare 1⅜ lb. ⅌ bag, tret 4 lb. ⅌ 104 : what do they come to at 8½d. ⅌ lb. *Ans.* £76 , 13 , 2¼.

34. My factor has bought goods on my account to the value of £500 , 13 , 4 : what will his commission come to at 3½ ⅌ Cent. *Ans.* £17 , 10 , 5½.

35. A reckoning of £7 currency in Jamaica was paid with £5 sterling · what was the exchange at that rate?

*Ans.* 140 ⅌ *Cent*

36. If 30 men in 40 days, build 50 rods of wall,
How many men in 60 days, will do the same—that's all?
                                        *Ans.* 20 *men*

37. B and C traded together, and gained £100; B put in
£640, and C as much as to entitle him to £60 of the gain:
I demand how much C advanced?                *Ans.* £960.

38. A, B, and C, traded in company; A advanced a cer-
tain sum, B put into the concern 20 pieces of broad cloths,
and C £500; they gained £1000, of which A claimed £350,
and B £400, as their just proportion: I desire to know C's
share, how much A put in, and the value of B's cloth?
    *Ans. C's share* £250; *A advanced* £700; *and B's cloth*
                        *was valued at* £800.

39. How many lb. of sugar, at 4½d. ⅌ lb., are equal in
value to 60 gross of inkle, at 8/8 ⅌ gross? *Ans.* 1386⅔ *lb.*

40. At what rate ⅌ Cent. will £956 amount to £1314, 10
in 7½ years, at simple interest?        *Ans.* 5 ⅌ *Cent.*

41. What is the amount of £1000 for 5½ years, at 4¾ ⅌
Cent. simple interest?                *Ans.* £1261, 5.

42. Sold goods amounting to £700; one half payable at
4 months and the other half at 8 months: what is the pre-
sent worth, at 5 ⅌ Cent. rebate or discount?
                        *Ans.* £682, 19, 5¼ +.

43. Of what sum of principal did £20 interest arise in one
year, at the rate of 5 ⅌ Cent.?            *Ans.* £400.

44. A man dies and leaves £120 to be given to three per-
sons; to A a certain sum, to B twice as much, and to C as
much as A and B. what is the share of each?
                *Ans. A* £20, *B* £40, *and C* £60.

45. Divide 1000 sovereigns among three persons; give A
120 more, and B 95 less, than C?
                *Ans. A gets* 445, *B* 230, *and C* 325.

46. Three butchers rent a field of pasture, for which they
pay £40: how much of the rent must each pay; A having
put in 28 cattle for 24 days; B 32, for 30 days; and C 40,
for 36 days? *Ans. A pays* £8, 15, *B* £12, 10, *and C* £18, 15

47. If £100 in 7 years yield £43, 15 of interest: in what
time will any sum of money double itself by the same rate of
interest?                        *Ans.* 16 *years.*

48. A guardian paid his ward £1643, 15 for £1250, which
he had in his hands for 7 years: what rate of interest did
he allow him?                    *Ans.* 4½ ⅌ *Cent.*

49. What is the difference between the interest of £500, at

∴ ₲ Cent. for 12 years ; and the discount or rebate of the same sum, at the same rate and time?          *Ans.* £112 , 10.

50. A merchant bought goods to the amount of £420, at 6 months' credit, but pays down £120 : at what time should he settle the balance?          *Ans.* 8 *month.,* 12 *days.*

51. If 2 horses consume as much as 5 oxen, and 12 horses cons·me 7 quarters in 20 days : how much will 18 oxen consume in 25 days?          *Ans.* 5 *qrs.* 2 *bushels.*

52. If 24 men, or 30 women, can reap 9 acres of wheat in a day : I demand how many acres 16 men and 20 women will reap, all working together?          *Ans.* 12 *acres.*

53. There are 5 farms of equal value to be sold ; A says, that with half of his money, he could buy one of them ; and, if he choose to borrow £3000, he could buy them all : what is the value of a farm?          *Ans.* £1000.

54. I have a bond of £1200 payable as follows : ⅓ is due at present, ¼ in 4 months, ⅕ in 5 months, and the rest in 6 months : what is the equated or average time for receiving the whole in payment?          *Ans.* 3 *months and* 9 *days*

55. A owes B £360, due in 9 months, but in 3 months pays **h**im £80, and in 6 months £100 more : how much longer than the 9 months is A entitled to retain the balance?
          *Ans.* 4 *months and* 10 *days.*

56. If I buy a yard of cloth at 12/6, and sell it for 14/3 : what do I gain ₲ Cent.?          *Ans.* 14 ₲ *Cent.*

57. If I buy yarn for 9*d* the lb. and sell it again for 13½*d*. ₲ lb.: what is the gain ₲ Cent.?          *Ans.* 50 ₲ *Cent.*

58. A discounted on the 3d of May a bill of £637 , 10, dated 20th of April, payable at 3 months, and allowed ½ ₲ Cent. commission : how much money should he have received?          *Ans.* £627 , 4 , 9½.

59. Lent a person £420 on Lady-day, which he repaid as follows : on 24th of June £100, on 29th of September £160, and the balance on 25th of December, with interest at 5 ₲ Cent.: how much did it amount to?          *Ans.* £171 , 7 , 10½.

60. A tobacconist mixes 24 lb. of tobacco at 9*d.* ₲ lb. 60 lb. at 1/. 36 lb. at 1/6, and 12 lb. at 1/10 : at what must he charge a lb. of the mixture to gain 12½ ₲ Cent.?
          *Ans.* 1/3¾ ₲ *lb.*

61. A farmer is willing to make a mixture of rye at 3/. a bushel, barley at 4/. and oats at 2/.: how much must he take of each, to afford to sell the mixture at 2/6 ₲ bushel?
          *Ans.* 6 *bushels of rye,* 6 *of barley, and* 24 *of oats.*

62. A grocer mixes $3\frac{1}{2}$ Cwt. of sugar at 80/. ⅌ Cwt. $2\frac{1}{4}$ Cwt. at 75/. and $1\frac{3}{4}$ Cwt. at $7\frac{1}{2}d.$ ⅌ lb.: what is the value of a Cwt. and at what price must it be retailed ⅌ lb. to gain 2d. on the shilling?        *Ans.* 76/2 ⅌ *Cwt. and* $9\frac{1}{2}d.$ ⅌ *lb.*

63. A tea dealer mixes 50 lb. of tea; part worth 6/1, and the rest at 4/. ⅌ lb. so that the value of the mixture is 5/. ⅌ lb.: how much of each was in the mixture?
        *Ans.* 24 *lb. at* 6/1, *and* 26 *lb. at* 4/.

64. A baker has on hand 120 sacks of flour, second quality, at 50/. ⅌ sack, and he wishes to mix it with as much of fine flour at 70/. ⅌ sack, as will yield a profit of 20 ⅌ Cent. when he sells the mixture at 66/. ⅌ sack: how much fine flour must he take to answer his purpose?   *Ans.* 40 *sacks.*

65. A piece of work was to have been done by 40 men in 21 days, but at the end of 15 days only two-thirds of it were finished: how many men must be added to complete the work in the proposed time?        *Ans.* 10 *men.*

66. When money was at 5 ⅌ Cent. I lent my friend £300, which he retained for 60 days: how long ought he to lend me £500 to requite the favour, when interest falls to 4 ⅌ Cent.?        *Ans.* 45 *days.*

67.    If money be at 6 ⅌ Cent.
        To them who have a mind to borrow;
    When shall I be worth a pound,
        If I should lend a crown to-morrow?
        *Ans.* 24 *years, reckoning compound interest.*

68. What number is that, to which if you add $7\frac{2}{3}$, the sum will be $12\frac{1}{4}$?        *Ans.* $4\frac{7}{13}$.

69. What number is that, from which if you subtract $\frac{4}{5}$, the remainder will be $\frac{1}{4}$?        *Ans.* $\frac{2}{3}\frac{1}{0}$.

70. What number is that, from which if $13\frac{1}{2}$ be taken, the remainder will be $5\frac{4}{5}$?        *Ans.* $19\frac{3}{14}$.

71. What number multiplied by $\frac{4}{7}$ will produce $11\frac{7}{17}$?
        *Ans.* $26\frac{3}{5}\frac{6}{6}$

72. What number is that, which being divided by $\frac{3}{4}$, the quotient will be 21?        *Ans.* $15\frac{3}{4}$.

73. Required a number, from which if you take $\frac{2}{3}$ of $\frac{4}{5}$ of itself, the remainder shall be equal to $\frac{1}{12}$ of $\frac{9}{10}$ of 560.
        *Ans.* 90.

74. If $\frac{4}{5}$ of an ounce of cochineal cost $\frac{7}{8}$ of a shilling; what will $\frac{5}{8}$ of a lb. cost?        *Ans.* 17/6

75. If $\frac{5}{6}$ of a gallon of French wine cost £$\frac{5}{8}$; what will $\frac{4}{9}$ of a tun cost?        *Ans.* £105.

76. If $3\frac{3}{4}$ yards of cloth, $1\frac{1}{4}$ yard wide, make a suit of clothes; how much cloth, $1\frac{1}{2}$ yard wide, will be required?
*Ans.* 3 *yards,* 2 *nails.*

77. If 12 men perform $\frac{3}{4}$ of a piece of work in $6\frac{1}{2}$ hours; in what time will 20 men perform the rest?
*Ans.* 1 *hour,* 18 *minutes.*

78. A person in the late war had $\frac{4}{5}$ of a privateer, $\frac{3}{5}$ of which he sold for £750: what was the value of the whole vessel at that rate?    *Ans.* £1250.

79. In a commercial and mathematical school, $\frac{2}{5}$ of the pupils are learning writing; $\frac{4}{15}$ arithmetic; $\frac{2}{15}$ bookkeeping; $\frac{1}{15}$ algebra; and 9 are in mensuration: how many were there in each branch of education?    *Ans.* 30 *writers,* 24 *arithmeticians,* 12 *bookkeepers,* 5 *algebraists, &c.*

80. A farmer being asked how many lambs he had; the ewes, replied he, brought me 2000; but, by paying the tithe, and other losses, they are much reduced; for at one time I lost half the number I now have, at another, $\frac{1}{3}$ of the same number, and $\frac{1}{4}$ at another time: how many has he remaining?    *Ans.* 864.

81. Three persons purchase a ship; A pays for $\frac{2}{5}$, B for $\frac{3}{8}$, and C pays £2700 for the remainder: required the value of the ship, what A and B paid, and what part of her belongs to C?    *Ans. Whole value* £12000; *A paid* £4800, *and B* £4500; *C's part is* $\frac{9}{40}$.

82. A barters with B 120 gallons of rum at 8/4, and 38 gallons of brandy at 15/6, for 750 lb. of wool, and receives £1,6,6 as the balance: what is the value of the wool ⅌ lb.?
*Ans.* 2/1.

83. An estate consisting of 130 acres, at 15/. ⅌ acre, 200 at 12/. and 250 at 9/. is to be divided between two sisters. The elder gets the best ground, but allows, in return, a greater quantity to the younger, so as to render the value equal: how much land has each?
*Ans. The elder sister* 242½ *acres, the younger* 337½ *acres.*

84. A has 648 yards of cloth, worth 14/. ⅌ yard, but in barter rates it at 16/.; B has wine at 40 guineas ⅌ pipe, ready money: how much wine must be given for the cloth, and what is the price of a pipe of wine in barter?
*Ans.* 10 *pipes,* 1 *hhd.* 37½ *gall.; barter price* £48 ⅌ *pipe.*

85. Paid £35 to A for 9 weeks' salary, and to B £64 for 15 weeks' salary; I have laid up £120 to pay them at a cer-

tain period together: at what time may they make their demand? *Ans. In* 14 *weeks,* 5 *days.*

86. C has candles at 6/. ⅌ dozen, ready money; but in barter 6/6. D has cotton at 9*d.* ⅌ lb.: at what price must it be rated in barter; and how much cotton must be given for 100 dozen of candles? *Ans.* 9¾*d.* ⅌ *lb. and* 800 *lb. given.*

87. A delivers to B, for a certain quantity of linen, 3¾ Cwt. of sugar, at 5½*d.* ⅌ lb. ready money, but in barter 7*d.* and is willing to lose 20 ⅌ Cent. for one-half in cash: how much linen, at 2/3 a yard, must be given by B ; and what is the ready money price ⅌ yard, to equal the barter? *Ans.* 43⅔ *yards; Cash price* 1/9 $\frac{3}{14}$ ⅌ *yard.*

88. A has 12½ Cwt. of hops, at 56/. ⅌ Cwt. but in barter he raises them to 60/.; B has British gin at 7/6 ⅌ gallon, which he rates in proportion; on settling, A received a hogshead of gin, and the balance in cash: how much money did he receive? *Ans.* £12, 3, 9.

89. A, with an intention to clear 30 guineas on a bargain with B, rates hops at 15*d.* ⅌ lb. which cost him only 10½*d.*; B, apprized of this, raises his malt, which cost 30/. ⅌ qr. in the same proportion: how much malt did they contract for? *Ans.* 49 *quarters.*

90. A and B barter; A has goods which cost 15/. which he puts in at 20/. and gives 6 months' credit; B has goods worth 30/. which he rates at £2, 5: I demand what time he must give to make an equal barter? *Ans.* 9 *months.*

91. A corn dealer gains 10 ⅌ Cent. by the sale of barley at 30/. ⅌ qr.: what will his gain ⅌ Cent. be, should the price rise to 33/4, and how much ⅌ Cent. will he lose if it fall to 24/.? *Ans. He gains by the rise* 22⅔ ⅌ *Cent. ; loses by the fall* 12 ⅌ *Cent.*

92. A merchant sold tobacco at 2/3 ⅌ lb. by which he lost 10 ⅌ Cent.; he afterwards sold £100 worth more of the same parcel, and gained 25 ⅌ Cent.: how many lbs. were there in the last parcel, and at what rate did he sell it ⅌ lb.? *Ans.* 640 *lbs. at* 3/1½ ⅌ *lb*

93. When I sell a yard of muslin for 15*d.* I gain 10/. by the piece; and when I sell the yard for 14*d.* I gain 6/. by the same piece: I demand how many yards were in the piece? *Ans.* 48 *yards.*

94. A jockey sold a horse for 40 guineas, by which he lost 4 ⅌ Cent.: whereas, in dealing he ought to have cleared

10 ⅌ Cent.: how much was the horse sold under his value?
*Ans.* £6 ,2 ,6.

95. A cargo of 1500 quarters of barley was purchased at
35/. ⅌ qr. and, being kept 15 months, lost 8 ⅌ Cent. in
measure, and sold at 41/. ⅌ qr.: required the gain or loss,
allowing interest at 5 ⅌ Cent. and granary rent £25?
*Ans. Gain* £14 ,18 ,9.

96. A quantity of oats cost £1200; 200 quarters, being
damaged, were sold at 22/. ⅌ qr. and the loss sustained on
them was £80; but the remainder was sold at such a price,
that there was a gain of £100 upon the whole: required the
quantity, price ⅌ qr. at which they were bought, and at
which the undamaged part was sold?
*Ans. The quantity* 800 *qrs.; prime cost* 30/.; *undamaged*
36/. ⅌ *qr.*

97. A and B traded in company; A's share is three-
fourths: at the dissolution of the copartnership, the goods
on hand amounted to £2564 ,10, and the debts due to them
£3658 ,6 ,8; A has the debts assigned to him at 17/6 ⅌
pound, and B takes the goods at 5 ⅌ Cent. discount: how
will accounts stand between them?
*Ans. B owes A* £1026 ,18 ,11.

98. A merchant has on hand 3 Cwt. 2 qr. of tea, which
cost him 3/9 ⅌ lb. besides a duty of 40 ⅌ Cent. a year
ago: how must he sell it ⅌ lb. to B, that, by taking his bill
at 3 months and discounting it, he may clear 20 ⅌ Cent. by
the sales? *Ans.* 6/8½ ⅌ *lb. nearly.*

99. A creditor compounded a debt of £1450, at 12/6 ⅌
pound, with 3 years' interest, at 5 ⅌ Cent. on the composi-
tion, out of which he had lain 4½ years: required his loss,
supposing he could have improved his money at the rate of
7½ ⅌ Cent. ⅌ annum? *Ans.* £966 ,17 ,2.

100. If a person possessed of £1000 improve his money
at 5 ⅌ Cent. ⅌ annum, and live at the rate of £100 a year:
how long will it be before all be spent?
*Ans.* 14 *years,* 74 *days.*

101. A room 109¾ feet in circumference, and 9¼ feet high,
is to be hung with tapestry ell wide: how much will it require,
deducting two windows, each 6½ feet by 5¾?
*Ans.* 83.595 *yards.*

102. Part of the earth from a rampart 70 feet long, 18
broad, and 12 high, was thrown in to fill up a ditch 50 feet

.ong, 20 broad, and 9 deep: how many cubical yards of the rampart are there remaining?            *Ans.* 226⅔ *yards.*

103. A contractor for a canal, 30 feet broad at top, and 20 at bottom, and 8 feet deep, gave in his bill when he had finished a mile in length: what does his charge come to at 2/3 ₰ cubic yard?            *Ans.* £4400.

104. If the breadth of a board be 8 inches; how many feet in length will it require, to make a door 4 feet in breadth, and 6½ in length?            *Ans.* 39 *feet.*

105. Required a number, which being added to the 17th part of 765, the sum shall be equal to 2601?            *Ans.* 6.

106. Required a number, from which if 7 be subtracted, and the remainder divided by 8, and the quotient multiplied by 5, and 4 added to the product; the square root of the sum extracted, and three-fourths of that root cubed, and the cube divided by 9; the last quotient may be 24?            *Ans.* 103.

107. A wall is 36 feet high, and a ditch before it is 27 feet wide: required the length of a ladder that will reach to the top of the wall, from the opposite side of the ditch?
            *Ans.* 45 *feet.*

108. If the depth of a cask, which contains a certain quantity of liquor, be 20 inches; what is the depth of another cask of similar dimensions which holds three times the quantity?            *Ans.* 28.84 + *inches.*

109. If 36 grains of gold will gild a wooden ball which weighs 729 ounces; how many grains will gild one of the same kind, that weighs 1728 ounces?            *Ans.* 64 *grains.*

110. Four men have a sum of money to be divided among them in such a manner, that the first shall have ⅓ of it, the second ¼, the third ⅙, and the fourth the remainder, which is £28: what is the sum?            *Ans.* £112.

111. Hetty told her brother George, that though her fortune on her marriage took £19312 out of her family, it was but ⅗ of two years' rent of his yearly income: how much was his income?            *Ans.* £16093, 6, 8.

112. A father, ignorant of numbers, ordered £500 to be divided among his five sons, thus: give A, says he, ⅓, B ¼, C⅕, D ⅙, and E ⅐ part: it is required to divide the money equitably among them, according to the father's intention?
*Ans. A* £152,10,1¼ − ₆₃₆₀⁄₇₅₆, *B* £114,7,6₇³²₅₆₃₈, *C* £91,10,0¾
      − ³⁷⁸, *D* £76,5,0½ − ¹⁶⁰²,  *E* £65,7,2¼ − ²⁷⁰.

113 A younger brother received £2200, which was just

$\frac{5}{12}$ of his eldest brother's fortune; and $3\frac{1}{8}$ times his money was half as much again as the father was worth: how much was that? *Ans.* £11000.

114. A person bequeaths his property, which amounted to £6039, 10, to his family in the following manner: to his eldest son $\frac{3}{5}$ of the whole; to his second son $\frac{2}{3}$ of the remainder; and the rest to be divided equally between his wife and daughter: what is the share of each?

*Ans.* Eldest son £3623, 14; second son £1610, 10, 8; wife and daughter each £402, 12, 8.

115. A legacy of £100,000 is left to A, B, and C, of which A is to have $\frac{1}{4}$, C $\frac{1}{5}$th, and B the remainder; but in case of the death of either, the two survivors are to have his share in the proportion of their respective shares: now supposing B died, what are A and C's shares of the legacy?

*Ans.* A gets £62500, and C £37500

116. A merchant left his eldest son $\frac{4}{9}$ of his money, to the younger $\frac{5}{8}$ of the remainder, and the rest to his wife: upon dividing the money it was found that the eldest son had £750 more than the younger: how much was left to each?

*Ans.* Eldest son £1200, younger £450, mother £270.

117. A gentleman dying, and leaving his lady in the "*family way*," ordered, by his will, that if she had a son he should have $\frac{2}{3}$ of the estate, and his mother the rest; but, if a daughter, the mother should have $\frac{3}{4}$, and the girl the remainder. It so happened, that the lady was delivered of a son and a daughter, by which she lost in equity £8100 more than if it had only been a girl: what would have been her dowry, had she only had a son? *Ans.* £3900.

118. An extravagant young fellow, in a short time, got the better of $\frac{1}{4}$ of his fortune; by the advice of his friends, he gave £2200 for an exempt's place in the horse guards; his profusion continued till he had no more than 880 guineas left, which he found was just $\frac{3}{35}$ part of his money, after the commission was bought: pray what was his fortune at first?

*Ans.* £10450.

119. A young gentleman, at the age of 9 years, had an estate left him of £500 a year, which was improved by his executors, at 5 ₱ Cent. interest, till he attained the age of 21, at which time he sold the estate at 20 years' purchase, and intends to live at the rate of £1500 annually: required how long it will be before his money be all spent?

*Ans.* 18 years, 257 days

120. If 5 oxen or 7 colts will eat up the grass of a close in 87 days; in what time will 2 oxen and 3 colts eat up the same?     *Ans.* 105 *days*

121.     When first the marriage knot was tied
                Between my wife and me,
            My age did hers as far exceed,
                As three times three does three ;
            But when ten years, and half ten years,
                We man and wife had been,
            Her age came then as near to mine,
                As eight does to sixteen.

*Ques.* What was each of our ages when we married?
*Ans.*   *Sir, forty-five years you had been,*
            *Your bride no more than just fifteen.*

122.  A lady was asked her age, who replied thus :
            My age if multiplied by three
            Two-sevenths of that product tripled be,
            The square root of two-ninths of that is four ;
            Now tell my age, or never see me more.

                                        *Ans.* 28 *years*

123. A butcher agrees with a grazier to feed 30 oxen for a year at £3 , 5 ; but at the end of 3 months the butcher puts in 6 more, and at the end of 6 months, 9 more : how long may the whole be continued for the sum already stipulated ; or what will be due to the grazier if the whole are continued to the end of the 12 months?

*Ans. The whole may be continued* 3⅔ *months, and if continued to the end of the year,* £126 , 15 *due.*

124. A gentleman courted a young lady, and as their birthdays happened together, they agreed to make that their wedding day.   On the day of marriage, the gentleman's age was just double of the lady's ; but after they had lived together 30 years, the gentleman observed his wife's age came nearer to his, in the proportion as 2 to 1⅔.   Thirty years after this, he found his and his wife's ages to be as near, as 2 to 1⅔ at which time they both died.  I desire to know their ages on the day of their marriage, and at their death?  Also, the reason why the lady's age, which was continually gaining upon her husband's, should, notwithstanding, be never able to overtake it?

*Ans.* 40 *years, the gentleman's, at the time of marriage.*
        *\*\* For the reason, see the Key, page* 235.

A TABLE for finding the Interest of any Sum of Money for any Number of Months, Weeks, or Days, at any Rate ⅌ Cent.

| Years. | Calen. Months. | | | Weeks. | | | Days. | | |
|---|---|---|---|---|---|---|---|---|---|
| £. | £. | s. | d. | £. | s. | d. | £. | s. | d. |
| 1 | — | 1 | 8 | — | — | 4½ | — | — | ½ |
| 2 | — | 3 | 4 | — | — | 9 | — | — | 1¼ |
| 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 | 8¼ | - | 1 | 1¼ |
| 30 | 2 | 10 | 0 | — | 11 | 6½ | - | 1 | 7¾ |
| 40 | 3 | 6 | 8 | — | 15 | 4½ | - | 2 | 2¼ |
| 50 | 4 | 3 | 4 | — | 19 | 2¾ | - | 2 | 9 |
| 60 | 5 | 0 | 0 | 1 | 3 | 1 | — | 3 | 3½ |
| 70 | 5 | 16 | 8 | 1 | 6 | 11 | — | 3 | 10 |
| 80 | 6 | 13 | 4 | 1 | 10 | 9¼ | — | 4 | 4½ |
| 90 | 7 | 10 | 0 | 1 | 14 | 7¼ | — | 4 | 11¼ |
| 100 | 8 | 6 | 8 | 1 | 18 | 5½ | — | 5 | 5¾ |
| 200 | 16 | 13 | 4 | 3 | 16 | 11 | — | 10 | 11½ |
| 300 | 25 | 0 | 0 | 5 | 15 | 4½ | — | 16 | 5¼ |
| 400 | 33 | 6 | 8 | 7 | 13 | 10 | 1 | 1 | 11 |
| 500 | 41 | 13 | 4 | 9 | 12 | 3½ | 1 | 7 | 4¾ |
| 600 | 50 | 0 | 0 | 11 | 10 | 9 | 1 | 12 | 10½ |
| 700 | 58 | 6 | 8 | 13 | 9 | 2¾ | 1 | 18 | 4¼ |
| 800 | 66 | 13 | 4 | 15 | 7 | 8¼ | 2 | 3 | 10 |
| 900 | 75 | 0 | 0 | 17 | 6 | 1¾ | 2 | 9 | 3¾ |
| 1000 | 83 | 6 | 8 | 19 | 4 | 7¼ | 2 | 14 | 9¼ |
| 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 | 6¼ |
| 8000 | 666 | 13 | 4 | 153 | 16 | 11 | 21 | 18 | 4¼ |
| 9000 | 750 | 0 | 0 | 173 | 1 | 6¼ | 24 | 13 | 1¾ |
| 10,000 | 833 | 6 | 8 | 192 | 6 | 1¾ | 27 | 7 | 11¼ |
| 20,000 | 1666 | 13 | 4 | 384 | 12 | 3½ | 54 | 15 | 10½ |
| 30,000 | 2500 | 0 | 0 | 576 | 18 | 5½ | 82 | 3 | 10 |

RULE.—Multiply the principal by the rate ℔ 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. Add 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 a half-penny; and for every 40 in the days, 1 farthing.

### Examples.

1. What is the interest of £2467,10 for 10 months, at 4 ℔ Cent. ℔ annum?

$$
\begin{array}{ll}
£2467,10 & 900 = £75, \ 0,0 \\
\underline{\qquad 4} & 80 = \quad 6,13,4 \\
9870, \ 0 & \underline{\ \ 7 = \quad 0,11,8} \\
\underline{\quad \ 10} & 987 = £82, \ 5,0 \\
987|00 &
\end{array}
$$

2. What is the interest of £2467,10 for 12 weeks, at 5 ℔ Cent.?

$$
\begin{array}{ll}
£2467,10 & 1000 = £19, \ 4, \ 7\frac{1}{4} \\
\underline{\qquad 5} & 400 = \quad 7,13,10 \\
12337,10 & 80 = \quad 1,10, \ 9\frac{1}{4} \\
\underline{\quad \ 12} & \underline{\ 50 = \quad 0, \ 0, \ 2\frac{1}{2}} \\
& 1480|50 = £28, \ 9, \ 5
\end{array}
$$

3. What is the interest of £2467,10 for 50 days, at 6 ℔ Cent.?

$$
\begin{array}{ll}
£2467,10 & 7000 = £19,3, \ 6\frac{1}{2} \\
\underline{\qquad 6} & 400 = \quad 1,1,11 \\
14805, \ 0 & 2 = \quad 0,0, \ 1\frac{1}{4} \\
\underline{\quad \ 50} & \underline{\ 50 = \quad 0,0, \ 0\frac{1}{4}} \\
7402|50 & 7402|50 = £20,5, \ 7
\end{array}
$$

To find what an estate, from £1 to £60,000 ℔ 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 ℔ annum, what is that ℔ day?

$$
\begin{array}{l}
£300 = £0,16, \ 5\frac{1}{4} \\
70 = \quad 0, \ 3,10 \\
\underline{\ \ 6 = \quad 0, \ 0, \ 4} \\
\quad £1, \ 0, \ 7\frac{1}{4}
\end{array}
$$

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 ⅌ 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, 8¼ |
| 11 | 900 = 75, 0,0 | | 3 | 10 = 0, 3,10 |
| 2970 | 70 = 5,16,8 | | 810 | = £15,11, 6¼ |
| | 2970 = £247,10,0 | | | |

| £. | For 6 Days. | | For the whole Time. |
|---|---|---|---|
| 270 | 1000 = £2,14, 9½ | | £247,10,0 |
| 6 | 600 = 1,12,10½ | | 15,11,6¼ |
| 1620 | 20 = 0, 1, 1 | | 4, 8,9 |
| | 1620 = £4, 8, 9 | | £267,10,3¾ *Ans.* |

A TABLE, showing the Number of Days from any Day in the Month to the same Day in any other Month through the Year.

| To | Jan. | Feb. | Mar. | April | May | June | July | Aug. | Sept. | 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

## REPEATING AND CIRCULATING DECIMALS.

DECIMALS are distinguished into two kinds, finite, and infinite; or, as they are frequently called, *terminate*, and *interminate* decimals.

Interminate decimals are divided into two classes, REPEATING and CIRCULATING DECIMALS.

In reducing vulgar fractions to decimals, finite decimals are known by the quotient, or *decimal,* having no remainder.

A repeating decimal is known from the quotient repeating the same figure. If the figure repeat from the beginning or point, the decimal is a *pure repeater.* If there be figures before the repeater, it is called a *mixed repeater,* and the repeating figure is marked either with a point or dash for distinction.

A circulating decimal is known from the quotient repeating two or more figures continually. If the figures circulate from the decimal point, the decimal is a *pure circulate.* If there be figures before the circle, the decimal is called a *mixed circulate,* and are marked with a point over the *first* and *last* figures of the circle: the figures before the repeating ones are called the *finite part.*

## REDUCTION

OF

### INTERMINATE DECIMALS.

CASE I.—*To reduce vulgar fractions to decimals.*

RULE.—Annex ciphers to the numerator, and divide by the denominator, as in finite decimals; and continue the dividend till the decimal either *repeat* or *circulate.*

## Examples.

1. Red. $\frac{7}{60}$ to a decimal.

$$60)7.0(.11\dot{6} \; Ans.$$
$$\underline{60}$$
$$\overline{100}$$
$$\underline{60}$$
$$\overline{*400}$$
$$\underline{360}$$
$$\overline{*40}$$

2. Red. $\frac{8}{27}$ to a decimal.

$$27)*8.0(.29\dot{6} \; Ans.$$
$$\underline{54}$$
$$\overline{260}$$
$$\underline{243}$$
$$\overline{170}$$
$$\underline{162}$$
$$\overline{*8}$$

*Note.*—The following examples exhibit the different kinds of interminate decimals.

3. Reduce $\frac{2}{9} = .\dot{2}$, *a pure repeater.*

4. Reduce $\frac{7}{12} = .58\dot{3}$, *a mixed repeater.*

5. Reduce $\frac{3}{11} = .\dot{2}\dot{7}$, *a pure circulate.*

6. Reduce $\frac{51}{55} = .9\dot{2}\dot{7}$, *a mixed circulate.*

7. Reduce $\frac{2}{3}$ and $\frac{5}{6}$ to decimals.    *Ans.* $.\dot{6}$ and $.8\dot{3}$

8. Reduce $\frac{3}{7}$ and $\frac{8}{9}$ to decimals.    *Ans.* $.\dot{4}2857\dot{1}$ and $.\dot{8}$

9. Reduce $\frac{10}{11}$ and $\frac{5}{12}$ to decimals.    *Ans.* $.\dot{9}\dot{0}$ and $.41\dot{6}$

10. Reduce $\frac{8}{15}$ and $\frac{4}{21}$ to decimals.

*Ans.* $.5\dot{3}$ and $.\dot{1}9047\dot{6}$

11. Reduce $\frac{7}{22}$ and $\frac{13}{56}$ to decimals.

*Ans.* $.3\dot{1}\dot{8}$ and $.23214285\dot{7}$

12. Reduce $\frac{1}{99}$ and $\frac{111}{112}$ to decimals.

*Ans.* $.\dot{0}\dot{1}$ and $.99107142\dot{8}\dot{5}$

CASE II.—*To reduce Lower denominations to decimals of Higher.*

RULE.—Proceed as in finite decimals, and mark the repeating or circulating figures with a point.

## Examples.

13. Reduce 12/8¾ to the decimal of £1.

$$4|3.0$$
$$12|\overline{8.75}$$
$$20)\overline{12.7291\dot{6}}$$
*Ans.* $.6364583$

14. Reduce 2 qrs. 16 lbs. to the decimal of a Cwt.

$$28\begin{cases} 4|16.0 \\ 7|\overline{4.0} \\ 4|\overline{2.571428} \end{cases}$$
*Ans.* $.6\dot{4}2857\dot{.}$

15. Reduce 7/10 to the decimal of £1    *Ans.*

16. Reduce 19/11¾ to the decimal of £1.

*Ans.* .9969583

17. Reduce 7 oz. 12 dwt. 8 grs. to the decimal of 1 *lb.* Troy.                                                    *Ans.* .63472

18. Reduce 8 oz. 6⅓ drams to the decimal of 1 *lb.* Avoir.

*Ans.* .524739583

19. Reduce 3 qrs. 20 *lb.* to the decimal of 1 Cwt.

*Ans.* .9285714

20. Reduce 2 ro. 15⅔ per. to the decimal of an acre.

*Ans.* .597916

CASE III.—*To reduce* a Pure Repeater, or Pure Circulate, *to a vulgar fraction.*

RULE.—Place 9 for the denominator of the repeater; and 9 for every figure in the circle.

*Examples.*

21. Reduce .6 to a vulgar fraction.      .6 = 6/9 or ⅔ *Ans*
22. Reduce .81 to a vulgar fraction.      81 = 81/99 or 9/11 *Ans.*
*Note.*—If ⅓ be reduced to a decimal, it will produce a pure repeater .1 ; and .1 is the decimal to ⅑ ; .2 = 2/9, .3 = ⅓, and so on till .9 = 9/9 ; hence every repeating figure is the numerator of a fraction whose denominator is 9.
23. Reduce .3 and 6 to vulgar fractions.      *Ans.* ⅓ and ⅔.
24. Reduce .7 and .36 to vulgar fractions.      *Ans.* 7/9 and 4/11.
25. Reduce .09 and .90 to vulgar fractions. *Ans.* 1/11 and 10/11.
26. Reduce .148 and .037 to vulgar fractions.

*Ans.* 4/27 and 1/27.

27. Reduce .162 and .765 to vulgar fractions.

*Ans.* 6/37 and 84/111.

CASE IV.—*To reduce* a Mixed Repeater, or Circulate, *to a vulgar fraction.*

RULE.—Subtract the *finite part* from the whole decimal ; the remainder is the *numerator :* then place 9 below each figure of the circle, with a cipher for every finite place, for the *denominator.*

*Examples.*

28. Reduce .583 to a vulgar fraction.

From .583
Sub.    58
    —————
*Ans.* 525/900 or 7/12

29. Red. .927 to a vulgar fraction.

From .927
Sub.    9
    —————
*Ans.* 918/990 or 51/55.

*Note.*—The reason of this operation will appear, by dividing the decimal into its *finite* and *circulating* parts. Thus, in lastExample, the finite decimal is 9, and the circle .02$\dot{7}$; but 9 = $\frac{9}{10}$, and .02$\dot{7}$ should be $\frac{27}{99}$ provided the circulation began at the decimal point; but as it begins after the place of tenths, it is $\frac{27}{99}$ of $\frac{1}{10}$, or $\frac{27}{990}$. The sum of the two fractions should be the value of the decimal required. To add them, we reduce them to the same denominator: thus, $\frac{9}{10} = \frac{891}{990}$, and add to it $\frac{27}{990}$, the sum is $\frac{918}{990}$, or reduced to its lowest terms $\frac{51}{55}$, which is the same as by the Rule.

30. Reduce .1$\dot{6}$ and .58$\dot{3}$ to vulgar fractions.

*Ans.* $\frac{1}{6}$ and $\frac{7}{12}$.

31. Reduce .02$\dot{6}$ and .91$\dot{2}$ to vulgar fractions.

*Ans.* $\frac{4}{15}$ and $\frac{821}{900}$.

32. Reduce .42$\dot{9}$ and .81$\dot{2}$ to vulgar fractions.

*Ans.* $\frac{85}{198}$ and $\frac{134}{165}$.

33. Reduce .113$\dot{6}$ and .568$\dot{1}$ to vulgar fractions.

*Ans.* $\frac{5}{44}$ and $\frac{25}{44}$.

**Case V.**—*To find the value of an interminate decimal.*

**Rule 1.**—If the decimal be a *repeater*, carry by 9, in multiplying the right-hand figure ; and where a cipher occurs on the right of the multiplier, annex the repeating figure for it.

2. If the decimal be a *circulate*, to reduce it to a vulgar fraction ; and proceed as in Case II. of that Rule.

### Examples.

34. Value .636458$\dot{3}$ of £1.
```
        20
  ─────────────
  12.7291666
        12
  ─────────────
   8.7500000
        4
  ─────────────
     3.00.
  Ans. 12/8¾
```

35. Value .642857$\dot{1}$ of 1 Cwt.

.642857$\dot{1}$ = $\frac{9}{14}$ by Case IV
```
        9 num.
        4
  ───────────
  14)36(2 qr. 16 lb. Ans.
     28
  ───────
      8
     28
  ───────
    224
     14
  ───────
     84
     84
  ───────
```

36. Find the value of .3916 of £1.     *Ans.* 7/10.

37. Find the value of .998958$\dot{3}$ of ditto.   *Ans.* 19/11¾

38. Find the value of .634́7́2́ of 1 lb. Troy.
> *Ans.* 7 oz. 12 dwt. 8 grs.

39. Find the value of .524739583́ of 1 lb. Avoirdupois.
> *Ans.* 8 oz. 6¼ drs

40. Find the value of .9285714́ of 1 Cwt.
> *Ans.* 3 qrs. 20 lb.

41. Find the value of .597916́ of an acre.
> *Ans.* 2 ro. 15⅔ per.


# ADDITION

#### OF

## INTERMINATE DECIMALS.

### Case I.—*To add repeating decimals.*

Rule.—Extend the repeating figures to the same number of places, and one place beyond the longest finite ones : and carry by 9 at the right-hand column.

#### *Examples.*

1. Add .375́4́ + .8́ + .645, and .8́3́ together.

| | | | | | |
|---|---|---|---|---|---|
| .375́4́ | (2.) | .85 | (3.) | .6́ | |
| .8888́ | | .3́ | | .913́ | |
| .645 | | .428́ | | .375 | |
| .8́3́33 | | .1875́ | | .7́ | |
| 2.7428́ *Ans.* | | 1.79972́ | | 2.7327́ | |

*Note.*—The reason why we extend the repeaters a place beyond the longest finite decimals, and carry by 9 at the right-hand figure is, because by this operation like things come to be added ; for the finite decimals are tenth parts, but *repeaters* signify ninth parts.

4. Find the sum of 98.6́,123.3́, 67.83́, .125
> *Ans.* 289.9583́

5. Reduce and add 54⅓, 43⅝, 68¹¹⁄₁₂, and 150⅞.
> *Ans.* 317.9583́

6. Reduce and add 27⅙, 15¼, 32⅓, and 18⅘.
> *Ans.* 93.0694́

7. Reduce and add £16,3,4, £21,19,11, £18,0,6¾, and £9,12,9.
> *Ans.* £65.828125́

## Case II.—*To add circulating decimals.*

**Rule.**—Extend them till they become similar, and when you add the right column, include the figure which would have been carried if the circle had been extended farther.

*Note.*—All circulating decimals may be extended to a simi·lar form, having a like number of finite and circulating places. For this purpose we extend the finite part of each as far as the longest, and then extend all the circles to as many places as may be a multiple of the number of places in each.

### Examples.

| | | | |
|---|---|---|---|
| 8. Add | .574 | Extended | .574574 |
| | .2698 | ——— | .269869 |
| | .428 | ——— | .428 |
| | .37983 | ——— | .37983 |

*Ans.* 1.652284 sum.

*Note.*—1. The sum of the circles must be considered as a similar circle, and marked accordingly. If it consist entirely of ciphers the sum is terminate, if all the figures be the same the sum is a repeater.

2. The operation may be proved by reducing the decimals to vulgar fractions, and adding them according to that rule.

| | | | |
|---|---|---|---|
| 9. Add | .874 | Extended | .874874874 |
| | .1463 | ——— | .146333333 |

| | .323232323 |
|---|---|

*Ans.* 1.503026390 sum.

*Note.*—1. In this example the finite part of the decimals is extended to three places being the longest, and the circle to 9 places.

2. Repeaters, mixed with circulates, are extended and added as circulates. Thus in the above example; .1463 is extended as far as the circulates, and added with them.

10. Add .368 + 57 + .895 + .742     *Ans.* 2.581646
11. Add together .3 + .62 + .4375     *Ans.* 1.3971334
12. Find the sum of .7 + .583 + .27, and .927

*Ans.* 2.561

# SUBTRACTION

## oʀ

## INTERMINATE DECIMALS.

CASE I.—*To subtract repeating decimals.*

RULE.—Extend them, as directed for Addition, and borrow at the right-hand place, if necessary, by 9.

### *Examples.*

| 1. From .93566 | (2.) .675 | (3.) .7383 |
|---|---|---|
| Subtr. .34218 | .53183 | .68 |
| .59347 | .14316 | .0494 |

4. From .675 subtract .583                *Ans.* .0916

5. Subtract .5625 from .913                *Ans.* .35083

6. From .81 take .1825                *Ans.* .62861

7. From .25 take .138                *Ans.* .111 = $\frac{1}{9}$

8. Reduce and subtract $109\frac{7}{15}$ from $190\frac{5}{6}$

*Ans.* 80.84583

## CASE II.—*To subtract circulating decimals.*

RULE.—Extend them till they become similar; and, when you subtract the right-hand figure, consider whether one would have been borrowed if the circles had been extended farther, and make the allowance accordingly.

### *Examples.*

| 9. From .974 | Extended | .974974 |
|---|---|---|
| Subtract .86 | ———— | .868686 |

*Ans.* .106288 difference.

| 10. From .8135 | or | .8135135 |
|---|---|---|
| Subtract .452907 | — | .4529074 |

*Ans.* .3606060 or 360

*Note.*—The operation may be proved, by reducing the given decimals to their equivalent fractions, and subtracting them according to that rule. The fraction expressing the *difference*, reduced to a decimal, will be the same.

11. From .18 subtract .036                *Ans.* .145782

12. From .3̇4̇ subtract .12̇3̇      *Ans.* .21530̇5̇
13. Subtract .682 from .943̇      *Ans.* .261115661̇
14. Reduce and subtract $\frac{1}{9 \cdot 1}$ from $\frac{3}{1 \cdot 1}$.      *Ans.* .23106̇

# MULTIPLICATION

### OF

## INTERMINATE DECIMALS.

**CASE I.**—*When either the multiplier or multiplicand is finite, and the other repeats.*

**RULE.**—Multiply by the finite factor, and carry by 9, when you multiply the repeating figure. The right-hand figure of each line of the product is a repeater; and they must be extended and added accordingly.

### *Examples.*

1. Mult.   13.494̇ by .367.      2. Mult. .65 by 5.7̇8̇

```
1. Mult.   13.494 by .367.          2. Mult. .65 by 5.78
             .367                          5.78
                                           ——
           94461                            65
          809666                           ——
         4048333                          2894
                                          34733
     Ans. 4.952461                        ————
                                        37.627 Ans.
```

*Note.*—If the sum of the right-hand column be an even number of 9s the product is finite; otherwise it is a repeater,

3. Multiply 123.4̇ by .8      *Ans.* 99.7̇5̇
4. Multiply 321.6̇ by 2.5      *Ans.* 804.16
5. Multiply 4.916̇ by 18.75      *Ans.* 17.1875
6. Multiply 70.83̇ by 500      *Ans.* 35416.6̇
7. Multiply .145 by .48̇      *Ans.* .07088̇
8. Multiply 6.9 by 2.84̇      *Ans.* 19.626̇

**CASE II.**—*When both multiplier and multiplicand repeat.*

**RULE.**—Reduce either of them to a vulgar fraction; and take parts of the multiplicand for the fraction.

### *Examples.*

9. Mult. 217.63̇ by .6̇ = $\frac{2}{3}$.      10. Mult. 143.7̇ by 12.3̇

```
9. Mult. 217.63 by .6 = 2/3.    10. Mult. 143.7 by 12.3
         2 num.                              12¼
                                            ————
       3)435.26                             1725.333
                                   ¼         47.925
     Ans. 145.08                            ————
                                   Ans. 1773.258
```

*Note.*—In Example 10 we add 1 to the right-hand figure of the sum, for the carriage which would have taken place if the circle had been extended farther. *See* Rule for Case II. in Addition.

11. Multiply 84.5 by .8        *Ans.* 75.16049382$\dot{7}$
12. Multiply 43.$\dot{7}$ by 16.$\dot{3}$        *Ans.* 715.03$\dot{7}$
13. Multiply 9.58$\dot{3}$ by 8.01$\dot{6}$      *Ans.* 76.8263$\dot{8}$
14. Multiply £98,16,8 by 26.5 and value the product.
            *Ans.* £2624,11,6.
15. Multiply £123,8,10 by 3.1$\dot{6}$, and value the product
            *Ans.* £390,17,11$\frac{1}{2}$.
16. Multiply £321,19,11 by 7.6$\dot{3}$ and value the product.
            *Ans.* £2457,18,0$\frac{1}{4}$.

**Case III.**—*When either, or both multiplier and multiplicand circulate.*

**Rule.**—Reduce them to their equivalent vulgar fractions, and multiply proceed as directed in that rule: then convert the fraction expressing the *product* into a decimal, for the answer.

### Examples

17. Multiply .2$\dot{7}$ by .31$\dot{8}$
     .31$\dot{8}$ = $\frac{10\dot{0}}{33}$ and .2$\dot{7}$ = $\frac{3}{11}$ by Case II. of Reduction.
And $\frac{10\dot{0}}{33}$ × $\frac{3}{11}$ = $\frac{10\dot{0}}{12\dot{1}}$ product in its lowest terms.
Then .$\frac{10\dot{0}}{12\dot{1}}$ reduced to a decimal . = .086650$\dot{2}$ *Ans.*
18. Multiply .1$\dot{8}$ by .1$\dot{8}$      *Ans.* .03305785 + &c.
19. Multiply .38$\dot{1}$ by .5$\dot{3}$        *Ans.* .2036$\dot{3}$
20. Multiply .784 by .3$\dot{6}$         *Ans.* .2850$\dot{9}$
21. Multiply .157142$\dot{8}$ by .6$\dot{3}$        *Ans.* .1
22. Multiply .68$\dot{3}$ by .$\dot{2}\dot{5}$      *Ans.* .17255892$\dot{2}$
23. Multiply .735 by .32$\dot{6}$        *Ans.* .23980$\dot{3}$

# DIVISION

### of

## INTERMINATE DECIMALS.

**Case I.**—*When the divisor is finite, and the dividend repeats or circulates.*

**Rule.**—Proceed as in finite decimals; and when the figures of the dividend are taken down, annex the repeating or circulating figures, instead of ciphers, to the remainder and carry on the division.

### Examples.

1. Divide .38.416 by 6.25

```
    6.25)38.416(6.146 Ans.
       3750
       ────
        916
        625
       ────
       2916
       2500
       ────
      *4166
       3750
       ────
      *416 &c.
```

Proof.

```
6.146 quotient
6.25  divisor.
───────
30733
12293̇
36880
───────
38.41666 dividend.
```

2. Divide .224 by .12       *Ans.* .018703
3. Divide .768 by .32       *Ans.* .24024
4. Divide .27 by .4625       *Ans.* .589680
5. Divide 9.142857 by 27       *Ans.* .338624+
6. Divide 1.537 by 64       *Ans.* .024027

CASE II.—*When both divisor and dividend repeat.*

RULE.—Multiply them both by any figure which exterminates the repeater: then divide the results as in finite decimals.

*Note.*—The digit 9 will always exterminate the repeating figure; but when it is either 3 or 6, the figure 3 will do it.

To divide by $.\dot{3} = \frac{1}{3}$ multiply the dividend by 3; and to divide by $.\dot{6}$ or $\frac{2}{3}$ multiply by 3 and divide by 2: or add one half of the dividend to itself.

### Examples.

7. Divide 158.8 by 2.7.      8. Divide 4.216 by $.\dot{5} = \frac{5}{9}$.

```
2.7)158.8(
  9      9
──────────
25.0)1430.0(57.2 Ans.
     125
     ───
     180
     175
     ───
      50
      50
      ──
```

```
       4.216
           9 den.
num. 5)37.950
       ──────
       7.59 Ans.
```

9. Divide .8 by .12       *Ans.* 7.27
10. Divide 8.962 by .3       *Ans.* 26.886
11. Divide .37845 by .6       *Ans.* .567683
12. Divide 161930.6 by 25.3       *Ans.* 6392.

CASE III.—*When the divisor circulates, and the dividend is finite or repeats.*

RULE.—Reduce the divisor to a vulgar fraction; and multiply the dividend by the denominator, and divide by the numerator.

### Examples.

13. Divide .245892 by .218 $\frac{818}{818}$ or $\frac{12}{55}$.

$$55 \ den.$$
$$\overline{1229460}$$
$$1229460$$
$$num. \ 12)\overline{13.524060}$$
$$\overline{1.127005} \ Ans.$$

14. Divide .481 by .2̇7̇          *Ans.* 1.7636̇
15. Divide .12963 by .1939̇        *Ans.* .668421875
16. Divide .7631992̇6̇ by .51̇7̇      *Ans.* 1.47399

CASE IV.—*When both divisor and dividend circulate.*

RULE.—Reduce them to their equivalent vulgar fractions; and proceed as in division of that rule: then convert the fraction expressing the *quotient* into a decimal, for the answer.

### Examples.

17. Divide .4̇2̇ by .18̇5̇
   .4̇2̇ = $\frac{42}{99}$ or $\frac{14}{33}$ and .18̇5̇ = $\frac{185}{999}$.
And $\frac{999}{185} \times \frac{14}{33} = \frac{13986}{6105}$ or $2\frac{509}{2035}$ *quotient.*
Then $2\frac{509}{2035}$ reduced to a decimal is 2.290̇ *Ans.*

18. Divide .2̇04̇7̇ by .18̇     *Ans.* 1.12587̇
19. Divide .2589̇ by .16̇      *Ans.* 1.6025
20. Divide .284̇ by .16̇       *Ans.* 1.75900

# APPLICATION
## OF
# VULGAR AND DECIMAL FRACTIONS.

1. A has $\frac{1}{3}$ of a trading vessel, B $\frac{1}{4}$, and C $\frac{1}{5}$, and the rest of her belongs to the master: how much is his share?

*Ans.* $\frac{13}{60}$

2. Find the value of 156⅞ yards of cloth, at 18/4 ⅌ yard by vulgar fractions and by decimals?

*Ans.* $\frac{13805}{96}$ £ = £143.802083 *or* £143,16,0½.

3. Divide 304 sovereigns among 3 persons, and give B ⅔ of A's share, and C ⅔ of B's?

*Ans. A receives* 144, *B* 96, *C* 64.

4. It is required to divide a prize of 1000 guineas among a captain, a lieutenant, and 90 men; giving the captain ¼ of the whole, and the lieutenant $\frac{1}{10}$ of the remainder, and what remains equally among the 90 men?

*Ans. Captain* £150, *lieutenant* £90, *and each man* £9

5. The effects of a bankrupt amount to £12685,6,6, and the claims against his estate to £32561,10: what *decimal multiplier* will apportion his effects among his creditors?

*Ans.* .38958 +.

6. A person paid away ½ of his money, then ¼ of what remained, and afterwards ¼ of that: what proportion has he left?

*Ans.* ¼.

7. How many French feet are there in an English mile; one foot at Paris being equal to 1.0657$\frac{4}{5}$ English foot?

*Ans.* .4954.2317 +.

8. Find how many cubic feet in a block of marble, 3¾ feet long, 2¼ feet broad, and 1$\frac{1}{5}$ feet thick; and prove the operation either by vulgar fractions or decimally.

*Ans.* 12 *feet*, 7 *inches*, 10½ *parts.*

9. Required the solid contents of a wall 74.5 feet long, 2.75 feet broad, and 24.25 feet high; and prove the operation by vulgar fractions?

*Ans. Feet* 4968.21875.

10. Four persons receive the present of a guinea; of which A claims ½, B ⅓, C ¼, and D ⅕, but find it too little: it is therefore required to determine their shares of it in the above proportion?

*Ans. A* 8/2$\frac{2}{1}$T, *B* 5/5$\frac{5}{1}$T, *C* 4/1$\frac{1}{1}$T, *D* 3/3$\frac{3}{1}$T.

11. Three tradesmen are employed on a piece of work, $\frac{7}{10}$ of which A can do in one day, B $\frac{1}{12}$, and C $\frac{1}{15}$ in the same time: in what time will they do it working together?

*Ans.* 4 *days.*

12. What is the cavity of a pond 76⅔ yards long, 35 yards broad, and 3¼ yards deep: perform the work by vulgar fractions, and prove it by decimals?

*Ans.* 8720$\frac{5}{6}$ *yards* = 8720.8$\dot{3}$ *yards.*

13. King Solomon's annual revenue was 666 talents of gold, each weighing 114$\frac{1}{16}$ lbs. Troy· how much sterling

would it amount to, estimating the value of gold at the mint price £3 , 17 , 10½ ℘ oz.        *Ans.* £3549493 , 16 , 6¾.

14. Goliath, the giant mentioned in scripture, is said to be 6½ cubits high: required his height in English measure, the length of the cubit being 1 foot 9⅔ inches?

*Ans.* 11 *feet* 10-⁵⁄₁₃ *inches.*

15. The length of Noah's ark was 300 cubits, the breadth 50, and height 30: how many cubic yards did it contain; reckoning the cubit 1 foot 9¾ inches?  *Ans.* 99239. + *yards.*

16. The noted pirate, Hasen Bey, offered for his life and liberty 600,000 gold chequins, each worth 8/10-⁵⁄₆ : required the amount in pounds sterling?        *Ans.* £265781 , 5.

17. A, B, and C, were to share £100,000 in the proportion of ⅓, ¼, and ⅕, respectively; but B dying, his share is to be divided proportionably between the other two: required how much the survivor's shares will be augmented by B's death?

*Ans.* A's £19946⅓⁹⁄₄₇, C's £11968⁴⁄₄₇.

18. If ¾ of a yard of cloth, 33 inches wide, cost ⅝ of £1 ; what will 27¼ yards, 39 inches wide, cost, the price of the yard being in proportion to the breadth?  *Ans.* £36 , 2 , 2⅘.

19. The Winchester bushel contains 2150.42 cubic inches, and the new Imperial bushel 2218.19 inches: how much ℘ Cent. larger is the new standard measure?

*Ans.* 3.151 + *or* 3 *guineas* ℘ *Cent.*

20. A granary holds 1386¼ Winchester quarters of barley: how many bushels of the Imperial measure will fill it?

*Ans.* 10751 + *bushels.*

21. If a corn factor purchases 1000 quarters wheat at 67/6 ℘ qr. by the Winchester measure ; but, by the fall of grain, was obliged to sell it at the same price, by the Imperial standard: how much will he lose?    *Ans.* £103 , 2 , 3¼.

22. Suppose that the corn-factor in the last question purchased by the Imperial standard, and sold at the same price by the Winchester measure: how much would he have gained?

*Ans.* £106 , 7 , 3.

23. How many Imperial gallons will a cistern hold, whose inside dimensions are 38.5 feet in length, 23.3 feet broad, and 11.75 feet deep; the gallon containing 277.27 cubic inches?        *Ans.* 65783 + *gallons.*

24. The amount of the legacies bequeathed in a will was as follows: to A £1800, B £1500, C £1200, D £1000, and to E £900; but at the time of the testator's death his

property brought only £5800: what *decimal multiplier* will apportion their shares, and how much will each receive?

    *Ans.* .90625 ; *and A receives* £1631 , 5, *B* £1359 , 7 , 6, *C* £1087 , 10, *D* £906 , 5, *E* £815 , 12 , 6.

25. A person lent, at 5 ⅌ Cent. on bond, £1000, on 1st January, 1822, which he received as follows: on 25th May, 1823, £400; on 3d September, 1824, £350; and the balance on the 24th February, 1826: how much did it amount to, adding the interest due at the time of each payment to the principal? *Ans.* £389 , 4 , 10.

26. A merchant sold cloth at 13/4 a yard, by which he cleared ⅜ of his money: he afterwards raised the price to 14/7 : how much profit ⅌ Cent. had he by the latter price?
    *Ans.* 75 ⅌ *Cent.*

27. A garden measures ⅞ of an acre; the grass walks ¾ of a rood, the gravel walks 5½ perches, and the fruit trees occupy ⅙ of the whole garden: how much remains for kitchen garden? *Ans.* 1 *ro.* 8 *per.* 15⅙ *yd.*

28. A timber merchant imports from Spain 7000 cubic ft of mahogany, Spanish measure, for which he paid 1260 dollars, exchange 38¼d. besides £84 , 14 for freight and charges: how much does it stand him ⅌ English foot = 1.004 cubic foot Spanish ? *Ans.* 9¾d. ⅌ *foot.*

29.     A house was bought by A, B, C,
        Who paid for it full dear,
    They gave three thousand pounds in all,
        In manner stated here;
    Two-thirds of B's share A laid out,
        And B three-fifths of C's :
    How much did each pay of the same,
        Pray solve it, if you please?
    *Ans. A paid* £600, *B* £900, *and C* £1500.

30. If, in estimating the weight of cattle, the four quarters are usually reckoned equal to ½ of the beast, the tallow $\frac{1}{12}$, and the skin $\frac{1}{18}$ : required what proportion of the weight is left for the offals? *Ans.* $\frac{13}{36}$ *of the weight.*

31. Two neighbouring gentlemen have estates of equal value: A lived above his income and contracted £100 of debt yearly, for which he paid 6 ⅌ Cent. for interest and expenses; B, on the other hand, lived frugally and saved £150 yearly, which he improved at 5 ⅌ Cent. compound interest: required how much B is richer than A at the end of 14 years?
    *Ans.* £5041 , 6

32. Zaccheus the tax-gatherer, mentioned in scripture, when brought to repentance, proposed to give ½ of his goods to the poor, and to restore fourfold whatever he had exacted unjustly from any man. Now supposing, by doing so, he left himself nothing; what proportion of his wealth did he acquire by unjust means? *Ans. ⅛th part.*

33. A merchant, after trading four years, was possessed of £3240. The first year he gained ⅙ of his original stock, the second ¼, the third ⅓, and the fourth ½ of the same: how much did he begin with? *Ans. £1440.*

34. A brazen lion being placed in an artificial fountain, conveys water into a cistern by a stream issuing from his mouth, by two from his eyes, and by another from the bottom of his right foot: the pipes through which these streams pass are of different capacities, that by the foot set open, the cistern will be filled in 12 hours, by the mouth in 2 hours, by the right eye in 3 hours, and by the left in 4 hours: in what time will the cistern be filled if all these streams be set open at once? *Ans. 51 min. 25⅘ secon*

35. A person being asked what was the hour of the day, answered it is "*between 5 and 6 o'clock,*" and that the minute and hour hands were exactly together: required the hour of the day? *Ans. 27 1/11 minutes past 5 o'clock.*

36. If 12 oxen will eat 3⅓ acres of grass in 4 weeks, and 21 oxen will eat 10 acres in 9 weeks: how many oxen will eat 24 acres in 18 weeks, the grass being supposed to grow at an uniform rate during the time? *Ans. 36 oxen.*

THE END.