ARITHMETIC,

IN THE

PLAINEST AND MOST CONCISE METHODS HITHERTO EXTANT:

WITH NEW

IMPROVEMENTS

FOR DISPATCH OF BUSINESS IN ALL THE SEVERAL RULES;

AS, ALSO

FRACTIONS, VULGAR AND DECIMAL,

Wrought together after a New Method, that Renders both easy to be understood in their Nature and Use.

The whole perused and approved of by the most eminent Accomptants in the several Offices of the *Revenue*, viz. Custom, &c. as the only Book of its kind for variety of Rules and brevity of Work.

By GEORGE FISHER, ACCOMPTANT.

AN APPENDIX,

Containing the Construction and Use of TABLES, for calculating Questions in Compound Interest, and Annuities or Leases in Possession or Reversion.

LONDON, Printed:—

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1800.

TO THE

RIGHT WORSHIPFUL

SIR SAMUEL CLARK, KNT.

AND MERCHANT

OF THE

CITY OF LONDON.

SIR,

WHEN I considered of your great abilities, and most consummate knowledge, in things of this nature, I was under great hesitations, lest I should appear too presumptuous in dedicating such a trifle to your Worship: But then, Sir, again considering, that your candour, and obliging condescension was equally as great; and also encouraged by favours formerly received, I have ventured to shelter this *Treatise of Arithmetic* un-

der your great name; and if it gain but your approbation, I ſhall not be ambitious of any other Imprimature; but acquieſce with ſome aſſurance, that the Book will meet with a favourable and kind reception in the world. In this impreſſion, I have endeavoured to be as correct as poſſible, and have made large *additions* and *improvements* in the ſeveral *Rules*; which, with all humble ſubmiſſion, encourages me to hope may in part excuſe for my preſumption in troubling your Worſhip once more; and remain, with all poſſible reſpect and deference,

Your Worſhip's *moſt Devoted, and Obedient Humble Servant,*

GEO. FISHER.

THE

PREFACE.

SOMETIME before I attempted, or had any thoughts of compiling this Book, a very good friend of mine (Mr. Wilkins, Ruſſia merchant) deſired me to draw him out ome few notes of the ſhorteſt ways and me-hods of working ſome of the rules in Arith-netic; which when I ſet about, endeavour-ng to oblige my friend, I hit on ſeveral things not thought on by me before) which I hop-d, if made public, might be of good ſervice o the world.

If it be objected, That the Books on this ubject are too numerous already; That as many as there are extant, yet there are none ſo perfect, but there may be im-provements made upon them; and if ſo, and hat thoſe improvements may be of any con-iderable uſe and benefit to mankind, why may they not be made public?

Arithmetic (ſaith Mr. Locke, in his *Eſſay on Human Underſtanding*) is of ſuch general uſe and ſervice, in all the parts of life and buſineſs, that ſcarce any thing is to be done without it; and therefore I think there can-

not be too many or too good instructions, for its attainment; and before either Hodder's Cocker's, or Ayre's Books appeared in the world, there were many excellent pieces of that science then extant; and yet their books came abroad, and found encouraging entertainment, and they themselves, applause for their endeavours.

And if another improves as much upon them, as they did upon others before them, why may he not hope for some success and approbation? In short, if the Book meets with encouragement but equal to the Author's care and endeavours, to make it the most useful of its kind he will have reward enough.

As to the work, I have gone through *Numeration*, *Addition* (with several useful tables) *Subtraction*, *Multiplication*, and *Division*, with so much plainness and perspicuity, and in such familiar and pertinent terms, that the meanest may understand and apply them properly.

In *Multiplication* I have been more copious than ordinary, that I might shew the excellent uses that may be made of that rule only, particularly in money; where by having the price of one thing, I have shewn how to find out the value of many things at that rate: so that if a person well understands the methods and intentions of the rules, and directions therein laid down (which are as easy as ad-

dition of money) if he makes no farther advances in Arithmetic, yet he ſhall be able to caſt up moſt things that ordinarily occur in common buſineſs with elegancy and expedition.

In *Diviſion* I have ſhewn the two Italian ways of dividing; and alſo ſeveral examples whereby a ſum many times may be ſooner, and in much fewer figures, worked at two diviſions than at one: Likewiſe how ſums of divers denominations, as of *pounds*, *ſhillings*, and *pence*, &c. may be divided into equal parts, without reducing them into the loweſt name mentioned (as is generally the practice) and is done in half the time, and a quarter of the figures uſed in the other way. Alſo by *diviſion* to find, having the value of many things, the price of one thing at that rate.

In *Reduction* I have ſhewn great variety of working, and divers ways of abbreviating the common method uſed in that: as to bring *groſs weight* into *pounds* without multiplying.

Next I ſhew the ſhorteſt and beſt methods of deducting *Tare* and *Tret*, &c.

In the *Rule of Three* I have been very full in explaining its nature and uſe; with two ſeveral methods of ſhortening moſt operations in that rule, as is clearly evinced by ſundry examples therein.

From thence I paſs to the *Rule of Three Inverſe*, and exemplify it by variety of rules.

and examples: As alſo the *Double Rule of Three Direct* and *Inverſe*: with the *Rule of Three*, compoſed of the five given numbers.

Then the ſeveral *Rules of Practice* are taught with greater variety and improvements than in any one book of Arithmetic hitherto extant.

As alſo the *Rule of Company*, with a method of contracting the tedious way of working queſtions in that rule.

Likewiſe *Intereſt* at all rates, ſhewn in ſundry examples, variouſly wrought. With *Discount*, *Exchange*, *Profit and Loſs*.

Then I treat of *Fractions* both *Vulgar* and *Decimal*, working one with the other, in ſuch a method as renders both eaſy to be underſtood: and in ſuch familiar terms as explain their nature and uſe.

I have now, with the utmoſt care, diligence and probity endeavoured to make this piece [illegible] of its kind (conſidering its bulk and value) that is at preſent extant; Here is nothing abſtruſe or myſterious, but all plain and eaſy; and nothing but what will bear an intelligible demonſtration.

I have gone through the whole Book, line by line, and have taken all due care to correct what was amiſs in the other impreſſions; and as there was no other hand in the reviſal made uſe of but my own, I can with greater aſſurance affirm, and with the more confidence

aſſert, that the Book is now entirely correct*: and the *additions*, which are very numerous and conſiderable almoſt in every rule) are new, ſhort and very conciſe in operation; and pertinently interſperſed through the whole, as I had opportunity, & ſaw occaſion.

If there ſhould by chance be a tranſpoſition of a letter (though there hath been great care taken of that alſo) or by a greater chance, a falſe figure, or cipher, or a miſplaced one, I hope nay I doubt not, but truly judicious, and candidly ingenious readers will excuſe me for them: for though all may take care, there is none infallible. But I can with modeſt boldneſs, aſſure them there is no occaſion for an *Errata* page, which may diſcourage them at beginining, or cool them at the latter end of the Book.

P. S. To this Edition is added, an *Appendix*, containing the conſtruction and uſe of Tables, for calculating queſtions in Compound Intereſt, and annuities of leas in Compoſſion or reverſion, neceſſary for the young Accomptant to learn.

*That is to be underſtood of a former edition, which the Author himſelf corrected; but many errors have crept in ſince, in ſome latter London editions, which with great care, and pains *have been corrected* in this edition.

THE

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ARITHMETIC

WITH

NEW IMPROVEMENTS.

IN THE

PLAINEST AND MOST CONCISE METHODS HITHERTO EXTANT.

CHAP. I.

ARITHMETIC is the art of caſting accompts by number, and hath theſe five parts, viz. *Numeration*, *Addition*, *Subtraction*, *Multiplication*, and *Diviſion*, which ought thoroughly to be known and underſtood; for by theſe rules only, the whole art is attainable—all others being wrought by them.

OF NUMERATION.

NUMERATION teaches to read or write any ſum or number known or propoſed.

To which end obſerve, That all numbers whatſoever are expreſſed by or compoſed of theſe ten figures or characters, viz.

One,	Two,	Three,	Four,	Five,
1	2	3	4	5
Six,	Seven,	Eight,	Nine,	Cipher.
6	7	8	9	0

The firſt nine of theſe are called ſignificant figures, to diſtinguiſh them from the 0, or Cipher, which, of itſelf, is inſignificant, and therefore, by ſome is called a Nought; but it ſerveth to increaſe or decreaſe the value of other figures, according as it is placed.

Every one of the nine digits hath two values; the one certain by its form, the other uncertain by its place.

The value of a figure may be ſaid to be certain when it ſtands alone, without any figure or cipher annexed to it; or, if it ſtands in the firſt place, or place of units in a number; for then it never ſignifies any more than its own ſimple value; as 2 is but two, 6 but ſix.

The value of a figure may be ſaid to be uncertain, with reſpect to the place it is found in; ſo any of the nine figures, in the place of units, ſignifies but its ſimple value as was ſaid before; but in the ſecond place, it is [illegible] 10 many tens as it contains units: as 5, in the firſt place, is but five; but in the ſecond place it ſignifies ſo many tens or fifty; ſo that 5 may ſignify five or fifty, or five hundred, or five thouſand; and 7 may ſignify ſeven, or ſeventy or ſeven hundred, or ſeven thouſand, &c.

So every figure is increaſed in value by a ten-fold proportion from the right hand to the left. As in the firſt place, it is ſo many units, or ones; in the ſecond

place ſo many tens; in the third place, ſo many hundreds, in the fourth, ſo many thouſands; in the fifth, ſo many ten thouſands; in the ſixth ſo many hundred thouſands; in the ſeventh ſo many millions, &c.

Admit this number for explanation, viz 1234567, the 7, is only ſeven units, or ſeven; but 6 in the ſecond place is 6 times ten, or ſixty; the 5 in the third Place, an hundred times five, or five hundred; the 4 in the fourth place, a thouſand times four, or four thouſand; the 3, three times ten thouſand, or thirty thouſand; the 2 in the ſixth place two hundred thouſand; and 1 in the ſeventh place, one million. Thus the order of places, is accounted from the right-hand to the left, but to be read from the left-hand to the right, thus; one million, two hundred, thirty four thouſand, five hundred ſixty ſeven.

If any figure hath a cipher, or ciphers, joined to it, it will ſtill retain the value of its place, as much as if joined with any other figure or figures, in the room of the cipher or ciphers. So, if to the figure 5, there be annexed a cipher thus, 50, its value is five tens, or fifty; becauſe it ſtands in the ſeconds place, or place of tens. Or, if it have two ciphers joined with it, thus, 500, its value is five hundred; becauſe it poſſeſſeth the place of hundreds, or third place, &c.

For the eaſier underſtanding the foregoing directions, and better reading any number, obſerve the following TABLE.

The NUMERATION TABLE.

Places	9 Hundreds of Millions.	8 Tens of Millions.	7 Millions.	6 Hundreds of Thousands.	5 Tens of thousands.	4 Thousands.	3 Hundreds.	2 Tens.	1 Units.	Mill.	Thous.	Units.
	9	8	7	6	5	4	3	2	1	987	654	321
		9	8	7	6	5	4	3	2	98	765	432
			9	8	7	6	5	4	3	9	876	543
				9	8	7	6	5	4		987	654
					9	8	7	6	5		98	765
						9	8	7	6		9	876
							9	8	7			987
								9	8			98
									9			9

The first thing to be done, is to get by heart the value of the several places with their numbers, at the head of the Table, viz, Units, Tens, Hundreds, Thousands, &c. which being well understood, the learner may thereby be capable of reading or writing any number proposed.

And for the easier reading of the numbers in the Table, they are, on the right-hand set by periods; and over them the names of Units, Thousands, and Millions; and to be read thus, 987 Millions, 654 Thousands, 321. The next line, 98 Millions, 765 Thousands, 432. And the next, 9 Millions 876 Thousands, 543, &c.

Though this table consists of but nine places, yet it might have been extended to twelve, fourteen or more places, at pleasure: as after Hundreds of Millions, say Thousands of Millions, Ten Thousands of Millions, Hundred Thousands of Millions, then Millions of Millions, &c.

As admit of this number of thirteen places, viz. 1234567890123. For the easier reading of which, or any other number, make a point under or over every third figure, beginning at the right, thus;

1 234 567 890 123

. . . . .

So that the first point is under 1, and the last under 2, towards the left hand; and you are to account every third place, or period, hundreds, and to read it thus, 1 million of millions, 234 thousands, 567 millions, 890 thousands, 123.

QUESTIONS.

1. *What is 5 in the fifth place?*

Ans. By annexing four ciphers on the right hand thus, 50000, it is fifty thousand.

2. *What is 7 in the seventh place?*

Ans. By putting six ciphers on the right-hand thus, 7000000, it is seven millions.

3. *How do you set down eleven thousand, eleven hundred, and eleven?*

Ans. Thus, 12111.

	11000,	Eleven thousand
	1100,	Eleven hundred.
	11,	Eleven.
Proved by Addition	12111,	*Proof.*

4. *How do you write fourteen thousand, fourteen hundred, and fourteen?*

Anſ. Thus, 15414.

14000,	Fourteen thouſand.
1400,	Fourteen hundred.
14,	Fourteen.
15414,	*Proof.*

Proved by Addition.

NUMBERS.

707,	Seven hundred and ſeven.
4006,	Four thouſand and ſix.
60606,	Sixty thouſand, ſix hundred and ſix.
100004,	One hundred thouſand and four.
7770405,	Seven millions, 770 thouſand, 405.
500007,	Five hundred thouſand and ſeven.
111111,	One hundred and 11 thouſand, 111.
999999,	A million wanting one.
400400400,	Four hundred millions, 400 thouſ. 400.
100000000,	Ten thouſand times ten thouſand; or One hundred Millions, Rev. v. 11.
200000000,	Two hundred thouſand thouſand; or, Two hundred millions, Rev. ix. 16.
2070040500,	Two thouſand and ſeventy millions, forty thouſand, five hundred.

A Table of old Roman numbers.

100 C.
200 CC.
300 CCC.
400 CCCC.
500 D or, IↃ.
600 DC.
700 DCC.
800 DCCC.
900 DCCCC.
1000 M or CIↃ.
2000 CIↃ.CIↃ. or M. M.

3000 CIↃ.CIↃ.CIↃ, or, M.M.M.
5000 IↃↃ.
10000 CCIↃↃ.
50000 IↃↃↃ.
100000 CCCIↃↃↃ. or, CM.
500000 IↃↃↃↃ.
1000000 CCCCIↃↃↃↃ.
1666 MDCLXVI.
1718 MDCCXVIII or, CIↃIↃCCXVIII.

CHAP. II.

OF ADDITION.

ADDITION is the putting two or more numbers or ſums together, and thereby bringing them into one total ſum.

And is of one denomination, or ſeveral.

Addition of one denomination is, when the numbers of ſeveral articles are all of one name; that is, all pounds, gallons, ells, miles, ſheep, &c.

Addition of ſeveral denominations is, when the ſeveral lines conſiſt of divers names, as pounds, ſhillings and pence; hundreds, quarters and pounds; or yards, quarters, and nails, &c.

Numbers to be added together, muſt be placed in ſuch order, under one another (it matters not which is uppermoſt, the greateſt or leaſt numbers) that units may ſtand under units, tens under tens, hundreds under hundreds, thouſands under thouſands, &c.

As if you were to add 120 feet, 44 feet, and 34 feet, together, they muſt be ſet down one under the other, as follows viz.

Feet.		*Feet.*
120	or thus	34
44		44
34		120

Having placed the numbers to be added, as above, draw a line under them, and begin at the loweſt figure on the right hand being the place of units, ſaying 4 and 4 is 8, which put directly under the line, and juſt under its own rank, viz. under 4 and 4 and 0; and then go to the next row towards the left-hand, ſaying, 3 and 4 is 7 and 2 is

9; which alſo ſet down under the line, juſt under i own proper rank, viz. under 3, 4 and 2; then go to th laſt row, where you find but 1, which you muſt pu down alſo under the line juſt under itſelf; and ſo th numbers are added together; and you will find tha they make 198 feet in all, as by the Example fol lowing:

Hundreds.	*Tens.*	*Units.*
1	2	0
	4	4
	3	4
1	9	8

Hundreds.	*Tens.*	*Units.*	
	3	4	
	4	4	
1	2	0	
1	9	8	*Feet in all.*

When any of the ranks amount to ten, or tens, or they exceed ten or tens, then you muſt place a cipher under the line in its proper place; or elſe what is above ten or tens; and for every ten carry a unit, or one, to be added to the next rank. *As for example:* If the ſeries, or row, amount juſt to ten, I ſet down a cipher under the line in its place (for every figure or cipher muſt be ſure to ſtand under its own rank) and carry one to the next rank for the one ten. So if any of the rows come juſt to even tens, as 20, 30, 40, &c. I ſet down a cipher, and carry either two, three, or four according to the number of tens. And when it happens, that any of the ranks exceed ten or tens, then whatever the exceſs is, ſet it down under the line in its place. As if it amounts to 45, ſet down 5, and carry 4, for four tens, to the next row. If to 72, ſet down 2, and cary 7, for the ſeven tens, &c. And when you come to the laſt row, ſet down what it amounts to, let it be what it will. Examples following examplifying the directions above.

Add 26l. 15l. 20l. and 45l. together. Alſo 265 ells, 354 ells, 460 ells, 375ells, and 246 ells, together; which muſt be ſet down as underneath.

Pounds.	*Ells.*
26	265
15	354
20	460
45	375
	246
106	1700

Beginning at the lowermoſt figure in the place of units ſay, 5 and 5 is 10, and 6 is 16, which is 6 over one ten, therefore ſet down 6 under its own rank, and carry 1, for the ten, to the next rank, ſaying, 1 that you carry, and 4 is 5, and 2 is 7, and 1 is 8, and 2 is 10; which being the laſt row, ſet down ten and the work is done; and the total of the four numbers is 106l. as in the example.

So in the next Example, begin with the bottom figure on the right-hand, and ſay, 6 and 5 is 11, and 4 is 15, and 5 is 20; which being juſt 2 tens, and nothing over ſet down a 0, and carry 2 to the next rank, for the 2 tens, and ſay, 2 that you carry, and 4 is 6, and 7 is 13, and 6 is 19, and 5 is 24, and 6 is 30, which amounting juſt to 3 tens, ſet down a 0, again, and carry 3 for the 3 tens, ſaying 3 that you carry, and 2 is 5, and 3 is 8, and 4 is 12, and 3 is 15, and 2 is 17, which being the laſt row, ſet down 17, and the total ſum is 1700 ells, as may be ſeen in the Example.

The reaſon for carrying one for every ten to the left-hand is, becauſe the increaſe of every place that way, is by a ten-fold proportion, as was ſaid in Numeration.

Examples for Practice.

Yards		*Gallons.*	*Pounds.*
74		74	746
09		9	379
72	or thus	72	024
19		19	100
07		7	074
70		70	047
251		251	1370

Some choose to omit the ciphers on the left-hand, as in the second example, thinking it a little too precise, since ciphers on the left-hand signifying nothing; but the other is best for a learner, for his better understanding the value of the places, &c.

More Examples.

l.	*Ells.*	*l.*
71	742	7444
17	371	270
46	462	5000
64	072	500
20	971	6742
2	674	240
56	321	52
65	015	9
341	3628	20257

Here follow some familiar Examples, shewing the nature and use of this rule, viz.

Question 1. Between London and Royston are 33 es; from thence to Cambridge 10; thence to New-rket 10; thence to Bury 10; thence to Thetford ; thence to Attlebourough 10 and from thence to rwich 12 miles; How many miles are there between ndon and Norwich?

	Miles.
Set the numbers down thus:	33
	10
	10
	10
	10
	10
	12

ween London and Norwich are 95 miles.

Question 2. Again, How many days are there in these calendar months, or a year?

		Days.
January	hath	31
February		28
March		31
April		30
May		31
June		30
July		31
August		31
September		30
October		31
November		30
December		31
	Answer,	365

uestion 3. Suppose a farm contains these acres in the al fields following, viz.

	Acres.
In one field - - - .	10
Another - - -	15
Another - - -	12
Another - - -	20
Another - - -	9
Another - - -	6
And, in another - -	22
How many acres in all ? -	94 *Answe*

Question 4. Admit a Draper measure 10 pieces f eloth, and their contents are, viz.

No.	*Yds.*	
1 piece - -	35	How many yards in a
2 - - -	12	
3 - - -	25	
4 - - -	10	
5 - - -	9	
6 - - -	16	
7 - - -	10	
8 - - -	20	
9 - - -	15	
10 - -	8	

Answer, 160 Yards.

Note, That in setting down the numbers, care must taken, not to place units under the place of tens, but put them properly, as in the 5th and last articles of sum above.

Question 5. A Corn-factor bought as follows, viz.

		qrs.
Wheat	- -	56
Oats	- - -	45
Peafe	- - -	24
Rye	- -	72
Barley	- -	220
		417 *quarters in all.*

Question 6. A ſhip from the Indies, whoſe cargo is as follows viz.

			l.
In	*Pepper*	- -	14280
	Other ſpices	- -	9741
	Diamonds	- -	112579
	Calicoes	- -	47217
	Muſlins	- -	74219
	Drugs	- -	11241
What is the value of the whole			*l.* 269277 *Anſwer.*

Question 7. What number is that, from which if you ſubtract 18, the remainder will be 24?

Anſwer 42: For if you add 18 and 24 together, they make 42, the number ſought.

To prove Addition.

Begin at the top, and caſt it downwards, in the ſame manner as you did upwards; and if the figures or ciphers of the total, prove the ſame as in caſting upwards, the work is right; otherwiſe they muſt be caſt upwards and downwards, till they do agree.

ADDITION OF MONEY.

In Addition of ſeveral denominations muſt be obſerved how many of the ſmaller name make one of the next greater; as, how many farthings make a penny; how many pence a ſhilling; and how many ſhillings a pound: Wherefore I ſhall place the ſeveral *Tables of Money, Weight, Meaſure &c.* before the Examples, they being neceſſary to be firſt known.

Note, 4 farthings make one penny, 12 pence one ſhilling, and 20 ſhillings one pound.

In a pound ſterling, are { 20 Shillings. 240 Pence. 960 Farthings.

Note alſo, That in Addition of Engliſh money, *l.* ſtands for pounds; *s.* for ſhillings; *d.* for pence: *qr.* for farthings becauſe *libra* ſignifies a pound: *ſolidus* a ſhilling; *denarius* a penny: and *quadrans* a farthing.

But the beſt way to ſet down farthings, or parts of a penny, is:

$\frac{1}{4}$ { A *farthing*, or quarter of a penny.
$\frac{1}{2}$ A *halfpenny*, half a penny.
$\frac{3}{4}$ *Three farthings*, three quarters of a penny.

Example 1.

Suppoſe I owe one perſon, 5*l.* 4*s.* 6*d.* to another, 7*l.* 11*s.* 9*d.* to another, 4*l.* 7*s.* 5*d.* to another, 7*l.* 8*s.* 4*d.* to another, 8*l.* 0*s.* 0*d.* and to another, 9*l.* 7*s.* 6*d.* How much do I owe in all to the ſeveral perſons?

To do this, theſe ſeveral ſums muſt be ſet down in ſuch order, that pounds may ſtand under pounds, ſhillings under ſhillings, and pence under pence, with points or ſtrokes of ſeperation between them, as follows.

l.	*s.*	*d.*
5	04	6
7	11	9
4	07	5
7	08	4
8	00	0
9	07	6

In caſting up this, and all other ſums in this rule, you muſt remember, That for every 4 in the farthings, you muſt carry 1 to the pence, becauſe four farthings make a penny: for every 12 in the pence, you muſt carry 1 to the ſhillings, becauſe 12 pence make a ſhilling; and for every 20 in the ſhillings, you muſt carry 1 to the pounds, becauſe 20 ſhillings make a pound; and the pounds muſt be caſt up as ſums of one denomination, for every ten carrying one to the next row: and in all additions, whether of money, weight, or meaſure, &c. that denomination towards the left hand (which is the firſt in ſetting down, but the laſt in caſting up) muſt be ſo caſt up.

The ſame being again ſet down with a line drawn under it, appears thus:

l.	*s.*	*d.*
5	04	6
7	11	9
4	07	5
7	08	4
8	00	0
9	07	6
41	19	6

I begin at the ſmalleſt denomination towards the right hand (as in all additions we muſt, whether of money, weight, or meaſure) to wit, pence, and ſay, 6 and 4 is 10, and 5 is 15, and 9 is 24, and 6 is 30, now 30 pence is 2 ſhillings and 6 pence, wherefore, I put down the 6

pence under its own rank, and carry 2 for the 2 ſhillings, to the rank of ſhillings, ſaying, 2 that I carry, and 7 is 9, and 8 is 17, and 7 is 24, and 11 is 35, and 4 is 39; now 39 ſhillings is 1 pound 19 ſhillings, wherefore I ſet down the 19 ſhillings under its own rank, and carry the 1 pound to the pounds, ſaying, 1 that I carry, and 9 is 10, and 8 is 18, and 7 is 25, and 4 is 29, and 7 is 36, and 5 is 41, which being placed under the title of pounds, is forty-one pounds; ſo the whole ſum is, 41*l.* 19*s.* 6*d.* as in the Example may be ſeen.

Addition of ſeveral denominations, is proved in the ſame manner as addition of one, by caſting it downwards; and if it agrees with the ſum when caſt upwards, it is right.

There is another way uſed in ſchools; that is, to caſt up all again, except the upper line, and then that total they add to the upper line, and if it agree with the ſum firſt found, it is right. But this way is not ſo practical in matters of real buſineſs; therefore I prefer the other before it.

For the readier diſpatch in caſting up the pence; it is very neceſſary to have the following tables by heart.

Pence		*s.*	*d.*			*d.*
20		1	8		1	12
30		2	6		2	24
40		3	4		3	36
50		4	2		4	48
60		5	0		5	60
70	is	5	10	or 12 times	6 is	72
80		6	8		7	84
90		7	6		8	96
100		8	4		9	108
110		9	2		10	120
120		10	0		12	144

Get theſe tables by heart, thus; 20*d.* is 1*s.* 8*d.* 30*d.* is 2*s.* 6*d.* &c.

Example 2.

Bought by a Country Shop-keeper, in London, viz.

	l.	*s.*	*d.*
Linen cloths to the value of	21	11	4
Sugars, - - - -	7	10	0
Tobacco, - - - -	16	14	2
Wollen cloth and ſtuffs, - -	37	10	0
Fruit, - - - -	11	16	8
Brandy and waters, - -	9	14	2
How much did he lay out in all?	104	16	4

Beginning at the pence, I ſay, 2 and 8 is 10, and 2 is 12, and 4 is 16; and 16*d.* is 1*s.* 4*d.* I ſet down the 4, and carry the ſhilling to the next, the place of ſhillings, ſaying 1 that I carry, and 4 is 5 (for I omit the tens of ſhilllings till I come to the top) and 6 is 11, and 4 is 15, and 1 is 16; then I come downwards with the tens, ſaying 10 and 10 is 26; and 10 is 36, and 10 is 46, and 10 is 56, and 10 is 66, and 10 is 76 ſhillings which is 3*l.* 16*s.* I ſet down the 16 under the the place of ſhillings, and carry the 3 pound to the pounds, ſaying 3 and 9 is 12, and 1 is 13, (for I go up but with one row at a time) and 7 is 20, and 6 is 26, and 7 is 33, and 1 is 34; I ſet down 4, and carry, 3 for the 3 tens, (for the laſt denomination muſt be caſt up as ſums of one denomination, for every 10 carrying 1, as was ſaid before) and ſay, 3 that I carry, and 1 is 4, and 3 is 7, and 1 is 8, and 2 is 10; which being the laſt row, I ſet it down, So the whole ſum is 104*l.* 16*s.* 4*d.* as *per* the work.

Example 3.

A Merchant upon the balancing of his books, finds he has in money, debts, and goods, viz.

	l.	s.	d.
In cash,	2000	00	0
In chambrics,	60	00	0
In tobaccos,	47	16	6
By Henry Harper, owing,	121	17	4
In sugar,	246	07	2
In serges,	70	11	0
By voyage to Lisbon,	724	06	7
In indigo,	370	12	0
By William Waxham,	1000	00	0
In cochineal,	424	16	8
By the ship Rose,	640	11	0
In Canary wine,	142	17	0
Total,	5849	15	3

Example 4.

A Brewers Clerk receives of several persons as follows, viz.

		l.	s.	d.
Of	Laurence Lick Spiggot,	12	14	0
	Frank Froth,	9	10	4
	Sam Swigg,	20	11	6
	Ben Bumper,	36	16	8
	Henry Here's-t'ye,	24	00	0
	Stephen Stout,	8	16	6
	Received in all,	112	09	0

Example 5.

A Collector of Excise receives in

		l.	*s.*	*d.*
Sussex,		1420	10	6
Kent,		974	11	2
Surry,		641	17	4
Hampshire,		1344	11	1
Hertfordshire,		741	17	4
Bucks,		617	10	0
	Total,	5740	17	5

Example 6.

Sold by a Hosier,

		l.	*s.*	*d.*	*qrs.*
4 *pr.*	silk stockings, at	2	10	6	$\frac{1}{2}$
7 *pr.*	worsted ditto, at	1	15	2	$\frac{1}{4}$
9 *pr.*	thread hose, at	0	18	3	$\frac{3}{4}$
2 *pr.*	of childrens, at	2	07	6	$\frac{1}{2}$
3 *yds.*	of flannel, at	0	02	7	$\frac{1}{2}$
6 *pr.*	of mill'd hose, at	1	04	6	$\frac{3}{4}$
	In all,	8	18	9	

Here I begin with the farthing, saying 3 and 1 is 4, and 2 is 6, and 3 is 9, and 1 is 10, and 2 is 12, which is three-pence, which I carry to the pence, &c.

Sometimes sums are expressed one way, and set down another viz.

Example 7.

Expressed.		Set down
For { Coals, *six and thirty shillings*,	*l.* 1	16
For { Cloth, *seven and fifty shillings*,	2	17
Sum,	4	13

Example 8.

	l.	*s.*	*d.*
A guinea, - - -	1	01	0
A mark, - - -	0	13	4
An angel, - - -	0	10	0
A noble, - - -	0	06	8
A Crown, - -	0	05	0
A half-crown, - -	0	02	6
Total,	2	18	6

Example 9.

Expressed.	Set down.		
	s.	*d.*	*qr.*
Mutton, *eight groats*, - - -	2	8	
Onions, *seven farthings*, - - -	0	1	$\frac{3}{4}$
Tobacco, *two and twenty pence*, -	1	10	
Wine, *fifteen pence*, - -	1	3	
Thread, *three half-pence*, - -	0	1	$\frac{1}{2}$
Soap, *nineteen pence*, - - -	1	7	
Veal, *eleven groats and two-pence*, -	3	10	
Sum.	11	05	$\frac{1}{4}$

Though when ſome of theſe ſums are to ſtand alone, nd not in order of pounds, ſhillings and pence, as in a etter, &c. it is better to ſet them down as ſpoken; as, 15*d.* 45*s.* &c. rather than 1*s.* 3*d.* or 2*l.* 5*s.*

Note, That in ſetting down your ſums, care muſt be aken, that you do not ſet down more or ſo much in the place of a leſſer denomination than makes one of the next greater: for it would be abſurd to write down 18*l.* 22*s.* 15*d.* for 19*l.* 3*s.* 3*d.* Or, 15 *C.* 3*q.* 29*lb.* for 16 *C.* 0*q.* 1*lb.*

Some uſed formerly (and ſome of weak heads do now) to make a *point* or *ſtop*, at every 4 in the farthings; at every 12 in the pence; at every 20 in the ſhillings; and at every 10 in the pounds; if they conſiſt of ſeveral ranks, carrying ſo many ones, as they find points or ſpecks in one denomination, to the next: but this way is both tedious and ſlovenly. But if your ſums are very large, you may make a ſtop at every 60 in the pence, for 5*s.* and carry according to the ſhillings: and for the units rank in ſhillings, caſt them up as ſums of one denomination, for every ten carrying one to the tens of ſhillings, and reckon them as ſo many ones; and when you come to the top, halve them, which half carry to the pounds —but if they halve not even, ſet down the odd one in the tens place of ſhillings, &c. Examples of which you will find in the following page.

Whenever there is a neceſſity to *point* or *ſtop*, do it rather upon your nail, or on a bit of paper, than in your book or paper where the ſum is; becauſe, in proving it, the points very rarely happen in the ſame place; and the many ſtops may be apt to confound you, and alſo make the work appear foul.

Example 10.

l.	*s.*	*d.*
16	17*	10
47	11	6.
74	06	9
54	19	7
45	09	8
72	14	5
27	04	3
16	07*	9
61	17	8
24	06	7.
42	17	5
24	19	7
47	11	5
74	01	9
41	00	7
36	17	5
47	17	9
20	10	11
777	12	10

Example 11.

l.	*s.*	*d.*
714	19	6
412	10	7
374	11	9
241	14	5
474	16	4
372	12	6
330	12	9
200	07*	9.
472	12	7
521	09	6
245	17	8
324	12	2
725	15	4
317	13	9
972	14	5
321	15	7
733	17	3
245	11	1
8004	04	11

Here in the tenth Example, I begin at the bottom, ſaying thus, 11 and 9 is 20, &c. till I come to the article 24*l.* 6*s.* 7*d.* where the figures amount to 65; there I make a point or ſtop, for 5*s.* and carry 5 to the next figure over it, ſaying 5 and 8 is 13, &c. till I come to the article 47*l.* 11*s.* 6*d.* where it amounts to juſt 60; and there I make another point for 5*s.* more; and for the odd 10*d.* I ſet it down in its place, and carry the two 5*s.* making 10, to the ſhillings, ſaying, 10 and 7 is 17, and 7 is 24, &c. till I come to the top, there it amounts to 102; wherefore I ſet down 2, and carry 10 to the *tens* of ſhillings, ſaying 10 and 1 is

1, &c. And at the top it comes to 21, the half of hich is 10, and 1 over, which I place on the left hand the 2, and it makes 12*s.* and I carry the 10 to the ounds, ſaying 10 and 7 is 17, and 6 is 23, &c. ſting the pounds up as ſums of one denomination; d the total is 777*l.* 12*s.* 10*d.* as in the Example may ſeen.

Or the ſhillings may be caſt up by pointing at every 0 and 40 in the unit rank of ſhillings, which make 5*l.* at the articles *l.* 16 : 07 : 9*, and *l.* 16 : 17 : 10*. uppermoſt number, where a ſmall *aſteriſm* is placed to note it accordingly. At the top it comes to 42; I down 2, and carry 5*l.* to the tens of ſhillings, taking o of them as I go up for 1*l.* ſaying, 5 I carry, and 1 6, and 1 is 7, &c.

AVOIRDUPOIS-WEIGHT.

By this weight is weighed all kinds of grocery wares, goods ſubject to waſte; as, tobacco, ſugar, fruit, ugs, butter, cheeſe, allum, iron, braſs, lead, ſoap, tal- w, pitch, roſin, tin, ſalt, wax, flax, hemp, and all kinds garble goods, &c.

A Table of Avoirdupois-Weight.

16 Drams 16 Ounces 28 Pounds 4 Quarters 20 Hundred	make	1 Ounce 1 Pound 1 Quarter of a Hundred 1 Hundred 1 Ton	*oz.* *lb.* *qr.* *C.* *T.*

Note, A pound Avoirdupois-weight is equal to 14 oun- s, 12 penny-weight, Troy.

In a ton weight are
- 573440 Drams.
- 35840 Ounces.
- 2240 Pounds.
- 80 Quarters.
- 20 Hund. weight, of 112*lb.* each.

Avoirdupois Great Weight.

Examples.

(10) *Tons.*	(20) *C.*	(4) *qr.*	(28) *lb.*
7	14	3	12
5	19	1	06
9	07	1	00
7	07	2	12
2	15	0	20
9	17	3	21
43	02	0	15

(10) *Tons.*	(20) *C.*	(4) *qr.*	(28 *lb.*
7	11	1	12
6	07	2	15
7	09	1	17
4	15	1	06
6	07	1	14
2	17	0	19
35	08	0	27

Here you muſt begin at the leaſt denomination to wards the right hand (as before in money) viz. pounds ſaying, 21 and 10 is 31 (taking but one ten in the 2 for the eaſier reckoning) which is 3 above 28, make point on your nail for the quarter, and ſay, 3 and 10 that was left in the 20, is 13, and 12 is 25, and 6 is 31 make another point, and ſay 3 and 12 is 15, which ſe down under its own rank; and for the two points o ſtops, made for the quarters, carry 2 to the quarters ſaying, 2 and 3 is 5 and 2 is 7, and 1 is 8 and 1 is 9 and 3 is 12. Now 12 quarters is juſt 3 *C.* wherefore ſe down 0, and carry 3 to the hundreds; and proceed as i money, 20 *C.* making a ton, as 20*s.* did a pound, ſaying

and 7 is 10, and 5 is 15, and 7 is 22, and 7 is 29, nd 9 is 38, and 4 is 42; and coming down with the tens, ay, and 10 is 52, and 10 is 62, and 10 is 72, and 10 is 82, which is 4 tons, and 2 *C.* over, which I set down, nd carry 4 to the tons, saying, 4 and 9 is 13, and 2 is 15, and 7 is 22, and 9 is 31, and 5 is 36 and 7 is 43; and so the sum is finished, the total being 43 tons, 2 *C*, 0 *qr.* nd 15 *lb.* as in the Example may be seen.

The figures over the titles of each respective denomination shew what you must stop or point at, and are distinguished thus, (10) (20) (4) and (28).

More Examples for Practice.

(10)	(20)	(4)	(28)
Tons.	*C.*	*qr.*	*lb.*
74	13	0	15
46	11	1	17
44	09	2	06
74	19	3	16
44	07	0	21
74	14	1	15
359	15	2	06

(10)	(20)	(4)	(28)
Tons.	*C.*	*qr.*	*lb.*
74	14	1	16
41	06	1	11
24	15	2	07
19	06	3	15
26	14	1	07
14	12	2	15
201	10	0	15

Twelve Hogſheads of Tobacco, containing, viz.

No.	C.	qr.	lb.	No.	C.	qr.	lb.	Tare.
1	7	3	12	7	5	1	24	90
2	4	1	17	8	4	2	19	94
3	9	0	24	9	4	3	23	99
4	6	3	26	10	3	3	21	84
5	5	1	17	11	4	1	23	79
6	4	2	20	12	4	3	24	96
	38	2	04		28	1	22	542

C.	qr.	lb.	C.	qr.	lb.
71	1	19	46	1	19
47	3	24	24	3	03
57	2	16	23	0	21
71	0	21	67	2	13
47	1	12	27	1	17
51	2	06	34	3	23
347	0	14	224	1	12

Avoirdupois Small Weight.

This is in uſe chiefly for ſilk; as among ſtocking makers, weavers, &c. they deliver their ſilk out and in, by pounds, ounces, and drams.

Examples.

	(16)	(16)
lb.	*oz.*	*dr.*
4	10	06
7	14	12
5	07	04
9	14	15
4	05	07
6	11	14
39	00	10

	(16)	(16)
lb.	*oz.*	*dr.*
4	11	14
2	13	12
7	10	15
4	07	14
6	09	06
4	07	10
30	13	07

But in weighing worſted, and ſome other things, it is ſual to go no lower than a quarter of an ounce; as in ſe Examples.

	(16)	(4)
lb.	*oz.*	*qr.*
4	13	1
7	12	2
9	11	3
7	04	2
4	13	1
34	07	1

	(16)	(4)
lb.	*oz.*	*qr.*
9	07	2
7	10	1
8	15	3
7	12	2
3	13	3
37	11	3

Wool is alſo weighed by Avoirdupois-weight, but fferently divided, according to the following Table;
:.

Note, That	7 Pounds is one Clove, 2 Cloves one Stone, 2 Stones one Tod, 6½ Tods one Wey, 2 Weys one Sack, 12 Sacks one Last,	or,	lb. 14 28 182 364 4368

And in a Last of Wool are	4368	Pounds.
	624	Cloves.
	312	Stone.
	156	Tods.
	24	Weys.
	12	Sacks.

Note, That the wey differs in some counties; as in Suffolk, the wey is 336lb. or 42 cloves; in Essex 256, or 32 cloves; and according to the division above, 182 lb.

TROY-WEIGHT.

By this weight are weighed Jewels, Gold, Silver, Pearl, Electuaries, and Liquors; a pint of Water, Wine, &c. being a pound. And the usual denominations are Pounds, Ounces, Penny-weights, and Grains, as in the following Table.

Note,	24 Grains 20 Penny-weights 12 Ounces	make	1 Penny-weight. 1 Ounce. 1 Pound.

In a Pound Troy are	5760	Grains.
	240	Penny-weights.
	12	Ounces.

25 lb.	1 Quarter of a hundred.
100 lb.	1 Hundred-weight.
20 C.	1 Ton of gold or silver.

The value of Gold.

		l. s. d.
Pound wt.	is worth	48-0-0
Ounce	- -	4-0-0
Penny-wt.	-	0-4-0
Grain	- -	0-0-2

The value of Silver.

		l. s. d.
1 Pound wt.		3-3-0
1 Ounce		0-5-2
1 Penny-wt.		0-0-3 $\frac{1}{26}$
1 Grain	$\frac{1}{2}$	Farthing.

A ton of gold, at 4*l.* the ounce *l.* 96000
A ton of Silver, at 5*s.* the ounce *l.* 6000

Examples of Troy Weight.

	(12)	(20)	(24)
lb.	*oz.*	*dwt.*	*gr.*
4	10	12	20
5	04	06	13
7	07	07	06
5	04	19	4
4	11	04	14
6	04	17	21
34	07	08	6

	(12)	(20)	(24)
lb.	*oz.*	*dwt.*	*gr.*
5	10	10	11
4	11	17	19
6	10	01	10
5	06	14	15
4	10	14	17
2	05	04	04
30	07	03	04

(10)	(20)	(24)
oz.	*dwt*	*gr.*
24	13	10
19	11	15
07	04	14
21	13	16
11	05	23
08	04	12
14	07	10
15	0	11
122	11	15

(10)	(20)	(24)
oz.	*dwt.*	*gr.*
105	10	05
217	06	08
360	03	06
195	11	07
217	02	09
196	02	08
321	07	05
172	08	11
1785	11	11

Here is no occaſion for pointing, but only in the grains; but if you do ſtop at more, only mind the figures over the titles, as before in Avoirdupois-weight, and they direct at what to point.

Note, A pound Troy is about 13 ounces, 2 drams and a half Avoirdupois; or as 17 to 14: and the ounce Troy, as 51 to 56.

			l. s. d.
A pound Troy of gold	is worth		48-00-0
A pound Avoirdupois of gold			58-08-0

			l. s. d.
A pound Troy of ſilver	is worth		3-03-0
A pound Avoirdupois of ſilver			3-15-3½

		lb. oz.	
100*l.* in gold, weighs		1-11¾	Avoirdupois.
100*l.* in ſilver, weighs		26-04	

A pound Avoirdupois is heavier than a pound Troy; but the ounce Avoirdupois is lighter than the ounce Troy; for the ounce Troy weighs 480 grains, but the ounce Avoirdupois, but 438 grains.

APOTHECARIES WEIGHT.

Apothecaries have their weight deduced from Troy; their pound being the ſame, to wit, 12 ounces; but differently divided, as follows, viz.

20 Grains	make	1 Scruple	℈
3 Scruples		1 Dram	ʒ
8 Drams		1 Ounce	℥
12 Ounces		1 Pound	℔

By theſe weights Apothecaries compound their medicines; but they buy and ſell their drugs by Avoirdupois weight.

Examples.

(10)	(12)	(8)	(3)	(20)
lb.	*oz.*	*dr.*	*scr.*	*gr.*
4	10	7	2	19
3	10	6	1	10
2	09	5	0	06
1	08	4	2	04
1	06	3	1	12
1	00	0	0	00
15	10	3	2	11

(10)	(12)	(8)	(3)	(20)
lb.	*oz.*	*dr.*	*scr.*	*gr.*
48	07	1	1	17
12	11	4	2	12
24	06	7	1	07
19	10	5	2	12
34	07	6	0	00
24	04	4	1	15
165	00	6	1	03

In a pound are { 5760 Grains. 288 Scruples. 96 Drams. 12 Ounces,

CLOTH MEASURE.

Note, That { 4 Nails, 4 Quarters, 5 Quarters, 3 Quarters } make { 1 Quarter. 1 Yard. 1 Ell English. 1 Ell Flemish.

qrs.		*N.*		
3	or	12	make	1 Ell Flemish.
4		16		1 Yard.
5		20		1 Ell English.
6		24		1 French aulne or ell.

Examples.

(10)	(4)	(4)	(10)	(5)	(4(	(10	(3)	(4)
Yds.	*qrs.*	*Nls.*	*El. Eng.*	*qrs.*	*Nls.*	*El. Fl.*	*qrs.*	*Nls.*
14	1	3	24	3	3	25	2	3
21	2	2	17	4	1	36	1	2
56	1	0	46	2	2	42	2	3
42	2	3	27	1	0	54	2	1
17	0	1	34	4	3	61	1	2
24	1	2	51	2	2	72	2	3
176	1	3	202	3	3	294	1	2

LIQUID MEASURE,

Is of two ſorts; one for wine, ſpirits, oil, &c. and the other for ale and beer. The Tables of which are as follows:

IN WINE MEASURE.

231 Solid Inches	make	1 Gallon.
42 Gallons		1 Tierce.
63 Gallons or 1 tierce and $\frac{1}{2}$		1 Hogſhead.
2 Hogſheads		1 Pipe or butt
2 Pipes or butts		1 Ton.
84 Gallons		1 Puncheon.

By this meaſure all wines, brandies, ſpirits, ſtrong waters, cider, perry, mead, oil, and honey are ſold.

In a Ton are	2016 Pints.
	1008 Quarts.
	252 Gallons.
	14 Rundlets.
	6 Tierces.
	3 Puncheons.
	4 Hogſheads.
	2 Pipes, or butts.

Note, 18 Gallons is a Rundlet.
31 ½ Gallons is a Wine or Vinegar Barrel.
A Ton weighs 18 C. Avoirdupois.

Note, Oil, and Honey are measured by Wine measure.

Note, That Oil hath but 236 gallons to the ton, except Whale Oil, or Oil from Greenland, which hath 252 to the ton.

IN BEER MEASURE.

282 Solid inches	make	1 Gallon.
9 Gallons		1 Firkin.
2 Firkins		1 Kilderkin.
2 Kilderkins		1 Barrel
1½ Barrel, or 54 Gallons		1 Hogshead.

Note, That in all other places besides London the Firkin of Beer and Ale contains 8½ gallons.

In a Barrel of Beer are	10152 Solid inches.
	288 Pints.
	144 Quarts.
	72 Pottles.
	36 Gallons.
	4 Firkins.
	2 Kilderkins.

Note, That 3 Barrels, or 108 Gallons, make 1 Butt of Beer.

ALE MEASURE.

282 Solid Inches	make	1 Gallon.
8 Gallons		1 Firkin of Ale, Soap, or Herrings.
2 Firkins		1 Kilderkin.
1½ Bar. or 48 Galls.		1 Hogshead.

In a Barrel of Ale are
- 9024 Solid inches.
- 256 Pints.
- 128 Quarts.
- 64 Pottles.
- 32 Gallons.
- 4 Firkins.
- 3 Kilderkins.

The Beer and ale Gallons are the ſame, viz 282 ſolid inches, but with this difference, *i, e,* the barrel, of beer contains 1128 cubic inches more than the Barrel of ale that is 4 gallons.

Exaples of Wine Meaſure.

(10) *Tons,*	(4) *Hhds.*	(63) *Gal.*	(8) *Pints.*	(10) *Tons.*	(4) *Hhds.*	(63) *Gals.*	(8) *Pints.*
71	2	19	4	75	2	24	7
24	1	27	6	44	1	17	2
12	2	56	4	27	1	46	6
42	0	37	7	29	1	19	4
15	3	60	2	24	3	46	4
166	3	12	7	201	2	28	7

DRY MEASURE.

By this are meaſured all ſorts of grain, ſalt, ſea-coal, &c.

Note, That
- 2 Pints
- 2 Quarts
- 2 Pottles
- 2 Gallons
- 4 Pecks
- 8 Buſhels
- 4 Quarters
- 5 Quarters
- 2 Weys

is
- 1 Quart.
- 1 Pottle.
- 1 Gallon.
- 1 Peck.
- 1 Buſhel.
- 1 Quarter, or 2 combes
- 1 Chaldron.
- 1 Wey.
- 1 Laſt.

Note. Four pecks is one buſhel Land Meaſure; and pecks one buſhel Water Meaſure.

Obſerve likewiſe, That when ſalt and ſea-coal are eaſured by the corn-meaſure, they are heaped; or elſe ere are 5 ſtriked pecks to the buſhel; and 36 buſhels a chaldron of coals, there being 21 chaldrons to the ore, in the River of Thames.

A gallon contains 268 $\frac{4}{5}$ cubic inches; and a buſhel corn 2150 $\frac{2}{3}$ cubic inches.

Note, A buſhel ought to be 18 $\frac{1}{2}$ inches wide, and 8 ches deep, as by act of parliament in 1697.

Some make 6 quarters of meal a wey; and 1 wey, 3 arters, a laſt.

Examples of Dry-Meaſure.

(10) *u.*	(8) *Buſh.*	(4) *Pecks.*	(2) *Gal.*
4	6	2	1
7	3	2	0
0	7	1	1
5	5	0	1
1	2	1	1
9	4	2	0
9	5	2	0

(10) *Chal.*	(4) *Qu.*	(8) *Buſh.*	(4) *Pecks.*
174	3	6	3
241	1	7	2
296	2	4	3
171	1	5	0
098	0	5	3
470	3	4	3
1453	2	2	2

LONG MEASURE.

Note.

3 Barley-corns make one Inch.
12 Inches one Foot.
3 Feet one Yard.
3 Feet 9 Inches, one Ell Engliſh.
2 Yards, or 6 Feet, one Fathom.
5 Yards ½, or 16 Feet ½, one Pole.
40 Square Poles, or 220 Yards, one Furlong.
8 Furlongs or 1760 Yards, one Mile.
3 Miles one League.
60 Minutes one Degree, which is equal to abou 69 Engliſh Miles.
360 Degrees, or 24840 Miles, is equal to the cir cumference of the earth and the ſea.

Note, That an Engliſh Mile is 286 feet leſs than a Italian Mile. And that 5 Feet is a geometrical Pace.

In a mile are

190080 Barley-corns.
63360 Inches.
5280 Feet.
1760 Yards,
320 Poles.
8 Furlongs.
80 Chains.
1056 Paces.
1408 Ells.
8000 Links of the Chain.

Examples in Long Measure.

(10) Miles	(8) Furl.	(40) Poles.
24	6	22
37	5	26
15	4	34
74	3	39
41	7	24
194	4	25

(10) Miles.	(8) Furl.	(40) Poles.
37	4	21
20	3	17
42	5	19
31	6	27
52	4	19
185	0	23

From the preceeding Table of Long Measure, is deduced this of Land Measure, viz.

40 poles, or perches, in length, and 4 in breadth, make an acre, or 160 square perches. Or 4840 square yards make an acre; or 43560 square feet.

A hide of land is 100 acres; 40 square poles make a rood, and 4 roods an acre.

Note, The pole, or perch, of 16 feet ½ is statute measure; but there are some customary measures which are more; as for fens and wood-lands, there are reckoned 18 feet to the pole; and for forests 21 feet to the pole.

Examples.

(10) Acres.	(4) Roods.	(40) Poles.
14	2	24
26	3	29
17	1	19
26	2	20
36	2	36
24	1	12
146	2	20

(10) Acres.	(4) Roods.	(40) Poles.
74	2	27
61	1	20
20	2	36
14	3	11
37	1	10
27	2	34
236	2	18

TIME

Is measured by years, months, days, hours, and r
nutes; as in the Table following.

Mark'd			*In a Year are*
60″ Seconds	make	1 Minute.	31557600 Sec
60′ Minutes		1 Hour.	525960 Mi
24 Hours		1 Day natural.	8766 Hou
7 Days		1 Week.	365 Da
4 Weeks		1 Month.	52 Wee
13 Months		1 Solar Year.	1 day
			6 hou

A *Century* is 100 years; an *Indiction* among the R
mans, a revolution of 15 years.

Of the MOTION *of the Heavenly Bodies.*

60″ Seconds	make	1 Minute.
60′ Minutes		1 Degree.
30 Degrees		1 Sign.
12 Signs, or 360 Degrees		1 Revolution of t whole Sphere, 360 Degrees.

DOZENS.

There are several commodities sold by the dozen,
Table of which follows, viz.

In a great Gross are	1728 Pieces, or Things.
	144 Dozens.
	12 Small Gross.

SQUARE MEASURE.

6 Quarter of an Inch	is	1 Inch
4 Inches		1 Foot
9 Feet		1 Yard
0 Yards $\frac{1}{4}$, 272 $\frac{1}{4}$ ſquare Feet		1 Pole.
0 Poles long, and 1 broad		1 Rood.
4 Roods		1 Acre.
0 Acres		1 Mile.

In a ſquare acre are 4 ſquare roods, 160 ſquare poles, c. and in a ſquare pole, 30 ſquare yards $\frac{1}{4}$.

a ſquare Mile are	4014489600	Inches.
	27878400	Feet.
	3097600	Yards.
	102400	Poles.
	2560	Roods.
	640	Acres,

Some other things neceſſary to be known, and of Uſe in Arithmetic.

OF FISH.

0 of Ling, Cod, or Haberdine, to the Hundred, viz.

120	accounted	A Hundred.
1200		A Thouſand, or a Barrel.
2000		A Laſt, or 12 Barrels.

PAPER AND PARCHMENT.

1 Bale is 10 Ream; 1 Ream, 20 Quires; 1 Quire, 2 Sects.—1 Roll of Parchment, 5 Dozen; 1 Dozen, 1 Skins.

OF WOOD.

A cord of wood is 4 feet over, 4 feet deep, and 8 fee long, being 128 cubic feet. A ſtack of wood is 3 fee over, 3 feet deep, and 12 feet long, being 108 cubi feet.

Block wood, being great logs, are ſold by the cord and ſmall by the ſtack. A cubic foot is 1728 cubic inches A cubic yard, 27 cubic feet, or 46656 inches, 4 inche is a hand in meaſuring a horſe. 2 feet is 1 pace 4 poles, or 100 links 1 chain. 125 geometrical pace one ſtade, 8 ſtades an Italian mile. 4000 geometrica paces a ſmall German mile, and 5000 a great. 16 perches in length, and one in breadth; or 80 in length and 2 in breadth; or 40 in length and 4 in breath, mak an acre of land. 10 feet every way is a ſquare; tha is 100 ſquare feet. A faggot of ſteel, 120 *lb.* A bur den of gad-ſteel, 9 ſcore, or 180 *lb.* A ſack of coals 3 buſhels: Scots coals 112 *lb.* to the *C.* A load o timber 50 feet, a ton 40. A load of hay 36 truſſes and 56 *lb.* the truſs; or four ſtone, at 14 *lb.* the ſtone; bu new hay ought to be 60 *lb.* the truſs. 500 of bricks load; and a thouſand pan-tiles the ſame. 25 buſhels o lime, 1 *C.* A brick ought to be 9 inches long, 4½ broad and 2 ½ thick. A ton of train oil, 252 gallons: a ton of ſweet oil, 236 gallons. Raw-ſilk (except China) i 24 ounces to the Pound. A ton of lead, called a fod der. 19 ½ *C.* A gallon of wheaten meal weighs 7 *lb* Avordupois. A dicker of hides, or ſkins, are 10; an 20 dicker a laſt. A ſtone of glaſs is 5 *lb.* a ſeam of glaſ is 24 ſtone. 40 ſkins, make a timber of ſables, martens minks, jenites, fitches and greys. 120 to the hundred o conies, kid, lamb, budge and cat-ſkins; 50 to a kip o goat ſkins; and 13 tanned calf ſkins to a dozen.

CHAP. III.

SUBTRACTION.

SUBTRACTION is the taking of a leſſer number or) ſum out of a greater, thereby to find the remainder difference between the ſaid two numbers; As if you ke thirteen from nineteen, the remainder or difference 6.

Subtraction is of one denomination, or of divers:

Of one, when the two numbers are both of one kind; at is, both yards, gallons, pounds, &c.

Of divers, when the two ſums conſiſt of pounds, ſhil-gs, and pence; or tons, hundreds, quarters, and unds, &c.

Subtraction is juſt the reverſe of Addition; for *that* ts numbers together, and this takes numbers from each her.

In ſetting down numbers for work, you muſt always ace the greater number, or ſum, uppermoſt; and in ch order, that units may ſtand under units, tens under ns, hundreds under hundreds, &c. as before in Addi-on.

A General Rule.

Whatever you ſtop at in Addition, the ſame you muſt rrow in Subtraction, when need requires, remembering vays to pay it to the next figure towards the left hand.

Example 1.

Suppoſe I would know the difference between 453 rds bought, and 232 yards ſold

I ſet them down as follows, and as before recited, viz.

	Yards.	
Bought,	453	*Greater number.*
Sold,	232	*The Lesser.*
Difference,	221	*Remains unsold.*
	453	*Proof.*

After I have drawn a line under the sum, I begin at the first figure towards the right hand (as in *Addition*) and say, 2 from 3 (the figure just over it) and there remains 1, setting it in its proper place under the line; and then go to the next figure, saying, 3 from 5, and there remains 2, which I also put under the line; and then to the last figure, saying, 2 from 4, and there remains 2, and the work is done; and I find the remainder of yards unsold to be 221; or that 453 is 221 more than 232. To prove the truth of which, I add the remainder, or difference, to the lesser number; and if they two, put together, make the greater, or upper number, the sum is right, otherwise not: wherefore I say, 1 and 2 is 3; and 2 and 3 is 5; and 2 and 2 is 4; which are the same figures with the upper or greater number: wherefore I know the work is right, as may be seen in the Example; and by this way are all sums of one denomination proved in this Rule.

Example 2.

Let it be required to find the difference between 756 gallons received, and 444 gallons delivered. To do which, I set the numbers, the one under the other, as before directed, and they stand thus:

Gallons.	
756	*Greater.*
444	*Lesser.*
312	Remainder.
756	Proof.

Then having drawn a line under them, I begin and ay, 4 from 6, and there rests 2; and 4 from 5, and here remains one; and 4 from 7, and there remains 3; o the work being done, I find the difference to be 312; r so many gallons remaining. And it is proved by Addition, as before; as may be seen by the work bove.

When any one of the under figures is greater than the gure over it, then you must borrow 10 (as you carried o in Addition) and put it to the figure from whence ou are to subtract, and then take it from their sum, paying 1 for the said 10 borrowed, to the next figure towards the left hand in the lower line.

Example 3.

I would subtract 496 pounds paid, from 654 pounds ent, viz.

	l.	
Lent,	654	*Greater.*
Paid,	496	*Lesser.*
	158	Rests due.
	654	Proof.

Having set down the numbers, as before directed, ith a line under them, *I* say, 6 from 4 *I* cannot, but putting 10 to the said 4, it is made 14), 6 from 14, and here remains 8, which *I* set down under the line: then say 1 that *I* borrowed, and 9 (the next figure) is 10, om 5 *I* cannot, but 10 from 15 (adding 10 to the 5) nd there rests 5, which *I* also set down; then 1, that *I* orrowed, and 4 is 5, from 6, and there remains 1. The sum being thus finished, I find that there remains ue, or unpaid, 158l. which is proved by Addition, as efore.

Example 4.

Suppose there is advanced on a Subsidy,

	l.	
	636420	
Paid off,	47294	How much remains?
Remainder,	589126	
Proof,	636420	

Here I say, 4 from 0 I cannot, but 4 from 10, and there remains 6; 1 that I borrowed, and 9 is 10, from 2 I cannot, but 10 from 12, and there rests 2; then 1 that I borrowed, and 2 is 3, from 4, and there remains 1; here I borrow none, so must not pay any thing to the next figure) then 7 from 6 I cannot, but 7 from 16, and there remains 9; 1 that I borrowed, and 4 is 5, from 3 *I* cannot, but 5 from 13, and there remains 8; and now, because there is no figure standing under the 6, to carry the one borrowed to, *I* suppose a (0) to be placed there, and say, 1 that *I* borrowed, and 0 is 1, from 6, and there remains 5: and so the work is done and the remainder is 589126, as in the Example.

More Examples for Practice.

	l.		*Ells.*
Borrowed,	14075	Bought,	74000
Paid,	08424	Sold,	29460
Rests due,	5651	Rests unsold	44540
Proof,	14075	Proof,	74000

	Sheep.		*l.*
Received,	492	Advanced,	47692
Delivered,	397	Paid off,	29767
Remains,	95	Remains,	17925
Proof,	492	Proof,	47692

Some Questions proper to this Rule, shewing its nature and use.

Quest. 1. What is the difference between a piece of timber, containing 56 feet, and another piece of 29 feet?

	Feet.
	56
	29
Ans.	27

Quest. 2. A man borrowed 96*l.* and paid 38*l.* What remains?

	l.
	96
	38
Ans.	38

Quest. 3. If a person hath 150 miles to travel, and hath gone 99 miles, how many miles hath he yet to go?

	Miles.
	150
	99
Ans.	51

From 100 pounds borrowed, take 72 paid;
'Twas a virgin that lent it, what's due to the maid?
Ans. 28*l.*

Queſt. 4. If a perſon be 48 years of age this preſent year, what year was he born in?

	Years.
	1795
	48
Anſ.	1747

Queſt. 5. How many years ſince the Spaniſh invaſion, it being in the year 1588?

	Y.
Greater Number,	1795
Leſſer Number,	1588
Anſ.	207

From 90 take 30, from 40 take 10; Subtract 6 from 60, and what remains then?

Anſ. 144.

Queſt. 6. What number muſt be put to 297*l.* to make it 730*l.*?

	l.
	730
	297
Anſ.	433
Proof,	730

In fifteen hundred ninety-two there died a noble prince; How many years is it ago, that is, how many ſince;

	1795
	1592
Anſ.	203

Queſt. 7. What 5 numbers, and all different, will make 65?

To do this set down four different numbers at random, bserving that they do not amount to the number propo-ed; and add them together, and subtract that total from he number proposed, and the remainder will be the 5th umber, to make the other numbers 65, as in the follow-ng Example.

65	The number proposed.
12	The four numbers set down at random
13	
9	
16	
50	Total
15	The 5th number.

And so of any other numbers proposed to be made up y different numbers, let them be 5, 6, 7, &c. remem-ering always, that the random numbers be less than the umbers proposed to make up the number assigned.

OF MONEY.

When the sums to be subtracted, are of divers deno-inations, whether they be money, weight, or measure, he same method must be observed in setting them down s in Addition; that is, the several names must be set just nder one another: as pounds under pounds, shillings un-er shillings, and pence under pence, &c. with *points* or *rokes of separation* between them; always observing, that he great sum must be uppermost, as before, in sums of he denomination. Then proceed to take the under um out of the uppermost, beginning at the least denomi-ation towards the right hand, as in Addition; and the me respect must be had, when there is occasion to bor-ow, as before in Addition, observing how many of the sser denomination makes one of the next greater, and orrow accordingly; remembering always to pay what ou borrow to the next denomination.

Examples.

I would ſubtract 247*l.* 11*s.* 9*d.* $\frac{1}{2}$ diſburſements, from 372*l.* 11*s.* 6*d.* $\frac{1}{4}$ received. To do which, *I* ſet them down as before directed; and then they ſtand thus:

	l.	*s.*	*d.*	
Received,	372	11	6 $\frac{1}{4}$	*Greater*
Diſburſed,	247	11	9 $\frac{1}{2}$	*Leſſer*
Remains	124	19	8 $\frac{3}{4}$	
Proof,	372	11	6 $\frac{1}{4}$	

I begin at the leaſt denomination towards the right hand, viz. farthings: ſaying, 2 from 1 *I* cannot, wherefore *I* borrow 1 from the next name, which is pence, one of which is 4 farthings, but 2 from 4 and there remains 2 (which remainder always add to the upper number or figure you ſubtract from, for the more eaſy reckoning) and the 1 farthing over it makes $\frac{3}{4}$, which *I* place under the line, and go to the next denomination of pence, ſaying 1 that *I* borrowed, and 9 is 10, from 6 pence 1 cannot, but *I* borrow 1 of the next, which is ſhillings, one of which is 12 pence; but 10 pence from 12 pence and there remains 2, which *I* put to the figure 6 *I* ſubtract from and it makes 8, which *I* alſo put under the line, in its proper place, and then *I* go to the next denomination which is ſhillings, ſaying, 1 that *I* borrowed, and 11 is 12, from 11 ſhillings *I* cannot, wherefore *I* borrow one of the next, which is pounds (one of which is 20 ſhillings) but 12 from 20, and there remains 8, and the 11 ſhillings over it, which *I* ſubtract from, is 19, which place under the line, in its place, then going to the pounds *I* ſay, 1 that *I* borrowed, and 7 is 8, 8 from 2 *I* cannot (here *I* borrow 10, as in ſums of one denomination) but 8 from 12, and there remains 4; then, 1 that *I* borrowed, and 4 is 5, 5 from 7, and there remains 2; and laſtly, 2 from 3, and there remains 1; and ſo the ſum is finiſhed, and the remainder, or difference, is 124*l.* 19*s.* 8*d.* $\frac{3}{4}$, as by the Example may be ſeen.

Example 2.

A collector of the Excise, has received 2479*l.* 12*s.* 6*d.* $\frac{3}{4}$, and paid into the office, by several remittances, 1977*l.* 11*s.* 2*d.* How much remains in his hands?

	l.	*s.*	*d.*
Received,	2479	12	6 $\frac{3}{4}$
Paid,	1977	11	2
Remains	502	01	4 $\frac{3}{4}$.
Proof,	2479	12	6 $\frac{3}{4}$

Here I begin and say nothing from $\frac{3}{4}$, and there remains $\frac{3}{4}$; then 2 from 6, and there remains 4: and 11 from 12, and there remains 1; and then I go to the pounds, saying, 7 from 9, and there remains 2; and 7 from 7, and there remains 0; and 9 from 4 I cannot, but 9 from 14, and there remains 5; and 1 that I borrowed, and 1 is 2, from 2, and there remains 0; and so the sum is done; and he hath remaining in his hands, 502*l.* 01. 4*d.* $\frac{3}{4}$, as by the said work.

More Examples for Practice.

	(20)	(12)		(20)	(12)		(10)	(20)	(12)
	l.	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*
From	7	10	1	5	00	0	77	00	7
Take	4	07	9	3	11	5	57	04	6
Rem.	3	02	4	1	08	7	19	16	1
Proof	7	10	1	5	00	0	77	00	7

		(20)	(12)	(4)		(10)	(20)	(12)	(4)		(20)	(12)
	l.	*s.*	*d.*			*l.*	*s*	*d.*		*l.*	*s.*	*d.*
Dr.	7	11	1 $\frac{1}{2}$			476	10	9 $\frac{1}{4}$		7	00	0
Cr.	4	17	3 $\frac{1}{4}$			277	17	7 $\frac{1}{4}$		4	10	4 $\frac{1}{4}$
Bal.	2	13	10 $\frac{1}{4}$			198	13	2		2	09	7 $\frac{3}{4}$
Pr.	7	11	1 $\frac{1}{2}$			476	10	9 $\frac{1}{4}$		7	00	0

	[10]	[20]	[12]	[4]	[10]	[20]	[12]	[4]
	l.	*s.*	*d.*	*q.*	*l.*	*s.*	*d.*	*q.*
Borrowed,	419	02	10	$\frac{1}{4}$	7174	11	1	
Paid,	197	03	10	$\frac{1}{2}$	2176	15	9	$\frac{1}{4}$
Rem. due	221	18	11	$\frac{3}{4}$	4997	15	3	$\frac{3}{4}$
Proof,	419	02	10	$\frac{1}{4}$	7174	11	1	

When a sum is borrowed, or a debt paid, at several times, then you must add the several sums of payment into one total, and subtract that total from the first lent, or otherwise due.

Examples.

Suppose A. lends B. 70*l.* and B. hath paid A. at several times, viz.

	l.	*s.*	*d.*
Lent, - -	70	00	0
Paid at one time, - -	24	10	0
Another time, - -	7	11	6
Another, - -	20	00	0
Another, - - -	4	10	6
Another, - -	1	01	6
Paid in all,	57	13	6
Remains due,	12	06	6
Proof.	70	00	0

To prove this, add the sum paid in all, and the sum resting due, together; and if they make the sum first lent, the work is right.

	l.	*s.*	*d.*	*l.*	*s.*	*d.*		*l.*	*s.*	*d.*
Lent	7	10	0	560	10	9 $\frac{1}{4}$		1	01	6
Paid at several times.	1	10	6	146	10	5		0	07	6
	0	11	9	17	15	0		0	01	6
	0	07	6	97	7	6		0	02	6
	2	10	6	76	00	0		0	01	6
	0	07	9	100	17	4		0	02	0
	1	10	0	100	01	7		0	01	0
Pd. in all,	6	18	0	528	11	10		0	16	0
Rem.	0	12	0	21	18	11 $\frac{1}{4}$		0	05	6
Proof.	7	10	0	560	10	9 $\frac{1}{4}$		1	01	6

A familiar Example.

	l.	*s.*	*d.*
Received of Mr East, - - -	59	06	0
Paid to Mr. West, - - -	20	00	0
Paid to Mr. North, - - -	14	13	6
Paid to Mr South, - - -	15	12	0
Paid in all,	50	05	6
Remains in the bag,	09	00	6

What eight sums of pounds, shillings, and pence, and all different, will amount to just 50*l*?

To do this, you must observe the directions given in page 47. Example 7. for sums of one denomination; and see the following work.

	From *l.*	50	00	0 the sum assigned;
The seven sums set down at random.	4	17	6	
	5	01	6	
	1	01	6	
	7	11	4	
	6	04	2	
	9	03	9	
	1	13	5	
Subtract,	35	13	2	
Remainder,	14	06	10	the eight sum.

AVOIRDUPOIS-WEIGHT.

Here you are only to observe the title of your account, and borrow accordingly, when there is occasion.

Example 1.

An Ironmonger buys 74 Tons, 13 C. 2 qrs. 14 lb. of Bilboa Iron, and hath ſold out of the ſaid parcel, 56 Tons, 11 C. 1 qr. 20 lb. how much remains unſold?

I ſet down the ſum as before directed, that each denomination may ſtand under that of the ſame kind, and draw a line under them, as may be ſeen in the margin.

I begin at the right hand, and ſay, 20 from 14 I cannot, but 20 from 28, (ſo many lb. making a qr. of a hundred, an integer of the next name) and there remains 8; which add to the 14, and they make 22, which I place under the line: and go to the quarters and ſay, 1 that I borrowed, and 1 is 2, from 2, and there remains 0; which I alſo ſet down; then 11 from 13 C, and there reſts 2, which I likewiſe put down, and go to the tons, ſaying, 6 from 4 I cannot, but 6 from 14, and there remains 8; then 1 that I borrowed, and 5 is 6, from 7, and there reſts 1: And ſo the work is done, and I find there remains unſold 18 tons, 2 C. 0 qrs. 22 lb.

	(10)	(2)	(4)	(28)
	Tons.	*C.*	*qrs.*	*lb.*
	74	03	2	14
	56	11	1	20
	18	02	0	22
Pr.	74	13	2	14

Example 2.

A Grocer buys 96 C. 2 qrs. 20 lb. of raiſins, and ſells out again 49 C. 3 qrs 24 lb. what quantity remains in his hands?

	C.	*qrs.*	*lb.*	
Bought,	96	2	20	*Greater number.*
Sold,	49	3	24	*Leſſer number.*
Remains in his hands,	46	2	24	
Proof,	96	2	20	

Here I ſay, 24 from 20 I cannot, but 24 from 28, and there remains 4; and the 20 over it makes 24, which I ſet down; then 1 that I borrow, and 3 is 4, from 2 I cannot, but 4 from 4, and there reſts 0; but 2 that ſtands over it, is 2, which I ſet down: then 1 that I borrowed, and 6 is 7, from 6 I cannot, but 7 from 16, and there reſts 9, and 1 that I borrowed, and 4 is 5, from 9, and there remains 4. So there remains in his hands, 46 C. 2 qrs. 24 lb. which is proved by addition, by adding the *remainder* and *leſſer* ſum together, and they make the *greater*; and therefore the work is right.

Examples for Practice.

	(10) *Tons.*	(20) *C.*	[4] *qrs.*	(28) *lb.*	(10) *C.*	(4) *qrs.*	(28) *lb.*
Received,	700	11	1	17	756	3	24
Deduct,	421	04	2	20	327	1	25
Remaind.	279	06	2	25	429	1	27
Proof,	700	11	1	17	756	3	24

C.	*qrs.*	*lb.*	*C.*	*qrs.*	*lb.*	*C.*	*qrs.*	*lb.*
4	0	12	24	1	12	9	0	00
3	1	07	19	2	24	5	3	15
3	0	05	04	2	16	3	0	13
4	0	12	24	1	12	9	0	00

Admit I have on board of a ſhip from Jamaica, 94 Tons, 13 C. 0 qrs. 00 lb. of Logwood, and have received by ſeveral lighters, as follows, viz.

	(10) Tons.	(20) C.	(4) qrs.	(28) lb.
On board,	94	13	0	00
By one Lighter,	12	11	3	09
Another,	19	14	0	21
Another,	17	12	2	24
Another,	15	14	3	06
Received,	65	13	2	04
Remains on board,	28	19	1	24

	(10) C.	(4) qrs.	(28) lb.		(10) C.	(4) qrs.	(28) lb.
	49	3	22	Currants,	70	2	20
Sold at several times.	4	1	24		10	1	14
	9	2	17		7	2	14
	4	1	25		1	1	20
	7	3	20		12	1	19
	8	1	27		9	3	12
	9	2	20		10	0	00
Sold in all,	44	2	21		51	2	23
Re. unfold,	5	1	01		18	3	25
Proof,	49	3	22		70	2	20

AVOIRDUPOIS SMALL-WEIGHT.

	(10) lb.	(16) oz.	(16) dr.	[10] lb.	[16] oz.	[16] dr.
Delivered,	4	10	14	46	13	10
Received,	2	09	09	27	15	14
Remains,	2	01	05	18	13	12
Proof,	4	10	14	46	13	10

	(10) lb.	(16) oz.	(16) dr.		(10) lb.	(16) oz.	(16) dr.
Delivered,	55	00	00		79	15	14
Received,	37	10	14		49	15	15
Rests due,	7	05	02		29	15	15
Proof,	55	00	00		79	15	14

TROY-WEIGHT.

	(10) lb.	(12) oz.	(20) dwt.	(24) gr.		(10) oz.	(20) dwt.	(24) gr.
Received,	24	09	14	12		756	12	15
Melted,	19	07	15	20		478	11	22
Remains,	05	01	18	16		278	00	17
Proof,	24	09	14	12		756	12	15

	(10) lb.	(12) oz.	(20) dwt.	(24) gr.		(10) oz.	(20) dwt.	(24) gr.
Received,	370	07	12	20		7420	15	20
Delivered,	174	11	09	22		5789	18	15
Remains,	195	08	02	22		1630	17	05
Proof,	370	07	12	20		7420	15	20

CLOTH MEASURE.

	(10) Yds.	(4) qrs.	(4) N.		Ells.	(10) En.	(5) qrs.	(4) N.
Bought	54	2	2			420	3	2
Sold,	27	2	3			247	4	3
Remains,	26	3	3			172	3	3
Proof,	54	2	2			420	3	2

I might give Examples in Subtraction of all the other Rules mentioned before in Addition, viz. of Apothecaries Weight, Dry and Liquid Measure, &c. but all of them being worked in the same manner with those before it is unnecessary.

CHAP. IV.

MULTIPLICATION.

I. IN this Rule there are always two numbers given to find out a third which will contain either of the given numbers, as often as the other containeth units.

II. This Rule alſo excellently and moſt conciſely performeth the work of Addition, either in ſimple or compound numbers; as ſhall be illuſtrated and proved by ſundry examples, explications, and improvements, not hitherto treated of.

III. It likewiſe ſerveth to bring great denominations into leſs, of the ſame value; as pounds into farthings, and tons weight into pounds, &c.

IV. Multiplication hath three parts, or things, particularly to be noted, and known, viz.

1ſt, The *Multiplicand*, or number to be multiplied, and is generally the greateſt of two numbers given.

2dly, The *Multiplier*, or number by which you multiply; and is generally the leaſt of the two numbers given.

3dly, The *Product*, or reſult of the multiplication which is the anſwer.

V. Before any procedure can be made, the following Table muſt be got perfectly by heart.

MULTIPLICATION TABLE.

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

The foregoing Table is ſo plain and eaſy that it nee no explanation: and therefore I ſhall proceed immediat to the rule of working.

VI. When any number is given to be multiplied another, ſet the biggeſt uppermoſt, which is the *Mu plicand*, and under that your *Multiplier*, in the ſame ord as in Addition and Subtraction, viz. Units under unit Tens under tens, &c. Then draw a line, and procee beginning at the right hand, and multiply every partic lar figure of the *multiplicand* by the *multiplier*.

Example 1.

How much is 3 times 472 ? *Multiplicand.*
3 *Multiplier.*

Anſ. 1416 *Product.*

Here I ſay, 3 times 2 is 6, which I put under th line, as in the Example; then 3 times 7 is 21, I ſe down 1, and carry 2, for the 2 tens, to the next: (a in Addition of one denomination) then 3 times 4 is 12 and 2 that I carry is 14; ſo, becauſe it is the laſt figure I ſet down the 14, and the work is done; ſo I find tha 3 times 472 is 1416, the product, or reſult of 472 mul tiplied by 3.

If the ſaid 472 be three times ſet down, one unde the other, and added together, the total will be the ſame with the product above, which ſhews, that Multiplication briefly performs the work of Addition, (as was ſaid before) which is ſhewn in the margin.

```
  4 7 2
  4 7 2
  4 7 2
-------
1 4 1 6
```

Example 2.

How many makes 742 *Multiplicand.*
Multiplied by 4 ? *Multiplier.*

2968 *Product.*

Here I ſay, 4 times 2 is 8, which I ſet down under line; then 4 times 4 is 16; I ſet down 6, and carry or the ten to the next figure: then 4 times 7 is 28, 1 that I carry is 29; and it being the laſt, I ſet it wn, ſo the work is done, and I find the product, or anr, to be 2968, as above.

To prove the work, multiply the multiplier by the ltiplicand, and if the product is the ſame figures as be-, it is right. This is the quickeſt and beſt way of ving Multiplication, till Diviſion be known. I do move the ſum to any other place, but let it ſtand as ore multiplied, and begin with the firſt figure of the ltiplicand, towards the right hand, to multiply the ltiplier, ſaying twice 4 is 8, which I find to be right. en to the next figure, which is 4, and multiply the ltiplier by that, ſaying, 4 times 4 is 16, which is 6, carry 1, which I alſo find right. Then to the next laſt figure in the multiplicand, which is 7, and mul-y the multiplier 4 by that alſo, ſaying, 7 times 4 is and 1 that I carried, is 29, which I likewiſe find ht: and ſo the work is proved, and known to be tru-vrought.

Example 3.

What is the product of 90704 *Multiplicand.*
Multiplied by 8 ? *Multiplier.*

725632 *Product.*

Here I begin, ſaying 8 times 4 is 32, I ſet down 2, carry 3; then 8 times 6 is 0, but 3 that I carry is then 8 times 7 is 56, I ſet down 6 and carry 5; then imes 0 is 0, but 5 that I carry is 5. Laſtly, 8 times 72, which I ſet down, and the work is done, as by Example above. And this is proved as before, by ltiplying the multiplier by the multiplicand, ſaying, imes 8 is 32, &c.

This way of proof is alſo a perfecting any one in the ltiplication Table; becauſe the digits, or nine figures, multiplied forwards and backwards: ſo that they y as readily anſwer, that 9 times 8 is 72 (not found he Table but reverſely) as that 8 times 9 is the ſame.

More Examples for Practice.

Multiply	7460	*Multiplicand.*
By	7	*Multiplier.*
	52220	*Product*, or *Answ.*

How many are 9 times 365 ?
Or, how many days in 9 Years ?

3285

Multiplicand,	432107	596432
Multiplier,	5	6
Product,	2160535	3578592
709543	675908	7654309
7	8	9
4966801	5407264	68888781

VII. When the multiplier consists of more figures tha one, then there must be as many several products a there are figures in the multiplier, and placed under th line and added together, and the total is the whole pro duct required. But observe always to place the fir figure of each product just under the figure you multipl by, and so you move one place towards the left hand fo every product, be as many as there will.

Example 1.

How much is 24 times	365 ?	*Multiplicand.*
Or, how many hours in a year?	24	*Multiplier.*
	1460	*Product by* 4.
	730	*Product by* 2.
	8760	

The numbers being placed in order, as above, and ac-
rding to the 6th Rule of this Chapter, after having
awn a line under them, I begin with the first figure
the multiplier, viz. 4, saying, 4 times 5 is 20, set
own 0, and carry 2; then 4 times 6 is 24, and 2 I
rry is 26, that is 6, and carry 2; then 4 times 3, is
1, and 2 is 14; and so I have done with the figure 4.
hen I go to the second figure in the multiplier, viz. 2.
d I multiply the multiplicand 365 by that also; saying,
ice 5 is 10, I set down 0, and carry 1, which 0 I set
own just under the figure 2 that I multiply by, and go
place farther to the left hand, as was said before: Then
go on, saying, twice 6 is 12, and 1 that I carry is 13,
t is 3 and carry 1, and twice 3 is 6, and 1 is 7, and
I have done with this figure of the multiplier also:
d then I draw a line under these two products, and add
m together, and they make 8760 for answer. And
the work is done, as may be seen in the Example a-
e, and may be proved as before.

Example 2.

Let it be required to multiply 527537
By 285

2637685
4220206
1055074

150348045

A line being drawn under the two numbers, I
el, saying, 5 times 7 is 35, &c. going through all
h figures of the multiplicand by 5, and find its pro-
t to be 2637685, then I go to the next figure in
h multiplier, viz. 8, and multiply all the figures in
h multiplicand by that also; and find the product
20296; then I multiply the multiplicand by the
figure, viz. 2, and the product by that is 1055074;

Then drawing a line under theſe three products, I ad them together, and find their total to be 150348045 for the true product ſought; that is, I find that 28 times 527537 amounts to 150348045; as by the wor above may be ſeen.

VIII. Whenever the multiplier is ſuch a numbe that any two numbers of the Multiplication Table, be ing multiplied together, make the ſaid multiplier; as i the foregoing page, where the multiplier is 24, and i made by multiplying 6 and 4 together. Then if yo multiply the multiplicand by either of theſe number that is either 6 or 4, and then multiply that product b the other number, the laſt product ſhall be the anſwe and the ſame with the other way

```
 365 multiplied.
   4
 ----
 1460
    6
 -----
 8760 Product agreeable to the firſt Ex
      ample; and ſo of any other.
```

There are ſometimes figures ſaved by this method, an there is no addition of products.

More Examples.

```
 4765        6796        476
   14          17         19
 -----       -----       ----
 19060       47572       4284
 4765        6796        476
 -----       -----       ----
 66710      115532       9044
```

```
 56071592          275827
      123           19725
 ---------         -------
 168214776         1379135
 112143184          551654
 56071592          1930789
 ---------         2481443
 6896805816        275827
 ---------         -------
                   5440687575
```

How to porove Multiplication by the CROSS.

The common way ufed in fchools is this : they make crofs thus X, then add all the figures in the multiplicand together, as in Addition, and caft away the nines oft as they arife, and bear the remainder to the next ure : when they come to the end of the line, they note hat remains after the nines are caft away, and fet fuch remainder on the left fide of the crofs; then they do the ne by the multiplier, and note what remains there alfo, ting that on the right of the crofs; then they multiply em two figures together, and caft the nines out of the oduct, fetting the remainder on the top of the crofs : lly they caft away the nines out of the product, and if e remainder be like the figure on the top of the crofs, y fet it down at the bottom, and conclude the work ght.

But this way of proof is not infallible, as I have experienced many times ; but this may be faid for it, that a fum be done right it will never appear to be wrong this way ; but it many times makes a fum appear ght when it is utterly falfe, and therefore not to be deended on as a certain proof. I'll give one Example to ake the foregoing directions the more intelligible which ll be one of the preceding fums fet down again here, . the fecond foregoing.

```
 3          56071592  Multiplicand.
X 6            123    Multiplier.
 ---------------------
 3        6896805816  Product.
```

Here, after having made the crofs, thus X, *I* begin at the multiplicand, its no matter at which end; But *I*'ll begin towards the left hand, faying, 5 and 6 is 11, *I* caft away 9, and there refts 2, and 2 and 7 is 9. and there refts nothing; then 1 and 5 is 6 (*I* mifs the 9) and 2 is 8, which *I* fet on the left hand of the crofs, as appears in the margin. Then going to the multiplier, *I* fay 1 and 2 is 3, and 3 is 6, which *I* place on the right. Then multiply one by the other, faying, 8 times 6 is 48, *I* caft away 5 nines out of it, and there remains 3, which I put on the top, as you fee in the margin: after the fame manner *I* caft away the nines out of the product, and at the laft there remains 3 likewife, and fo the work is done.

8 X

8 X 6

3
8 X 6
3

Note. That the figures on each fide of the crofs, being multiplied, make 48, and if you add them two figures together as they ftand, and caft away the nines, the remainder will be the fame; that inftead of faying, how many nines in 48, you fay, 8 and 4 is 12, the nines in 12 once, and there remains 3, as before.

IX. The greateft difficulty in Multiplication is when there is a cipher, or ciphers, intermixed with the figures. In fuch cafes, only remember what was faid before in the 7th Rule to move for every figure or cipher one place towards the left hand, and to take care that each firft figure of the feveral products ftand directly under its refpective multiplier. An Example will make it eafy to be underftood.

Let it be required to multiply 50710984 by 4050607. Having fet the numbers down as before directed, with a line under them, they ftand thus?

```
   50710984  Multiplicand.
    4050607  Multiplier.
  ----------
  354976888
 3042659040
2535549200
2028439360
-----------
205410266767288.
```

Here I begin, ſaying, 7 times 4 is 28, &c. and ſo go through the multiplicand by 7, and find its product 54976888; then I come to a cipher, which I ſet down under the ſecond figure of the above-mentioned product, viz. 8, then I multiply the multiplicand by the next figure of the multiplier (viz. 6, in the ſame line) ſaying, 6 times 4 is 24: I ſet down 4 next to the cipher, in the ſame line, and it ſtands under the third figure in the laſt product, juſt under its multiplier 6, and find this product, or line, to be 3042659040. Then coming to another cipher, I ſet it down juſt under its own place, and go forward with the next figure 5 in the ſame line, as before, ſaying, 5 times 4 is 20, &c. I ſet down the 0, juſt under 5 the multiplier, and find this product to be 2535549200. Then I come to another cipher, and proceed as before, and find this laſt line, or product, 2028439360. All which products being added together, make 2054102667672 88, for anſwer. See the foregoing work.

More Examples.

7864371	327586
20604	6030
31457484	9827580
471862260	19655160
157287420	1975343580
162037500084	

X. When there is a cipher, or ciphers, in the multiplier towards the right hand, then ſet it, or them, backward from the place of units, towards the right hand and multiply by the ſignificant figure, or figures, as uſual; and afterwards annex the cipher, or ciphers, to the general product on the right hand, as in the following Examples.

Examples.

326	4762	4796
20	70	400
6520	333340	1918400

746094	729764
3600	476000
4476564	4378584
2238282	5108348
	2919056
2685938400	347367664000

XI. When there are ciphers both in the multiplicand and multiplier, then omit the ciphers in both, till you have multiplied by the significant figures: and then join the ciphers in each to the product; as in these

Examples.

42600	423000	376400
220	5600	2400
852	2538	15056
852	2115	7528
9372000	2368800000	903360000

CONTRACTIONS.

Or, how to multiply by 10, 100, 1000, 10000, &c.

To multiply by	10, 100, 1000, 10000, 100000	Add to the multiplicand	0, 00, 000, 0000, 00000

Examples.

428 multiplied by	10	makes	4280
	100		42800
	1000		428000
	10000		4280000
	100000		42800000

If you would be expeditious and dextrous in accompts, always so multiply by 11 and 12, that the product may be in one line only.

Examples.

Multiply	456	7890	3425
	11	11	11
Product	5016	86790	37675

In the first of these, I say, 11 times 6 is 66, 6 and go 5; and 11 times 5 is 55, and 6 is 61, 1 and go 6; and 11 times 4 is 44, and 6 is 50, as above; and so of the rest.

Multiply	1234	56789	30762
By	12	12	12
Product	14808	681468	369144

Here I say, 12 times 4 is 48, 8 and carry 4; and 12 times 3 is 36, and 4 is 40, 0 and go 4, &c.

When any number is to be multiplied by 5, it may be contracted by annexing a cipher to the number, and then halve it, because 5 is the half of 10.

And the rule holds good for brevity if a number is to be multiplied by 15. *Example*, Multiply 567 by 15.

5670

$\frac{1}{2}$ 2835

By 3, because 3 times 5 is 15.

8505

When you multiply by any of these compound numbers, viz. 110, 120, 1100, or 1200, then multiply as before, and annex the cipher afterwards.

Examples.

Multiply	3762	34567	46972	96796
	110	120	1100	1200
Product,	413820	4148040	51669200	116155200

Which way of multiplying is much better than the following.

Or thus,

3762	34567
110	120
37620	691340
3762	34567
413820	7148040

XII. To multiply by article numbers, viz. 13, 14, 15, &c. to 20, to have the work in one line.

Examples.

74974	45678
13	18
974662	822204

Or thus,

74974	45678
24922	365424
974662	822204

RULE *for the first two Examples.*

Multiply each figure in the multiplicand by the unit figure of the multiplier, adding to each single product its back figure; and to the last figure add what you carry.

As in the first Example, I say 3 times 4 is 12, 2 and go 1; and three times 7 is 21; and 1 carried is 22, and 4 the back figure of the multiplicand is 26, 6 and go 2; and 3 times 9 is 27, and 2 is 29, and 7 the back figure, is 36, 6 and go 3; and 3 times 4 is 12, and 3 is 15, and 9, the back figure makes 24, 4 and carry 2; then 3 times 7 is 21, and 2 is 23, and 4, the back figure, is 27, 7 and go 2, which 2 add to the last figure 7, and it makes 9, as in the work.

In the two laſt Examples, I multiply by the unit figure ſ the multiplier, and ſet the firſt figure of the product ne place forward to the right hand.

XIII. To multiply by a *mixt number*, that is, a *whole umber* joined with a *fraction*, whether it be $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{3}$, $\frac{1}{5}$.

The RULE.

When you have multiplied by the whole number, take ne $\frac{1}{4}$, the $\frac{1}{2}$, the $\frac{3}{4}$, the $\frac{1}{3}$ or the $\frac{1}{5}$ of the multiplicand, nd add it to the product, and that total ſhall be the hole product, as in the following Examples.

Example 1.

In 276 barrels of raiſins,
Each $3\frac{1}{4}$ C. How many hundred weight;

828, the product by 3
69. the 4th part of the multiplicand 276.

Anſw. 897, hundred weight in all.

Example 2.

In 756 pieces of Stuff,
Each $24\frac{1}{2}$ yards, how many yards?

3024
1512
378, the half of the multiplicand 756.

Anſw. 18522 yards in all.

Example 3.

In 63 fodder of Lead,
Each $19\frac{1}{2}$ C. how many hundreds?

567
63
$31\frac{1}{2}$, the half of 63, the multiplicand.

Anſw. $1228\frac{1}{2}$ hundred weight in all.

If the multiplier had been accounted money, or 19*s.* 6*d.* and the multiplicand 63 integers, at that price, then the product would have been 1228*s.* 6*d.* or 61*l.* 8*s.* 6*d.*

Example 4.

In 24 casks of Tobacco.
Each $2\frac{3}{4}$ C. how many hundreds?

48
12, the half of 24.
6; the 4th part of 24, or half of 12.

Answ. 66 hundreds in all.

It would have been the same, if I had said, 24 pair of stockings, or any thing else at 2*s.* $\frac{3}{4}$, or 2*s.* 9*d.* (for 9*d.* is $\frac{3}{4}$ of a shilling) then the product would have been 66*s.* or 3*l.* 6*s.*

Example 5.

224 French Crowns,
At 54*d.* $\frac{1}{3}$ per Crown.

896
1120
$74\frac{2}{3}$ the $\frac{1}{3}$ of 224 the multiplicand.

Pence, $12170\frac{2}{3}$

Example 6.

340 gross of Pasteboards,
At 7*d.* $\frac{1}{5}$ per gross, custom.

2380
68, the $\frac{1}{5}$ part of 340.

Product, 2448 pence.

This method of multiplying by a mixt number is of excellent use in a multitude of cases, particularly in exchanging of money of different nations.

XIV. I ſhall now ſhew the excellent uſe of Multi-
plication, in anſwering all manner of queſtions that or-
linarily occur in buſineſs, where we have the price of
ne thing, and want to know the value of *many things* at
hat rate, and ſhew that it performs the *office* and an-
wers the *work* of queſtions in *The Rule of Three Direct*
f that kind, but in a much conciſer method, and more
legant manner; and that by ſuch eaſy rules and direc-
ions that any one who underſtands Addition of money
hall as readily caſt up any thing this way as he ſhall in
ſum in that; for nothing more is required here than to
arry from one denomination to the next, exactly as we do
here; and therefore it may be truly ſaid, That this Rule
erformeth the work of many Additions, as was hinted
efore.

Example 1.

How much is 3 times, Or, 3 yards of cloth, at 11*s.* 9*d.*

l.	*s.*	*d.*	
	11	9	*Multiplicand.*
		3	*Multiplier.*
1	15	3	*Prod.* or *Anſ.*

The RULE.

Obſerve always to multiply the *price* by the *quantity*, nd the *product* is the *anſwer*.

Here *I* ſay, 3 times 9 is 27 pence, which is 2*s.* and *d.* *I* ſet down 3*d.* under the place of pence, and carry ie 2*s.* to the ſhillings; then 3 times 11 is 33, and 2 iat *I* carry is 35*s.* which is 1*l.* 15*s.* *I* ſet down the 5*s.* under the ſhillings place, and ſet down the 1*l.* a ttle forward to the left hand; and ſo the queſtion is nſwered, and found to amount to 1*l.* 15*s.* 3*d.* as by the ie work above. Now here is no more difficulty than Addition, it being the ſame in effect, and altogether as ıſy.

l.	*s.*	*d.*
	11	9
	11	9
	11	9
1	15	3

If 11*s.* 9*d.* is three times ſet down as in Addition, and caſt up, it will prove the ſame, as may be ſeen in the margin; and is a ſure proof of the truth of this method.

Example 2.

How much is 5 times 7*s.* 4*d.* or, 5 gallons of Brandy, at 7*s.* 4*d.*

	l.	*s.*	*d.*	
Multiplicand,		7	4	*the price.*
Multiplier,			5	*the quantity.*
Product,	1	16	8	*Answer.*

Here I say, 5 times 4 is 20 pence, which 1*s.* 8*d.* *I* set down 8 and carry 1, just as in Addition of money, (and nothing more is required to be remembered, let the example be what it will) and 5 times 7 is 35, and 1 *I* carried is 36*s.* which is 1*l.* 16*s.* *I* set down the 16*s.* under the place of shillings, and the 1*l.* towards the left hand, and the answer is 1*l.* 16*s.* 8*d.* as above.

Example 3.

	s.	*d.*	
What is 7 times 21*d.*			
Or, 7 stone of Beef, at -	1	9	*price.*
		7	*quantity.*
	12	3	

Here *I* say, 7 times 9 is 63*d.* that is, 5*s.* 3*d.* *I* set down 3, and carry 5; and 7 times 1 is 7, and 5 is 12; which makes 12*s.* 3*d.* for the answer.

Example 4.

What comes 9 ℔ of Tea to, at 9*s.* 9*d.* ½ *per* ℔?

l.	*s.*	*d.*	*q.*
	9	9	½
			9
4	8	1	½

I ſay here, 9 times 2 is 18, 18 farthings is $4d\frac{1}{2}$. *I* ſet own $\frac{1}{2}$, and carry 4; then 9 times 9 is 81, and 4 *I* car- r is 85*d.* which is 7*s.* 1*d.* *I* ſet down 1, and carry 7; hen 9 times 9 is 81, and 7 is 88*s.* which makes 4*l.* 8*s.* ſet down 8*s.* and the 4*l.* out to the left hand, as be- ore; and the anſwer is 4*l.* 8*s.* 1*d.* $\frac{1}{2}$, as above.

Example 5.

	l.	*s.*	*d.*
What come 10 times		11	6 to ?
r, 10lb. of Nutmegs, at 1 1*s.* 6*d.*		.	10
	5	15	0

Here *I* ſay, 10 times 6 is 60 pence, which is juſt 5*s.* ſet down 0, and carry 5: then 10 times 11 is 110, and is 115 ſhillings, which is 5*l.* 15*s.* for the anſwer.

Example 6.

	l.	*s.*	*d.*
How much is 11 times		17	6
r, 11 Piſtoles, at ditto			11
	9	12	6

I ſay here, 11 times 6 is 66 pence, which is 5*s.* 6*d.* ſet down 6, and carry 5; then 11 times 7 is 77, and that *I* carry is 82, *I* ſet down 2, and carry 8; then 1 times 1 is 11, and 8 is 19; and as they are ſo many ngels (it being in the tens of ſhillings) *I* take the half f them which is 9, or 9*l.* and 10*s.* over, which I put to e left of the 2*s.* ſet down before, and they make 12*s.* nd the 9*l.* *I* ſet at a proper diſtance towards the left and, as in the Example may be ſeen.

Example 7

	l.	*s.*	*d.*
What comes 12 ſheep to, at		13	4
			12
	8	00	0

Note, It is beſt to multiply the ſhillings as ſimple numbers, for every 10 carrying 1, &c. and then to halve the tens of ſhillings, which half is always ſo many pounds: and if they halve even, ſet down a cipher in the tens of ſhillings place; but if odd, then ſet down a 1 in that place: inſtances of both may be obſerved in the two laſt ſums.

In the laſt ſum I ſaid, 12 times 4 is 48 pence, or 4*s*. *I* ſet down 0, and carry 4; then 3 times 12 is 36, and 4 is 40; *I* ſet down 0, and carry 4 for 4 tens; then 12 times 1 is 12, and 4 is 16, the half of 16 is 8, which is 8*l*. for anſwer, as in the work.

Some more Examples.

	l.	*s.*	*d.*
9lb. of Cinnamon, at - -		7	2
			9
Anſw.	3	4	6
8 C. of Sugar, at - - - -		44	4
			8
Here the $\frac{1}{2}$ of 35 is 17 and $\frac{1}{2}$. *Anſw.*	17	14	8
12 pair of Stockings, at 9*s*. 8*d*. per pair.		9	8
			12
Anſw.	5	16	0
7 C. of Hops, at	3	6	9
			7
Anſw.	23	07	3
11 ounces of Silver, at	0	5	$5\frac{1}{2}$
			11
Anſw.	3	0	$0\frac{1}{2}$

		l.	s.	d.
o pipes of Wine, at *per* pipe		24	15	0
				10
	Anſw.	247	10	0
yards of Flannel, at			1	2
				6
	Anſ.		7	0
C. of Tallow, at			34	6
				9
ere the ½ of 31 is 15 and ½.		15	10	6

XV. When the quantity exceeds 12, find two numbers, he Multiplication Table, which being Multiplied toge- er will make the quantity: then multiply the price by one the numbers (it matters not which you multiply firſt by) d then that product by the other number, and the laſt oduct will be the anſwer.

Example 1.

	l.	s.	d.	
What is 18 times		4	6 ?	
18 gallons of Brandy			3	the 1ſt multiplier.
4s. 6d. *per* gallon.		13	6	the 1ſt prod. by 3.
			6	the 2d multiplier.
Anſw.	4	01	0	the laſt prod. by 6.

Here *I* find this quantity two ways (as many times apens) viz. either by 3 and by 6, or by 2 and by 9; ither of them multiplied together make the quantity, 18.

l.	*s.*	*d.*
	4	6
		2
	9	0
		9
4	1	0

Here is the anſwer produced by 2 and 9, as above.

Example 2.

	l.	*s.*	*d.*
How much is 32 times,		5	9 ½
Or, 32 ℔ of Tea, at 15*s.*			4
9*d.* ½, *per* pound.			
The 1ſt product by 4,	3	03	2
The 2d. multiplier,			8
Anſ.	25	05	4

Here the numbers are 4 and 8; 4 times 8 making 32 the quantity; wherefore *I* begin and ſay 4 times 2 is 8 farthings, which being juſt 2*d.* *I* carry it to the pence; then 4 times 9 is 36, and 2 is 38 pence, which is 3*s.* and 2*d.* *I* ſet down 2 and carry 3*s.* &c. After *I* have multiplied by 4, *I* find that Product to be 3*l.* 3*s.* 2*d.* which *I* multiply by 8, the other number, and find the laſt product, or anſwer, to be 23*l.* 5*s.* 4*d.* as in the work may be ſeen.

	l.	*s.*	*d.*
What is 120 times		19	8
Or, 120 quarters of Corn, at 19*s.* 8*d.*			10
per quarter?			
	9	16	8
			12
Anſw.	118	00	0

Here 10 times 12 makes 120 the quantity, wherefore *I* multiply firſt by 10, and that product is 9*l.* 16*s.* 8*d.* which *I* multiply by the other number 12, and that produces 118*l.* for the anſwer.

	l.	*s.*	*d.*
77 C. of Madder, at	3	15	6
			7
	26	08	6
			11
Anſw.	290	13	6

Here 11 times 7 makes the quantity; when *I* come to multiply by the ſecond multiplier, viz. 11, *I* ſay, 11 times 6 is 66, which is 5*s.* 6*d.* *I* ſet down 6, and carry 5; then 11 times 8 is 88; and 5 is 93*s.* which is 4*l.* 13*s.* *I* ſet down 13, and carry 4; then 11 times 6 is 66 and 4 is 70, *I* ſet down 0, and carry 7 for the ſeven tens: then 11 times 2 is 22, and 7 is 29, &c.

More Examples.

	l.	*s.*	*d.*
15 yards of Ribbon, at		2	1
			3
		6	3
Here 3 times 5 is 15, the quantity.			5
Ans.	1	11	3
21 yards of Tabby, at		5	11
			7
	2	01	5
			3
Anſ.	6	04	3

		l.	*s.*	*d.*
72 gallons of Wine, at			5	4
				6
Here 6 times 12 makes the quantity; or, 8 times 9 makes 72 likewise.		1	12	0
				12
	Anſ.	19	04	0
81 lb. of Nutmegs, at			12	3 $\frac{3}{4}$
				9
		5	10	9 $\frac{3}{4}$
Here 9 times 9 makes the quantity.				9
	Anſ.	49	17	3 $\frac{3}{4}$

XVI. When the quantity is ſuch a number that no two numbers in the Table can be found to anſwer it, then multiply by two ſuch numbers as come neareſt to the number given, as before; and for the number wanting, to make up the number given, multiply the price of one by the number that is wanting, and add it to the other product, and the total will be the anſwer.

Example 1.

		l.	*s.*	*d.*
39 C. of Currants, at per C.		2	13	6
				6
		16	01	0
				6
		96	06	0
The price 2*l.* 13*s.* 6*d.* multiplied by 3,		8	00	6
	Anſ.	104	06	6

Here I find the two numbers that come the nearest are 6 times 6, by which I multiply as before, and the last product is 96*l.* 6*s.* 0*d.* but 6 times 6 is but 36, and the quantity is 39, so that there is 3 C. wanting: wherefore *I* multiply the price 2*l.* 13*s.* 6*d.* by 3, and it produces 8*l.* 0*s.* 6*d.* to be added to the last product, 96*l.* 6*s.* 0*d.* which together make 104*l.* 6*s.* 6*d.* for the answer.

Example 2.

	l.	*s.*	*d.*
79 firkins of Butter, at	00	17	6
			7
Here the two numbers that come nearest are 7 times 11, which is 77.	6	02	6
			11
	67	07	6
The price multiplied by 2 that are wanting.	01	15	0
Ans.	69	02	6

More Examples.

	l.	*s.*	*d.*
57 gross of Pipes, at per gross,		1	4
			7
		09	4
			8
	03	14	8
1 gross wanting,	00	01	4
Ans.	03	16	0

	l.	s.	d.	q.
76 C. $\frac{3}{4}$ of Ship-Biſcuit, at		13	6	
			6	
	4	01	0	
			12	
	48	12	0	
The price multiplied by 4.	02	14	0	
The $\frac{1}{2}$ of 13*s.* 6*d.* for the $\frac{1}{2}$ C.	00	06	9	
The $\frac{1}{4}$ of ditto, for the $\frac{1}{4}$ C.	00	03	4	$\frac{1}{2}$
Anſ.	51	16	1	$\frac{1}{2}$

87 ells of Holland, at		3	5	$\frac{1}{2}$
			7	
	1	04	2	$\frac{1}{2}$
Here 7 times 12 is 84, and 3 is 87.			12	
	14	10	6	
The price multiplied by 3.		10	4	$\frac{1}{2}$
Anſ.	15	00	10	$\frac{1}{2}$

If I had multiplied by 11 times 8, which is 88, and ſubtracted the price of 1 from the product, the remainder would have been the anſwer, as before.

	l.	s.	d.
97 C. $\frac{1}{2}$ of Cheeſe, at per C.		25	6
		1	8
	10	04	0
			12
	122	08	0
For the 1 C. wanting,	1	05	6
The half of the price for the $\frac{1}{2}$ C.		12	9
Anſ.	124	06	3

Thus, by the various examples foregoing, is manifeſtly ſeen, that when the price of one thing is given, the price of many, at the ſame rate, may be found by Multiplication only; and ſooner and much handſomer, than by the Rule of Three.

Larger ſums may be caſt up this way as well as ſmall, obſerving the directions following.

When your ſum is 1, 2, 3 4, or more hundreds, always multiply the price by 10, and then that product by 10 alſo, which produces the value of one hundred; then multiply that product by the number of hundreds, whether 2, 3, 4, or 5, &c. and that product is the value of ſo many hundreds as there are; then for the tens, whether 20, 30, 40, &c. multiply that product which gives the price of 10, either by 2, 3, 4, or 5, as the tens ſhall happen, which place under the laſt product, without drawing a line; and for the units always multiply the price by them, whether 2, 3, 4, &c. and ſet that alſo juſt under the former products, ſo that you will have three lines to add together, and the total of them is always the anſwer. An Example, or two, will make it eaſy to be underſtood.

Example 1.

	l.	*s.*	*d.*	
What is 648 times		4	6	
Or, 648lb. of indigo, at ditto?			10	
The value of 10,	2	05	0	
			10	
The value of 100,	22	10	0	
The number of hundreds			6	
The value of 600,	135	00	0	600
The price of 10, multiplied by 4,	9	00	0	40
The price multiplied by 8,	1	16	0	8
Anſw.	145	16	0	648

First, I multiply 4*s*. 6*d*. the price, by 10, and that produces 2*l*. 5*s*. for the price of 10; also I multiply the said 2*l*. 5*s*. the price of 10, by 10 again, and that produces 22*l*. 10*s*. for the value of 100; then I multiply the value of 100 by 6, the number of hundreds, and that product is the value of 600, being 135*l*. 0*s*. 0*d*. wherefore I am now only to find out the value of 48: for the four tens in 48, I multiply the price of 10, viz. 2*l*. 5*s*. by 4, and that product shews the value of 40, which is 9*l*. then for the 8 units, in the 48, I multiply the first price, viz. 4*s*. 6*d*. and that product gives the value of 8, which is 1*l*. 16*s*. All which, being added together (that is, only the three lines that have no line of separation between them) make 145*l*. 16*s*. 0*d*. for answer.

And thus may any sum be done, let it be as large as it will; only when the sum consists of thousands you have 4 lines to add together; but when of hundreds, but 3.

Example 2.

	l.	*s.*	*d.*	
355 ells of Holland, at		2	3 ½	
			10	
The value of 10,	1	02	11	
			10	
The value of 100,	11	09	2	
The number of hundreds,			3	
The value of 300	34	07	6	300
The value of 10 mul. by 5	5	14	7	50
The price by 5 units,	0	11	5 ½	5
Answ.	40	13	6 ½	355

Example 3.

	l.	*s.*	*d.*	
966 lb. of Bohea Tea, at		14	5	
			10	
The value of 10, - -	7	04	2	
			10	
The value of 100,	72	01	8	
The number of hundreds, -			9	
The value of 900 -	648	15	0	900
The value of 10 mult. by 6,	43	05	0	60
The price of 1 mult. by 6,	4	06	6	6
Anſ.	696	06	6	966

Example 4.

	l.	*s.*	*d.*	
954 gallons of Rum, at		03	5	
			10	
The price of 10, -	1	14	2	
			10	
The price of 100, -	17	01	8	
			10	
The price of 1000, -	170	16	8	
The number of thouſands,			8	
The value of 8000, -	1366	13	4	8000
The value of 100 mult. by 9,	153	15	0	900
The value of 10 mult. by 5,	8	10	10	50
The price mult. by 4 units,	0	13	8	4
Anſ.	1529	12	10	8954

I have insisted the longer on this excellent method, that it might be well understood; not only for its elegant, expeditious, and facile dispatch of ordinary affairs, but for its utility in contracting many operations in other Rules, as *The Rule of Three*, &c.

I know it is not customary to introduce any thing of this kind to be learnt so early; imagining (it may be) the scholar not capable of understanding them till he has made farther advances in Arithmetic; but since they are only Multiplication, the foregoing methods properly belong to the Rule, and may well be taught in it, especially since they are of such excellent use in all manner of business, and may be of service to some whose leisure or ability admit of no larger improvements in Arithmetic.

Quantities of weight, measure, &c. are expeditiously found by this method of multiplying by component parts.

Examples.

In 64 barrels of Anchovies, each $30\frac{1}{2}$ lb.
how many pounds? Multiply by 8 and 8

Answ. 1952

In 56 firkins of Butter, each 56 lb.
how many pounds? Multiply by 7 and 8

Answ. 3136

	C.	*qrs.*	*lb.*
In 98 casks of Capers, each	3	3	14
how many hundreds, &c.			10, 9, and 8.
Answ.	379	3	0

In 104 bars of Spanish Silver, each $46\frac{1}{4}$ *oz.*
how many ounces? 10, 10, and 4.

Answ. 4810

In 48 packs of Linen each 4225 ells Flemiſh, how many ells Flemiſh ? 6 and 8.

Anſwer, 202800

I might here alſo ſhew the method of Croſs Multiplication, or multiplying ſhillings and pence by ſhillings and pence, or feet and inches by feet and inches (it being all one) and ſome other methods in Practical Multiplication, but there being too much of Diviſion uſed with them, *I* ſhall defer them till *I* come to another place.

CHAP. V.

DIVISION.

I. DIVISION is a Rule by which we diſcover how often one number is contained in another; as, if it were aſked, How often is 8 contained in 48 ? The anſwer would be 6 times. It likewiſe ſerveth to bring ſmall denominations into greater ; as farthings into pounds, and pounds weight into tons weight, &c.

II. This rule is comprehended under 3 certain branches, and one uncertain, viz.

1. The *Dividend*, or number given to be divided.
2. The *Diviſor*, or number given to divide by.
3. The *Quotient*, or number of equal parts ſhewing how often the diviſor is contained in the Dividend.
4. The *Remainder* after the work is ended ; which is always of the ſame name or quality with the dividend, and muſt be leſs than the Diviſor if the work be right, and this is the uncertain branch, becauſe there is ſometimes a Remainder, and ſometimes not.

III. Diviſion is either ſingle, or compound. Single when the Diviſor conſiſteth of one figure only, and the dividend of two at the leaſt. Any thing of this kind is

anſwered by the Multiplication Table; as if 54 were to be divided by 6, the anſwer would be 9; for 6 is contained 9 times in 54; here 54 is the Dividend, 6 the Diviſor, and 9 is the Quotient or anſwer.

IV. Compound Diviſion is when the Dividend conſiſteth of many places or figures, and the Diviſor of one or more figures. As if 365, the days in a year, were to be divided by 7, the days in a week; 365 is the dividend, 7 the diviſor, 52 the quotient, and 1 the remainder.

Dividend,
Diviſor, 7)365(52 *Quotient.*
35
15
14
1 *Remainder.*

A General Rule *for the working.*

N. B. { 1. Seek,
2. Multiply.
3. Subtract.

This Rule comprehends three of thoſe foregoing, and is accounted the hardeſt leſſon of Arithmetic; but *I* ſhall by plain Rules and familiar examples render it eaſy to the meaneſt capacity. And as in Multiplication, ſo in this Rule *I* ſhall endeavour at ſome new improvements; diſcovering that many things in this Rule may be abridged, and ſhew its excellent uſe in anſwering many queſtions, which ſeem to require a more progreſſive knowledge in Arithmetic.

Example 1.

Let it be required to divide 7420 by 5. In order to which *I* place my dividend (or ſum to be divided into 5 equal parts or ſhares) thus, 7420. Then *I* place my diviſor 5, before the dividend, with a crooked line before it, and a ſtraight line drawn underneath it, thus;

5)7420

Then *I* proceed according to the Rule; and, first, *I* *seek*, saying, how many times 5, the divisor, can *I* have in 7, the first figure of the dividend, and the answer is once, which I *I* place under the line, just under the 7; then, according to the Rule, *I* *multiply*, saying once 5, the divisor, is 5; then, as the Rule directs, I *subtract*, saying, 5 from 7, and there remains 2, which are two tens, which *I* suppose stand before the next figure in the dividend, viz. 4, and so makes it 24

5)7420
1

for a new dividual. Then again I *seek*, saying, how many times 5, the divisor, can *I* have in 24, the dividual, and the answer is 4 times, which *I* place under the line, just under 4, the second figure in the dividend; then I *multiply*, saying, 4 times 5 (the divisor) is 20, which I *subtract* from 24, and there rests 4, which being 4 tens, makes the next figure 2, in the dividend, to be 42. Then again I *seek* how many times 5 *I* can have in 42, and the answer is 8 times, which *I* put under the line, just under 2, the third figure in the dividend: then *I* multiply, saying, 8 times 5 is 40, which *I* subtract from 42, and there remains 2, which 2 tens make the cipher in the dividend to be 20; then *I* say, how many times 5, the divisor, in 20, and the answer is 4 times; then 4 times 5 (the divisor) is 20, from 20, and there remains nothing. And so the work is done, as by the following Example.

Divisor, 5)7420 *Dividend.*

1484 *Quotient*, or *Answer.*

So that *I* find by the work, that 5 is contained in 7420 just 1484 times: or, if the dividend had been so many shillings or pounds to be parted among 5 persons, each person must have had so many shillings or pounds for his share.

V. When the figure of your dividend is less than the divisor, or first figure of your divisor, then make the first two figures of the dividend your dividual, and work as before.

Example.

Divide 4263 gallons of wine among 7 persons.

Having set down the dividend for the work, as before, with the divisor before it, thus,

7)4263 *Dividend.*

609 *Quotient.*

I proceed, saying, how many times 7, the divisor, can *I* have in 4, the first figure of the dividend: and knowing *I* cannot take 7 out of 4, *I* take it out of 42, the first two figures of the dividend, and the answer is 6 times, which *I* put just under 2, the second figure of the dividend, and then multiply, saying, 6 times 7 (the divisor) is 42, and there remains nothing: Then the sevens that are in 6 (for you must never take more than one figure or cipher at a time out of the dividend, except you are obliged to do it at first) *I* cannot take, wherefore *I* put a cipher in the quotient, under 6 and the 6 remains as so many tens, and makes the next or last figure in the dividend 3, to be 63. Then the sevens in 63, 9 times, and the work is done: and the quotient is 609, or 609 gallons for each man's share.

The PROOF.

To prove this or any other sum in division, multiply the quotient by the divisor, and if the product is like the dividend, the work is right: but observe, whenever there is a remainder, such remainder must be taken in, or added to the product.

Example.

7)4263

609
7

4263 *Proof.*

Here *I* ſay, 7 times 9 is 63; 3 and carry 6, then 7 times 0 is nothing, but 6 is 6; laſtly, 7 times 6 is 42: ſo that I find this product to be the very ſame figures with the dividend, therefore the work is right.

So likewiſe as Multiplication proves Diviſion, doth Diviſion prove Multiplication. For if you divide the product by the multiplier, the quotient, if the work is right, will be the ſame with the multiplicand; as thus:

In proving the laſt ſum, 609 is the multiplicand, and 4263 is the product, and 7 the multiplier. Now if the product 4263 be divided by 7, the multiplier, the quotient will be 609 the multiplicand, as may be ſeen in the foregoing work.

Example.

Divide 97961 pieces of Eight among 9 men.

9)97961

10884$\frac{5}{9}$ *Anſwer.*

9

97961 *Proof.*

Here *I* ſay, the nines in 9, once, which *I* put under the line, juſt under 9 in the dividend, and then I multiply, ſaying, once 9 from 9, and there remains nothing: then the nines in 7 none, wherefore *I* ſet down a 0 in the quotient, juſt under 7, and the 7 remains, and makes the next figure in the dividend to be 79; then the nines in 79 are 8, then 8 times 9 is 72, from 79, and there reſts 7, which makes the next figure 6, in the dividend, to be 76; then the nines in 76 are 8, 8 times 9 is 72, from 76, and there reſts 4, which makes the next and laſt figure in the dividend to be 41; then the nines in 41 are 4, 4 times 9 is 36, from 41, and there reſts 5, which is the remainder, and may be ſet at ſome ſmall diſtance from the quotient, towards the right hand, with the diviſor 9 under it, thus $\frac{5}{9}$: ſo that there are 5 parts of 9 over, beſides 10884, that comes to each man's ſhare,

and is called a fraction, and signifies, that each person ought to have five-ninths of a *piece of eight*, more to his share.

What hath been already said for instruction, to divide by a single figure, *I* think sufficient to any intelligent person, and therefore shall only add some Examples for the learner's practice, and so proceed forward in the Rule.

Examples for Practice.

Divisor,	6)9654	7)4702	5)44044
Quotient,	1609	671 $\frac{5}{7}$	8808 $\frac{4}{5}$ *Rem.*
	4)57802	9)345678	6)407060
	14450 $\frac{2}{4}$	38408 $\frac{6}{9}$	67843 $\frac{2}{6}$

Divisor,	7)89012	8)98765	9)4567097
Quotient,	12716	12345 $\frac{5}{8}$	507455 $\frac{2}{9}$
	7	8	9
Proof,	89012	98765	4567097

Note, There can be no shorter way, nor a more regular method of dividing by a single figure, than by the Examples foregoing.

As in Multiplication we multiply by 11 and 12 at once, to have the product in one line, so in this Rule it is most expeditious and commendable to divide by the above-mentioned numbers, as by a single figure, as in the following Examples.

By	11)45678	11)379600
Quotient	4152 $\frac{6}{11}$	34509 $\frac{1}{11}$

By 12)42697	12)3967040
Quotient 3558 $\frac{1}{12}$	330586 $\frac{8}{12}$
12	12
Proof, 42697	3967040

In the first Example, I say, the elevens in 45, 4 times; the elevens in 16, once; the elevens in 57, 5 times; the elevens in 28, twice, and there remains 6; and the quotient is 4152, as by the Example.

In the third Example, where I divide by 12, I say, the twelves in 42, 3 times; the twelves in 66, 5 times; the twelves in 69, 5 times; the twelves in 97, 8 times, and there remains 1; and the quotient is 3558, as by the Example.

In like manner you may divide by these numbers, viz. 110, 120, 1100, or 1200, &c. cutting off the cipher or ciphers, with a downright stroke of the pen; and also as many figures, or ciphers towards the right hand as in the dividend, which will be the remainder, or part of it, as in the following

Example.

Divide by 11[0)809714	12[00)2880[00
Quotient, 736 $\frac{14}{110}$	240
110	
Proof, 80974	

VI. Contractions; or how to divide by 10, 100, 1000, or 10000, &c. So many ciphers as you have in your divisor, cut off, with a stroke, so many figures or ciphers from your dividend, from the right hand towards the left, and the work is done. The figures on the left hand of the stroke is the quotient, and those on the right hand the remainder, as in these

Examples.

Q. R.	Q. R.	Q. R.
1[0)3615	1[00)749160	1[000)5671890
10	100	1000

Quot.

1[0000)7496[4600 *Remains.*

VII. When the divisor consists of several figures, then arises the greatest difficulty in the work of Division: but I shall give such plain directions, which, if heedfully attended, and observed, will render it very easy.

Example 1.

Let it be required to divide 78901 by 32. In order to the work, I place the numbers down with two crooked lines, one behind the divisor, and the other before the quotient, thus:

Divid. Quotient.

Divisor, 32)78901(. . . .

Then I set out as many figures towards the left hand of the dividend as there are places in the divisor, by making a point under 8 as above; then remembering the General Rule, viz. to *seek*, *multiply*, and *subtract*, *I* begin, saying, how many times 3, the first figure of the divisor, can I have in 7, the first figure in the dividend, and the answer is twice; wherefore I set down 2, in the quotient, thus:

32)78901(2

Then according to Rule, I multiply the divisor 32, by 2, the times *I* take, saying, twice 2 is 4, which I set down under 8 in the dividend; then twice 3 is 6, which I place under 7 in the dividend; then I draw a line, and, according to the Rule, subtract 64 from 78, and there remains 14, as in the first step of the work may be seen, standing thus:

```
32)78901(2
   .
   64
   ---
   14
```

Then *I* make a point under the next figure, to wit, 9, and bring it down, ſetting it on the right hand of the remainder 14, and then there is 149 for a new dividend, and ſtands thus:

```
32)78901(2
   .
   64
   ---
   149
```

Then again *I* ſeek how oft *I* can have 32, the diviſor, in 149 the dividual; but ſince that is too hard to reach by the mind, there being one figure more in the dividual than in the diviſor, (for there never ought to be more than one) *I* ſeek how often *I* can have 3, the firſt figure of the diviſor, in 14, the two firſt figures in the dividual, and *I* find *I* can have it 4 times; wherefore *I* put 4 in the quotient and multiply the diviſor 32, by 4, the figure placed in the quotient, ſaying, 4 times 2 is 8, which *I* ſet under 9: then 4 times 3 is 12, which *I* put under 14, and then ſubtract 128 from 149, and there remains 21. (*Note*, After any ſubtraction, there muſt never remain ſo much as the diviſor, for if there doth, you have made an error, by taking a time too little, which muſt be rectified before you proceed any further.) Then *I* make a point under the next place in the dividend, which is a cipher, and bringing it down, ſet it on the right of the remainder 21, and it makes 210 for a dividend; and after this ſecond ſtep, the work ſtands thus;

```
32)78901(24
   ...
   64
   ---
   149
   128
   ---
   210
```

Then again *I* ſeek how oft *I* can have 32, the diviſor, in 210, or how oft (becauſe there is one figure more in the dividual than in the diviſor) *I* can have 3, the firſt in the diviſor, out of 21, the two firſt figures in the dividual, and the anſwer is 7 times: but *I* muſt obſerve not to take the firſt figure any more times than *I* can the next. Wherefore I try if I can take all the figures 7 times, by multiplying 32, the diviſor, by 7, and note its product on paper, or in my mind, only by obſerving the two laſt figures, whether it be not too big to ſubtract from the dividual, and *I* find it is, for I cannot take 224 (the product of 32 by 7) out of 210, the dividual, wherefore I take a time leſs viz. but 6, and put that in the quotient, and ſay 6 times 2 is 12, 2 and carry 1, and 6 time 3 is 18 and 1 is 19, and then *I* have 192 to take out of 210, and there reſts 18. Then *I* make a point under the laſt figure of the dividend 1, and bring it down to the remainder 18, and it makes 181, and the work ſtands thus:

```
32)78901(246
   ....
   64
   ----
   149
   128
   ----
    210
    192
    ----
     181
```

Then *I* ſeek how often *I* can have 32 out of 181; or how oft 3 in 18, and the anſwer is 6 times; but on trial *I* find that too much; and therefore *I* take but 5 times, and ſet 5 in the quotient, and multiply the diviſor 32 by 5, and find that product is 160, to be ſubtracted from 181, and the remainder is 21, and ſo the work is finiſhed, and the quotient is 2465, and the remainder 21; which ſhews that 32 is contained in 78901, 2465 times and 21 over. See the work.

Dividend.

Divisor, 32)78901(2465 *Quotient.*

....

64

149
128

210
192

181
160

21 *Remainder.*

Example 2.

Divide 16790 days by 365

365)16790(46 years, *Quotient.*

..

1460

2190
2190

0

In the Example above, I find I cannot take the first figure of the divisor out of the dividend, wherefore I say how oft 3 in 16: upon trial I find 5 times too much, wherefore I set down 4 in the quotient, and say, 4 times 5 is 20, I set down 0 under the 9 in the dividend and carry 2, saying, 4 times 6 is 24, and 2 is 26, 6 and carry 2; then 4 times 3 is 12, and 2 is 14; which product of 1460 I subtract out of the dividual 1679, and there remains 219, to which I set down the cipher out of the dividend, and it makes 2190 for a dividual, &c. See the work above.

Example 3.

Divide 345678901 by 2345. In order to do the work, set it down thus:

2345)345678901(

In this ſum are four places in the diviſor, wherefore I make a point under the 4th figure in the dividend, viz. under 6, for my firſt dividual: but if the firſt figure in the diviſor had been bigger than the firſt in the dividend, then I muſt have made the point under the fifth figure in the dividend, to wit, under the 7, and then have tried how oft the firſt figure in the diviſor could have been taken out of the two firſt figures in the dividend.

But to proceed, I firſt ſeek how oft I can have 2, the firſt figure of the diviſor, out of 3, the firſt of the dividend, which is once, wherefore I put 1 in the quotient, and multiply the diviſor 2345 by 1, ſetting the product juſt under the firſt dividual, and ſubtract according to Rule, and then the work ſtands thus:

```
2345)345678901(1
     .
     2345
     ----
     1111
```

Note, You muſt never bring down more than one figure or cipher at a time out of the dividend, and for every figure or cipher brought down there muſt be one, or a cipher, put in the quotient.

Then I make a point under the next figure in the dividend, viz. 7, and bring it down, placing it on the right of the remainder 1111, and then I have 11117 for a dividual, which contains one figure more than the diviſor; wherefore I take the firſt figure of the diviſor out of the firſt two figures of the dividual, viz. 2 out of 11, ſaying, the two's in 11, 5 times; but on trial I find I cannot take 5 times through the whole diviſor; for when I multiply the diviſor by 5, I find the product to be 11725, which cannot be taken out of 11117, that is, I cannot take 117 out of 111, wherefore I take one leſs, and ſet 4 in the quotient, by which I multiply the diviſor 2345, and find its product 9380, which ſubtracted from 11117 leaves 1737 for the remainder; to which I bring down the next figure of the dividend, viz. 8, and annex it on the right hand, and then there is 17378 for a dividual, and the work ſtands thus:

```
2345)345678901(14
     ...
     2345
     ----
     11117
      9380
     -----
     17378
```

Then *I* ſeek how oft *I* can have 2 in 17, and the anſwer is 8 times; but on trial *I* find it too much, wherefore *I* ſet 7 in the quotient.

Note in General. When you are upon trial for the times you can take, you need only mind the two laſt figures of the product towards the left hand; for if you can take them out of the firſt two of the dividual, it will moſt commonly bear the times you take.

Having ſet 7 in the quotient, *I* multiply the diviſor by it, and the product is 16415, which *I* ſubtract from 17378, and the remainder is 963; to which *I* bring down the next figure in the dividend, viz. 9, and then *I* have 9639 for a dividual, and then the work will appear as follows:

```
2345)345678901(147
     ....
     2345
     ----
     11117
      9380
     -----
      17378
      16415
      -----
       9639
```

Here this laſt dividual hath an equal number of figures with the diviſor, viz. 4: wherefore *I* ſeek how often *I* can have 2, the firſt figure of the diviſor, out

of 9, the first of the dividual, and the answer is 4 times, which I put in the quotient, and then multiply the divisor by it, and the product is 9380, which subtracted from 9639, the remainder is 259, to which I bring down the cipher, the next place in the dividend, and then I have 2590 for a dividual; then I seek again, and set 1 in the quotient, by which I multiply the divisor, and subtract, according to rule, and the remainder is 245, to which I bring down the last figure out of the dividend, viz. 1, and then there is 2451 for the last dividual, and then I seek again, and I find I can take but once, wherefore I set another one in the quotient and work as before, and I find the remainder 106: and so the work is finished, as by the whole operation below.

The PROOF.

To prove the following sum, or any other sums in this Rule, multiply the quotient, by the divisor, and if there be a remainder, it must be taken in as you multiply; and if the product is like the dividend, the work is right, as may also be seen in the Example.

```
2345)345678901(
     ......
  2345
  -----
  11117
   9380
  -----
   17378
   16415
   -----
    9639
    9380
   -----
     2590
     2345
    -----
      2451
      2345
    -----
       106 Remainder.
```

```
  147411
    2345
  ------
  737061
 589644
442234
294822
---------
345678901 Proof.
---------
```

```
   7
5 X 0 Proof.
   7
```

In proving (after *I* have ſet the diviſor under the quotient, as in the Example) *I* ſay, 5 times 1 is 5, and 6 that remains in the units place of the remainder, is 11, 1 and carry 1, &c. When *I* come to the third figure in the multiplier, *I* take in the 1 that ſtands in the place of hundreds in the remainder, as 3 times 1 is 3, and 1 is 4, &c.

Diviſion may alſo be proved by the croſs, as in Multiplication; for trial, let us prove the foregoing ſum, thus:

5 X 0

Firſt, caſt the nines out of the diviſor, and there remains 5, which *I* place on the left of the croſs (as you ſee in the margin:) then out of the quotient, and there remains 0, which *I* ſet on the right of the croſs; then *I* multiply theſe two together, and they make 0; but the nines muſt have been caſt out there alſo, if by multiplying them together they had made any, and what was over carried to the remainder, which here makes 7, which *I* ſet on the top as in the margin. Laſtly, *I* caſt away the nines out of the dividend, and there reſts 7 alſo, which *I* put underneath the croſs, and finding the top and bottom figures to be alike, *I* conclude the work is right.

The foregoing directions to the preceding Examples are ſo plain and eaſy that there is no occaſion for any more; ſo I ſhall ſet down ſome more Examples, without any verbal directions, thinking what hath been already ſaid to that purpoſe to be ſufficient.

More Examples.

Divisor, 14)5873456(419532 *Quotient.*

```
          ......
          56
          ---
 2        27
5 X 6     14
 2        ---
          133
          126
          ---
           74
           70
           ---
            45
            42
            ---
             36
             28
             --
Remainder    8
```

```
47)27072329(576007
   ......
   235
   ---
    357
    329
    ---
     282
     282
     ---
      329
      329
      ---
Remainder 0
```

```
   5
2 X 7
   5
```

Divisor, 426)7890123(18521

```
          .....
          426
          ---
 3        3630
3 X 8     3408
 3        ----
          2221
          2130
          ----
           912
           852
           ---
            603
            426
            ---
           (177)
```

```
96)7400900(77092
   .....
   672
   ---
   680
   672
   ---
    890
    864
    ---
     260
     192
     ---
    (68)
```

```
   2
6 X 7
   2
```

Here follow some other sums with their quotients and remainders only, their working being purposely omitted, leaving that to the learner for a trial of his ingenuity.

As if you divide 796976499 by 49654, the quotient will be 16050, and the remainder, after the work is ended, 29799.

Again, if you divide 5345678905 by 765432, the quotient will be 6983, and the remainder 667249.

Also, if you divide 45678901234 by 9876543, the quotient will be 46249, and there will be a remainder of 8775138.

And if you divide 123456789012 by 123456789, there will be for the quotient 1000, and for the remainder 12.

And that nothing may be wanting to a perfect understanding of this Rule, I have subjoined the following general notes concerning division.

1*st*. So many places as are in your divisor, you point off so many in your dividend, for your first dividual, except the first figure of the divisor exceed the first of the dividend, and then you move a place farther towards the right hand, and make your point there; and then your dividual marked out hath a figure more than your divisor, and then you must take the first figure of your divisor out of the two first figures of your dividual.

2*dly*. You never place a cipher in the quotient the first time you seek.

3*dly* The times that you take the divisor out of the dividual never exceed 9.

4*thly*. The dividual never exceeds the divisor above one figure.

5*thly*. You never bring down but one figure or cipher at a time out of the dividend.

6*thly*. For every figure or cipher brought down from the dividend, there must be one or a cipher placed in the quotient also.

7*thly*. When you cannot take the divisor out of the dividual, you must put a cipher in the quotient, and take another Figure from the dividend: and if, again, you cannot take it, place another cipher in the quotient, and then seek again.

8thly. When at any time, after you have subtracted, there remains nothing, and yet there remains a cipher or ciphers in the dividend, it or them must be put in the quotient as part of it, and the work is done, and there will be no remainder.

The Short Italian Way of Division.

There is another way of Division shorter than the foregoing; because you omit setting down the several products of your multiplication, but multiply and subtract together; and is like the common *scratch* or *cancelling* way of Division, only you are not at the trouble of removing your divisor every time you seek, as in that way you are.

Example.

Let us divide the second Example in page 100, by this, as it is called, *Short Italian Way; viz.* Divide 16790 days by 365. In order to the work, I set it down as before, thus:

```
365)16790(46
     • •
    -2190
    -----
      (0)
```

Here I seek, as before, how oft I can have 3 in 16, my point being under 9, for the dividual, and I find I can have but 4 times; wherefore I put 4 in the quotient, and multiply the divisor, as before, saying 4 times 5 is 20, but I do not set down 0, and carry 2, as in the other way, for the product must not be set down, as was said before, but forthwith subtract, saying 4 times 5 is 20, 20 from 9 I cannot, but 20 from 29 (borrowing two tens) and there remains 9, which *I* set under the line; then 4 times 6 is 24, and 2 that *I* borrowed is 26, from 7 I cannot, but 26 from 27, and there remains 1, which *I* also set down, then 4 times 3 is 12, and 2 that *I* borrowed is 14, from 16, and there remains 2, which *I* place under

the line; then there is a remainder of 219, to which *I* bring down the cipher out of the dividend, and then *I* have the last dividual 2190; then *I* say the 3's in 21, 6 times, by which *I* multiply the divisor, saying, 6 times 5 is 30, from 0 *I* cannot, but 30 from 30 (borrowing 3 tens) and there rests 0; then 6 times 6 is 36, and 3 that *I* borrowed is 39, from 9 *I* cannot, but 39 from 39, and there remains 0; then 6 times 3 is 18, and 3 that *I* borrowed is 21, from 21 and there remains 0: and so the work is done.

Let another Example be this: Divide 345678901 by 2345, which is the third Example in page 101.

```
2345)345678901(1
     11117
     -----
```

Here *I* say, once 5 is 5, from 6, and there remains 1, &c. then *I* bring down the 7, and set 4 in the quotient, and say 4 times 5 is 20, from 7 *I* cannot, but 20 from 27, and there remains 7. Then 4 times 4 is 16, and 2 that *I* borrowed is 18, from 1 *I* cannot, but 18 from 21, and there remains 3. Then 4 times 3 is 12, and 2 is 14, from 1 *I* cannot, but 14 from 21, and there remains 7. Then 4 times 2 is 8 and 2 is 10, from 11, and there remains 1; so that there remains 1737, to which *I* bring down the next figure 8, for the dividual and the work stands thus:

```
2345)345678901(14
     11117
     -----
     17378
```

Again, *I* seek, and put 7 in the quotient, and say, 7 times 5 is 35, from 8 *I* cannot, but 35 from 38, and there remains 3. Then 7 times 4 is 28, and 3 that *I* borrowed is 31, from 7 *I* cannot, but 31 from 37, and there remains 6. Then 7 times 3 is 21, and 3 that *I*

borrowed is 24, from 3 I cannot, but 24, from 33, and there remains 9. Then 7 times 2 is 14, and 3 that I borrowed is 17, from 17, and there remains 0. Then I bring down the next figure 9, and the work appears thus:

```
2345)345678901(147
     ...
     -----
     11117
     -----
      17378
      -----
       9639
```

Then I bring down the rest of the figures, one after another, working as before, till the whole is finished, in the following manner:

```
2345)345678901(147411
     .....
     ----
     11117
     -----
      17378
      -----
       9639
       -----
        2590
        -----
         2451
         -----
```

Remainder (106)

Thus have I explained both the Italian ways of Division, leaving it to the learner to use which he likes best. But my method will be to pursue the first Italian way through the remaining part of this book, it being very plain and easy to be understood.

There is a very short way of Division (*I* think the shortest that can be) by cancelling; and so *I* shall give one Example to shew its brevity, my design in this book being not only to shew the most intelligible, but the shortest way of working in all the Rules.

Example.

```
                    11(1
                    472(4
                  142584(3
Divide 6945407 by 276)6945407(25164
```

First, I seek, and I find I can take 2 times, and say, twice 6 is 12, from 4 I cannot, but 12 from 14, (the 2 bring over the point or stop for the first dividual) and there remains 2; then twice 7 is 14, and 1 is 15, from 19, 4; and twice 2 is 4, and 1 is 5, from 6, 1; and then there is 1425 for a new dividual, &c. See the work, the quotient being 25164, and the remainder 143.

VIII. When there is a cipher or ciphers, in the divisor, towards the right hand, you may cut it, or them off, with a downright stroke of the pen, and also do the same with as many figures or ciphers, to the right of the dividend, and then divide the remaining figures of the dividend by the remaining figures of the divisor, as if there had been no ciphers in the divisor or dividend; and what you cut off from the dividend is the remainder, or part of it, for what remains after the work is done, must be put to what you cut off from the dividend, for the whole remainder.

Examples.

```
                                  By the Short Italian Way.
24|00)7694|06(320          3451000)8092320|000(23456
      72                           1192
      ---                          ----
       49                          1573
       48                          ----
      ----                         1932
Rem.   1406                        ----
                                   2070
                                   ----
                                Rem.  0
```

For the first 0, in these Examples, there are two ciphers in the divisor, wherefore I cut off two places from the dividend, and divide 7694 by 24, and there remains 14 at the last: to which I bring down the two places cut

off, viz. 06, and annex them to the 14, for the whole remainder, viz. 1406, and the quotient is 320.

In the ſecond Example, there are three ciphers in the diviſor, which *I* cut off, and alſo as many in the dividend, and divide by 345, and the work is done, and there remains nothing.

IX. Any Diviſion ſum, when the diviſor is ſuch a number that any two digits or numbers in the Multiplication Table being multiplied together, do make it, viz. the diviſor, then ſuch ſum may be done at two diviſions, or by component parts, much ſooner, and in fewer figures than at one.

Examples.

Divide 16560 by 48.

At one diviſion.	*At two diviſions or component parts.*
48)16560(345	6)16560
...	
144	8)2760
216	345 Quotient.
192	
240	
240	
0	

Here the two numbers in the Table, multiplied together, that make the diviſor, are 6 and 8, for 6 times 8 is 48, the diviſor; wherefore *I* divide the dividend 16560, by 6, and the quotient is 2760, which *I* divide by 8, the ſecond number, and the quotient, by that, is the true quotient ſought, viz. 345, as in the common way.

Bring 1212288 ounces of Raw Silk, into pounds of 24 ounces.

At one division.

```
24)1212288(50512
   .....
   120
   ---
    122
    120
    ---
      28
      24
      --
      48
      48
      --
      (0)
```

At two divisions, or component parts.

```
12)1212288
   -------
 2) 101024
    ------
      50512 Quotient sought.
```

Here are eleven figures difference between one way and the other.

More Examples.

At one Division.

```
72)488808(6789
   ...
   432
   ---
    568
    504
    ---
     640
     576
     ---
      648
      648
      ---
      (0)
```

By two divisions, or component parts,

```
8)488808
  -------
9)61101
  ------
   6789 Quotient.
  ------
```

Here if *I* had taken 6 and 12 for my divisors, they would have produced the same quotient, for 6 times 12 is 72, as well as 8 times 9.

56 *the divisor.*	99 *the divisor.*
7)18648	9)537768
8) 2664	11) 59752
333 *Quotient sought.*	5432

If there happen to be any remainder, either in the first or second division, or in both, yet the quotient will be the same. But when there are remainders, the way to find the true remainder, as if you divided at once, is to multiply the first divisor by the last remainder, taking in the first remainder, if any be.

OF MONEY.

X. Now *I* will shew how to divide pounds, shillings, and pence, without reducing them any other way than in your mind; and also how this Rule answers many questions that seem to require a recourse to *The Rule of Three* for their solution.

Divide 12*l.* 10*s.* 6*d.* among 5 persons.

Divisor 5)12 10 6 *Dividend.*

Each must have 2 10 $1\frac{1}{5}$ *Quotient*, or *Answ.*

Here *I* say, the fives in 12, twice, and the remainder 2 which are 2*l.* (for the remainder is always the same with your dividend) or 40*s.* and 10*s.* in the shillings place, is 50*s.* the fives in 56, 10 times, which *I* put in its place viz. under the place of shillings. Then the fives in 6 once, and there remains 1, which is $\frac{1}{5}$ of a penny. So each man must have 2*l.* 10*s.* 1*d.* $\frac{1}{5}$.

The Common Way.

The foregoing work is much sooner done, and looks a great deal handsomer than that in the margin; for there you are obliged to reduce the 12*l.* 10*s.*6*d.* into pence, and then you divide by 5, and the quotient gives the pence each person must have; and then those pence are brought into pounds, &c. The sum above is proved by the brief rules in Multiplication of Money, sufficiently shewn in that Rule, in the following manner.

	l.	*s.*	*d.*
	12	10	6
	20		
	250		
	12		
5)	3006 ($\frac{1}{5}$		
12)	601		
20)	50	(10	
	l. 2	10	1 $\frac{1}{5}$

l. 2	10	1 $\frac{1}{5}$	each.	
		5	persons.	
12	10	6	*Proof.*	

In this excellent method of Division of several denominations, (for weight or measure may be so divided as well as money) whatever remains, you always bring it (in your mind only) into the quality of the next denomination towards the right hand and if there be any thing there, you take it in, and then seek, &c. as in the foregoing sum, where *I* said, the fives in 12, twice, and there remained 2, which *I* turned into shillings (the name of the next denomination) which, with 10*s.* in the place of shillings, make 50; then *I* say the 5's in 50, &c.

Again, divide *l.* 67 09 4 among 8 persons.

8)

Quotient *l.* 8 08 8 *Answer.*

Here *I* say, the eights in 67, 8 times, and there remains 3*l.* or 60 shillings, and 9 shillings in the place of shillings, is 69; the eights in 69, 8 times, and there remains 5 shillings, or 60 pence, and the 4 pence in the

place of pence make 64 ; the eights in 64, 8 times, and nothing remaining. So each muſt have 8*l.* 8*s.* 8*d.* as by the work above.

If 5 gallons of Brandy coſt 1*l.* 16*s.* 8*d.* what is that the gallon ?

A General Rule.

Divide the money by the quantity. And here *I* ſay, the fives in 36, &c.

	l.	*s.*	*d.*
	5)1	16	8
Anſw.	0	07	4
			5
Proof	1	16	8

If 9 ſtone of Beef coſt - - - what is that a ſtone ?

	9) *s.*	*d.*
	16	6
Anſw.	1	10

If 9 gallons of Arrack coſt - what is that a gallon ?

	9) *l.*	*s.*	*d.*
	4	8	1 ½
Anſ.	0	9	9 ½

If 11 C. of Hops coſt what is that *per* C ?

	11)		
	53	01	6
Anſ.	4	16	6

If the charge of a country feaſt amounts to 314*l.* 16*s.* 8*d.* and it is to be paid by 12 Stewards; what muſt each Steward pay?

12)314	16	8	
Each muſt pay 26	04	$8\frac{1}{2}$	$\frac{8}{12}$
314	16	8	*Proof.*

XI. As in Diviſion of one denomination, according to the 9th Rule of this Chapter, where two numbers in the Multiplication Table make the diviſor, being multiplied together, the work might be performed at two diviſions; ſo in Diviſion of ſeveral denominations, the work may be done after the ſame method, following the directions given in the ſaid 9th Rule.

Example.

A reckoning of 6*l.* 00*s.* 0*d.* among 32 men, what muſt each man pay?

	l.	*s.*	*d.*
4)	6	00	0
8)	1	10	0
Each pays	0	03	9

Here the two numbers are 4 and 8, therefore *I* firſt divide by 4, and then that quotient by 8; or firſt by 8, and then by 4, it will be all one.

If 56lb of Coffee coſt what is that a pound?

7)	*l.*	*s.*	*d.*
	21	11	8
8)	3	01	8
Anſw.	00	07	$8\frac{1}{2}$

10)	*l.*	*s.*	*d.*	
Divide	32	12	6	between 100 persons.
10)	3	05	3	
	0	06	6 $\frac{3}{10}$	each.

If 72 gallons of Wine coſt what a gallon ?

8)	*l.*	*s.*	*d.*
	19	4	0
9)	2	8	0
Anſ.	0	5	4

If 81 ℔ of Nutmegs coſt what a pound ?

9)			
	49	17	3 $\frac{3}{4}$
9)	5	10	9 $\frac{3}{4}$
Anſ.	0	12	3 $\frac{3}{4}$

If 45 *C.* of Hops coſt what a *C.* weight ?

5)			
	120	07	6
9)	24	01	6
Anſ.	2	13	6

A General Rule for Weight.

Having the price of a hundred weight, to know the price of a pound, divide by 7 and 8 (7 times 8 being 56, the half hundred weight) and take the half of the laſt quotient, which half will be the anſwer.

Examples.

If 112lb. of Caſt-Iron coſt what a pound?

7)	*s.*	*d.*
	2	4
8)		4
		$\frac{1}{2}$

The half of a half-penny is $\frac{1}{4}$, Price of a lb.

If 112lb. of Lead coſt what a pound?

7)	
	7*s.*
8)	1
	1 $\frac{1}{2}$

The half is - - - $\frac{3}{4}$

If 112lb. of Sugar coſt what a pound?

7)	*l.* 1	17	4	
8)		05	4	
			8	

The half of 8*d.* is - - - 4 *Anſ.*

If 112lb. of Currants coſt what a pound?

7)	*l.* 3	10	0	
8)		10	0	
		1	3	

The half of 15*d.* is - - $7\frac{1}{2}$

So at any time, in any Division sum, if the divisor be 112, the quotient is soon found by this way of Division by parts.

I will give one Example also by the common way, to shew the tediousness of the one, and the expedition of the other.

The common Way.

Divide *l.* 1476 19 8 $\frac{3}{4}$ between 27 persons.

```
        20
      ------
      29539
         12
      ------
     354476
          4
   --------- 4)
27)1417907(     52515 farthings each.
   ....
    135       12)13128 3/4
    ---
     67       210) 10914
     54
     ---        l. 54  14  0 3/4 Answ.
     139
     135
     ---
      40
      27
      ---
      137
      135
      ---
      (2)
```

The other Way.

```
3)1476  19  8 2/4
  ----------------
9) 492  06  6 3/4 2/3
  ----------------
Ans. l. 54  14  0 3/4
```

Here is a prodigious difference between one way and the other, one having almoſt 60 figures more in the work than the other

Note, That weight and meaſure may be divided by parts as money.

Examples.

If 42 bags of Spaniſh Wool weigh what one bag?

6)	*C.*	*qrs.*	*lb.*
	110	1	00
7)	18	1	14
Anſw.	2	2	14

If 45 pieces of Linen contain what one piece?

9)	*Yds.*	*Qrs.*	*N.*
	2157	0	3
5)	239	2	3
Anſw.	47	3	3

CHAP. VI.

REDUCTION.

I. REDUCTION is wholly performed by Multiplication and Diviſion; and teaches to bring or change numbers of one denomination into numbers of another, without the leaſt alteration of value, though in different terms. For inſtance,

Suppoſe I am to bring 20*l.* into farthings, which when I have done, the work will produce 19200 farthings, which are equal in value to 20*l.* for when they are reduced rightly back again, the laſt quotient will preciſely produce 20*l.* neither more nor leſs.

II. All great names are brought into ſmaller, of equal value, by Multiplication: that is by multiplying the given number by as many of the next leſſer name as makes one of that greater; as pounds into ſhillings, pence or farthings. Or tons weight into pounds weight, &c.

III. All ſmall names are brought into greater, of equal value, by Diviſion; that is, by dividing the given number, by as many of the leſſer as make one of the next greater name; as farthings into pence, ſhillings or pounds. Or, pounds weight into quarters, hundreds or tons weight.

Example 1.

In 20*l.* how many farthings?
20 ſhillings make a pound.

400 ſhillings in 20*l.*
12 pence make 1 ſhill.

4800 pence in 20*l.*
4 farthings 1 penny.

19200 farthings in 20*l.*

20*s.*
12

In a pound 240 pence
4

In a pound 960 farthings.

Or thus:
20*l.*
960 farthings in a pound.

Anſw. 19200 farthings.

In the queſtion above it is required to bring pounds into farthings, which is a great name to be brought into a ſmaller; which, according to the 2d Rule of this chapter, is to be done by multiplication; wherefore, as is there directed, I multiply the given number 20*l.* by 20, the ſhillings in a pound, and the product is the ſhillings in 20*l.* then thoſe ſhillings by 12, the pence in a ſhilling, and the product is the pence in 20*l.* and thoſe pence by 4, the farthings in a penny, and that product

is the farthings in 20*l.* and the anſwer to the queſtion, as may be ſeen by the preceding work.

Or as before, I multiply the 20*l.* by 960, the farthings in a pound; but *I* multiply 960 by 20, though the 20 be uppermoſt, to ſave room; for at any time, the multiplier may be multiplied by the multiplicand, the product being the ſame either way.

By the foregoing methods are all Reductions deſcending (that is, from great denominations to leſſer) worked, whether they be money, weight, or meaſure, that is, by conſidering how many of the next leſſer make a unit or one of the foregoing greater denominations, as before directed, and then multiply accordingly, deſcending from one denomination to the next till the work is finiſhed. And for further aſſiſtance reſpect muſt be had to the ſeveral Tables of Quantity in money, weight, and meaſure, in the 2d Chapter of this book.

Pounds multiplied by 20 produce ſhillings; ſhillings multiplied by 12 give pence; pence multiplied by 4 produce farthings.

Farthings divided by 4 are pence; pence divided by 12 quote ſhillings; ſhillings divided by 20 are pounds.

Example 2.

In 19200 farthings how many pounds;

```
4)19200
  ------
12) 4800
    -----
210) 4010
     -----
  l. 20 Anſw.
```

Or thus:

```
9610)192010(20l.
     192
     ---
      (0)
```

Here it is required to bring farthings into pounds, which is a ſmall name into a greater; and therefore, according to the 3d Rule of this Chapter, it is done by Diviſion; wherefore I divide the given number 19200 by 4, the farthings in a penny, and the quotient is pence, and thoſe pence I divide by 12, the pence in a

ſhilling, and the quotient is ſhillings; and thoſe ſhillings I divide by 20, the ſhillings in a pound, and the quotient is pounds, to wit, 20*l.* and is a ſure proof of the foregoing Example.

Or I divide the 19200 farthings by 960 the farthings in a pound, and the quotient is the ſame, viz. 20*l.*

Example 3.

In 576*l.* how many ſhillings, pence, and farthings?

By 20

11520 ſhillings.

By 12

138240 pence.

By 4

552960 farthings

This is a great name to be brought into a ſmaller, and therefore I multiply.

Example 4.

In 552960 farthings, how many pence, ſhillings, and pounds?

Divide by
4)552960
12)138240
20)11520

l. 576 *Anſwer and Proof.*

This is the reverſe of the 3d Example, and a ſmall name to be brought into a great, and therefore I divide, and find 576*l.* the anſwer and proof to the ſaid Example; for Reduction aſcending proves Reduction deſcending, and the contrary.

Note, When you are to bring ſhillings into pounds (let the number be what it will) cut off the laſt figure

or cipher, towards the right hand, and halve the other towards the left, (which is dividing by 20, but ſhorter) and that half ſhall be pounds, and the figure cut off is ſhillings; and if any thing remain, after the halving of the laſt figure, which is never more than 1, it muſt be joined to the figure, or cipher, cut off, as in the 4th Example foregoing, and in the following, viz.

Bring 42317 ſhillings into pounds.

l. 211 : 17

Here the $\frac{1}{2}$ of 4 is 2, the $\frac{1}{2}$ of 2 is 1, and the $\frac{1}{2}$ of 3 is 1, and there remains 1, which is one ten, which muſt be put to the 7 cut off, and it makes 17*s.* ſo the whole is *l.* 211 : 17, as above. By the ſame method may hundreds weight be reduced into tons.

A General Rule.

When you have pounds to be reduced into farthings, multiply by 20, by 12, and by 4; or by 960, the farthings in a pound.

When you have farthings to be reduced into pounds, divide by 4, by 12, and by 20, or by 960.

If pounds are to be brought into pence, multiply by 240, the pence in a pound; if the contrary, divide by 240.

Example 5.

Reduce 476*l.* into pence.

```
   240
 ------
 19040
 952
 ------
ence 114240
```

Or thus: [According to the 8th Rule of Chap. IV.

```
   476
    12
 ------
  5712
     2
 ------
114240
```

Here I multiply by 12, and by 2, twice 12 being 24, and for the cipher I add it at the last.

Reduce 114240 pence into pounds, by dividingby 240)114240(476 *Answ.*

```
 96
 ---
 182
 168
 ---
  144
  144
  ---
   (0)
```

Or thus.

```
12)114240
  ---
 2)  952
     ---
 Answ. l. 476
```

Here in the second way, after I have cut off a place from the dividend, for the divisor's cipher, I divide by 12 and by 2, which multiplied together make 24; and for the cipher, to make it 240, there is a place cut off from the dividend; so that I divide only by 12, and by 2, according to the 9th Rule of the foregoing Chapter. See the work above.

By the second way there are many figures and much trouble saved, as may be seen by comparing one way with the other.

Example 6.

Bring 476 pounds into farthings, by multiplying by

```
  960
  476
  ---
 5760
6720
3840
------
456960 farthings.
```

Or thus:

```
 l. 476
      8
 ----
 3808
   12
 ----
456960 farthings
```

In the ſecond way I multiply by 8, and by 12, according to the 8th Rule of the 4th Chapter, 8 times 12 making 96, and I add the cipher at laſt.

Example 7.

Bring 456960 farthings into pounds, by dividing by 9610)456960(476*l.* *Anſ.*

```
384
---
 729
 672
 ---
  576
  576
  ---
    0
```

Or thus:

```
8)4569610
---------
12) 5712
--------
 l. 476  Anſ.
```

IV. When the ſum to be reduced conſiſts of ſeveral denominations, as pounds, ſhillings, and pence; or tons, hundreds, quarters, and pounds, then you muſt multiply as before, but you muſt take in the ſhillings, pence, or farthings, that ſtand in each denomination, as you reduce the higher name to the next inferior.

Example 8.

```
In l. 426   19   8 ½ how many farthings?
      20
    ----
    8539 ſhillings.
      12
    -----
   102476 pence.
        4
   ------
Anſw. 409906
   ------
```

Again, marks are brought into pounds by deducting $\frac{1}{3}$, Example the 9th.

In 746	00	0	marks, how many pounds ?	
248	13	4	the $\frac{1}{3}$ to be deducted.	
497	06	8	*Ans.* and *Proof* to the Exam. above.	

In 40 marks, and 90 groats, and pounds in number 10,
The pence and farthings there contain'd, *I* ask it from [your pen ?

Answer, { 9160 pence.
36640 farthings.

The 10th Example foregoing may be done by Multiplication, thus:

		l.	*s.*	*d.*	
746 marks at			13	4	
				10	
Or thus:					
746		6	13	4	Value of 10 marks.
4				10	
2984		66	13	4	Ditto 100 marks.
4				7	
12)119360		466	13	4	Ditto 700
		26	13	4	Ditto 40
210) 99416-8		4	00	0	Ditto 6
l. 497 06 8	*Ans.*	497	06	8	746

In the Example on the left hand, after *I* have multiplied by 4 and by 4, *I* annex a cipher, to make the last product pence, in regard that there's a 0 in 160, the pence in a mark.

Example 11.

In *l.* 389 10 how many florins, at 3*s.* 2*d*?

```
     20                          12
   ------                        --
   7790                          38 pence.
     12
   ------ Florins
38)93480(2460 Answer.
   76...
   ----
    174
    152
    ----
     228
     228
     ---
     (0)
```

Example 12.

In 2460 florins, at 3*s.* 2*d.* how many pounds [Sterling?

```
     38                          12
   ------                        --
   19680                         38 pence.
   7380
   ------
12)93480 pence.
   ------
2[0) 7791[0
   ------
```

l. 389 10 *Answer and Proof.*

*** At any time when you can discover how many of one sort of pieces, or coin, are equal to any number of the other, the example is speedily done by multiplying by the lesser, and dividing by the greater number.

Example. n 542-4*d.*, how many 13*d.* $\frac{1}{2}$? Multiply by 3, and divide by 9. *Answ.* 18 $\frac{2}{3}$ pieces, there being three 4*d.* $\frac{1}{2}$, in 13*d.* $\frac{1}{2}$, and 9 half-pence in 4*d.* $\frac{1}{2}$.

Example 13.

In 2712 guilders, at 2*s.* each, how many rix-dollars, [at 4*s.* 5*d.* ½?

```
   96                                          12
 ----                                        ----
 16272          Halfpence, 48 in 2s. ---
24408                              2        53
 ------                            ---       4
214)260352(1216 rix-doll. qrs. 96 in a guil.---
    214...                                  214 qrs. in
    ----                                    [a dollar.
     463
     428
     ---        Here the answer is 1216 rix dollars,
      355       and 128 farthings remainder, or 2s. 8d.
      214
      ---
       1412
       1284
       ----
       (128)
```

Pounds are brought into guineas by multiplying by 20, and dividing by 21, thus:

In 730*l.* how many guineas?

```
      20
   ------
7)14600
   ------
3) 2085-5
   ------
```

Ans. 695 guineas, and 5*s.* over.

If I had nobles 80 score, and marks just 52,
In part of 1400 pounds, what money rests still due?
Answ. 832*l.*

In 695 guineas and 5*s*. how many pounds?

	Guin.	s.	
	695	5	
	7		and 3 multiply by.
	4865		
	3		
210)	14600		the 5 shillings taken in.
	l. 730		*Proof.*

Example 14.

In 798*l*. how many nobles, marks, crowns, shillings, pence, and farthings.

I bring the nobles into marks by dividing them by 2, because 2 nobles make a mark.

Nobles, in 20*s*.	3
Nobles, - -	2)2394
Marks, -	1197

	l.
	798
Crowns in a pound,	4
Crowns, - -	3192
8hill. in a crown,	5
Shillings, - -	15960
Pence in a shillings,	12
Pence, - -	191520
Farth. in a penny	4
Farthings, - -	766080

Examples for Practice.

In *l.* 74622 17 6 how many half-crowns?

Multiply by 8, and take in 7. *Answ.* 596983.

In *l.* 22740 13 4 how many nobles?

Multiply by 3, and take in 2. *Answ.* 68222.

In 76543 bitts of Jamaica, each 7*d.* $\frac{1}{2}$ Sterling, how many pounds Sterling? *Answ.* *l.* 2391 19 4 $\frac{1}{2}$

In *l.* 1725 19 4 Sterling how many Spanish dollars, at 4*s.* 4*d*? *Answ.* 7966.

In 279623 milreas of Portugal, at 5*s.* 3*d.* $\frac{1}{4}$, how many pounds Sterling? *Answ.* *l.* 73692 06 2 $\frac{3}{4}$

In 1276 moidores, at 26*s.* 6*d.* how many guineas, at 21*s.* *Answ.* 1610 $\frac{48}{252}$.

In 150000 crusadoes, each 400 reas, 1000 reas to a milrea, at 5*s.* 6*d.* Sterling, how many pounds Sterling? *Answ.* 16500.

In *l.* 3400, how many crowns, half-crowns, shillings, groats, and three-pences, and of each the same number? *Answ.* 7486 pieces of each sort, and 18*d.* over.

AVOIRDUPOIS WEIGHT.

In reducing this weight, Troy Weight, or of Meaſure, Time, &c. You muſt be acquainted with the Tables of Quantity in the 2d Chapter of this book.

Example 1.

Tons. C. qrs. lb.
In 24 14 3 15 how many pounds weight?
20 C. 1 Ton

494 hundreds weight.
4 qrs. 1 C.

1979 quarters.
28 lb. 1 qr.

15837
3959

55427 *Anſw.*

Here are great names to be brought into ſmaller, and therefore to be done by Multiplication; wherefore *I* multiply, according to the Table in the afore-mentioned Chapter, viz. by 20, by 4, and by 28, taking in the odd weight in each denomination, as in reduction of money; and the laſt product is the anſwer, viz. 55427 lb.

Example 2.

In 55427 pounds how many tons, &c.

```
                 4)
28)55427(        1979
   ...           ----
   28      210) 4914-3
   ---          ------------
   274  Tons, 24  14  3  15 Answer.
   252          ------------
   ---
    222
    196
    ---
     267
     252
     ---
     (15)
```

Here *I* proceed reverſely, dividing by 28, by 4, and by 20. Or this Diviſion ſum may be done by 4 and 7, the component parts of 28.

In 5036 pounds weight of Cotton, how many hundreds weight.

	C.	*qrs.*	*lb.*
Anſw.	44	3	24

Example 3.

	C.	*qrs.*	*lb.*	*oz.*	*drs.*	
In	24	3	24	12	14	how many drams?

```
 4 qrs. 1 C.
 ---
 99 quarters.
 28 lb. 1 quarter.
 ----
  796
 200
 ----
 2796 pounds.
   16 oz. 1 lb.
 -----
 16778
 2797
 -----
 44748
   16 drams 1 oz.
 ------
 268492
 44749
 ------
```

In 16)715982 drams, how many hundreds, &c?

```
 64 ...      16)44748          4)
 ----          32 ...      28)2796(99 qrs.
  75           ----          252  ----
  64            127           ---- 24 3
 ----           112          276
 119            ----         252
 112             154         ----
 ----            144         (24)
   78            ----
   64             108
  ----             96
   142             ----
   128             (12)
  ----
```

(14) *C.* 24 3 24 12 14 *Ans.* and *Proof.*

Example 4.

In *C.* 24 3 26 how many pounds?

```
 4
 --
 99
 28
 --
 798
200
 ---
*Ans.* 2798 pounds.
```

Or thus:

```
112 lb. a C. weight.
 24 the number of C.
 ---
 448
224
 110 the odd weight.
 ---
lb. 2798 Answer.
```

Example 5.

```
      C.   qrs.  lb.
In   425    3    22  how many pounds?
Mult. by 112
 ----
 5100
425
  106 odd weight.
 ----
 47706 Answer.
```

Here I say, 12 times 5 is 60, &c and take in the odd weight at last.

A quicker Way.

Hundreds, quarters, and pounds, may be speedily reduced into pounds, thus: Set down the gross hundred four several times, in the form following, and take in the odd weight as above.

```
      C.   qrs.  lb.
In    24    3    26  how many pounds?
  24
 24
24
  110 odd weight.
```

Answ. 2798 pounds, as above.

Here is nothing to do but to set the hundreds down as before, with the odd weight, and add them together and therefore it is the shortest way of all others to reduce hundreds gross into pounds.

More Examples.

In C. 27 3 19 how many pounds?

```
  27                    112 lb. 1 C. wt.
 27                      27
27                      ----
 103 odd weight.        784
 ----                  224
Answ. 3127 pounds.      103 odd weight.
 ----                  ----
                       3127 Proof.
```

In 1 hogshead, *qt.* C. 7 ½ 12 lb. how many pounds?

```
7
7
7
68 odd weight.
----
Answ. 852 pounds.
```

C. qrs. lb.
In 256 1 17 how many pounds?

```
256
256
256
 45 odd weight.
----
Answ. 28717 pounds.
```

In C. 476 ¼ 24lb. of Copper, how many pounds?
Answ. 53364 lb.

In C. 4 3 27 how many pounds?

```
  4                     112 lb. 1 C. wt.
 4                        4
4                       ----
111 odd weight.         448
----                    111 odd weight.
559 Answ.               ----
----                    559 Proof.
```

Examples at large.

In C. 9 $\frac{1}{2}$ 14lb. of Indigo, how many pounds?

```
 112
 ----
 1078  Anſ.
```

In C. 246 $\frac{3}{4}$ of cotton yarn, how many pounds? *Anſ.* 27636.

	Tons.	*C.*	*qrs.*	*lb.*
In	276	12	3	24 of Cheeſe, how many pounds?

Anſ. 619692.

In 574859 pounds of Copper, how many tons, &c?

	Tons.	*C.*	*qrs.*	*lb.*
Divide by 112, &c. *Anſ.*	256	12	2	19

In 426 C. of Tobacco, how many boxes, each to weigh 12 lb. *Anſ.* 3976.

In C. 417 3 12 of Pimento, how many caſks, each C 3 $\frac{1}{4}$ 26 lb? *Anſ.* 120.

In 242 caſks of Nutmegs, each C. 3 $\frac{1}{2}$, how many ounces? *Anſ.* 1517824.

Suppoſe 6 Oxen weigh C. 38 2 8 how many ſtone? *Anſ* 540.

Turkiſh ſilk of 24 ounces to the pound is reduced to pounds of 16 ounces by adding $\frac{1}{2}$, becauſe 8, the $\frac{1}{2}$ of 16, is the difference between 16 and 24.

Example.

Reduce 756 lb. of Tripoli Belladine Silk, of 24 ounces to the pound, to 16 ounces to the pound.

```
   756                    Short Way.
    24                       756
   ----                      378 the ½ added.
   3024                      ----
  1512                       1134
  ----                       ----
16)18144(1134 Anſwer.
```

If I have C. 155 3 22 of Beef for sea use, and to be cut into pieces, viz. into $\frac{1}{2}$ pound pieces, pound pieces, pound and $\frac{1}{2}$ pieces, 2 pound pieces, 3 and 4 pound pieces, and of each of these quantities an equal number, *i. e.* as many pieces of 4 pound each, as of pieces of $\frac{1}{2}$ pounds, &c. each, what is the number?

Answ. 1455 pieces, and $\frac{6}{12}$, or $\frac{1}{2}$ piece of each, *qt.*

TROY-WEIGHT.

lb. oz. dwt. gr.

In 212 10 17 22 how many grains?

12 ounces 1 pound.

2554 ounces.

20 dwt. 1 ounce.

51097 penny-weights.

24 grains 1 dwt.

204390
102196

1226350 grains, *Answ.*

In 1226350 grains, how many pounds, &c.

```
                 210)
24)1226350(      510917
    ....
  120          12)2554   17
  ---             ----------
   26          lb. 212   10   17   22
   24             ----------
   --
   235
   216
   ---
    190
    168
    ---
    (22)
```

In 246 ingots of silver, each weighing 4 lb. $\frac{1}{2}$ Troy how many ounces? *Ans.* 13284 oz.

Out of 79640 oz. of silver, how many snuff-boxes may be made, each to weigh 3 oz. $\frac{3}{5}$?

Ans. 21237 boxes, $\frac{9}{15}$, or $\frac{3}{5}$.

What quantity of gold must there be to make 674 funeral rings, each to weigh 3 dwt. 12 gr?

Ans. 117 oz. 19 dwt.

In 47624 bars of Spanish silver, each 36 oz. $\frac{1}{4}$, how many ounces? *Ans.* 1726370 oz.

How many tankards, each to weigh 19 oz. $\frac{1}{2}$ of silver, may be made out of 8658 oz. *Ans.* 444 tankards.

CLOTH MEASURE.

Yds. qrs. n.
In 246 3 2 how many nails?
4 qrs. 1 yard

987
4 nails 1 quarter.

Ans. 3950 nails.

In 426 ells Flem. how many ell Eng.
3 qrs. 1 ell Flemish.

5 qrs. 1 ell Eng. 5)1278 qrs.

English ells 255 $\frac{3}{5}$

Or you may multiply by 6 half quarters, and divide by 10 half quarters, which is shorter, because in dividing by 10 you only cut off a figure from the dividend, and the work is done.

In 5426 ells Flemish, how many yards?

3

4)16278

Answ. 4069 $\frac{2}{4}$ or $\frac{1}{2}$ yard.

In 376 French aulns or ells how many yards?

6 qrs. 1 French auln.

4)2256

564 yards, *Answer.*

In 47290 ells Flemish, how many ells English, and yards? *Answ.* 28374 ells Eng. 35467 yards $\frac{1}{2}$.

In 40 score of Flemish ells, how many ells of French?
'Twas given by a prodigal unto a saucy wench.
Answ. 400 ells French.

In 564 yards, how many aulns?

4

6)2256

376 *Ans.* and *Proof* to 376 French aulns foregoing.

Ells English are reduced into yards by adding $\frac{1}{4}$.

More Examples.

In 426 ells English, how many yards?

106 2 the $\frac{1}{4}$ to be added.

532 2 *Facit.*

On the contrary, yards are brought into ells English by subtracting $\frac{1}{5}$.

In 532 $\frac{1}{2}$ yards how many ells English?

106 the $\frac{1}{5}$ to be subtracted.

Answ. 426 ells English.

Ells Flemish are are brought into yards by deducting $\frac{1}{4}$.

In 5960 ells Flemish, how many yards?

1490 the $\frac{1}{4}$ to be subtracted.

4470 yards.

Yards are reduced into ells Flemish by adding $\frac{1}{3}$.

In 4470 yards, how many ells Flemish?

1490 the $\frac{1}{3}$ to be added.

5960

In 45 packs of cloth, each 45 pieces, and each piece 45 ells Flemish, how many ells and yards English?

Answ. 54675 ells. 68343 $\frac{3}{4}$ yards.

Ells Flemish are brought into ells English, as expressed before, viz. by multiplying by 6, and dividing by 10, or cutting off the last figure or cipher.

In 4920 ells Flemish, how many ells English?

6

---

10)29520

Ans. 2952 ells English.

Ells English are reduced into ells Flemish, by adding a cipher, and dividing by 6, or by adding $\frac{2}{3}$.

In 4726 ells English, how many ells Flemish?

6)47260

Answ. 7876 $\frac{4}{6}$ or $\frac{2}{3}$ ells Flem.

Or thus:

4726
1575$\frac{1}{3}$ } The $\frac{2}{3}$ to
1575$\frac{1}{3}$ } be added.

As before, 7876$\frac{2}{3}$.

LIQUID MEASURE.

Tons. Hhds. Gals.
In 65 2. 24 how many pints of wine ?
4 Hhds. 1 ton

262 Hhds.
63 Gallons 1 Hhd.

790
1574

16530 Gallons
8 Pints 1 Gallon

132240 Pints, *Answer*,
In 8) 132240 pints of wine, how many tons, &c. ?

63) 16530 (4)
126 ·· 262 Hogsheads
Tons 65 *Hhds.* 2 *Galls.* 24

393
378

150
126

(24)

In 20 tons of Beer, how many quarts ?
4 hogsheads 1 ton

80 hogsheads
54 gallons 1 hogshead of Beer

320
400

4320 gallons
4 quarts 1 gallon

17280 quarts, *Answer*.

54 Gallons make a hogſhead of Beer, therefore to bring firkins into hogſheads, take one ſixth part, or divide by 6, and it quotes hogſheads, becauſe 6 times 9, the gallons in a firkin, make 54.

To bring hogſheads into barrels, add $\frac{1}{2}$, becauſe 18, the $\frac{1}{2}$ of a barrel, and 36, the whole, make 54, the hogſhead. To bring kilderkins into hogſheads divide by 3, becauſe 3 times 18 makes 54. Barrels are brought into tons, by dividing by 7, as follows.

In 7)420 barrels, how many tons ?

60

In 40 butts of curious Beer, by people called ſtout, How many quarts may thence be drawn before thoſe butts are out. *Anſ.* 17280.

Examples.

Admit a ſhip's cargo from the Canaries to be viz. 250 pipes, 130 hogſheads, and 150 quarter-caſks, how many gallons in all ? And allowing every pint to be a lb. what is the weight alſo ?

Anſwer, 44415 gallons. 158 tons 12 C. $\frac{1}{2}$.

In 444 firkins of Ale, how many pints ?

Anſwer, 2841 C.

In 74640 pints of Beer, how many barrels ?

Anſwer, 295 $\frac{6}{36}$.

In 45 fats or vats of Rheniſh Wine, each 242 gallons, how many Aumn caſks, each 42 gallons ?

Anſw. 295 $\frac{12}{42}$.

Note, Rheniſh Wine is ſold by the Aumn, of about 42 gallons.

In 57 pipes and 42 gallons of Madeira Wine, how many puncheons, hogſheads, and tierces ?

Anſ. 86 pun. 115 hhds. 42 gall. 172 tier.

In 40 tons, and 50 butts, and 60 pipes of Wine,
How many tierces do they make, admit they came from Rhine? *Answ.* 570.

DRY MEASURE.

Lasts.	*qrs.*	*B.*	*G.*	
In 24	7	6	2	how many gallons of Wheat?
	10 quarters 1 last.			
247 quarters.				
8 bush. 1 quarter.				
1982 bushels.				
8 gallons 1 bush.				
15858				

In 40 lasts of Barley, how many combs? *Ans.* 800.

In 3228 fats or vats of Sea-coal, how many chaldrons and scores? *Answ.* 807 chaldrons. 38 $\frac{9}{91}$ scores.

In 33 weys of Salt, how many quarters, bushels, and pecks? *Answ.* 165 quarters. 1320 bushels. 5280 pecks.

In 20 lasts, and 30 weys of Corn, that's called Rye,
How many bushels do they make, if you by bushel buy?
Answ. 2800 bushels.

In 38880 pecks of Sea coal, how many chaldrons?
Answ. 270.

LONG MEASUEE.

In 50 miles how many barley-corns in length?

```
    8 furlongs 1 mile.
  ----
  400 furlongs.
  220 yards a furlong.
 -----
 8000
800
 -----
88000 yards.
    3 foot 1 yard.
 ------
264000
   12 Inches 1 foot.
 -------
3168000
    3 barleycorns 1 inch.
 --------
9504000 barley corns in 50 miles.
```

In 17490 ſquare poles, how many acres, &c.

```
      160)174910(109 acres.
          16...
          -----
           149
           144
          -----
   40)      510(1 rood.
            4 .
            ---
            10                  Acr. roods. poles.
                          Anſ. 109    1    10
```

Here is a ſmall name to be brought into a great, and therefore it is performed by Diviſion; wherefore *I* divide the ſquare poles by 160, the ſquare poles in an acre, and the quotient is acres, and the remainder is poles which *I* divide by 40, the ſquare poles in a rood, and there comes but one rood, or $\frac{1}{4}$ of an acre, and 10 poles remain. So the whole is 109 acres, 1 rood, and 10 poles, as by the work above.

TIME.

I desire to know how many days, hours, and minutes there are since the birth of our Saviour to this present year?

```
 1770
    6 hours wanting.
 ------
10620 hours to be added
```

```
   1770
    365 days in a year.
 -------
   8850
  10620
  5310
 -------
 646050 days.
     24 hours in a day.
 -------
 2584200
1292100
  10620 hours added.
 --------
15515820 hours.
     60 minutes in an hour.
 ---------
930949200
```

Here in regard that there are 6 hours lost every year (for the year consists of 365 days 6 hours) *I* multiply the years by 6, which produces 10620 hours to be added to the product of hours.

Or it may be done thus: Bring a year into hours, in which you will find 8766, by which multiply that number of years, and that product by 60, and the last product will be the answer; as by the following work.

```
Days.  Hours.
 365   6 a year.
  24   hours 1 day.
 ----
1466
730
 ----
8766
```

```
   1770 years.
   8766 hours in a year.
 -------
  10620
  10620
 12390
14160
 --------
15515820 hours since.
     60
 ---------
930949200 minutes since.
```

From the 6th of June 1682, to the 15th of August exclusively, 1921, how many days; adding 9 days for the leap years, being 1 day every 4th year?

Ans. 14313.

From the 19th of August, 1701, to the 21st of January exclusive, 1717 (noting the leap-years) how many days? *Ans.* 5998.

Here follow some questions promiscuously set for the exercise of the learners ability.

In 305*l.* 12*s.* 7*d.* how many half-pence?

Ans. 146702.

In 3192 lb. weight, how many hundred weight?

Answ. C. 28 $\frac{1}{2}$.

In C. 3 $\frac{3}{4}$ of Tobacco, how many 12 lb. boxes?

Ans. 35.

In 270 lb. 11 oz. 12 dwt. how many penny-weights?

Answ. 65032.

In 730 rix dollars, at 4*s.* 5*d.* $\frac{3}{4}$, how many ducats at 4*s.* 4*d.*? *Ans.* 754 $\frac{118}{208}$, and 2*s.* 5*d.* $\frac{1}{2}$ over.

In 3 lb. 10 oz. of gold, how many wedding rings, each 2 dwts. 12 grains? *Ans.* 368.

In 1260 quarts, how many hogsheads of wine?

Ans. 5 hogsheads.

In 60 kintals of Pruans, how many C. weight (a kintal being 100 lb.) *Answer*, 53 C. 2 qrs. 8lb.

In 506*l.* 12*s.* 2*d.* how many Portugal réis at 20 for 3*d.*? *Ans.* 810560 $\frac{2}{3}$

In 56 boxes of sugar, each 2 C. $\frac{3}{4}$ how many hundred weight? *Ans.* 154.

In 4679 yards how many ells Eng.? *Ans.* 3743 $\frac{1}{5}$.

In 86*l.* how many guineas at 21*s.* 6*d.*? *Ans.* 80.

In 88000 yards, how many miles? *Ans.* 50.

In 14703 ells Flemish, how many yards?

Ans. 11027 $\frac{1}{4}$ yards.

In 75 C. 3 qrs. 24 lb. how many pounds?

Ans. 8504 lb.

In 176 C. 2 qrs. 24 lb. ſugar at Jamaica (the C. weight being 100 lb.) how many C. weight at London (the C. weight being 112 lb?) *Anſ.* 157 C. 3 qrs. 6 lb.

In 6000 French crowns, at 57*d.* each, how many pounds Sterling? *Anſ.* 1425.

In 34 lb. 6 oz. Troy, how many ounces? *Anſ.* 414 ounces.

In guineas ninety, and in piſtoles nine,
How many pence, and what in ſterling coin?

The guineas at 21*s.* and piſtoles at 17*s.* } *Anſ.* 24516 pence. or 102*l.* 3*s.*

In 46 packs of cloth, each pack 24 pieces, and each piece 42 ells Flemiſh, how many ells and yards Engliſh? *Anſ.* 27820 $\frac{4}{5}$ Eng. ells. and 34776 yards.

How many times does a regular clock ſtrike in a year? *Anſ.* 56940.

In 15420 vares of Valencia, 100 of which make 85 yards Engliſh, how many yards and ells Engliſh? *Anſ.* 13090 $\frac{20}{85}$, or $\frac{4}{17}$ yds. and 10472 ells Engliſh.

CHAP. VII.

OF TARE AND TRET.

GROSS WEIGHT is the weight of a commodity, with the weight of the hogſhead, cheſt, caſk, box, wrapper, or any thing elſe that contains the goods: or any quantity given in hundreds, quarters, and pounds is *groſs weight.*

TARE is an allowance made by the feller to the buyer, for the weight of the hogfhead, cafk, cheft, box, bag, &c. wherein the goods are contained. And is fometimes reckoned at fo much per bale, bag, barrel, cheft, &c. as in filks, cotton, raifins, capers. At other times at fo much per C. as 10, 14, 16, or 24 lb. per C. There is alfo a diftinction of Cuftom-Houfe and Invoice *tare*, as in tobaccos and indigos, &c. and fometimes uncertain, as in tobaccos and fugars, happening according to the fize of the cafks.

TARE is an allowonce of 4 lb. upon every 104 lb. *futtle* claimed by freemen of London (and fometimes to others alfo) and this is allowed for wafte and duft on fome forts of goods, as on tobaccos, fpice, drugs, &c.

CLOFF is an allowance of 2 lb. upon every draught above 3 C. weight to the citizens of London.

NEAT WEIGHT is what remains when the allowances are deducted.

Example.

In 29 bags of Hops, containing *grofs* 88 C. 1 qr. 19 lb. *tare* 4 lb. per C. how many C. *neat?*

	C.	qrs.	lb.
Grofs	88	1	19
Tare	3	0	17
Neat	85	1	02

88 1 19
4 lb. per C.

112)353 *tare* (3 C.
336
(17)

I multiply the given hundreds by 4, the *tare* allowed for each hundred, which produces, with 1 lb. allowed for the quarter, 353 lb. *tare*, which I divide by 112, and the quotient gives 3 C. weight, and 17 lb. remains, which I fubtract from the *grofs weight*, and the remainder is C. 85 1 02, for the *neat weight*. See the work.

When the *tare* is at so much *per* C. wt. multiply the *gross weight* by the *tare*, and divide the product by 112, and the quotient will be the *tare*. Or subtract the *tare per* C. from 112, and by the remainder multiply the *gross weight*, and the product divide by 112, and the quotient will be the *neat weight*. Or if you multiply the pounds *gross* by the pounds *tare*, and divide by 112, the quotient gives the pounds *tare*.

In 7 bags of Cotton each 2 C. $\frac{1}{2}$, *tare* 7 lb. *per* bag, how many pounds *neat*?

2 $\frac{1}{2}$ C. each
7
———
17 $\frac{1}{2}$
17
17
17
17,56 the $\frac{1}{2}$ C.
———

7 bags.
7 lb. *tare* each.
———
49 lb. *tare*.
———

From 1960 lb. *gross*.
Subtract 49 lb. *tare*.
———
Answ. 1911 lb. *neat*.

In 27 bags of Pepper, containing *gross* 58 C. 3 qrs. 11 lb. *tare* 4 lb. per bag, how many pounds *neat*?

58
58
58,95 for 3 qrs.
———
11 lb.

27
4 lb. *tare*.
———
108 lb. *tare*.
———

Pounds *gross*, 6591
Tare 108
———
Pounds *neat*, 6483 *Answer*.

Three hogſheads of Tobacco, weight, viz.

	C.	qrs.	lb.		lb.
N°. 1	5	1	17	*Tare*	90
2	6	2	10		87
3	5	3	20		85
	17	3	19		262

17
17
17
17
103 odd weight.
2007 *groſs weight.*
262 pounds *tare.*
1745 pounds *neat.*

How many pounds *neat* ?

Six hhds. of Tobacco, wt. viz. *tret* 4 lb. per 104 lb. and *cloff* 12 lb. how many pounds *neat* ?

	C.	qrs.	lb.		lb.
	4	3	21	*Tare*	76
	5	2	17		96
	6	1	20		100
	4	3	24		84
	7	1	13		102
	5	2	26		98
Groſs	35	0	09		556

35
35
35,9

The *tret* is always found by dividing the *Suttle* pounds by 26, becauſe 4 times 26 is 104.

26)3373(129 lb. $\frac{1}{2}$.
26··
77
52
253
234
(19)

3929 pounds *groſs.*
556 pounds *tare.*
3373 pounds *ſuttle.*
129 $\frac{1}{2}$ pounds *tret.*
3243 $\frac{1}{2}$ reſts.
12 *cloff.*
Anſw. 3231 $\frac{1}{2}$ *neat weight.*

The half-pound in the *tret* is allowed for the 19 pounds remaining.

In four barrels of indigo, *qt.* viz.

		C.	*qrs.*	*lb.*	
N°. 1	*qt.*	4	1	10	*Tare* 36
2		3	3	20	29
3		4	0	19	32
4		4	0	00	35
How many pounds *neat?*		16	1	21	132

Answ. lb. 1709

In 5 barrels of Nutmegs, wt. 18 ½ C. 7 lb. *gross*; *tare* 30 lb. *per* barrel; and *tret* 4 lb. *per* 104 lb. how many pounds *neat?*

		C.	*qrs.*	*lb.*
30 lb. *tare.*		18	2	7
5 barrels.		18		
		18		
150		18,63		
	2079 pounds *gross.*			
	150 *tare.*			
	1929 rests.			
	74 *tret.*			
	1855 *Answ.*			

26)1929(74 lb. *tret.*
182
109
104
(5)

When the *tare* is at so many pounds *per* Cwt. or 112 lb. if it happen to be any part of a hundred weight, it may be sooner done by dividing the *gross weight* by that part, according to the rule of Division of several denominations. As admit it to be at 14 lb. *tare per* Cwt. then take the 8th part of the *gross weight*, or divide it by 8, because 14 lb. is the 8th part of an hundred weight, and the quotient will be the *tare* in *gross weight*, which subtract from the first *gross weight*, and the remainder will be the *neat weight*.

Example 5.

	8) C.	qrs.	lb.	
20 bags, qt.	48	1	24	*gross, tare* 14 lb. *per* C.
	6	0	06 ½	*tare.*
Facit C.	42	1	17 ½	*neat weight.*

Here I say, the eights in 48, 6 times; then the eights in 1, 0 times, but turning it into pounds, that is 28, and 24 in the place of pounds make 52: then the eights in 52, 6 times, and there rests 4, which I multiply by 4, the quarters in a pound, and they make 16; then the eights in 16, twice, or ½ a pound. So the *tare* is 6 C. 0 qrs. 6 lb. and an half, which I subtract from 48 C. 1 qr. 24 lb. and the remainder is 42 C. 1 qr. 17 lb. ½, for the *neat weight*, as by the work above.

If the *tare* be 16lb. *per* Cwt. then divide the *gross weight* by 7, because 16 lb. is the 7th part of a hundred weight.

Example.

	C.	qrs.	lb.	
12 hogsheads, qt.	59	3	14	at 16 lb. *per* Cwt.
Tare	8	1	06	the 7th part.
Neat weight	51	1	08	

If the *tare* be 18 lb. *per* Cwt. then for 16 pounds work as in the last Example; and for the 2 pounds take the 8th part of the quotient and add them together for the whole *tare*.

If the tare be 20 lb. per Cwt. then for the 16 pounds work as before; and for the 4 pounds take the 4th part of the quotient, and add them together for the whole *tare*.

If the *tare* be 8, 10, or 12 lb. *per* Cwt. or any lesser number; then take the half of the *gross weight*, which will make it half-hundreds; then 8 lb. is the 7th part of ½ C. 10 lb is divided into the 7th part, and 4th of

that 7th part; 12 lb. into the 7th part, and half of that part, &c.

Oil is entered at the Cuſtom-houſe, by the gallon, and pays duty accordingly; yet in uncertain caſks it is weighed, and the *tare* allowed is 18 lb. per C. which being deducted, is computed at 7 lb. $\frac{1}{2}$ per gallon; and reduced thus: multiply by 94 (that being the *neat weight* of 112) and the product is the neat pounds, which doubled, brings them into half pounds, which divide by 15, the half pounds in 7 gallons and $\frac{1}{2}$, the quotient gives the contents in gallons, which, if divided by 252 gives tons, &c.

Example.

```
                C.  qrs.  lb.
Reduce         124   3   16 into gallons.
                94
               ---
               496
              1116
               100
              -----
             11756 pounds.
                 2
             -----
Half-pounds 15)23512(1567 7/15 gallons.
               -----
```

Oil in certain caſks, 1 in 20 is allowed for leakage, but under 10 none.

In Candy barrels the *tare* is 29 lb. per barrel; and from New-England 50 lb. per barrel.

In 46 C. of Pruans, *tare* 16 lb. how many C. wt. *neat*?
Anſ. 39 C. 1 qr. 20 lb.

Admit 50 barrels of Oil from New-England to contain

```
  122 C. 3 qrs. 12 lb.
  122
 122
122,96
-------
13760 pounds.
 2500 tare.
-------
11260 neat.
11260
-------
15)22520 half-pounds.
-------
Ans. 1501 1/3
-------
```

Or pounds of Oil are reduced into gallons by multiplying the *neat* pounds by 2, and dividing that product by 3; and that quotient again by 5, gives the *neat* gallons of 7 lb. ½ per gallon.

TARES.

	C.			C.	
Tare of sugars from	8	to	12	1	Allum in casks 12 lb. per C.
	12		15	1	Pot-ashes 10 ditto.
	15		17	1 ¼	Argil or Argol in casks, 14 ditto.
					Almonds in bags, 14 ditto.
					Raisins in frails or baskets, 14 lb. per frail.

Oil 18 lb. per C.
Madder in bales, 28 lb. *tare* per bale.
Ditto in fats, or vats, 10 lb. per C.

Many more Examples might be offered, but those foregoing, I think, are sufficient for the service and improvement of any ingenious person.

CHAP. VIII.

THE

GOLDEN RULE;

OR

RULE OF THREE DIRECT.

THIS is called *The Rule of Three*, from its having three numbers to work with to find a fourth in proportion to them; which fourth number is the anſwer to the queſtion.

It is alſo called *The Golden Rule*, from its excellent uſe and performances in Arithmetic.

And ſometimes *The Rule of Proportion*, becauſe the fourth number bears the ſame rate or reaſon to the third, as the ſecond does to the firſt.

I. Obſerve, that of the three given numbers in any queſtion of this Rule, you have two of them always of one name, or kind; that is, if one be money, ſo is the other; or, if one be weight, the other is ſo alſo; and one of which numbers muſt be the firſt number in ſtating, and the other the third; and that muſt always be the third which moves the queſtion, and the other of the ſame kind muſt be the firſt number; and the other number, which is of another denomination, always poſſeſſes the middle place, and is evermore of the ſame kind with the anſwer, or fourth number ſought. As for Example;

If 12 ells of Holland coſt 36*s*. what will 456 ells coſt at that rate?

Here, in ſtating the queſtion for the work, 456 muſt be the third number, becauſe that is the number that aſketh the queſtion; for it is required to know what will 456 ells coſt? And the other number of the ſame name is to be the firſt, which here is 12: and the laſt number which is of the ſame kind with the number ſought, or anſwer to the queſtion, poſſeſſes the middle place, and when ſtated for the working ſtands thus:

Ells.	*s.*	*Ells.*
If 12 coſt	36,	what 456?

II. Whenever it happens, that either one, or both of the extreme numbers, are of divers denominations, they muſt be reduced into the loweſt name mentioned; that is if they be pounds, ſhillings, and pence; or hundreds, quarters, and pounds; then they muſt be reduced into pence, or pounds weight. And if one of the extremes be of ſeveral denominations, and not the other, yet muſt both be reduced into one name; that is, if one conſiſt of pounds, ſhillings, and pence, and the other only of pounds, yet that number which is only pounds muſt be brought into pence as well as the other, that the firſt and third numbers may be of like name, which always muſt be; that is, if the firſt number be feet, the third number muſt be feet likewiſe; and if one be gallons, the other muſt be gallons alſo, &c. as was ſaid before, if the middle number be of divers denominations, it muſt be reduced into the loweſt name mentioned therein (or lower if there is occaſion) as well as the firſt or third numbers.

III. When the numbers are diſpoſed in ſuch order, as before directed, and ſtated accordingly, then multiply

the 2d and 3d numbers together; that is, the third by the 2d, or the 2d by the 3d (it being all one) and divide that product by the first number, and the quotient of that division will be the answer, and in the same name with the middle number; that is, if the middle number be shillings, so will the quotient also. Or if the middle number be pence, or farthings, so likewise will be the quotient, or answer.

For the better understanding the foregoing notes and directions, I shall comprise them under those short heads following, viz.

1. That must be the third number which asketh the question.

2. First and third numbers must be of one name, or so reduced.

3. The middle number, if of divers denominations, must be brought into the lowest mentioned; or lower if occasion require it.

4. Multiply the second and third numbers together, and divide that product by the first number and the quotient thence arising will be the answer to the question, in the same name you left your middle number in.

The fourth number, or answer to the question, if in a direct proportion, may be found these three several ways, viz.

1. By multiplying the second and third numbers together, and dividing the product by the first, and the quotient will be the answer; as in the fourth direction above.

2. By dividing the second number by the first, and then multiplying that quotient by the third, and that product will be the number sought.

3. By dividing the third by the first, and then multiplying that quotient into the second number, and that product will be the answer.

Though all these ways be equally true, and the two last very concise, when either the second or third terms may be divided by the first, yet the first is most in use.

N. B. When the first term is an unit, the answer is found by Multiplication only. When the second or third term is an unit, then the answer will be found by Division only.

Example 1.

If 12 ells of Holland cost 36 shillings, what will 456 ells cost at that rate?

The numbers being ranked according to the directions given in the first Rule of this Chapter, they stand thus:

```
  Ells.      s.      Ells.
If 12 cost 36, what 456 ?
                     36 second number.
                    ----
                   2736
                   1368
                    ----
The first number, 12)16416
                    ----
                 210) 1368
                    ----
                 Answ. l. 68 08
```

Ans. 1.16; 4; 7.4; 4; 64.16; 3.12; £68.8 Ans.

Here according to Rule, I multiply the third number 456 by 36, the second number, and the product is 16416, which I divide by 12, the first number, and the quotient is 1368, which are so many shillings, because the middle number was left in shillings: then those shillings in the quotient I bring into pounds, according

to the Rule given in Reduction, page 129, by cutting off the figure towards the right hand, and halving those towards the left, and the answer is 68*l.* 8*s.* as may be seen in the work.

Example 2.

If 456 ells of Holland cost 68*l.* 8*s.* what will 12 ells cost at that rate? Stated thus:

```
      Ells.     l.  s.     Ells.
If 456 cost  68   8, what 12?
             20
             ---
            1368
              12 third number.
            ----
First number, 456)16416(36s. Answer.
              1368
              ----
               2736
               2736
               ----
                  0
```

or thus
as 456 : 68 : 8 : : 12
20
38/1368(36
114
228
228

Here the question lies upon 12 ells; for it is asked, what will 12 ells cost? Therefore in the stating it is the third number (as it is also in the question, but sometimes it does not so happen that the numbers in a question lie in such order as they ought to do in stating) and the other of the same name is the first, viz. 456; and the middle number is of the same name you seek for, viz. money; for we want to know how much money 12 ells will cost; but here the middle number is of more denominations than one, viz. of pounds and shillings; and therefore it is brought into the lowest name mentioned, to wit, shillings. Then *I* multiply

the ſecond and third numbers together, and divide their product by the firſt, and the quotient is the anſwer, viz. 36*s.* and is a proof to the firſt Example. And ſo may any queſtion be proved by ſtating it reverſely, or otherwiſe varying the queſtion ſeveral ways.

IV. If after you have divided the product of the ſecond and third numbers, multiplied together, by the firſt number, any thing remains, the value of that remainder may be found, by multiplying the ſaid remainder by the parts of the next inferior denomination, that are equal to one of the quotient; that is, ſuppoſe the quotient is ſhillings, and there is a remainder, that remainder muſt be multiplied by 12, becauſe 12 of them, viz. pence (the next lower denomination) make one of the quotient, to wit, a ſhilling, and divide that product by your former diviſor, the firſt number, and the quotient will be the value of that remainder, in the parts aforeſaid. And if any yet remain, it muſt be multiplied by the parts of the next inferior denomination, that are equal to an unit of the laſt quotient, and ſtill divide by the ſame diviſor, &c. And ſo muſt you proceed till nothing remains, or till you have brought it as low as you deſire.

Example 3.

If one hundred weight of Currants coſt 2*l.* 9*s.* 6*d.* what will 45*C.* 3*qrs.* 14*lb.* coſt at that rate? Stated as in the following page.

```
   lb.      l. s. d.        C. qrs. lb.
If 112 cost 2 9 6, what 45  3   14 ?
      20                  4
     ---                 ---
      49                183
      12                 28
     ---                ---
     594 2d num.       1468
                        367
                       ----
                       5138 3d number.
                        594 2d number.
                      -----
                      20552
                     46242
                    25690
                    -------- 12)
The 1st num. 112)3051972(      27249 pence:
                 224 : : :     -------
                 ---         210) 2271-0-9d.
                  811         ----------
                  784     Ans. l. 113-10-9d. 3/4
                  ---
                   279
                   224
                   ---
                    557
                    448
                   ----
                     1092
                     1008
                     ----
                       84 remainder:
                        4
                    ------
                  112)336(3/4
                      336
                      ---
                      (0)
```

Here the third number is brought into the lowest name mentioned, viz. pounds; therefore the first number, 1 hundred weight, must be in pounds also. Like-

wise the middle number is brought into the lowest name mentioned in that. Then the second and third numbers are multiplied together, and that product divided by the first; and the quotient is pence, because the middle number was reduced into pence; then the pence in the quotient are brought into pounds by Reduction; and they make 113*l.* 10*s.* 9*d.* But there is a remainder of 84; wherefore I conclude that makes something more; therefore I multiply that remainder by 4, the parts of the next inferior denomination, and divide that product by the former divisor, viz. 112, and it quotes 3, which is 3 farthings, and nothing remains: So that the whole is 113*l.* 10*s.* 9*d.* $\frac{3}{4}$. See the work.

Example 4.

If 15 weeks pay come to 2*l.* 12*s.* 6*d.* what is that a year? Stated thus:

```
                W.      l.   s.   d.      W.
          If 15 give    2    12    6, what 52?
                       20
                      ----
                       52
                       12
                      ----
                      630  2d number.
                       52  3d number.
                     -----
                     1260
                    3150
                   ------
                                12)
First number,  15)32760(        2184 pence.
                   30...       -----
                   ----      2[0)1812
                     27       -----
                     15        l. 9-2
                   ----
                    126
                    120
                   ----
                      60
                      60
                      --
                      (0)
```

Example 5.

If one ounce of silver be valued at 5*s.* 2*d.* what is the value of 240 ounces 15 penny-weights?

If 1 *oz.* cost 5*s.* 2*d.* what 240 *oz.* 15 *dwt.*

```
 20        12              20
 --        --              ---
20 dwt.    62            4815 penny-weights.
                           62 2d number.
                          ----
                          9630
                         28890
                         -----
        1st number, 210)298530
                        ------
  10 remainder.      12)14926 10/20
   4 farthings.      ---------
 ----                210)1243-10d.
 210)410             ------------
 ----                Answ. l. 62-3-10 1/2.
   2 qrs.
```

Example 6.

If a ton of wine cost 56*l.* 14*s.* what cost a quart?

```
Hhds.      l.   s.     qt.                d.
 If 4——56  14——1     1008)13068(13 1/2 Answ.
 63        20                1008
 --        ---               ----
 252      1134                3528
  4         12                3024
 ----      ----                ---
1008qts.13608 pence.           504
                                 4
                               ----
                            1008)2016( 1/2
                                 2016
                                 ----
                                  (0)
```

Here the middle number is reduced lower than is mentioned, that being but ſhillings, but I have brought it into pence, becauſe I would have the anſwer the ſooner, by not having ſo many remainders to reduce lower. Here alſo the 2d and 3d numbers are not multiplied together, becauſe I would only produce the ſame figures again; wherefore I only divide the 2d number by the 1ſt, and the quotient is the anſwer in pence agreeable with the middle number, and the remainder, 504, I multiply by 4, and divide again by 1008, according to the Rule, and the quotient produces two farthings more, to be joined to the 13*d.* ſo the anſwer is 13*d.* $\frac{1}{2}$ the quart, as by the work may be ſeen.

Example 7.

Suppope my ſalary be 73 pounds a year, what is that a day?

Days. *l.* *Day.*
If 365 give 73, what 1?
20

365)1460(4*s.* *per* day, *Anſw.*
1460

(0)

Here the year is brought into days, that the firſt number may agree with the third; and here alſo I do not multiply by 1, for the reaſons above ſaid (for an unit of itſelf neither multiplies nor divides) and I cannot divide 73 by 365; wherefore I bring the pounds into a lower denomination, viz. ſhillings or lower, if there be occaſion. Then I divide, according to Rule, and the quotient gives 4*s.* the day for anſwer, agreeable to the ſecond aſſertion of *N. B.* in page 173.

Example 8.

Nutmegs at 4*d.* ½ *per* ounce, what is that the Cwt.

```
   oz.    d.          lb.
If 1 coſt 4 ½, what 112 ?
           4           16
          ---         ----
          18          672
                      112
                     ----
                     1792 ounces.
                       18 2d. number.
                    -----
                    14336
                    1792
                   -----
                 4)32256
                 -------
               12) 8064
                 -------
              210) 6712
                 -------
                    33 12 Anſw.
```

Here the middle number is reduced into the loweſt name mentioned, viz. farthings, by which I multiply the third, and the product is farthings; and, according to Rule, I ſhould divide by the firſt number, but the firſt number being 1, it neither multiplies nor divides (as was ſaid before) and therefore the quotient, or fourth number is the ſame with the product of the 2d and 3d, which is farthings, becauſe the 2d number was farthings, which are reduced into pounds, as above.

I ſhall now ſhew, that many times queſtions in this Rule may be contracted, and much ſooner wrought by another method of working; that is only by following the brief methods of Multiplication and Diviſion, ſufficiently ſhewn in the 4th and 5th Chapter of this book.

Example 9.

If 5 gallons of Brandy coſt 1*l.* 6*s.* 8*d.* what will 63 gallons, or a hogſhead, coſt at that rate?

The Common Way.

```
   G.  l.  s.  d.  g.
If 5—1  06  8—63
     20
     --
     26
     12
    ---
    320 2d num.   1ſt num.
     63 3d num.
    ---
    960
   1920
   ----
 5)20160
   ----
12) 4032 d.
    -----
20) 336
    -----
```

Anſw. l. 16 16

The Short Way.

```
   G.  l.  s.  d.  g.
If 5—1  06  8—63
                 9
              -----
           12 00  0
                  7
              -----
        5)84 00  0
              -----
Anſwer, l. 16 16  0
```

In working by the ſhorter way, *I* do not reduce the middle number at all, but multiply (according to the 14th Rule of the 4th Chapter of this book) by 7 and 9, they multiplied together making the quantity 63, which product *I* divide by 5, the firſt number (according to the 10th Rule of the 5th Chapter) and the quotient is the anſwer, viz. 16*l.* 16*s.* as in the common way. Here in this ſhort method, the rule of ſtating and working is followed, as in the common way; for the 2d and 3d numbers are multiplied together, and their product divided by the firſt; but there is above twenty figures difference between one way and the other.

Example 10.

If the wages of 3 weeks come to 2*l.* 3*s.* 6*d.* what is a year's wages at that rate?

Common Way.

```
Wks.  l.  s.  d.  Wks,
If 3—2 03 6—52
     20
    ——
     43
     12
    ——
    522 second.
     52 third.
   ————
   1044
  2610
  ————
 3)27144
 ————
12) 9048 pence.
 ————
210) 7514
 ————
  l. 37 14 Answ.
```

Short Way.

```
Wks.  l.  s.  d. Wks.
If 3—2 03 6—52
          10
        ————
      21 15 0
            5
        ————— Wks.
     108 15 0—50
l. 2-3-6 mul. by 2. 4 07 0   2
     ————————————————————————
1st number, 3)113 02 0—52
              ————————————
        Answ. l. 37 14 0
```

After I have multiplied by 10, and by 5, which make 50, I multiply 2*l.* 3*s.* 6*d.* the middle number, by 2, which is wanting, and add them together.

How many yards were in that piece of cloth that cost *l.* 14-2-6, the yard being valued at 7*s.* 6*d.*?

Answ. 39 yards.

Example 11.

If 56 lb. of Coffee coſt 21*l.* 11*s.* 8*d.* what will 3 lb. coſt at that rate?

Common Way.

```
 lb.  l.  s.  d. lb.
If 56—21 11  8—3
     20
    ---
    431
     12
    ----
   5180 ſecond.
      3 third.
   ----- 12)
56)15540(  277
   112     ----
   ---  210)213(1 1/2
   434     -----
   392   l. 1-03-1 1/2 Anſ.
   ---
    420
    392
    ---
     28 remainder.
      4
    ---
  56)112(2
     112
     ---
       0
```

Short Way.

```
 lb.  l.  s.  d. lb.
If 56—21 11  8—3
                 3
              -----
          7)64 15  0
          ----------
          8) 9 05  0
          ----------
Anſ.      1 03  1 1/2
```

Here I divide by the firſt number, at twice, according to the 11th Rule of the 5th Chapter. Here is above 30 figures difference.

Example 12.

If the freight of a ship be 529*l.* 11*s.* what must be given to A. B. for his $\frac{5}{32}$ parts?

```
 Pts.        l.   s.        Pts.
If 32 give  529  11;  what  5 ?
            20
           ----
           10591
               5
           -----
           20)
     32)52955(      16514
        32          ------
        --- Answ. l. 82 14 10 5/32, or ½ of a farthing.
        209
        192
        ---
         175
         160
         ---
          155
          128
          ---
   Rem.    27
           12
           --
     32)324(10
        32
        --
   Rem.  4
         --
         32
```

Short Way.

```
Pts.  l.   s.  Pts.
32—529 11—5
            5
        -----
   4)2647 15
   ---------
    8) 661 18 09
    ------------
Answ. l. 82 14 10 ½ farthing.
```

Here is almost 40 figures difference.

For 3 weeks board I pay 11*s.* 3*d.* what is that a year? *Answ.* 9*l.* 15*s.*

Example 13.

If 72 C. of Starch coſt 63*l.* what will 15 C. coſt at that rate?

	C.	*l.*	*C.*		*C.*	*l.*	*C.*
If	72	—63	—15	If	72	—63	—15
						3	
Work as uſual, &c.						—	
						189	
						5	
Anſw. l.	13	2	6			—	
					8)945		
					9)118 $\frac{1}{8}$ of a *l.*		
					l. 13	2	6

☞ *Note,* If at any time we know but what part the ſecond number is of the firſt; the ſame part alſo will the fourth number (or anſwer) be of the third. As for example.

If 10*s.* gain 2*s.* what 100*l.*

Anſwer 20*l.* which is the 5th part of 100, as 2 is of 10.

Another Short Way.

There is another way of contracting queſtions in this Rule, viz. by dividing the third number by the firſt, and by that quotient to multiply the ſecond, which product, or products, will be the anſwer; as in the following Examples.

Example 14.

If 8 yards of cloth coſt 4*l.* 10*s.* 8*d.* what will 24 yards coſt at that rate?

Common Way.

```
 Yds.  l.   s.  d.   Yds.
If 8-----4  10  8-----24?
        20
       ---
        90
        12
      ----
      1088
        24
      ----
      4352
     2176
     -----
  8)26112
  -------
 12) 3264
  -------
 2[0) 27[2
  -------
Anſw. l. 13 12
```

Second Short Way.

```
 Yds.   l.  s.  d.   Yds.
If 8------4 10 8------24(3 2
                  3
                 ----
Anſ. l. 13 12 0
```

Here I divide 24, the third number, by 8, the firſt number, and it quotes 3; by which I multiply 4*l.* 10*s.* 8*d.* the middle number, and the product is the anſwer, viz. 13*l.* 12*s.* 0*d.* as before. But if the queſtion had been ſtated contrariwiſe, viz. If 24 yards coſt 13*l.* 12*s.* what 8 yards? then you might have done it by the other ſhort way, as follows:

Yds.	*l.*	*s.*		*Yds.*
If 24	cost 13	12,	what	8 ?
		8		
8)	108	16		
3)	13	12		
Ans.	*l.* 4	10		8

Or thus:

	l.	*s.*
3)	108	16
8)	36	05 $\frac{1}{3}$
As before, *l.*	4	10 8

Or divide the first number (when that is greatest) by the 3d, and by that quotient divide the 2d, and the last quotient is the answer, as under;

Yards.	3) *l.*	*s.*		*Yards.*
If 24	cost 13	12,	what	8 ?
3	4	10	8	*Answ.*

When any thing remains (in the second short method) after you have divided the third number by the first, then the first and third numbers are not proportional; for if they be, there will remain nothing. In this case, I say, when any thing remains, you must, after you have multiplied the middle number by the quotient, or whole number; then multiply also the middle number by the *numerator* of the fraction in its lowest terms, and divide that product by the *denominator*, and add that quotient to the former product of the second number, multiplied by the quotient or whole number aforesaid. An example or two will make it easy to be understood.

But, before I proceed, it will be necessary a little to explain the meaning of the *numerator* and *denominator* of a fraction, and how to reduce it into its lowest terms.

A fraction, or part of a whole number, arises from division; and what remains after the division is ended is the *numerator*, and the divisor is the *denominator*. As suppose your divisor is 12, and your remainder 4,

then 4 is the *numerator*, and 12 the *denominator*; and if set fraction-wise, stand as follows:

Remainder 4 *Numerator*.

Divisor 12 *Denominator*.

And to reduce this, or any other fraction, into its lowest terms, halve the *numerator*, and also the *denominator*; or divide them by 3, 4, 5, &c. or by any of the 9 digits, that nothing remain in either; for that figure which divides one without a remainder, may not do so by another: but you must divide both *numerator* and *denominator* by such a number as leaves no remainder in either. But if you cannot do so, then is the fraction in its lowest terms already.

Example.

Reduce the forementioned fraction $\frac{4}{12}$ into its lowest terms.

$$\frac{1}{2}\left\{\frac{4}{12}\right\}\frac{2}{6}\left\{\frac{1}{3}\right\}\text{ Lowest terms.}$$

$$\frac{1}{4}\left\{\frac{4}{12}\right\}\frac{1}{3}\Big\}\text{ Lowest terms.}$$

Here I reduce it, by dividing it by 2, or halving it, saying, the half of 4 is 2, and the the half of 12 is 6; then again the half of 2 is 1, and the half of 6 is 3, which is as far as I can go; and the fraction is reduced into its lowest terms, viz. $\frac{1}{3}$. But if I divide it by 4, it reduces it sooner; for I say, the 4's in 4, once, and the 4's in 12, 3 times; and so it is reduced at once into $\frac{1}{3}$, as per work. And thus $\frac{1}{3}$ is equal in value with $\frac{4}{12}$; for as 1 is the the 3d part of 3, so is 4 of 12.

Example 15.

If in 15 weeks I spend 5*l.* 5*s.* what is that a year?

The Common Way.

	W.	*l.*	*s*	*W.*
If	15—	5	5—	52

```
      20
     ---
     105
      52
     ---
     210
    525
    ---
    210)
15)5460(    3614
   45 ·
   ---
    96
    90
    ---
     60
     60
     ---
     (0)
```

l. 18 4 *Answer.*

Short Way.

	W.	*l.*	*s.*	*W.*
If	15—	5	5—	52(3 $\frac{7}{15}$
			3	
		15	15	3)36 15
		2	9	5)12 05
Ans.		18	4	2 09

Here I divide 52, the third number, by 15, the 1st number, and it quotes 3, and the remainder is 7, by which 7, after I have multiplied by 3, I multiply *l.* 5-5, the middle number, and the product is *l.* 36-15, which I divide by 15, the 1st number, at twice, and the last quotient is *l.* 2-9, which is $\frac{7}{15}$ of *l.* 5-5, which is added to the *l.* 15-15. the product of *l.* 5-5, multiplied by the quotient 3, and they make *l.* 18-4, as by the common way. See the work.

Example 16.

If 45*l.* buy 15 C. $\frac{3}{4}$ 12 lb. of Madder, what will 200*l.* buy at that rate?

IV. In your first stating, you must observe always to make that the second number which is of the same denomination with the number required; and one of the other numbers in the supposition (it matters not which) must be the first number; and that number in the demand of the same name with the first, must be the third number; and then your first stating will stand thus:

l. pr. *l. in.* *l. pr.*
If 100 gain 6, what 25?

Here the 2d number is of the same name with the number required; for the interest of 25*l.* is required, and the 2d number is pounds interest; and the 1st number is pounds principal; and so is the 3d number 25, being one of the numbers in the demand. And being so stated, *I* work as in the Single Rule of Three, thus:

l. pr. *l. in.* *l. pr.*
If 100 gain 6, what 25?
6

l. 1|50
20

s. 10|00 *Answer*, 1*l.* 10*s.*

Here *I* cut off two figures towards the right hand, which is dividing by 100, according to the directions given in Division.

And now having found the interest of 25*l.* by this first operation, *I* proceed to the second. And *note always*, That the answer to the first stating is the middle number to the second, as thus:

M. *s.* *M.*
If 12 give 30, what 4?
4

12)120

10*s.* *Answer.*

Here, in the ſecond ſtating, the remaining number in the ſuppoſition is the firſt; and the other of the ſame name in the demand is the third number; and the middle number is of the ſame name we ſeek for, viz. intereſt; and is the anſwer to the queſtion, to wit, 10 ſhillings.

And thus, by theſe two operations in the Rule of Three, *I* find the anſwer to the queſtion, viz. That if 100*l.* principal in 12 months, gain 6*l.* intereſt, then 25*l.* principal will gain 10*s.* intereſt in 4 months.

The ſame anſwer will alſo be found, if you work after the following manner:

M. *l.* *M.*
If 12 gain 6, what 4?
4
12)24
2 *l.* *Anſw.*

l. pr. *l. in.* *l. pr.*
If 100 gain 2, what 25?
20 40 2d number.
40 1000 *Anſw.* 10*s.*

The middle number in the laſt ſtating is brought into ſhillings, otherwiſe *I* could not have divided by the firſt number.

V. The laſt queſtion, or any other in this Rule, may be alſo anſwered by a Rule compoſed of the five given numbers (as was ſaid in the 2d Rule of this Chapter) after this manner: State the queſtion ſo that the numbers may ſtand in one continued rank; and in ſuch order, that the firſt and fourth numbers may be of one denomination, and the ſecond and fifth.

Then multiply the two firſt numbers together for a diviſor, and the three laſt together for a dividend; and the quotient will be the anſwer, in the ſame name with

times it is more concise to take part of parts: Suppose 9*d.* were the price, I first take $\frac{1}{2}$ for 6*d.* and then the $\frac{1}{2}$ of that $\frac{1}{2}$ for the 3*d.* because 3*d.* is the $\frac{1}{2}$ of 6*d.* and then I add the two lines together: Or, if the price were 5 farthings, I take the $\frac{1}{12}$, for the penny, and then the $\frac{1}{4}$ of that line for the farthing, because a farthing is the $\frac{1}{4}$ of a penny.

Examples.

342 lb. Candles, at 5*d.*

3*d*	$\frac{1}{4}$	85-6
2*d*	$\frac{1}{6}$	57
		1412-6
		l. 7-2-6 *Answ.*

679 yds. Paving, at 7*d.*

3*d*	$\frac{1}{4}$	169-9
4*d*	$\frac{1}{3}$	226-4
		3916-1
		19-16-1 *Answ.*

3790 yds. Linen, at 10*d.*

6*a*	$\frac{1}{2}$	1895
4*d*	$\frac{1}{3}$	1263-4
		31518-4
		l. 157-18-4 *Answ.*

429 lb. Loaf-Sugar, at 9*d.*

6*d*	$\frac{1}{2}$	214-6
3*d* of 6*d*	$\frac{1}{2}$	107-3
		3211-9
	l.	16-1-9 *Answ.*

Or thus:

429 lb. at 9*d.*

6*d*	$\frac{1}{2}$	214-6
3*d*	$\frac{1}{4}$	107-3
		3211-9
	l.	16-1-9 *Answ.*

Or thus:

12)37900 yds.

20) 31518-4

l. 157-18-4

In the last work I put a cipher to the given number, which is multiplied by 10, and the product is pence which I divide by 12 and 20.

		1349 lb. of Tobacco, at 11*d.*	
6*d.*	$\frac{1}{2}$	674-6*d.*	
4	$\frac{1}{3}$	449-8	
1	$\frac{1}{4}$	112-5	Odd Penny.
of 1*d.*		12316-7	
		l. 61-16-7 *Answ.*	

Or thus:

1349 lb. at 11*d.*
10
13490
Odd Penny. 1349
12)14839
12316-7
Answ. l. 61-16-7

		4796 quarts of Beer, at 5 qrs.
1*d.*	$\frac{1}{12}$	399- 8
$\frac{1}{4}$	$\frac{1}{4}$	99-11
of 1*d.*		4919-7
		l. 24-19-7 *Answer.*

VI. When the price is pence and farthings, then work for the pence, as before; and for the farthings, observe what part they make of the parts taken before, which take out of any one of the lines, of which the farthing or farthings make an even part, and add all together.

		856 yds. Ribband, at 4*d* $\frac{1}{2}$.
4*d.*	$\frac{1}{3}$	285-4
$\frac{1}{2}$	$\frac{1}{8}$	35-8
of 4*d.*		3211-0
		l. 16-1-0 *Answ.*

		987yds. Painting. at 10*d.* $\frac{3}{4}$.
6*d*	$\frac{1}{2}$	493-6
4*d*	$\frac{1}{3}$	329
$\frac{1}{2}$	$\frac{1}{8}$	41-1-$\frac{1}{2}$
of 4*d*		20-6-$\frac{3}{4}$
$\frac{1}{4}$	$\frac{3}{4}$	8814-2-$\frac{1}{4}$
		l. 44-4-2-$\frac{1}{4}$ *Answ.*

Here I firſt take the $\frac{1}{3}$ part of the given number for the groat; then for the halfpenny, I conſider it is the 8th part of 4*d.* wherefore I take the 8th part of that line, viz. 285*s.* 4*d.* ſaying, the 8's in 28, &c.

		479lb. of Pepper, [at 9*d.* $\frac{3}{4}$
6*d*	$\frac{1}{2}$	239- 6
3*d*	$\frac{1}{2}$6*d*	119- 9
$\frac{3}{4}$	$\frac{1}{4}$3*d*	29-11-$\frac{1}{4}$
		38[9- 2-$\frac{1}{4}$
		*l.*19-9- 2-$\frac{1}{4}$

		679lb. of Cotton, [at 7*d.* $\frac{1}{2}$.
6*d*	$\frac{1}{2}$	339- 6
1$\frac{1}{2}$	$\frac{1}{4}$	84-10-$\frac{1}{2}$
	of 6*d.*	42[4- 4-$\frac{1}{2}$
		*l.*21-4- 4-$\frac{1}{2}$ *Anſ.*

VII. When the price is any number of pence above a ſhilling, and not two ſhillings, let the given quantity ſtand as ſhillings, and take even parts for the pence, and ſet the quotient underneath in proper order, without drawing a line, and add it to the given number, and the total will be the anſwer in ſhillings.

Examples.

		469 yds. Stuff, at [13*d.*
1*d*	$\frac{1}{12}$	39-1*d.*
		50[8-1
		l. 25-8-1 *Anſw.*

		742 yds. at 19*d.*
6*d*	$\frac{1}{2}$	37[
1	$\frac{1}{6}$	61-10
	of 6*d.*	117[4-10
		l. 58-[4-10 *Anſ.*

Here 469 ſtands as ſhillings, of which I take the 12th part for the penny, and add both together. In the next Example, 742 ſtands as ſhillings, of which I take the $\frac{1}{2}$ for the 6*d.* and the 6th part of 371, &c.

		2460 lb. Tobacco, at 16*d.*	Or thus:
4*d*	$\frac{1}{3}$	820	3)2460
		3281-0	5) 820
		l. 164 *Ans.*	*l.* 164

		420 ells Holland,			794 bushels of Oats,
4*d*	$\frac{1}{3}$	140 [at 20*d.* $\frac{1}{2}$	6*d*	$\frac{1}{2}$	397 [at 22*d.* $\frac{1}{2}$.
4*d*	$\frac{1}{3}$	140	4*d*	$\frac{1}{3}$	264-8
$\frac{1}{2}$	$\frac{1}{3}$	17-6	$\frac{1}{2}$	$\frac{1}{3}$	33-1
		7117-6			14818-9
		l. 35-17-6 *Ans.*			*l.* 74-8-9 *Ans.*

Note. That in the second work of the first Example above, I divide by 15, according to the 9th Rule of the 5th Chapter; because 16*d.* is the 15th part of a pound, as 15*d.* is the 16th part: Or, when the price is 14, 16, 18, 21, or 22*d.* under 2*s.* if you bring the said prices into 2*d.* 3*d.* 4*d.* 6*d.* or 8 pences, you may bring them into pounds, &c. at one operation, by taking parts according to the 2d Table of Practice, at the beginning of the Rules of Practice.

Examples.

		7890 yds. at 14*d.*			988 lb. at 15*d.*
		7			5
2.	$\frac{1}{12}$	52310 two-pences.	3*d*	$\frac{1}{8}$	14940 three-pences
		l. 460-5 *Answ.*			*l.* 61-15 *Ans.*

6709 *lb.* at 21*d.*
7

3*d.*-$\frac{1}{10}$|469613 three-pences.

l. 587-0-9 *Answer.*

3796, at 22*d.*
11

2*d.*-$\frac{1}{10}$|11751 6

l. 347-19-4 *Answer.*

VIII. When the price given is such a number of shillings, or shillings and pence, as make an even part of a pound, divide the given quantity by that part, and the quotient will be pounds.

12*m.* Sills.|$\frac{1}{10}$|16574 gulls. at 20*sl.*

Answer. l. 331-34

746 gulls. Spirits, at 20*s.*

20-|$\frac{1}{10}$|1 *l.* 74-12 *Answer.*

In the first of these Examples, I divide the given quantity by 12, because 20*sl.* is $\frac{1}{10}$ of a pound, and there remains 2, which is two 12*m.* Sills, or 3*s.* 4*d.* So the answer is *l.* 331-34.

IX. When, at any time, the price is 20*s.* as in the second Example above, the answer may be known at sight; for it is but doubling the last figure towards the right hand, and notes it for shillings; and the other figures towards the left hand are pounds, as above, the double of 6 is 12*s.* and the other two figures are pounds, viz. 74*l.* in all *l.* 74-12*s.*

From this method of readily finding the value of any quantity, at 20*s.* a sight, many things may be expeditiously answered, viz.

Examples.

756 gal. at 3*s.* 6*d.* per g.

75-12, at 2*s.*
$\frac{1}{2}$ | 37-16, at 1*s.*
$\frac{1}{4}$ | 18-18, at 6*d.*

l. 132-06 *Anſw.*

3*s.* 4*d.* $|\frac{1}{6}|$ 576 *lb.* Indigo, at [3*s.* 4*d.*
Anſw. l 96

5*s.* $|^{1}|$ 296 yds. Silk, at 5*s.*

l. 74 *Anſw.*

2*s.* 6*d.* $|\frac{1}{8}|$ 973 Florins, at 2*s.* 6*d.*
Anſw. l. 121-12-6

Here five half crowns remain, or 12*s.* 6*d.*

492 yds. at 9*s.* 4*d.*

49-4, at 2*s.*
4 times 2 is 8*s.*

192-16, at 8*s.*
24-12, at 1*s.*
4*d.* $|\frac{1}{3}|$ 8-04, at 4*d.*

l. 229-12 *Anſw.*

4*s.* $|\frac{1}{3}|$ 749 pieces of eight, [at 4*s.*
l. 149-16 *Anſw.*

6*s.* 8*d.* $|\frac{1}{3}|$ 988 gal. Brandy, [at 6*s.* 8*d*
l. 329-6-8 *Anſw.*

10*s.* $|\frac{1}{2}|$ 575 yds. Br. Cloth [at 10*s.*
l. 287-10 *Anſw.*

X. When the price is ſhillings and pence, or ſhillings, pence, and farthings, and no even part of a pound, then multiply the given quantity by the ſhillings in the price, and take parts for the reſt, and add all together.

Examples.

736 lb. Coffee, at 5s. 8d.
5

	4368
d	978
4	244
	4284

l. 214-4 *Answ.*

4361b. Cinnamon, at 9s. 7d.
9

	3924
d	218
6	36-4
	4171-4

l. 208-18-4

570 qrs. of Wheat, at 32s. 6d.
32

	1140
d	1710
6	285
	18525

l. 926-5 *Answ.*

746 C. Cheese, at 27s. 4d.
27

	5222
	1492
4d	248-8
	20390-8

l. 1019-10-8 *Ans.*

XI. When the price is shillings and pence, and no even part of a pound, yet many times it may be divided into even parts; as 7s. 6d. is compoſed of 5s. and 2s. 6d. and 11s. 8d. of 10s. and 1s. 8d. 12s. 6d. of 10s. and 2s. 6d. 13s. of 10s. and 3s. &c.

205 gal. Tent, at 7s. 6d.

5s.	51-05
2s. 6d.	25-12-6
	l. 76-17-6

Or thus:

	205
2s. 6d.	25-12-6
3 half-crowns in 7s. 6d.	3
	l. 76-17-6

190 barr. Argal, at [11s. 8d.

s. d.		
10	$\frac{1}{2}$	95
1-8	$\frac{1}{12}$	15-16-8
		l. 110-16-8

172 C. Iron, at [12s. 6d.

s. d.		
10	$\frac{1}{2}$	86
2-6	$\frac{1}{8}$	21-10
		l. 107-10

XII. When at any time the price is an even number of ſhillings, multiply the quantity by half of the price, and double the firſt figure of the product, and ſet it apart for ſhillings; and the other figures to the left hand will be pounds.

Examples.

79 buſhels Wheat, at 6s.
3 — The half 3
l. 23-14 *Anſw.*

764 C. Suff. Cheeſe, at 12s.
6 — 6
l. 458-8 *Anſ.*

326 lb. Mace, at 22s.
11 — 11
l. 358-12 *Anſ.*

99 lb. Saſſafras, at 8s.
4 — 4
l. 36-00 *Anſ.*

85 yds. of Cloth, at 14s.
7 — 7
l. 59-10 *Anſ.*

623 C. Ginger, at 24s.
12 — 12
l. 747-12 *Anſ.*

When the multiplier conſiſts of two places (when the price is an even number of ſhillings) and that it cannot well be worked to have the product in one line; after you have done with the unit figure, and come to multiply by the ſecond, obſerve to ſet the firſt figure of the product juſt under the ſecond of the firſt line; for that doubled and ſet apart for ſhillings takes up the firſt place.

756 *C.* of Currants, at 48*s.*
24

302-8
1512

l. 1814-8 *Fa.*

219 *C.* at 56*s.*
28

175-4
438

l. 613-4 *Answ.*

When the price is an even number of ſhillings, if it be required to know what quantity of any thing may be bought for ſo much money, it may be known by this ſhort Rule, viz. annex a cipher to the money, and divide by half of the propoſed price.

Examples.

How many pounds of Indigo may be bought for 54*l.* at 4*s.* per *lb.* ?

2)540

Anſ. 270 *lb.*

What quantity of Cloth, at 12*s.* per yard, may be bought for 236*l.* ?

6)2360

Yards 393 $\frac{2}{6}$, or $\frac{1}{3}$, *Anſw.*

How many gallons of Canary, at 6*s.* per gallon, may be bought for 250*l.* ?

3)2500

Gal. 833 $\frac{1}{3}$ *Anſw.*

XIII. When the price is an odd number of shillings, work for the even part, as in the last Rule; and for the odd shilling take the $\frac{1}{20}$ of the given number, and add them together, as in the following Examples.

95 Pillows, at 17s.	260 *lb.* China silk, at
8	10 [*lb.*
81	260 00 10 1.
76 16	13 00
11-1[20] 4 16	
L. 81 12 *Answer.*	*L.* 273 00 *Answer.*

XIV. When the price of the integer is pounds, shillings and pence, reduce the pounds and shillings into shillings, and multiply the given number of integers by the full shillings; and then take parts for the pence as before: Or if the shillings and pence make an even part or even parts of a pound, then multiply the quantity by the pounds, and take even parts of a pound for the remainder of the price, and add the results together: Or, when the price is shillings, above 20, and under 60, you may let the integers stand as pounds, and, without drawing a line, take parts for the odd money, and add all together.

426 *C.* Turmeric, at	Or thus:
72 [3*l.* 12*s.* 6*d.*	*C.* *l.* *s.* *d.*
20	426, at 3 12 6
852 —	3
2982 72	
6*d.* [1 213	1278
	10*s.* 213
5088 15	2-6*d.* 53 5
L. 1544 15 *Answer.*	*L.* 1544 5 *Answer.*

```
C.                l. s. d.
316 Saltpetre at 4-15-6
 95               20
----              --
1580              95
d 2844
6|½| 158
-------
30171 8
-------
l.1508-18
```

Or thus:

```
C.        l. s. d.
316, at 4-15-6
  4
----
1264
10s.  ½ | 158
5     ½ |  79
6d.  1/10 |  7 18
-----------------
l. 1508 18 Ans.
```

XV. If the quantity given hath any odd weight, or measure annexed to it, as $\frac{1}{4}$, a $\frac{1}{2}$, or $\frac{3}{4}$ (after you have worked, as before, for the whole number) then take $\frac{1}{4}$, a $\frac{1}{2}$, or $\frac{3}{4}$ of the price, and add it to the other work.

Examples.

```
lb.                  (15s. 7d.
256½ Legee Silk, at
 15
----
1280                 ½217  9½
d.  256
6|½| 128
1|¼| 21 4
       7 9½ for ½ lb.
-------
½139917 1½
-----------
l. 199 17 1½
```

```
lb.                 s. d.
326¾ Saffron, at 54 8
 54
----
1304                ½| 27 4
d 1630              ¼| 13 8
6|½| 163                41 0
2|⅓| 54 4
     41 0 for the ¾ lb.
-----------
17861 2 4
-----------
l.893 2 4
```

When you take the 3 qrs. of any thing, first take $\frac{1}{2}$ of the given price, and then the $\frac{1}{2}$ of that $\frac{1}{2}$, and add them together as above: or you may take the $\frac{1}{2}$ and $\frac{1}{4}$ parts, and add them together; but the other is easier and quicker.

C.	s. d.
246 $\frac{1}{4}$ Faltic, at	11 6
d. 246	
6 $\frac{1}{2}$ 123	$\frac{1}{4}$ 2-10 $\frac{1}{2}$
2829	
2 10 $\frac{1}{2}$	
2831	10 $\frac{1}{2}$
l. 141	11 10 $\frac{1}{2}$ *Ans.*

Ells.	s. d.
216 $\frac{1}{5}$ Lawns, at	12 9
12	
d 2592	$\frac{1}{5}$ 2 6 $\frac{2}{5}$
6 $\frac{1}{2}$ 108	
3 $\frac{1}{2}$ 54	
2 6 $\frac{1}{2}$ $\frac{2}{5}$	
2751	6 6 $\frac{1}{2}$ $\frac{2}{5}$
l. 137	16 6 $\frac{1}{2}$ $\frac{2}{5}$ *Answer.*

C. lb.	s. d.
134 $\frac{1}{2}$ 14 Raisins, at	31 6 per Cwt.
38	
$\frac{1}{2}$ C. 14 lb.	5 9
134	3 11 $\frac{1}{2}$
4 qrs.	
6 d. 11 6	19 8 $\frac{1}{2}$
19 8 $\frac{1}{2}$ for $\frac{1}{2}$ C. 14 lb.	
4 qrs. 19 d. 8 $\frac{1}{2}$	
2 qrs. 10 d. 8 $\frac{1}{2}$ *Answer.*	

Where the even parts of weight must be observed, as they are set down in the beginning of this Chapter. As for the $\frac{1}{2}$ C. you take half of the price, and for 14 lb. you take the $\frac{1}{4}$ of 56 lb. the half being $\frac{1}{4}$ of $\frac{1}{2}$ Cwt. &c.

Sums of this kind, and many others, may as profitably be done by Multiplication only (except taking the parts) as it is taught in the 9th Chapter of this book.

Examples.

C.		s.	d.
75 ½ Nicorago Wood, at		22	6
			8
	9	00	0
			9
	81	00	0
	3	07	6
	0	11	3
l.	84	18	9

Here I multiply, first by 8, and then by 9; 8 times 9 making 72; and for the three odd hundreds wanting, I multiply the price by 3, and then I take half of the price for the ½ C. and add them together, as by the work may be seen.

C.		s.	d.	
63 ¾ Allum, at		12	10	per Cwt.
			7	
	4	09	10	
			9	
	40	08	06	
	00	06	05	
	00	03	02 ½	
l.	40	18	01 ½	

Here I multiply by 7, and by 9, 7 times 9 making 63, the quantity.

Hhds.		*l.*	*s*
156	Wine, at	12	13
12			
s. 1872			
10 $\frac{1}{2}$	78		
2 $\frac{1}{5}$	15	12	
1 $\frac{1}{2}$	7	16	
l. 1973		08	

Or thus:

l. 12	13	per hhd.
	10	
126	10	
	10	
1265	00	
632	10	
75	18	
l. 1973	08	*Anſ.*

	96 fodder of Lead, at *l.*	8	13 4
	8		12
s. d.	768	104	00 0
13 4 $1\frac{2}{3}$	32		8
	32		
	l. 832 *Anſ.*	*l.* 832	00 0

As for ſhort methods of caſting up bills of parcels, &c. it is beſt to do them by Multiplication, as is directed in that Rule.

Here follow ſome queſtions, with their anſwers, for the learner's exerciſe.

75 C. $\frac{1}{2}$ 19 lb. at 4*d.* $\frac{1}{2}$ per pound ?
Anſ. l. 158-18-1 $\frac{1}{2}$.
71081 lb. at 35*s.* 6*d.* per Cwt ? *Anſ. l.* 1126-10-1.
67108 oz. at 16*d.* $\frac{1}{4}$ per lb ? *Anſ. l.* 283-12-8 $\frac{1}{2}$.
71 lb. 10 oz. 15 dwt. at 5*s.* 9*d.* per ounce ?
Anſ. l. 248-00-9 $\frac{3}{4}$.
318 yds. at 5*s.* 6*d.* per ell ? *Anſ. l.* 70-03-7 $\frac{1}{5}$.
419 $\frac{7}{8}$ yds. at 4*s.* 10*d* $\frac{1}{5}$? *Anſ. l.* 101-13-9 $\frac{5}{8}$.
47 qrs. at 4*s.* 9*d.* per buſhel ? *Anſ. l.* 89-06.
715 $\frac{1}{4}$ yds. at 4*s.* 10*d.* $\frac{1}{8}$? *Anſ. l.* 173-04-5 $\frac{7}{8}$.

59 *oz.* 11 *dwt.* 18 *gr.* at 5*s.* 7*d.* per ounce ?
Anſw. l. 16-12-8.

50 $\frac{3}{4}$ *lb.* of Silk, at 20*d.* per ounce ? *Anſw. l.* 67-13-4.

66 groſs, at 3*s.* 9*d.* per dozen ? *Anſw. l.* 148-0-0.

56 load of Hay, at 18*d.* per truſs ? *Anſw. l.* 151-04-0.

Sold 3 ſacks of Rice, contents, viz.

No. 1	4	1	10	*Tare* 7		*Clough* 2 lb. per ſack,
2	3	2	19	8		*tret* 4 lb. per 104 lb. at
3	4	0	20	7		10*d.* $\frac{1}{2}$ per pound *neat* ;

what comes the three ſacks to ? *Anſw. l.* 56-4-11.

For the deducting of *tare*, *tret*, &c. the learner muſt have recourſe to the 7th Chapter of this book.

Sugar 95 *C.* 1 *qr.* 19 *lb. groſs*, *tare* 12 *C.* 3 *qrs.* 10 *lb.* at 47*s.* 6*d.* per Cwt. *neat*, what comes the Sugar to at that rate ? *Anſw. l.* 196-2-6 $\frac{1}{2}$.

OTHER TABLES OF THE EVEN PARTS OF A SHILLING, AND OF A POUND.

Parts of a Shilling.

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

Parts of a Pound.

s.	*d.*		
18		is	$\frac{9}{10}$
17	6		$\frac{7}{8}$
16	8		$\frac{5}{6}$
15			$\frac{3}{4}$
14			$\frac{7}{10}$
13	4		$\frac{2}{3}$
12	6		$\frac{5}{8}$
8			$\frac{4}{10}$
7	6		$\frac{3}{8}$
6			$\frac{3}{10}$

If the price of the integer be at any of the rates in either of theſe tables, multiply the given quantity by the numerator, and divide by the denominator, and the quotient will be the anſwer.

Examples.

10*d.* $|\frac{5}{6}|$ 456 lb. Loaf-Sugar, [at 10*d.*
5

6)2280

38|0

l. 19 *Answ.*

Feet.
9*d.* $|\frac{3}{4}|$ 765 Glazing at 9*d.*
3

4)2295

5713 9

l. 28 13 9 *Answ.*

C.
18*s.* $|\frac{9}{10}|$ 695 Shomac, at 18*s.*
9

10)62515

l. 625 10 *Answ.*

6*s.* $|\frac{3}{10}|$ 950 pair Hose, at 6*s.*
3

10)2850

l. 285 *Answ.*

746 yds. Paving. [at 4*d.* $\frac{1}{2}$,
3

4*d.* $\frac{1}{2}$ $|\frac{3}{8}|$ 2238

2719 9

l. 13 19 9 *Ans.*

lb.
671 Joppa Soap, [at 7*d.* $\frac{1}{2}$.
5

7*d.* $\frac{1}{2}$ $|\frac{5}{8}|$ 3355

4119 4 $\frac{1}{2}$

l. 20 19 4 $\frac{1}{2}$ *Ans.*

lb.
694 Belladine Silk. [at 17*s.* 6*d.*
7

s. *d.*
17 6 $|\frac{7}{8}|$ 4858

l. 607 5 *Facit.*

842 lb. Rhubarb, at [13*s.* 4*d.*
2

s. *d.*
13 4 $|\frac{2}{3}|$ 1684

l. 561 6 8

Other Examples of Practice, promiscuously set, and most expeditiously wrought.

Gall.

15*d.* is $\frac{1}{16}$ of a pound. | 4 | 1536, at 15*d.* per (gallon,
| 4 | 383

l. 96 *Answ.*

8*d.* [$\frac{1}{30}$ of a *l.* | 76914 lb. Tobacco, at (8*d.* per lb.
256 9 4 *Ans.*

5*s.* | $\frac{1}{4}$ | 205 yds. at 7*s.* 6*d.*
2*s.* 6*d.* | $\frac{1}{8}$ |
of a *l.* 51 5
25 12 6

Facit. *l.* 76 17 6

40*s.* } 125 pieces, at *l.* 2-5-6
125 (per piece,
5*s.* [$\frac{1}{4}$ 31 5
6*d.* [$\frac{1}{10}$ 3 2 6
of 5*s.*

l. 284 7 6 *Facit.*

75$\frac{1}{2}$ *C.* Logwood, at
2*s.* 6*d.* [$\frac{1}{8}$ 19 07 6 [22*s.* 6*d.*
The $\frac{1}{2}$ *C.* 11 3

l. 84 18 9 *Facit.*

lb.

16*d* is $\frac{1}{15}$ of a pound | 5 | 7490 at 16*d* per [*lb.*
| 3 | 1498

l, 499 $\frac{1}{3}$ *Facit.*

756 gal. at 5*s.* 8*d.*

5*s.* | $\frac{1}{4}$ | 189
8*d.* | $\frac{1}{30}$ | 25 4

l. 214 4 *Facit.*

170 lb. Raw silk,
[at 16*s* 8*d*
10*s* | $\frac{1}{2}$ | 85
6*s* 8*d* | $\frac{1}{3}$ | 56 13 4

l. 141 13 4 *Facit.*

215 *C.* of Hops,
[at *l.*3-17-6
860
Sub. $\frac{1}{8}$[26 17 6

l. 833 02 6 *Facit.*

Days.
365, at 5*d.* per day.

6*d.*	$\frac{1}{10}$	9	02	6
Subt.	$\frac{1}{12}$	1	10	5
l.		7	12	1 *Ans.*

26812 lb. at 19*d.*

20*d.*	$\frac{1}{12}$	2234	06	8
Subt.	$\frac{1}{20}$,	111	14	4
Ans. l.		2122	12	4

3796 yds. at 22*d.*

20*d.*	$\frac{1}{12}$	316	06	8
2*d.*	$\frac{1}{120}$	31	12	8
Ans. l.		347	19	4

75 C. at 20*s.* 8*d.*

4*d.*	$\frac{1}{60}$	1	5
4*d.*	$\frac{1}{60}$	1	5
Ans. l.		77	10

C.	*qrs.*	*lb.*	
12	3	14	Long Pepper, at
			l. 3 10 6
			12
			42 06 0
$\frac{1}{2}$ *C.* the $\frac{1}{2}$			1 15 3
$\frac{1}{4}$ *C.* the $\frac{1}{2}$ of $\frac{1}{2}$ *C.*			17 7 $\frac{1}{2}$
14 *lb.* the $\frac{1}{2}$ of $\frac{1}{4}$ *C.*			8 9 $\frac{3}{4}$
Facit. l.			45 07 8 $\frac{1}{4}$

lb.
6709, at 21*d.*

2*s.*	$\frac{1}{10}$	670	18	
Sub	$\frac{1}{80}$ for	83	17	3
3*d.* over				
Ans. l		587	00	9

When it happens that the price of the integer is a known part of a pound, as 17*s.* 6*d.* is $\frac{7}{8}$; 13*s.* 4. is $\frac{2}{3}$; 16*s.* 8*d.* is $\frac{5}{6}$; and 7*s.* 6. $\frac{3}{8}$, &c. then multiply by the given number by the numerator, and divide the product by the denominator; Or divide by the denominator, and multiply by the numerator. See the following work.

Examples.

420 yds. at 7*s.* 6*d.*

```
   3
8)1260
```

l. 157 10 *Facit.*

Or thus:

```
8)420
   52 10
       3
```

Answ: *l.* 157 10

479 ells, at 17*s.* 6*d.*

```
   7
8)3353
```

l. 419 $\frac{1}{8}$, or 2*s.* 6*d.*

Or thus:

Subtract $\frac{1}{8}$ *l.* 59 17 6
from the given 7
number

Facit, *l.* 419 02 6

697 gall. at 16*s.* 8*d.*

```
   5
6)3485
```

l. 580 $\frac{5}{6}$, or 16*s.* 8*d.*

Or thus:

Subtract $\frac{1}{6}$ *l.* 116 03 4
from the given 5
number.

Facit, *l.* 580 16 8

CHAP. XIII.

COMPANY.

THIS Rule teaches (by knowing the parts of which a joint ſtock is compoſed, with a ſuppoſed *gain* or *loſs* reſulting therefrom by trade) to eſtimate or determine each perſon's particular ſhare of the *gain* or *loſs*, in proportion to his principal in the joint ſtock.

By this Rule may alſo a bankrupt's eſtate be divided among his creditors. Likewiſe legacies, &c. adjuſted, in caſe of a deficiency of aſſets, or effects; and many other things.

I. Queſtions in this Rule are worked by the Rule of Three, there being to be as many ſeveral ſtatings as there are members in the joint ſtock, if none of their ſtocks be alike.

II. The total ſum of the ſeveral ſtocks is to be the firſt number in the Rule of Three; the *gain* or *loſs*, the ſecond; and each man's particular ſtock, the third.

Example 1.

A and B enter into partnerſhip; A puts into ſtock 230*l.* and B 320*l.* and after twelve months trade, they have gained 165*l* how much muſt each perſon have of the gain, in proportion to his money in company.

230*l.* A.
320*l.* B.

If 550 gain 165, what 230, A's ſtock?

```
        230
       ----
       4950
      330
     -----
55[0)37950(69l. A's ſhare.
     330
     ---
      495
      495
      ---
       (0)
```

Again, If 550*l.* gain 165*l.* what 320*l.* *B*'s ſtock ?

```
      320
    ------
     3300
    495
   -------
550[0)52800[0(        96l. B's ſhare
      495              69  A's ſhare
      ---              ---
      330              165 Proof.
      330
      ---
       (0)
```

Here I add their ſeveral ſtocks together, and they make 550*l.* which is the firſt number, in the Rule of Three; the *gain*, viz. 165*l.* the ſecond: and 230*l.* the ſtock of *A*, is the third number, which makes the firſt ſtating, which being worked according to Rule, the anſwer gives *A*, 69*l.* for his ſhare. Then it is again repeated, and then the ſtock of *B* 320*l.* is the third number; and after working the ſecond ſtating, there ariſes 96*l.* for the ſhare of *B* in the *gain*, which two ſhares, being added together, make the total *gain*, viz. 165*l.* and is a ſure proof the work is right, and that each perſon had his juſt proportion of the profit.

Example 2.

Three perſons, *A*, *B*, and *C*, join in company; *A*'s money in ſtock is 750*l.* *B*'s 460*l.* and *C*'s 500*l.* and after a certain time, when they ſettle their accounts, find their neat profit 684*l.* what muſt each have of the *gain* ?

```
750l.
460
500
---
If 1710l. gain 684l. what 750l. ? Anſw. l. 300 A
If 1710 gain 684, what 460 :              184 B
If 1710 gain 684, what 500 :              200 C
                                          ---
                                Proof, l. 684.
```

Example 3.

Admit 4 persons make a joint adventure to sea: *A* sends 60*l.* in Tobacco, *B* 80*l.* in Cloth, *C* 120*l.* in Leather, and *D* 140*l.* in Silk Hose; and after they have disposed of their returns, their neat profit amounts but to 72*l.* what is each man's share of the said 72*l.*?

If 400*l.* gain 72*l.* what 60*l.*?			*Answ.*	*A*	10 16
It 400 gain 72 what 80	-	-		*B*	14 08
If 400 gain 72 what 120	-	-		*C*	21 12
If 400 gain 72 what 140	-	-		*D*	25 04
				l.	72 00

The common way of having so many statings and workings, as there are partners in the concern, being intolerably tedious, I have here set down a much more compendious method of working sums belonging to this Rule; and though it is derived from Decimals, yet it will well enough answer our end by a Vulgar Operation, which is this: Annex a cipher or ciphers, to the middle number (except it be big enough to divide without, which very rarely is) and then divide it by the first number or total sum of the stocks; and then, by that quotient multiply each person's particular stock, and the products will be each man's proportional share in the *gain* or *loss*. But you must observe that when you have multiplied each person's particular stock by the quotient aforesaid, you must point, or strike off to the right hand, so many figures or ciphers as you annex ciphers to the sum to be divided.

Or Examples in this Rule may be shortened by finding the proportional *gain* or *loss* of one pound, thus; Bring the *gain* or *loss* into pence, and divide those pence by the total of the stocks, and the quotient shews what it is per pound; and then the answers may be found by the Rules of Practice, &c.

Example by the ſaid propoſed method.

For a ſpecimen, let us take the 1ſt Example in this Rule, where the ſum of the ſtocks was 550*l.* and the total gain 165*l.* Here I cannot divide 165 by 550; wherefore I join a cipher to 165 thus, 1650; and then divide it by 550, and the quotient is 3; by which I multiply 230*l.* the ſtock of *A*, and it produces 690; and the cipher on the right hand being pointed off, for the cipher annexed to the dividend, there is left 69*l.* for *A*'s ſhare in the gain. Then I multiply *B*'s ſtock, 320*l.* by the ſaid quotient 3, and the product is 960; then cutting off the cipher, there remains 96*l.* for *B*'s ſhare, &c. which are the ſame anſwers as by the other way.

The 2d Example worked by this ſhorter way.

A 750
B 460 } The gain is 684*l.*
C 500

1710)6840(4 the common multiplier.
6840
(0)

750 *A*'s ſtock,
4
l. 3000 *A*'s ſhare of gain, *l.* 300

460 *B*'s ſtock,
4
l. 1840 *B*'s ſhare of gain, 184

500 *C*'s ſtock,
4
l. 2000 *C*'s ſhare of gain, 200

Proof, *l.* 684

The 3d Example, by the ſhorter method, ſtands thus:

l. Parts.		*l.*		*s.*
10 8	*i. e.*	10, eight-tenths of a *l.*	or	16
14 4		14, four-tenths of a *l.*		8
21 6		21, ſix-tenths of a *l.*		12
25 2		25, two-tenths, of a *l.*		4
Fa. l. 72 0		72		00

Example 4.

Divide *l.* 5760-10 among ſeveral perſons, ſo that *A* may have $\frac{1}{2}$, *B* $\frac{1}{3}$, *C* $\frac{1}{4}$, *D* $\frac{1}{6}$, and *E* $\frac{1}{8}$, and tell me each man's part.

In this, and ſuch like caſes, take a number out of which ſuch parts may be taken, and take the like parts of that number, to find the numbers you ſeek, viz. each man's juſt proportion, &c. See the following works and anſwers.

	s.		*s. d.*	*l.*	*s.*	*s.*	
	20	Then ſay, If	27 6—	5760	10, what	10, &c.	
		Remainders.					
$\frac{1}{2}$	10 0		18		*l.* 2094	14 06	*A*
$\frac{1}{3}$	6 8		12		1396	09 08	*B*
$\frac{1}{4}$	5 0		9		1047	07 03	*C*
$\frac{1}{6}$	3 4		6		698	04 10	*D*
$\frac{1}{8}$	2 6		21		523	13 07	*E*
						2	
	27 6	3310)6610(2*d.*					
	12			*Prin.*	*l.* 5760	10 00	
	330						

Example 5.

In like manner may be done, that queſtion ſo often critically propoſed, viz. of dividing 20*s.* into $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{3}$ parts. See the following work.

$\frac{1}{3}$
4
—
12 If 342*d.* pay 20*s.* what 120*d.* &c.?
5
—
60
6 If 342 pay 20, what 90, &c.?
—
360 Common denominator.

			s.	*d.*	*Parts.*
$\frac{1}{3}$	of 360	120	7	0	72
$\frac{1}{4}$		90	5	3	54
$\frac{1}{5}$		72	4	2	180
$\frac{1}{6}$		60	3	6	36
1st *Num.* *R. of Three*		342	20	0	342 make 1 to carry, because equal to the divisor 342.

Example 6.

Suppose a Bankrupt's money and effects amount to 811*l.* 10*s.* and he owes to several persons as follows, viz.

To Mr. Cruel	-	-	*l.* 220	16 6
Mr. Gripe	-	-	312	00 0
Mr. Hard	-	-	117	12 6
Mr. Covet	-	-	106	12 6
Mr. Near	-	-	200	06 0
Mr. Squeeze	-	-	124	12 6
			l. 1082	00 0

How much must each person have of the above-mentioned 811*l.* 10*s.* in proportion to his debt?

	l.	*l.*	*s.*	*l.*	*s.*	*d.*
If	1082 —	811	10 what	220	16	6?

Answ. *l.* 165 12 4 $\frac{1}{2}$.

Or nearer, by ſeeing firſt what it comes to in the pound (as mentioned in page 235) and then work each particular ſum by Practice. Thus, bring 811*l.* 10*s.* into pence, and then divide them pence by 1082, the pounds that are owing, and the quotient ſhews what it is in the pound, viz. 15 ſhillings. Then proceed for further ſolution thus:

What comes *l.* 220-16-6, at 15*s.* per pound?
l. 220 16 6 at 15*s.* per pound?

10	$\frac{1}{2}$	110
5	$\frac{1}{2}$	55

12 4 $\frac{1}{2}$ for the 16*s.* 6*d.*

Anſw. l. 165 12 4 $\frac{1}{2}$

And ſo of the reſt, ſee the following anſwer. Or ſhorter by taking $\frac{3}{4}$ of each perſon's debt, becauſe 15*s.* is $\frac{3}{4}$ of a pound.

Mr. Cruel muſt have	-	*l.* 165 12 4 $\frac{1}{2}$
Mr. Gripe	- -	234 00 0
Mr. Hard	- - -	88 04 4 $\frac{1}{2}$
Mr. Covet	- -	79 19 4 $\frac{1}{2}$
Mr. Near	- - -	150 04 6
Mr. Squeeze	- - -	93 09 4 $\frac{1}{2}$
	Proof, l.	811 10 0

WITH TIME.

When this Rule hath any relation to a particular time, then you muſt multiply each man's particular ſtock of money by the reſpective times it continues in the joint ſtock, and add all the products together; which total muſt be the firſt number in the Rule of Three; the gain or loſs the ſecond; and each man's ſtock multiplied by his time, the third: and then work as before, and as often repeat as there are partner's, &c.

Example 1.

A and B enter into company: A puts into Stock 120*l.* for 7 months; and B puts 230*l* for 10 months; and in trading they gain 100*l.* what is each man's ſhare, in proportion to his ſtock and time? See the work following

120*l.* A's ſtock.	230*l.* B's ſtock.
7 months, A's time.	10 months, B's time.
840 A's ſtock and time.	2300 B's ſtock and time.
2300	

If 3140 gain 100*l.* what 840*l.* A's ſtock and time?

Again,

If 3140 gain 100*l.* what 2300*l.* B's ſtock and time.

					Parts.
Anſ.	*l.* 26	15	00 $\frac{1}{2}$		1660 A
	73	04	11 $\frac{1}{2}$		1480 B
Proof, l. 100					3140 a farthing.

Or the anſwers may be known by finding a common multiplier, as directed in page 235; or by finding the proportional part of the gain due to one pound, as mentioned in the ſame page.

Example 2.

Three perſons enter into partnerſhip, viz. A, B, and C, A puts into ſtock 65*l.* for 8 months; B 78*l.* for 12 months, and C 84*l.* for 6 months; and they gain 166*l.* 12*s.* what is each man's ſhare, &c.

A's ſtock, multiplied by 8, produces	-	*l.* 520
B's ſtock, multiplied by 12, gives	-	936
C's ſtock, multiplied by 6, produces	-	504
	Stock and time, *l.*	1960

Then say,

Whole S. and T. *l.* *s.* *l.* *A's S. and T.*
If 1960 gain 166-12 (or 166-6) what 520;
Answ. 44*l.* 4*s.* (or *l.*44-2) &c.

CHAP. XIV.

BARTER.

BARTER, or TRUCK, is no more than exchanging one commodity for another, and so to proportion their rates as that neither of the persons may sustain loss.

Example 1.

Suppose A has 144 ells linen cloth, worth 15*d.* per ell, which he would *truck* with B for butter, at 18*s.* 9*d.* per 100 lb. how many pounds of butter must B give A for the linen? *Answ.* 960 lb.

The concisest way to answer questions in this Rule, is first to find the value of the first goods mentioned, by the shortest way of Practice; and then to answer it by the Rule of Three.

15*d.* is $\frac{1}{16}$ of a *l.* | 4)144 ells, at 15*d.*
4) 36
l. 9, or 180*s.*

Then say,
If 18*s.* $\frac{3}{4}$ give 100 lb. what 180*s.* &c?
Answ. 960 pounds.

To prove the work, cast up the 960 lb. at 2*d.* $\frac{1}{4}$ per pound (for so much it is per pound, at 18*s* 9*d.* per 100 lb) and if it amounts to 9*l.* the value of the linen, the work is right. Thus:

2*d.* $\frac{1}{120}$ of a *l.*	960, at 2*d.* $\frac{1}{4}$ per pound?
$\frac{1}{4}$*d.* or $\frac{1}{8}$ of 2*d.*	8
	1
	l. 9 *Facit.*

Example 2.

A hath Broad Cloths, at 10*l.* 10*s.* per piece, and B hath Mace, at 12*s.* per pound; how many pounds of Mace must B give A for 24 Broad Cloths?

Ans. 420 lb.

24[0
12

If 12*s.*—1 lb. what 252 lb. &c.

Example 3.

A hath 14 Cwt. of Sugar, at 6*d.* per pound; for which B gave him 1 C. $\frac{3}{4}$ of Cinnamon: what was the Cinnamon rated per pound?

14
14
14
14

112
84 6*d*[$\frac{1}{20}$[1 5 6 8

If 196 lb. cost *l.* 39-4 what 1 lb? *Ans.* 4*s.*

Example 4.

A and B Barter; A hath 86 gallons of Brandy, worth 9*s.* 2*d.* per gallon, ready money; but in Barter he will have 11*s.* per gallon; B hath serge, worth 2*s.* 1*d.* per yard, ready money. *Quere*, How many yards of serge must B give A for his 86 gallons of Brandy?

The Rule. First find what advance B ought to make per yard for his serge, in proportion to what A hathdone upon a gallon of his Brandy. thus;

If 9*s.* 2*d.* increase to 11*s.* what must 2*s.* 1*d.* increase to? *Answ.* 2*s.* 6*d.*

Then see by Practice, what A's Brandy comes to, at 11*s.* per gallon; which will be found to amount to 47*l.* 6*s.* Then say, by the Rule of Three,

If 2*s.* 6*d.* buy 1 yard, what will 47*l.* 6*s.* buy? *Answ.* 378 yds. $\frac{1}{5}$.

And so of any other Example in a Rule of this kind.

CHAP. XX.

INTEREST.

INTEREST is an allowance of the borrower to the lender, in consideration of the use made of the lender's money; and therefore Interest sometimes is called Use-Money; and this Interest is either Simple or Compound. Simple Interest is that which cometh of the Principal only; and Compound Interest is that which arises from Principal and Interest also; and is therefore called Interest upon Interest: but this latter, being ac-

counted very unlawful, is seldom allowed, but in some particular agreements, &c. I shall therefore not insist upon it; but as to the former, to wit, Simple Interest, I shall endeavour at some practical rules and methods to render it easy to the meanest capacity; and shew also, that by the methods of working Interest, several other useful things are answered, that do not come under that denomination.

Example 1.

What comes the Interest of a bond of *l.* 374-12-9 to, at 6 per Cent. for a year?

Rule, Multiply the principal money by the rate of Interest, be it what it will, and divide by 100. State it thus:

l. pr.	*l. in.*	*l.*	*s.*	*d. pr.*
If 100 gain	6, what	374	12	9
				6
		22147	16	6
		20		
		9156		
		12		
		6178		
		4		
		3112		

l. s. d.
22 9 $6\frac{3}{4}\frac{12}{100}$

Here I multiply the third number by the second, according to Multiplication of Money, and the product is *l.* 2247-16-6, which I divide by 100, by cutting off two figures with a dash of the pen (which is dividing by 100, according to the 6th Rule of the 5th Chapter) then I multiply the several remainders by 20, by 12, and by 4, and still divide by 100, as before, and the answer is *l.* 22-9-6 $\frac{3}{4}\frac{12}{100}$; as may be seen by the work above. And the truth may be proved by stating and working it back again, thus;

	l.	*s.*	*d. pr.*		*l.*	*s.*	*d. in*		*l.*
If	374	12	9	gain	22	9	6 $\frac{3}{4}$ $\frac{12}{100}$,	what	100?

Example 2.

What is the interest of *l.* 826 13 9 for a year, at 5 *per Cent*?

Shorter thus:

$\frac{1}{20}$ | 82 | 6 13 9

Facit l. 41 06 8 $\frac{1}{4}$

```
      826 13 9
                5
      ---------
     4133 8 9
       20
     ----
     6168
       12
     ----
     8125
        4
     ----
     1100
```

} *l.* 41 6 8 $\frac{1}{4}$.

In this shorter method, I consider that the rate of Interest, viz. 5 *per cent.* is the 20th part of 100*l.* wherefore I take that part of the principal money, which is done only by halving it, thus; The $\frac{1}{2}$ of 8 is 4, and the $\frac{1}{2}$ of 2 is 1, or 41*l.* and the 6 cut off is (for the cipher in $\frac{1}{20}$) 6*s.* and the 13*s.* 9*d.* reduced into pence by your head or pen makes 165, and supposing the 5 cut off, the $\frac{1}{2}$ of 16 is 8 pence; and 5 reduced into farthings, makes 20, and supposing the 0 to be cut off from that likewise, the $\frac{1}{2}$ of 2 is $\frac{1}{4}$, and so the answer is the same with the other, viz. *l.* 41 6-8 $\frac{1}{4}$; and the most concise method there can be.

Example 3.

What is the Simple Interest of *l.* 34 | 8 13 2 at 6 *per cent.*

17	08	7	$\frac{2}{5}$	$\frac{3}{5}$, for 5 *per cent.*
3	09	8	$\frac{2}{25}$	$\frac{3}{25}$, for 1 *per cent.*
Facit. l. 20	18	4	$\frac{1}{5}$	

Example 4.

What is the Intereſt of *l.* 746 12 6, at 5 $\frac{1}{2}$ *per cent.*

```
                    5
              ----------
            3733 02 6
The ½ of 746l. &c. 373 06 3
              ----------
            41106 08 9
                20
              ----------
Sooner thus:   1128
7146 12 6        12 }
              ----- }  l. 41 01 3 ¼
 37 06 7 ½   3145 }
 3 14 7 ¾       4
              -----
l. 41 01 3 ¼ Facit.  1180
```

Thus, by either of theſe ways, may the Intereſt of any ſum of money, for a year, be found, at any rate *per cent.* Likewiſe, by the ſame method of working, may the proviſion, commiſſion, or factorage, of any ſum be known: as alſo inſurance, average, ſtorage, brokerage, or any thing elſe, rated at ſo much *per cent.*

What is the factorage of goods bought, or otherwiſe negociated, to the value of *l.* 479 16 9, at 2 *per cent.*

```
              479 16 9
              ---------
            9159 13 6
Or thus:        20
2 per C. 1/50 479 19 16 9   ----
              ---------   11193
Facit, l. 9 11 11            12 }
                            ---- }  Anſw. l. 9 11 11
                            11122
```

What is the insurance of 230*l.* at 10 $\frac{3}{4}$ *per Cent*?

l. 2300—10 *per Cent.*

```
 115
  57 10
 ------
24172 10
   20
 ------
14150
   12 }
 ---- } l. 24 14 6
 6100 }
```

Or thus:

```
10 per Cent. l. 2310
10s. |1/20| 1  3
 5s. |1/2 |    11 6
 ----------------
l. 24 14 6
```

This method may be of good use for taking off 5 *per Cent.* for prompt payment in Custom-house duties, and 15 *per Cent.* the additional duty on French and East-India goods.

```
Admit I were to take off 5 per C. from l. 275 12
                      Subtract 1/20 |  13 15 07
                                    ----------
                          Ans. l. 261 16 05

Again, Take off 15 per Cent. from l. 672 16 08
                                  1/10 | 67 05 08
                                  1/2  | 33 12 10
                                       ----------
                          Subtract     100 18 06
                                       ----------
                          Ans. l. 571 18 02
```

Once more, take 25 *per Cent.* from 321 12 4

```
                    ----------
5 per Cent. 1/20 | 16 01 7 1/4
                            5
                    ----------
Deduct              80 08 0 1/2
                    ----------
Ans. l. 241 04 3 3/4
```

Example 5.

What comes the Interest of *l.* 446-12 to, for 9 months, at 6 *per Cent per annum*?

Here I take the $\frac{1}{2}$ of the year's Interest for 6 months, and then the $\frac{1}{2}$ of that for 3 months, and add them together for 9 months, as in the following work.

223-6 half sum
9 months
2069-14
594
11,28
£ s d
20 1 11¼

l. 446 12
6 *per Cent.*

26179 12
20

l. 26 15 11 $\frac{4}{100}$ for a year.

15192 6 months, 13 07 11 $\frac{1}{2}$ for $\frac{1}{2}$ a year.
12 3 months, 6 13 11 $\frac{3}{4}$ for $\frac{1}{2}$ of $\frac{1}{2}$ a year.

11104 *l.* 20 01 11 $\frac{1}{4}$ for 9 months.

Example 6.

To what comes the Intereſt of *l.* 297-12, at 5 *per Cent.* for 6 months?

l. 14 17 7 for a year.

Take $\frac{1}{2}$ for 6 months, *l.* 7 08 9 $\frac{1}{2}$ *Anſwer.*

When, at any time, the rate of Intereſt hath $\frac{1}{4}$ $\frac{1}{2}$, or $\frac{3}{4}$ annexed, you muſt firſt multiply by the whole number, and then take $\frac{1}{4}$ $\frac{1}{2}$, or $\frac{3}{4}$, of the principal money (as is taught in the 13th Rule of the 4th Chapter) and add the two lines together, and then divide by 100, as before.

Example 7.

What is the Intereſt of *l.* 376 12 6
at 4 $\frac{1}{2}$ *per Cent.*
4

For the $\frac{1}{2}$ *per Cent.* take half of the principal. } 1506 10 0
188 06 3

16194 16 3
20

18196
12
11155
4
2120

Anſ. l. 16-18-11 $\frac{1}{2}$

What is the Intereſt of *l.* 226 10 0
at 3 $\frac{3}{4}$ *per Cent.* $3\frac{3}{4}$

per Cent. 679 10 0
$\frac{1}{2}$ | $\frac{1}{2}$ | 113 05 0
$\frac{1}{4}$ | $\frac{1}{2}$ | 56 12 6

8149 07 6
20

9187
12

Anſw. l. 8-9-10 $\frac{1}{2}$ { 10150
4

2100

Another way (when the time is odd, or not juſt a year) is to multiply the principal by the Intereſt of 100*l.* for the nominated time, cutting off two figures to the right hand, as before.

Example 1.

What is the Intereſt of *l.* 234 1 2 6 for 2 years, at
The int. of 2 years at 5 *p: C.* 10 [5 *per Cent* ?

23146 05 0
20

9125
12 } *l.* 23 9 3
3100

Example 2.

What is the intereſt of *l.* 312 16 for 5 years, at 6 *per Cent.*

```
                 5 and 6
              ---------
            1564 00
                    6
            ---------
           93184 00
              20
            ---------
           16180
              12 }
            ------ }  l. 93 16 9 ½
            9160 }
               4
            ------
            2140
```

Here the intereſt of 100*l.* for the time is 30*l.* therefore I multiply by the ratios of 30, viz. 5 and 6; as in the Example.

Example 3.

What is the intereſt of *l.* 428 14, for 9 months, at [4 *per cent.*

```
The intereſt of 100l. }
for 9 mo. at 4 per C. }  is      3l.
                       ----------------
                       12186  2
                          20
                       ---------
                       17122
                          12 }
                       ------ }  l. 12 17 2 ½
                       2164 }
                          4
                       ------
                       2156
```

When the rate is at { 5, 6, 4, 3 } *per Cent.* for { 12, 10, 15, 20 } Months.

Then the intereſt of any principal is juſt ſo many ſhillings as there are pounds; therefore only take $\frac{1}{20}$ of the principal, &c.

Example 1.

What is the intereſt of *l.* 412 06 9, at 5 *per cent.* for 12 months?

$\frac{1}{20}$| 20 12 4 $\frac{1}{20}$ *Anſw.*

Example 2.

What is the intereſt of *l.* 324 12 0, at 6 *per cent.* for 10 months?

$\frac{1}{20}$| 16 04 7 $\frac{4}{20}$ *Anſw.*

Example 3.

What is the intereſt of *l.* 428 16 4, at 4 *per cent.* for 15 months?

$\frac{1}{20}$| 21 08 9 $\frac{3}{4}$ *Anſw.*

Hence it neceſſarily follows, that the intereſt of any given principal may be found, by taking parts for the time propoſed, out of the time mentioned in the foregoing Table, thus: If the intereſt of *l.* 412-6-9, for 12 months, be 20*l.* 12*s.* 4*d.* $\frac{1}{2}$. (as in page 251) at 2*d.* in the pound; then for 6 months, it muſt be $\frac{1}{2}$, viz. *l.* 10-6-2 $\frac{1}{4}$; and for 3 months, $\frac{1}{4}$.

Examples.

What is the intereſt of *l.* 276 05 9, for 4 months, at 5 *per cent.*?

20)
13 16 3 $\frac{1}{4}$

4 months, $\frac{1}{3}$ of 12 months. *l.* 4 12 1 *Anſw.* for 4 mo.

Again, what is the Intereſt of *l.* 157 09 0, for 5 months, at 6 *per Cent*?

20)
157 09 0
7 17 5 $\frac{1}{4}$

5 months $\frac{1}{2}$ of 10 months. *l.* 3 18 8 $\frac{1}{2}$

And ſo for 4 or 3 *per Cent.* for 15 or 20 months, in the ſame manner.

When the *principal money* is any number of pounds, without ſhillings or pence, then it may be done by the following method of working.

Example 5.

What is the Intereſt of 40*l.* for 7 years, 5 months, and 26 days, at 6 *per cent. per annum*?

Years. Mon. Days.
7 5 26
12 Months in a Year.

89
30 Days in a Month.

2696
40 Principal Money.

1|00)1078|40
6|0)1071|8 Groats in all.
---
l. 17 58 Groats, or 19*s.* 4*d.* and 1*d.* $\frac{1}{2}$. for the [fraction.

Here the time is set down, and multiplied by 12, the calender months in a year, and the odd months taken in, and then by 30, the supposed days in a month, and the odd days taken in likewise, which product of days is multiplied by the principal money, viz. 40*l.* which product is divided by 100, and then that quotient by 60, the groats in a pound, and the remainder is groats, viz. 58, which is 19*s.* 4*d.* and 1*d.* $\frac{1}{2}$. for the fraction; in all, *l.* 17-19-5 $\frac{1}{2}$, as in the work.

Example 6.

What is the Interest of 590*l.* for 3 years, 7 months, and 19 days, at 6 *per cent. per annum*?

```
        Years. Mon. Days.
          3     7    19
         12 Months in a Year.
         ---
         43
         30 Days in a Month.
       -----
       1309
        590 Principal Money.
     -------
     117810
     6545
   ---------
   1[00)77231[10
    6[0)77213
   ---------
Ans. l. 128  43 groats, or 14s. 4d.
   ---------
                In all, l. 128-14-4
```

There is alſo another way of calculating Intereſt, by days, which is thus: Bring the principal money into pence, then multiply theſe pence by the days it is out at Intereſt, and if the rate be at 6 *per cent.* then divide by 6083, which is what is produced by the days of a year multiplied by 100, and divided by the rate of intereſt; but if the rate be 5 *per cent.* then divide by 7300.

Example 7.

What is the Intereſt of 150*l.* for 10 months and 24 days, at 5 *per cent. per annum*?

l.	*M.*	*Days.*
150	10	24
20	30	
3000	324	
12		
36000		
324 Days at Intereſt.		
144000		
72000		
108000		
11664000		

73100)11664000(12)

1597

1313 1

Anſw. l. 6 13 1

ANOTHER RULE BY DAYS.

Multiply theſe three numbers continually, viz. the given Intereſt of 100*l.* for a year; the principal whoſe Intereſt is required: and laſtly, the number of days required: and the laſt product is to be reſerved for a dividend. Then multiply 365 days by 100 (which is only annexing two ciphers) and let that product be your diviſor (which ſerves for all rates) and then divide as uſual, and the quotient will be the Intereſt ſought.

Note here, That the two principals, viz. 100*l.* and the other propoſed, are ſuppoſed to be of one denomination; alſo the Intereſt required will be of the ſame name with the given Intereſt of 400*l.*

Example.

What is the Intereſt of 400*l.* for a week, or 7 days, at 6 *per cent. per annum*?

```
                          400
                            6
                         ----
365                      2400
100                         7
-----                    -----
36500 Diviſor.           16800 Dividend.
36500)16800,000(,4602, or 9s. 2d. ¼, Anſw.
```

Here, in valuing, the farthings are always leſſened by one.

When the rate is 5*s. per cent.* take the ¼ of the principal, and work as before.

```
What is the Brokerage of l. 465   12   6
  at 10s. per Cent?
                            ---------------
                            ½1 2132  16  3
                                20
                            ----
                            6156
                              12
                            ------
                            6175
                              4
                            ----
                            3100
```

Anſw. l. 2-6-6 ¾.

If you would know what any ſum comes to, at 30, 40, or 50 *per cent.* firſt ſee what it comes to at 10 *per cent.* and multiply that anſwer by 3, 4, or 5, &c.

Example.

What comes *l.* 726 10 6 to, at 40 *per cent.* ?

```
                10
            ----------
72|165 05  0
   20
  ------
13|05
   12 }
   ---}      l. 72 13 0 ½, 10 per cent.
   60}                4
    4          ----------
  ----         l. 290 12 2 Answ.
  2|40
```

CHAP. XVI.

DISCOUNT

DISCOUNT is when a sum of money, hereafter due, is satisfied by paying down so much present money, which, if put to interest (at such a rate, and for such a time) would increase itself to the sum first due.

Example 1. What is the Discount of *l.* 487-12 for 6 months, at 6 *per Cent.* per annum ?

To answer this, and other sums of the same kind, the general rule is to make 12 months the first number in the Rule of Three; the rate of interest the second; and discounted time the third.

If 12 months give 6*l.* what 6 months ?

```
      6
   -----
12)36
   -----
     3
```

To be added to 100*l.* the first number in the next work. Then say again, if 103*l.*

abate 3*l.* what *l.* 487-12 *Answer, l.* 14-4 Discount. See the following Proof.

After I find the Discount to be *l.* 14-4, I deduct it from the sum first due, viz. *l.* 487-12, and the remainder is the present money to be paid down: and for the proof of the assertion in the first Rule, I take the sum to be paid down, and calculate it at 6 *per cent.* the rate of Interest proposed, and the answer is *l.* 28-8 the Interest for a year; the half of which for 6 months (the time discounted) is *l.* 14-4 the discounted sum. As by the following work.

l. 487	12	first due.
14	04	discounted.
473	08	to pay down.
	6	*per cent.*
28	40	08
	20	Interest for a year, *l.* 28 8
	8	00
		½ for 6 months, *l.* 14 4

From whence it is manifest, no one allows Interest for any more money than he receives.

Example 2. What is the Discount of 275*l.* 10*s.* for 7 months, at 5 *per cent. per annum*?

5*l. per cent.*

6 months	1	2 10	
1 month	6	0 08	4
		l. 2 18	4

If *l.* 102-18-4. abate *l.* 2-18-4. what *l.* 275-10?
Answ. *l.* 7 16 1.

First due, *l.* 275 10 0
Discounted, 7 16 1

Paid down, 267 13 11
5 *per C.*

13138 09 07
20

7169
12

8135
4

1140

	l.	*s.*	*d.*
Interest,	13	7	8 $\frac{1}{4}$
6 mon. $\frac{1}{2}$	6	13	10
1 mon. $\frac{1}{6}$	1	02	03
Proof, l.	7	16	01

Example.

Bought goods to the value of *l.* 109-10, on 9 months. Discount at 6 *per cent. per annum*, what must be paid down?

6 *l. per Cent.*

6 mon.	$\frac{1}{2}$	3	00
3 mon.	$\frac{1}{4}$	1	10
		4	10
		1	00

If 104 10 abate 4*l.* 10, what 109 10 0?
Answ. 4 14 3.

Answer, to be paid down. *l.* 104 15 9.

Example 4.

Sold goods amounting to *l.* 217-12, on two 3 months discount (that is, half at 3 months, and the other half 3 months after that) at 5 *per cent.* per annum, what must be paid down?

5*l. per cent.*

If 101-05 abate *l.* 1-5, what *l.* 108-16

3 m. $\frac{1}{4}$ 1 5 — *Answ. l.* 1-06-10 Disc.

100 0 — *l.* 217-12 } 2 parts.

101 5 — 108-16

Again, If 102-10 Discount *l.* 2-10, what *l.* 108-16?

Answ. l. 2-13-0 Disc.

217 12 Value sold.

5*l. per cent.*

l. 108-16 for 3 m. 1 06 10 Disc.

6 m. $\frac{1}{2}$ 2 10 — 108-16 for 6 m. 2 13 00 Disc.

100 00

Total Discount, 3 19 10

l. 102 10

Paid down, *l.* 213 12 02 *Answ.*

In the foregoing Example, I first divide the given sum into two equal parts, by taking the half of it; then for 3 months, I take $\frac{1}{4}$ part of the rate, viz. 5 *per cent.* and it makes it 1*l.* 5*s.* Then I add that Facit to 100*l.* and make the first stating, saying, If *l.* 101-5. discount *l.* 1-5, what *l.* 108 16? and the answer is *l.* 1-6-10, for the first 3 months discount. Then for 6 months I take the $\frac{1}{2}$ of the rate, and it makes *l.* 2-10. Then I say, again. If *l.* 102-10 abate *l.* 2-10, what l. 108-16? and the answer is l. 2-13 for 6 months discount. Then I add the two discounts together, and subtract the total from the sum first due, and the remainder is l. 213-12-2 to be paid down presently. Which may be seen by the work.

When the payments are to be made at three ſeveral times, then divide the given ſum into three equal parts, and work as before; and if at four payments, then divide the ſum into four equal parts, &c.

There is another and better way, when the rate is at 6 *per cent.* Diſcount, which is thus:

Bring the given ſum into pence, and then multiply those by the time, which product divide by 200 and the time added together, and the quotient will be the anſwer in pence, which reduce into pounds, &c.

Example 5.

For trial, let us take the firſt Example in this Rule, viz.

What is the diſcount of *l.* 487-12, for 6 months, at 6 *per cent?*

```
                    20
                   ----
                  9752
                    12
                  ----
   200           117024 pence.
     6                6 months time.
   ----           ------
Diviſor, 206   206)702144(3408 pence.
                   618
                   ---
  12)3408 pence.   841
     ----          824
     2814          ---
     ----          1744
Diſcount, l. 14 4  1648
                   ----
                    (96)
   l. 487 12 firſt due.
      14 04
   -------
Anſw. l. 473 08
```

A third way of Discount is to multiply 12 months l 100 (which is only annexing two ciphers to 12) a divide the product by the rate of Discount, and to th quotient add the time proposed; which sum reserve f a divisor; then multiply the sum to be discounted by tl proposed time, and divide that product by the abo mentioned divisor.

Example 6.

What is the discount of *l.* 487-12, for 6 months, at *per cent.* per annum? the first Example of this Rule)

Sum to be discounted, *l.* 487 12
6

```
                                206)2925 12(1
                                    206
                                    ---
                                    865
                                    824
                                    ---
                                     41
                                     20
                                    ---
                                    832(4s.
                                    8 4
                                    ---
                                    (8)
```

```
                12
               100
               ----
Rate, 6)       1200
               ----
               200
Time added,      6
               ----
Divisor,       206
```

Answ. l. 14-4 to be discounted.

Example 7.

What present money will discharge a debt of 122*l.* 11 4*d.* due at 3 months, discounting after the rate of 6 *p. sent.* per annum? *Answ. l.* 120-15 1 ½

After the last method of operation.

```
                l.     s.  l.  s.   d.
Divisor, 203)367      14(1  16   2 ½ Discount.
                &c.
```

Example 8.

What is the difcount of *l.* 275-10, for 7 months, at 5 *er cent.* per annum? *Anfw.* *l.* 7-16-1 $\frac{3}{4}$.

As before:

	l.	*s.*	*l.*	*s.*	*d.*	
Divifor, 247)	1928	10(	7	16	1 $\frac{3}{4}$	Difcount.
&c.						

'or	2, 3, 4, 5, 6, 7, 8, 9, 10	*per cent.* Difcount.	600, 400, 300, 240, 200, 171, 150, 133, 120	with the time added is the Divifor.

When the difcount of any fum is at any of the rates n the Table above, viz. from 2 to 10, then the oppofite umbers, with the time of difcount added to them, will e proper divifors for your intended purpofe, and are ound by dividing 1200 by the rate of Difcount: accorling to the Rule of the third method of Difcount.

If the Difcount be 20, 30, or 40 *per cent.* then cut off cipher from 600, 400, 300, &c. and add the time to 10, 30, or 40, for the divifor, &c.

Example 9.

What is the difcount of *l.* 212-15, for 3 months, at 0 *per cent.* per annum?

According to Rule, I add 3 (the time) to 30, and it makes 33 for a divifor, &c.

212 15
3

33)638 05(*l.* 19 6 9 $\frac{3}{4}$ $\frac{3}{11}$, *Anfw.*
&c.

CHAP. XVII.

EXCHANGE.

EXCHANGE is the receiving of money in one country, or nation, and paying it again in another, value for value, having respect to the several species of coin, or money of each nation.

Exchange of coins is like the business of exchanging, or bartering of goods, and depends on a clear understanding of the Golden Rule, to find what sum of one country's money will be equal in value to any proposed sum of another country's money: In order to which, it is very necessary to have at all times a true account of the just values of those foreign coins that are to be exchanged, as they are compared in value to our English at all times, as above said: because the *par* of Exchange differs almost every day, from London to other countries; that is, it rises and falls, &c.

The way of working Exchange is either by the Rule of Three, or by Practice and most commonly by the latter.

London exchanges with Holland, Flanders, &c. upon so many shillings, and pence Flemish for the pound Sterling; the *par* being 33*s.* 4*d.* Flemish.

DUTCH MONEY.	*Sterl. Val.*	
	s.	*d.*
2 Groats, 1 stiver,		
1 Stiver,	0	$1\frac{1}{5}$
6 Stivers, 1 shilling Flemish,	0	$7\frac{1}{5}$
20 Stivers, 1 guilder,	2	0
6 Guilders, 1 pound Flemish of 20*s.*	12	0
33*s.* 4*d.* Flemish, or 10 guilders,	20	0
A common dollar,	3	9
A specie dollar,	5	0

Example 1.

Remitted from London to Amſterdam, a bill of Exchange of *l.* 285-10*s.* Sterling, the Exchange at 33*s.* 9*d.* Flemiſh per pound Sterling, how many guilders Flemiſh muſt the bill be drawn for;

Anſ. 2890 guild. 13 ſtiv.

Worked thus:

If 20*s.* Sterl. give 33*s.* 9*d.* Flem. what *l.* 285 10 Sterl

```
   12                    20
  ---                   ---
  405                   5710
                         405
                       -----
                       28550
                      228400
                     -------
                 210)2312551 0
                     -------
2 groats, 1 ſtiver,  2)115627 10
                     -------
20 ſtivers, 1 guilder, 210) 578113
                     -------
                     Anſ. 2890 13
```

When you would know your gain, or how much the exchange is in your favour, ſubtract the par from the courſe, or price of the exchange, and the difference is the gain per pound Flemiſh, as here it is but 5*d.* And so on the contrary for loſs, &c.

Example 2.

A merchant in Rotterdam remits a bill of Exchange of 7621 guilders, 7 ſtivers, to be paid in London, how much Sterling money muſt the ſaid bill be drawn for, the Exchange at 33*s.* 4*d.* Flemiſh per pound Sterling?

Anſ. l. 762-2-8.

If 33*s.* 4*d.* Flem. gives 20*s.* Sterl. what

			Guild.	Stiv.
12	12		20	
400	240		152427	
			2	groats.
			304854	
			240	
			12194160	
			609708	
		4100	)73164916 0	
		12	)182912	8
		210	) 15241 2	
			Anſ. l. 762	02 08

Sterling money may be brought into Flemiſh money, by Practice, thus: Conſider how much the rate of Exchange is above a pound Sterling, which reduce to the parts of a pound, and take thoſe parts of the Sterling money, and add them to the Sterling money; which total multiply by 6, becauſe 6 guilders make a pound Flemiſh, and the product will be the anſwer.

Example.

The anſwer to the 2d Example of Flemiſh money, reduced to Sterling money, is

Here the difference is 13*s.* 4*d.* or $\frac{2}{3}$ of a *l.* wherefore I take $\frac{2}{3}$ of *l.* 762-2-8, and add the reſults to it, and it makes 7621 guilders, 6 ſtivers, 8 pennies, or 1 groat; as by the Rule of Three.

l. 762	2	08	
254	0	10	$\frac{2}{3}$
254	0	10	$\frac{2}{3}$
1270	4	05	$\frac{1}{3}$
		6	
Gall 7621	6	08	

Or Flemish money may be brought into Sterling money, by bringing the course or rate of Exchange into pence for a divisor; and the Flemish money into pence likewise for a dividend; and the quotient will be the answer in Sterling money.

Example 3.

For how much Sterling money must a bill be drawn for goods bought in Holland, amounting to 11715 guilders, 12 stivers, the Exchange at 34*s.* 8*d.* Flemish per pound Sterling?

```
        s.  d.      Guil. Stiv.
        34  8       11715  12
        12                40 groats.
      ------      ---------
Divisor, 416      )468624( l. 1126 10 Sterling.
                    (208) Remainder.
                      20
                   -----
                    4160(10s.
                    4160
```

London exchanges with France upon the French crown, whose par is 54*d.* that is, to pay so many pence, or shillings and pence for the French crown.

	French Money.	*Val. Sterl.* *s.*	*d.*
12 Deniers, 1 sous,	- -	0	0 $\frac{3}{4}$ $\frac{1}{5}$.
20 Sous, 1 livre,	- - -	1	6
3 Livres, 1 crown,	- - -	4	6

Example 4.

If I draw a bill per Exchange, *l.* 210-17-10 Sterling, to be paid in Paris, the Exchange at 57*d.* $\frac{1}{8}$, for how many crowns must I draw the bill?

Answ. 886 *Fr. Cr.* 0 *Liv.* 1 *Sous.*

```
   d.      F. C.      l.   s.  d.
If 57 1/8 give 1 what 210  17  10
    8        3 Liv.   20
 ------     ----     -----
   457        3      4217
             20 Sous.  12
             ----    -----
             60      50614
                        8 Eights.
                    ------
                    404912
                        60 Second number.
                    ------
        457)24294720(53161 Sous.
2 Fr. Crs. 60 Sous 6[0)531611
```

Answ. Fr. Cr. 886 00 *liv.* 1 *sous.*

Example 5.

Admit a bill drawn in Lyons, and payable in London for 1510 crowns, 2 livres, 10 sous, how much English money comes it to, the exchange at 55*d.* $\frac{1}{8}$?

Answ. l. 347-9-4 $\frac{5}{9}$.

Again, Suppose a Merchant in London buys goods for another in Calais, to the value of *l.* 102-4 Sterling, for which he is to draw a bill on him in Calais; for how many crowns must the bill be drawn ?

Answ. 438 *Fr. Cr.*

```
   s.  Fr. Cr.  l.  s.
If 4 2/3 — 1 — 102  4
   3            20
  ---          ----
   14         2044
                 3
              ----
           7)6132
              ----
           2)876
              ----
```

Here the first and third numbers are brought into thirds, and then I divide by 7 and 2, the ratios of 14, &c.

Answ. 438 *Crowns.*

London exchanges with Spain upon the piece of eight, at 54*d.* Sterling.

Spanish Money.		Sterling Val. s.	d.
1 Mervid,	- - - - -	0	0 $\frac{1}{8}$ $\frac{1}{57}$.
34 Mervids, 1 rial (formerly 6*d.*)	-	0	4 $\frac{3}{4}$
11 Rials plate, 1 ducat,	- - -	4	4
10 Rials Plate, 1 piece of eight	-	4	0

Example 6. How many pieces of eight, at 48*d* $\frac{1}{4}$, will anſwer a bill of *l.* 344-11-8 $\frac{1}{2}$ Sterling? *Anſw.* 1417.

Example 7. In 24690 rials plate, how many pieces of eight and pounds Sterling, the exchange at 4*s.* 6*d.* per piece of eight? *Anſw.* { 2469 pieces of eight, *l.* 555-10-6 Sterling.

London exchanges with Portugal upon the milrea of about 5*s.* 6*d.* to 5*s.* 7*d.*

Portugal Money.		Ster. Va. s.	d.
12 $\frac{1}{2}$ Rees,	- - - -	0	1
1000 Rees, 1 milrea,	- - - -	6	8
1 Feſtoon,	- - - -	1	3

Example 8. How many milreas muſt a bill be drawn for, to pay *l.* 125-11-11 $\frac{3}{4}$ Sterling, the exchange at 5*s.* 6*d.* $\frac{1}{4}$ per milrea?

If 5*s.* 6*d.* $\frac{1}{4}$—*l.* 1—*l.* 125-11-11 $\frac{3}{4}$, *Anſw.* 455.

Example 9. How many pounds Sterling, &c. muſt a bill be drawn for, to anſwer 500 milreas, the exchange at 5*s.* 5*d.* $\frac{5}{8}$ per milrea? *Anſw.* *l.* 136-14-4 $\frac{1}{2}$.

Example 10. How many pounds Sterling, &c. muſt a bill be drawn for, to anſwer 600 milreas, 550 reas, at 5*s.* 7*d.* per milrea? *Anſw.* *l.* 167-13-0 $\frac{3}{4}$ $\frac{5}{30}$.

London exchanges with Venice upon the ducat of 52*d.* and with Leghorn upon the dollar, or piece of eight, of 54*d.*

ITALIAN MONEY.	*Sterl. Val.*	
	s.	*d.*
1 Livre, at Leghorn, - - -	0	9
1 Crown, current at Florence, - -	5	3
1 Ducat de Banco, at Venice, - -	4	4
1 St. Mark, - at ditto, - -	2	10
1 Palermo Florin, - - -	2	6

When the comparison is made between *Foreign coins* of one country and another, such questions may be answered by the Single Rule of Three Inverse.

Example 11.

How many Spanish ducats, at 4*s.* 4*d.* must be drawn for 700 rix-dollars, at 5*s.* 6*d.*

If 700——5*s.* 6*d.*------4*s.* 4*d.*

```
        12          12
        ---         ---
        66          52
       700
      -----
  52)46200(888 24/52 Answ.
     416 ..
     -----
       460
       416
       ---
        440
        416
        ---
        (24)
```

CHAP. XVIII.

PROFIT AND LOSS.

Example 1.

IF I buy 220 yards of broad cloth, at 8*s.* 6*d.* *per* yard, and ſell it again at 10*s.* 4*d.* *per* yard, what do I gain by the whole?

Firſt find the difference by Subtraction between the price bought and the price ſold for; then by Practice caſt up the number of yards by that difference, as underneath.

10	4	ſold for.
8	6	bought for.
1	10	difference.

220 yards, at 1*s.* 10*d.*

6*d.* $\frac{1}{2}$	110		
4*d.* $\frac{1}{3}$	73	4	
	40	13	4

Anſ. *l.* 20 3 4 total gain.

Or thus:

	220		
	22		
Subtract $\frac{1}{120}$	1	16	8
	20	03	4

Example 2.

If a draper buys 750 ells of holland, for *l.* 81-5, how muſt it be ſold *per* ell to gain *l.* 21-17-6 in the whole?

Anſw. 2*s.* 9*d.*

Here the intended gain muſt be added to the prime coſt, which makes *l.* 103-2-6. Then ſay,

If 750 ells coſt *l.* 103-2-6, what 1 ell? and the anſwer will be 2*s.* 9*d.* *per* ell. And for ſo much muſt he ſell it per ell, to gain *l.* 21-17-6 in the whole.

And for proof, see by Practice what 750 ells come to at 2*s.* 9*d.* and you will find it amount to *l.* 103-2-6.

Example 3. Admit a merchant to buy goods to the value of 425*l.* and offers them again for *l.* 15 *per cent.* profit, what come they to? State it thus:

If *l.* 100 gain 115, what *l.* 425

115

2125

425

425

488|175

20

15|00

Answ. *l.* 488 15

Or thus:

425 at 15 *per cent.*

4 hundred under 15 *per cent.* 60

25 is $\frac{1}{4}$ of 100*l.* } 3 15, or $\frac{1}{4}$ of 15*l.*

63 15 Profit

Add 425 00 Prime cost

Answ. *l.* 488 15

Answ. *l.* 488 15 What they must be sold for as before.

Example 4.

If I buy 500 pairs of silk hose, at 8*s.* 6*d.* *per* pair, how much must I sell them for *per* pair, to gain 30 *per cent.* profit?

First see what they come to, at 8*s.* 6*d.* *per* pair, thus:

500 pairs, at 8*s.* 6*d.*

8

4000

6*d.* 250

4250|0

Answ. *l.* 212 10

Then ſee what *l.* 212 10 comes to at 30 *per cent.*
10 *per cent.*

21|25 00
20

5|00

l. 21 5, 10 *per Ct.*
3

30 *per Ct.* profit, *l.* 63 15 *Anſw.*
Prime coſt, 212 10 added.

l. 276 05

Then ſay, If 500 pairs coſt *l.* 276-5, what 1 pair ?
Anſw. 11*s.* 0*d.* $\frac{12}{25}$.

Example 5. An halfpenny in the ſhilling, what is that *per Cent* ?

l. 100
20

$\frac{1}{2}$)2000 ſhillings
12) 1000
8|13 4

Or thus:
4)100
6)25
l. 4 3 4

Anſw. l. 4 3 4 *per Cent.*

A penny in the ſhilling is as much again ; 2*d.* four times as much ; 3*d.* ſix times as much, &c. So you may multiply it either by 2, 4, or 6, to know how much you gain *per cent.* at thoſe rates in a ſhilling, &c. Or conſider what part of a ſhilling your profit is $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, or $\frac{1}{5}$, &c. and take that part of 100*l.* and the quotient will be what ſuch profit in a ſhilling makes *per cent.*

Example 6. As ſuppoſe 2*d.* in the ſhilling be your profit, two-pence we know, is the $\frac{1}{6}$ of a ſhilling, wherefore I take the 6th part of 100*l.* thus.

6)100*l.*

Answ. *l.* 16 13 4 *per Cent.*

In the last Example $\frac{1}{2}$*d.* in the shilling was *l.* 4 3 4 *per cent.* where if you multiply by 4, the $\frac{1}{2}$*d.* in 2*d.* you will find the same answer *l.* 16-13-4 proof: and so the contrary.

Again, admit I gain 3*d.* $\frac{1}{2}$, or 5*d.* in the shilling, what is that *per cent?*

Here in regard that 3*d.* $\frac{1}{2}$, is $\frac{7}{12}$, and 5*d.* $\frac{5}{12}$ of a shilling, I multiply 100 by the numerator, and divide by the denominator, according to the 4th Table at the beginning of the Rule of Practice, thus,

	100		100	
3*d.* $\frac{1}{2}$ in the *s.*	7 half-pence,		5 pence in the *s. i. e.* $\frac{5}{12}$.	
	4)700		12)500	
	6)175		*l.* 41 $\frac{8}{12}$ or $\frac{2}{3}$, *i. e.* 13*s.* 4*d.*	

Answ. *l.* 29 $\frac{1}{6}$, or 3*s.* 4*d.*

As whatever part of a shilling is your profit, the same *per cent.* will be your profit also: so on the contrary, whatever part of 100*l.* is your profit, the same part of a shilling will be your profit likewise; as suppose your gain be 25 *per cent.* which is the 4th part of 100*l.* so your gain in a shilling will be 3*d.* at the rate of 25 *per cent.* for as 25 is the 4th part of 100*l.* so is 3*d.* of 12*d.*

Example 7.

If I purpose to get on any goods 20*l.* *per cent.* profit, what is that in a shilling? 20*l.* is the 5th part of 100*l.* wherefore take the 5th part of a shilling for the profit, thus:

5)12*d.*

2 $\frac{1}{4}$ $\frac{3}{5}$.

Example 8. Suppose I have goods to the value of *l.* 415-12-6, that come to a bad market, and know that they impair by lying, I therefore am obliged to sell them at 12 *per cent.* loss, what come they to?

Here the loss must be subtracted from 100*l.* and the remainder is the middle number.

From 100	If 100—88*l.* what	*l.* 415	12	6
Take 12	*Answ.*	365	15	0
88	Lost in all,	*l.* 49	17	6

Or thus; See what *l.* 415-12-6 comes to, at 12 *per cent.* and subtract that from the cost of the goods.

l. 415 12 6				
12				
l. 49187 10				
20				
s. 17150	From	*l.* 415	12	6
12	Take	49	17	6
d. 6100	*Answ.*	*l.* 365	15	0

If deal-boards be bought at 18*d.* *per* piece, and sold again at 21*d.* what is that *per cent.* profit.

Answ. *l.* 16-13-4, thus:

If 18*d.* gain 3*d.* what 100*l.*

If I buy cinnamon for 6*s.* 7*d.* *per* ℔ and sell it again for 5*s.* 9*d.* what is lost *per cent.*? *Answ.* *l.* 12-13-1 $\frac{77}{79}$

If 6*s.* 7*d.* lose 10*d.* what 100*l.*?

There are two or three other Rules which might be introduced, such as Allegation Medial and Alternate, and the Rule of False; but they being more for amusement than real use, I shall omit them; and, in the next place, say something of Fractions.

CHAP. XIX.

OF

FRACTIONS,

VULGAR AND DECIMAL.

NUMERATION.

I. A FRACTION is part of a whole number, and arises from Division (as was said before) and hath these two parts, viz. *numerator* and *denominator*, which have a short line between them, and set thus:

Remainder, 5 *Numerator*.

Divisor, 8 *Denominator*.

The numerator expresses the number of parts, and the denominator giveth to those parts their names: As suppose 277*l.* be divided among 8 men, the quotient will be 34*l.* (the share to each man) and there will be a remainder of 5, which must be set over the divisor 8, thus $\frac{5}{8}$; and signifies that if a pound or 20*s.* were divided into 8 parts, each man must have 5 of those 8 parts, or $\frac{1}{2}$ crowns more to his share as was before hinted.

II. A Vulgar Fraction is either Simple or Compound.

III. A simple Vulgar Fraction is that which hath only one numerator, and one denominator, and is either proper or improper.

IV. A proper Fraction hath always its denominator greater than its numerator; as $\frac{2}{7}$, $\frac{7}{8}$, $\frac{12}{26}$, &c.

V. An improper Fraction hath its numerator always greater than its denominator, as $\frac{5}{3}$, $\frac{9}{4}$, $\frac{30}{12}$, &c.

VI. Compound Fractions consist of divers *numerators* and *denominators*, and are known by this particle [of] being between them; and are therefore sometimes called Fractions of Fractions, as $\frac{2}{3}$ of $\frac{5}{6}$ of $\frac{7}{8}$, that is, two-thirds of five-sixths of seven-eighths.

VII. Fractions are of two kinds, Vulgar and Decimal.

What Vulgar Fractions are, hath been declared already. A Decimal Fraction is an artificial way of expressing Vulgar Fractions, by setting down the *numerators* only, the *denominators* being understood, but not expressed, and is always an unit, with as many ciphers annexed as there are places in the *numerator*; and therefore must be either 10, 100, 1,000, 10,000, 100,000, &c.

VIII. A Decimal Fraction is distinguished from a whole number by a comma, or point prefixed, thus ,5, and signifies 5 tenths of an integer: So the following Fractions are exhibited Vulgarly and Decimally, viz.

		Vulgarly.	*Decimally.*
7	Tenths,	$\frac{7}{10}$	,7
35	Hundredths,	$\frac{35}{100}$	,35
327	Thousandths.	$\frac{327}{1000}$	,327
64	Ten Thousandths,	$\frac{64}{10000}$	,0064
108	Hundred Thousandths,	$\frac{108}{100000}$	,00108

In Decimals, $\frac{1}{4}$ of any thing is, ,25; $\frac{1}{2}$ of ditto is ,5; $\frac{3}{4}$ is ,75.

IX. As whole numbers increase by a tenfold proportion from the units' place to the left hand; so Decimals decrease by the same proportion, from unity to the right hand, as may by seen be the following Table.

Integers.							*Decimals.*					
Millions.	C of Thousands.	X of Thousands.	Thousands.	Hundreds.	Tens.		Tenth parts.	Hundredths.	Thousandths.	X. Thousandths.	C. Thousandths.	Millions of parts.
7	6	5	4	3	2	1	2	3	4	5	6	7
						Units.						
Seventh place	Sixth place	Fifth place	Fourth place	Third place	Second place		Primes	Seconds	Thirds	Fourths	Fifths	Sixths
Integers, or whole increasing numbers.							*Decimals, or fractional decreasing numbers.*					

Here the figure 2, in the integers, signifies 2 tens, or twice 10 units: but the figure 2 in the Decimals, signifies but 2, or 2 tenths of unity, or one.

X. The order of places in whole numbers is from the right hand to the left; but in Decimals it is from the left hand to the right: So in this Decimal, ,456, the figure 4 stands in the first place, and is 4 primes, or 4 tenths of an integer; and 5, the second figure, is 5 seconds, or five hundred parts of an integer, &c.

XI. Ciphers before integers and after Decimals, are of no value; but after integers and before Decimals, they have their value; for, in integers they increase, and in Decimals they decrease the value of the figure joined with them: For 4, and 04, and 004, in whole numbers, is still but four; but in Decimals, 4, by having a point prefixed thus, ,4, is decreased from 4 integers to $\frac{4}{10}$ of an integer, and ,04 to four hundredth parts of an inte-

ger, &c. Again, in whole numbers, 30 is thirty, and 300 is three hundred; but in Decimals, ,30 or ,300 is ſtill but $\frac{3}{10}$ of an integer.

Reduction of Fractions is to bring a Fraction into a common, or into the leaſt denomination; thereby preparing Fractions to be added, ſubtracted, multiplied, or divided.

XII. To reduce Fractions that have unequal *denominators*, to Fractions of one common *denominator*.

THE RULE.

Multiply each *numerator* into all the *denominators* (except its own) and take the reſpective *products* for new *numerators*. 2*dly*, Multiply all the *denominators* continually; ſo ſhall that *product* be a new *denominator*, common to all the *numerators* found before.

Example. Reduce $\frac{2}{5}$, $\frac{3}{7}$, and $\frac{8}{9}$ of a pound, to a common *denominator*.

The 1ſt 2	the 2d 3	the 3d 8	*Denominators*.
7	5	7	5
			7
14	15	56	
9	9	5	35
			9
$\frac{2}{5}$ 126	$\frac{3}{7}$ 135	$\frac{8}{9}$ 280	
315	315	315	315 *Common denominator*.

Here I firſt multiply 2 by 7, and the product is 14, which I multiply by 9, and the reſult is 126, for the firſt *numerator*. Again, I multiply 3 by 5, and the product is 15, which multiplied by 9, makes 135, for the ſecond *numerator*. Then I multiply 8 by 7, and the product is 56, which multiplied by 5, produces 280, for the laſt *numerator*. Laſt of all, I multiply 5, 7, and 9, the ſeveral *denominators*, together, and their product is 315, for the common *denominator* to all the Fractions. See the work above.

Reduce $\frac{1}{2}$, and $\frac{5}{8}$, $\frac{8}{16}$, $\frac{10}{16}$,
Reduce $\frac{7}{11}$ and $\frac{11}{12}$ $\frac{84}{132}$, $\frac{121}{132}$, } *Facit.*
Reduce $\frac{3}{7}$, and $\frac{5}{19}$ $\frac{57}{133}$, $\frac{35}{133}$,

To prove your work, divide the new *numerator* by the *numerator* of the Fraction; and alſo divide the common *denominator* by the *denominator* of the Fraction; and if both quotients are alike the work is right.

XIII. Abbreviation, or how to bring a Fraction into its loweſt denomination.

THE RULE.

Divide both *numerator* and *denominator* by ſuch a number as will leave no remainder in either of them. When the *numerator* and *denominator* are both even numbers, they may be reduced by halving, or dividing them by 2.

Example.

Reduce $\frac{12}{28}$ into its loweſt terms or denomination.

$$2\left\{\begin{array}{c|c|c} 12 & 6 & 3 \\ \hline 28 & 14 & 7 \end{array}\right\} \textit{Anſw. } \frac{3}{7}$$

Here I ſay, the $\frac{1}{2}$ of 12 is 6, and the $\frac{1}{2}$ of 28 is 14; and then again the $\frac{1}{2}$ of 6 is 3, and the $\frac{1}{2}$ of 14 is 7; So is the Fraction $\frac{12}{28}$ reduced to $\frac{3}{7}$ its loweſt terms; and $\frac{3}{7}$ of any thing is equal in in value to $\frac{12}{28}$; Or, if you had divided the ſaid Fraction by 4 it had been reduced at once; for the 4's in 12, 3 times, and the 4's in 28, 7 times, or $\frac{3}{7}$, as before.

When you can no longer halve the Fraction, then divide it either by 3, 4, 5, 6, 7, &c. if any of them ſo divide as to leave no remainder. And after you have divided by a greater, you may after divide by a leſſer number, to reduce the Fraction lower ſtill.

Example. Reduce $\frac{84}{168}$ into its loweſt denomination.

by 2) 2) 7) 3)

$$\frac{1}{2}\left\{\frac{84}{168}\,\middle|\,\frac{42}{84}\,\middle|\,\frac{21}{42}\,\middle|\,\frac{3}{6}\,\middle|\,\frac{1}{2}\right\}\textit{Anſw.}\ \tfrac{1}{2}.$$

Here I firſt take the $\frac{1}{2}$, or divide it by 2, and then by 2 again, and then by 7, and then by 3, which brings the Fraction into $\frac{1}{2}$, its loweſt terms.

(3) If the Fraction, viz. *numerator* and *denominator*, end each with a figure of 5, or a cipher, or the one with a 5, and the other with a cipher, divide each of them by 5, and the quotient will be a new *numerator* and *denominator*.

Example. Reduce $\frac{55}{80}$, and $\frac{75}{95}$, to their loweſt terms.

$$5\left\{\frac{55}{80}\,\middle|\,\frac{11}{16}\right\}\textit{Anſw.}\ \tfrac{11}{16}.$$

$$5\left\{\frac{75}{95}\,\middle|\,\frac{15}{19}\right\}\textit{Anſw.}\ \tfrac{15}{19}.$$

(4) There is a way of reducing a Fraction into its loweſt name by a common meaſure, which is thus:

Divide the *denominator* by the *numerator*, and if any thing yet remains, divide the foregoing or laſt diviſor by it; and ſo you muſt do till nothing remains, and then the laſt diviſor is the common meaſure required, which will divide both the *numerator* and *denominator*, without leaving any remainder; and ſo reduce the Fraction into its loweſt terms at once: But if your laſt diviſor be 1, the Fraction is in its loweſt terms already.

Example. Reduce $\frac{128}{144}$ into its loweſt terms by a common meaſure.

```
                                        16)128(8
128)144(1                                  128
    128                                    ---
    ---                                     (0)
      16)128(8          16)144(9
         128               144
         ---               ---
          (0)               (0)
```

Here I firſt divide 144 by 128, and there remains 16; by which I divide the laſt diviſor, 128, and there remains 0, wherefore 16, the laſt diviſor, is the common meaſure ſought for, and divides both *numerator* and *denominator*, without leaving any remainder, as may be ſeen in the work above, and reduces the Fraction into $\frac{8}{9}$, its loweſt terms.

But I prefer the other way, in common buſineſs, before this latter; for the time ſpent in finding the common meaſure is longer than that ſpent in reducing the Fraction the other way.

It is very expeditious in many caſes, to work fractionally, viz. to multiply by the *numerator*, and divide by the *denominator* of a Fraction in its loweſt terms.

Example. What comes a hundred weight to, at *6d.* $\frac{1}{2}$ per pound? Conſider that $\frac{112}{12}$, in its loweſt terms, is $\frac{7}{15}$; wherefore multiply *6d.* $\frac{1}{2}$ by 7, and divide by 15, thus;

```
   6d. 1/2
      7
   -------
3)45 1/2   Rem. 2/3, or 8d.
   -------
5)15
   -------
```

Anſw. l. 3 0 8 *per cent.*

Or, if you double the price of a pound, and multiply by 7 and by 8, as follows, you have the answer.

```
      6d. ½.
    ---------
  s. 1  1
       7
    ---------
     7  7
        8
    ---------
Ans. l. 3 0 8
```

Or contrariwise, you have the price of a pound, thus:

```
  7)60s.  8d.
    ----------
  8)  8   8
    ----------
  2)  1   1
    ----------
        6d. ½ Ans.
```

Any goods sold by the long hundred, in tale, or 120 to the hundred, as linen, fish, deals, &c. being $\frac{120}{240}$, multiply the price of one by 6, and divide that product by 12, thus;

Example. Fish, at 3*d.* ½ a piece.

```
      6
    -----
  12)21
    -----------
     l. 1 9/12 or 15s.
```

When things are sold by the 100, as bricks, tiles, hoops, &c. standing thus, $\frac{1000}{240}$, then multiply the price of one by 50, and divide by 12, it gives the price of 1000.

Example. Oranges, at 2*d.* a piece.

```
        50
      ----
12)100
      ----
```

Ans. l. 8 $\frac{4}{12}$, or 6*s.* 8*d.* per thousand.

```
        12
      ----
50)100 0 0
      ----
```

Contrary, 2*d.* a piece.

Or any thing sold by the 1000, may be done by multiplying the quantity by the price, always cutting off 3 figures or ciphers, towards the right hand.

Example. Bought 4796 plain tiles, at 17*s.* 6*d.* per thousand

```
        17
      ----
6d. is ½ of 1s.|81532
          2398
      ------
       831930
           12
      ------
      11|160
```

Ans. l. 4-3-11 $\frac{160}{1000}$.

This is an easy and plain method.

Again, Sold 45874 grey stock bricks, at 18*s.* per thousand.

```
        18
      ----
8251732
     12
      ----
  8|784
     4
      ----
   31|36
```

I multiply by 18, and it produces 825*s.* and 732 cut off for 1000, and that multiplied by 12, gives 8*d.* &c.

Ans. l. 41-5-8 $\frac{3}{4}$ $\frac{136}{1000}$.

A Fraction is seldom abbreviated in Decimals.

XIV. *Valuation.* The value of a Fraction is found by multiplying the integer by the *numerator* of the Fraction, and dividing that product by the *denominator*; Or contrariwise, by dividing by the *denominator*, and multiplying by the *numerator*.

Example. What is the $\frac{2}{3}$ of a pound Sterling?

Contra 3) 20
6 8
2
s. 13 4 *Answ.*

20*s.* the integer.
2 *Numerator.*
3)40
s. 13 4 *Answ.*

What is the $\frac{4}{5}$ of a pound?

20*s.*
4
5)80
16 *Answ.*

What is $\frac{12}{28}$ of 20*s.*

$\frac{3}{7}$ its lowest terms.
7)60
s. 8 $\frac{4}{7}$ *Answ.*

What is $\frac{3}{7}$ of a hundred weight?

Contra, 7)112
16
3
48 *lb. Answ.*

112 *lb.* the integer.
3
7)336
48 *lb. Answ.*

What is	$\frac{6}{7}$ of a pound?	*Anſ.* 17*s.* 1*d.* $\frac{1}{2}$	$\frac{6}{7}$
	$\frac{7}{8}$ of a ſhilling?	*Anſ.* 10*d.* $\frac{1}{2}$	
	$\frac{6}{8}$ of 100*l.* Sterling?	*Anſ.* 75	
	$\frac{7}{10}$ of a ton of wine?	*Anſ.* 176 $\frac{4}{10}$ ga	
	$\frac{7}{10}$ of a Cwt.	*Anſ.* 78 *lb.* $\frac{4}{10}$	
	$\frac{4}{10}$ of a gallon?	*Anſ.* 3 $\frac{2}{10}$ pints	
	$\frac{12}{16}$ of a ton weight?	*Anſ.* 15 C	
	$\frac{2}{3}$ of a foot?	*Anſ.* 8 inches	
	$\frac{3}{4}$ of a pound weight?	*Anſ.* 12 oz	

MIXED NUMBERS.

What is $\frac{4}{6}$ of 12*s.* 6*d.*

```
      4
    ----
6)50  0
    ----
     8  4
```

Contra, 6)12*s.* 6*d*

```
        2  1
           4
        ----
        8  4
```

If a yard of cloth be worth 8*s.* 10*d.* what $\frac{3}{4}$?

```
          3
       -----
4)26  6
       -----
      6  7 ½ Anſ.
```

If a ſhip be worth *l.* 946 12 6, what $\frac{4}{32}$ parts?

```
                 4
          ----------
8)3786  10  0
          ----------
4)437   06  3
          ----------
 l. 118 06  6 ¾
```

XV. If you would know what part of a pound any number of ſhillings and pence is, or what part of a ton any quantity of *C. qrs.* and *lbs.* is, bring them into the loweſt name mentioned; and alſo bring the integer into

he ſame name, and ſet it for a *denominator ;* and then ring the Fraction into its loweſt terms.

Example. What part of a pound is 12*s.* 6*d.*

20*s.* the integer.
12
240

12
Numerator, 1510 | 5
Denominator, 2410 | 8 } *Anſ.*

When there are ciphers in a Vulgar Fraction at the nd, they may be cut off, and you work as if there were none, as in the foregoing Example.

Example. What part of a C. weight is 71 lb. $\frac{3}{11}$?

112 lb. the integer.
11
1232

11
784
1232

Anſ. $\frac{784}{1232}$, or $\frac{7}{11}$ in its loweſt terms.

XVI. To reduce Vulgar Fractions into Decimals. Reduction of Decimals is either from common Fractions r into ſome known *denomination* : therefore to reduce a- y Vulgar Fraction into a Decimal, to the *numerator* of he Fraction, annex 1, 2, 3, 4, 5, or more ciphers ; at leaſure, and then divide by the *denominator.*

Example. Reduce $\frac{3}{4}$ of a *l.* into a Decimal Fraction.

4)300

,75 *Facit,* or 15*s.*

Here, to the *numerator* 3, I annex two ciphers and di- de by the *denominator,* and it quotes ,75 ; which is e- ual in value to $\frac{3}{4}$ of any thing.

If I had annexed three ciphers to the *numerator,* the notient would then have been ,750, which is ſtill but 5 ; for ciphers on the right hand do not increaſe or miniſh a Decimal, as was ſaid before. Again,

Reduce $\frac{2}{3}$ of a pound into a decimal.

3)2000

,666 *Facit*, or 13*s*. 4*d*.

Reduce 6*s*. 8*d*. into a Decimal.

12

810 | 2

2410 | 6

6)2000

,333 *Facit*, or 6*s*. 8*d*

XVII. Valuation of Decimals. In money you mu account for every prime or unit in the first place 2 shi lings: and for every 5 in the second place, 1 shilling and what is above 5, account so many tens; and th figure in the third place, so many units; which tens an units are farthings; but if they exceed $\frac{25}{48}$, there mu be one farthing abated.

Example. What is the value of 75*l*. the first of th foregoing Examples? *Ans.* 15*s*. for the 7 in the fir place, I reckon 14*s*. and for 5 in the second I accoun 1*s*. which put together, make 15*s*. the value of the De cimal Fraction.

Again, Another Example is ,333; for the first 3 reckon 6*s*. and for the other two I account 33 farthing and abating 1 (because above 25) there rests 32 or 8*d*.

What is the value of ,9749? The first figure 9, bein doubled, makes 18*s*. and the figure 7 in the second, bein above 5, I reckon 1*s*. which put to the 18 makes 19 and the excess of 7 above 5 being 2, or 2 tens, makes th next figure 4 to be 24, which is 24 farthings, or six pence; So the Decimal Fraction ,9749 is in valu 19*s*. 6*d*. *A decisive Rule:* As often above 13 makes les by 1 or above 39 makes less by 2.

When you would know the value of a Decimal i weight, measure, &c. (as the value of Decimals of mo ney may be also found) multiply the Decimal by th parts of the next inferior denomination, which mak

an integer in the ſame denomination with the given Decimal; and cut off ſo many figures towards the left hand as there are places in the Decimal, and the figures on the other ſide of the ſtroke towards the left hand, are the value of the Decimal, in the next inferior denomination. And if there be any thing remaining, multiply it by the parts of the next lower denomination, &c. and ſo the Fraction may be reduced as low as you pleaſe.

Example. What is the value of this Decimal of a Cwt? viz. ,875 *Anſ.* $\frac{3}{4}$ 14 lb.

```
 ,875
    4 qrs. 1 Cwt.
 ----
 3,500
    28 lb. 1 qr.
 -----
 14,000
 1,000
 ------
14,1000
```

Here three places are cut off towards the left hand, becauſe there are ſo many in the Decimal. And thus may the value of any Decimal be found, whether of money, weight, meaſure, time, &c.

XIX. To reduce compound Fractions into ſimple ones of the ſame value.

Rule, Multiply all the *numerators* continually for a *numerator*, and all the *denominators* for a *denominator*.

Exam. Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{7}{8}$ of a pound into a ſimple Fraction

```
  3          4
  5          6
 ---        ---
 15         24
  7          8
 ---        ---
Numerator, 105 }                192 Denominat.
           --- } Facit.
Denominator, 192 }
```

Reduce $\frac{9}{10}$ of $\frac{11}{12}$ of $\frac{13}{14}$ of a ton? *Anſ.* $\frac{1287}{1680}$

XX To reduce whole or mixed numbers into improper Fractions.

Rule, (1) If a whole number is to be reduced into an improper Fraction, set the whole proposed number for the *numerator*, and an unit, or 1, for the *denominator* thus 8 integers may be reduced to $\frac{8}{1}$: or else you may assign a *denominator* to the integer, and multiply it by the assigned *denominator*, and the product will be the *numerator* to the said *denominator*.

Ex. Admit 9 integers are to be reduced into an improper Fraction, whose *denominator* shall be 5. Here multiply 9 by 5, the proposed *denominator*, and the product is 45, for a *numerator* to the said *denominator* 5; so is the improper Fraction $\frac{45}{5}$ equal to 9 integers.

Reduce 24 into an improper Fraction, whose *denominator* shall be 8

$$\begin{array}{r} 24 \\ 8 \\ \hline \end{array}$$

$$\left.\frac{192}{8}\right\} \textit{Facit.}$$

(2) If a mixed number is to be reduced into an improper Fraction.

Rule, Multiply the whole number by the *denominator* of the Fraction, and take in the *numerator*.

Example. Reduce 12 $\frac{3}{4}$ into an improper Fraction.

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

$$\left.\frac{51}{4}\right\} \textit{Facit}, \text{ equal to } 12\tfrac{3}{4}.$$

Again, Reduce *l.* 14 $\frac{7}{8}$ or *l.* 14-17-6, into an improper Fraction.

$$\begin{array}{r} 8 \\ \hline \end{array}$$

$$\left.\frac{119}{8}\right\} \textit{Facit.}$$

XXI. To reduce improper Fractions into whole or mixed numbers.

Rule. Divide the *numerator* by the *denominator*, and if it be a mixed number, what was taken in will remain.

Example. Reduce $\frac{119}{8}$ (the foregoing ſum) into its equivalent mixed number.

8)119

14 $\frac{7}{8}$ *Anſ.* Or *l.* 14-17-6.

Here the anſwer is 14 integers, and $\frac{7}{8}$ of an integer.

Reduce $\frac{51}{4}$ yards into a mixed number.

4)51

12 $\frac{3}{4}$ yards, *Anſw.*

Reduce $\frac{45}{5}$ into its equivalent whole number.

5)45

9 *Anſ.* 9 integers.

XXII. To reduce Fractions from one denomination to another.

(1) This is either a ſmaller Fraction to be brought into the denomination of a greater: Or,

(2) A greater into that of a ſmaller.

Example. Reduce 3*d.* $\frac{1}{2}$ into the Fraction of a *l.* Sterl. Make of it a compound Fraction thus. Reduce the mixed number into an improper Fraction thus, $\frac{7}{2}$; then ſay, What is $\frac{7}{2}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a pound? *Anſw.* $\frac{7}{480}$.

Or you may ſay, What is $\frac{7}{2}$ of $\frac{1}{240}$? *Anſ.* $\frac{7}{480}$.

Here it being reduced from a compound Fraction to a ſimple one, according to the 19th Rule of this Chapter, it produces $\frac{7}{480}$, the proper Fraction of a pound belonging to 3*d.* $\frac{1}{2}$.

Reduce $\frac{3}{4}$ of a penny to the proper Fraction of a *l.* Say $\frac{3}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$: Or $\frac{3}{4}$ of $\frac{1}{240}$. *Anſ.* $\frac{3}{960}$.

By the ſame method may be reduced either weight or meaſure, &c.

When the Fraction is to be brought from a greater to a leſſer name, then multiply the *numerator* by the parts in the ſeveral denominations, betwixt that and it, that you would reduce it to.

As ſuppoſe the reverſe of the laſt queſtion was aſked, viz.

What part of a penny is the $\frac{3}{960}$ of a pound?

```
  3
 20
 ---
 60
 12
-----
720
  4      2880
-----    ----  } Anſ.:                3)2880
2880       3                          -----
                                      960  Proof:
```

Again, Reduce $\frac{3}{4}$ of a *l.* to the Fraction of a penny.

```
  3
 20
 ---
 60
 12
-----
720
----  } Facit:
  3
```

ADDITION OF FRACTIONS.

If the Fractions to be added have a common *denominator*, then add all the *numerators* together for a *numerator*, and place it over the common *denominator*:

Example. What is the ſum of $\frac{2}{5}$, $\frac{3}{5}$, and $\frac{4}{5}$ of a *l.*

$$\begin{array}{c} 2 \\ 3 \\ 4 \\ \hline 9 \\ \hline 5 \end{array}$$

This being an improper Fraction, I reduce it to a mixed number, and it makes 1 $\frac{4}{5}$, or *l.* 1-16.

Or thus, Decimally:		Demonſtration.
$\frac{2}{5}$,4	$\frac{2}{5}$,40	$\left.\begin{array}{c}\frac{2}{5}\\\frac{3}{5}\\\frac{4}{5}\end{array}\right\}$ is $\left\{\begin{array}{ccc}0 & 8 & 0\\0 & 12 & 0\\0 & 16 & 0\end{array}\right.$
$\frac{3}{5}$,6	$\frac{3}{5}$,60	
$\frac{4}{5}$,8	$\frac{4}{5}$,80	
l. 1 ,8	1,80, or *l.* 1-16.	*l.* 1 16 0 *Proof.*

Here the Vulgar Fractions being reduced to Decimals, according to the 16th Rule of this Chapter, I caſt up the reſpective Decimals, as I do whole numbers, and the anſwer is 1 integer, and ,8 of an integer; that is *l.* 1-16, the 8 primes being accounted 16*s.* according to the rule of valuation of Decimals, given in the 17th Rule of this Chapter.

In Addition of Decimals, we obſerve the ſame method as in whole numbers, only in ſetting down, regard muſt be had that the fractional parts ſtand one under the other, viz. primes (or tenths) under primes, ſeconds under ſeconds, thirds under thirds, *&c.* And if mixed numbers are to be added, then the Fractions to ſtand, as before directed, and the whole numbers to ſtand as in whole numbers; that is, units under units tens under tens, *&c.* without any regard to the Fractions annexed.

Examples.

Fractions.		Mixed numbers.
,45	,4	124,97
,5	,574	7,065
,095	,0067	27,5
,225	,56	65,007
1,270	1,5407	224,542

Note, That so many fractional places as are found in the greatest among those numbers that are added, so many places must be pointed off from the total, towards the right hand, for Decimal parts, and the other figures towards the left hand are whole numbers, as in the foregoing Examples may be observed.

Again, Add 4 feet 3 inches, 6 feet 9 inches, and 8 feet 6 inches together.

Feet Parts.

4	,25
6	,75
8	,50
19	,50

Answ: 19 feet $\frac{1}{2}$

More Examples.

Integers.	Pts.	Decimal Parts of a *l.*		*l.*	*s.*	*d.*
41	,426	,333	or	0	6	8
16	,04	,25		0	5	0
36	,274	,75		0	15	0
22	,8	,0033		0	0	0 $\frac{3}{4}$
		,3		0	6	0
116	,540	1,6363		*l.* 1	12	8 $\frac{3}{4}$

SUBTRACTION.

I. As in Addition, if the Fractions have unequal *denominators*, they must be reduced to a common *denominator*, before Subtraction can be made. Then subtract one *numerator* from the other, and place the difference over the common *denominator*.

From $\frac{7}{8}$ of a *l.* take $\frac{2}{3}$ *l.*

Decimally.

,875
,666
———
,209 *Ans.* 4*s.* 2*d.*

$$\begin{array}{rrr} 7 & 2 & 8 \\ 3 & 8 & 3 \\ \hline 21 & 16 & 24 \\ 16 & & \\ \hline \end{array}$$

$$\left.\begin{array}{r} 5 \\ \hline 24 \end{array}\right\} \textit{Ans.}\ 4s.\ 2d.$$

From $\frac{7}{8}$ take $\frac{3}{8}$. *Ans.* $\frac{4}{8}$, or $\frac{1}{2}$.

Decimally.
,875
,375

Ans. ,500

From $\frac{11}{16}$ take $\frac{1}{2}$.

$$\begin{array}{r} 16 \\ \hline 8 \end{array} \qquad \begin{array}{r} 11 \\ 8 \\ \hline \end{array}$$

$$\left.\begin{array}{r} 3 \\ \hline 16 \end{array}\right\} \textit{Ans.}\ 3s.\ 9d.$$

Subtraction of Decimals is the same as in whole numbers, observing to keep the same order of placing the numbers, as directed in Addition of Decimals.

II. To subtract a Fraction from a whole number.

Rule. Subtract the *numerator* of the Fraction from the *denominator*, and the remainder place over the given *denominator*, for a *numerator*; and take an unit from the whole

number for what you borrowed, and the remainder pla
before the Fraction found; which mixed number sh
be the difference sought.

Example. Subtract $\frac{6}{8}$ of a *l.* from 25*l.* *Facit, l.* 24

Here 6 from 8, and there rests 2, which I put ov
the denominator 8, thus $\frac{2}{8}$; then 1 from 25, there re
24, which I place before the Fraction $\frac{2}{8}$, thus 24, $\frac{2}{8}$
which is the difference sought.

From 12 ells take $\frac{5}{8}$. *Facit,* 11

Decimally. From ,6875 take ,5 of a pound.

,5000

,1875 *Answ.* or 3*s.* 9*d.*

Here the vacancy is supplied with ciphers, or th
might have been omitted and only supposed to have be
there: and if at any time there should be a vacancy
the upper number, it may be supplied with ciphers; o
as above said, accounted there.

Example. Subtract this Decimal of a pound, viz. ,7
from this whole number, 25*l.*

25,00
,75

24,25, or *l.* 24-5.

Here the defect (though not of places, yet of numbe
s supplied by annexing ciphers to the whole number; f
otherwise you could not subtract, ,75 from 25.

III. To subtract a mixed number from a whole numbe

Rule. From the *denominator* of the Fraction subtra
the *numerator*, and set the remainder over the *denomin*
tor, and then pay 1 to the whole number, and subtract
from the integer, and the remainder is the true differenc
sought.

Example. From 12*s.* take 5 $\frac{3}{8}$.

12*s.*
5 $\frac{3}{8}$

Facit. 6 $\frac{5}{8}$, or 6*s.* 7$\frac{1}{2}$*d.*

Decimally.

s. 12 · · ·
5,375

6,625, or 6*s.* 7$\frac{1}{2}$*d.*

Again, From 24 ells take 19 ells $\frac{3}{5}$

19 $\frac{3}{5}$

Answ. 4 $\frac{2}{5}$

Decimally.

24
19,6

Answ. 4,4

From 16 C. take C. 13 $\frac{7}{16}$.

13 $\frac{7}{16}$

2 $\frac{9}{16}$ *Answ.*

Decimally.

16 · · · ·
13,4375

2,5625

V. To subtract a mixed number from a mixed number.

Rule, (1) Take the lesser *numerator* from the greater.

Example. From 37 $\frac{7}{8}$ take 23 $\frac{5}{8}$.

23 $\frac{5}{8}$

14 $\frac{2}{8}$

Decimally.

37,875
23,625

14,250

(2) When a greater Fraction is to be taken from a lesser, then take the *numerator* of the greater Fraction from its *denominator*, and put the remainder to the *numerator* of the lesser, which is borrowing an integer, &c.

Example. Take C. 24 $\frac{12}{16}$ from 35 $\frac{7}{16}$.

C. 35 $\frac{7}{16}$
24 $\frac{12}{16}$

Facit. 10 $\frac{11}{16}$.

From Gal. 78 $\frac{3}{4}$ take Gal. 29 $\frac{2}{3}$. Reduce to a common *denominator*. The Fractions $\frac{9}{12}$ and $\frac{8}{12}$.

Then, from 78 $\frac{9}{12}$
take 29 $\frac{8}{12}$

Facit, 49 $\frac{1}{12}$

MULTIPLICATION.

Rule, (1) First multiply the *numerators* together for a new *numerator*; and, secondly, multiply the *denominators* together for a new *denominator*.

Example. Multiply $\frac{7}{8}$ of a pound by $\frac{3}{4}$ of a pound.

Here 7 times 3 is 21, the *numerator*, 21
And 8 times 4 is 32, the *denominator*, 32 } *Facit*, or 13*s*. 1*d*. $\frac{1}{2}$

Multiplication in whole numbers increases the product, but in Fractions it decreases; that is, makes it less than either of the two numbers alone.

The reason is, because 1 multiplied by 1, is but 1; therefore, that which is less than 1, being multiplied by that which is less than 1, must needs be lessened by Multiplication.

In Multiplication of Decimals, we proceed as in whole numbers; only, when you have done your Multiplication, you must point off from the product as many figures or ciphers, towards the right hand, as there are fractional places in both multiplicand and multiplier; and what figures remain towards the left hand beside what are cut off are integers; but if there are not so many places, such defect must be supplied by ciphers towards the left hand.

Example. Multiply the foregoing sum, viz. $\frac{7}{8}$ by $\frac{3}{4}$ Decimally.

$\frac{7}{8}$,875
$\frac{3}{4}$,75

4375
6125

,65625 *Answ.* 13*s.* 1*d.* $\frac{1}{2}$.

Here are 5 Decimal places in both the Fractions, therefore all the product is pointed off for Decimal parts

II. When a compound Fraction is to be multiplied by a simple one, then reduce the compound Fraction into a simple one, according to the 19th Rule in Reduction of Fractions, and work as before.

Example. Multiply $\frac{3}{8}$ of a pound by $\frac{5}{8}$ of $\frac{3}{4}$ of a pound. The compound Fraction being reduced makes $\frac{15}{32}$, which multiplied by $\frac{3}{8}$, produces $\frac{45}{256}$, or 3*s.* 6*d.*

When a Fraction or mixed number is to be multiplied by a whole number, constitute a unit, for a *denominator* to the whole number, and then it becomes an improper Fraction; then work as before.

Exam. Multiply 24 by $\frac{2}{3}$ (*i. e.* $\frac{24}{1}$ by $\frac{2}{3}$) *Facit*, $\frac{48}{3}$.

Multiply 12*l.* by $\frac{3}{8}$ of a pound.

$\frac{2}{1}$ per $\frac{3}{8}$, *Answ.* $\frac{36}{8}$, or 4*l.* 10*s.*

Decimally.

,375
12

Facit, 4,500, or *l.* 4-10.

III. When a mixed number is to be multiplied by a Fraction, reduce the mixed number into an improper Fraction and work as before.

Example. 16 $\frac{1}{2}$ by $\frac{4}{12}$

2

$\left.\frac{33}{2}\right\}$ per $\frac{4}{12}$, *Facit* $\left.1\frac{32}{2}\right\}$

Multiply 7 $\frac{1}{4}$ by $\frac{3}{4}$ of a yard. *Fac.* $\frac{87}{16}$, or 5 $\frac{7}{16}$ yards.

Decimally.

```
  7,25
   ,75
 ------
  3625
 5075
 ------
 5,4375
```

IV. To multiply mixed numbers by mixed numbers; that is, a whole number and a Fraction by a whole number and a Fraction.

Rule. Reduce the given numbers into improper Fractions, and work as before.

Ex. Multiply 120 $\frac{1}{4}$ by 48 $\frac{1}{2}$

```
                 4      2          481
                                    97
   4            ----   ---        ----
   2            481    97         3367
  ---           ---    ---        4329
Denom. 8          4      2       -------
                                Denom. 8)46657 Num.
                                -------
                                Answ. 5832 1/8 feet
```

Or thus: First multiply the whole numbers together, as 120 by 48; and to the product add $\frac{1}{2}$ of 48, and $\frac{1}{4}$ of 120.

Example.

```
Decimally.                    120 1/4 long
  120,25                       48 1/2 broad.
   48,5                       -------
 --------                       960
   60125                       480
  96200                         60 the 1/2 of 120
 48100                          12 the 1/4 of 48
 --------                      -------
 5832,125                      5832 1/8 Answ.
```

Then multiply the Fractions by themſelves, ſaying, once 1 is 1, and twice 4 is 8; which produces the $\frac{1}{8}$, as in the Example.

And thus by either of theſe ways, having the length and breadth of any ſuperficial quantity, its contents may be found.

Multiply 2*s.* $\frac{1}{3}$ by 3*s.* $\frac{2}{4}$.

3 $\frac{2}{4}$

6
1
1

Facit, 8 $\frac{2}{12}$, or 8*s.* 2*d.*

Or 2*s.* 4*d.* by 3*s.* 6*d.*

(2.)

Or thus:

s.	*d.*
2	4
3	6
6	0
1	0
1	2
Anſw. 8	2

(3.)

Or thus

2	4
3	6
7	0
1	2
8	2

Decimally.

2,333
3,5
11665
6999

Anſw. 8,1655, or 8*s.* 2*d*

The ſecond of theſe ways is called Croſs Multiplication, or Duo Decimals, by which ſhillings and pence may be multiplied by ſhillings and pence, or feet and inches by feet and inches, carrying the ſame from one denomination to the next; for as 12 pence make a ſhilling, ſo does ſo many inches a foot. In the work I firſt multiply the whole numbers by themſelves, ſaying, 3 times 2 is 6; then *croſs* ways, I ſay, 6 times 2 is 12*d.* or 1*s.* and 3 times 4 is 12*d.* or 1*s.* Then the pence by the pence, ſaying, 6 times 4 is 24, which I divide by 12, ſaying the 12's in 24, twice, &c.

But the third and beſt way is wrought practically, and the laſt decimally; each method producing the ſame anſwer, as may be ſeen in each work.

	l.	*s.*	*d.*
Multiply	3	15	9
By		*l.* 4	7 6
	15	3	0
2*s.* 6*d.* [$\frac{1}{8}$]		9	5 $\frac{1}{2}$
ditto		9	5 $\frac{1}{2}$
ditto		9	5 $\frac{1}{2}$
Facit, l. 16	11	4	$\frac{1}{2}$

	l.	*s.*	*d.*	
	84	13	6	
		l. 17	3	
	338	14	0	*p.* 4 and 4
			4	
	1354	16	0	
	84	13	6	
	8	9	4 $\frac{2}{10}$	
	4	4	8 $\frac{1}{10}$	
l.	1452	3	6 $\frac{3}{10}$	

By the ſame method may be multiplied weight or meaſure.

DIVISION.

I. If the Fractions are ſingle, and have a common *denominator*, divide the one *numerator* by the other, and place the quotient over the *denominator*.

Examples.

Divide $\frac{6}{8}$ by $\frac{3}{8}$	*Facit*, 2.
Divide $\frac{9}{12}$ by $\frac{3}{12}$	*Facit*, 3.
Divide $\frac{27}{32}$ by $\frac{3}{32}$	*Facit*, 9.

II. Diviſion of Decimals is worked juſt as it is in whole numbers; only when the work is over, you muſt point off as many places from the quotient, for Decimal parts, as the dividend has more than the diviſor; that is, there muſt be as many Decimal places in the diviſor and quotient as there are in the dividend; but if not, the

defect must be supplied by ciphers being annexed to the left hand of the quotient, and is just the converse of Multiplication of Decimals.

III. When the divisor consists of more places than the dividend, a competent number of ciphers must be annexed to the dividend before you can make a division.

Example. Let us divide the first sum on the other side Decimally. When the Fractions are reduced to Decimals, they make ,75, to be divided by ,375; wherefore, I join two ciphers to the dividend ,75, thus, 7500, and then divide, as in whole numbers.

```
,375)7500(,20 or ,2
     750
     ---
      (0)
```

IV. When in Vulgar Fractions, the dividend and divisor are both simple Fractions, then multiply the *numerator* of the dividend by the *denominator* of the divisor for a *numerator*; and also multiply the *denominator* of the dividend into the *numerator* of the divisor, for a *denominator*, and the work is done.

Example.

What is the quotient of $\frac{4}{5}$ of a *l.* divided by $\frac{3}{4}$ of a *l.*

$\frac{3}{4})\frac{4}{5}(\frac{16}{15}$ *Ans.*

Divide $\frac{12}{14}$ by $\frac{9}{12}$. *Facit*, $\frac{144}{126}$, or $\frac{8}{7}$.

Or you may reduce the Fractions to a common *denominator*, and then divide the new *numerator* of the dividend by the new *numerator* of the divisor.

Example.

Divide $\frac{12}{14}$ by $\frac{9}{12}$. $\frac{144}{168}$, $\frac{126}{168}$.

126)144(1 $\frac{18}{126}$ *Answ.*

V. To divide a whole number by a Fraction, multiply the integer by the denominator of the Fraction, and divide by the numerator.

Example.

Divide 15 yards by $\frac{3}{4}$. 3)$\frac{60}{20}$ *Answ.*

Decimally.

,75)15,00(,20 or ,2
150
(0)

VI. To divide a Fraction by a whole number, let the numerator stand as numerator, and multiply the integer into the denominator for a denominator.

Example.

Divide $\frac{2}{5}$ of an ell by 9 ells. *Facit*, $\frac{2}{45}$.

Decimally.

9),400

,044 *Ans.*

VII. To divide a mixed number by a whole number, reduce the mixed number into an improper Fraction, and by its *denominator* multiply the integer for a divisor.

Example.

Divide $5\frac{3}{4}$ yds. by 4 yards.

```
 4          4
 --         --
 23         16)23(1 7/16 Answ.
 --            16
  4            --
               7
```

Decimally.

```
4)5,750
  -----
```

Facit, 1,437

VIII. To divide a mixed number by a Fraction, reduce the mixed number into an improper Fraction, and then multiply the numerator of the improper Fraction, by the denominator of the Fraction, and the denominator of the improper Fraction by the numerator.

Example.

Divide *l.* $12\frac{2}{3}$ by $\frac{5}{8}$.

```
 3        3        38
 --       5        8
 38       --       --
 --       15       15)304(20 4/15, Answ.
  3
```

Decimally.

```
,625)12,666000(20,265 Answ.
```

IX. To divide a whole number by a mixed number, reduce the mixed and whole numbers into improper Fractions, and work as before.

Example.

48
2
—
25)96(3 $\frac{21}{25}$ *Answ.*
75
—
21

Divide *l.* 48 by *l.* 12 $\frac{1}{2}$.

—
1

2
—
25
—
2

Decimally.

12,5)48,000(3,84 *Answ.*

X. To divide a mixed number by a mixed number, bring them into improper Fractions, and work as before.

Example.

Decimally.

5,5)8,750(1,59
55
—
325
275
—
500
495
—
(5)

Divide 8 $\frac{3}{4}$ yards by 5 $\frac{1}{2}$ yards.

4
—
35
—
4

2
—
11
—
2

44)70(1 $\frac{26}{44}$
44
—
26

THE RULE OF THREE.

Here, as in whole numbers, the first and third numbers must be of one denomination; and as is the stating, so is the operation the same, viz. second and third numbers are multiplied together, and that product divided by the first; according to the foregoing Rules of working Fractions.

Example.

If $\frac{3}{4}$ yard of cloth coſt $\frac{4}{5}$ of a *l.* what $\frac{5}{6}$ yard.

	4		5
3	20	80	30
4	30	90	*Anſw.* $\frac{8}{9}$ or 17*s.* 9*d.* $\frac{1}{3}$.

When the *numerator* and *denominator* both terminate with a cipher, or ciphers, they may be cut off, and the Fraction ſtill retains the ſame value.

There is another and better way of working the queſtion, when it is ſtated, which is thus: Multiply the *numerators* of the firſt into the *denominators* of the ſecond and third Fractions, for a new *denominator*; and then the *denominator* of the firſt Fraction into the *numerators* of the ſecond and third, for a new *numerator*; which, if an improper Fraction, may be reduced into a whole or mixed number.

Example.

If $\frac{3}{4}$ yard coſt $\frac{4}{5}$*l.* what $\frac{5}{6}$ yard.

4	3	
16	15	
5	6	
80	90	*Facit*, $\frac{80}{90}$ or $\frac{8}{9}$, as before.

The foregoing Queſtions wrought Decimally.

Yards. *l.* *Yards.*
If ,75 coſt ,8, what ,833
,8

,75),66640(,888 *Anſw.* or 17*s.* 9*d.* $\frac{1}{3}$.

lb.		*s.*	*lb.*
If $2\frac{3}{4}$	Tobacco cost	$3\frac{1}{2}$,	what $242\frac{1}{4}$
4		2	4
11		7	969
4		2	4
7		11	
28		22	
969		4	
252		88 *Denominator.*	
168			
252		27132	*Answ.*
27132 *Numerator.*		88	

88)27132(3018

l. 15 8 3 $\frac{3}{4}$ *Facit.*

Decimally.

lb.	*s.*	*lb.*
If 2,75	3,5	242,25
		3,5
		121125
		72675

2,75)847,875(3018,3

Anſ. l. 15 8 3 $\frac{3}{4}$

Here the operation is juſt as it is in whole numbers.

Before I conclude, I ſhall work ſome Examples in Intereſt by Decimals, by which may be ſeen that the Decimal way, in ſome caſes, has the advantage of the Vulgar.

SIMPLE INTEREST.

Example 1. What is the amount of a year's Intereſt of 826*l.* 13*s.* 9*d.* at 5 *per Cent.*

826,687
,05

Anſw. 41,33435, or *l.* 41 6 8 $\frac{1}{4}$, according to the Rule of valuing a Decimal in Reduction of Fractions.

Here the 13*s.* 9*d.* is reduced to the Decimal ,687 annexed to the whole number 826*l.* with the Decimal characteriſtic between them; which multiplied by ,05, the Decimal of the rate, viz. 5 *per Cent.* which is found by annexing ciphers to the rate, and dividing by 100, thus:

per C.
100)5,00(,05 according to the way of valuing the quotient in Diviſion of Decimals, viz. the quotient muſt have as many Decimal places as the dividend exceeds the diviſor. After the ſame manner the Decimal for 4 *per Cent.* is found to be ,04, and of 6, 06, &c.

Example 2.

What is the year's intereſt of 348*l.* 13*s.* 2*d.* at 6 *per Cent. per annum.*

l. 348,658
,06

20,91948 *Anſ. l.* 20-18-4 ½

Here there are as many Decimal places ſeperated to the right hand as there are Decimal places in both multiplicand and multiplier, according to the Rule of Multiplication in Decimals (as in the foregoing Example alſo) and the Decimal parts are found to be 18*s.* 4*d.* ½ according to the Rule of valuing a Decimal of Money &c.

Example 3.

What is the intereſt of *l.* 326, at 4 *per Cent.*

,04

13,04 *Anſ. l.* 13-0-9 ½.

When the ſimple intereſt of any ſum is required for 2, 3, 4, or 5 years, &c. 'tis only to find the intereſt for 1 year, and then to multiply that intereſt by 2, 3, 4, or 5, &c.

Example 4.

What is the intereſt of 324*l.* 10*s.* for 4 years at 4 *per Cent. per annum.*

l. 324,5
,04

l. 12,980 *Anſ.* for 1 year *l.* 12 19 7 $\frac{1}{4}$
4 years.

Anſw. *l.* 51 18 5

If the intereſt required be for parts of a year, *i. e.* months, &c. take ſuch parts of the year's intereſt; as 6 months is the $\frac{1}{2}$, 3 months the $\frac{1}{4}$, and 4 months the $\frac{1}{3}$, &c.

To find the intereſt of any ſum of money, for any number of days, at any rate of intereſt.

Rule. Multiply the principal by the rate of intereſt, and then that product by the number of days, which reſerve for a dividend, which divided by 36500 (the common diviſor for all rates, being the days of a year multiplied by 100) anſwers the queſtion.

Example 5.

What is the intereſt of 240*l.* for 96 days, at 5 *per Ct. per annum.*

5
1200
96

365|00)1152|00(*l.* 3-3-1 $\frac{3}{4}$. *Anſw.*

Likewiſe there may be found Decimal numbers correſpondent to the duty or cuſtom on Tobacco, Holland cloth, viz.

	240 *lb.*	Old ſubſidy	,95
		New ſubſidy	,92625
1 *d.* per *lb.*	1 *lb.*	Addit. duty	,87875
5 *per Cent.* cut off	,05	New ſubſidy	,29485625
		Impoſt	2,484
Old ſubſidy	,95	Duty of 240 *lb.*	5,53385625
2 $\frac{1}{2}$ *per Cent.* off	,02375		
New ſubſidy	,92625		
5 *per Ct.* more off the Old, viz. 7*d.* $\frac{1}{2}$	,0475		
Additional duty	,87875		
$\frac{1}{3}$ of the new ſubſidy	,30875		
with 4 $\frac{1}{2}$ *per Ct.* off	,01389375		
	,29485625		
3*d.* per *lb.*	3,0		
10 *per Cent.* off	,3		
	2,7		
8 *per Cent.* off	,216		
Impoſt	2,484		

And ſo for Holland cloth.

So ſome of the Rules of Practice may be worked by Decimals, but ſhorter by Vulgar Fractions.

AN

APPENDIX;

CONTAINING

THE CONSTRUCTION AND USES OF TABLES, for calculating Questions in COMPOUND INTEREST, and Annuities or Leases in Possession or Reversion.

OF COMPOUND INTEREST.

COMPOUND INTEREST, is that which arises from any Principal and its Interest put together as the Interest becomes due, so that at every payment or time when payment becomes due, there is created a new principal, and for that reason it is called Interest upon Interest, or Compound Interest.

And although it be not lawful to let out money at compound interest, yet in purchasing of annuities, &c. and taking leases in reversion, it is very usual to allow compound interest to the purchaser for his ready money.

In computations of this kind, whether they are about money forborn at interest, or those relating to annuities, &c. we generally make use of the amount of a pound one year, the amount of a pound for a year at any given rate of interest *per Cent.* may be found by this proportion.

As 100 is to 106, so is 1 to 1,06 the amount of a pound, at 6 *per Cent.*

Or, as 100 is to 107, so is 1 to 1,07 the amount of a pound, at 7 *per Cent.* and so on for any rate of interest.

The Construction of TABLES *or Calculation of Questions in Compound Interest and Annuities, for Leases in Possession or Reversion.*

Years.	Table I. Shewing the amount of a Pound for 31 Years, at 5 and 6 *per Cent.* Compound Interest		Table II. Shewing the Rebate of 1 Pound for 31 Years, at 5 and 6 *per Cent.* Compound Interest.	
	5	6	5	6
1	1. 050000	1. 060000	. 952381	. 943396
2	1. 102500	1. 123600	. 907030	. 889996
3	1. 157625	1. 191016	. 863837	. 839619
4	1. 215506	1. 262477	. 822703	. 792093
5	1. 276281	1. 338225	. 783526	. 747258
6	1. 340096	1. 418519	. 746215	. 704960
7	1. 407100	1. 503630	. 710683	. 665057
8	1. 477455	1. 593848	. 676839	. 627412
9	1. 551328	1. 689479	. 644609	. 591898
10	1. 628895	1. 790848	. 613913	. 558394
11	1. 710339	1. 898298	. 584679	. 526787
12	1. 795856	2. 012196	. 556837	. 496969
13	1. 885649	2. 132928	. 530321	. 468839
14	1. 979932	2. 260904	. 505068	. 442301
15	2. 078928	2. 396558	. 481017	. 417265
16	2. 182874	2. 540352	. 458111	. 393647
17	2. 292018	2. 692773	. 436296	. 371364
18	2. 406619	2. 854339	. 415520	. 350343
19	2. 526950	3. 025599	. 395734	. 330513
20	2. 653298	3. 207135	. 376889	. 311804
21	2. 785962	3. 399564	. 358942	. 294115
22	2. 925261	3. 603537	. 341849	. 277505
23	3. 071524	3. 819750	. 325571	. 261797
24	3. 225100	4. 048935	. 310067	. 246978
25	3. 386355	4. 291871	. 295302	. 232998
26	3. 555673	4. 549383	. 281240	. 219810
27	3. 733456	4. 822346	. 267848	. 207368
28	3. 920129	5. 111687	. 255093	. 195630
29	4. 116135	5. 418388	. 242946	. 184556
30	4. 321942	5. 743491	. 231377	. 174110
31	4. 538030	6. 088101	. 220359	. 164254

The Conſtructions and Uſes of the foregoing Tables.

The Conſtructions of the Firſt Table.

By the proportion above, find the amount of a pound for one year, which multiplied by itſelf, gives the amount for the ſecond year, and that product multiplied by the amount of a pound for one year, gives the number for the third year; and ſo multiplying the amount for every precedent year, by the amount of a pound for one year; the product will be the amount for every following year, till the whole Table be finiſhed.

But the moſt expeditious method is by Logarithms thus: Find the Logarithm of the amount of a pound for a year, and add that Logarithm to itſelf, the ſum is the Logarithm of the number belonging to the ſecond year, and to that ſum add again the Logarithm of the amount, gives the Logarithm of the number belonging to the third year, and thus adding the Logarithm of the amount of a pound for a year, to the Logarithms of the amount for any precedent year, that ſum will be the Logarithm of the number belonging to the following year, till the whole Table be finiſhed.

The Conſtruction of the Second Table.

Divide Unity (or the number 1) by the numbers in the firſt Table, and the quotients will be the correſponding numbers in the ſecond Table.

As for Example			Under 5 *per Cent.*
Divided by	1. 050000	will give	.952381
	1. 102500		.907030
	1. 157625		.863837
	&c.		&c.

After the ſame manner the numbers, at 6 *per Cent.* were found.

The Uſe of the Firſt Table.

What ſum will 567*l.* 10*s.* amount to in 9 years, at the rate of 6*l. per Cent.*

In the firſt Table under 6 *per Cent.* and over against 9 years, is 1,689479
Which mult. by 567,5

8447395
11826353
10136874
8447395

The product is 958,7793325 Which is equal to *l. s. d.* 958-15-7

The Uſe of the ſecond Table.

What ready money will pay a debt of 46*l.* 10*s.* due 22 years hence, at 6 *per Cent* ?

In the ſecond Table under 6 *per Cent.* and over againſt 22 years, is ,277505
Multiplied by 46,5

1387525
1665030
1110020

The product is 12,9039825 Equal to *l.* 12 18 0½

Table III.

Shewing the Amount of one Pound Annuity, forborn 31 Years, at 5 and 6 *per cent.*

Years.	5	6
1	1. 000000	1. 000000
2	2. 050000	2. 060000
3	3. 152500	3. 183610
4	4. 310125	4. 374616
5	5. 525621	5. 637093
6	6. 801913	6. 975381
7	8. 142008	8. 393837
8	9. 649108	9. 897647
9	11. 026564	11. 491315
10	12. 577892	13 108794
11	14. 206787	14. 971642
12	15 917126	16. 869940
13	17 712982	18. 882137
14	19. 598631	21. 015165
15	21. 578563	23. 275969
16	23 657491	25 672527
17	25. 840366	28. 212879
18	28. 132384	30. 905651
19	30. 539003	33. 759990
20	33 065954	36. 715590
21	35 719251	39. 992725
22	38. 505214	43. 392280
23	41 430475	46 995826
24	44. 501999	50 815575
25	47. 727099	54. 864510
26	51. 113453	59. 156381
27	54. 669126	63. 705763
28	58. 402583	68. 528100
29	62 32271	73. 639796
30	66 438847	79. 058188
31	70 760790	84 80167

The Construction and Use of this Table is as follows:

Its Construction.

Divide each of the given numbers of the first Table less by unity by the amount of a pound for a year (less by unity) and the quotients will give the numbers in this Table.

Thus { .05, .1025, .157625, &c. } Which are the Numbers for the first 3 years less by Unity.

Divided by .05 the amount of a Pound less by Unity, the quotients will be

1.
2. 05
3. 1525 } The numbers for the first 3 numbers in this Table.
&c.

After the same manner the whole Table may be constructed.

The Use of the Table is,

I demand what an annuity of 46l. 12s. 6d. will amount to forborn 9 years, at 5 per Cent.

In the 3d Table opposite 9 years, and under 5 per Cent. is 11,026564

Multiplied by 46,625

55152820
22053128
66159384
66159384
44106256

The Product is 514.113546500

Equal to 514l. 2s. 3d. ¼.

Years.	Table IV. Shewing the Present Worth of one Pound Annuity to continue for 31 Years, at 5 & 6 *per cent.*		Table V. Shewing what Annuity to continue for 31 Years, will purchase, at 5 & 6 *per cent.*	
	5	6	5	6
1	0. 952381	0. 943396	1. 05000	1. 060000
2	1. 859410	1. 833392	537805	543637
3	2. 723248	2. 673012	367208	374110
4	3. 545950	3. 465105	282012	288591
5	4 329477	4. 212363	230952	237396
6	5. 075692	4 917324	197017	203363
7	5. 786373	5. 582381	172820	179135
8	6. 463212	6 209792	154722	161036
9	7. 107821	6. 801691	140691	147022
10	7. 721734	7. 360086	129505	135868
11	8. 306414	7. 886873	120389	126793
12	8. 863251	8. 383843	112825	119272
13	9. 393572	8. 852682	106456	112960
14	9. 898640	9. 294983	101023	107585
15	10. 379658	9 712248	096342	101963
16	10. 837769	10. 105894	092270	098952
17	11. 274065	10. 477258	088699	095445
18	11. 689586	10. 827602	085546	092356
19	12. 085320	11. 158115	082745	089621
20	12. 462209	11. 469920	080242	087184
21	12. 821155	11. 764075	077990	085004
22	13. 163002	12. 041580	075970	083045
23	13 488573	12. 303377	074137	081278
24	13. 798641	12. 550356	072441	079679
25	14. 093944	12 783354	070955	078227
26	14. 375184	13. 003164	069564	076904
27	14. 643033	13. 210531	068292	075697
28	14. 898127	13. 406162	067122	074592
29	15. 141073	13. 590719	066045	073579
30	15. 372450	13. 764829	065051	072649
31	15. 592810	13. 929084	064132	071702

The Construction of the Fourth Table.

Divide each number of the third Table by the number corresponding in the same year in the first Table, their respective quotients will give the numbers corresponding to the same years in this Table.

Thus	1. 000000	Divide by	1. 050000	Will give	0. 952381
	2. 050000		1. 102500		1. 859410
	3. 152500		1. 157625		2. 723248
	&c.		&c.		&c.

The Construction of the Fifth Table.

Divide unity by the numbers in the fourth Table, the quotients will be the numbers in the fifth Table.

The Use of the Fourth Table.

Example 1.

Suppose a lease of 250*l. per annum*, were to be let for 21 years; what may the present worth of that lease be, at the rate of 5 *per cent.*

Multiply the number under 5 *per cent.* and over against 21 years, viz. 12.821155

By 250

64105775 0

25642310

Product, 3205.288750 Equal to *l.* 3205 5 9 $\frac{1}{4}$.

Example 2.

There is a lease of land worth 32*l. per annum* more than the rent paid to the lord; of which land there is yet a lease in being for 7 years; and the lessee is desirous to take a lease in reversion for 21 years, to begin when his old lease is expired: What sum of money is to be paid for this lease, allowing interest at the rate of 6 *per cent.*

First, See what this rent of 32*l.* is worth for 7 years, which will be 178*l.* 12*s.* 9*d.*

Secondly, Add 7 years to 21 years, which make 28 years; then see what 32*l.* to continue 28 years, is worth, which will be 428*l.* 19*s.* 11*d.* ½.

Lastly, Subtract the present worth for 7 years, from the present worth for 28 years, the difference is the answer to the question, to wit, 250*l.* 7*s.* 2*d.* ½.

The work for 7 years.	For 28 years.
5,582381	13,406162
32	32
11164762	26812324
16747143	40218486
178,636192	428,997184

From 428,997184
Take 178,636192

			l.	*s.*	*d.*
Product 250,360992	Equal to		250	7	2 ½

The Use of the Fifth Table.

What annuity, or yearly rent, to continue 22 years may be purchased for 965*l.* 10*s.* at the rate of 6 *per cent. per annum.*

In Table V. over against 22, and under 6 *per cent.* is ,083045
Multiply by 965,5

415225
415225
498270
747405

			l.	*s.*	*d.*
Product 80,1799475	Equal to		80	3	7

The Application of the foregoing Tables, to find the Present worth in Reversion.

Example.

There is one who has nine years to come in a lease of 175*l. per annum*, and he is desirous to enlarge his time 11 years more (viz. to enjoy it 20 years to come;) what sum must be given in ready money for that purchase, allowing the rate of 6 *per Cent.* to the purchaser.

The first work in this question, is to find the present worth of 175*l.* to continue 11 years, at 6 *per Cent.* over-against 11 years, is 7,886873

Multiplied by 175

39434365
55208111
7886873

1380,202775

Then by the second Table find the rebate for 9 years, which will be the sum required.

In the second Table, at the rate of 6 *per Cent.* opposite to 9, is ,591898

Multiplied by 1380,2

1183796
47351840
1775694
591898

Product 816,9376196 equal to 816*l.* 18*s.* 9*d.*

To conclude this TREATISE, I shall here lay down the practice of *Cross Multiplication*, as is commonly made use of in the measure of *Mason* and *Carpenter* work.

As the French divide their inch into twelve lines, so our masons, in measuring their work, suppose the inch divided into twelve equal parts, which we shall likewise

call Lines: So the meafure, upon which our calculation depends, ftands thus:

Lineal, or Length Meafure.

12 lines	are	1 inch
12 inches		1 foot
3 feet		1 yard
6 yards		1 rood

Superficial Meafure.

144 lines	are	1 inch.
144 inches		1 foot.
9 feet		1 yard.
36 yards		1 rood.

Solid Meafure.

1728 lines	are	1 inch.
1728 inches		1 foot.
27 feet		1 yard.
216 yards		1 rood.

The *fuperficial content* of any *rectangular quadrilateral* figure is found by multiplying the length by the height or breadth; and that of a *right-angled triangle* is found by multiplying the bafe by the $\frac{1}{2}$ the height.

Solid Meafure is found by multiplying the furface by the thicknefs.

The lengths, breadths, and thicknefſes are taken in lineal feet, inches and lines: fo the whole calculation of the *contents* is performed by a *Crofs Multiplication* of feet, inches and lines, by feet, inches and lines.

Example 1. In an area, paved with free-ftone, in length 22 feet 4 inches, and in breadth 19 feet 7 inches, how many fquare feet? *Anfw.* 437 feet, 4 inches, 4 lines.

Here I multiply my 22 feet in the *multiplicand*, by 19 feet in the *multiplier*, and I have 418 fquare feet; then I multiply 19 feet into 4 inches, in the *multiplicand*, the *product* 76, affords 6 twelves, or 6 feet, 4 inches.

Next, I multiply 7 inches in the *multiplier* into 22 feet in the *multiplicand*, the *product* 154, affords 12 feet, which I fet down under feet, and the remain-

F.	*in.*	*l.*
22	4	0
19	7	0
418	0	0
6	4	0
12	10	0
	2	4
437	4	4

ing 10 inches I ſet under inches; then I multiply 7 inches into 4 inches, the product 28, gives 2 inches, which I ſet down under inches, and the remaining 4 ſet in the place of lines; theſe added give the anſwer 437 feet, 4 inches, 4 lines.

If I would reduce this product to yards, I divide my 437 feet by 9, the number of ſquare feet in a ſquare yard, as in the margin, and have my area, 48 yards, 5 feet, 4 inches, 4 lines.

	F.	*in.*	*l.*
9)	437	4	4
yds.	*f*	*in.*	*l.*
48	5	4	4

If I would reduce theſe 48 yards to roods, I divide by 36, the number of yards in a rood, and find my area to be 1 rood, 12 yards, 5 feet, 4 inches, 4 lines.

36)48(1 *rood.*
36
—
12 *yards.*

Example 2. In a floor 49 feet, 7 inches, 4 lines long, and 26 feet 6 inches broad; how many ſquare feet?

Anſ. 1314 feet, 8 inches, 4 lines.

Here as in the former Example, I firſt multiply my 26 feet into the whole *multiplicand*, and then my 6 inches into the whole *multiplicand*.

In multiplying my 26 feet into 4 lines, the product 104, affords eight twelves, or 8 inches, and 8 lines; and in multiplying my 6 inches into 4 lines, the product 24, affords juſt 2 lines.

F.	*in.*	*l.*
49	7	4
26	6	0
1274	0	0
15	2	0
0	8	8
24	6	0
	3	6
		2
1314	8	4

Example 3.

In a piece of timber, whoſe length is 17 feet 6 inches, breadth 1 foot 11 inches, thickneſs, 2 feet 7 inches, how many ſolid feet?

Anſ. 86 feet, 7 inches 9 lines $\frac{1}{2}$.

Here I firſt multiply my length, 17 feet, 6 inches, by 1 foot, 11 inches of breadth, and find the *ſuperficial* meaſure of the baſe of my *ſolid* to be 33 feet, 6 inches, 6 lines which I multiply by the thickneſs, 2 feet, 7 inches, and find the *ſolid* content to be 86 feet, 7 inches, 9 lines; for the fraction of the line may be neglected.

F.	*in.*	*L.*
17	6	0
1	11	0
17	6	0
15	7	0
00	5	6
33	6	6
2	7	0
66	0	0
1	0	0
0	1	0
19	3	0
00	3	6
00	0	3
86	7	9

Let theſe three Examples ſuffice to illuſtrate and explain the uſe and practice of *Croſs Multiplication* in the menſuration of *Surfaces* and *Solids*. Mean time I could heartily wiſh, that theſe gentlemen, who have daily occaſion for that kind of meaſure, would rather chooſe the Decimal way of working as being fully as expeditious and leſs liable to miſtakes, eſpecially conſidering in our rules of foot meaſure the inch is divided, not into twelve but ten equal parts which naturally introduces the Decimal way. And I muſt here take notice, that, in working *decimally*, we have real ſolid inches, or 1728th parts of a ſolid foot; and in ſuperficial meaſure we have real ſquare inches, or 144th parts of a ſquare foot; whereas, in working by *Croſs Multiplication*, we have only 12th part of a ſolid foot, which we call inches, and only 12th part of a ſquare foot, which we call ſquare inches.

FINIS.