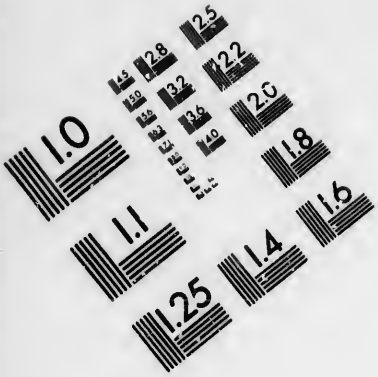

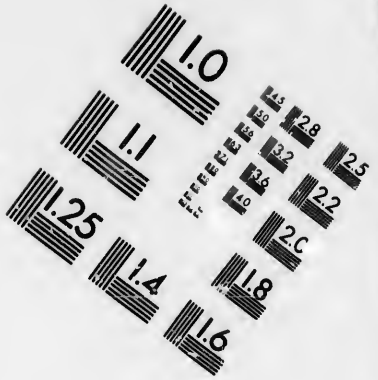

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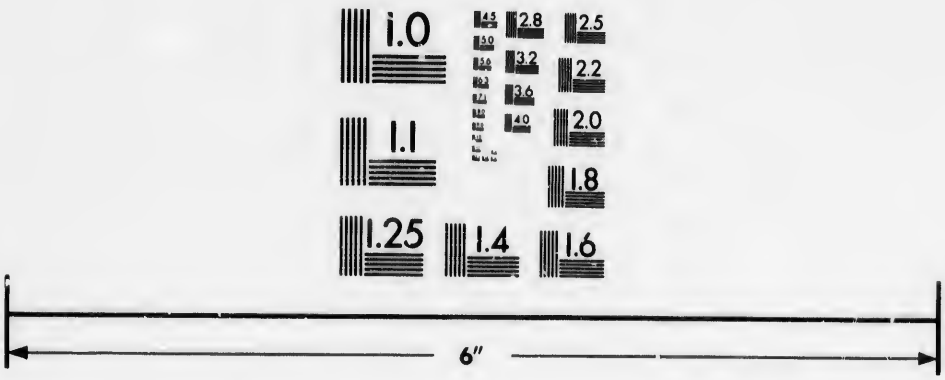

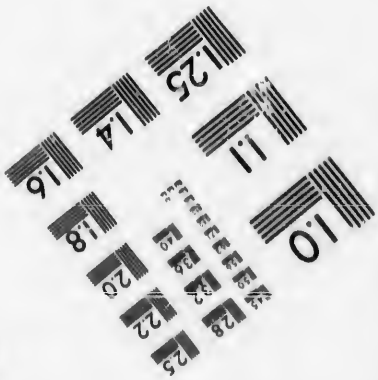

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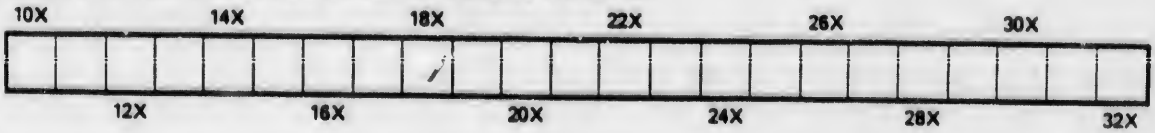

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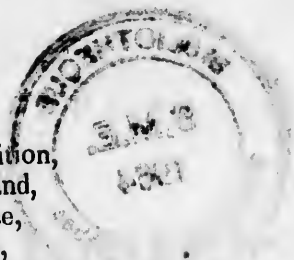

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PREFACE.

THE immense circulation of WALKINGAME'S TUTOR'S ASSISTANT, even in its original form, is sufficiently evinced by the very extensive and uniformly increasing demand which the Proprietors of the present Edition have for many years experienced.

To advance the utility of a work held in such high estimation among Conductors of Schools; by simplifying the Rules, correcting and modernizing the antiquated phraseology, supplying deficiencies where there was a paucity of Examples, and incorporating with its original matter such emendations and additions as appear to be called for by the present improved state of Arithmetical Science; will, it is presumed, be rendering an acceptable service to the Public.

Amongst the various improvements introduced in this Edition, may be enumerated, a more intelligible elucidation of the system of Notation; of Direct, Inverse, and Compound Proportion, Practice, Interest, Progression, &c.; more perspicuous illustrations of the theory and practice of Vulgar and Decimal Fractions, Evolution, Duodecimals, &c.; the substitution of the *new Arithmetical* and *Commercial Tables;* the insertion of many additional Examples, (particularly in the elementary Rules) adapted to exercise and improve the judgment of the Learner; also of Rules for the particular cases in Profit and Loss, of Involution, & Theorems for the solution of all the possible cases in Arithmetic and Geometrical Progression, Superficial Mensuration, a numb of useful Supplemental Questions, and a Compendium of Boo Keeping.

Such are the attempts that have been made to enhance the real worth of this popular *Treatise on Arithmetic.* How far the intention may have been judiciously or successfully executed, must be left to a candid Public to determine.

With a confident reliance, however, on the favorable consideration of those whose judgment and experience most essentially qualify them to discriminate between realities and specious pretensions to improvement, and duly to appreciate the difficulties of such an undertaking; the work is respectfully submitted to a trial before the tribunal of its legitimate judges, with an anxious and hopeful anticipation of obtaining their verdict of approval.

Derby, February 7, 1837.

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TUTOR'S ASSISTANT;

BEING A COMPENDIUM

OF PRACTICAL ARITHMETIC.

Integers, or Whole Numbers

ARITHMETIC is the science of numbers; or the art of numerical computation. A *whole number* is a *unit*, or a collection of *units*.

Numbers are expressed by ten written characters called figures, or digits: *viz.* 1, 2, 3, 4, 5, 6, 7, 8, 9, which are *significant* figures, all declaring their own values by the names; and the *cipher*, or *nought* (0) an *insignificant* figure, indicating no value when it stands alone.

NUMERATION AND NOTATION.

A figure standing alone, or the *first on the right* of others, denotes only its simple value, as so many *units*, or *ones*; the second is so many *tens*; the third so many *hundreds*, &c. increasing continually towards the left in a *tenfold* proportion.

Numeration is the art of *reading* numbers expressed in figures; and *Notation* the art of *expressing numbers by figures.*

THE TABLE.

Billions	Hund. of Thou.	Tens of Thou.	Thousands	Hundreds	Tens	Millions	Hundreds	Tens	Thousands	Hundreds	Tens	Units
	5	7	8	6	9	5	2	7	3	8	4	1
	of Millions			of Millions			of Thousands					
	Millions' period.						Units' period.					

This Table might be infinitely extended.

NOTE *To read any Number.* Divide it into *periods* of six figures each, beginning at the right hand; and each period into *semi periods* with a *different mark*, for the sake of distinction. The *first* on the right hand is the *Units'* period, the second the *Millions'* period, &c. Beginning at the left, observe that the three figures of every *complete semi-period* must be reckoned as so many *hundreds, tens,* and *units;* joining the word *thousands* when you come to the middle of the period, and the *proper name* of the period at the end of it.

2. *To express any given Number in Figures.* Begin at the left, and write the figures which denote (as so many *hundreds, tens,* and *units*) the number in that *semi-period;* and proceed thus with each successive semi-period, till the whole is completed; placing a separating comma in the middle of each period, or immediately after the thousand, and a semicolon between the periods. But observe, that though every semi-period but the first on the left must have its complete number of *three* figures, *that* may be incomplete, and consist of only one or two figures,: also, where *significant figures are not required* in any part of a number, no semi-period must be omitted, but the places must be filled up with *ciphers.*

Example. Write in figures, seventy thousand four hundred billions, two hundred and ten thousand millions, and ninety-six.

First write 70 (seventy) with a comma, these being thousands; then 400 (four hundred) with a semicolon, denoting the end of the period; next, write 210 (two hundred and ten) and, because they are thousands, put a comma after them, and then 000 (three ciphers, there being no more millions) followed by a semicolon, to denote the completion of the period; again, put 000 (three more ciphers, denoting the absence of thousands) with a comma after them, and then 096, (ninety-six) which will complete the number: thus, 70,400; 210,000; 000,096.

EXERCISES IN NUMERATION AND NOTATION.

Read, or write in words the following numbers.

*(1) 3	(13) 721	(25) 500050005
(2) 30	(14) 906	(26) 1010100
(3) 33	(15) 4294	(27) 11110101
(4) 300	(16) 94294	(28) 499994949
(5) 303	(17) 294294	(29) 3584600987
(6) 330	(18) 3703	(30) 584610070840
(7) 333	(19) 703703	(31) 5846100708400
(8) 127	(20) 311311	(32) 37613590200116
(9) 172	(21) 113113	(33) 5008000400000
(10) 217	(22) 131131131	(34) 6010080001800 70
(11) 271	(23) 708807780	(35) 37000000000075048
(12) 712	(24) 807078087	

* The figures in parentheses refer to the Editor's Key to this work.

Express in figures the following numbers.

(1) Nine; ninety; ninety-nine; nine hundred; nine hundred and nine; nine hundred and ninety; nine hundred and ninety-nine.

(2) One hundred and eight; one hundred and eighty; eight hundred and one; eight hundred and ten; one hundred and sixteen; one hundred and sixty-one; six hundred and eleven.

(3) One hundred and twenty-three; one hundred and thirty-two; two hundred and thirteen; two hundred and thirty-one; three hundred and twelve; three hundred and twenty-one.

(4) Two thousand five hundred and seventy-two.

(5) Seventy-two thousand five hundred and seventy-two.

(6) Five hundred and seventy-two thousand five hundred and seventy-two.

(7) Ten thousand nine hundred and ten.

(8) Nine hundred and ten thousand nine hundred and ten.

(9) One hundred and nine thousand nine hundred and one.

(10) One hundred and ninety thousand and ninety-one.

(11) Nine hundred and one thousand and nineteen.

(12) One hundred and fourteen millions, one hundred and forty-one thousand four hundred and eleven.

(13) Four hundred and six millions, six hundred and four thousand four hundred and sixty.

(14) Six hundred and forty millions, forty-six thousand and sixty-four.

(15) Seven millions, seventy thousand seven hundred.

(16) Seven hundred millions, seven thousand and seventy.

(17) Ten millions, one thousand one hundred.

(18) One hundred and one millions, eleven thousand one hundred and ten.

(19) Twelve billions, seventeen thousand and nine millions, and eighty-nine.

(20) Seven thousand five hundred and four trillions, sixty thousand millions, eight hundred thousand.

Roman Numerals.

I	1 One.	III	3 Three.	V	5 Five.
II	2 Two.	IV	4 Four.	VI	6 Six.

VII	7	Seven.	LX	60	Sixty.
VIII	8	Eight.	LXX	70	Seventy.
IX	9	Nine.	LXXX	80	Eighty.
X	10	Ten,	XC	90	Ninety.
XI	11	Eleven.	C	100	One hundred.
XII	12	Twelve.	CC	200	Two hundred.
XIII	13	Thirteen.	CCC	300	Three hundred.
XIV	14	Fourteen.	CCCC	400	Four hundred.
XV	15	Fifteen.	D	500	Five hundred.
XVI	16	Sixteen.	DC	600	Six hundred.
XVII	17	Seventeen.	DCC	700	Seven hundred.
XVIII	18	Eighteen.	DCCC	800	Eight hundred.
XIX	19	Nineteen.	DCCCC	900	Nine hundred.
XX	20	Twenty.	M	1000	One thousand.
XXX	30	Thirty.	MDCCCXXX	1830	One thousand eight hundred and thirty.
XL	40	Forty.			
L	50	Fifty.			

NOTE. A less numerical letter standing before a greater, must be taken from it, as I before V or X, and X before L or C, &c. thus IV. Four; IX. Nine; XL. Forty; XC. Ninety, &c. And a less numerical letter standing after a greater, is to be added to it, thus. VI. Six; XI. Eleven; LX. Sixty: CX. One Hundred and Ten.

All operations in Arithmetic are comprised under four *elementary or fundamental Rules:* viz. *Addition, Subtraction, Multiplication* and *Division.*

ADDITION.

TEACHES to find the *sum* of several numbers.

RULE. Place the numbers one under another, so that units may stand under units, tens under tens, &c.; add the units, set down the units in their sum, and *carry* the *tens as so many ones* to the next row; proceed thus to the last row, under which set down the whole amount.

PROOF. Begin at the top and add the figures downwards: if the *sum* is found the same as before, it is presumed to be right.

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

(5)590046	(6)370416	(7) 781943
73921	2890	56820
400080	60872	1693748
4987	998	300486
19874	47523	920437500
201486	9836	78632109
9883	26627	9408175

(8) What is the *sum* of 43, 401, 9747, 3464, 2263, 314, 974 ?

(9) Add 246034, 298765, 47321, 58653, 64218, 5376, 9821, and 640 together.

(10) If A has £56. B £104. C £274. D £1390. E £7003. F £1500. and G £998. ; how much is the whole amount of their money ?

(11) How many days are in the twelve calendar months ?

(12) Add 87929,135594,7964,3621,27123, 8345, 35921, 2374, 64223, 42354, 3560, and 152165, together.

(13) Add 6228,27305,7856,287, 7664, 100, 1423, 25258, 528, 3135, and 838.

(14) How many days are there in the first six months of the year ; how many in the last six ; and how many in the whole ?

(15) In the year 1832, how many days from the Epiphany or Twelth-day (Jan. 6th) to the last day of July ?

(16) In the common year how many days from each Quarter-day to the next ? That is, from Lady-day to Midsummer-

* Say 2 and 1 are 3, and 4 are 7, and 3 are 10, and 5 are 15, set down 5 and carry 1 ; 1 and 5 are 6, and 7 are 13, and 5 are 18, and 7 are 25, and 1 are 26, and 7 are 33, set down 3 and carry 3; 3 and 3 are 6, and 2 are 8, and 3 are 11, and 4 are 15, and 1 are 16, and 2 are 18, set down 18 : so the *sum* is 1835.

After practising a few examples, it will be better for the learner to add the figures without naming them. Thus, in adding the first column of the above examply, say 2, 3, 7, 10, 15, ; set down 5 and carry 1, &c.

This method will tend both to quickness and precision.

day, from thence to Michaelmas-day, from thence to Christmas-day, and from Christmas-day to the ensuing Lady-day?

(17) When will the lease of a farm expire, which was granted in the year 1799, for ninety-nine years?

(18) A person deceased left his widow in possession of £2500. His eldest son inherited property of the value of £1 1340. To his two other sons he bequeathed a thousand pounds each more than to his daughter; whose portion exceeded the property left to her mother by £500. A nephew and a niece had legacies of £525, each; a public charity £105.; and his four servants the same sum to be divided amongst them. What was the agregate amount of his property?

(19) Tell the *name* and *signification* of the *sign* put between the following numbers: and find what they are equal to, as the sign requires?

1724+649+17+5400+12+999.

(20) Required the *sum* of forty-nine thousand and sixteen; four thousand eight hundred and forty; eight millions, seven hundred and seven thousand one hundred; nine hundred and ninety-nine; and eleven thousand one hunded and ten.

(21) When will a person born in 1819, attain the age of 45?

(22) Henry came of age 13 years before the birth of his cousin James. How old will Henry be when James is of age?

(23) Homer, the celebrated Greek poet, is supposed to have flourished 907 years previous to the commencement of the christian era. Admitting this to be fact, how many years was it from Homer's time to the close of the 18th century; and how long to A. D. 1827?

SUBTRACTION

Teaches to take a less number from a greater, to find the remainder or *Difference*.

The number to be subtracted is the *Subtrahend*, and the other is called the *Minuend*.

Rule. Having placed the Subtrahend under the Minuend (in the same order as in Addition) begin at the units, and subtract each figure from that above it, setting down the remainder underneath. But when the lower figure is the

greater, *borrow ten*; which add to the upper, and then subtract: set down the remainder, and carry one to the next figure of the subtrahend for the *one that was borrowed.*

PROOF. Add the *Difference* to the *Subtrahend*, and their sum will be the *Minuend.*

(1)	From 2714754 Take 1542725	(4)	271508300 72841699	(7)	1000000000 987654321
(2)	42087296 34096187	(5)	375021599 278104609	(8)	2746981340 1095681539
(3)	45270509 32761684	(6)	400087635 9184267	(9)	666746825 109348172

(10) From 123456789 subtract 98765432.

(11) From 31147680975 subtract 767380799.

(12) Subtract 641370035 from 1630054154.

(13) Required the *Difference* between 240914 and 24091.

(14) How much does twenty-five thousand and four exceed sixteen thousand three hundred and ninety.

(15) If eighty-four thousand and forty-eight be deducted from half a million, what will remain?

(16) The annual income of Mr. Lemmington, senior, is twelve thousand five hundred and sixty pounds. Mr. Lemmington, junior, has an income of seven thousand eight hundred and eighteen pounds per annum. How much is the son's income less than his father's?

(17) George the Fourth, at his accession to the throne, in 1820, was in the 58th year of his age. In what year was he born, and how long had he reigned on the 29th of January, 1829. the anniversary of his accession?

EXAMPLE. From 32906547 subtract 8210468.

32906547	Minuend.	Say 8 from 7 I cannot; borrow 10, and 7 are 17, 8 from 17, 9 remain; set down 9 and carry 1.—1 and 6 are 7, 7 from 4 I cannot; borrow 10, and 4 are 14, 7 from 14, 7; set down 7 and carry 1.—1 and 4 are 5, 5 from 5, nothing; set down (0) nought.—0 from 6, 6; set down 6.—1 from 0 I cannot; but 1 from 10, 9; set down 9 and carry 1. Proceed in like manner to the end.
8210468	Subtrahend.	
24696079	Difference.	
32906547	Proof.	

When the pupil is initiated in the practice by working an example or two, he may simplify the work by omitting to express some of the particulars Thus, in the preceding example, it will be sufficient merely to say, 8 from 17, 9; set down 9 and cary 1: 1 and 6 are 7, 7 from 14, 7; set down 7 and carry 1, &c.

(18) The sum of two numbers is 36570, and one of them is twenty thousand and twelve : what is the other?

(19) Thomas has 115 marbles in two bags. In the green bag there are 68 : how many are there in the other ?

(20) Two brothers who were sailors in Admiral Lord Nelson's fleet, were born, the elder in 1767, and the younger in 1775. What was the difference of their ages, and how old was each when they fought in the battle of Trafalgar, in 1805?

(21) Henry Jenkins died in 1670, at the age of 169. How long prior to his death was the discovery of the continent of America by Columbus, in 1498 ?—Also, how many years have elapsed from his birth to 1827 ?

(22) Borrowed at various times. £644.. £957., £90,. £1378., and £1293. ; and paid again the different sums of £763., £591., £1161., £1000., and £847.—What remains unpaid ?

(23) Explain the *name* and *signification* of the *sign* used ; and work the two following examples.

10874 — 9999 51170 — 50049

(24) John is seventeen years younger than Thomas : how old will Thomas be when John is of age ; and how old will John be when Thomas is 50?

MULTIPLICATION

TEACHES to repeat a given number as many times as there are units in another given number.

The number to be multiplied is called the *multiplicand ;* that by which we multiply is the *multiplier ;* and the number produced by multiplying is the *Product.*

RULE. When the multiplier is not more than 12, multiply the units' figure of the multiplicand, *set down the units* of the product, *reserving the tens ;* multiply the next figure, to the product of which *carry the tens reserved :* proceed thus till the whole is multiplied, and set down the last product in full.*

* EXAMPLE. Multiply 713097 by 4.

713097
4
2852388

Say 4 times 7 are 28, set down 8 and carry 2 ; 4 times 9 are 36 and 2 are 38, set down 8 and carry 3 ; 4 times 0 (nought) and 3 are 3 set down 3 ; 4 times 3 are 12, set down 2 and carry 1 ; 4 times 1 are 4 and 1 are 5, set down 5 ; 4 times 7 are 28, set down 28.

MULTIPLICATION TABLE.

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

(1) Multiply 25104736 by 2.
(2) Multiply 52471021 by 3.
(3) Multiply 7925437521 by 4.
(4) Multiply 27104107 by 5.
(5) Multiply 23104759 by 6.
(6) Multiply 7092516 by 7.
(7) Multiply 3725104 by 8.
(8) Multiply 4215466 by 9.
(9) Multiply 2701057 by 10.*
(10) Multiply 31040171 by 11.
(11) Multiply 73998063 by 12.

(12) Multiply 780149326 by 3, 4, 5, 6, 7, 8, 9, and 10.
(13) Multiply 123456789 by 4, 5, 6, 7, 8, and 9.
(14) Multiply 987654321 by 9, 10, 11, and 12.

When the multiplier is between 12 and 20, multiply by the units' figure in the multiplier, adding to each product the last figure multiplied.†

(15) 5710592 × 13.
(16) 5107252 × 14.
(17) 7653210 × 15.
(18) 2057165 × 16.
(19) 6251721 × 17.
(20) 9215324 × 18
(21) 2571341 × 19.

* To multiply by 10, annex a cipher to the multiplicand, for the product. To multiply by 100, annex two ciphers, &c.

EXAMPLES.

† Multiply 96048 by 15.

96048	Say 5 times 8 are 40, set down 0 and carry 4; 5 times 4 are 20 and 4 are 24, and 8 are 32, set down 2 and carry 3; 5 times 0 and 3 are 3, and 4 are 7, set down 7; 5 times 6 are 30, set down 0 and carry 3; 5 times 9 are 45 and 3 are 48, and 6 are 54, set down 4 and carry 5; 5 and 9 are 14, set down 14.
15	
1440720	

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

PROOF. Make the former multiplicand the multiplier, and the multiplier the multiplicand; and if the work is right, the products of both operations will correspond. *Otherwise*, A presumptive or probable proof (not a positive one) may be obtained thus: Add together the figures in *each factor*, casting out or rejecting the *nines* in the sums as you proceed; set down the remainders on each side of a *cross*, multiply them together, and set down the *excess* above the nines in their product at the top of the cross. Then cast out the nines from the *product* and place the *excess* below the cross. If these two correspond, the work is *probably* right: if not, it is *certainly* wrong.

(22) 271041071 × 5147. | (24) 170925164 × 7419.
(23) 62310047 × 1668. | (25) 9500985742 × 61879.
(26) 1701495868567 × 4768756.

When ciphers are intermixed with the significant figures in the multiplier, they may be omitted; but great care must be taken to place the first figure of the next product under the figure you multiply by.*

Ciphers on the right of the multiplier or multiplicand (if omitted in the work) must be placed in the total product.†

---

‡ Multiply 76047 by 249.

76047			Proof.
249			
684423	Product by	9.	0
304188	do. by	40.	6×6
152094	do. by	200.	0
18935703	Total product,		

EXAMPLES.

* Multiply 31864 by 7008.

31864	
7008	Proof.
	6
254912	4×6
223048	6
223302912	

† Multiply 63850 by 5200.

63850	
5200	Proof.
	1
12770	4×7
31925	1
332020000	

(27) 571204 × 27009.
(28) 7561240325 × 57002.
(29) 562710934 × [illegible]30.
(30) 1379500 × 3400.
(31) 7271000 × 52600.
(32) 74837000 × 975000.

A number [illegible] multiplying two numbers together, is called a *composite number*; [illegible] the two numbers producing it are called the *factors*, or *component parts*. When the multiplier is a *composite* [illegible], you may multiply by one of the *factors*; and that product multiplied by the *other* will give the total product.

(33) 7710[illegible]
(34) 92156[illegible]
(35) 715241 × [illegible]
(36) 679998 × 132.
(37) 7984956 × 144.
(38) 8760472 × 999.§
(39) 7039654 × 99999.

(40) A boy can point 16000 pins in an hour. How many can five boys do in six days, supposing them to work 10 clear hours in a day?

(41) If a person walks upon an average 7 miles a day, how many miles will he travel in 42 years, reckoning 365 days to a year?

(42) Multiply the *sum* of 365, 9081, and 22048, by the *difference* between 9081 and 22048.

(43) Required the *continued product* of 112, 45, 17, and 99.

NOTE. Multiply all the numbers one into another.

DIVISION

TEACHES to find how often one number is contained in another: or to divide a number into any equal parts required.

The number to be divided is called the *Dividend;* that by which we divide is the *Divisor;* and the number obtained by

‡ Multiply 63175 by 45.

63175
5×9=45
315875
9
2842875

§ For an abridged method of multiplying by a series of *nines* see the Key.

dividing is the *Quotient;* which shows how many times the divisor is contained in the dividend. When it is not contained an exact number of times, there is a part of the dividend left, which is called the *Remainder*.

RULE. When the divisor is not more than 12, find how often it is contained in the first figure (or two figures) of the dividend; set down the quotient underneath, and carry the overplus (if any) to the next in the dividend, *as so many tens;* find how often the divisor is contained therein, set it down, and continue in the same manner to the end.

When the divisor exceeds 12. find the number of times it is contained in a sufficient part of the dividend, which may be called a *dividual;* place the quotient figure on the right, multiply the divisor by it, subtract the product from the dividual, and to the remainder bring down the next figure of the dividend, which will form a new dividual: proceed with this as before, and so on, till all the figures are brought down.

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

(1) Divide 725107 by 2.*
(2) Divide 7210472 by 3.
(3) Divide 7210416 by 4.
(4) Divide 7203287 by 5.
(5) Divide 5231037 by 6.
(6) Divide 2532701 by 7.
(7) Divide 2547325 by 8.
(8) Divide 25047306 by 9.
(9) Divide 70312645 by 10
(10) Divide 12804763 by 11.
(11) Divide 79043260 by 12.
(12) Divide 37000421 by 3, 5, 7, and 9.
(13) Divide 111111111 by 6, 9, 11, and 12.

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* EXAMPLE. Divide 7328105 by 4.

Divisor 4)7328105 Dividend.
Quotient 1832026—1 Rem.
4
7328105 Proof.

Say the fours in 7, once and 3 over; the fours in 33, 8 times 4 are 32 and 1 over; the fours in 12, 3 times; the fours in 8, twice; the fours in 1, 0 and 1 over; the fours in 10, twice 4 are 8, and 2 over; the fours in 25, six fours are 24 and 1 over.

(14) 7210473 ÷37.*
(15) 42749467 ÷347.
(16) 734097143 ÷5743.†
(17) 1610478407 ÷54716.
(18) 4973401891 ÷510834.
(19)51704567874÷4765043.
(20)17453798946123741 ÷ 31479461.
(21) 25473221 ÷27100.‡
(22) 725347216 ÷572100.
(23) 752473729 ÷373000.
(24) 6325104997 ÷215000.

When the divisor is a *compósite number*, you may divide the dividend by one of the *compónent parts*, and that quotient by the *other*; which will give the quotient required. But the *true remainder* must be found by the following

RULE. Multiply the second remainder by the first divisor: to that product add the first remainder, which will give the *true one.*

(25) 3210473 ÷ 27.§
(26) 7210473 ÷ 35.
(27) 6251043 ÷ 42,
(28) 5761034 ÷ 54.

A number may be divided by 10, 100, 1000, &c. by merely cutting off one, two, three, &c. figures on the right: the other figures are the quotient, those cut off are the remainder.

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* EXAMPLE. Divide 40855 by 29.

Dividend.
Divisor 29)40855(1408 Quotient.
29 29
118 12672
116 2816
255 23 Remainder.
232 40855 Proof.
23

† When the divisor is large, the quotient figures are most easily found by *trials of the first figure* (or *two*) in the *leading figures* of the dividend.

‡ Ciphers at the right of the divisor may be cut off, and as many figures from the right of the dividend, but these must be annexed to the remainder at last.

§ EXAMPLE. Divide 314659 by 21.

21=7×3)314659
7)104886—1
14983—5
∴=5×3+1=16 rem.

Thus 76390÷10=7639; 238457÷10=23845 and 7 rem.
And 4598653÷1000=4598 and 653 rem.

(29) 65941089 ÷ 10 | (31) 18043329 ÷ 10000.
(30) 7208165 ÷ 100 | (32) 7406572 ÷ 1200.

(33) What is the difference between the 12th part of 107724, and the 23rd part of 346610?

(34) If a ship bound to Jamaica set sail from Liverpool on the 25th of January, 1828, and arrived at that island on the 8th of March, what was the velocity of her sailing per day and per hour; the distance being 4558 miles?

NOTE. This is the *direct* distance. The circuitous course of the ship would be considerably more.

(35) The period of Jupiter's revolution in his orbit round the sun, which is the year of that planet, is 4330 of our days. How many of our years, reckoning 365 days to the year, are equal to five years of Jupiter?

(36) I would plant 2072 elms in 14 rows, the trees in each row 17 feet asunder: what length will the grove be?

(37) If a chest of oranges, 1292 in number, be distributed, one moiety among 19 boys, the other among 17 girls: how many will fall to the share of each?

(38) The circumference of the earth's orbit, or annual path round the sun, is about 596440000 miles. Supposing the year to be exactly $365\frac{1}{4}$ days, or 8766 hours, how many miles in an hour, and how many in a minute, are we carried by this motion?

(39) Required the sum, the difference, the product, and the quotient, of 3679 and 283: and also the quotient of the product divided by the sum.

(40) The sum of two numbers is 4290; the less number is 143: what is their difference, product, and quotient; and the quotient of the product divided by the difference?

(41) The product of a certain number multiplied by 694, when 320 are added, is equal to 500000: what is that number?

(42). Allowing the earth to revolve on its axis in exactly 24 hours, and the circumference at the equator to be 24864 miles; at what rate per hour and per minute are the inhabitants of that part carried round by the revolution? Also, at what rate are the inhabitants of London carried round, the circumference in that latitude being 15480 miles?

ARITHMETICAL AND COMMERCIAL TABLES.

STERLING MONEY.

4 farthings (*qrs.*) make 1 penny, *d.*
12 pence ..... 1 shilling, *s.*
5 shillings ..... 1 crown, *cr.*
20 shillings, 1 pound, or sovereign, £.

$\frac{1}{4}d.$ denotes a farthing, $\frac{1}{2}d.$ a halfpenny, and $\frac{3}{4}d.$ three farthings.

Qrs 4 = 1 penny.
48 = 12 = 1 shilling.
240 = 60 = 5 = 1 crown.
960 = 240 = 20 = 4 = 1 pound.

OBSOLETE COINS.

A guinea (weight 5 *dwts* 9½ *grs.*) value 21*s.* A moidore. 27*s.* A pistole, 17*s.* A mark 13*s.* 4*d.* An angel, 10*s.* A noble, 6*s* 8*d.* A tester, 6*d.* A groat, 4*d.*

NOTES. Gold is considered the standard metal; and there is no alteration in the *new coin*, either in fineness or weight, from that of former coinages; 21 sovereigns being equal in weight to 20 guineas. 1869 sovereigns weigh exactly 40 lbs. troy. A sovereign is therefore a little more than 5 *dwts.* 3¼ *grs.* (5 *dwts.* 3·274 *grs.*) and a half sovereign rather exceeds 2 *dwts.* 13½ *grs.* (2 *dwts.* 13·637 *grs.*) The *new silver coin* is of the same fineness as that of former coinages; but 1 lb of silver is now coined into 66*s*, instead of 62*s.* as it was formerly, so that one shilling now weighs 3 *dwts.* 15$\frac{1}{11}$ *grs.*, and other silver pieces in proportion.

The mint value of gold is £3..17..10½. per ounce, and of silver 5*s* 6*d.*

The standard for gold coin is 22 parts (commonly called *carats*) of fine gold, and 2 parts (or *carats*) of copper, melted together. For silver coin 11 *oz.* 2 *dwts.* of fine silver alloyed with 18 *dwts.* of copper.

MONEY TABLE.

Farthings.	*Farthings.*	*Pence.*	*Pence.*	*Pence.*	*Shillings.*
qrs. *d*	*qrs.* *d*	*d.* *s.*	*d.* *s.* *d.*	*d.* *s.* *d.*	*s.* £. *s.*
4 are 1	32 are 8	36 are 3	20 are 1 8	160 are 13 4	80 are 4 0
6 ... 1½	34 ... 8½	48... 4	30... 2 6	170...14 2	90... 4 10
8 ... 2	36 ... 9	60... 5	40... 3 4	180...15 0	100... 5 0
10 ... 2½	38 ... 9½	72... 6	50... 4 2	190...15 10	110... 5 10
12 ... 3	40 ...10	84... 7	60... 5 0	200...16 8	120... 6 0
14 ... 3½	42 ...10½	96... 8	70... 5 10		130... 6 10
16 ... 4	44 ...11	108... 9	80... 6 8	*Shillings.*	140... 7 0
18 ... 4½	46 ...11½	120...10	90... 7 6	*s.* £. *s.*	150... 7 10
20 ... 5	48 ...1*s.*	132...11	100... 8 4	20 are 1 0	160... 8 0
22 ... 5½		144...12	110... 9 2	30... 1 10	170... 8 10
24 ... 6	*Pence.*	156...13	120...10 0	40... 2 0	180... 9 0
26 ... 6½	*d.* *s.*	168...14	130...10 10	50 .. 2 10	190 .. 9 10
28 ... 7	12 are 1	180...15	140...11 8	60... 3 0	200...10 0
30 ... 7½	24 ... 2	192...16	150...12 6	70... 3 10	210 ..10 10

NOTE. When the units' figure is cut off from any number of shillings, half the remaining figures will be the pounds. Thus, 256*s.* = £12. 16*s.* because half of 25 = 12; and the *one* over prefixed to the 6, gives 16*s.*

WEIGHTS AND MEASURES.

TROY WEIGHT.

24 grains (*gr.*) make 1 pennyweight, *dwt.*
20 pennyweights . 1 ounce, *oz.*
12 ounces . . 1 pound, . lb.

Grains 24 = 1 pennyweight.
480 = 20 = 1 ounce.
5760 = 240 = 12 = 1 pound.

Gold, silver, and gems, are weighed by this weight.

APOTHECARIES' WEIGAT.

20 grains (*gr.*) make 1 scruple, ℈
3 scruples . . 1 dram, . . ʒ
8 drams . . . 1 ounce, . . ℥
12 ounces . . . 1 pound, . . lb.

Grains. 20 = 1 scruple.
60 = 3 = 1 dram.
480 = 24 = 8 = 1 ounce.
5760 = 288 = 96 = 12 = 1 pound.

This is used only in the mixing of medicines.

These are the same grain, ounce, and pound, as those in Troy Weight.

AVOIRDUPOIS WEIGHT.

16 drams (*dr.*) make . . . . 1 ounce, . . *oz.*
16 ounces . . . . . 1 pound, . *lb.*
14 pounds . . . . . 1 stone, . *st.*
28 pounds, or 2 stones . . . . 1 quarter, . *qr.*
4 quarters, or 8 st. or 112 lb . 1 hundred, *cwt.*
20 hundreds . . . . . 1 ton, . . *t.*

Drams. 16 = 1 ounce,
256 = 16 = 1 pound.
3584 = 224 = 14 = 1 stone.
7168 = 448 = 28 = 2 = 1 quarter.
28672 = 1792 = 112 = 8 = 4 = 1 cwt.
573440 = 35840 = 2240 = 160 = 80 = 20 = 1 ton.

By this weight nearly all the common necessaries of life are weighed. A truss of hay=56 lb and one of straw=36 lb. A load is 36 trusses. A peck loaf weighs 17 lb. 6 oz. 1 dr. In the metropolis, 8 lb. are a stone of meat. A fother of lead is 19½ cwt. In some districts, goods of various descriptions (as cheese, coal, &c.) are sold by the *long cwt.* or 120 lb.

WOOL.

When wool is purchased from the grower, the legal stone of 14 lb. and the tod of 28 lb. are used. But in the dealings between woolstaplers and manufacturers,

15 pounds are . . 1 stone.
2 stones, or 30 lb. . 1 tod.
8 tods, or 240 lb. . 1 pack or sack.

COMPARISON OF WEIGHTS.

A grain is the elementary or standard weight.

1 ounce avoirdupois is . . 437½ grains.
1 ounce troy 480
1 pound troy 5760
1 pound avoirdupois . . 7000
175 pounds troy=144 pounds avoirdupois.
175 ounces troy=192 ounces avoirdupois.

We may, therefore, reduce lbs. Troy into Avoirdupois by multiplying them by 144, and dividing by 175, &c.

LINEAL, OR LONG MEASURE.

12 inches *(in.)* make . . .	1 foot, . .	*ft.*
3 feet, or 36 inches . . .	1 yard, . .	*yd.*
2 yards, or 6 feet . . .	1 fathom, .	*fa.*
5½ yards, or 16½ feet . . .	1 pole, rod, or perch,	*p.*
4 poles, or 22 yards . . .	1 land-chain,*	*ch.*
40 poles, or 10 ch., or 220 yds.	1 furlong, .	*fur.*
8 furlongs, or 1760 yards .	1 mile, . .	*m.*
3 miles	1 league, .	*l.*

Barley-corns.

3 =	1 inch.				
36 =	12 =	1 foot.			
108 =	36 =	3 =	1 yard.		
594 =	198 =	16½ =	5½ =	1 pole.	
23760 =	7920 =	660 =	220 =	40 =	1 furlong.
190080 =	63360 =	5280 =	1760 =	320 =	8 = 1 mile.

* The chain consists of 100 links, each link being = 7·92 inches

NOTE. It is commonly supposed that the English inch was originally taken from three grains of barley, selected from the middle of the ear, and well dried.

A twelfth part of an inch is called a *line*.

4 inches are a hand, used in measuring the height of horses. 5 feet are a pace. A cubit = 1½ feet nearly.

This measure determines the length of lines. A line has the dimension of length only, without breadth or thickness.

CLOTH MEASURE.

2¼ inches *(in.)* make	1 nail,	*n.*
4 nails, or 9 inches	1 quarter,	*qr.*
4 quarters	1 yard,	*yd.*
5 quarters	1 English ell,	*E. e.*

A Flemish ell is 3 qrs. A French ell 6 qrs.

Used for all drapery goods.

SUPERFICIAL OR SQUARE MEASURE.

144 square inches *(sq. in.)* make	1 square foot	*sq. ft.*
9 square feet	1 square yard,	*sq. yd.*
30¼ sq. yards, or 272¼ sq. feet	1 sq. rod, pole, or perch.	

Also, in the measure of land.

40 perches make	1 rood,	*r.*
4 roods or 4840 yards	1 acre,	*a.*
10,000 square links	1 square chain,	*sq. c.*
10 sq. chains, or 100,000 links	1 acre,	*a.*
640 acres	1 square mile,	*sq. m.*

Inches.				
144 =	1 foot.			
1296 =	9 =	1 yard.		
39204 =	272¼ =	30¼ =	1 pole.	
1568160 =	10890 =	1210 =	40 =	1 rood.
6272640 =	43560 =	4840 =	160 = 4 =	1 acre.

Roofing, flooring, &c. are commonly charged by the *Square*, containing 100 square feet.

By this measure is expressed the area of any superficies, or surface. A superficies has measurable length and breadth.

CUBIC OR SOLID MEASURE.

1728 cubic inches *(in.)* make	1 cubic foot.
27 cubic feet	1 cubic yard.*
40 feet of round timber or 50 feet of hewn timber	1 ton, or load.
42 feet	1 ton of shipping.

* A solid yard of earth is called a load.

A cord of wood is 4 feet broad, 4 feet deep, and 8 feet long, being 128 cubic feet.

A stack of wood is 3 feet broad, 3 feet deep, and 12 feet long, being 108 cubic feet.

This determines the solid contents of bodies. A solid has three dimensions, length, breadth, and thickness.

IMPERIAL MEASURE

This is the standard now established by Act of Parliament, as a *general measure of capacity* for liquid and dry articles.

2 pints *(pt.)* make	1 quart,	*qt.*
4 quarts	1 gallon,	*gal.*

The imperial or standard gallon must contain 10 lbs. Avoirdupois Weight of pure water, at the temperature of 62° of Fahrenheit's thermometer. This quantity measures 277¼* cubic inches; being about *one fifth greater* than the old wine measure, *one-thirty-second greater* than the old dry measure, and *one-sixtieth less* than the old ale measure.

IN DRY MEASURE,

2 gallons *(gal.)* make	1 peck,	*pk.*
4 pecks	1 bushel,	*b.*
8 bushels	1 quarter,	*qr.*

Corn to be stricken off the measure with a round stick, or roller.

Obsolete. A coom = 4 bushels; a chaldron = 4 quarters; a wey = 5 quarters; a last = 2 weys.

Solid inches. 277¼ = 1 gallon.
554½ = 2 = 1 peck.
2218 = 8 = 4 = 1 bushel
17744 = 64 = 32 = 8 = 1 quarter.

OF COALS,

3 bushels make	1 sack.
12 sacks, or 36 bushels	1 chaldron.
21 chaldrons	1 score.

All the measures used for heaped goods are to be of cylindrical form; the diameter being at least double the depth. The height of the raised cone to be equal to three-fourths of the depth of the measure.

The old dry gallon contained 268⅘ cubic inches.

NOTE. The bushel, for measuring heaped goods, must be 17.81 inches in diameter, and 8.904 inches deep; or if made 18 inches in diameter, the depth will be 8.717 inches. The cone to be raised 6.6 inches in height.

* More accurately, 277·274 cubic inches.

IN WINE AND SPIRIT MEASURE, the old gallon contained 231 cubic inches.

63 gallons were	a hogshead, *hhd.*
2 hogsheads, or 126 gallons	a pipe or butt
4 hogsheads, or 252 gallons	a tun.

Some other denominations have been long obsolete; as, an anker (10 gallons); a runlet (18 gallons); a tierce (42 gallons); a puncheon (84 gallons). But casks of most descriptions are generally charged according to the number of gallons contained.

Solid inches.				
$34\frac{2}{3}\frac{1}{2}$ =	1 pint.			
$69\frac{5}{16}$ =	2 =	1 quart.		
$277\frac{1}{4}$ =	8 =	4 =	1 gallon.	
$1746\frac{3}{4}$ =	504 =	252 =	63 =	1 hogshead.
$3493\frac{3}{2}$ =	1008 =	504 =	126 = 2 =	1 pipe.
69867 =	2016 =	1008 =	252 = 4 = 2 =	1 tun.

IN ALE, BEER, OR PORTER MEASURE, the old gallon contained 282 cubic inches; and measures of the following denominations have been in use:

A firkin, containing .	9 gallons.
A kilderkin . . .	18 gallons.
A barrel	36 gallons.
A hogshead . . .	54 gallons.
A butt	108 gallons.

Cubic inches.					
$34\frac{3}{3}\frac{1}{2}$ =	1 pint.				
$69\frac{5}{16}$ =	2 =	1 quart.			
$277\frac{1}{4}$ =	8 =	4 =	1 gallon.		
$2495\frac{1}{4}$ =	72 =	36 =	9 =	1 firkin.	
$4990\frac{1}{2}$ =	144 =	72 =	18 =	2 =	1 kilderkin.
9981 =	288 =	144 =	36 =	4 = 2 =	1 barrel.
$14971\frac{1}{2}$ =	432 =	216 =	54 =	6 = 3 = $1\frac{1}{2}$ =	1 hogshead.
29943 =	864 =	432 =	108 =	12 = 6 = 3 = 2 =	1 butt.

* RULES FOR CHANGING OLD MEASURES TO IMPERIAL.

ALE. Multiply by 60, and divide by 59; or add $\frac{1}{59}$ part. (True within $\frac{1}{10000}$ part of the whole.)

Or, multiply by 179, and divide by 176. (True, within $\frac{1}{1000000}$ part.)

DRY. Multiply by 32, and divide by 33; or deduct $\frac{1}{33}$ part. (Error, less than $\frac{1}{3700}$ part.)

WINE. Multiply by 5, and divide by 6, or deduct $\frac{1}{6}$ part. (Error, less than $\frac{1}{4000}$ part.)

Or, multiply by 624, and divide by 749. (Error, less than $\frac{1}{5000000}$ part.)

RULES FOR CHANGING IMPERIAL TO OLD MEASURES.

ALE. Multiply by 59, and divide by 60, or deduct $\frac{1}{60}$ part.

Or, multiply by 176, and divide by 179.

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* Examples applying to these Rules will be found in the Miscellaneous Questions in the latter part of the book.

DRY. Multiply by 33, and divide by 32, or add $\frac{1}{32}$ part.—That is, add one peck in every quarter, one quart in every bushel, or half a pint in every peck.

WINE. Multiply by 6, and divide by 5, or add $\frac{1}{5}$ part.

Otherwise, Multiply by 749, and divide by 624.

TIME.

60 seconds (*sec.*) make	1 minute, .	*min.*
60 minutes	1 hour, . .	*hr.*
24 hours	1 day, . .	*d.*
7 days	1 week, . .	*wk.*
52 weeks, 1 day, 6 hours, or 365 days, 6 hours . . .	1 Julian year,	*yr.*
365 days, 5 hours, 48 min. $51\frac{1}{2}$ seconds	The Solar year,†	
100 years	1 century.	

Seconds. 60 = 1 minute.
3600 = 60 = 1 hour,
86400 = 1440 = 24 = 1 day.
604800 = 10080 = 168 = 7 = 1 week.

31557600 = 525960 = 8766 = 365 *d.* 6 *h.* = 52 *w.* 1 *d.* 6*h.* = 1 Julian year.
31556931 = 525948 = 8765 = 365 *d.* 5 *h.* 48 *m.* $51\frac{1}{2}$″ = 1 Solar year.

The year is divided into 12 Calendar months; January, February, March, April, May, June, July, August, September, October, November, December.

The days are thirty in September,
In April, June, and in November;
Twenty-eight in February alone,
And in each other thirty-one:
But every leap-year we assign,
To February twenty-nine.

The *leap-year* are those which can be *exactly* divided by 4; as, 1824, 1828, &c. Hence it appears that the year is accounted 365 days, for *three years together*; and 366 days in the *fourth*; the average being $365\frac{1}{4}$ days. (*The Julian Year.*)

Four weeks are frequently called a *month*; but in this sense it is better to avoid the term.

NOTE. In all questions in this book, where the proposed or required time consists of years, months, weeks, &c. allow 4 weeks to a month, and 13 months to a year.

GEOMETRY.

60 seconds (″) make .	1 minute,	
60 minutes	1 degree,	°
360 degrees	1 circle.	

* A day is the time in which the earth revolves once upon its axis; by law and custom it is reckoned from midnight to midnight; but the astronomical day begins at noon.

† The Solar, or true year, is that portion of time in which the earth makes one entire revolution round the sun.

Many highly important calculations in the mathematical sciences are founded on this division of the circle.

In Astronomy, the great circle of the *ecliptic* (or of the *zodiac)* is divided into 12 *signs*, each 30°

In *Geography*, a degree of latitude, or of longitude on the equator, measures nearly 69 $\frac{1}{10}$ British miles. But a minute of a degree is called a geographical mile.

ARTICLES SOLD BY TALE.

12 articles of any kind, are	1 dozen.	24 sheets of paper	1 quire.
13 dozen	1 gross.	20 quires . .	1 ream.
12 gross	1 great gross.	2 reams . .	1 bundle.
20 articles	1 score.		

DEFINTIONS.

1. A NUMBER is called *ábstract*, when it is considered *simply*, or without reference to any subject; as seven, a thousand, &c.

2. when a number is applied to denote so many of a par, ticular subject, it is a *concréte* number; as seven pounds, a thousand yards, &c.

3. A *denomination* is a name of any particular distinctive part of money, weight, or measure; as penny, pound, yard, &c.

4. The association of a concrete number with its subject, forms a *quantity*.

5. A *simple quantity* has only *one denomination*; as seven pounds.

6. A *compound quantity* consists of *more denominations* than one; as seven pounds five shillings.

EXAMPLE.

Reduce £8..8..6½. into farthings.

£.	s.	d.
8	8	6½
20		
168 *s.*		
12		
2022 *d.*		
4		
8090 *qrs. Ans.*		

The £8. being multiplied by 20, and the 8*s.* added, make 168*s.*; these being multiplied by 12, and the 6*d.* added, make 2022*d*; which being multiplied by 4 and the 2 farthings added, make in the whole 8090 *farthings*.

REDUCTION

Is the method of changing quantities of one denomination into another denomination, retaining the same value.

RULE. Consider how many of the *less name* make *one* of the *greater*; and *multiply* by that number to reduce the *greater name to the less*, *or divide* by it to reduce the *less name to the greater*.

(1) In £12. how many shillings, pence, and farthings? *Ans.* 240*s.* 2880*d.* 11520 *qrs.*

(2) In 311520 farthings, how many pounds? *Ans.* £324..10.

(3) Change 21 guineas into farthings. *Ans.* 21168 *qrs.*

(4) In £17..5..3¼. how many farthings? *Ans.* 16573 *qrs.*

(5) In £25..14..1. how many pence? *Ans.* 6169*d.*

(6) Reduce 17940 pence to crowns. *Ans.* 299 *crowns.*

(7) In 15 crowns, how many shillings and sixpences? *Ans.* 75*s.* 150 *sixpences.*

(8) Change 57 half-crowns into threepences, pence, and farthings. *Ans.* 570 *threepences*, 1710*d* 6840 *farthings.*

(9) How many half-crowns, and how many sixpences, are equivalent to £25..17..6? *Ans.* 207 *half-cr.* 1035 *sixpences.*

(10) Convert £17..11..9. into threepences. *Ans.* 1407 *threep.*

(11) Change £10..13..10½. into halfpence. *Ans.* 5133.

(12) In 52 crowns, as many half-crowns, shillings, and pence, how many farthings? *Ans.* 21424 *far.*

(13) Convert 17380 farthings into £. *Ans.* £18..2..1.

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

(15) Reduce 60 guineas to shillings, crowns, and pounds. *Ans.* 1260*s.* 252 *crowns*, £63.

(16) Reduce 76 moidores † into pounds. *Ans.* £102..12.

Cónverse to the preceding EXAMPLE.

In 8090 farthings, how many pounds?

4)8090 *qrs.*
12)2022½ *d.*
20)168*s.* 6½*d.*
Ans. £8..8..6½.

Dividing the farthings by 4, we obtain 2022*d.* and 2 over, which are *farthings*, because the remainder is a part of the dividend. Divide 2022 by 12, and we obtain 168*s.* and 6*d.* over; these shillings divided by 20, give £8. 8*s.* so that the answer is £8..8..6½.

† 27 shillings. The moidore is current in Portugal, but not in England.

(17) How many shillings, half-crowns, and crowns, an equal number of each, are there in £556.?

Ans. 1308 *of each, and* 2*s. over.*

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

(19) Seven men brought £15..10. each into the mint, to be exchanged for guineas; how many would they have?

Ans. 103 *guineas and* 7*s. over.*

(20) In 525 American dollars, at 4*s.* 6*d.* each, how many pounds sterling? *Ans.* £118..2..6.

WEIGHT AND MEASURE.

TROY WEIGHT.

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

(22) Reduce 3 *lb.* 10 *oz.* 7 *dwt.* 5 *gr.* to grains? *Ans.* 22253.

(23) In 8 ingots of silver, each ingot weighing 7 *lb.* 4 *oz.* 17 *dwts.* 15 *gr.* how many grains? *Ans.* 341304 *grs.*

(24) How many ingots weighing 7 *lb.* 4 *oz.* 17 *dwts.* 15 *gr.* each are there in 341304 grains? *Ans.* 8 *ingots.*

APOTHECARIES' WEIGHT

(25) In 27 ℔ 7 ℥ . 2 ʒ . 1 ℈ . 2 *gr.* how many grains?

Ans. 159022 *grains.*

(26) In a compound of 9 ℥ . 4 ʒ . 1 ℈ . how many pills of 5 *grains* each? *Ans.* 916 *pills.*

AVOIRDUPOIS WEIGHT

(27) In 14769 ounces, how many cwt.?

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

(28) In 34 *tons*, 17 *cwt.* 1 *qr.* 19 *lb.* how many pounds?

Ans. 78111 *lbs.*

(29) In 9 *cwt.* 2 *qrs.* 14 *lb.* of indigo, how many half stones, and how many pounds? *Ans.* 154 *half stones*, 1078 *lb.*

(30) How many stones and pounds are there in 27 hogsheads of tobacco, each weighing net 8¼ *cwt.*?

Ans. 1890 *stones*, 26460 *lbs.*

(31) Bought 32 bags of hops, each bag 2 *cwt.* 1 *qr.* 14 *lb.* and another of 150 *lb.* how many *cwt.* are there in the whole?

Ans. 77 *cwt.* 1 *qr.* 10 *lb.*

(32) In 27 *cwt.* of raisins, how many parcels of 18 *lb.* each?

Ans. 168.

(32) In 27 *cwt.* of raisins, how many parcels of 18 *lb.* each *Ans.* 168.

CLOTH MEASURE.

(33) In 27 yards, how many nails? *Ans.* 432.

(34) In 75 English ells, how many yards?
Ans. 93 *yards*, 3 *qrs.*

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

(36) in 17 pieces of cloth, each 27 Flemish ells, how many yards? *Ans.* 344 *yards*, 1 *qr.*

(37) In 911¼ yards, how many English ells? *Ans.* 729.

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

LONG MEASURE.

(39) In 57½ miles, how many furlongs and poles?
Ans. 460 *furlongs*. 18400 *poles*.

(40) In 7 miles how many feet and inches?
Ans. 36960 *feet*, 443520 *inches*.

(41) In 72 leagues, how many yards? *Ans.* 389160 *yards*.

(42) If the distance from London to Bawtry be accounted 150 miles, what is the number of leagues, and also the number of yards, feet, and inches?

Ans. 50 *leagues*, 264000 *yards*, 792000 *feet*, 9504000 *inches*

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

(44) How many barley-corns will reach round the globe, the circumference being 360 degrees, supposing that each degree were 69 miles and a half? *Ans.* 4755801600.

See Table of Geometry, page 30.

LAND MEASURE.

(45) In 27 *a.* 3 *r.* 19 *p.* how many perches? *Ans.* 4459.

(46) A person having a piece of ground, containing 37 acres, 1 perch, intends to dispose of 15 acres: how many perches will he have left? *Ans.* 3521 *perches.*

(47) There are 4 fields to be divided into shares of 75 perches each; the first field contains 5 acres; the second 4 acres

2 perches ; the third 7 acres, 3 roods ; and the fourth 2 acres, 1 rood: how many shares will there be ?

Ans. 40 *shares*, 42 *perches*, *rem.*

(48) In a field of 9 acres and a half, how many gardens may be made, each containing 500 square yards ?

Ans. 91, *and* 480 *yards rem.*

IMPERIAL MEASURE.

(49) In 10080 pints of port wine, how many tuns ?

Ans 5 *tuns.*

(50) In 35 pipes of Madeira, how many gallons and pints ?

Ans. 4410 *gals.* 36280 *pints.*

(51) A gentleman ordered his butler to bottle off $\frac{2}{3}$ of a pipe of French wine into quarts, and the rest into pints. How many dozen of each had he ? *Ans.* 28 *dozen of each.*

(52) In 46 barrels of beer, how many pints ? *Ans.* 13248.

(53) In 10 barrels of ale, how many gallons and quarts ?

Ans. 390 *gals.* 1440 *qts.*

(54) In 12480 pints of porter how many kilderkins ?

Ans. 86 *kil.* 1 *fir.* 3 *gals.*

(55) In 108 barrels of ale, how many hogsheads ? *Ans* 72.

(56) In 120 quarters of corn, how many bushels, pecks, gallons, and quarts ? *Ans.* 960 *bu.* 3840 *pks.* 7680 *gal.* 30720 *qts.*

(57) How many bushels are there in 970 pints ?

Ans. 15 *bu.* 1 *gal.* 2 *pts.*

(58) In 1 score, 16 chaldrons of coals, how many sacks and bushels ? *Ans.* 444 *sacks*, 1332 *bushels.*

TIME.

(59) In 72015 hours, how many weeks ?

Ans. 428 *weeks*, 4 *days*, 15 *hours.*

(60) How many days were there from the birth of Christ, to Christmas, 1794, estimating $365\frac{1}{4}$ days to the year ?

Ans. $655258\frac{1}{2}$ *days.*

(61) Stowe writes, that London was built 1108 years before our Saviour's birth. Find the number of hours to Christmas, 1794 ? *Ans.* 25438932 *hours.*

(62) From July 18th, 1799, to April 18th, 1826, how many days? *Ans.* 9770½ *days, reckoning* 365¼ *days to a year.*

(63) In a lunar month, containing 29 days, 12 hours, 44 minutes, 2 seconds and eight-tenths, how many tenth parts of seconds? *Ans.* 25514428.

(64) How many seconds are there in 18 centuries, estimating the solar year at 365 days, 5 hours, 48 minutes, 51½ seconds? *Ans.* 56802476700 *seconds.*

COMPOUND ADDITION.

TEACHES to find the *sum* of *Compound Quantities.*

RULE. Add the numbers of the *least denomination;* divide the sum by as many as make *one* of the *next greater;* set down the remainder (if any) and carry the quotient to those of the next greater: proceed thus to the *greatest denomination,* which add as in Simple Addition.

PROOF. As in Simple Addition.

MONEY.

(1)			(2)			(3)			(4)		
£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
2	13	5½	27	7	0	35	17	0	75	3	0
7	9	4¼	34	14	10¼	59	14	10½	54	17	1
5	15	4½	57	19	2¼	97	13	10¼	91	15	11¼
9	17	6¼	91	16	0	37	16	8¼	35	16	1¾
7	16	3	75	18	7¾	97	15	7	29	19	11¼
5	14	7¾	97	13	5	59	16	0½	91	17	3¼

EXAMPLE.

£.	*s.*	*d.*
15..	7..	4½
7..	18..	10¾
11..	19..	5
6..	10..	11¼
4..	0..	9¾
45..	17..	4¾

Say 1, 2, 5, 7 farthings are 1 penny 3 farthings; set down ¾ and carry 1*d.*—1, 10, 11, 16, 20, 30, 40*d.* are 3*s.* 4*d.*; set down 4*d.* and carry 3*s.*—3, 12, 20, 27, 37, 47, 57,*s* are £2. 17*s.*; set down 17*s.* and carry £2. The rest as in Simple Addition.

In Addition of Money, the reduction of one denomination to the *next greater* is generally done without the trouble of *dividing,* by the knowledge previously acquired of the Money Tables.

(5)

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

(7)

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

(9)

£.	s.	d.
127	4	7½
525	3	10
271	0	0
524	9	1
379	4	0½
215	5	11¾

(11)

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

(6)

£.	s.	d.
525	2	4¼
179	3	5
250	4	7¼
975	3	5¼
254	5	7
379	4	5¾

(8)

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

(10)

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

(12)

£.	s.	d.
27	13	5½
16	12	10¼
9	13	0½
15	2	10½
37	19	0
56	19	1¾

WEIGHTS AND MEASURES.

TROY WEIGHT.

(13)

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

(14)

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

APOTHECARIES' WEIGHT.

(15)

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

(16)

℥.	ʒ.	℈.	gr.
2	1	0	12
1	7	1	17
10	2	0	14
5	7	1	15
9	5	2	13
1	4	1	18

AVOIRDUPOIS WEIGHT

(17)

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

(18)

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

(19)

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

LONG MEASURE.

(20)

yds.	*ft.*	*in.*
225	1	9
171	0	3
52	2	6
397	0	10
154	2	7
137	1	4

(21)

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

(22)

m.	*fur.*	*yds.*
39	6	36
14	7	214
3	4	160
45	3	202
17	1	19
32	4	176

CLOTH MEASURE.

(23)

yds.	*qrs.*	*n.*
135	3	3
70	2	2
95	3	0
176	1	3
26	0	1
279	2	1

(24)

E. e.	*qrs.*	*n.*
272	2	1
152	1	2
79	0	1
156	2	0
79	3	1
154	2	1

LAND MEASURE.

(25)

a.	*r.*	*p.*
726	1	31
219	2	17
1455	3	14
879	1	21
438	2	14
757	0	0

(26)

a.	*r.*	*p.*
1232	1	14
327	0	19
131	2	15
1219	1	18
223	2	8
236	0	9

IMPERIAL MEASURE

WINE.

(27)			(28)			
hhds.	*gals.*	*qts.*	*t.*	*hhd.*	*gals.*	*qts.*
31	57	1	14	3	27	2
97	18	2	19	2	56	3
76	13	1	17	0	39	2
55	46	2	75	2	16	1
87	38	3	54	1	19	2
55	17	1	97	3	54	3

ALE AND BEER.

(29)			(30)		
bar.	*fir.*	*gal.*	*hhd.*	*gal.*	*qts.*
25	2	7	76	51	2
17	3	5	57	3	3
96	2	6	97	27	3
75	1	8	22	17	2
96	3	7	32	19	3
75	0	5	55	38	3

DRY.

(31)			(32)			
qrs.	*b.*	*p.*	*b.*	*p.*	*gal.*	*qts.*
300	2	1	16	2	1	2
167	0	1	21	0	1	3
369	7	0	7	3	0	0
50	3	2	15	1	1	2
74	6	3	3	2	0	1

TIME

(33)			(34)				
w.	*d.*	*h*	*w.*	*d.*	*h.*	*m.*	*s.*
71	3	11	57	2	15	42	41
51	2	9	95	3	21	27	51
76	0	21	76	0	15	37	28
95	3	21	53	2	21	42	27
79	1	15	98	2	18	47	38

(35) A, B, C, and D, were partners in the purchase of a quantity of goods: A laid out £7. half-a-guinea, and a crown; B, 49*s.* C, 54*s.* 6*d.* and D, 87*d.* What was the purchase?

Ans. £13..6..3.

(36) A man lent his friend at different times these several sums, *viz.* £63.—£25..15.—£32..7.—£15..14..10. and four score and nineteen pounds, half-a-guinea, and a shilling. How much was the whole loan? *Ans.* £236..8..4.

(37) Bought goods, for which I paid £54..17; for packing 13*s.* 8*d*; carriage £1..5..4; and expenses over making the bargain 14*s.* 3*d.* What was the whole cost? *Ans.* £57..10..3.

(38) A nobleman, previous to quitting town, wished to discharge his tradesmen's bills. On enquiry he found that he owed 82 guineas for rent;—to his wine-merchant, £72..5;—to his confectioner, £12..13..4;—to his draper, £47..13..2;—

to his tailor, £110..15..6;—to his coach-maker, £157..8;—to his tallow-chandler, £8..17..9;—to his corn-factor, £170..6..8;—to his brewer, £52..17..0;—to his butcher, £122..11..5;—to his baker, 37..9..5;—and to his servants for wages, £53..18. What money must he draw from his banker, including £100. that he wished to take with him?

Ans. £1032..17..3.

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

Ans. 58 *years*, 7 *months*, 10 *days*.

(40) A clerk having been out collecting debts, presented an account that A paid him £7..5..2;—B £15..18..6½;—C £150..13..2¼;—D £17..6..8;—E 5 guineas, 2 crown pieces, 4 half-crowns and 4*s*. 2*d*;—F paid him only twenty groats;—G £76..15..9½;—and H £121..12..4. How much was the whole amount?

Ans. £396..7..6¼.

(41) A nobleman had a service of plate, which consisted of twenty dishes, weighing 203 *oz*. 8 *dwts*; 36 plates, 408 *oz*. 9 *dwts*.; 5 dozen spoons, 112 *oz*. 8 *dwts*.; 6 salts, and 6 pepper-boxes, 71 *oz*. 7 *dwts*.; knives and forks, 73 *oz*. 5 *dwts*; two large cups, a tankard, and a mug, 121 *oz*. 4 *dwts*.; a tea-urn and lamp, 131 *oz*. 7 *dwts*.; with sundry other small articles, weighing 105 *oz*. 5 *dwts*. The weight of the whole is required?

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

(42) A hop-merchant buys 5 bags of hops, of which the first weighed 2 *cwt*. 3 *qrs*. 13 *lb*.; the second, 2 *cwt*. 2 *qrs*. 11 *lb*.; the third, 2 *cwt*. 3 *qrs*. 5 *lb*.; the fourth, 2 *cwt*. 3 *qrs*. 12 *lb*.; the fifth, 2 *cwt*. 3 *qrs*. 15 *lb*. He purchased also two pockets, each pocket weighing 84 *lb*. I desire to know the weight of the whole.

Ans. 15 *cwt*. 2 *qrs*.

COMPOUND SUBTRACTION

TEACHES to find the *difference* of *Compound Quantities*.

RULE. Subtract as in integers: but borrow (when there is

occasion) *as many* as are *equal* to *one* of the *next greater* denomination: observing to *carry one* to the next for that which was borrowed.*

PROOF. As in Simple Subtraction.

MONEY.

(1)	£.	s.	d.
From	715	2	$7\frac{1}{4}$
Take	476	3	$8\frac{1}{2}$

(2)	£.	s.	d.
	316	3	$5\frac{1}{2}$
	218	2	$1\frac{3}{4}$

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

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

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

(6)	£.	s.	d.
	37	3	$4\frac{1}{4}$
	25	5	$2\frac{1}{4}$

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

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

(9)	£	s.	d.
	71	2	4
	19	13	$7\frac{1}{4}$

(10)	£.	s.	d.
	527	3	$5\frac{1}{4}$
	139	5	$7\frac{1}{2}$

(11)	£.	s.	d.
	300	15	0
	296	15	10

(12)	£.	s.	d.
	68	13	9
	44	19	$10\frac{1}{2}$

(13)	£.	s.	d.
	10	7	6
	9	19	7

(14)	£.	s.	d.
	500	0	0
	499	19	$11\frac{3}{4}$

(15)	£.	s.	d.
	779	12	0
	689	13	6

* EXAMPLE Subtract £54..17..$9\frac{3}{4}$. from £89..12..$7\frac{1}{2}$.

£.	s.	d.
89..	12..	$7\frac{1}{2}$
54..	17..	$9\frac{3}{4}$
34..	14..	$9\frac{3}{4}$

Because 3 farthings cannot be taken from 2 say 3 from 4, 1, and 2 are 3; set down 3 and carry 1.—1 and 9 are 10, 10 from 12, 2, and 7 are 9: set down 9 and carry 1.—1 and 17 are 18, 18 from 20, 2, and 12 are 14; set down 14 and carry 1 to the pounds.

(16)

	£.	s.	d.
Borrowed	350	0	0
Paid at different times	26	5	0
	73	10	6
	41	9	$8\frac{1}{2}$
	66	14	9
Paid in all			
Remains to pay			

(17)

	£.	s,	d
Lent	577	10	0
Received at several times	95	10	0
	80	0	0
	74	15	9
	23	17	$4\frac{1}{2}$

WEIGHTS AND MEASURES.

TROY WEIGHT.

(18)

lb.	oz.	dwt.	gr.
52	1	7	2
39	0	15	7

(19)

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

APOTHECARIES WEIGHT.

(20)

lb.	℥.	ʒ.	℈.
5	2	1	0
2	5	2	1

(21)

lb.	℥.	ʒ.	℈.	gr
9	7	2	1	13
5	7	3	1	18

AVOIRDUPOIS WEIGHT.

(22)

lb.	oz.	dr.
35	10	5
29	12	7

(23)

cwt.	qr.	lb.
35	1	21
25	1	27

(24)

t.	cwt.	qrs.	lb
21	1	2	7
9	11	3	15

LONG MEASURE.

(25)

yds.	ft.	in.
107	2	10
78	2	11

(26)

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

CLOTH MEASURE.

(27)

yds.	qrs.	n.
71	1	2
3	2	1

(28)

E.	e.	qrs.	n.
35	2	1	
14	3	2	

LAND MEASURE.

(29)

a.	*r.*	*p.*
175	1	27
59	0	37

(30)

a.	*r.*	*p.*
325	2	1
279	3	5

ALE AND BEER.

(33)

ar.	*fir.*	*gal.*
37	2	1
25	1	7

(34)

hhd.	*gal.*	*qts.*
27	27	1
12	50	2

IMPERIAL MEASURE—WINE.

(31)

hhd.	*gal.*	*qts.*	*pts.*
47	47	2	1
28	59	3	0

(32)

tun.	*hhd.*	*gal.*	*qts.*
42	2	37	2
17	3	49	3

CORN AND COAL.

(35)

qr.	*b.*	*p.*
65	2	1
57	2	3

(36)

sc.	*ch.*	*sa.*	*b.*
3	16	1	0
2	12	2	1

TIME.

* (37)

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

(38)

h.	*m.*	*sec.*
24	42	45
19	53	47

† (39)

yrs.	*m.*	*d.*
10	7	20
5	8	29

(40) When an estate of £300. per annum is reduced by the payment of taxes, to 12 score and £14..6. what are the taxes?

Ans. £45..14.

(41) A horse with his furniture is worth £37..5.; without it, 14 guineas; how much does the price of the furniture exceed that of the horse? *Ans.* £7..17.

(42) A merchant commencing trade, owed £750; he had in cash, commodities, the stocks, and good debts, £12510..7; he cleared the first year by commerce £452..3..6. What was he then worth? *Ans.* £12212..10..6.

(43) A gentleman left £45247. to his two daughters, of which the younger was to have 15 thousand, 15 hundred, and twice £15. What was the elder sister's fortune?

Ans. £28717.

(44) A tradesman being insolvent, called all his creditors together, and found he owed to A £53..7..6;—to B £105..10;—to C £34..5..2;—to D £28..16..5;—to E £14..15..8;—to

* In this example allow 4 weeks to a month, and 13 months to the year.

† In this, reckon 30 days to a month, and 12 months to the year.

F £112..9;—and to G £143..12..9. The value of his stock was £212..6; and the amount of good book-debts was £112..8..3; besides £21..10..5. money in hand. How much would his creditors lose by taking the whole of his effects?

Ans. The creditors lost £146..11..10.

(45) My agent at Seville, in Spain, renders me the following account of money received for the sale of goods sent him on commission *viz.* for bees' wax £37..15..4; stockings £37..6..7; tobacco £125..11..6; linen cloth £112..14..8; tin £115..10..5. He informs me at the same time, that he has shipped, agreably to my order, wines, value £250..15; fruit £51..12..6; figs £19. 17..6; oil £19..12..4; and Spanish wool, value £115..15..6. How stands the balance of the account between us? *Ans. Due to the agent* £28..14..4.

(46) The great bell at Oxford, the heaviest in England, is stated to weigh 7 *tons*, 11 *cwt.* 3 *qrs.* 4 *lbs.* that of St. Paul's in London, 5 *tons*, 2 *cwt.* 1 *qr.* 22 *lbs.* and that of Lincoln, called the *Great Tom*, 4 *tons*, 16 *cwt.* 3 *qrs.* 16 *lbs.* How much is the aggregate weight of these three bells inferior to that of the great bell at Moscow, which is 198 *tons?*

Ans. 180 *tons*, 8 *cwt.* 3 *qrs.* 14 *lbs.*

COMPOUND MULTIPLICATION

Is the method of multiplying *Compound Quantities.*

RULE. Multiply the *least denomination;* reduce the product and carry to the next as directed in Compound Addition; and the same with the rest.

When the multiplier is a *compósite* number above 12, multiply (as before directed) by its *compōnent parts.* For other numbers, multiply by the *factors* of the *nearest compósite; adding* to the last product, *so many times* the *top line* as will supply the deficiency; or *subtraction so many times,* if there is an *excess.*

MONEY.

(1)			(2)			(3)			(4)		
£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*	£.	*s.*	*d.*
35	12	$7\frac{1}{4}$	75	13	$1\frac{1}{2}$	62	5	$4\frac{1}{4}$	57	2	$4\frac{3}{4}$
		2			3			4			5
71	5	$3\frac{1}{2}$									

* In this example, say twice 3 are 6, 6 farthings are $1\frac{1}{2}d.$ set down $\frac{1}{2}d.$ and carry 1; twice 7 are 14 and 1 are 15, 15*d.* are 1*s.* 3*d.* set down 3*d.*

	£.	s.	d.			£.	s.	d.	
(5)	57	18	$7\frac{1}{4}$	× 6.	(9)	135	13	$6\frac{3}{4}$	× 10.
(6)	81	9	$11\frac{1}{2}$	× 7.	(10)	79	16	$7\frac{1}{2}$	× 11.
(7)	64	10	5	× 8.	(11)	247	14	$11\frac{1}{2}$	× 12.
(8)	118	6	$4\frac{1}{4}$	× 9.	(12)	119	7	$5\frac{3}{4}$	× 12.

	£.	s.	d.			s.	d.		£.	s.	d.	
(13)	0	9	6	×18.†	(16)	15	$3\frac{1}{2}$	×35.	(19)	1	5	3×97.
(14)	1	2	6	×26.‡	(17)	7	$2\frac{3}{4}$	×75.	(20)	4	0	4×43.
(15)	0	7	$8\frac{1}{2}$	×21.	(18)	9	7	×37.				

(21) What is the value of 127 lb. of souchong tea, at 12*s.* 3*d.* per lb.? *Ans.* £77..15..9.

(22) 135 stones of soap, at 7*s.* 5*d.* per stone? *Ans.* £50..1..3.

(23) 74 ells of diaper, at 1*s.* $4\frac{1}{2}$*d.* per ell? *Ans.* £5..1..9.

(24) 6 dozen pairs of gloves at 1*s.* 10*d.* per pair? *Ans.* £6..12.

NOTE. When the fraction $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ is connected with the multiplier, take *half* the given price (or the price of *one*) for $\frac{1}{2}$, *half of that* for $\frac{1}{4}$, and for $\frac{3}{4}$, add them together.§

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and carry 1; twice 12 are 24 and 1 are 25, 25*s.* are £1..5. set down 5*s.* and carry 1; twice 5 are 10 and 1 are 11, set down 1 and carry 1; twice 3 are 6 and 1 are 7, set down 7.

†	*s.*	*d.*
9..	6
2×9=18
19..	0
9
£8. 11..	0 *Ans.*

‡	£.	*s.*	*d.*
1..	2..	6
	8×3+2=26
9..	0..	0
	3
27..	0..	0
Multiplicand×2=	2..	5..	0
£29..	5..	0 *Ans.*

§ EXAMPLE.
What is the value of $11\frac{3}{4}$ lbs. of tea, at 10*s.* 9*d.* per *lb.*?

	s.	*d.*
$\frac{1}{2}$×10..	9	
	11	
£5..	18..	3	=the value of 11.
$\frac{1}{2}$ × 5..	$4\frac{1}{2}$	=... do.	$\frac{1}{2}$.
2..	$8\frac{1}{4}$	=... do.	$\frac{1}{4}$.
£6. 6.. | $3\frac{3}{4}$ *Ans.*

(25) What is the value of $25\frac{1}{2}$ ells of Holland at 3*s*. $4\frac{1}{2}$*d*. per ell? *Ans.* £4..6..$0\frac{3}{4}$.

(26) $75\frac{1}{2}$ lb. of hemp, at 1*s*. 3*d*. per lb? *Ans.* £4..14..$4\frac{1}{2}$.

(27) $19\frac{1}{2}$ yds. of muslin, at 4*s*. 3*d*. per yd.? *Ans* £4..2..$10\frac{1}{2}$.

(28) $35\frac{1}{2}$ cwt. of raw sugar, at £4..15..6. per cwt? *Ans.* £169..10..3.

(29) $154\frac{1}{2}$ cwt. of raisins, at £4..17..10. per cwt.? *Ans.* £755..15..3.

(30) 1 $17\frac{1}{4}$ gallons of gin, at 12*s*. 6*d*, per gallon? *Ans.* £73..5..$7\frac{1}{2}$.

(31) $85\frac{1}{4}$ cwt. of logwood, at £1..7..8. per cwt.? *Ans.* £118..12..5.

(32) $17\frac{1}{4}$ yards of superfine scarlet cloth, at £1..3..6. per yard? *Ans* £20..17..$1\frac{1}{2}$.

(33) $37\frac{1}{2}$ lb. of hyson tea, at 12*s*. 4*d*. per lb.? *Ans.* £23..2..6

(34) $56\frac{3}{4}$ cwt. of molasses, at £2..18..7. per cwt.? *Ans.* £166..4..$7\frac{1}{4}$.

(35) $87\frac{3}{4}$ lb. of Turkey coffee, at 4*s*. 3*d*. per lb.? *Ans.* £18..12..$11\frac{1}{4}$.

(36) $120\frac{1}{4}$ cwt. of hops, at £4..7..6. per cwt.? *Ans.* £528..5..$7\frac{1}{2}$.

When the multiplier is large, multiply the given quantity (or price) by a series of *tens*, to find 10, 100, 1000 times, &c., as far as to the value of the *highest place* of the multiplier; multiply the last product by the figure in that place, and each preceding product by the figure of corresponding value; that is, the product for 100 by the *number of hundreds*, the product for 10 by the *number of tens*, and the *original quantity*, by the *units' figure*, &c. The *sum* of the products thus obtained will be the *total product*.*

* EXAMPLE. Multiply £7..14..$9\frac{1}{2}$. by 3645.

	£. s. d.		£. s. d.	times.
	7..14.. $9\frac{1}{2}$	×5 =	38..13..$11\frac{1}{2}$	= 5
	10			
The product for 10	77.. 7..11	×4 =	309..11.. 8	= 40
	10			
The product for 100	7[illegible].19.. 2	×6 =	4643..15.. 0	= 600
	10			
The product for 1000	7739..11.. 8	×3 =	23218..15..0	= 3000
		Ans.	28210..15..$7\frac{1}{2}$	= 3645

(37) 407 lb of gall-nuts, at 3*s*. 9½*d*. per lb ? *Ans*. £77 .3..2½

(38) 729 stones of beef, at 7*s* 7¼*d*. per stone ?

Ans. £277..3..5¼

(39) 2068 yards of lace, at 9*s*. 5½*d*. per yard ?

Ans. £977..19..10.

(40) What is the produce of a toll-gate in the course of the year, if the tolls amount, on an average, to 11*s*. 7½*d*. per day ?

Ans. £212..3..1½.

(41) How much money must be equally divided among 18 men, to give each £14..6..8½ ? *Ans*. £255..0..9.

(42) A privateer manned with 250 sailors captured a prize, of which each man shared £125..15..6. What was the value of the prize ? *Ans*. £31443..15.

(43) What sum did a gentleman receive as a dower with his wife, whose fortune was a cabinet with two divisions, in each division 87 drawers, and each drawer, containing 21 guineas ? *Ans*. £3836..14.

(44) A merchant began trade with £19118 ; for 5 years together he cleared £1086. a year ; and the next 4 years £2715..10.. . a year ; but the last 3 years he was in trade he had the misfortune to lose upon an average, £475..4..6. a year. What was his real fortune at the end of the 12 years ?

Ans. £33984..8..6.

(45) In many parts of the kingdom coals are weighed in the waggon or cart upon a machine, constructed for the purpose. If three of these draughts amounted together to 137 *cwt*. 2 *qrs*. 10 *lb*. ; and the tare, or weight of the waggon, was 13 *cwt*. 1 *qr*. ; how many coals had the customer in 12 such draughts ?

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

(46) A certain gentleman lays up every year £294..12..6. and spends daily £1..12..6. What is his annual income ?

Ans. £887..15.

WEIGHTS AND MEASURES.

(47) Multiply 9 *lb*. 10 *oz*. 15 *dwts*. 19 *gr*. by 9, 11, and 12.

(48) Multiply 23 *tons*, 9 *cwt*. 3 *qrs*. 18 *lb*. by 7, 8, and 9.

(49) Multiply 107 *yards*, 3 *qrs*. 2 *nails*, by 10, 17, and 29.

(50) Multiply 33 *bar*. 2 *fr*. 3 *gal*. by 11, and 12.

(51) Multiply 110 *miles*, 6 *fur*. 26 *poles*, by 12, 13, and 39.

(52)A lunar month contains 29 days, 12 hours, 44 min. 3 seconds nearly. What time is contained in 13 lunar months?

COMPOUND DIVISION

TEACHES to find any required part of a *Compound quantity.*

RULE. Divide the *greatest denomination:* reduce the remainder to the *next less,* to which add the next; divide that, and proceed as before to the end.

When the divisor is above 12, the work must be done at length: unless it is a *compósite* number, for which observe the directions in Simple Division.—*Proof by Multiplication.*

MONEY.

*(1) £. s. d.	(2) £ s. d.	(3) £. s. d.	(4) £ s. d.
2)25 2 4	3)37 7 7	4)57 5 7	5)52 7 0

	£. s.	d.		£. s.	d.
(5)	78 10	$9\frac{1}{2} \div 6.$	(9)	87 14	0 by 10.
(6)	25 19	$7\frac{3}{4} \div 7.$	(10)	68 0	0 by 11.
(7)	16 14	$1\frac{1}{2} \div 8.$	(11)	49 14	7 by 12.
(8)	124 15	$2\frac{1}{2} \div 9.$	(12)	496 8	6 by 12.
(13)	66 6	$6\frac{3}{4} \div 25.$	(16)	248 17	4 by 99.
(14)	596 12	$7\frac{1}{4} \div 36.$	(17)	928 12	8 by 110.
(15)	564 4	$6 \div 63.$	(18)	608 13	9 by 144.

(19) Divide £1407..17..7. by 243.
(20) Divide £700791..14..4. by 1794.
(21) Divide £490981..3..7½. by 31715.
(22) Divide £19743052..5..7½. by 214723.

*EXAMPLE, Divide £27..14..11½. by 5.

£ s. d.	
5)27..14 11½	
5..10..11¼ ⅗	

Say the fives in 27, 5 times 5 are 25 and 2 over; £2. are 40*s.* and 14 are 54, the fives in 54, 10 times 5 are 50 and 4 over; 4*s.* are 48*d.* and 11 are 59, the fives in 59, 11 fives are 55 and 4 over; 4*d.* are 16 *qrs.* and 2 are 18 the fives in 18, 3 times five are 15, and 3 over, or ⅗.

(23) If a man spend £257..2..5. in 12 months, what is that per month? *Ans.* £21..8..6$\frac{1}{4}$ $\frac{8}{12}$.

(24) The clothing of 35 charity boys came to £57..3..7. what was the expence of each boy? *Ans.* £1..12..8$\frac{12}{35}$.

(25) If I gave £37..6..4$\frac{3}{4}$. for nine pieces of cloth, what was that per piece? *Ans.* £4..2..11$\frac{7}{9}$.

(26) If 20 *cwt.* of tobacco cost £27..5..4$\frac{1}{2}$; at what rate did I buy it per *cwt.*? *Ans.* £1..7..3$\frac{18}{20}$.

(27) What is the value of one hogshead of beer, when 120 hogsheads are sold for £154..17..10? *Ans.* £1..5..9$\frac{3}{4}$ $\frac{16}{120}$.

(28) Bought 72 yards of cloth for £85..6. What was the price per yard? *Ans.* £1..3..8$\frac{1}{4}$ $\frac{24}{72}$.

(29) Gave £275..3..4. for 18 bales of cloth. What is the price of one bale? *Ans.* £15..5..8$\frac{3}{4}$ $\frac{10}{18}$.

(30) A prize of £7257..3..6. is to be equally divided among 500 sailors. What is each man's share? *Ans.* £14..10..3$\frac{1}{4}$ $\frac{388}{500}$.

(31) A club of 25 persons joined to purchase a lottery ticket of £10. value, which was drawn a prize of £4000. What was each man's contribution, and his share of the prize-money? *Ans. each contribution* 8*s. and share of prize* £160.

(32) A tradesman cleared £2805. in 7$\frac{1}{2}$ years; what was his yearly profit? *Ans.* 374.

(33) What was the weekly salary of a clerk who received £266..18..1$\frac{1}{2}$. for 90 weeks? *Ans.* £2..19..3$\frac{3}{4}$.

(34) If 100000 quills cost me £187..17..1. what is the price per thousand? *Ans.* £1..17..6$\frac{3}{4}$ $\frac{40}{100}$.

WEIGHTS AND MEASURES.

(35) Divide 83 *lb.* 5 *oz.* 10 *dwts.* 17 *gr.* by 8, 10, and 12.

(36) Divide 29 *tons*, 17 *cwt.* 0 *qrs.* 18 *lb.* 9, 15, and 19.

(37) Divide 114 *yards*, 3 *qrs.* 2 *nails*, by 10, and 16.

(38) Divide 1017 *miles*, 6 *fur.* 38 *poles*, by 11, and 49.

(39) Divide 2019 *acres*, 3 *rods*, 29 *perches*, by 26.

(40) Divide 117 *years*, 7 *months*, 26 *days*, 11 *hours*, 27 *minutes*, by 37.

PROMISCUOUS EXAMPLES.

(1) Of three numbers, the first is 215, the second 519, and the third is equal to the other two. What is the sum of them all? *Ans.* 1468.

(2) The less of two sums of money is £40, and their difference £14. What is the greater sum, and the amount of both? *Ans.* £54. *the greater*, £94. *the sum.*

(3) What number added to ten thousand and eighty-nine, will make the sum fifteen thousand and forty? *Ans.* 4951.

(4) What is the difference between six dozen dozen, and half a dozen dozen; and what is their sum and product?
Ans. diff. 792, *sum* 936, *product* 62208.

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

(6) The greater of two numbers is 37 times 45, and their difference is 19 times 4: required their sum and product?
Ans. 3254 *sum*, 2645685 *product.*

(7) A gentleman left his elder daughter £1500. more than the younger, whose fortune was 11 thousand, 11 hundred, and £11. Find the portion of the elder, and the amount of both. *Ans. Elder's portion* £13611. *amount* £25722.

(8) The sum of two numbers is 360, the less is 144. What is their difference and their product?
Ans. 72 *difference.* 31104 *product.*

(9) There are 2545 bullocks to be divided among 509 men. Required the number and the value of each man's share, supposing every bullock worth £9..14..6?
Ans. Each man had 5 *bullocks, and* £48..12..6. *for his share.*

(10) How many cubic feet are contained in a room, the length of which is 24 feet, the breadth 14 feet, and the height 11 feet?* *Ans.* 3696.

(11) A gentleman's garden containing 9625 square yards, is 35 yards broad: what is the length? *Ans.* 275 *yards.*

(12) What sum added to the 43rd part of £4129. will make the total amount=£240? *Ans.* £137.

(13) Divide 20*s.* among A, B, and C, so that A may have 2*s.* less than B, and C 2*s.* more than B.
Ans. A 4*s.* 8*d.* *B* 6*s.* 8*d. and C* 8*s.* 8*d.*

* Multiply the three dimensions continually together.

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

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

(16) There are 1000 men in a regiment, of whom 50 are officers: how many privates are there to one officer? *Ans.* 19.

(17) What number must 7847 be multiplied by, to produce 3013248? *Ans.* 384.

(18) Suppose I pay eight guineas and half-a-crown for a quarter's rent, but am allowed 15*s.* for repairs; what does my apartment cost me annually, and how much in seven years? *Ans. In one year*, £31..2. *In seven*, £217..14.

(19) The quotient is 1083; the divisor 28604; and the remainder 1788: what is the dividend? *Ans.* 30979920.

(20) An assessment was made on a certain hundred, for the sum of £386..15..6. the amount of the damage done by a riotous assemblage. Four parishes paid £37..14..2. each; four hamlets £31..4..2. each; and four townships £18..12..6. each: how much was deficient; *Ans.* £36..12..2.

(21) An army consisting of 20,000 men, got a booty of £12,000; what was each man's share, if the whole were equally divided among them? *Ans.* 12*s.*

(22) A gentleman left by will, to his wife, £4560;—to a public charity, £572..10;—to four nephews, £750..10. each;—to four nieces, £375..12..6. each;—to thirty poor housekeepers, 10 guineas each;—and to his executors 150 guineas. What was the amount of his property? *Ans.* £10109..10,

(23) My purse and money said Dick to Harry, are worth 12*s.* 8*d.* but the money is worth seven times the value of the purse: what did the purse contain? *Ans.* 11*s.* 1*d.*

(24) Supposing 20 to be the remainder of a division, 423 the quotient, and the divisor the *sum* of both, *plus* 19; what is the dividend? *Ans.* 195446.

(25) A merchant bought two lots of tobacco, which weighed 12 *cwt.* 3 *qrs.* 15 *lb.* for £114..15..6; their difference in

weight was 1 *cwt.* 2 *qrs.* 13 *lb.* and in price £7..15..6. Required their respective weights and value?*

Ans. Greater weight 7 *cwt.* 1 *qr. value* £61..5..6.
Less weight 5 *cwt.* 2 *qrs.* 15 *lb.* value £53..10.

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

(27) If 103 guineas and 7*s.* be divided among 7 men, how many pounds sterling is the share of each? *Ans.* £15..10.

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

(29) A gentleman, in his will, left £50. to the poor, and ordered that $\frac{1}{3}$ should be given to old men, each man to have 5*s.*—$\frac{1}{4}$ to old women, each woman to have 2*s.* 6*d.*—$\frac{1}{5}$ to poor boys, each boy to have 1*s.*—$\frac{1}{6}$ to poor girls, each girl to have 9*d.* and the remainder to the person who distributed it: how many of each sort were there, and what remained for the person who distributed the money?

Ans. 66 *men,* 100 *women,* 200 *boys,* 222 *girls*:
£2..13..6. *for the distributor.*

(30) A gentleman sent a tankard to his goldsmith, that weighed 50 *oz.* 8 *dwts.* to be made into spoons, each weighing 2 *oz.* 16 *dwts.* how many would he have? *Ans.* 18.

(31) A gentlemen has sent to a silversmith 137 *oz.* 6 *dwts.* 9 *gr.* of silver, to be made into tankards of 17 *oz.* 15 *dwts.* 10 *gr.* each; spoons of 21 *oz.* 11 *dwts.* 13 *gr.* per dozen; salts, of 3 *oz.* 10 *dwts.* each; and forks, of 21 *oz.* 11 *dwts.* 13 *gr.* per dozen; and for every tankard to have one salt, a dozen spoons, and a dozen forks: what number of each will he have?

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

(32) How many parcels of sugar of 16 *lb.* 2 *oz.* each are there in 16 *cwt.* 1 *qr.* 15 *lb.*?

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

(33) In an arc of 7 signs, 14° 3′ 53″, how many seconds?
Ans. 806633″.

(34) How many *lbs.* of *lead* would counterpoise a mass of

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* Add the difference to the sum, and divide by 2 for the *greater*; subtract the difference from the sum, and divide by 2 for the *less.*

bullion weighing 100 *lbs.* Troy ?* *Ans.* 82 *lb.* 4 *oz.* $9\frac{25}{175}$ *dr.*

(35) If an apothecary mixes together 1 *lb.* avoirdupois of white wax, 4 *lbs.* of spermaceti, and 12 *lbs.* of olive oil, how many *ounces apothecaries' weight*, will the mass of ointment weigh, and how many masses of 3 drams each will it contain? *Ans. the whole* 247 *oz.* 7 $\frac{64}{192}$ *dr. and* 661 *of* 3 *dr. each.*

PROPORTION.

PROPORTION is either DIRECT or INVERSE. It is commonly called the RULE OF THREE; there being always *three numbers* or *terms given*, two of which are terms of *supposition;* and the other is the term of *demand:* because it requires a *fourth term* to be found, in the same proportion to itself, as that which is between the other two.

GENERAL RULE FOR STATING THE QUESTION. Put the *term of demand* in the *third* place; that *term of supposition* which is of the *same kind* as the *demand*, the *first;* and the other, which is of the *same kind* as the *required term*, the *second.***

Also the terms being thus arranged, reduce the first and third (if necessary) to one name, and the second into the lowest denomination mentioned.

THE RULE OF THREE DIRECT

REQUIRES the *fourth* term to be *greater* than the *second*, when the *third* is *greater* than the *first;* or the *fourth*, to be *less* than the *second*, when the *third* is *less* than the *first.*

RULE. Multiply the second and third together, and divide

* *Bullion* is the term denoting gold or silver in the mass. Lead is weighed by Avoirdupois weight. See the Table of COMPARISON OF WEIGHTS.

** Some modern authors prefer placing the *term of demand* the *second*, and that *similar* to the *required term* the *third.* This arrangement will answer the purpose equally well, observing that those of *like kind* must be reduced (if necessary) to the *same name.*

their product by the first: the quotient will be the answer, in the same denomination as the second.*

The following methods of contracting the operations in the RULE OF THREE are highly important, and should never be lost sight of.

1. Let the first and third terms be reduced *no lower* than is *necessary*, to make them of the *same denomination*.

2. Let the *dividing term* and *either* (but not *both*) of *the other* terms be divided by any number that will divide them *exactly*; and use the quotients instead of the original numbers.

3. When it is conveniently practicable, work by Compound Multiplication and Division, instead of reducing the terms.

(1) If one *lb.* of sugar cost $4\frac{1}{2}d.$ what will 54 *lb.* cost?†

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

(3) If a pair of shoes cost 4*s.* 6*d.* what is the value of 12 dozen pairs?‡

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

(5) If 32 yards of cloth cost £24..16. what is the value of one yard? *Ans.* 15*s.* 6*d.*

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

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* The following GENERAL RULE comprehends both the cases of DIRECT and INVERSE PROPORTION under one head; which is considered by many scientific men of the present day as a more systematic arrangement.

RULE. The question being stated, and the terms prepared, consider, from the nature of the case, whether the *required term* is to be *greater* or *less* than the *second*, or term of *similar kind*: if greater, multiply that *similar to the answer* by the greater of the other two, and divide the product by the less; if less, multiply it by the less and divide the product by the greater. In either case the quotient will be the *term required*, in the same denomination as the *similar term*.

NOTE. It is evident that the above Rule will answer generally, whether the term of demand is put in the second or third place,

† As *lb.* 1 : *d.* $4\frac{1}{2}$: : *lbs.* 54
4 18
18 4)972 *qrs.*
12)243 *d.*
20*s.* 3*d.* = £1..0..3. *Ans.*

‡ As *pr.* 1 : *s.* 4..*d.* 6 : : *prs.* 144
12
2..14..0
12
£32..8..0. *Ans.*

(7) Bought 20 pieces of cloth, each piece 20 ells, for 12*s* 6*d*. per ell, what is the value of the whole? *Ans.* £250.

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

(9) Bought 27¼ yards of muslin, at 6*s.* 9½*d* per yard, what is the amount of the whole? *Ans.* £9..5..0¾ ½.

(10) Bought 17 *cwt.* 1 *qr.* 14 *lb.* of iron, at 3¼*d*. per *lb.* what was the price of the whole? *Ans.* £26..7 .0½.

(11) If coffee is sold for 5½*d*. per ounce, what will be the price of 2 *cwt.*? *Ans.* £82..2..8.

(12) How many yards of cloth may be bought for £21. 11..1¼. when 3½ yards cost £2..14..3.?

Ans. 27 *yards*, 3 *qrs.* 1 1/3 *nail.*

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

(14) Bought 1 *cwt.* 24 *lb.* 8 *oz.* of old lead, at 9*s* per *cwt.* what did the lead cost? *Ans.* 10*s.* 11½ ½½¼*d.*

(15) If a gentleman's income be £500. a year, and he spend 19*s.* 4*d.* per day, what is his annual saving? *Ans.* £147..3..4.

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

(17) If 504 Flemish ells, 2 quarters, cost £283..17..6· what is the cost of 14 yards? *Ans.* £10..10.

(18) At the rate of £1..1..8. for 3 *lb.* of gum acacia what must be given for 29 *lb.* 4 *oz.*? *Ans.* £10..11..3

(19) If 1 English ell, 2 quarters cost 4*s.* 7*d.* what will 39½ yards cost at the same rate? *Ans.* £5..3..5¼ 1/7.

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

(21) If 7 yards of cloth cost 17*s.*..8*d.*. what is the value of 5 pieces, each containing 27½ yards? *Ans.* £17..7..0¼ 1/7.

(22) A draper bought 420 yards of broad cloth, at the rate of 14*s.* 10¼*d.* per ell English: what was he amount of the purchase money? *Ans.* £250..5.

(23) A grocer bought 4 hogsheads of sugar, each hogshead weighing neat 6 *cwt.* 2 qrs. 14 *lb.* at £2..8..6. per *cwt.* what is the value? *Ans.* £64..5..3.

(24) A draper bought 8 packs of cloth, each pack containing 4 parcels, each parcel 10 pieces, and each piece 26 yards; at the rate of £4..16. for 6 yards: what was the purchase money? *Ans.* £6656.

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

(26) When the price of silver is 5*s.* per ounce, what is the value of 14 ingots, each ingot weighing 7 *lb.* 5 *oz.* 10 *dwts.*?
Ans. £313..5.

(27) What is the value of a pack of wool, weighing 2 *cwt.* 1 *qr.* 19 *lb.* at 17*s.* per tod of 28 lb.? *Ans.* £8..4..6$\frac{1}{4}\frac{20}{28}$

(28) Bought 171 tons of lead, at £14. per ton; paid carriage and other incidental charges, £4..10. Required the whole cost, and the cost per *lb.*?

Ans. £2398..10. *the whole cost, and the cost per lb.* $1\frac{1}{2}d.\ \frac{432}{384}$.

(29) If a pair of stockings cost 10 groats, how many dozen pairs can I buy for £43..5.? *Ans.* 21 *doz.* 7$\frac{1}{2}$ *pairs.*

(30) Bought 27 *doz.* 5 *lb.* of candles, at the rate of 5*s.* 9*d.* a dozen: what did they cost? *Ans.* £7..17..7$\frac{1}{4}$.

(31) A factor bought 86 pieces of stuff, which cost him £517..17..10. at 4*s.* 10*d.* per yard. How many yards were there in the whole, and how many English ells in a piece?

Ans. 2143 *yards; and* 19 *ells,* 4 *qrs.* $2\frac{60}{86}$ *nails, in a piece.*

(32) A gentleman has an annuity of £896..17. What may he spend daily, that at the year's end he may lay up 200 guineas, after giving to the poor quarterly 10 moidores?
Ans. £1..14..8 $\frac{44}{365}$.

THE RULE OF THREE INVERSE

Requires the *fourth* term to be *less* than the *second*, when the *third* is *greater* than the *first*; or the *fourth* to be *greater* than the *second*, when the *third* is *less* than the *first.*

Rule. Multiply the first and second together, and divide their product by the third: the quotient will be the answer, as before.

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

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*As $\underset{m.}{8}$: $\underset{d.}{12}$ :: $\underset{m.}{16}$: $\frac{8 \times 12}{16}$ = 6 *days. Ans.*

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

(3) If, when a peck of wheat is sold for 2*s.* the penny loaf weighs 8 *oz*; how much must it weigh when the peck is worth but 1*s.* 6*d.*? *Ans.* $10\frac{2}{3}$ *oz.*

(4) How many sovereigns, of 20*s.* each, are equivalent to 240 piece, value 12*s.* each? *Ans.* 144.

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

(6) If I lend a friend £200. for 12 months, how long ought he to lend me £150.? *Ans.* 16 *months.*

(7) If for 24*s.* I have 1200 *lb.* carried 36 miles, what weight can I have carried 24 miles for the same money? *Ans.* 1800 *lb.*

(8) If I have a right to keep 45 sheep on a common 20 weeks, how long may I keep 50 upon it? *Ans.* 18 *weeks.*

(9) A besieged town has a garrison of 1000 soldiers, with provisions for only 3 months. How many must be sent away, that the provisions may last 5 months? *Ans.* 400.

(10) If £20. worth of wine be sufficient to serve an ordinary of 100 men, when the price is £30. per tun; how many will £20. worth suffice, when the price is only £24. per tun? *Ans.* 125 *men.*

(11) A courier makes a journey in 24 days, by travelling 12 hours a day: how many days will he be in going the same journey, travelling 16 hours a day? *Ans.* 18 *days.*

(12) How much will line a cloak, which is made of 4 yards of plush, 7 quarters wide, the stuff for the lining being but 3 quarters wide? *Ans.* $9\frac{1}{3}$ yards.

DIRECT AND INVERSE PROPORTION PROMISCUOUSLY ARRANGED.

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

(2) If 14 pioneers make a trench in 18 days, in how many days would 34 men make a similar trench; working in both cases, 12 hours a day? *Ans.* 7 *days*, 4 *hours*, $56\frac{8}{17}$ *minutes.*

(3) How much must I lend to a friend for 12 months, to requite his kindness in having lent me £64. for 8 months?

Ans. £48..13..4.

(4) Bought 59 *cwt.* 2 *qrs.* 21 *lb.* of tobacco, at £2..17..4. per *cwt.* what does it come to? *Ans.* £171..2..1.

(5) A woollen draper purchased 147 yards of broad cloth at 14*s.* 6*d.* per yard. Suppose that he sold it in pieces for coats, each $1\frac{3}{4}$ yard, how much must he charge for each, so as to gain £16..10..9. by the whole? *Ans.* £1..9..$3\frac{3}{4}$.

(6) If £100. gain £4.1.0. interest in 12 months, what sum will gain the same in 18 months? *Ans.* £66..13..4

(7) A draper having sold 147 yards of cloth, at the rate of £1..9..$3\frac{3}{4}$. for $1\frac{3}{4}$ yard, found that he had gained £16.10..9. What did the whole cost him, and how much per yard?

Ans. the whole £106..11..6. *and* 14*s.* 6*d. per yard.*

(8) If £100 in 12 months gain £4..10. interest, in what time will £66..13..4 gain the same interest?

Ans. 18 *months.*

(9) If a draper bought 147 yards of cloth, at 14*s.* 6*d.* per yard, and sold it out in pieces for coats, each $1\frac{3}{4}$ yard, for £1..9..$3\frac{3}{4}$.; how much would he gain per yard, and by the whole? *Ans* 2*s.* 3*d. per yard,* £16..10..9. *by the whole.*

(10) If 1 *cwt.* cost £12..12..6. what must be given for 14 *cwt.* 1 *qr.* 19 *lb.?* *Ans.* £182..0..$11\frac{1}{2}\frac{8}{112}$.

(11) If £100. gain £4..10. in 12 months, what interest will £375. gain in the same time? *Ans.* £16..17..6.

(12) A regiment of soldiers, consisting of 1000 men, are to have new coats, each to be made of $2\frac{1}{2}$ yards of cloth, 5 quarters wide, and to be lined with shalloon of 3 quarters wide. How many yards of shalloon will line them.

Ans. 4166 *yards,* 2 *qrs.* $2\frac{2}{3}$ *nails.*

THE DOUBLE RULE OF THREE

HAS *five terms given,* three of supposition and two of demand, to find a *sixth,* in the same proposition with the terms of demand, as that of the terms of supposition. It comprises *two* operations of the SINGLE RULE.—But it may comprise *three four,* or *more* operations of the Single Rule; as there may be

seven terms given to find an *eighth*, or *nine* to find a *tenth*, &c. In this respect it is unlimited; and is therefore more properly called COMPOUND PROPORTION.

RULE 1. Put the *terms of demand* one under another in the *third place;* the *terms of supposition* in the same order in the *first place;* except that which is of the *same nature* as the *required term*, which must be in the *second place.*

Examine the statings separately, using the middle term in each, to know if the proportion is *direct* or *inverse.* When direct, mark the *first* term with an asterisk: when inverse mark the *third* term.

Find the product of the *marked* terms for a *Divisor*, and the product of *all the rest* for a *Dividend:* divide, and the quotient will be the answer.*

RULE 2. (1) Of the conditional terms, put the principal cause of action, gain or loss, &c. in the *first* place. (2) Put that which denotes time or distance, &c. in the *second*, and the other in the *third.* (3) Put the terms of demand under the *like* terms of supposition. (4) If the blank falls in the *third* place, multiply the first and second terms for a divisor, and the other three for a dividend. (5) But if the blank is in the *first* or *second* place, divide the product of the rest by the product of the third and fourth terms, for the answer.

NOTE. It will save much labour to write the terms of the Dividend *over*, and those of the Divisor *under a line*, like those of a *compound fraction*, and to cancel them accordingly. See Reduction of Vulgar Fractions, Case 6.

PROOF. By two operations of the Single Rule of Three.

(1) If 14 horses eat 56 bushels of oats in 16 days, how many bushels will serve 20 horses for 24 days?†

(2) If 8 men in 14 days can mow 112 acres of grass, how many men can mow 2000 acres in ten days?

Ans. 200 *men.*

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

See also Supplemental Questions, Nos. 6 and 7.

By two single rules.				or in one stating, worked thus:			
	hor.	bu.	hor.	bu.	hor.	days.	bu.
1. As	14	56 ..	20	. 80	14	. 16 .	56
	days.	bu.	days.	bu	20	. 24 .	—
2. As	16	80 ..	24	. 120			

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

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

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

(6) If a carrier charges £2..2. for the carriage of 3 *cwt* 150 miles, how much ought he to charge for the carriage of 7 *cwt.* 3 *qrs.* 14 *lb.* 50 miles? *Ans.* £1..16..9.

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

(8) If £2. will pay 8 men for 5 day's work, how much will pay 32 men for 24 day's work? *Ans.* £38..8.

(9) If a regiment of soldiers, consisting of 1360 men, consume 351 quarters of wheat in 108 days, how much will 11232 soldiers consume in 56 days? *Ans.* $1503\frac{9}{85}$ *qrs.*

(10) If 939 horses consume 351 quarters of oats in 168 days, how many horses will consume 1404 quarters in 56 days? *Ans.* 11268.

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

(12) If 144 *threepenny* loaves serve 18 men for 6 days, how many *fourpenny* loaves will serve 21 men for 9 days? *Ans.* 189.

PRACTICE

Is so called from its general use among merchants and tradesmen.

It is a concise method of computing the value of articles, &c. by taking *aliquot parts.*

The GENERAL RULE is to *suppose* the *price* one pound, one shilling or one penny each. Then will the given number of articles, considered accordingly as *pounds*, or *shillings*, or *pence*, be the *supposed* value of the whole; out of which the *aliquot part* or *parts* are to be taken for the *real* price.

NOTE. An *aliquot part* of a number is such a part as being taken a certain number of times will produce the *number exactly*: thus, 4 is an aliquot part of 12; because 3 fours are 12.

ALIQUOT PARTS.

Of a pound.

s.	*d.*	£.
10	0 are	$\frac{1}{2}$
6	8 ...	$\frac{1}{3}$
5	0 ...	$\frac{1}{4}$
4	0 ...	$\frac{1}{5}$
3	4 ...	$\frac{1}{6}$
2	6 ...	$\frac{1}{8}$
2	0 ...	$\frac{1}{10}$
1	8 ...	$\frac{1}{12}$
1	4 ...	$\frac{1}{15}$
1	3 ...	$\frac{1}{16}$
1	0 ...	$\frac{1}{20}$
0	8 ...	$\frac{1}{30}$
0	6 ...	$\frac{1}{40}$

Of a shilling.

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

Of a penny.

2 *qrs.* are $\frac{1}{2}d.$
1 *qr.* is $\frac{1}{4}d.$

Of a ton.

cwt.	*ton*
10 are	$\frac{1}{2}$
5	$\frac{1}{4}$
4	$\frac{1}{5}$
2 3*qr.* 12*lb.*	$\frac{1}{9}$
$2\frac{1}{2}$	$\frac{1}{8}$
2	$\frac{1}{10}$
1 is	$\frac{1}{20}$

Of a cwt.

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

Of a quarter.

lb.	*qr.*
14 are	$\frac{1}{2}$
7 ...	$\frac{1}{4}$
4 ...	$\frac{1}{7}$
$3\frac{1}{2}$ ...	$\frac{1}{8}$
2 ...	$\frac{1}{14}$
$1\frac{3}{4}$ ...	$\frac{1}{16}$
1 is	$\frac{1}{28}$

Of a lb.

oz.	*lb.*
8 are	$\frac{1}{2}$
4 ...	$\frac{1}{4}$
2 ...	$\frac{1}{8}$
1 is	$\frac{1}{16}$

Of a lb. Troy.

oz.	*lb.*
6 are	$\frac{1}{2}$

4, &c. as in the parts of a shilling.

Of an oz. Troy.

The same as the parts of a £. changing the names from *shillings* to *dwts.*

Of a dwt.

gr.	*dwt.*
12 are	$\frac{1}{2}$
8 ...	$\frac{1}{3}$
6 ...	$\frac{1}{4}$
4 ...	$\frac{1}{6}$
3 ...	$\frac{1}{8}$
2 ...	$\frac{1}{12}$
$1\frac{1}{2}$ ...	$\frac{1}{16}$
1 is	$\frac{1}{24}$

RULE 1. When the price is less than a penny, call the given number *pence*, and take the *aliquot parts* that are in a penny; then divide by 12 and 20, to reduce the answer to pounds.

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

12)1426

2|0)11|8..10.

Ans. £5..18..10.

(2) 7695 at $\frac{1}{2}d.$
Ans. £16..0..7$\frac{1}{2}$.

(3) 5470 at $\frac{1}{2}d.$
Ans. £11..7..11.

(4) 6547 at $\frac{1}{4}d.$
Ans. £20..9..1$\frac{1}{4}$.

(5) 4573 at $\frac{1}{4}d.$
Ans. £14..5..9$\frac{3}{4}$.

RULE 2. When the price is less than a shilling, call the given number *shillings*, take the *aliquot part* or *parts* that are in a shilling, add the quotients together, and divide by 20, as in the preceding rule.

*(1) 7547 at 1*d*. *Ans.* £31..8..11.	(16) 2107 at $4\frac{3}{4}$*d*. *Ans.* £41..14..$0\frac{1}{4}$.	(31) 2759 at $8\frac{1}{2}$*d*. *Ans.* £97..14..$3\frac{1}{2}$.
†(2) 3751 at $\frac{1}{4}$*d*. *Ans.* £19..10. $8\frac{3}{4}$.	(17) 3210 at 5*d*. *Ans.* £66..17..6.	(32) 9872 at $8\frac{3}{4}$*d*. *Ans.* £359..18..4.
(3) 54325 at $1\frac{1}{2}$*d*. *Ans.* £339..10..$7\frac{1}{2}$.	(18) 2715 at $5\frac{1}{4}$*d*. *Ans.* £59..7..$9\frac{3}{4}$.	(33) 5272 at 9*d*. *Ans.* £197..14.
(4) 6254 at $1\frac{3}{4}$*d*. *Ans.* £45..12..$0\frac{1}{2}$.	(19) 3120 at $5\frac{1}{2}$*d*. *Ans.* £71..10.	(34) 6325 at $9\frac{1}{4}$*d*. *Ans.* £243..15..$6\frac{1}{4}$.
(5) 2351 at 2*d*. *Ans.* £19..11..10.	(20) 7521 at $5\frac{3}{4}$*d*. *Ans.* £180..3..$9\frac{3}{4}$.	(35) 7924 at $9\frac{1}{2}$*d*. *Ans.* £313..13..2.
(6) 7210 at $2\frac{1}{4}$*d*. *Ans.* £67..11..$10\frac{1}{2}$.	(21) 3271 at 6*d*. *Ans.* £81..15..6	(36) 2150 at $9\frac{3}{4}$*d*. *Ans.* £87..6..$10\frac{1}{2}$.
(7) 2710 at $2\frac{1}{2}$*d*. *Ans.* £28..4..7.	(22) 7914 at $6\frac{1}{4}$*d*. *Ans.* £206..1..$10\frac{1}{2}$.	(37) 6325 at 10*d*. *Ans.* £263..10..10.
(8) 3250 at $2\frac{3}{4}$*d*. *Ans.* £37..4..$9\frac{1}{2}$.	(23) 3250 at $6\frac{1}{2}$*d*. *Ans.* £88..0..5.	(38) 5724 at $10\frac{1}{4}$*d*. *Ans.* £244..9..3.
(9) 2715 at 3*d*. *Ans.* £33..18..9.	(24) 2708 at $6\frac{3}{4}$*d*. *Ans.* £76..3..3.	(39) 6327 at $10\frac{1}{4}$*d*. *Ans.* £270..4..$3\frac{3}{4}$.
(10) 7062 at $3\frac{1}{4}$*d*. *Ans.* £95..12..$7\frac{1}{2}$.	(25) 3271 at 7*d*. *Ans.* £95..8..1.	(40) 3254 at $10\frac{1}{2}$*d*. *Ans.* £142..7..3.
(11) 2147 at $3\frac{1}{2}$*d*. *Ans.* £31..6..$2\frac{1}{2}$*d*.	(26) 3254 at $7\frac{1}{4}$*d*. *Ans.* £98..5..$11\frac{1}{2}$.	(41) 7291 at $10\frac{3}{4}$*d*. *Ans.* £326..11..$6\frac{1}{4}$.
(12) 7000 at $3\frac{3}{4}$*d*. *Ans.* £109..7..6.	(27) 2701 at $7\frac{1}{2}$*d*. *Ans.* £84..8..$1\frac{1}{2}$.	(42) 3256 at 11*d*. *Ans.* £149..4..8.
(13) 3257 at 4*d*. *Ans.* £54..5..8.	(28) 3714 at $7\frac{3}{4}$*d*. *Ans.* £119..18..$7\frac{1}{2}$.	(43) 7254 at $11\frac{1}{4}$*d*. *Ans.* £340..0..$7\frac{1}{2}$.
(14) 2056 at $4\frac{1}{4}$*d*. *Ans.* £36..8..2.	(29) 2710 at 8*d*. *Ans.* £90..6..8.	(44) 3754 at $11\frac{1}{2}$*d*. *Ans.* £179..17..7.
(15) 3752 at $4\frac{1}{2}$*d*. *Ans.* £70..7..0.	(30) 3514 at $8\frac{1}{4}$*d*. *Ans.* £120..15..$10\frac{1}{2}$.	(45) 7972 at $11\frac{3}{4}$*d*. *Ans.* £390..5..11.

* 1*d*.=$\frac{1}{12}$ 7547*s*.

2|0)62|8..11

Ans. £31..8..11.

† 1*d*.=$\frac{1}{12}$ 3751*s*.

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

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

£19..10..$8\frac{3}{4}$. *Ans.*

RULE 3. When the price is more than one shilling, and less than two, take the *part* or *parts* for the *excess* above a shilling, add the quotients to the given quantity, and reduce the whole to pounds as before. Or, when convenient, take the *aliquot part* of a pound.

*(1) 2106 at 12¼*d.* *Ans.* £107..9..10½	(16) 2915 at 1*s.* 4*d.* *Ans.* £194..6..8.	(31)2504 at 1*s.* 7¼*d.* *Ans.* £206..1..2.
(2)3715 at 12½*d.* *Ans.* £193..9..9½.	(17) 3270 at 1*s* 4¼*d.* *Ans.* £221..8..1½.	(32)7152 at 1*s.* 8*d.* *Ans.* £596.
(3) 2712 at 12¾*d.* *Ans.* £144..1..6.	(18) 7059 at 1*s.* 4½d. *Ans.* £485..6..1½.	(33)2905 at 1*s.* 8¼*d.* *Ans.* £245..2..2¼.
(4) 2107 at 1*s.* 1*d.* *Ans.* £114..2..7.	(19)2750 at 1*s.* 4¼*d.* *Ans.* £191..18..6½	(34)7104 at 1*s.* 8½*d.* *Ans.* £606..16.
(5) 3215 at 1*s.* 1¼*d.* *Ans.* £177..9..10¾.	(20) 3725 at 1*s.* 5*d.* *Ans.* £263..17..1.	(35)1004 at 1*s.* 8*d*¼. *Ans.* £86..16..1.
(6) 2790 at 1*s.* 1½*d.* *Ans.* £156..18.9.	(21)7250 at 1*s.* 5¼*d* *Ans.* £521..1..10½.	(36) 2104 at 1*s.* 9*d.* *Ans.* £184..2.
(7) 7904 at 1*s.* 1¾*d.* *Ans.* £452..16..8.	(22)2597 at 1*s.*5½*d.* *Ans.* £189..7..3½.	(37)2571 at 1*s.* 9¼*d.* *Ans.* £227..12..9¾.
(8) 3750 at 1*s.* 2*d.* *Ans.* £218..15.	(23)7210 at 1*s.*5¾*d* *Ans.* £533..4..9½.	(38)2104 at 1*s.* 9½*d.* *Ans.* £188..9..8.
(9) 3291 at 1*s.* 2¼*d* *Ans.* £195. 8..0¾.	(24) 7524 at 1*s.*6*d.* *Ans.* £564..6.	(39)7506 at 1*s.* 9¾*d.* *Ans.* £680..4..7½.
(10)9254 at 1*s.* 2½*d.* *Ans.* £559..1..11.	(25) 7103 at 1*s.*6¼*d* *Ans.* £540..2..5¾	(40)1071 at 1*s.* 10*d.* *Ans.* £98..3. 6.
(11)7250 at 1*s.* 2¾*d* *Ans.* £445..11..5½.	(26) 3254 at 1*s.*6½*d* *Ans.* £250..16..7.	(41)5200 at 1*s.*10¼*d.* *Ans.* £482..1..8.
(12) 7591 at 1*s.* 3*d* *Ans.* £474..8..9.	(27) 7925 at 1*s.*6¾*d* *Ans.* £619..2..9¾.	(42)2117at 1*s.*10½*d.* *Ans.* £198..9. 4½.
(13)6325 at 1*s.* 3¼*d* *Ans.* £401..18..0¼.	(28) 9271 at 1*s.* 7. *Ans.* £733..19..1.	(43) 1007at1*s.*10¾*d.* *Ans.* £95..9..1¼*d.*
(14)5271 at 1*s.* 3½*d* *Ans.* £340..8..4½.	(29) 7210 at 1*s.*7¼*d* *Ans.* £578..6..0½.	(44) 5000 at 1*s.*11*d.* *Ans.* £479..3 .4.
(15)3254 at 1*s.* 3¾*d.* *Ans.*£213..10..10½.	(30)2310 at 1*s* 7½*d.* *Ans.* £187..13..9.	(45)2105 at1*s.*11¼*d.* *Ans.*£203..18..5¼.

* *d.* ¼ = { 1/12 of 2106*s.* / 01 of (175. 6) / ¼ of ——

43..10½

2|0)214|9..10½

Ans. £107..9..10½

This example is worked by taking $\frac{1}{12}$, and then ¼ of that; because a farthing is $\frac{1}{48}$ of a shilling; which is $= \frac{1}{12}$ of ¼, or ¼ of $\frac{1}{12}$, because 4 *twelves* are 48.

(46) 1006 at 1*s*.11½*d*.	(47) 2705 at 1*s*.11¼*d*.	(48) 5000 at 1*s*.11½*d*.
Ans. £98..10..1.	*Ans* £267..13..7¼.	*Ans*. £489..11..8.

RULE 4. When the price is an *even* number of shillings, the given quantity may be multiplied by *half* that number, doubling the units' figure of the product for shillings, and the rest of the product will be pounds. Or take the aliquot part of a pound.

(1) 2750 at 2*s*. *Ans*. £275.	(4) 1572 at 8*s*. *An*. £628..16.	(7) 5271 at 14*s*. *Ans*. £3689..14.
(2) 3254 at 4*s*. *Ans*. £650..16.	(5) 2102 at 10*s*. *Ans*. £1051.	(8) 3123 at 16. *Ans*. £2498..8.
(3) 2710 at 6*s*. *Ans*. £813.	(6) 2101 at 12*s*. *Ans*. £1260..12.	(9) 1075 at 16*s*. *Ans*. £860.
(10) 1621 at 18*s* *Ans*. £1458..18.	NOTE. At 2*s*. take the *tenth*, and at 10*s*. take the *half* of so many £	

RULE 5. When the price is an *odd* number of shillings, work by Rule 4th. for the *greatest even* number, and add $\frac{1}{20}$ of the given quantity for the odd shilling.—Or, take such parts of a pound as will make the given price.

*(1) 3270 at 3*s*. *Ans*. £490..10.	(4) 3214 at 9*s*. *Ans*. £1446..6.	(7) 2150 at 15*s*. *Ans*. £1612..10.
(2) 3271 at 5*s*. *Ans*. £817..15.	(5) 2710 at 11*s*. *Ans*. £1490..10.	(8) 3142 at 17*s*. *Ans*. £2670..14.
(3) 2715 at 7*s*. *Ans*. £950..5.	(6) 3179 at 13*s*. *Ans*. £2066 .7·	(9) 2150 at 19*s*. *Ans*. £2042..10.

RULE 6. When the price consists of shillings and pence, suppose the given number to be *pounds*, and take such *aliquot part*, or the *sum* of such *aliquot parts*, as will make the given price.—Or, work for the shillings as in the preceding Rules, and take parts for the residue.

†(1) 2710 at 6*s*. 8*d*. *Ans*. £903..6 .8.	(4) 7150 at 1*s*. 8*d*. *Ans*. £595..16..8.	‡(7) 2710 at 3*s*. 2*d*. *Ans*. £429..1..8.
(2) 3150 at 3*s*. 4*d*. *Ans*. £325.	(5) 3215 at 1*s*. 4*d*. *Ans*. £214..16..8.	(8) 7514 at 4*s*. 7*d*. *Ans*. £1721..19..2.
(3) 2715 at 2*s*. 6*d*. *Ans*. £339..7..6.	(6) 7211 at 1*s*. 3*d*. *Ans*. £450..13..9.	(9) 2517 at 5*s*. 3*d*. *Ans*. £660..14..3.

s.	*s*.	*s*. *d*.	£.	*s*. *d*.	£.
*2=1/10	3270	†6..8=1/3	2710	‡2..6=1/3	2710
				8=1/30	
1=1/2	327				338..15
	163 .10.	*Ans*.	£903..6..8.		90.. 6..8
Ans.	£490..10.			*Ans*.	£429.. 1, 8.

(10)2547 at 7*s*. 3½*d*.	(13)7152 at17*s*.6¾*d*.	(16)2572 at13*s*.7½*d*.
Ans.£920..11..10½.	*Ans.* £6280..7.	*Ans.* £1752..3..6.
(11)3271 at 5*s* 9¼*d*.	(14)2510 at14*s*.7¼*d*.	(17)7251 at14*s*.8¼*d*.
Ans.£943..16..4¾.	*Ans.*£1832..16..5½.	*Ans.*£5324..19..0¼.
(12)2103 at15*s*.4½*d*.	(15)3715 at 9*s*. 4½*d*.	(18)3210 at15*s*.7¾*d*.
Ans.£1616..13..7½.	*Ans.* £1741..8..1½.	*Ans.* £2511..3..1½.

RULE 7. When the price consists of pounds, shillings, and pence, multiply the given quantity by the *number* of pounds, and take *aliquot parts* for the residue.—Or, work for the shillings as in the preceding Rules, &c.—Or, when the given number of articles is not large, work by Compound Multiplication.

*(1) 7215 at £7..4.	(7)2107 at 1..13.	(13)3210at£1..18..6¾.
Ans. £51948.	*Ans.* £3476..11.	*Ans.*£6189..5..7½.
(2)2104 at £5..3.	(8)3215 at £4..6..8.	(14)2157at£2.7.4½.
Ans. £10835..12.	*Ans.*£13931..13 .4.	*Ans.*£5109..7..10½.
(3)2107 at £2..8.	(9)2154 at £7..1..3.	(15)142at£1.15.2¾.
Ans. £5056..16.	*Ans.*£15212..12..6.	*Ans.* £250..2..6½.
(4)7156 at £5..6.	(10)2701at£2..3..4.	(16)95at£15.14.7¼.
Ans. £37926 .16.	*Ans.*£5852..3..4.	*Ans.*£1494 .7..4¾.
(5)2710at£2..3..7½.	(11)2715at£1..17..2½.	(17)37at£1..19 .5¾.
Ans. £5911..3..9.	*Ans.* 5051..0..7½.	*Ans.* £73..0..8¾.
(6)3215 at £1..17.	(12)2157at£3..15..2¼.	(18)2175at£2..15..4½.
Ans. £5947..15.	*Ans.*£8108..19..5¼.	*Ans.* £6022..0..7½.

RULE. 8 When the given quantity consists of several denominations, multiply the price by the number of the highest, and take aliquot parts for the inferior denominations,

(1) At £2..17..6. per *cwt.* what is the value of 250 *cwt.* 2 *qrs.* 14 *lb.* of soap ? †

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s.	
* 4=⅕	7215
	7
	50505
	1443
	£51948 *Ans.*

†2 *qrs*=½		£3..17..6 0
		5×5=25
		19.. 7..6
		5
	lb.	96..17..6
	14=¼	1..18..9
		9..8¾
		£99..5..11¼ *Ans.*

(2) At £1..4..9. per *cwt.* what is the value of 17 *cwt.* 1 *qr.* 17 *lb.*? *Ans.* £21..10..8.

(3) Sold 85 *cwt.* 1 *qr.* 10 *lb.* of iron, at £1..7..8. per *cwt.* what is the value of the whole? *Ans.* £118..1..0¼.

(4) If hops are sold at £4..5..8. per *cwt.* what must be given for 72 *cwt.* 1 *qr.* 18 *lb.*? *Ans.* £310..3..2.

(5) What is the value of 27 *cwt.* 2 *qrs.* 15 *lb.* of logwood, at £1..1..4. per *cwt.*? *Ans.* £29..9..6¼.

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

(7) Sold 56 *cwt.* 1 *qr.* 17 *lb.* of sugar, at £2..15..9. per *cwt.* how much is the whole charge? *Ans.* £157..4..4¼

(8) What is the value of 97 *cwt.* 15 *lb.* of currants, at £3. 17..10. per *cwt.*? *Ans.* £378..0..3.

(9) At £4..14..6. the *cwt.* what is the value of 37 *cwt.* 2 *qrs.* 13 *lb.* of raw sugar? *Ans.* £177..14..8½.

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

(11) Required the value of 17 *oz.* 8 *dwts.* 18 *grs.* of gold, at £3..17..10½. per *ounce.* *Ans.* £67..17..11.

(12) At £37..6..8. per *cwt.* the value of 1 *cwt.* 2 *qrs.* 10½ *lb.* of cochineal is required. *Ans.* £59..10.

(13) Required the value of 13 *hhds.* 42 *gals.* of Champagne wine, at £25..13..6. per *hhd.* *Ans.* £350..17..10.

(14) A gentleman purchased at an auction an estate of 149 *a.* 3 *r.* 20 *p.* at £54..10. per acre. What was the whole purchase money, including the auction duty of 7*d.* in the £. the attorney's bill for the deeds of conveyance, £33..6..8. and his surveyor's charge for measuring it, at 1*s.* per acre? *Ans.* £8447..5..0½.

RULE 9. To find the price of 1 *lb.* at a given *number of shillings per cwt.*

Multiply the shillings by 3 and divide the product by 7; the quotient will be the price of 1 *lb.* in farthings.*

(1) What is the price of 1 *lb.* at 44*s.* 4*d.* per *cwt.*?†

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* Multiplying by 3 reduces the shillings to *fourpences*, and 7 fourpences (or 2*s.* 4*d.*) are the value of 1 *cwt.* at 1 *farthing* per *lb.*

† 44*s.* 4*d.*

3

7)133

19 farthings=4¾*d.* *per lb.* *Ans.*

(2) What are the respective prices per *lb.* at 86*s.* 4*d.*; 91*s.*; and 116*s.* 8*d.* per *cwt* .*Ans.* 9¼*d.*, 9¾*d.* *and* 1*s.* 0½*d.*

RULE 10. It is sometimes expedient to change the price and the quantity for each other. Thus 48 yards at 2*s.* 9*d.* will be equivalent to 33 yards at 4*s.*; because 2*s.* 9*d.* = 33*d.* and 4*s.* = 48*d.*

(1) What is the value of 72 *yds.* at 3*s.* 5*d.* and at 14*s.* 7*d.* per yard? *Ans.* £12..6., *and* £52..10.

(2) 80 *yds.* at 15*s.* 3*d.* and at 16*s.* 8*d.* per yard? *Ans.* £61., *and* £66..13..4.

(3) 42 *lbs.* at 11½*d.* and at 1*s.* 3¼*d.* per *lb.*? *Ans.* £2..0,.3., *and* £2..13..4½.

TARE AND TRET.

Gross weight is the weight of any goods, together with that of the package which contains them.

Neat weight is that of the *articles alone*, or what remains after the deduction of all allowances.

Tare is an allowance for the weight of the package. It is either so much in the whole, or at so much per bag, box, barrel, &c. or at so much in the cwt.

Tret is an allowance of 4 *lb.* in 104 *lb.* (or 1/26 part for waste.)

Cloff is an allowance of 2 *lb.* in 3 *cwt.* on some goods: but both these are nearly obsolete.

Suttle is the remainder when any particular allowance has been deducted.

RULE. When the *Tare* is at so much for each bag, &c. the *whole Tare* may be found by multiplying by the number of them. When it is at so much per *cwt.* take the *aliquot parts* of the *Gross* for the *Tare*. Subtract the *Tare* from the *Gross*; the remainder is the *Neat*; unless there is *Tret* allowed.

If *Tret* is allowed, it is 1/26 of the *Tare suttle*, which being subtracted from it, the remainder is the *Neat*. But if *Cloff* also is to be allowed the *cwts. Tret suttle*, multiplied by 2, and divided by 3, will be the lbs. *Cloff*, which subtract to find the *Neat*.

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

(2) What is the neat weight of 25 hogsheads of tobacco, weighing gross 163 *cwt.* 2 *qrs.* 15 *lb.* tare 100 *lb.* per hogshead? *Ans.* 141 *cwt.* 1 *qr.* 7 *lb.*

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

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

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

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

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

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

(9) In 1 butt of currants, weighing 12 *cwt.* 2 *qrs.* 24 *lb.*

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cwt. qr. lb.
*5..2..5 gross.
23 tare.

5..1..10 neat of 1 frail.
7

Ans. 37..1..14 neat of the whole.

cwt. qr. lb.
† 8..2..5
9×2=18

76..3..17
2

lb.
14=½ 153..3..6 whole gross.
19..0..25½ tare.

Ans. 134..2..8½ neat.

gross, tare 14 *lb.* per *cwt.* tret 4 *lb.* per 104 *lb.* what is the neat weight?*

(10) In 7 *cwt.* 3 *qrs.* 27 *lb.* gross, tare 36 *lb.* tret according to custom, how many pounds neat? *Ans.* 826 *lb.*

(11) In 152 *cwt.* 1 *qr.* 3 *lb.* gross, tare 10 *lb.* per. *cwt.* tret as usual, how much neat weight? *Ans.* 133 *cwt.* 1 *qr.* 12 *lb.*

(12) What is the neat weight of 3 hogsheads of tobacco, weighing 15 *cwt.* 3 *qrs.* 20 *lb.* gross, tare 7 *lb.* per *cwt.* tret and cloff as usual?†

(13) In 7 hogsheads of tobacco, each weighing gross 5 *cwt.* 2 *qrs.* 7 *lb.*; tare 8 *lb.* per *cwt.* tret and cloff as usual, how much neat weight? *Ans.* 34 *cwt.* 2 *qrs.* 8 *lb.*

INVOICES, OR BILLS OF PARCELS.

(1) Mrs. Bland, London, Sept. 1. 1830.

Bought of Jane Harris.

		s.	d.		£.	s.	d.
15	pairs worsted stockings at	4	6	per pr. .	3	7	6
1	doz. thread ditto . at	3	2	..... .	1	18	0
½	doz. black silk ditto. at	8	3	..... .	2	9	6
1½	doz. milled hose . at	4	2	..... .	3	15	0
2	doz. cotton ditto . at	7	6	..... .	9	0	0
17	pairs kid gloves . . at	1	8	..... .	1	8	4
					£21	18	4

* 14 *lb.* = $\frac{1}{8}$ *cwt.*

	cwt.	*qrs.*	*lb.*	
	12	2	24	gross.
	1	2	10	tare.
4 *lb.* = $\frac{1}{26}$	11	0	14	suttle.
	1		19	tret.
Ans.	10	2	23	neat.

† 7 *lb.* = $\frac{1}{16}$ *cwt.*

	cwt.	*qrs.*	*lb.*	
	15	3	20	gross.
		3	27½	tare.
26)	14	3	20½	suttle.
		2	8	tret.
	14	1	12½	
14 × 2 ÷ 3 =			9½	cloff.
Ans.	14	1	3	neat.

(2) Mr. Isaac Pearson, Derby, June 3, 1830.

Bought of John Sims and Son.

			s.	d.		£.	s.	d.
15	yds.	satin . . . at	9	6	per yard .	7.	2.	6
18¼	yds.	flowered silk . at	17	4	..... .	15.	16.	4
12	yds.	rich brocade . at	19	8	..... .	11.	16.	0
16½	yds.	sarcenet . . at	3	2	..... .			
13⅜	yds.	Genoa velvet at	27	6	..... .			
23	yds.	lustring . . at	6	3	..... .			

£62..11..9¼

(3) Miss Enfield, Nottingham, June 4, 1830.

Bought of Joseph Thompson.

			s.	d.		£.	s.	d.
4½	yds.	cambric . . at	12	6	per yard.			
12½	yds.	muslin . . at	8	3	..... .			
15	yds.	printed calico at	5	4	..... .			
2	doz.	napkins . . at	2	3	each.. .			
14	ells	diaper . . . at	1	7	per ell.. .			
35	ells	dowlas . . at	1	1½	..... .			

£17..14..11

Received the above.

Joseph Thompson.

(4) Mrs. Mary Bright sold to the Right Honorable Lady Anna Maria Lamb, 18 yards of French lace at 12*s.* 3*d.* per yd. 5 pairs of fine kid gloves at 2*s* 2*d.* per pair, 1 dozen French fans at 3*s.* 6*d.* each, two superb silk shawls at three guineas each, 4 dozen Irish lamb at 1*s.* 3*d.* per pair, and 6 sets of knots at 2*s* 6*d.* per set.—Please to make the Invoice for her. *Total amount* £23..14 .4.

(5) Mr. Thomas Ward sold to James Russell Vernon, Esq. 17¼ yards of fine serge at 3*s.* 9*d.* per yd. 18 yds. of drugget at 9*s.* per yd. 15½ yds. of superfine scarlet at 22*s.* per yd.

16¼ yds. of Yorkshire black at 18*s*. per yd. 25 yds. of shalloon at 1*s*. 9*d*. per yd. and 17 yds. of drab at 17*s*. 6*d* per yd.—Make an Invoice of these articles.

Total amount £60..10..5¼.

(6) Mr Samuel Green of Wolverhampton, sent to Messrs. Wright and Johnson, agreeable to order, 27 calf skins at 3*s*. 6*d*. each, 75 sheep skins at 1*s*. 7*d*. 39 coloured ditto, at 1*s*. 8*d*. 15 buck skins at 11*s*. 6*d*. 17 Russia hides at 10*s*. 7*d*. and 125 lamb skins at 1*s*. 2½*d*.—Draw up the Invoice.

Total amount £39..1..8½.

(7) Mr Richard Groves sent the following articles to the Rev. Samuel Walsingham ; *viz*. 2 stones of raw sugar at 6½*d*. per ℔. 2 loaves of sugar, 15½ ℔. at 11½*d* per ℔. a stone of East India rice at 3½*d*. per ℔. 2 stones Carolina rice at 5*d*. per ℔. 15 oz. nutmegs at 5½d. per oz. and half a stone of Dutch coffee at 1*s*. 10*d*. per ℔.—Make a copy of the Invoice.

Total amount £3..5..5¼.

BILLS OF BOOK-DEBTS.

(8) Mr. Charles Cross, Chester.

To Samuel Grant, and Co., Dr.

1830.		*s*.	*d*.	£.	*s*.	*d*.
April. 14.	Belfast butter, 1 *cwt* at	0	6½ per ℔.			
	Cheese, 7 *cwt*. 3*qrs*. 12*lb*. at	56	0 long cwt.			
May 8.	Butter, ½ firkin, 28 *lb*. at	0	5½ per ℔.			
July 17.	5 Cheshire cheeses, 127*lb*. at	0	6¼			
Sept. 4.	2 Stilton ditto. 15 *lb*. at	0	10½			
	Cream cheese, 13 *lb*. at	0	8½			
				£30..1..6¼.		

Dec. 28. *Received the contents,*

Samuel Grant.

(9) Mr. Charles Septimus Twigg, Newark.

To Isaac Jones, Dr.

1829.		s.	d.	£	s.	d.
Oct. 22.	Tares, 39 bushels at	1	10 per bush.			
1830.	Pease, 18 bushels at	30	4 per qr.			
Feb. 18.	Malt, 7 qrs. at	63	6 per qr.			
	Hops, 2 cwt. 1 qr. at	1	5 per lb.			
Feb. 20.	Oats, 6 qrs. . at	2	4½ per bush.			
	Beans, 17 qrs. at	37	4 per qr.			
				£84	9	11.

1830, *July* 1. *Received the above for Isaac Jones,*
Thomas West.

SIMPLE INTEREST

Is the premium allowed for the loan of any sum of money during a given space of time.

The *principal* is the money lent, for which *Interest* is to be received.

The *Rate per cent. per annum*, is the quantity of *Interest* (agreed on between the Borrower and the Lender) to be paid for the use of every £100. of the *principal*, for one year.

The *Amount* is the principal and Interest added together.

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

RULE. Multiply the *Principal* by the *Rate per cent.* and that Product divided by 100, will give the *Interest* required.

NOTE. When the *Rate* is an aliquot part of 100, the *Interest* may be calculated more expeditiously by taking such part of the *Principal*. Thus, for 5 per cent. take $\frac{1}{20}$; for 4 per cent. $\frac{1}{25}$, or $\frac{1}{2}$ of $\frac{1}{2}$; for 2 per cent. $\frac{1}{50}$; for $2\frac{1}{2}$ per cent. $\frac{1}{40}$; for 3 per cent. $\frac{1}{30}$, *plus* $\frac{1}{2}$ of that; &c.

This Rule is applied to the calculation of commission, Brokerage, Purchasing Stocks, Insurance, Discounting of Bills, &c.*

* To discount a Bill of Exchange is to advance the cash for it before it becomes due; deducting the *Interest* for the time it has to run. Bankers always charge *Discount* as the *Interest* of the sum.

II. *For several years.* Multiply the *Interest* of *one* year by the *number* of years, and the product will be the answer.

For parts of a year, as months and days, &c. the *Interest* may be found by taking the aliquot parts of a year; or by the Rule of Three: and it is customary to allow 12 months to the year, and 30 days to a month.†

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

(2) What is the interest of £945..10. for a year, at £4 per cent. per annum ? *Ans.* £37..16..4¾

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

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

NOTE. *Commission* and *Brokerage* (commonly called *Brokage*) are allowances of so much per cent, to an agent or broker, for buying or selling goods, or transacting business for another.

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† At the rate of 5 per cent. the interest of £1. for a year is 1*s.*; or *one penny* for a *month*.. Therefore, the *principal* × the *number of months*, gives the *interest* in *pence*.

Or, take the parts of a year for the *months*, out of *as many shillings* as there are *pounds* in the *principal*.

Thus to find the interest of £40..10. for 2 months, say 40½*d.* × 2 = 81*d.* = 6*s.* 9*d.*; or, 2 months being ⅙ of a year, 40*s.* 6*d.* ÷ 6 = 6*s.* 9*d.* *Ans.*

For days, take the aliquot parts of a month. The interest for days, at 5 per cent. may also be found by multiplying the principal by the number of days; and the product divided by 365 will give the answer in *shillings*; or divided by 7300 (=365×20) will give the answer in pounds.

*£375
5

£. 18|75
20

s. 15|00

Ans. £18..15.

Better thus :

£ £
5=1/20 375

Ans. £18..15.

Cutting the two figures in the above divides the number by 100 : see Division, p. 23.

(5) What is the amount of £556..13..4. at £5. per cent. per annum, in 5 years? *Ans.* £695..16..8.

(6) My correspondent informs me that he has bought goods to the amount of £754..16. on my account, what is his commission at £2½. per cent. ? *Ans.* £18..17..4¾.

(7) If I allow my factor £3¾. per cent. for commission, what will he require on £876..5..10 ? *Ans.* £32..17..2½.

NOTE. *Stock* is a general term to designate the Capitals of our Trading Companies; or to denote *Property* in the *Public Funds*; which means the Money paid by Government for the interest of the *National Debt*. The quantity of Stock is a *nominal* sum, for which the owner receives a certain rate of interest while he holds the same.

(8) At £110¼. per cent. what is the purchase of £2054..16. South Sea Stock ! *Ans.* £2265..8..4.

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

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

(11) At £124⅝ per cent. what is the purchase of £758..17..10. India stock ? *Ans.* £945..15..4¼.

(12) What sum will purchase £1284. of the 3 per cent. Consols, at £59⅞. per cent. ; including the broker's charge of ⅛. or 2*s*. 6*d*. per cent. on the amount of stock ?

Ans. £770..7..11¾.

(13) If I employ a broker to buy goods for me, to the amount of £2575..17..6. what is the brokerage at 4*s*. per cent. ?*

(14) What is the broker's charge on a sale amounting to £7105..5..10. at 5*s*. 6*d*. per cent. ? *Ans.* £19..10..9¼.

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s.	£.	*s.*	*d.*	
*4=⅕	2575 ..	17 ..	6	03
				12
£.	5|15 ..	3 ..	6	—
	20			42
s.	3|03			4
		Ans.	£5..3..0¼.	1|68

(15) What is the brokage on goods sold for £975..6. 4. at 6*s*. 6*d*. per cent. ? *Ans*. £3..3..4½.

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

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

(18) What is the amount of £576..2..7. in 7¼ years, at £4½. per cent. per annum ? *Ans*. £764..1..8½.

(19) What is the interest of £259..13..5. for 20 weeks, at £5. per cent. per annum ? *Ans*. £4..19..10¼.

(20) What is the interest of £2726..1..4. at £4½ per cent. per annum, for 3 years, 154 days ? *Ans* £419..15..6¼.

(21) Compute the interest of £155, for 49 days, and for 146 days, at £5. per cent. per annum ?

Ans. £1..0..9½. *and* £3..2..0.

(22) What will a banker charge for the discount of a bill of £76..10. and another of £54. negotiated on the 18th of May ; the former becoming due June 30, and the latter July 13 ; discounting at £5. per cent ? *Ans*. 8*s*. 11*d*. *and* 8*s*. 3*d*.

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

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

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

(24) What principal being put to interest for 9 years, will amount to £734..8. at £4. per cent. per annum ? *Ans*. £540.

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

Ans. £248.

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

RULE. As the interest for 1 year, is to 1 year, so is the whole interest, to the number of years.

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† £3×5÷100=£115. As £. £. £. *s*. £.
115 : 100 : : 402 .. 10 : 350 *Ans*.

(26) In what time will £350. amount to £402..10. at £3. per cent. per annum ?.

(27) In what time will £540. amount to £734..8. at £4. per cent. per annum ? *Ans.* 9 *years.*

(28) In what time will £248. amount to £334..16. at £5. per cent. per annum ? *Ans.* 7 *years.*

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

RULE. As the principal, is to the whole interest, so is £100. to its interest for the given time. Divide that interest by the number of years, and the quotient will be the rate per cent.

(29) At what rate per cent. will £350. amount to £402..10. in 5 years ?†

(30) At what rate per cent. will £248. amount to £334..16. in 7 years ? *Ans.* £5. *per cent.*

(31) At what rate per cent. will £540. amount to £734..8 in 9 years ? *Ans.* £4. *per cent.*

DISCOUNT

Is the abatement of so much money, on any sum received before it is due, as the money received, if put to interest, would gain at the rate, and in the time given. Thus £100. *present money* would discharge a debt of £105. to be paid a year hence, *Discount* being made at £5. per cent.

RULE. As £100. with its interest for the time given, is to that interest ; so is the sum given, to the *Discount* required.

£.

* $\frac{350 \times 3}{100}$ = £10..10. the interest for 1 year.

£402..10.—£350.=£52..10. the whole interest.

As £10..10 : 1 year : : £52.10 : 5 years. *Ans.*

† As £350 : £52..10 : : £100 : £15=the interest of £100. for 5 years. Then 15÷5=£3. the rate per cent.

Also, As that *Amount* of £100. is to £100. so is the given sum, to the *Present worth*.

But if either the *Discount* or the *Present worth* be found by the proportion, the other may be found by substracting that from the given sum.

(1) What are the discount and present worth of £386..5. for 6 months, at £6. per cent. per annum ?*

(2) How much shall I receive in present payment for a debt of £357..10. due 9 months hence; allowing discount at £5. per cent. per annum. *Ans.* £344..11..$6\frac{3}{4}$ $\frac{15}{83}$.

(3) What is the discount of £275..10. for 7 months, at £5. per cent. per annum ? *Ans.* £7..16..$1\frac{3}{4}$ $\frac{95}{247}$.

(4) What is the present worth of £527..9..1. payable in 7 months, at £$4\frac{1}{4}$ per cent. per annum ?

Ans. £514..13..$10\frac{1}{2}$ $\frac{6930}{24595}$.

(5) Required the present worth of £875..5..6. due in 5 months, at £$4\frac{1}{2}$. per cent. per annum ?

Ans. £859..3..$3\frac{3}{4}$ $\frac{75}{4075}$.

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

(7) How much ready money ought I to receive for a note of £75. due in 15 months, at £5. per cent. per annum ?

Ans. £70..11..$9\frac{3}{17}$.

---

* 6 m.=$\frac{1}{2}$ £6

£.
100+3=103=amount of £100. in 6 months.

£. £. £. s. £ s.
As 103 : 3 : : 386.. 5
3 386.. 5

103)1158..15(11.. 5 discount.
1133
25
20
103)515=5s.
375.. 0 present worth.

(8) What will be the present worth of £150. payable at 3 instalments of four months; *i. e.* one third at 4 months, one third at 8 months, and one third at 12 months, discounting at £5. per cent per annum? *Ans.* £145..3..8½.

(9) Of a debt of £575..10. one moiety is to be paid in 3 months, and the other in 6 months. What discount must be allowed for present payment, at £5. per cent. per annum?

Ans £10..11..4¾.

(10) What is the present worth of £500. at £4. per cent. per annum, £100. being to be paid down, and the rest at two 6 months? *Ans.* £488..7..8½.

(11) Bought goods amounting to £109..10· at 6 months' credit, or £3½ per cent. discount for prompt payment. How much ready money will discharge the account?

Ans. £105..13..4½.

NOTE. The Rule to find the present worth of any sum of money is precisely identical with that case in Simple Interest in which the Amount, Time, and Rate per cent. are given to find the Principal. See page 70.

COMPOUND INTEREST

Is that which arrises from both the Principal and Interest: that is, when the Interest of money, having become due, and not being paid, is added to the Principal, and the subsequent Interest is computed on the *Amount*.

RULE. Compute the first year's interest, which add to the principal: then find the interest of that amount, which add as before, and so on for the number of years. Subtract the given sum from the *last Amount* and the remainder will be the *Compound Interest*.

* The discount in cases of this sort is so much per cent. on the sum, without regard to time. It is, therefore, computed as a year's *interest*.

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

(2) What is the amount of £400. in $3\frac{1}{2}$ years, at £5. per cent. per annum, compound interest? *Ans.* £474..12..$6\frac{1}{4}$.

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

(4) What is the amount of £550..10. for $3\frac{1}{2}$ years, at £6. per cent. per annum, compound interest? *Ans.* £675..6..5.

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

(6) What is the compound interest of £57..10..6. for 5 years, 7 months, and 15 days, at £5. per cent. per annum ? *Ans.* £18..3..$8\frac{1}{4}$.

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

EQUATION OF PAYMENTS.

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

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

† $\frac{1}{20}$ £500
25

$\frac{1}{20}$ 525 amount in 1 yr.
26..5

551..5 do. in 2 yrs.

$\frac{1}{20}$ £551.. 5
27..11. 3

578..16..3 amount in 3 years.
500 . 0..0 principal subtract.

£78..16. 3 *Ans.*

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

£.
40× 3= 120
60× 5= 300
100×10=1000

2|00)14|20

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

(2) B owes C £800. whereof £200. is to be paid at 3 months, £100. at 4 months, £300. at 5 months, and £200. at 6 months; but they agree that the whole shall be paid at once; what is the equated time? *Ans.* 4 *months,* $18\frac{6}{8}$ *days.*

(3) A debt of £360. was to have been paid as follows: *viz.* £120. at 2 months, £200. at 4 months, and the rest at 5 months; but the parties have agreed to have it paid at one mean time; what is the time? *Ans. 3 months,* $13\frac{1}{3}$ *days.*

(4) A merchant bought goods to the value of £500. to pay £100. at the end of 3 months, £150. at the end of 6 months, and £250. at the end of 12 months; but it was afterwards agreed to discharge the debt at one payment: required the time. *Ans,* 8 *months,* 12 *days.*

(5) H is indebted to L a certain sum, which is to be paid at 6 different payments, that is $\frac{1}{4}$ at 2 months, $\frac{1}{8}$ at 3 months, $\frac{1}{8}$ at 4 months, $\frac{1}{4}$ at 5 months, $\frac{1}{8}$ at 6 months, and the rest at 7 months; but they mutually agree that the whole shall be paid at one equated time: what is that time? *Ans.* $4\frac{1}{4}$ *months.*

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

BARTER

Is the exchange of commodities.

RULE. Compute, by the most expeditious method, the value of the article whose quantity is given: then find what quantity of the other, at the rate proposed, may be had for the same money.

NOTE. Sometimes one tradesman, in bartering, advances his goods above the ready money price. In this case, it will be necessary to proportionate the other's bartering price to his ready money price, by the Rule of Three.

(1) What quantity of chocolate at 4*s.* per *lb.* must be exchanged for 2 *cwt.* of tea, at 9*s.* per *lb.* ?*

(2) A and B barter: A has 20 *cwt.* of prunes, at 4*d.* per *lb.* ready money. but in barter will have 5*d.* per *lb.* and B has hops worth 32*s.* per *cwt.* ready money: what ought B to charge his hops, and what quantity must he give for the 20 *cwt.* of prunes ?†

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

(4) A exchanges with B $23\frac{1}{2}$ *cwt.* of cheese, worth 52*s* 6*d.* per *cwt.* for 8 pieces of cloth containing 248 yards, at 4*s.* 4*d.* per yard; the difference to be paid in money. Who receives the balance, and how much ? *Ans. A receives* £7 . 19 . 1.

(5) How much ginger at $15\frac{1}{4}d.$ per *lb.* must be exchanged for $3\frac{1}{2}$ *lb.* of pepper, at $13\frac{1}{2}d.$ per *lb.* ? *Ans.* 3 *lb.* $1\frac{35}{51}$ *oz.*

(6) How many dozen of candles, at 5*s.* 2*d.* per dozen, must be bartered for 3 *cwt* 2 *qrs.* 16 *lb.* of tallow, at 37*s.* 4*d.* per *cwt.* ? *Ans.* 26 *dozen*, $3\frac{5}{6\frac{1}{2}}$ *lb.*

(7) A exchanges with B 608 yards of cloth, worth 14*s.* per yard, for 85 *cwt.* 2 *qrs.* 24 *lb.* of bees' wax, and £125..12. in cash. What was the wax charged per *cwt.* ? *Ans.* £3 . 10.

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* 224×9=2016*s.* the value of the tea.

As 4*s.* : 1 *lb.* : : 2016*s.* : 504 *lb.* of chocolate. *Ans.*

† As 4*d.* : 5*d.* : : 32*s.* : 40*s.* the price per *cwt.* to be charged for the hops.

20 *cwt.*=2240 *lb.*
5

11200*d.* the value of the prunes.

As 40*s.* : 1 *cwt.* : : 11200*d.* : $\frac{11200}{480}$=23 *cwt.* 1 *qr.* 9$\frac{9}{12}$ *lb.* *Ans.*

12

480*d.*

(8) A barters with B 320 dozen of candles at 4*s*. 6*d*. per dozen, for cotton at 8*d*. per *lb*. and £30. in cash. What was the quantity of cotton? *Ans*. 11 *cwt*. 1 *qr*.

(9) How much cotton, at 1*s*. 2*d*. per *lb*. must be given for 114 *lb*. of tobacco, at 6*d*. per *lb*. *Ans*. $48\frac{6}{7}$. *lb*.

PROFIT AND LOSS

Is a Rule by which we discover the gain or loss in the buying and selling of goods; and which enables us to adjust the prices of articles, so as to gain or loose so much per cent. &c.

The questions are solved by the Rule of Three, or Practice.

The *prime cost* means the purchase money: therefore

The prime cost { *plus* the gain, or / *minus* the loss, } *equal* the selling price.

The selling price *minus* { the prime cost *equal* the gain. / the gain *equal* the prime cost.

The selling price *plus* the loss *equal* the prime cost.

Gain or loss *per cent.* means so much on £100. purchase money, or *prime cost*: therefore, when £20. per cent. are gained, £120. is the *selling price per cent.*; when £20. per cent. are lost, £80. is the *selling price*.

Case 1. Given, the *prime cost* and the *selling price* of an integer or quantity, to find the *gain* or *loss per cent*.

As the *prime cost* given: the *gain* or *loss* :: £100 : the *gain* or *loss per cent*.

Case 2. Given, the *prime cost* as before, with a proposed *gain* or *loss per cent*. to find the *selling price*.

As £100.: { £100. plus the *gain* / or £100. minus the *loss* } :: the *prime cost*: the *selling price*.

Case 3. Given, the *selling price* of an integer or quantity, and the *gain* or *loss per cent*. to find the *prime cost*.

As £100. plus the *gain* / or, £100. minus the *loss* } : £100. :: the *selling price*: the *prime cost*.

Case 4. Given, the *selling price* of an integar, and the *gain per cent*. to find the *gain per cent*. at some *other proposed price*.

As the *selling price*: £100. plus the *gain* :: the *proposed price*: the *selling price per cent*. from which deduct £100. for the *gain per cent. required*.

Secondly. To find another *selling price*, at a *different gain per cent*.

As £100. plus the *gain*: the *selling price* :: £100. plus the *proposed gain*: the *selling price* required.

A much greater variety of cases may occur; but it is presumed that the student who attains a due knowledge of these, will easily comprehend the rest.

(1) If 1 yard of cloth cost 11*s.* and is sold for 12*s.* 6*d.* what is the gain per cent. ?*

(2) If 60 ells of Holland cost £18. what must 1 ell be sold for to gain £8. per cent. ?†

(3) If 1 *lb.* of tobacco cost 16*d* and be sold for 20*d.* what is the gain per cent. ? *Ans.* £25.

(4) If a parcel of cloth be sold for £560. gaining £12. per cent. what is the prime cost ? *Ans.* £500.

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

(6) If 112 *lb.* of iron cost 27*s.* 6*d.* what must 1 *cwt.* be sold for to gain of £15. per cent. ? *Ans* £1 . 11 . $7\frac{1}{2}$.

(7) If 375 yards of cloth be sold for £490. at £20. per cent. profit, what did it cost per yard? *Ans.* £1 . 1 . $9\frac{1}{4}\ \frac{125}{375}$.

(8) Sold 1 *cwt.* of hops for £6..15. at the rate of £25. per cent. profit. What would have been the gain per cent. if they had been sold for £8. per *cwt.* ? *Ans.* £48 . 2 . $11\frac{1}{2}\ \frac{2}{9}$.

(9) If 90 ells of cambric cost £60. how must I sell it per yard to gain £18. per cent. ? *Ans.* 12*s.* $7\ \frac{18}{450}$.

(10) A plumber sold 10 fothers of lead for £204..15. and gained after the rate of £12..10. per cent. What did it cost him per *cwt.* ? *Ans.* 18*s.* 8*d.*

(11) What was the profit on 436 yards of cloth, bought at 8*s.* 6*d.* and sold at 10*s* 4*d.* per yard ? *Ans.* £39 . 19 . 4.

(12) Bought 14 tons of steel at £69. per ton, which was retailed at 6*d.* per *lb.* What was the loss sustained ? *Ans.* £182.

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*As $\frac{\text{cost}}{2}$ 11*s.* : $\frac{\text{gain}}{2}$ 1*s.* 6*d.* : : cost £100 : $\frac{100\times3}{22}$ = £13..12..8$\frac{2}{11}$. *Ans.*

sixp. $\frac{22}{\text{cost}}$: $\frac{3}{\text{s. price}}$ *sixp.*

†As cost £100 : s. price £108 : : £18 : $\frac{108\times18}{100}$ = £19..8..9$\frac{1}{10}$ the selling price. And £19..8..9$\frac{1}{2}$ ÷ 60 = 6*s.* 5$\frac{1}{2}$*d.* the price per ell.

(13) Bought 124 yards of linen for £32. How should the same be retailed per yard, to gain £15. per cent.?

Ans. 5*s.* 11 $\frac{28}{124}$.

(14) Bought 249 yards of cloth at 3*s.* 4*d.* yer yard, and retailed the same at 4*s.* 2*d.* per yard. What was the whole gain, and how much per cent. ?‡

Ans. £10 . 7 . 6. *profit, and* £25. *per cent.*

FELLOWSHIP OR PARTNERSHIP

Is a rule by which any number or quantity may be divided into certain proportionate parts. It is applied to determine the respective shares of gain or loss of the several partners in a company, in proportion to their respective shares of the capital employed as a joint stock: also in the division of common lands, and other cases of a similar kind.

FELLOWSHIP WITHOUT TIME.

RULE. As the whole stock is to the whole gain or loss; so is each individual share, to the correspondent gain or loss.

PROOF. The sum of the shares will be equal to the whole gain or loss.

(1) A and B join in trade. A puts into stock £20. and B £40; and they gain £50. What is the share of each?*

(2) A, B, and C join in trade; A put in £20; B £30; and C £40; and they gain £180. What is each man's part of the gain? *Ans.* A £40. B £60. C £80.

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‡ For the solving of this question, see Cases 1 and 2.

* 20+40=60

As 60 : 50 : : $\begin{cases} 20 : £16..13.. 4 = \text{A's share.} \\ 40 : 33 . 6.. 8 = \text{B's share.} \end{cases}$

50.. 0.. 0 Proof.

(3) Four persons, B, C, D, and E formed a joint stock; B put in £227; C £349; D £115; and E £439; they gained £428. Require each person's share of the gain.

Ans. B £85..19..6$\frac{3}{4}$ $\frac{69}{113}$. C £132..3..9 $\frac{12}{113}$.
D £43..11..1$\frac{3}{4}$ $\frac{25}{113}$. E £166..5..6$\frac{1}{2}$ $\frac{7}{113}$.

(4) D, E, and F entered into partnership. D's stock was £750; E's £460; and F's 500; and at the end of 12 months they had gained £684. What is each mans particular share of the gain? *Ans* D £300. E £184. *and* F £200.

(5) A tradesman is indebted to B £275..14; to C £304..7; to D. £152: and to E £104..6; but upon his decease his estate is found to be worth but £675..15. How must it be divided amongst his creditors?

Ans. B's *share* £222..15..2—6584. C's £245..18..1$\frac{1}{2}$—15750.
D's £122..16..2$\frac{3}{4}$—12227. *and* E's £84..5..5—15620.

(6) Four persons trade together with a joint capital; of which A has $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$, and D $\frac{1}{6}$, and at the end of 6 months they gain £100. What is each persons share of the gain? *Ans.* A £35..1..9—12. B £26..6..3$\frac{3}{4}$—9.
C £21..1..0$\frac{1}{2}$.—30. *and* D £17..10..10$\frac{1}{2}$—6.

(7) Two persons joined in the purchase of an estate yielding £1700. per annum, for £27200. whereof D paid £15000. and E the rest: some time after, they sold it for 24 years' purchase. What was each person's share?*

D £22500. E £18300.

(8) D, E, and F formed a capital of £647. Their respective shares are in proportion to each other as 4, 6, and 8; and the gain is equal to D's stock. Required each person's stock and gain?

Ans. D's *stock* £143..15..6$\frac{6}{9}$ *gain*, £31..19..0$\frac{4}{27}$.
E's . . . 215..13..4 . . . 47..18..6$\frac{6}{27}$.
F's . . . 287..11..1$\frac{3}{9}$ . . . 63..18..0$\frac{8}{27}$.

(9) D, E, and F joined in partnership; the amount of their stock was £100; D's gain was £3; E's £5; and F's £8; what was each man's stock?

Ans. D's *stock* £18..15. E's £31..5. *and* £F's 50.

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* The sale of a property for *so many years' purchase*, is understood to be, for so much present money as the *annual rent* or value × that number of years.

FELLOWSHIP WITH TIME.

RULE. As the sum of the products of each person's money and time, is to the whole gain or loss; so is each individual product, to the corresponding gain or loss.

(1) D and E enter into partnership; D puts in £40. for three months, and E £75. for four months, and they gain £70. What is each man's share of the gain?†

(2) Three tradesmen joined in company: D put into the joint stock £195..14. for three months; E £169..18..3. for five months; and F £59..14..10. for eleven months: they gained £364..18. What is each man's share of the gain?

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

(3) Three merchants joined in company for 18 months: D puts in £500. and at 5 months' end takes out £200. at 10 months' end puts in £300. and at the end of 14 months takes out £130; E puts in £400. and at the end of 3 months £270. more, at 9 months he takes out £140. but puts in £100. at the end of 12 months, and withdraws £99. at the end of 15 months; F puts in £900. and at six months takes out £200. at the end of 11 months puts in £500. but takes out that and £100. more at the end of 13 months. They gain £200. Required each mans share of the gain?

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

(4) D, E, and F, hold a piece of ground in common, for which they are to pay £36..10..6: D puts in 23 oxen 27 days; E 21 oxen 35 days; and F 16 oxen 23 days. What is each man to pay of the said rent?

Ans. D £13..3..1½—624. *E* £15..11..5—1688.
and F £7..15..11—1136.

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† 40×3=120
75×4=300
420

As 42|0 : 7|0 : : 120 : £20=D's share.
300 : 50=E's share.
70 Proof.

ALLIGATION

Is a rule by which we ascertain the *mean price* of any compound formed by mixing ingredients of *various prices;* or the quantities of the various articles which will form a mixture of a certain *mean* or *average value.* It comprises four distinct cases.

CASE 1. ALLIGATION MEDIAL. The various quantities and prices being given, to find the *mean price* of the mixture.

RULE. Multiply each quantity by its price, and divide the sum of the products by the sum of the quantities.*

(1) A grocer mixed 4 *cwt.* of sugar, at 56*s.* per *cwt.* with 7 *cwt.* at 43*s.* per *cwt.* and 5 *cwt.* at 37*s.* per *cwt.* What is the value of 1 *cwt.* of this mixture? *Ans.* £2..4..4½.

(2) A vinter mixes 15 gallons of Canary, at 8*s.* per gallon, with 20 gallons, at 7*s.* 4*d.* per gallon; 10 gallons of sherry, at 6*s.* 8*d.* per gallon; and 24 gallons of white wine, at 4*s.* per gallon. What is the worth of a gallon of this mixture?

Ans. 6*s.* $2\frac{1}{2}\ \frac{46}{69}d.$

(3) A malster mixes 30 quarters of brown malt, at 28*s.* per quarter, with 46 quarters of pale, at 30*s.* per quarter, and 24 quarters of high dried ditto, at 25*s.* per quarter. What is one quarter of the mixture worth? *Ans.* £1 . 8 . $2\frac{1}{4}\ \frac{6}{10}d.$

(4) A vinter mixes 20 quarts of port, at 5*s.* 4*d.* per quart, with 12 quarts of white wine, at 5*s.* per quart, 30 quarts of Lisbon, at 6*s.* per quart, and 20 quarts of mountain, at 4*s.* 6*d.* per quart. What is a quart of this mixture worth?

Ans. 5*s.* $3\frac{3}{4}\ \frac{50}{82}d.$

EXAMPLE.

* A farmer mixed 20 bushels of wheat, at 5*s.* per bushel, and 36 bushels of rye, at 3*s.* per bushel, with 40 bushels of barley, at 2*s.* per bushel. What is the worth of a bushel of this mixture?

	s.	*s.*
	20×5 =	100
	36×3 =	108
	40×2 =	80
	96	96)288(3*s. Ans.*

(5) A refiner melts 12 *lb.* of silver bullion, of 6 *oz.* fine, with 8 *lb.* of 7 *oz.* fine, and 10 *lb.* of 8 *oz.* fine ; required the fineness of 1 *lb.* of that mixture? *Ans.* 6 *oz.* 18 *dwt.* 16 *gr.*

CASE 2. ALLEGATION ALTERNATE. The *various prices* being given, to find the *quantities* which may be mixed, to bear a *certain average price.*

RULE. Arrange the given prices in one column, with the proposed average price on the left.

Link *each less* than the average with *one greater.*

Place against each term the difference between that with which it is linked and the mean; and the respective differences will be the quantities required.

NOTE. Questions in this rule admit of a great variety of answers, according to the manner of linking them : also by taking other numbers proportional to the answers found.

(1) A vinter would mix four sorts of wine together, of 18*d.* 20*d.* 24*d.* and 28*d.* per quart, what quantity of each sort must he take to sell the mixture a 22*d.* per quart?*

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

Ans. 2 *lb. at* 4*d.* 2 *lb. at* 6*d. and* 6 *lb. at* 10*d.*

(3) How much tea at 16*s.* 14*s.* 9*s.* and 8*s.* per *lb.* will compose a mixture worth 10*s.* per *lb.*?

Ans. 1 *lb. at* 16*s.* 2 *lb. at* 14*s.* 6 *lb. at* 9*s. and* 4 *lb. at* 8*s.*

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

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

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

(5) A tobacconest would mix tobacco at 2*s*., 1*s*. 6*d*., and 1*s*. 3*d*. per *lb*. so that the compound may be worth 1*s*. 8*d*. per *lb*. What quantity of each sort must he take ?

Ans. 7 *lb. at* 2*s* 4 *lb. at* 1*s*. 6*d. and* 4 *lb. at* 1*s*. 3*d*.

CASE 3. ALLIGATION PARTIAL. This is similar to Case 2, except that *one* of the *quantities is limited.*

RULE. Link the prices, and place the differences as before.

Then, as the difference opposite to that whose quantity is given, is to each other difference; so is the given quantity to each required quantity.

(1) A tobacconist intends to mix 20 *lb*. of tobacco at 15*d*. per *lb*. with others at 16*d*. 18*d*. and 22*d*. per *lb*. How many pounds of each sort must he take to make one pound of the mixture worth 17*d*. ?*

(2) How much coffee, at 3*s*. at 2*s*. and at 1*s*. 6*d*. per *lb*. with 20 *lb*. at 5*s*. will make a mixture worth 2*s*. 8*d*. per *lb*.

Ans. 35 *lb. at* 3*s*. 70 *lb. at* 2*s. and* 10 *lb. at* 1*s*. 6*d*.

(3) A distiller would mix 10 gallons of French brandy, at 48*s*. per gallon, with British at 28*s*. and spirits at 16*s*. per gallon. What quantity of each sort must he take to afford it for 32*s*. per gallon ? *Ans.* 8 *British and* 8 *spirits.*

(4) What quantity of teas at 12*s*. 10s. and 6s. must be mixed with 20 *lb*. at 4*s*. per *lb*. that the mixture may be worth 8*s*. per *lb*. ? *Ans.* 10 *lb. at* 6*s*. 10 *lb*. 10*s*. 20 *lb. at* 12*s*.

CASE 4. ALLIGATION TOTAL. This is also similar to Case 2, except that the *whole quantity* of the compound *is limited.*

RULE. Link the prices, and place the differences as before.

Then, As the sum of the differences, is to each particular difference ; so is the quantity given, to each required quantity.

	Answer.		*Proof.*		*lb.*	*lb.*
*15	5 20 *lb.* at 15*d.*	= 300*d.*	As 5 : 1 : : 20 : 4			
16	1 4 *lb.* at 16*d.*	= 64*d.*				
17	1 4 *lb.* at 18*d.*	= 72*d.*	As 5 : 2 : : 20 : 8			
18	2 8 *lb.* at 22*d.*	= 176*d.*				
22						
	As 36 *lb.*	:	612*d.*	: : 1*lb.* : 17*d.*		

(1) A grocer has four sorts of sugar at 12*d.* 10*d.* 6*d* and 4*d.* per *lb.* and would make a composition of 144 *lb.* worth 8*d.* per *lb.* What quantity of each sort must he take ?*

(2) A grocer having 4 sorts of tea at 5*s.* 6*s.* 8*s.* and 9*s.* per *lb.* would have a composition of 87 *lb.* worth 7*s.* per *lb.* What quantity must there be of each sort ?

Ans. 14½ *lb. of* 5*s.* 29 *lb. of* 6*s.* 29 *lb. of* 8*s. and* 14½ *lb. of* 9*s.*

(3) A vinter having 4 sorts of wine, *viz.* white wine at 16*s.* per gallon, Flemish at 24*s.* per gallon. Malaga at 32*s.* per gallon, and Canary at 40*s.* per gallon ; would make a mixture of 60 gallons worth 20*s.* per gallon. What quantity of each sort must he take ?

Ans. 45 *gallons of white wine,* 5 *of Flemish,* 5 *of Malaga, and* 5 *of Canary.*

(4) A jeweller would melt together four sorts of gold, of 24, 22, 20, and 15 carats fine, so as to produce a compound of 42 *oz.* of 17 carats fine. How much must he take of each sort ? *Ans.* 4 *oz. of* 24, 4 *oz. of* 22, 4 *oz. of* 20, *and* 30 *oz. of* 15 *carats fine.*

COMPARISON OF WEIGHTS AND MEASURES.

This is merely an application of the Rule of Proportion.

(1) If 50 Dutch pence be worth 65 French pence, how many Dutch pence are equal to 350 French pence ?†

(2) If 12 yards at London make 8 ells at Paris, how many ells at Paris, will make 64 yards at London ? *Ans.* 42⅔.

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

† As 65 : 50 : : 350 : $\frac{3500}{13}$ = 269$\frac{3}{13}$. *Ans.*

or, as 13 : 10 : : 350 :

(3) If 30 *lb.* at London make 28 *lb.* at Amsterdam, how many *lb.* at London will be equal to 350 *lb.* at Amsterdam ?

Ans. 375.

(4) If 95 *lb.* Flemish make 100 *lb.* English, how many *lb.* English are equal to 275 *lb.* Flemish ? *Ans.* $289\frac{3}{19}$

PERMUTATION

Is the changing or varying of the order of things.

To find the number of changes that may be made in the position of any given number of things.

RULE. Multiply the numbers 1, 2, 3, 4, &c. continually together, to the given number of terms, and the last product will be the answer.

(1) How many changes may be rung upon 12 bells ; and in what time would they be rung, at the rate of 10 changes in a minute, and reckoning the year to contain 365 days, 6 hours ?

$1 \times 2 \times 3 \times 4 \times 5 \times 6\ 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 47900\,1600$ changes, which $\div$ 10 = 47900160 minutes=91 *years*, 26 *days*, 6 *hours*.

(2) A young scholar, coming to town for the convenience of a good library, made a bargain with the person with whom he lodged, to give him £40. for his board and lodging, during so long a time as he could place the family (consisting of 6 persons besides himself) in different positions, every day at dinner. How long might he stay for his £40. ?

Ans. 5040 *days*.

VULGAR FRACTIONS.

DEFINITIONS.

1. *A Fraction* is a part or parts of a unit, or of any whole number or quantity ; and is expressed by two numbers, called the *terms*, with a line between them.

2. The *upper term* is called the *Numerator*, and the *lower term* the *Denominator*. The Denominator shows into how many equal parts *unity* is divided; and the Numerator is the number of those equal parts signified by the Fraction.*

3. Every Fraction may be understood to represent *Division;* the Numerator being the *dividend*, and the Denominator, the *divisor*.†

Fractions are distinguished as follows:

4. A SIMPLE FRACTION consists of *one numerator* and *one denominator:* as $\frac{3}{4}$, $\frac{11}{12}$, &c.

5. A COMPOUND FRACTION, or fraction of a fraction, consists of two or more fractions connected by the word *of:* as $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{7}{12}$, &c. This properly denotes the *product* of the several fractions.

6. A PROPER FRACTION, is one which has the numerator *less* than the denominator: as $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{11}{12}$, &c.‡

7. An IMPROPER FRACTION is one which has the numerator either *equal to*, or *greater than* the denominator: as $\frac{4}{4}$, $\frac{5}{4}$, $\frac{8}{4}$, $\frac{15}{12}$, &c.‡

8. A MIXED NUMBER is composed of a whole number and a fraction, as $1\frac{2}{3}$, $17\frac{1}{2}$, $8\frac{71}{97}$, &c.

9. A COMPLEX FRACTION has a *fractional* numerator or

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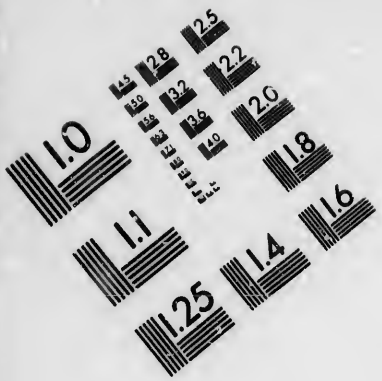
* In the fraction *five-twelfths* ($\frac{5}{12}$) the *Danominator* 12 shows that the *unit* or *whole quantity* is supposed to be divided into 12 equal parts: so that if it be one shilling, each part will be one-twelfth of 1*s* or one penny. The *Numerator* shows that 5 *is* the number of those twelfth parts intended to be taken; so $\frac{5}{12}$ of a shilling are the same as 5 pence; $\frac{5}{12}$ of a foot, the same as 5 inches.

† The fraction $\frac{5}{12}$ signifies not only $\frac{5}{12}$ of a unit, but 5 units divided into 12 parts, or a twelfth part of 5: and it is obvious that *five twelfth parts* of *one* shilling (or five pence) is the same as *one twelfth part* of *five* shillings. This mode of considering Fractions removes many of the student's difficulties.

‡ A *proper fraction* is always *less than unity:* thus $\frac{3}{4}$ *wants one fourth*, and $\frac{11}{12}$ *wants one twelfth* of being equal to 1. But an *improper fraction* is *equal to unity* when the *terms are equal*, and *greater than unity* when the *numerator* is the *greater*.

Thus $\frac{4}{4}$, or $\frac{11}{11}$, or $\frac{73}{73}$, is each $=1$; and $\frac{5}{4}=1\frac{1}{4}$, $\frac{8}{4}=2$, $\frac{60}{20}=\frac{39}{20}$.



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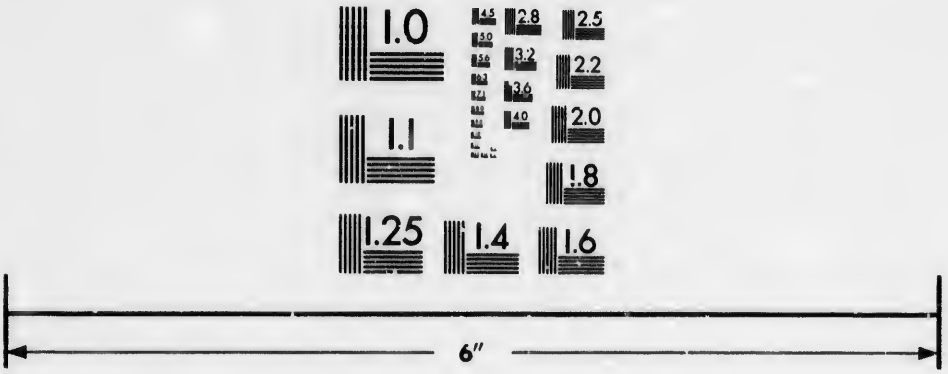

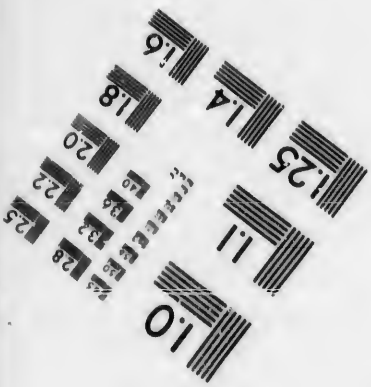

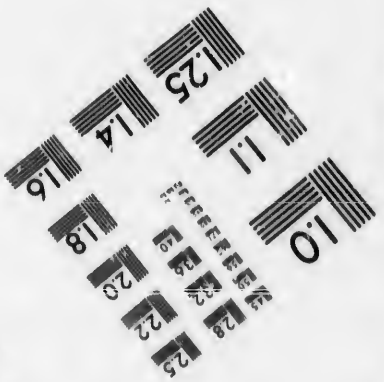

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denominator: but this denotes *Division of Fractions*. Thus, $\frac{2}{3}$ / $\frac{5}{6}$, two-thirds *divided by* five-sixth, $\frac{8}{1\frac{2}{3}}$, eight *divided by* one and two-thirds.

10. A COMMON MEASURE (or DIVISOR) is a number that will exactly divide *both* the *terms*. When it is the *greatest* number by which they are both divisible, it is called the GREATEST COMMON MEASURE.

NOTE. A *prime* number has no *factor*, except itself and unity.

A *multiple* signifies any product of a number; and is therefore divisible by the number of which it is a multiple: thus 14, 21, 28. &c. are *multiples of seven*. Also 14 is a multiple of 2 and 7; 21, of 3 and 7, &c.

REDUCTION

Is the method of changing the form of fractional numbers or quantities, without altering the value.

Case 1. *To reduce a fraction to its lowest terms.*

RULE. Divide both the terms by *any common measure* that can be discovered by inspection; which will produce an equivalent fraction in *lower* terms. Treat the new fraction in a similar manner; repeating the operation till the *lowest terms* are obtained.*

When the object cannot be accomplished by this process, divide the greater term by the less, and that divisor by the remainder, and so on till nothing remains. The last divisor

* This first method of *abbreviating* fractions is, when practicable, always to be preferred: and in the application of it, the following observations will be found exceedingly useful.

An *even* number is divisible by 2.

A number is divisible by 4, when the *tens* and *units* are so; and by 8, when the *hundreds*, *tens*, and *units* are divisible by 8.

A number is a multiple of 3, or of 9, when the *sum of its digits* is a multiple of 3, or of 9.

A 5 or a 0 in the units' place, admits of division by 5; *one* cipher admits of division by 10, *two*, by 100, &c.

will be the *greatest common measure*; by which divide both terms of the fraction, and the quotients will be the *lowest terms*.

(1) Reduce $\frac{30}{125}$ to its lowest terms. *Ans.* $\frac{6}{25}$.
(2) Reduce $\frac{208}{684}$ to its lowest terms. *Ans.* $\frac{52}{171}$.
(3) Reduce $\frac{192}{576}$ to the least terms. *Ans.* $\frac{1}{3}$.
(4) Reduce $\frac{825}{960}$ to the least terms. *Ans.* $\frac{55}{64}$.
(5) Abbreviate $\frac{5184}{6912}$ as much as possible. *Ans.* $\frac{3}{4}$.
(6) Reduce $\frac{125405}{219245}$ to its lowest terms. *Ans.* $\frac{4}{7}$.
(7) Reduce $\frac{99715}{113960}$ to the lowest terms. *Ans.* $\frac{7}{8}$.
(8) What are the lowest terms of $\frac{31082}{35552}$? *Ans.* $\frac{7}{8}$.

Case 2. *To reduce an improper fraction to its equivalent number.*

RULE. Divide the upper term by the lower.

This is evident from Definition 3.

(1) Reduce $\frac{129}{7}$ to a mixed number. $\frac{129}{7}=18\frac{3}{7}$. *Ans.*
(2) Reduce $\frac{69}{5}$ to its equivalent number. *Ans.* $13\frac{4}{5}$.
(3) Reduce $\frac{245}{9}$ to its equivalent number. *Ans.* $27\frac{2}{9}$.
(4) Reduce $\frac{1245}{22}$ to its equivalent number. *Ans.* $56\frac{13}{22}$.
(5) Reduce $\frac{3649}{21}$ to its equivalent number. *Ans.* $183\frac{2}{7}$.
(6) Reduce $\frac{11514}{16}$ to its equivalent number. *Ans.* $71\frac{15}{16}$.

Case 3. *To reduce a mixed number to an improper fraction.**

RULE. Multiply the whole number by the denominator of the fraction, and to the product add the numerator for the numerator required, which place over the denominator.

NOTE. Any whole number may be expressed in a fractional form, by putting 1 for the denominator: thus $11=\frac{11}{1}$.

(1) Reduce $18\frac{3}{7}$ to the form of a fraction.†
(2) Reduce $56\frac{13}{22}$ to an improper fraction. *Ans.* $\frac{1245}{22}$.

A number is a multiple of 11, when the *sum* of the 1st. 3rd. 5th. &c. digits=*that* of the 2nd. 4th. 6th. &c. digits, after retrenching the *elevens* contained in each.

* This is the converse of Case 2.

† $18\frac{3}{7}=\frac{18\times 7+3}{7}=\frac{129}{7}$. *Ans.*

(3) Reduce $183\frac{5}{21}$ to an improper fraction. *Ans.* $\frac{3848}{21}$.
(4) Reduce $13\frac{4}{5}$ to its equivalent fraction. *Ans.* $\frac{69}{5}$.
(5) Reduce $27\frac{2}{9}$ to its equivalent fraction. *Ans.* $\frac{245}{9}$.
(6) Reduce $514\frac{5}{16}$ to a fractional form. *Ans.* $8229\frac{}{16}$.

Case 4. *To reduce a fraction to another of the same value, having a certain proposed numerator or denominator.*

RULE. As the present numerator, is to the denominator; so is the proposed numerator, to its denominator. Or, as the present denominator, is to the numerator; so is the proposed denominator, to its numerator.

(1) Reduce $\frac{2}{3}$ to a fraction of the same value, whose numerator shall be 12. As 2 : 3 : : 12 : 18. *Ans.* $\frac{12}{18}$.
(2) Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 25. *Ans.* $\frac{25}{35}$.
(3) Reduce $\frac{5}{7}$ to a fraction of the same value, whose numerator shall be 47. 47

Ans.— $65\frac{4}{5}$.

(4) Reduce $\frac{2}{3}$ to a fraction of the same value, whose denominator shall be 18. *Ans.* $\frac{12}{18}$.
(5) Reduce $\frac{5}{7}$ to a fraction of the same value, whose denominator shall be 35. *Ans.* $\frac{25}{35}$.

A multiple of both 2 and 3, is, of course, a multiple of 6; and a multiple of 3 and 4, may be divided by 12.

All *prime* numbers, except 2 and 5, have 1, 3, 7, or 9, in the units' place: all others are *composite*.

EXAMPLES.

(1) Reduce $\frac{1260}{1620}$ to the *least terms possible.*

$\div 10 \quad \div 9 \quad \div 2$

$\frac{1260}{1620} = \frac{126}{162} = \frac{14}{18} = \frac{7}{9}$. *Ans.*

(2) Reduce $\frac{12510}{21945}$ to the lowest terms.

$\div 5 \quad \div 3 \quad \div 11$

$\frac{12510}{21945} = \frac{2502}{4389} = \frac{834}{1463} = \frac{76}{133}$.

Now, because we cannot easily discover a common measure, proceed thus:

76)133(1 then 19)76

76 ——$=\frac{4}{7}$. *Ans.*

57)76(1

57

19)57(3

57

greatest com. meas.

(6) Reduce $\frac{8}{9}$ to a fraction of the same value, whose denominator shall be 19. $16\frac{8}{9}$

Ans.— 19.

Case 5. *To reduce complex and compound fractions, to a simple form.*

RULE. For a *complex* fraction, reduce both terms to simple fractions: then by *inverting* the lower fraction, they may be considered as the terms of a *compound* fraction. And to reduce a *compound* fraction, arrange all the numerators above a line, and the denominators below, with the *signs* of multiplication interserted: divide all the upper and lower terms that are *commensurable*,* cancelling them with a dash, and placing their quotients above and below them respectively. Do the same with the quotients: then the products of the uncancelled numbers will give the *single fraction* in its *lowest terms*.

(1) Reduce $\frac{36\frac{2}{3}}{48}$ to a simple fraction. *Ans.* $\frac{55}{72}$.

(2) Reduce $\frac{23\frac{5}{7}}{38}$ to a simple fraction. *Ans.* $\frac{8}{3}\frac{3}{3}$.

(3) Reduce $\frac{47}{65\frac{4}{5}}$ to a simple fraction. *Ans.* $\frac{5}{7}$.

(4) Reduce $\frac{19}{44\frac{1}{3}}$ to a simple fraction. *Ans.* $\frac{5}{7}$.

(5) Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ to a single fraction. *Ans.* $\frac{1}{4}$.

(6) Reduce $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{11}{12}$ to a simple fraction. *Ans.* $\frac{55}{189}$.

(7) Reduce $\frac{11}{12}$ of $\frac{13\frac{3}{5}}{14\frac{4}{6}\frac{2}{5}}$ of $\frac{28}{38\frac{2}{3}}$ to a simple fraction. *Ans.* $\frac{143}{252}$.

(8) Reduce $\frac{3}{4}$ of $\frac{8}{9}$ of $11\frac{3}{8}$ to a single fraction. *Ans.* $\frac{9}{12}$.

(9) Reduce $\frac{77}{128}$ of $37\frac{1}{3}$ of 5 to its equivalent number. *Ans.* $112\frac{7}{24}$.

* That is, having a *common divisor*.

(10) Reduce $\frac{1\frac{1}{2}}{14}$ of $\frac{23\frac{6}{3}}{\frac{4}{7}}$ of $\frac{\frac{1}{2}}{\frac{4}{7}}$ to its equivalent number.
Ans. $7\frac{3}{8}$.

Case 6. *To reduce a fractional quantity of a given denomination, to an equivalent fraction of another denomination.*

RULE. Consider what numbers would reduce the *greater* denomination to the *less;* then to reduce to a *greater* name, multiply the *denominator* by those numbers, and to reduce to a *less* name, multiply the *numerator:* the compound thus produced, when reduced to a simple form, will be the fraction required.

(1) Reduce $\frac{7}{8}$ of a penny to the fraction of a pound.*
(2) Reduce $\frac{3}{4}d.$ to the fraction of a crown. *Ans.* $\frac{1}{80}$ *cr.*
(3) Reduce $\frac{4}{5}dwt.$ to the fraction of a *lb.* troy. *Ans.* $\frac{1}{300}$ *lb.*
(4) Reduce $\frac{4}{7}lb.$ avoirdupois to the fraction of a *cwt.*
Ans. $\frac{1}{175}$ *cwt.*
(5) Reduce $\frac{7}{1920}$ of a pound to the fraction of a penny.†
(6) Reduce $£\frac{1}{320}$ to the fraction of a penny. *Ans.* $\frac{3}{4}d.$
(7) Reduce $\frac{1}{300}$ of a pound troy to the fraction of a penny-weight. *Ans.* $\frac{4}{5}dwt.$
(8) Reduce $\frac{1}{175}$ *cwt.* to the fraction of a *lb.* *Ans.* $\frac{4}{7}lb.$

Case 7. *To find the proper value of a fractional quantity.*

RULE. Reduce the numerator to such lower denomination as may be necessary, and divide by the denominator; abbreviating as much as possible in valuing the remainders.

NOTE. It is evident, from Definition 3, that this Case is precisely that of Compound Division.

(1) Reduce $\frac{3}{4}$ of a pound sterling to its proper value.‡

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* $\frac{7}{8}d. = \frac{7}{8\times12\times20} = £\frac{7}{1920}$. *Ans.*

† $£\frac{7}{1920} = \frac{7\times20\times12}{1920} = \frac{7\times12}{96} = \frac{7}{8}d.$ *Ans.*

‡ $£\frac{3}{4} = \frac{3\times20}{4} = 3\times5 = 15s.$ *Ans.*

(2) Reduce $\frac{2}{5}s.$ to its proper value. *Ans.* 4*d.* $3\frac{1}{5}$ *qrs.*

(3) Reduce $\frac{4}{7}$ of a *lb.* avoirdupois to its proper value.
Ans. 9 *oz.* $2\frac{2}{7}$ *dr.*

(4) Reduce $\frac{7}{9}$ *cwt.* to its proper value. *Ans.* 3 *qrs.* $3\frac{1}{9}$*lb.*

(5) Reduce $\frac{3}{5}$ of a *lb.* troy to its proper value.
Ans. 7 *oz.* 4 *dwts.*

(6) Reduce $\frac{14}{25}$ of an ell English to its proper value.
Ans. 2 *qrs.* $3\frac{1}{5}$ *nails.*

(7) What is the value of $£\frac{5719}{5760}$? *Ans.* 19*s.* $10\frac{1}{4}$ $\frac{1}{6}$.

(8) Reduce $\frac{285}{352}$ of a mile to its proper value.
Ans. 6 *fur.* 105 *yds.*

(9) Reduce $\frac{7}{4}\frac{3}{8}$ of an acre to its proper value.
Ans. 1 *a.* 2 *r.* $3\frac{1}{2}$ *per.*

(10) Find the value of $\frac{15467}{34160}$ *cwt.* *Ans.* 1 *qr.* 22 *lb.* $\frac{237}{305}$.

Case 8. *To reduce any given quantity to the fraction of a greater denomination.*

Rule. Reduce the given quantity (if compound) to the lowest denomination mentioned, that it may assume a *simple* form: then multiply the *denominator* as in Case 6.

(1) Reduce 15*s* to the fraction of a pound sterling.
15*s.* = $£\frac{15}{20}$ = $£\frac{3}{4}$. *Ans.*

(2) Reduce 4*d.* $3\frac{1}{3}$ *qrs.* to the fraction of a shilling. *Ans.* $\frac{3}{5}$.

(3) Reduce 9 *oz.* $2\frac{3}{7}$ *dr.* to the fraction of a *lb.* avoirdupois.
Ans. $\frac{4}{7}$ *lb.*

(4) Reduce 3 *qrs.* $3\frac{1}{9}$ *lb.* to the fraction of a *cwt.*
Ans. $\frac{7}{8}$ *cwt.*

(5) Reduce 7 *oz.* 4 *dwts.* to the fraction of a *lb.* troy.
Ans. $\frac{3}{5}$ *lb.*

(6) Reduce 2 *qrs.* $3\frac{1}{5}$ nails, to the fraction of an English ell.
Ans. $\frac{5}{9}$ *ell.*

(7) Reduce 14*s.* $6\frac{1}{2}d.$ $\frac{3}{11}$ to the fraction of a £.
Ans. $£\frac{8}{11}$.

(8) Reduce 4*d.* $1\frac{11}{13}$ *qrs.* to the fraction of a crown.
Ans. $\frac{28}{390}$ *cr*

(9) What fraction of an acre are 3 roods, 32 perches?
Ans. $\frac{1}{2}\frac{9}{0}$ *a.*

(10) What part of a shilling are $\frac{3}{4}$ of 2*d.* *Ans.* $\frac{1}{6}s.$

Case 9. *To find the least common multiple of two or more numbers.*

RULE. Arrange the given numbers in a line, (omitting any one that is a *factor* of one of the others) and divide any two or more of them by *a common divisor*, placing the quotients and undivided numbers below; proceed with these in the same manner, and repeat the process till there remain not any two numbers *commensurable:* the continued product of the divisors, quotients, and undivided numbers, will be the least common multiple

(1) Required the least common multiple of 2, 3, 4, 5, 6, 7, 8, 9, and 10.*

(2) Find the least number divisible by 3, 4, 5, 6, 7, and 8. *Ans.* 840.

(3) What is the least common multiple of 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12? *Ans.* 27720.

Case 10. *To reduce fractions to a common denominator.*

RULE 1. Multiply each numerator into all the denominators, except its own, for a numerator; and all the denominators for a common denominator. Or,

RULE 2. Find the *least common multiple* of the denominators, which will be the *least common denominator*. Divide this by each denominator, and multiply the several quotients by the respective numerators for the required numerators.

(1) Reduce $\frac{2}{3}$ and $\frac{4}{7}$ to a common denominator.†

(2) Reduce $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{8}$, to a common denominator.

Ans. $\frac{32}{64}$, $\frac{48}{64}$, *and* $\frac{40}{64}$; *or* $\frac{4}{8}$, $\frac{6}{8}$, *and* $\frac{5}{8}$.

---

* 2 and 4, being factors of 8, 3 a factor of 9, and 5 a factor of 10, may be omitted. Thus,

2)6, 7, 8, 9, 10
3)3, 7, 4, 9, 5
1, 7, 4, 3, 5

Then $2 \times 3 \times 7 \times 4 \times 3 \times 5 = 42 \times 60 = 2520$, the least number divisible by all the given numbers.

† $2 \times 7 = 14$, $4 \times 4 = 16$ } numerators. $4 \times 7 = 28$ the denominator. *Ans.* $\frac{14}{28}$ and $\frac{16}{28}$.

(3) Reduce $\frac{7}{8}$, $\frac{4}{5}$, $\frac{6}{10}$, and $\frac{6}{7}$, to a common denominator.
Ans. $\frac{735}{840}$, $\frac{560}{840}$, $\frac{504}{840}$, *and* $\frac{720}{840}$.

(4) Reduce $\frac{3}{5}$, $\frac{1}{2}$, and $\frac{1}{7}$, to a common denominator.
Ans. $\frac{42}{70}$, $\frac{35}{70}$, *and* $\frac{10}{70}$.

(5) Reduce $\frac{3}{11}$, $\frac{4}{7}$, and $\frac{3\frac{1}{2}}{15}$ of 2, to a common denominator.
Ans. $\frac{315}{1155}$, $\frac{660}{1155}$, *and* $\frac{539}{1155}$.

(6) Reduce $1\frac{1}{4}$, $2\frac{4}{5}$, and $\frac{1}{3}$ of $1\frac{1}{4}$, to a common denominator. *Ans.* $\frac{75}{60}$, $\frac{132}{60}$, *and* $\frac{25}{60}$.

ADDITION.

RULE. Reduce the given fractions to a common denominator, over which place the *sum* of the numerators.

(1) Add $\frac{2}{3}$ and $\frac{5}{7}$ together. $\frac{2}{3}+\frac{5}{7}=\frac{1}{2}\frac{4}{1}+\frac{1}{2}\frac{5}{1}=\frac{2}{2}\frac{9}{1}=1\frac{8}{21}$. *Ans.*

(2) Add $\frac{1}{4}$, $\frac{2}{7}$, and $\frac{5}{6}$.

(3) Add $\frac{1}{5}$, $4\frac{1}{3}$ and $\frac{2}{5}$.*

(4) Add $7\frac{2}{3}$ and $\frac{2}{5}$ together.

(5) Add $\frac{2}{7}$, and $\frac{2}{3}$ of $\frac{1}{4}$.

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

(7) Add $1\frac{4}{9}$, $3\frac{1}{7}$, and $\frac{1}{2}$ of 7.

(8) Add $\frac{9}{10}$ of $6\frac{7}{8}$ and $\frac{4}{7}$ of $7\frac{1}{2}$.

(9) Add $\frac{1}{5}$ of $9\frac{3}{8}$ and $\frac{2}{3}$ of $4\frac{5}{8}$.

Fractional quantities may be reduced to their proper values, and the sum found by Compound Addition.

(10) Add $\frac{3}{8}$ of a pound to $\frac{5}{6}$ of a shilling. *Ans.* 8*s.* 4*d.*

(11) Add $\frac{1}{2}$ *d.* $\frac{5}{8}$ *s.* and £$\frac{2}{3}$. *Ans.* 14*s.*

(12) Add $\frac{3}{5}$ *lb.* troy, $\frac{1}{8}$ *oz.* and $\frac{5}{8}$ *oz.* *Ans.* 7 *oz.* 19. *dwts.* 20 *gr.*

(13) Add $\frac{4}{7}$ of a ton to $\frac{5}{6}$ of a *cwt.* *Ans.* 12 *cwt.* 1 *qr.* $1\frac{1}{3}$ *lb.*

(14) What is the sum of $\frac{2}{3}$ of £17..7..6*d.*, $\frac{4}{5}$ of £$1\frac{2}{3}$, and $\frac{3}{8}$ of a crown? *Ans.* £13..0..$2\frac{1}{2}$.

(15) Add $\frac{4}{5}$ of 3 *a.* 1 *r.* 20 *p.*, $\frac{3}{8}$ of an acre, and $\frac{1}{4}$ of 3 roods, 15 perches. *Ans.* 3 *a.* 2 *r.* $33\frac{1}{4}$ *p.*

SUBTRACTION.

RULE. Reduce the given fractions to a common denominator, over which place the *difference* of the numerators.

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* When there are *integers* among the given numbers, first find the *sum of the fractions*, to which add the *integers*.
Thus in Ex. 3, $\frac{1}{3}+\frac{2}{5}=\frac{8}{5}$; then $\frac{3}{5}+\frac{1}{3}=\frac{9}{15}+\frac{5}{15}=\frac{14}{15}$; and $4+\frac{14}{15}=4\frac{14}{15}$. *Ans.*

When the numerator of the fractional part in the *subtrahend* is greater than the other numerator, borrow a fraction *equal* to *unity*, having the common denominator; then subtract, and carry one to the *integer* of the subtrahend.

(1) From $\frac{3}{4}$ take $\frac{5}{7}$. $\frac{3}{4}-\frac{5}{7}=\frac{21}{28}-\frac{20}{28}=\frac{1}{28}$. *Ans.*

(2) From $\frac{5}{6}$ take $\frac{3}{5}$.

(3) From $5\frac{2}{3}$ take $\frac{9}{10}$ of $\frac{5}{6}$.

(4) From $3\frac{3}{4}\frac{8}{5}$ take $\frac{3}{5}$ of $\frac{1}{3}$.

(5) From $\frac{18}{36}$ take $\frac{1}{7}$ of $\frac{2}{3}$.

(6) From $64\frac{1}{4}$ take $\frac{2}{3}$ of $\frac{1}{4}$.

(7) From $15\frac{1}{8}$ take $12\frac{7}{40}$.

(8) Subtract $2\frac{3}{5}$ from $1\frac{3}{5}$.

(9) Subtract $\frac{17}{11}$ from $\frac{1}{8}$ of 9.

Fractional quantities may be reduced to their proper values, as directed in addition.

(10) From $\frac{3}{8}$ of a pound take $\frac{3}{8}$ of a shilling, *Ans.* 7*s.* $1\frac{1}{2}$*d.*

(11) From $1\frac{3}{5}$*s.* take $\frac{2}{3}$ of $7\frac{1}{2}$*d* *Ans.* 1*s.* 3*d.*

(12) What is the difference between $\frac{3}{8}$ of £$1\frac{1}{2\,4}$. ; and $\frac{5}{18}$ of £$1\frac{3}{8}\frac{3}{0}$. ? *Ans.* 2*d.* $3\frac{1}{4}$ *qrs.*

(13) Subtract $\frac{5}{6}$ *cwt.* from $\frac{4}{7}$ *ton.* *Ans.* 10 *cwt.* 2 *qrs.* $10\frac{3}{7}$ *lb.*

(14) From $\frac{3}{3}$ of 5 *lb.* troy subtract $\frac{5}{9}$ of $3\frac{1}{2}$ *oz.* *Ans.* 3 *lb.* 2 *oz.* 1 *dwt.* $2\frac{3}{3}$ *gr.*

(15) Subtract $7\frac{13}{120}$ furlongs from $1\frac{1}{11}$ mile. *Ans.* 4 *fur.* 9 *yds.*

MULTIPLICATION.

Rule. Prepare the given numbers (if they require it) by the rules of Reduction: then multiply all the numerators together for the numerator of the *product*, and all the denominators for the denominator.

(1) Multiply $\frac{3}{4}$ by $\frac{3}{5}$. $\frac{3}{4}\times\frac{3}{5}=\frac{9}{20}$. *Ans.*

(2) Multiply $\frac{7}{9}$ by $\frac{2}{3}$.

(3) Multiply $48\frac{3}{5}$ by $13\frac{5}{6}$.

(4) Multiply $430\frac{3}{5}$ by $18\frac{1}{7}$.

(5) Multiply $\frac{16}{11}$ by $\frac{3}{4}$ of $\frac{5}{7}$.

(6) Multiply $\frac{1}{4}$ of $\frac{3}{8}$ by $\frac{5}{7}$.

(7) Multiply $5\frac{6}{7}$ by $\frac{5}{6}$.

(8) Multiply 24 by $\frac{3}{3}$.

(9) Multiply $\frac{3}{4}$ of 9 by $\frac{7}{8}$.

(10) Multiply £3..15..$9\frac{1}{4}$ $\frac{1}{3}$ by $\frac{9}{11}$ of 5. *Ans.* £15..9..$11\frac{3}{4}$ $\frac{1}{11}$.

(11) Multiply $3\frac{15}{11}$ miles by $\frac{4}{7}$ of $4\frac{3}{9}\frac{7}{6}$. *Ans.* 8 *m.* 2 *f.* $188\frac{4}{7}$ *yds.*

(12) Required the product, in square feet, of 14 *ft.* 7 *in.* by 8 *ft.* 9 *in.* *Ans.* $127\frac{3}{4}$ *sq. ft.*

DIVISION.

RULE. Prepare the given numbers (if they require it) by the rule of Reduction: then *invert the divisor*, and proceed as in Multiplication.*

(1) Divide $\frac{9}{20}$ by $\frac{3}{5}$.
(2) Divide $\frac{14}{27}$ by $\frac{5}{6}$.
(3) Divide $672\frac{3}{20}$ by $13\frac{5}{6}$.
(4) Divide $7935\frac{3}{16}$ by $18\frac{3}{7}$.
(5) Divide 16 by 24.
(6) Divide $\frac{9}{16}$ by $4\frac{1}{2}$.
(7) Divide $\frac{11}{63}$ by $\frac{3}{10}$ of $\frac{10\frac{1}{2}}{\frac{7}{15}}$.
(8) Divide $9\frac{1}{3}$ by $\frac{1}{2}$ of 7.
(9) Divide $\frac{3}{8}$ by $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{5}{6}$.
(10) Divide $\frac{2}{3}$ of 16 by $\frac{5}{7}$ of $\frac{1}{4}$.
(11) Divide $£\frac{11}{216}$ by $\frac{32}{9}$ of $1\frac{1}{3}$. *Ans.* £3..17..$10\frac{1}{4}$ $\frac{3}{5}$.
(12) Divide 1*s.* $4\frac{1}{2}$*d.* $\frac{5}{6}$ by $\frac{2}{3}$ of $\frac{5}{8}$. *Ans.* 6*d.* $3\frac{9}{12}$ *qrs.*
(13) Divide 3 *qrs.* $24\frac{13}{16}$ *lb.* by $\frac{7}{15}$ of $1\frac{1}{2}$ in the fraction of a *cwt*; and value the quotient. *Ans.* 1 *cwt.* 1 *qr.* $15\frac{5}{8}$ *lb.*
(14) What must £7..14..6. be multiplied by, to produce £21..17..9? *Ans.* $2\frac{5}{6}$.

THE RULE OF THREE.

RULE. Prepare the terms, previous to stating, so that no subsequent Reduction will be necessary: then, having stated the question, as previously directed *invert* the *dividing term*, and the continued product of the three will be the answer.

(1) If $\frac{3}{4}$ of a yard cost $£\frac{5}{8}$. what will $\frac{9}{10}$ of a yard cost
(2) If $\frac{5}{6}$ yard cost $£\frac{2}{3}$. what will $\frac{11}{12}$ yard cost? *Ans.* 14
(3) If $\frac{1}{4}$ of a yard of lawn cost 7*s.* 3*d.* what will 10 cost? *Ans.* £4..19..10
(4 If $\frac{7}{8}$ *lb.* cost $\frac{3}{4}$*s.* how much will $\frac{8}{9}$*s.* buy? *Ans.* $1\frac{1}{7}$
(5) If 48 men can build a wall in $24\frac{1}{4}$ days, how many men can do the same in 192 days? *Ans.* $6\frac{1}{13}$ *men.*
(6) If $\frac{1}{4}$ of a yard of Holland cost $£\frac{1}{3}$. what will $12\frac{2}{3}$ ells cost at the same rate? *Ans.* £7..0..$8\frac{3}{4}$ $\frac{5}{9}$.
(7) If $3\frac{1}{4}$ yards of cloth, that is $1\frac{1}{5}$ yard wide, be sufficient to make a cloak, how much that is $\frac{4}{5}$ of a yard wide, will make another of the same size! *Ans.* $4\frac{7}{8}$ *yards.*

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* A number *inverted* becomes the *reciprocal* of that number; which is the quotient arising from dividing *unity* by the given number: thus $1 \div 7 = \frac{1}{7}$, the *reciprocal* of 7; $1 \div \frac{3}{5} = \frac{5}{3}$, *reciprocal* of $\frac{3}{5}$.

(8) If $12\frac{1}{2}$ yards of cloth cost 15*s*. 9*d*. what will $48\frac{1}{4}$ yards cost at the same rate ? *Ans.* £3..0..$9\frac{1}{2}\frac{4}{23}$.

(9) If $25\frac{1}{7}$*s*. will pay for the carriage of 1 *cwt*., $145\frac{1}{4}$ miles, how far may $6\frac{1}{2}$ *cwt*. be carried for the same money ? *Ans.* $22\frac{9}{29}$ *miles*.

(10) If $\frac{9}{10}$ of *cwt*. cost £14..4*s*. what is the value of $7\frac{1}{2}$ *cwt* ? *Ans.* £118..6..8.

(11) If $\frac{1}{4}$ *lb*. of cochineal cost £1..5. what will $36\frac{7}{10}$ *lb*. come to ? *Ans.* £61..3..4.

(12) How much in length that is $7\frac{3}{16}$ inches broad, will make a foot square ? *Ans.* $20\frac{4}{115}$ *inches*.

(13) What is the value of 4 pieces of broad cloth, each $27\frac{3}{7}$ yards, at $15\frac{5}{8}$*s*. per yard ? *Ans.* £85..14..$3\frac{1}{4}\frac{5}{7}$.

(14) If a penny white loaf weigh 7 *oz*. when a bushel of wheat costs 5*s*. 6*d*. what is the bushel worth when a penny white loaf weighs but $2\frac{1}{2}$ *oz*. ? *Ans.* 15*s*. 4*d*. $3\frac{1}{5}$ *qrs*.

(15) What quantity of shaloon that is $\frac{3}{4}$ of a yard wide will line $7\frac{1}{2}$ yards of cloth, that is $1\frac{1}{2}$ yard wide ? *Ans.* 15 *yards*.

(16) Bought $3\frac{1}{2}$ pieces of silk, each containing $24\frac{3}{8}$ ells, at 6*s*. $0\frac{1}{4}d$ per ell. How must I sell it per yard, to gain £5. by the bargain ? *Ans.* 5*s*. $9\frac{1}{4}d$. $\frac{36}{43}\frac{9}{5}$.

THE DOUBLE RULE OF THREE.

(1) If a carrier receive £$2\frac{1}{10}$. for the carriage of 3 *cwt*. 150 miles, how much ought he to receive for the carriage of 7 *cwt*. $3\frac{1}{2}$ *qrs*. 50 miles ? *Ans.* £1..16..9.

(2) If £100. in 12 months gain £$5\frac{1}{4}$. interest, what principal will gain £$3\frac{3}{8}$. in 9 months ? *Ans.* £85..14..$3\frac{1}{4}\frac{5}{7}$.

(3) If 9 students spend £$10\frac{7}{9}$. in 18 days, how much will 20 students spend in 30 days ? *Ans.* £39..18. $4\frac{2}{6}\frac{0}{1}$.

(4) Two persons earned $4\frac{5}{8}$*s*. for one day's labour: how much would 5 persons earn in $10\frac{1}{2}$ days, at the same rate ? *Ans.* £6..1..$4\frac{3}{4}\frac{1}{7}$.

(5) If £50. in 5 months gain £$2\frac{3}{1}\frac{7}{44}$. what time will £$13\frac{1}{2}$. require to gain £$1\frac{1}{12}$. ? *Ans.* 9 *months*.

(6) If the carriage of 60 *cwt*., 20 miles, cost £$14\frac{1}{2}$. what weight can I have carried 30 miles for £$5\frac{7}{16}$. ? *Ans.* 15 *cwt*.

DECIMAL FRACTIONS.

In Decimal Fractions the unit is supposed to be divided into tenths, hundredths, thousandth parts, &c. consequently the denominator is always 10, or 100, or 1000, &c.

In our system of Notation, the figures of a *whole number* follow each other in a *decimal* (or *tenfold*) proportion. Hence, the *numerator* of a decimal Fraction is written as a whole number, only distinguished by a *separating point prefixed* to it. Thus ·5 for $\frac{5}{10}$, ·25 for $\frac{25}{100}$, ·123 for $\frac{123}{1000}$.

The *denominator* is, therefore, not expressed ; being always understood to be 1, with *as many ciphers affixed,* as there are *places* in the *numerator.*

The different values of figures will be evident in the annexed Table.

Integers.								*Decimal parts.*						
7	6	5	4	3	2	1	.	2	3	4	5	6	7,	&c.
Millions.	Hundreds of thous.	Tens of thous.	Thousands.	Hundreds.	Tens.	Units.		Tenth parts of *unity.*	Hundreth parts.	Thousandth parts.	Ten thous. parts.	Hund. thous. parts.	Millionth parts	

From this it plainly appears that the figures of the *decimal fraction* decrease successively from left to right in a tenfold proportion, precisely as those of the *whole number.**

Ciphers *on the right* of other decimals do not alter their value : for ·2=$\frac{2}{10}$, ·20=$\frac{20}{100}$, ·200=$\frac{200}{1000}$, are all equal. But one cipher *on the left* diminishes the value *ten times*, two ciphers, *one hundred times*, &c. for ·02=$\frac{2}{100}$, ·002=$\frac{2}{1000}$, &c.

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* The first, second, third, fourth, &c. places of decimals are called *primes, seconds, thirds, fourths,* &c. respectively; and decimals are read thus: 57·57 fifty-seven, and *five, seven,* of a decimal; that is, fifty-seven, and fifty-seven hundredths, 206·043 two hundred and six, and *nought, four, three* ; that is, 206, and forty-three thousandths.

A vulgar fraction having a denominator compounded of 2, or 5, or of both, when converted into its *equivalent decimal fraction*, will be finite: that is, will terminate at some certain number of places. All others are *infinite*; and because they have one or more figures continually repeated without end, they are called *Circulating Decimals*. The repeating figures are called *repetends*.

One repeating figure is called a *single repetend*; as ·222, &c.; generally written thus, ·2′; But when more than one repeat, the decimal is a *compound repetend*; as ·36 36, &c., or ·142857 142857, &c.

Pure repetends consist of the repeating figures alone; but *mixed repetends* have other figures before the circulating decimal begins: as ·045′, ·96\354′.

Finite decimals may be considered as infinite, by making ciphers to recur, which do not alter the value.

Circulating decimals having the *same number of repeating figures* are called *similar* repetends, and those which have an *unequal* number are *dissimilar*. *Similar* and *conterminous* repetends *begin* and *terminate* at the *same places*.

ADDITION.

RULE. Place the numbers so that the decimal points may stand in a perpendicular line: then will units be under units, &c. according to their respective values. Then add as in integers.

(1) Add 72·5+32·071+2·1574+371·4+2·75.
(2) Add 30·07+2·0071+59·432+7·1.
(3) Add 3·5+47·25+927·01+2·0073+1·5.

SUBTRACTION.

RULE. Place the *subtrahend* under the *minuend* with the decimal points as in Addition; and subtract as in integers.

(1) From ·2754 take ·2371.
(2) From 2·37 take 1·76.
(3) From 271 take 215·7.
(4) From 270·2 take 75·4075.
(5) From 571 take 54·72.
(6) From 625 take 76·91.
(7) From 23·415 take ·3742.
(8) From ·107 take ·0007.

MULTIPLICATION.

RULE. Place the factors, and multiply them, as in whole numbers ; and in the product point off as many decimal places as there are in both factors together. When there are not so many figures in the product, supply the defect with ciphers on the left.

(1) Multiply 2 071 by 2·27.	(7) 27·35×7·70011.
(2) Multiply 27·15 by 24·3.*	(8) 57·21×·0075.
(3) Multiply ·2365 by ·2435.	(9) ·007×.007.
(4) Multiply 72347 by 23·15.	(10) 20·15×·2705.
(5) Multiply 17105 by ·3257.	(11) ·907×·0025.
(6) Multiply 17105 by ·0327.	(12) ·3409803×·0016218.

When the multiplier is 10, 100, 1000, &c. it is only removing the separating point in the multiplicand so many places towards the right as there are ciphers in the multiplier :

CONTRACTED MULTIPLICATION.

RULE. Write the multiplier under the multiplicand in an *inverted* order, the units' figure under that place which is intended to be retained in the product.

In multiplying, begin with that figure of the multiplicand which stands over the multiplying figure, rejecting all on the right of that; and set down the first figures of all the products in a perpendicular row.

Increase the first figure of each product by *carrying to it* what would arise from multiplying the *two next* rejected figures on the right, at the rate of *one* from 5 to 14 inclusive, *two* from 15 to 24, *three* from 25 to 34 inclusive, &c.

NOTE. If perfect accuracy as far as the last decimal figure be desired, it will be eligible to find one figure more in the product than is actually wanted.

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* The 2nd. example may be multiplied in *two* products, first by 3, and that product by 8 for 24. The 3rd, 6th, 7th, and 12th may be contracted in a similar way.

(13) Multiply 384·672158 by 3·683, and let there be only four places of decimals in the product.*

(14) Multiply 3·141592 by 52·7438, retaining only 4 places of decimals in the product. *Ans.* 165·6995.

(15) Multiply 238·645 by 8217·5 retaining only the integers in the product. *Ans.* 1961065.

(16) Multiply 375·13758 by 16·7324, and reserve only one place of decimals; and again, reserving three places. *Ans.* 6276·9, *and* 6276·951.

(17) Multiply 395·3756 by ·75642, retaining only 4 places of decimals. *Ans.* 299·0700.

DIVISION.

DIVIDE as in integers; and the first figure of the quotient will be of the same value as that figure of the dividend which stands *over the units* in the *first product* of the divisor: so that the *point* must be placed accordingly; ciphers being prefixed, when necessary.

NOTE 1. After proceeding through the dividend, to ascertain if the quotient is correctly *pointed*, observe that the decimal places in the divisor and quotient together, must equal in number those of the dividend.

2. When there are *fewer* decimal places in the dividend than in the divisor, *equalise* than by *affixing ciphers;* and the quotient, to *that extent,* will be a *whole* number.

3. Ciphers may be subjoined to the decimal part of the dividend, or brought down as if they were subjoined; in order to continue the operation to any degree of exactness desired.

(1) Divide 217·75 by 65.
(2) Divide 709 by 2·574
(7) 7382·54 ÷ 6·4252.
(8) ·0851648 ÷ 423.

---

* *Contracted method.*

384·672158
386·3

11540165
2308033
307738
11540

1416·7476

Common method.

384 672158 | 3·683

11540 | 16474
307737 | 7264
2308022 | 948
11540164 | 74

1416·7475 57914

(3) Divide 1·25 by ·1045	(9) 267·15975 ÷ 13·25.
(4) Divide 48 by 144.	(10) 72·1564 ÷ ·1347.
(5) Divide 5·714 by 8275.	(11) 85643·825 ÷ 6·321.
(6) Divide 715 by 3075.	(12) 1 ÷ 3·1416.

To divide by 10, 100, 1000, &c. remove the separating point in the dividend so many places towards the left, as there are ciphers in the divisor, and the thing is accomplished.

Thus $5784 \div 10 = 578{\cdot}4$, $5784 \div 100 = 57{\cdot}84$, $5784 \div 1000 = 5{\cdot}784$, $5784 \div 10000 = {\cdot}5784$.

(13) 3719 ÷ 10.	(15) 130·7 ÷ 1000.
(14) 3·74 ÷ 100.	(16) 34·012 ÷ 10000.

CONTRACTED DIVISION.

ASCERTAIN the value of the first quotient figure: from which it will be known what number of figures in the quotient will serve the purpose required. Use *that number* of the figures in the divisor, (rejecting the others on the right) and a *sufficient number* of the dividend, to find the first figure of the quotient; make each remainder a new dividual, and for each succeeding figure reject another from the divisor: but observe to carry to each product from the rejected figures as in Contracted Multiplication.

NOTE. When there are *fewer* figures in the divisor than the number wanted in the quotient, proceed by the common rule till those in the divisor are just *as many* as remain to be found in the quotient, and then use the contraction.

(17) Divide 70·23 by 7·9863, to three places of decimals.*

.... * *Contracted Method.*

7·9863)70·230(8·793
63890

6340
5590

750
719

31
24

7

Common Method.

7·9863)70·2300(8·793
638904

6339|60
5590|41

749|190
718|767

30|4230
23|9589

6|4641
---

(18) Divide 721·17562 by 2·257432, to the extent of only three places of decimals in the quotient.

(19) Divide 25·1367 by 217·35, to the fourth decimal.

(20) Divide 51·47542 by ·123415, to the second decimal.

(21) Divide 27·104 by ·3712, the integral quotient only.

REDUCTION OF DECIMALS.

To reduce a Vulgar Fraction to a Decimal.

RULE. Add ciphers to the numerator, and divide by the denominator, the quotient is the decimal fraction required.

EXAMPLES.

1. Reduce $\frac{1}{4}$ ..... to a decimal. 4)1,00(,25 Facit.
2. Reduce $\frac{1}{2}$ ..... to a decimal. Facit, ,5.
3. Reduce $\frac{3}{4}$ ..... to a decimal. Facit, ,75.
4. Reduce $\frac{3}{8}$ ..... to a decimal. Facit, ,375.
5. Reduce $\frac{5}{26}$ ..... to a decimal. Facit, ,1923076 +.
6. Reduce $\frac{11}{14}$ of $\frac{10}{15}$.. to a decimal. Facit, ,6043956 +.

NOTE. If the given parts are of several denominations, they may be reduced either by so many distinct operations as there are different parts, or by first reducing them into their lowest denomination, and then divide as before; or,

2ndly. Bring the lowest into decimals of the next superior denomination, and on the right hand of the decimal found, place the parts given of the next superior denomination; so proceeding till you bring out the decimal parts of the highest integer required, by still dividing the product by the next superior denominator; or,

3dly. To reduce shillings, pence, and farthings. If the number of shillings be even, take half for the first place of decimals, and let the second and third places be filled with the farthings contained in the remaining pence and farthings, always remembering to add 1, when the number is, or exceeds 25. But if the number of shillings be odd, the second place of decimals must be increased by 5.

7. Reduce 5s. to the decimal of a £. Facit, ,25.
8. Reduce 9s. to the decimal of a £. Facit, ,45.
9. Reduce 16s. to the decimal of a £. Facit, ,8.
10. Reduce 8s. 4d to the decimal of a £. Facit, ,4166.
11. Reduce 16s. 7¾d. to the decimal of a £. Facit, ,8322916.

first.	second.	third.	$7\frac{3}{4}$d.
19s. $7\frac{3}{4}$d.	4)3,00	2)16	4
12			
199	12)7,75	,832	31
4	210)16,64583		
960)799(8322916	,8322916		

12. Reduce 19s. $5\frac{1}{2}$d. to the decimal of a £.
Facit, ,972916.

13. Reduce 12 grains to the decimal of a lb. troy.
Facit, ,002083.

14. Reduce 12 drams to the decimal of a lb. avoirdupois.
Facit, ,046875.

15. Reduce 2 qrs. 14 lb. to the decimal of a cwt.
Facit, ,625.

16. Reduce two furlongs to the decimal of a league.
Facit, ,0833.

17. Reduce 2 quarts, 1 pint, to the decimal of a gallon.
Facit, ,625.

18. Reduce 4 gallons, 2 quarts of wine, to the decimal of a hogshead. Facit, ,071428 +.

19. Reduce 2 gallons, 1 quart of beer, to the decimal of a barrel. Facit, ,0625.

20. Reduce 52 days to the decimal of a year.
Facit, ,142465 +.

To find the value of any Decimal Fraction in the known parts of an Integer.

RULE. Multiply the decimal given, by the number of parts of the next inferior denomination, cutting off the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding till you have brought in the least known parts of an integer.

EXAMPLES.

21. What is the value of ,8322916 of a lb.?

Ans. 16s. 7½d. +.

20

16,6458320
12

7,7499840
4

2,9999360

22. What is the value of ,002084 of a lb. tory?

Ans. 12,00384 gr.

23. What is the value of ,046875 of a lb. avoirdupois?

Ans. 12 dr.

24. What is the value of ,625 of a cwt.?

Ans. 2 qrs. 14 lb.

25. What is the value of ,625 of a gallon?

Ans. 2 quarts 1 pint.

26. What is the value of ,071428 of a hogshead of wine?

Ans. 4 gallons 1 quart, ,999856.

27. What is the value of ,0625 of a barrel of beer?

Ans. 2 gallons 1 quart.

28. What is the value of ,142465 of a year?

Ans. 51,999725 days.

Decimal Tables of Coin, Weight, and Measure.

TABLE I.
STERLING MONEY.
£1. the Integer.

s.	*dec.*	*s.*	*dec.*
19	·95	9	·45
18	·9	8	·4
17	·85	7	·35
16	·8	6	·3
15	·75	5	·25
14	·7	4	·2
13	·65	3	·15
12	·6	2	·1
11	·55	1	·05
10	·5		

6*d.*	·025
5	·020833
4	·016666
3	·0125
2	·008333
1	·004166

3*qrs.*	·003125
2	·0020833
1	·0010416

TABLE II.
ENG. COIN. 1*s.*
Long Meas. 1 Foot
the Integer.

Pence or Inches.	*Decimals.*
6	·5
5	·416666
4	·333333
3	·25
2	·166665
1	·083333

3*qrs.*	·0625
2	·041666
1	·020833

TABLE III.
TROY WEIGHT.
1 *lb.* the Integer.
Ounces the same as Pence in Table II.

dwts.	*Decimals.*
10	·041666
9	·0375
8	·033333
7	·029166
6	·025
5	·020833
4	·016666
3	·0125
2	·008333
1	·004166

12 *gr.*	·002083
11	·001910
10	·001736
9	·001562
8	·001389
7	·001215
6	·001042
5	·000868
4	·000694
3	·000521
2	·000347
1	·000173

1 *oz.* the Integer.
Penny-weights the same as Shillings in the first Table.

Grains.	*Decimals.*
12	·025
11	·022916
10	·020833
9	·01875
8	·016666
7	·014583
6	·0125
5	·010416
4	·008333
3	·00625
2	·004166
1	·002083

TABLE IV.
AVOIR. WEIGHT.
1 *cwt.* the Integer.

Qrs.	*Decimals.*
3	·75
2	·5
1	·25

14*lbs.*	·125
13	·116071
12	·107143
11	·098214
10	·089285
9	·080357
8	·071428
7	·0625
6	·053571
5	·044643
4	·035714
3	·026786
2	·017857
1	·008928

8*oz.*	·004464
7	·003906

Decimal Tables of Coin, Weight, and Measure.

6*oz.*	·003348
5	·002790
4	·002232
3	·001674
2	·001116
1	·000558
¾	·000418
½	·000279
¼	·000139

TABLE V.

AVOIR. WEIGHT.

1 *lb.* the Integer.

Ounces	*Decimals.*
8	·5
7	·4375
6	·375
5	·3125
4	·25
3	·1875
2	·125
1	·0625
8 *dr.*	·03125
7	·027343
6	·023437
5	·019531
4	·015625
3	·011718
2	·007812
1	·003906

TABLE VI.

LIQUID MEASURE.

1 Ton the Integer.

Gallons.	*Decimals.*
100	·396835
90	·357142
80 *g.*	·317460
70	·277777
60	·238095
50	·198412
40	·158730
30	·119047
20	·079365
10	·039682
9	·035714
8	·031746
7	·027777
6	·023809
5	·019841
4	·015873
3	·011904
2	·007936
1	·003968
4*pts.*	·001984
3	·001488
2	·000992
1	·000496

1 Hogshead the Integer.

Gallons.	*Decimals.*
30	·476190
20	·317460
10	·158730
9	·142857
8	·126984
7	·111111
6	·095238
5	·079365
4	·063492
3	·047619
2	·031746
1	·015873
3*pts.*	·005952
2	·003968
1	·001984

TABLE VII.

MEASURE.

Liquid. Dry.

1 *Gal.* 1 *Qr.*

the Integer.

Pts.	*Dec.*	*Bush.*
4	·5	4
3	·375	3
2	·25	2
1	·125	1
¾	·09375	3 *p*
½	·0625	2
¼	·03125	1

Decimals.	*Qr.*	*Pks.*
·0234375		3
·015625		2
·0078125		1

TABLE VIII.

LONG MEASURE.

1 Mile the Integer.

Yards.	*Decimals.*
1000	·568182
900	·511364
800	·454545
700	·397727
600	·340909

Decimal Tables of Coin, Weight, and Measure.

500*yd.*	·284091
400	·227272
300	·170454
200	·113636
100	·056818
90	·051136
80	·045454
70	·039773
60	·034091
50	·028409
40	·022727
30	·017045
20	·011364
10	·005682
9	·005114
8	·004545
7	·003977
6	·003409
5	·002841
4	·002273
3	·001704
2	·001136
1	·000568

2*ft.*	·0003787
1	·0001894

6*in.*	·0000947
3	·0000474
2	·0000315
1	·0000158

TABLE IX.

TIME.

1 Year the integer.

Months the same as Pence in Table II.

Days.	*Decimals.*
300	·821918
200	·547945
100	·273973
90	·246575
80*d.*	·219178
70	·191781
60	·164383
50	·136986
40	·109589
30	·082192
20	·054794
10	·027397
9	·024657
8	·021918
7	·019178
6	·016438
5	·013698
4	·010959
3	·008219
2	·005479
1	·002739

1 Day the Integer.

12*hrs.*	·5
11	·458333
10	·416666
9	·375
8	·333333
7	·291666
6	·25
5	·208333
4	·166666
3	·125
2	·083333
1	·041666

30*m.*	·020833
20	·013888
10	·006944
9	·00625
8	·005555
7	·004861
6	·004166
5	·003472
4	·002777
3	·002083
2	·001388
1	·000694

TABLE X.

CLOTH MEASURE.

1 Yard the Integer.

Qrs. the same as Table IV.

Nails.	*Decimals.*
3	·1875
2	·125
1	·0625

TABLE XI.

LEAD WEIGHT.

A Foth. the Integer.

Hund.	*Decimals.*
10	·512820
9	·461538
8	·410256
7	·358974
6	·307692
5	·256410
4	·205128
3	·153846
2	·102564
1	·051282

3*qrs.*	·038461
2	·025641
1	·012820

1 *lbs.*	·0064102
13	·0059523
12	·0054945
11	·0050366
10	·0045787
9	·0041208
8	·0036630
7	·0032051
6	·0027472
5	·0022893
4	·0018315
3	·0013736
2	·0009157
1	·0004578

THE RULE OF THREE.

(1) If $26\frac{1}{2}$ yards cost £3..16..3. what will $32\frac{1}{4}$ yds. cost?

(2) If $7\frac{3}{4}$ yards of cloth cost £2..12..9. what will $140\frac{1}{2}$ yards of the same cost? *Ans.* £47..16..$3\frac{1}{2}$.

(3) If a chest of sugar, weighing 7 *cwt.* 2 *qrs.* 14 *lb.* cost £36..12..9. what will 2 *cwt.* 1 *qr.* 21 *lb.* of the same cost? *Ans.* £11..14..$2\frac{3}{4}$.

(4) What will $326\frac{1}{4}$ *lb.* of coffee be worth when $1\frac{1}{2}$ *lb.* is sold for 3*s.* 6*d.*? *Ans.* £38..1..3.

(5) What is the value of 19 *oz.* 3 *dwts.* 5 *grs.* of gold, at £2..19. per *oz.*? £56..10..5..2·3 *qrs.*

(6) What is the charge for $827\frac{3}{4}$ yards of painting, at $10\frac{1}{2}$d. per yard? *Ans.* £36..4..3 .1·5 *qrs.*

(7) If I lent my friend £34. for $\frac{5}{8}$ of a year, how much ought he to lend me for $\frac{5}{12}$ of a year? *Ans.* £51.

(8) If $\frac{3}{4}$ of a yard of cloth, that is $2\frac{1}{4}$ yards broad, make a garment, how much of $\frac{4}{5}$ of a yard wide will make a similar one? *Ans.* 2 *yds.* 1·75 *nails.*

(9) If 1 *oz.* of silver is worth 5*s.* 6*d.* what is the price of a tankard that weighs 1 *lb.* 10 *oz.* 10 *dwt.* 4 *grs.*? *Ans.* £6..3..9..2·2 *qrs.*

(10) What is the value of 15 *cwt.* 1 *qr.* 19 *lb.* of cotton, at 15*d.* per *lb.*? £107..18..9.

(11) If 1 *cwt.* of currants cost £2..9..6. what will 45 *cwt.* 3 *qrs.* 14 *lb.* cost at the same rate? *Ans.* £113..10..$9\frac{3}{4}$.

(12) Bought 6 chests of sugar, each 6 *cwt.* 3 *qrs.* at £2..16. per *cwt.* What do they come to? *Ans.* £113..8.

(13) Bought a tankard for £10..12. at the rate of 5*s.* 4*d.* per *oz.* What was the weight? *Ans.* 39 *oz.* 15 *dwt.*

(14) Gave £187..3..3. for 25 *cwt.* 3 *qrs.* 14 *lb.* of coffee: at what rate did I buy it per *lb.*? *Ans.* 1*s* $3\frac{1}{2}$*d.*

(15) Bought 29 *lb.* 4 *oz.* of snuff for £10..11..3. What is the value of 3 *lb.*? *Ans.* £1..1..8.

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* As *yds.* 26·5 : £ 3·8125 : : *yds.* 32·25 : £ 4·63974

32·25

26·5)122·953125(4·63974=£4..12..$9\frac{1}{2}$. *Ans.*

(16) If I give 1*s*. 1*d*. for $3\frac{1}{2}$ *lb*. of rags, what will be the value of 1 *cwt*.?

Ans. £1..14..8.

EXCHANGE.

Is the act of bartering the money of one place for that of another; by means of a written instrument called a *Bill of Exchange*.

The operations in this Rule consist in finding the quantity of *one sort* of money that will be equal to a given sum of *the other*, according to the existing *Course of Exchange*.

Par of Exchange signifies the *equality* in the *intrinsic value* of two sums of money of different countries; and shows how much of the one is worth a constant sum (or piece of coin) of the other.

Course of Exchange is the comparative value between the money of two different countries at any particular time; which often fluctuates above or below the *Par*.

Agio is a difference of so much per cent. in the value of the *Bank-money* and the *Current-money* of some foreign countries, the former being of superior value.

To change Foreign Money into British Sterling Money, or Sterling into Foreign; according to a given course of Exchange.

RULE. As the quantity of Foreign mentioned in the given course of exchange, is to the quantity of Sterling; so is any other sum of the Foreign, is to the corresponding value in Sterling money.

And by mutually changing the words Foreign and Sterling, the Rule will serve for changing Sterling into Foreign money.

I. FRANCE.

Accounts are kept at Paris, Lyons, and Rouen, in livres, sols, and deniers, and exchange is made by the écu, or crown =4*s*. 6*d*. at par.

TABLE. 12 deniers make 1 sol.
20 sols . . . 1 livre.
3 livres . . 1 écu or crown.

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

(2) How much sterling must be paid in London, to receive in Paris 758 crowns, exchange at 4*s*. 8*d*. per crown?

Ans. £176..17..4.

(3) A merchant in London remits £176..17..4. to his correspondent at Paris; what is the value in French crowns, at 4*s*. 8*d*. per crown? *Ans.* 758 *crowns.*

(4) Change 725 crowns, 17 sols, 7 deniers, at 4*s*. 6½*d*. per crown, into sterling money. *Ans.* £164..14..0¼. $\frac{3\,19}{350}$.

(5) Change £164..14..0½. sterling into French crowns, exchange at 4*s*. 6½*d*. per crown.

Ans. 725 *crowns*, 17 *sols*, $7\frac{41}{109}$ *deniers.*

II. SPAIN.

Accounts are kept at Madrid, Cadiz, and Seville, in dollars, rials, and maravedies, and exchange is made by the piece of eight=4*s*. 6*d*. at par.

TABLE. 34 maravedies make 1 rial.
8 rials . . . 1 piaster or piece of eight.
10 rials . . . 1 dollar.

(6) A merchant at Cadiz, remits to London 2547 pieces of eight, at 4*s*. 8*d*. per piece, how much sterling is the sum?

Ans. £594..6.

(7) How many pieces of eight, at 4*s*. 8*d*. each, will answer a bill of £594..6. sterling? *Ans.* 2547.

---

* As 4..6 : 1 : : 180
s. d. cr. £

2 40

9 sixp. 9)7200 sixp.

800 crowns. *Ans.*

(8) If I pay here a bill of £2500., for what Spanish money may I draw my bill at Madrid, exchange at 4*s.* 9½*d.* per piece of eight? *Ans.* 10434 *pieces of eight*, 6 *rials*, 8 $\frac{2}{3}\frac{0}{}$ *mar.*

III. ITALY.

Accounts are kept at Genoa and Leghorn, in livres, sols, and deniers, and exchange is made by the piece of eight, or dollar=4*s.* 6*d.* at par.

TABLE. 12 deniers make 1 sol.
20 sols . . 1 livre.
5 livres . . 1 piece of eight at Genoa.
6 livres . . 1 piece of eight at Leghorn.

N. B. The exchange at Florence is by ducatoons; at Venice by ducats.

TABLE. 6 solidi make 1 gross.
24 gross . . 1 ducat.

(9) How much sterling money may a person receive in London, if he pay in Genoa 976 dollars at 4*s.* 5*d.* per dollar?
Ans. £215..10..8.

(10) A factor has sold goods at Florence, for 250 ducatoons, at 4*s.* 6*d.* each: what is the value in pounds sterling?
Ans. £56..5.

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

(12) A traveller would exchange £60..14..7. sterling for Venice ducats, at 4*s.* 5*d.* each: how many must he receive?
Ans. 275.

IV. PORTUGAL.

Accounts are kept at Oporto and Lisbon, in reas, and exchange is made by the milrea=6*s.* 8½*d.* at par.

TABLE. 1000 reas make 1 milrea.

(13) A gentleman being desirous to remit to his correspondent in London, 2750 milreas, exchange at 6*s.* 5*d.* per milrea, for how much sterling will he be creditor in London?
Ans. £882..5..10.

(14) A merchant at Oporto remits to London 4366 milreas, 183 reas, at 5*s*. 5⅝*d*. exchange per milrea: how much sterling must be paid in London for this remittance?

Ans. £1193..17..6..3·0375 *qrs*.

(15) If I pay a bill in London of £1193..17. 6..3·0375 *qrs*. what must I draw for on my correspondent in Lisbon, exchange at 5*s*. 5⅝*d*. per milrea? *Ans*. 4366 *milreas*, 183 *reas*.

V. HOLLAND, FLANDERS, AND GERMANY.

At Antwerp, Amsterdam, Brussels, Rotterdam, and Hamburgh, some accounts are kept in pounds, shillings, and pence, as in England; others in guilders, stivers and pennings: exchange with London, at 33*s*. to 36*s*. or 38*s*. Flemish per pound sterling.

TABLE. 8 pennings make..... 1 groat.
2 groats, or 16 pennings.... 1 stiver.
20 stivers..... ..... 1 guilder, or florin.
ALSO 12 groats, or six stivers make 1 schelling.
20 schellings, or 6 guilders 1 pound.

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

Ans. £1263. 15..9. *Flemish*.

(17) A merchant in Rotterdam remits £1263 .15 .9. Flemish to be paid in London, how much sterling money must he draw for, the exchange being at 33*s*. 6*d*. Flemish per pound sterling? *Ans* £754..10.

(18) If I pay in London £852..12..6. sterling, how many guilders must I draw for at Amsterdam, exchange at 34 schellings, 4½ groats flemish per pound sterling?

Ans. 8792 *guilders*, 13 *stiv*. 1 *gr*. 6½ *pennings*.

(19) What must I draw for in London, if I pay in Amsterdam 8792 guild. 13 stiv. 14½ pennings, exchange at 34 schellings, 4½ groats per pound sterling? *Ans*. £852..12..6.

To convert Bank money into Currency; and the contrary.

As 100: 100 *plus the agio*: : the Bank-money: the Currency.

As 100 *plus the agio* : 100 : : the Currency : the Bank-money.

(20) Change 794 guilders, 15 stivers, Current money into Bank florins, agio $4\frac{3}{8}$ per cent.

Ans. 761 *guilders*, 8 *stivers*, $11\frac{7}{8}\frac{3}{3}\frac{5}{5}$ *pennings*.

(21) Change 761 guilders, 9 stivers Bank, into Current money, agio $4\frac{3}{8}$ per cent.

Ans. 794 *guilders*, 15 *stivers*, $4\frac{3}{1}\frac{}{0}$ *pennings*.

VI. IRELAND.

The *par of Exchange*, long established with Ireland, was £108..6..8. Irish=£100. English. That is, £1..1..8. Irish =£1. English ; or 13*d*. Irish=1*s*. English.

But the English and Irish currency are now assimilated.

(22) A gentleman remitted to Ireland £575..15. sterling : what would he receive there, the exchange being at £10. per cent? *Ans.* £633..6..6.

(23) What would be paid in London for a remittance of £633 .6..6. Irish, exchange at £10. per cent. ?

Ans. £575..15.

EXTRACTION OF THE SQUARE ROOT.

Extracting the Square Root is to find out such a number, as, being multiplied into itself, the product will be equal to the given number.

RULE. First, Point the given number, beginning at the unit's place, then proceed to the hundreds, and so upon every second figure throughout.

Secondly. Seek the greatest square number in the first point towards the left hand, placing the square number under the first point, and the root thereof in the quotient; subtract the square number from the first point, and to the remainder brin down the next point and call that the resolvend.

Thirdly. Double the quotient, and place it for a divisor on the left hand of the resolvend; seek how often the divisor is contained in the resolvend; (preserving always the unit's place) and put the answer in the quotient, and also on the right-hand side of the divisor; then multiply by the figure last put in the quotient, and subtract the product from the resol-

vend; bring down the next point to the remainder (if there be any more) and proceed as before.

ROOTS.	1.	2.	3.	4.	5.	6.	7.	8.	9.
SQUARES.	1,	4.	9.	16.	25.	36.	49.	64.	81.

EXAMPLES.

1. What is the square root of 119025? *Ans.* 345.

```
  .  .  .
119025(345
  9
 ---
64)290
   256
 -----
685)3425
    3425
 -----
```

2. What is the square root of 106929? *Ans.* 327 +.
3. What is the square root of 2268741? *Ans.* 1506,23 +.
4. What is the square root of 7596796? *Ans.* 2756,228 +.
5. What is the square root of 36372961? *Ans.* 6031.
6. What is the square root of 22071204? *Ans.* 4698.

When the given number consists of a whole number and decimals together, make the number of decimals even, by adding ciphers to them; so that there may be a point fall on the unit's place of the whole number.

7. What is the square root of 3271,4007? *Ans.* 57,19 +.
8. What is the square root of 4795,25731? *Ans.* 69,247 +.
9. What is the square root of 4,372594? *Ans.* 2,091 +.
10. What is the square root of 2,2710957? *Ans.* 1,50701 +.
11. What is the square root of ,00032754? *Ans.* ,01809 +.
12. What is the square root of 1,270059? *Ans.* 1,1269 +.

To extract the Square Root of a Vulgar Fraction.

RULE. Reduce the fraction to its lowest terms, then extract the square root of the numerator, for a new numerator, and the square root of the denominator, for a new denominator.

If the fraction be a surd (*i. e.*) a number where a root can never be exactly found, reduce it to a decimal, and extract the root from it.

EXAMPLES.

13. What is the square root of $\frac{2304}{5184}$? *Ans.* $\frac{2}{3}$.
14. What is the square root of $\frac{2704}{4225}$? *Ans.* $\frac{4}{5}$.
15. What is the square root of $\frac{9216}{12544}$? *Ans.* $\frac{6}{7}$.

SURDS.

16. What is the square root of $\frac{275}{341}$? *Ans.* ,89802 +.
17. What is the square root of $\frac{357}{476}$? *Ans.* ,86602 +.
18. What is the square root of $\frac{474}{549}$? *Ans.* ,93309 +.

To extract the Square Root of a mixed number

RULE. Reduce the fractional part of a mixed number to its lowest term, and then the mixed number to an improper fraction.

2. Extract the root of the numerator and denominator for a new numerator and denominator.

If the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the square root therefrom.

EXAMPLES.

19. What is the square root of $51\frac{24}{25}$? *Ans.* $7\frac{1}{5}$.
20. What is the square root of $27\frac{9}{10}$? *Ans.* $5\frac{1}{4}$.
21. What is the square root of $9\frac{43}{49}$? *Ans.* $3\frac{1}{7}$.

SURDS.

22. What is the square root of $85\frac{14}{15}$? *Ans.* 9,27 +.
23. What is the square root of $8\frac{5}{7}$? *Ans.* 2,9519 +.
24. What is the square root of $6\frac{2}{3}$? *Ans.* 2,5819 +.

To find a mean proportional between any two given numbers.

RULE. The square root of the product of the given number is the mean proportional sought.

EXAMPLES.

5. What is the mean proportional between 3 and 12?
Ans. $3 \times 12 = 36$, then $\sqrt{36} = 6$ the mean proportional.

6. What is the mean proportional betweet 4276 and 842?
Ans. 1897,4 +.

To find the side of a square equal in area to any given superficies.

RULE. The square root of the content of any given superficies is the side of the square equal sought.

EXAMPLES.

27. If the content of a given circle be 160, what is the side of the square equal? *Ans.* 12,64911.

28. If the area of a circle is 750, what is the side of the square equal? *Ans.* 27,38612.

The Area of a circle given to find the Diameter.

RULE. As 355: 452, or, as 1: 1,273239: : so is the area: to the square of the diameter;—or, multiply the square root of the area by 1,12837, and the product will be the diameter.

EXAMPLES.

29. What length of cord will be fit to tie to a cow's tail, the other end fixed in the ground, to let her have liberty of eating an acre of grass, and no more, supposing the cow and tail to measure $5\frac{1}{2}$ yards? *Ans.* 6,136 perches.

The area of a circle given, to find the periphery, or circumference.

RULE. As 113: 1420, or, as 1: 12,56637: : the area to the square of the periphery;—or, multiply the square root of area by 3,5449, and the product is the circumference.

EXAMPLES.

30. When the area is 12, what is the circumference?
Ans. 12,279

31. When the area is 160, what is the periphery?
Ans. 44,839.

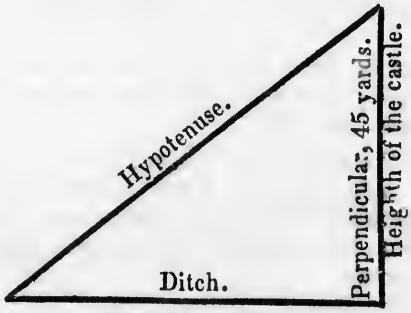
Any two sides of a right-angled triangle given, to find the third side.

1. The base and perpendicular given to find the hypotenuse.

RULE. The square root of the sum of the squares of the base and perpendicular, is the length of the hypotenuse.

EXAMPLES.

32. The top of a castle from the ground is 45 yards high, and surrounded with a ditch 60 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle? *Ans.* 75 yards.



33. The wall of a town is 25 feet high, which is surrounded by a moat of 30 feet in breadth: I desire to know the length of a ladder that will reach from the outside of the moat to the top of the wall? *Ans* 39,05 feet.

The hypotenuse and perpendicular given, to find the base.

RULE. The square root of the difference of the squares of the hypotenuse and perpendicular, is the length of the base.

The base and hypotenuse given, to find the perpendicular.

RULE. The square root of the difference of the squares of the hypotenuse and base, is the height of the perpendicular.

N. B. The two last questions may be varied for examples to the two last propositions.

Any number of men being given, to form them into a square battle, or to find the number of rank and file

RULE. The square root of the number of men given, is the number of men either in rank or file.

34. An army consisting of 331776 men, I desire to know how many rank and file? *Ans.* 576.

35. A certain square pavement contains 48841 square stones, all of the same size. I demand how many are contained in one of the sides? *Ans.* 221.

EXTRACTION OF THE CUBE ROOT.

To extract the Cube Root is to find out one number, which being multiplied into itself, and then into that product, produceth the given number.

RULE 1. Point every third figure of the cube given, beginning at the unit's place; seek the greatest cube to the first point, and subtract it therefrom; put the root in the quotient, and bring down the figures in the next point to the remainder, for a RESOLVEND.

2. Find a DIVISOR by multiplying the square of the quotient by 3. See how often it is contained in the resolvend, rejecting the units and tens, and put the answer in the quotient.

3. To find the SUBTRAHEND. 1. Cube the last figure in the quotient. 2. Multiply all the figures in the quotient by 3, except the last, and that product by the square of the last. 3. Multiply the divisor by the last figure. Add these products together, for the subtrahend, which subtract from the resolvend; to the remainder bring down the next point, and proceed as before.

ROOTS.	1.	2.	3.	4.	5.	6.	7.	8.	9.
CUBES.	1.	8.	27.	64.	125.	216.	343.	512.	729.

EXAMPLES.

1. What is the cube root of 99252847?

. . .
99252847(463
64 =cube of 4
Divisor————
Square of 4 × 3=48)35252 resolvend.

216=cube of 6.
432 =4 × 3 × by square of 6.
288 =divisor × by 6.

33336 subtrahend.

Divisor————
Square of 46 × 3=6348)1916847 resolvend.

27=cube of 3.
1242 =46 × 3 × by square of 3.
19044 =divisor × by 3.

1916847 subtrahend.

2. What is the cube root of 389017? *Ans.* 73.
3. What is the cube root of 5735339? *Ans.* 179.
4. What is the cube root of 32461759? *Ans.* 319.
5. What is the cube root of 84604519? *Ans.* 439.
6. What is the cube root of 259694072? *Ans.* 638.
7. What is the cube root of 48228544? *Ans.* 364.
8. What is the cube root of 27054036008? *Ans.* 3002.
9. What is the cube root of 22069810125? *Ans.* 2805.
10. What is the cube root of 122615327232? *Ans.* 4968.
11. What is the cube root of 219365327791? *Ans.* 6031.
12. What is the cube root of 673373097125? *Ans.* 8765.

When the given number consists of a whole number and decimals together, make the number of decimals to consist of 3, 6, 9, &c. places, by adding ciphers thereto, so that there may be a point fall on the unit's place of the whole number.

13. What is the cube root of 12,077875? *Ans.* 2,35.
14. What is the cube root of 36155,02756? *Ans.* 33,06+.
15. What is the cube root of ,001906624? *Ans.* ,124.
16. What is the cube root of 33,230979937 *Ans.* 3,215+.

17. What is the cube root of 15926,972504? *Ans.* 25,16+.
18. What is the cube root of ,053157376 *Ans.* ,376.

To extract the cube root of a vulgar fraction.

RULE. Reduce the fraction to its lowest terms, then extract the cube root of its numerator and denominator, for a new numerator and denominator; but if the fraction be a surd, reduce it to a decimal, and then extract the root from it.

EXAMPLES.

19. What is the cube root of $\frac{250}{686}$? *Ans.* $\frac{5}{7}$.
20. What is the cube root of $\frac{324}{1000}$? *Ans.* $\frac{3}{5}$.
21. What is the cube root of $\frac{1520}{5130}$? *Ans.* $\frac{2}{3}$.

SURDS.

22. What is the cube root of $\frac{4}{7}$? *Ans.* ,829+.
23. What is the cube root of $\frac{5}{9}$? *Ans.* ,822+.
24. What is the cube root of $\frac{2}{3}$? *Ans.* ,873+.

To extract the cube root of a mixed number.

RULE. Reduce the fractional part to its lowest terms, and then the mixed number to an improper fraction, extract the cube root of the numerator and denominator for a new numerator and denominator; but if the mixed number given be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the root therefrom.

EXAMPLES.

25. What is the cube root of $12\frac{19}{27}$? *Ans.* $2\frac{1}{3}$.
26. What is the cube root of $31\frac{15}{343}$? *Ans.* $3\frac{1}{7}$.
27. What is the cube root of $405\frac{28}{125}$? *Ans.* $7\frac{2}{5}$.

SURDS.

28. What is the cubs root of $7\frac{1}{5}$? *Ans.* 1,93+.
29. What is the cube root of $9\frac{1}{6}$? *Ans.* 2,092+.
30. What is the cube root of $8\frac{5}{7}$? *Ans.* 2,057+.

THE APPLICATION.

1. If a cubical piece of timber be 47 inches long, 47 inches broad, and 47 inches deep, how many cubical inches doth it contain? *Ans.* 103823,

2. There is a cellar dug, that is 12 feet every way, in length, breadth, and depth; how many solid feet of earth were taken out of it? *Ans.* 1728.

3. There is a stone of a cubic form, which contains 389017 solid feet, what is the superficial content of one of its sides? *Ans.* 5329.

Between two numbers given, to find two mean proportionals.

RULE. Divide the greater extreme by the less, and the cube root of the quotient multiplied by the less extreme, gives the less mean; multiply the said cube root by the less mean, and the product will be the greater mean proportional.

EXAMPLES.

4. What are the two mean proportionals between 6 and 162? *Ans.* 18 and 54.

5. What are the two mean proportionals between 4 and 108? *Ans.* 12 and 36.

To find the side of a cube that shall be equal in solidity to any given solid, as a globe, cylinder, prism, cone, &c.

RULE. The cube root of the solid content of any solid body given, is the sides of the cube of equal solidity.

EXAMPLES.

6. If the solid content of a globe is 10648, what is the side of a cube of equal solidity? *Ans.* 22.

The side of a cube being given, to find the side of a cube that shall be double, treble, &c. in quantity to the cube given.

RULE. Cube the side given, and multiply it by 2, 3, &c., the cube root of the product is the side sought.

EXAMPLES.

7. There is a cubical vessel, whose side is 12 inches, and it is required to find the side of another vessel, that is to contain three times as much? *Ans.* 17,306.

EXTRACTING OF THE BIQUADRATE ROOT.

To extract the Biquadrate Root, is to find out a number, which being involved four times into itself, will produce the given number.

RULE. First extract the square root of the given number, and then extract the square root of that square root, and it will give the biquadrate root required.

EXAMPLES.

1. What is the biquadrate of 27 ? *Ans.* 531441.
2. What is the biquadrate of 76 ? *Ans.* 33362176.
3. What is the biquadrate of 275 ? *Ans.* 5719140625.
4. What is the biquadrate root of 531441 ? *Ans.* 27.
5. What is the biquadrate root of 33362176 ? *Ans.* 76.
6. What is the biquadrate root of 5719140625 ? *Ans.* 275.

A GENERAL RULE FOR EXTRACTING THE ROOTS OF ALL POWERS.

1. Prepare the number given for extraction, by pointing off from the unit's place as the root required directs.
2. Find the first figure in the root, which subtract from the given number.
3. Bring down the first figure in the next point to the remainder, and call it the dividend.
4. Involve the root into the next inferior power to that which is given, multiply it by the given power, and call it the divisor.
5. Find a quotient figure by common division, and annex it to the root; then involve the whole root into the given power, and call that the subtrahend.
6. Subtract that number from as many points of the given power as are brought down, beginning at the lower place, and to the remainder bring down the first figure of the next point for a new dividend.
7. Find a new divisor, and proceed in all respects as before.

EXAMPLES.

1. What is the square root of 141376 ?

```
  .  .  .
141376(376
  9                    3 ×   2=6 divisor.
 ---                   37 ×  37=1369 subtrahend.
6)51 dividend,         37 ×   2=74 divisor.
  ----                 376 × 376=141376 subtrahend.
  1369 subtrahend.
 -----
74)447 dividend.
 -----
141376 subtrahend.
 ------
```

2. What is the cube root of 53157376 ?

```
          .  .  .
53157376(376
 ------
  27
  --
27)261 dividend.
 ------
  50653 subtrahend.
 -------
4107)25043 dividend.
 --------
  53157376 subtrahend.
 ---------

  3 ×  3 ×   3=27 divisor.
 37 × 37 ×  37=50653 subtrahend.
 37 × 37 ×   3=4107 divisor.
376 × 376 × 376=53157376 subtrahend.
```

3. What is the biquadrate of 19987173376 ?

19987173376(376
81

108)1188 dividend.

1874161 subtrahend.

202612)1245563 dividend.

19987173376 subtrahend.

3 × 3 × 3 × 4=108 divisor.
37 × 37 × 37 × 37=1874161 subtrahend.
37 × 37 × 37 × 4=202612 divisor.
376 × 376 × 376 × 376=19987173376 subtrahend.

SIMPLE INTEREST.

There are five letters to be observed in Simple Interest, viz.:

P. the Principal.
T. the Time.
R. the Ratio, or rate per cent.
I. the Interest.
A. the Amount.

TABLE OF RATIOS.

3	,03	5½	,055	8	,08
3½	,035	6	,06	8½	,085
4	,04	6½	,065	9	,09
4½	,045	7	,07	9½	,095
5	,05	7½	,075	10	,1

NOTE. The Ratio is the simple interest of £1. for one year, at the rate per cent. proposed, and is found thus:

£ £ £
As 100 : 3 : : 1 : ,03. As 100 : 3,5 : : 1 : ,035.

When the principal, time, and rate per cent. are given, to find the interest.

RULE. Multiply the principal, time, and rate together, and it will give the interest required.

NOTE. The proposition and rule are better expressed thus:—
I. When P R T are given to find I.
RULE. prt=I.
NOTE. When two or more letters are put together like a word, they are to be multiplied one into another.

EXAMPLES.

(1) What is the interest of £945 : 10, for 3 years, at 5 per cent. per annum.
Ans. 945,5 × ,05 × 3=141,825, or £141 : 16 : 6.
(2) What is the interest of £547 : 14, at 4 per cent. per annum, for 6 years? *Ans.* £131 : 8 : 11, 2 qrs. ,08.
(3) What is the interest of £796 : 15, at 4½ per cent. per annum, for 5 years? *Ans.* £179 : 5 : 4. 2 qrs.
(4) What is the interest of £397 : 9 : 5, for 2½ years, at 3½ per cent per annum? *Ans.* £34 : 15 : 6. 3,5499 qrs.
(5) What is the interest of £554 : 17 : 6, for 3 years, 8 months, at 4½ per cent per annum? *Ans.* £91 : 11 : 11 ,2.
(6) What is the interest of £236 : 18 : 8, for 3 years 8 months, at 5½ per cent. per annum? *Ans.* £47 : 15 : 7½ ,293.

When the interest is for any number of days only.

RULE. Multiply the interest of £1 for a day, at the given rate, by the principal and number of days, it will give answer.

INTEREST OF £1. FOR ONE DAY.

per cent.	Decimals.	per cent.	Decimals.
3	,00008219178	6½	,00017808219
3½	,00009589041	7	,00019178082
4	,00010958904	7½	,00020547945
4½	,00012328767	8	,00021917808
5	,00013698630	8½	,00023287671
5½	,00015068493	9	,00024657534
6	,00016438356	9½	,00026027397

NOTE. The above table is thus found :—
As 365 : ,03 : : 1 : ,00008219178. And as 365 : ,035 : : 1 : ,00009589041, &c.

EXAMPLES.

(7) What is the interest of £240, for 120 days, at 4 per cent per annum?

Ans. ,00010958904×240×120=£3 : 3 : 1¼.

(8) What is the interest of £364 : 18, for 154 days, at 5 per cent. per annum? *Ans.* £7 : 13 : 11¼.

(9) What is the interest of £725 : 15, for 74 days, at 4 per cent. per annum? *Ans.* £5 : 17 : 8½.

(10) What is the interest of £100, from the 1st June, 1775, to the 9th March following, at 5 per cent per annum?

Ans. £3 : 16 : 11¾.

II. When P R T are given to find A.

RULE. prt+p=A.

ANNUITIES OR PENSIONS, &c. IN ARREARS.

Annuities or Pensions, &c. are said to be in arrears, when they are payable or due, either yearly, half yearly, or quarterly, and are unpaid for any number of payments.

NOTE. U represents the annuity, pension, or yearly rent, T R A as before.

I U R T are given to find A.

RULE. $\frac{ttu-tu}{2}\times r : +tu=A.$

EXAMPLES.

(11) If a salary of £150 be foreborne 5 years, at 5 per cent. what will it amount to? £*Ans.* 825.

5×5×150—5×150=3000 then $\frac{3000}{2}\times,05+5\times150=$£825.

(12) If £250 yearly pension be foreborne 7 years, what will it amount to in that time at 6 per cent.? *Ans.* £2065.

(13) There is a house let upon lease for $5\frac{1}{2}$ years, at £60 per annum, what will be the amount of the whole time at $4\frac{1}{2}$ per cent.? *Ans.* £363 : 8 : 3.

(14) Suppose an annual pension of £28 remain unpaid for 8 years, what would it amount to at 5 per cent?

Ans. £263 : 4.

NOTE. When the annuities, &c. are to be paid half-yearly or quarterly, then

For half-yearly payments, take half the ratio, half of the annuity, &c., and twice the number of years—and

For quarterly payments, take a fourth part of the ratio, a fourth part of the annuity, &c., and four times the number of years, and work as before.

EXAMPLES.

(15) If a salary of £150, payable half-yearly, remains unpaid for 5 years, what will it amount to in that time at 5 per cent? *Ans.* £834 : 7 : 6.

(16) If a salary of £150, payable every quarter, was left unpaid for 5 years, what would it amount to in that time at 5 per cent.? *Ans.* £839 : 1 : 3.

NOTE. It may be observed by comparing these last examples, the amount of the half-yearly payments are more advantageous than the yearly, and the quarterly more than the half-yearly.

II. When A R T are given to find U.

RULE. $\frac{2a}{ttr-tr+2t}=U.$

EXAMPLES.

(17) If a salary amounted to £825 in 5 years, at 5 per cent., what was the salary? *Ans.* £150.

$825\times 2=1650.5\times 5\times ,05-5\times ,05+5\times 2=11$ then $1650\div 11=$£150.

(18) If a house is to be let upon a lease for $5\frac{1}{2}$ years, and the amount for that time is £363 : 8 : 3, at $4\frac{1}{2}$ per cent. what is the yearly rent? *Ans.* £60.

(19) If a pension amounted to £2065, in 7 years, at 6 per cent. what was the pension? *Ans.* £250.

(20) Suppose the amount of a pension be £263 : 4, in 8 years, at 5 per cent. what was the pension? *Ans.* £28.

NOTE. When the payments are half-yearly, then take 4 a, and half of the ratio, and twice the number of years; and if quarterly, then take 8 a, one fourth of the ratio, and four times the number of years, and proceed as before.

(21) If the amount of a salary, payable half-yearly, for 5 years, at 5 per cent. be £834 : 7 : 6, what was the salary? *Ans.* £150.

(22) If the amount of an annuity, payable quarterly, be £839 : 1 : 3, for 5 years, at 6 per cent., what was the annuity? *Ans.* £150.

III. When U A T are given to find R.

RULE. $\frac{2a-2ut}{utt-ut}=R$.

EXAMPLES.

(23) If a salary of £150 per annum, amount to £825, in 5 years, what is the rate per cent? *Ans.* 5 per cent.

$825\times 2-150\times 5\times 2=150$ then $\frac{150}{150\times 5\times 5-150\times 5}=,05$

(24) If a house be let upon a lease for $5\frac{1}{2}$ years, at £60 per annum, and the amount for that time be £363 : 8 : 3, what is the rate per cent? *Ans.* $4\frac{1}{2}$ per cent.

(25) If a pension of £250 per annum, amounts to £2065 in 7 years, what is the rate per cent.? *Ans.* 6 per cent.

(26) Suppose the amount of a yearly pension of £28, be £263 : 4, in 8 years, what is the rate per cent.? *Ans.* 5 per cent.

NOTE. When the payments are half-yearly, take 4 a—4 ut for a dividend, and work with half the annuity, and double the number of years for a divisor; if quarterly, take 8 a—8 ut, and work with a fourth of the annuity, and four times the number of years.

(27) If a salary of £150 per annum, payable half-yearly, amounts to £834 : 7 : 6, in 5 years, what is the rate per cent.?

Ans. 5 per cent.

(28) If an annuity of £150 per annum, payable quarterly, amounts to £839 : 1 : 3, in 5 years, what is the rate per cent.?

Ans. 5 per cent.

IV. When U A R are given to find T.

RULE. First, $\frac{2}{r} - 1 = x$ then : $\sqrt{\frac{2a}{ur} + \frac{xx}{4}} - \frac{x}{2} = T$.

EXAMPLES.

(29) In what time will a salary of £150 per annum, amount to £825, at 5 per cent.? *Ans.* 5 years.

$$\frac{2}{,05} - 1 = 39 \qquad \frac{826 \times 2}{150 \times ,05} = 220 \qquad \frac{39 \times 39}{4} = 380,25$$

$$\sqrt{229 + 380,25} = 24,5 - \frac{39}{2} = 5 \text{ years.}$$

(30) If a house is let upon a lease for a certain time, for £60 per annum, and amounts to £363 : 8 : 3, at $4\frac{1}{2}$ per cent., what time was it let for? *Ans.* $5\frac{1}{2}$ years.

(31) If a pension of £250 per annum, being forborne a certain time, amounts to £2065, at 6 per cent., what was the time of forbearance? *Ans.* 7 years.

(32) In what time will a yearly pension of £28, amount to £263 : 4, at 5 per cent.? *Ans.* 8 years.

NOTE. If the payments are half-yearly, take half the ratio, and half the annuity; if quarterly, one fourth of the ratio, and one fourth of the annuity; and T will be equal to those half-yearly or quarterly payments.

(33) If an annuity of £150 per annum, payable half-yearly, amounts to £834 : 7 : 6, at 5 per cent., what time was the payment forborne? *Ans.* 5 years.

(34) If a yearly pension of £150, payable quarterly, amounts to £839 : 1 : 3, at 5 per cent., what was the time of forbearance? *Ans.* 5 years.

PRESENT WORTH OF ANNUITIES.

NOTE. P represents the present worth; U T R as before.

I. When U T R are given to find P.

$$\text{RULE.} \quad \frac{ttr-tr+2t}{2tr+2} : +u=P.$$

EXAMPLES.

(35) What is the present worth of £150 per annum, to continue 5 years, at 5 per cent.? *Ans.* £660.

$5\times5\times,05-5\times,05+5\times2=11$, $,5\times,05\times2+2=2,5$ then $11\div2,5\times150=£660$.

(36) What is the yearly rent of a house of £60, to continue $5\frac{1}{2}$ years, worth in ready money, at $4\frac{1}{2}$ per cent.? *Ans.* £291 : 6 : 3.

(37) What is the present worth of £250 per annum, to continue 7 years, at 6 per cent.? *Ans.* £1454 : 4 : 6.

(38) What is a pension of £28 per annum, worth in ready money, at 5 per cent., for 8 years? *Ans.* £188.

NOTE. The same thing is to be observed as in the first rule of annuities in arrears, concerning half-yearly and quarterly payments.

(39) What is the present worth of £150, payable quarterly, for 5 years, at 5 per cent? *Ans.* £671 : 5.

NOTE. By comparing the last examples, it will be found that the present worth of half-yearly payments is more advantageous than yearly, and quarterly than half-yearly.

II. When P. T. R. are given to find U.

$$\text{RULE.} \quad \frac{tr+1}{ttr-tr+2t} : \times 2p=U.$$

EXAMPLES.

(40) If the present worth of a salary be £660, to continue 5 years, at 5 per cent., what is the salary? *Ans.* £150.

$5 \times ,05 + 1 = 1,25 \quad 5 \times 5 \times ,05 - 5 \times ,05 + 10 = 11.$

$$\frac{1,25}{11} \times 660 \times 2 = £150.$$

(41) There is a house let upon lease for $5\frac{1}{2}$ years to come, I desire to know the yearly rent, when the present worth, at $4\frac{1}{2}$ per cent., is £291 : 6 : 3 ? *Ans.* £60.

(42) What annuity is that which, for 7 years' continuance, at 6 per cent., produces £1454 : 4 : 6 present worth ?

Ans. £250.

(43) What annuity is that which, for 8 years' continuance, produces £188 for the present worth, at 5 per cent. ?

Ans. £28.

NOTE. When the payments are half-yearly, take half the ratio, twice the number of years, and multiply by 4 p ; and when quarterly, take one fourth of the ratio, and four times the number of years, and multiply by 8 p.

(44) There is an annuity, payable half-yearly, for 5 years to come, what is the yearly rent, when the present worth, at 5 per cent., is £667 : 10 ? *Ans.* £150.

(45) There is an annuity payable quarterly, for 5 years to come, I desire to know the yearly income, when the present worth, at 5 per cent., is £671 : 5 ? *Ans.* £150.

III. When U P T are given to find R.

$$\text{RULE.} \quad \frac{ut - p \times 2}{2pt + ut - tu} = R.$$

EXAMPLES.

(46) At what rate per cent. will an annuity of £150 per annum, to continue 5 years, produce the present worth of £660 ? *Ans.* 5 per cent.

$150 \times 5 - 660 \times 2 = 180, 2 \times 660 \times 5 + 5 \times 150 - 5 \times 5 \times 150 = 3600$ then $180 \div 3600 = ,05 = 5$ per cent.

(47) If a yearly rent of £60 per annum, to continue $5\frac{1}{2}$ years, produces £291 : 6 : 3, for the present worth, what is the rate per cent. ? *Ans.* $4\frac{1}{2}$ per cent.

(48) If an annuity of £250 per annum, to continue 7 years, produces £1454 : 4 : 6, for the present worth, what is the rate per cent. ? *Ans.* 6 per cent.

(49) If a pension of £28 per annum, to continue 8 years, produces £188 for the present worth, what is the rate per cent. ? *Ans.* 5 per cent.

NOTE. When the annuities, or rents, &c. are to be paid half-yearly, or quarterly, then

For half-yearly payments, take half of the annuity, &c. and twice the number of years, the quotient will be the ratio of half the rate per cent.—and

For quarterly payments, take a fourth part of the annuity, &c. and four times the number of years, the quotient will be the ratio of the fourth part of the rate per cent.

(50) If annuity of £150 per annum, payable half-yearly, having 5 years to come, is sold for £667 : 10, what is the rate per cent. ? *Ans.* 5 per cent.

(51) If an annuity of £150 per annum, payable quarterly, having 5 years to come, is sold for £671 : 5, what is the rate per cent. ? *Ans.* 5 per cent.

IV. When U P R are given to find T.

RULE. $\frac{2}{r}\frac{2p}{u}-1=x$ then $\sqrt{\frac{2p}{ur}+\frac{xx}{4}}-\frac{x}{2}=T.$

EXAMPLES.

(52) If an annuity of £150 per annum, produces £660 for the present worth, at 5 per cent., what is the time of its continuance ? *Ans.* 5 years.

$$\frac{2}{,05}\quad\frac{660\times 2}{150}-1=30,2\qquad\frac{660\times 2}{150\times ,05}=176$$

$$\frac{30,2\times 30,2}{4}=228,01 \text{ then } \sqrt{228,01}+176=20,1$$

$$20,1-\frac{30,2}{2}=5 \text{ years.}$$

(53) For what time may a salary of £60 be purchased for £291 : 6 : 3, at $4\frac{1}{2}$ per cent. ? *Ans.* $5\frac{1}{2}$ years.

(54) For what time may £250 per annum, be purchased for £1454 : 4 : 6, at 6 per cent. ? *Ans.* 7 years.

(55) For what time may a pension of £28 per annum, be purchased for £188, at 5 per cent. ? *Ans.* 8 years.

NOTE. When the payments are half-yearly, then U will be equal to half the annuity, &c., R half the ratio, and T the number of payments: and,

When the payments are quarterly, U will be equal to one fourth part of the annuity, &c., R the fourth of the ratio, and T the number of payments.

(56) If an annuity of £150 per annum, payable half-yearly, is sold for £667 : 10, at 5 per cent., I desire to know the number of payments, and the time to come ?

Ans. 10 payments, 5 years.

(57) An annuity of £150 per annum, payable quarterly, is sold for £671 : 5, at 5 per cent., what is the number of payments, and time to come ? *Ans.* 20 payments, 5 years.

ANNUITIES, &c. TAKEN IN REVERSION.

1. To find the present worth of an annuity, &c., taken in reversion.

RULE. Find the present worth of the yearly sum at the given rate and for the time of its continuance ; thus, $\frac{ttr-tr+2t}{2tr+2}\times : u=P.$

2. Change P into A, and find what principal, being put to interest, will amount to A at the same rate, and for the time to come before the annuity, &c. commences; thus,

$$\frac{a}{tr+1}=P.$$

EXAMPLES.

(58) What is the present worth of an annuity of £150 per annum, to continue 5 years, but not to commence till the end of 4 years, allowing 5 per cent. to the purchaser?

Ans. £550.

$$\frac{5\times5\times,05-5\times,05+2\times5=4,4\times150=660}{5\times,05\times2+2}\qquad\frac{660}{4\times,05+1}=550.$$

(59) What is the present worth of a lease of £50 per annum, to continue 4 years, but which is not to commence till the end of 5 years, allowing 4 per cent to the purchaser?

Ans. £152 : 5 : 11 3 qrs.

(60) A person having the promise of a pension of £20 per annum, for 8 years, but not to commence till the end of 4 years, is willing to dispose of the same at 5 per cent. what will be the present worth? *Ans.* £111 : 18 : 1 ,14+.

(61) A legacy of £40 per annum being left for 6 years, to a person of 15 years of age, but which is not to commence till he is 21; he, wanting money, is desirous of selling the same at 4 per cent., what is the present worth?

Ans. £171 : 13 : 11 ,07596.

2. To find the yearly income of an annuity, &c., in reversion.

RULE 1. Find the amount of the present worth at the given rate, and for the time before the reversion; thus,

$$ptr+p=A.$$

2. Change A into P, and find what annuity being sold, will produce P at the same rate, and for the time of its continuance; thus,

$$\frac{tr+1}{ttr-tr+2t}\times2p=U.$$

EXAMPLES.

(62) A person having an annuity left him for 5 years, which does not commence till the end of 4 years, disposed of it for £550, allowing 5 per cent. to the purchaser, what was the yearly income? *Ans.* £150.

$$\frac{550\times4\times,05+550}{5\times,05+1,}=660,5\times5\times,05-5\times,05+5\times2=$$
$$,113636\times660\times2=£150.$$

(63) There is a lease of a house taken for 4 years, but not to commence till the end of 5 years, the lessee would sell the same for £152 : 6, present payment, allowing 4 per cent. to the purchaser, what is the yearly rent? *Ans.* £50.

(64) A person having the promise of a pension for 8 years, which does not commence till the end of 4 years, has disposed of the same for £111 : 18 : 1 ,14 present money, allowing 5 per cent. to the purchaser, what was the pension? *Ans.* £20.

(65) There is a certain legacy left to a person of 15 years of age, which is to be continued for 6 years, but not to commence till he arrives at the age of 21; he, wanting a sum of money, sells it for £171 : 14, allowing 4 per cent. to the buyer, what was the annuity left him? *Ans.* £40.

REBATE OR DISCOUNT.

NOTE. S represents the sum to be discounted.
P the Present worth.
T the Time.
R the Ratio.

I. When S T R are given to find P.

RULE. $\frac{S}{tr+1}=P.$

EXAMPLES.

1. What is the present worth of £357 : 10, to be paid 9 months hence, at 5 per cent.? *Ans.* £344 : 11 : 6¾ ,168.

2. What is the present worth of £275 : 10, due 7 months hence, at 5 per cent. ? *Ans.* £267 : 13 : $10\frac{39}{247}$.

3. What is the present worth of £875 : 5 : 6, due at 5 months hence, at $4\frac{1}{2}$ per cent. ? *Ans.* £859 : 3 : $3\frac{1}{4}\ \frac{3}{163}$.

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

Ans. £70 : 11 : 9 ,1764d.

II. When P T R are given to find S.

RULE. ptr+p=S.

EXAMPLES.

5. If the present worth of a sum of money, due 9 months hence, allowing 5 per cent., be £344 : 11 : 6 3,168 qrs., what was the sum first due ? *Ans.* £357 : 10.

344,5783×,75×,05+344,5783=£357 : 10.

6. A person owing a certain sum, payable 7 months hence, agrees with the creditor to pay him down £267 : 13 : $10\frac{38}{247}$, allowing 5 per cent. for present payment, what is the debt ?

Ans. £275 : 10.

7. A person receives £859 ; 3 : $3\frac{1}{4}\ \frac{3}{163}$ for a sum of money, due 5 months hence, allowing the debtor $4\frac{1}{2}$ per cent. for present payment, what was the sum due ? *Ans.* £875 : 5 : 6.

8. A person paid £70: 11: 9 ,17641. for a debt due 15 months hence, he being allowed 5 per cent. for the discount, how much was the debt ? *Ans.* £75.

III. When S P T are given to find R.

RULE. $\frac{s-p}{tp}=R.$

EXAMPLES.

9. At what rate per cent. will £357: 10, payable 7 months hence, produce £344: 11: 6 3,168 qrs. for present payment ?

$$\frac{3575,-344,5783}{344,5783\times,75}=,05=5 \text{ per cent.}$$

10. At what rate per cent. will £275: 10, payable 7 months hence, produce £267: 13: $10\frac{38}{247}$ for the present payment? *Ans.* 5 per cent.

11. At what rate per cent. will £875: 5: 6, payable 5 months hence, produce the present payment of £859: 8: $3\frac{1}{4}$ $\frac{3}{163}$? *Ans.* $4\frac{1}{2}$ per cent.

12. At what rate per cent. will £75, payable 15 months hence, produce the present payment of £70; 11; 9 ,1764d.? *Ans.* 5 per cent.

IV. When S P R are given to find T.

RULE. $\frac{s-p}{rp}=T.$

EXAMPLES.

13. The present worth of £357: 10, due at a certain time to come, is £344: 11: 6 3,168 qrs. at 5 per cent., in what time should the sum have been paid without any rebate?

Ans. 9 months.

$$\frac{357,5-344,5783}{344,5783 \times ,05}=,75=9 \text{ months.}$$

14. The present worth of £275: 10, due at a certain time to come, is £267: 13: $10\frac{38}{247}$, at 5 per cent., in what time should the sum have been paid without any rebate?

Ans. 7 months.

15. A person receives £859: 3: $3\frac{1}{4}$,0184, for £875: 5: 6, due at a certain time to come, allowing $4\frac{1}{2}$ per cent. discount, I desire to know in what time the debt should have been discharged without any rebate? *Ans.* 5 months.

16. I have received £70: 11: 9 ,1764d. for a debt of £75, allowing the person 5 per cent. for prompt payment, I desire to know when the debt would have been payable without the rebate? *Ans.* 15 months.

EQUATION OF PAYMENTS.

To find the equated time for the payment of a sum of money due at several times.

RULE. Find the present worth of each payment for its respective time; thus, $\frac{s}{tr \times 1} = P.$

Add all the present worths together, ther, $s - p = D.$

and $\frac{d}{pr} = E.$

EXAMPLES.

I. D owes E £200, whereof £40 is to be paid at three months, £60 at six months, and £100 at nine months; at what time may the whole debt be paid together, rebate being made at 5 per cent.? *Ans.* 6 months, 26 days.

$$\frac{40}{1,0125} = 39,5061 \qquad \frac{60}{1,025} = 58,5365 \qquad \frac{100}{1,0375} = 96,3855$$

then $200 - 39,5061 + 58,5365 + 96,3855 = 5,5719$

$$\frac{5,5719}{194,4281 \times ,05.} = ,57315 = 6 \text{ months, } 26 \text{ days.}$$

2. D owes E £800, whereof £200 is to be paid in 3 months, £200 at 4 months, and £400 at 6 months; but they, agreeing to make but one payment of the whole, at the rate of 5 per cent. rebate, the true equated time is demanded?

Ans. 4 months, 22 days.

3. E owes F £1200, which is to be paid as follows: £200 down, £500 at the end of 10 months, and the rest at the end of 20 months; but they, agreeing to have one payment of the whole, rebate at 3 per cent, the true equated time is demanded?

Ans. 1 year, 11 days.

DUODECIMALS,

OR, WHAT IS GENERALLY CALLED

Cross Multiplication, and Squaring of Dimensions by Artificers and Workmen.

RULE FOR MULTIPLYING DUODECIMALLY.

1. Under the multiplicand write the corresponding denominations of the multiplier.

2. Multiply each term in the multiplicand (beginning at the lowest) by the feet in the multiplier; write each result under its respective term, observing to carry an unit for every 12, from each lower denomination to its next superior.

3. In the same manner multiply the multiplicand by the primes in the multiplier, and write the result of each term one place more to the right hand of those in the multiplicand.

4. Work in the same manner with the seconds in the multiplier, setting the result of each term two places to the right hand of those in the multiplicand, and so on for thirds, fourths, &c.

EXAMPLES.

Multiply 7 . 9 by 3 . 6.

Cross Multiplication.	Practice.	Duodecimals.	Decimals.
7 . 9	$6\frac{1}{2}$ 7 . 9	7 . 9	7,75
3 X 6	3 . 6	2 . 6	3,5
21.0 0=7X3	23 . 3	23 . 3— X3	3875
2.3.0=9X3	3 . 10 . 6	3 . 10 . 6X6	2325
3.6.0=7X6			
0.4.6=9X6	27 . 1 . 6	27 . 1 . 6	27,125
27.1.6			

		f.in.		f. in.	f. in. pts.
2.	Multiply	8,5	by	4. 7	Facit, 38. 6.11
3.	Multiply	9.8	by	7. 6	Facit. 72. 6
4.	Multiply	8.1	by	3. 5	Facit, 27. 7. 5
5.	Multiply	7.6	by	5. 9	Facit, 43. 1. 6

6. Multiply	4.7	by	3.10	Facit,	17. 6.10$_{mn\ n}$
7. Multiply	7.5.9$_{n}$	by	3. 5.3$_{n}$	Facit,	25. 8. 6.2.3
8. Multiply	10.4.5	by	7. 8.6	Facit,	79.11. 0.6.6
9. Multiply	75.7	by	9. 8	Facit,	730. 7. 8
10. Multiply	97.8	by	8. 9	Facit,	854. 7
11. Multiply	57.9	by	9. 5	Facit,	543. 9. 9
12. Multiply	75.9	by	17. 7	Facit,	1331.11. 3
13. Multiply	87.5	by	35. 8	Facit,	3117.10. 4
14. Multiply	179.3	by	38.10	Facit,	6960.10. 6
15. Multiply	259.2	by	48·11	Facit,	12677. 6.10
16. Multiply	257.9	by	39.11	Facit,	10288. 6. 3
17. Multiply	311.4.7	by	36. 7.5	Facit,	11402.2.4.11.11
18. Multiply	321 7.3	by	9. 3.6	Facit,	2988.2.10.4.6

THE APPLICATION.

Artificers's work is computed by different measures, viz :—

1. Glazing, and masons' flat work, by the foot.

2. Painting, plastering, paving, &c., by the yard.

3. Partitioning, flooring, roofing, tiling, &c., by the square of 100 feet.

4. Brick work, &c., by the rod of 16½ feet, whose square is 272¼ feet.

Measuring by the Foot Square, as Glaziers' and Masons' Flat Work.

EXAMPLES.

19. There is a house with 3 tier of windows, 3 in a tier—the height of the first tier 7 feet 10 inches, the second 6 feet 8 inches, and the third 5 feet 4 inches, the breadth of each is 3 feet 11 inches; what will the glazing come to, at 14*d.* per foot?

Duodecimals.			feet	in.	pts.	
7 . 10	the		233	0	6	at 14*d.* per ft.
6 . 8	heights					
5 . 4	added.	$2d. = \frac{1}{6}$	233			$= 1s.$
			38	10		$= 2d.$
19 . 10			0	$0\frac{1}{2}$		$= 6$ parts.
	3=windows in a tier.					
		2)10)27(1 . $10\frac{1}{2}$				
59 . 6						
3 . 11	in breadth.	£13 . 11 . $10\frac{1}{2}$ *Ans.*				
178 . 6						
54 . 6 . 6						
233 . 0 . 6						

20. What is the worth of 8 squares of glass, each measuring 4 feet 10 inches long, and 2 feet 11 inches broad, at $4\frac{1}{2}d.$ per foot? *Ans.* £1 : 18 : 9.

21. There are 8 windows to be glazed, each measures 1 foot 6 inches wide, and 3 feet in height, how much will they come to at $7\frac{1}{4}d.$ per foot? *Ans.* £1 : 3 : 3.

22. What is the price of a marble slab, whose length is 5 feet 7 inches, and the breadth 1 foot 10 inches, at 6*s.* per foot? *Ans.* £3 : 1 : 5.

Measuring by the Yard Square, as Paviers, Painters, Plasterers, and Joiners.

NOTE. Divide the square feet by 9, and it will give the number of square yards.

EXAMPLES.

23. A room is to be ceiled, whose length is 74 feet 9 inches, and width 11 feet 6 inches; what will it come to at 3*s.* $10\frac{1}{2}d.$ per yard? *Ans.* £18 : 10 : 1.

24. What will the paving of a court yard come to at $4\frac{1}{4}d.$ per yard, the length being 58 feet 6 inches, and breadth 54 feet 9 inches? *Ans.* £7 : 0 : 10.

25. A room was painted 97 feet 8 inches about, and 9 feet 10 inches high, what does it come to at 2*s.* 8¼*d.* per yard?

Ans. £14 : 11 : 1½.

26. What is the content of a piece of wainscoting in yards square, that is 8 feet 3 inches long, and 6 feet 6 inches broad, and what will it come to at 6*s.* 7½*d.* per yard?

Ans. Contents, yards 5.8.7.6; comes to £1 : 19 : 5.

27. What will the paving of a court-yard come to at 3*s.* 2*d.* per yard, if the length be 27 feet 10 inches, and the breadth 14 feet 9 inches? *Ans.* £7 : 4 : 5.

28. A person has paved a court-yard 42 feet 9 inches in front, and 68 feet 6 inches in depth, and in this he laid a foot-way, the depth of the court-yard of 5 feet 6 inches in breadth, the foot way is laid with Purbeck stone, at 3*s.* 6*d.* per yard, and the rest with pebbles, at 3*s.* per yard; what will the whole come to? *Ans.* £49 : 17.

29. What will be the plastering of a ceiling, at 10*d.* per yard, come to, supposing the length 31 feet 8 inches and the breadth 14 feet 10 inches? *Ans.* £1 : 9 : 9.

30. What will the wainscoting of a room come to at 6*s.* per square yard, supposing the height of the room (taking in the cornice and moulding) is 12 feet 6 inches, and the compass 83 feet 8 inches, the three window shutters each 7 feet 8 inches by 3 feet 6 inches, and the door 7 feet by 3 feet 6 inches? The shutters and door being worked on both sides, are reckoned work and half work. *Ans.* £36 : 12 : 2¼.

Measuring by the Square of 100 *feet, as Flooring, Partitioning, Roofing, Tiling, &c.*

EXAMPLES.

31. In 173 feet 10 inches in length, and 10 feet 7 inches in height of partitioning, how many squares?

Ans. 18 squarres, 39 feet, 8 inches, 10 p.

32. If a house of three stories, besides the ground floor, was to be floored at £6 : 10 per square, and the house measured 20 feet 8 inches, by 16 feet 9 inches; there are 7 fire-places, whose measures are, two of 6 feet by 4 feet 6 inches each, two of 6 feet by 5 feet 4 inches each, and two of 5 feet 8

inches by 4 feet 8 nches each, and the seventh of 5 feet 2 inches by 4 feet, and the well hole for the stairs is 10 feet 6 inches by 8 feet 9 inches; what will the whole come to?

Ans. £53: 13: $3\frac{1}{2}$.

33. If a house measures within the walls 52 feet 8 inches in length, and 30 feet 6 inches in breadth, and the roof be of a true pitch, that will it come to roofing at 10s. 6d. per square? *Ans.* £12: 42: $11\frac{1}{4}$.

NOTE. In tiling, roofing, and slating, it is customary to reckon the flat and half of the building within the wall, to be the measure of the roof of that bulding, when the said roof is of a true pitch, *i. e.* when the rafters are $\frac{1}{4}$ of the breadth of the building; but if the roof is more or less than the true pitch, they measure from one side to the other with a rod or string.

34. What will the tiling of a barn cost, at 25s. 6d. per square; the length being 43 feet 10 inches, and breadth 27 feet 5 inches on the flat, the eave boards projecting 16 inches on each side? *Ans.* £24: 9: $5\frac{3}{4}$.

Measuring by the Rod.

NOTE. Bricklayers always value their work at the rate of a brick and a half thick; and if the thickness of the wall is more or less, it must be reduced to that thickness by this

RULE. Multiply the area of the wall by the number of half bricks in the thickness of the wall; the product divided by 3, gives the area.

EXAMPLES.

35. If the area of a wall be 4085 feet, and the thickness two bricks and a half, how many rods doth it contain?

Ans. 25 rods, 8 feet.

36. If a garden wall be 254 feet round, and 12 feet 7 inches high, and 3 bricks thick, how many rods doth it contain?

Ans. 23 rods, 136 feet.

37. How many squared rods are there in a wall $62\frac{1}{2}$ feet long, 14 feet 8 inches high, and $2\frac{1}{2}$ bricks thick?

Ans. 5 rods, 167 feet.

38. If the side walls of a house be 28 feet 10 inches in length, and the height of the roof from the ground 55 feet 8 inches, and the gable (or triangular part at top) to rise 42 course of bricks, reckoning 4 course to a foot. Now, 20 feet high is $2\frac{1}{2}$ bricks thick, 20 feet more at two bricks thick, 15 feet 8 inches more at $1\frac{1}{2}$ brick thick, and the gable at 1 brick thick; what will the whole work come to at £5 16s. per rod?

Ans. £48: 13: $5\frac{1}{2}$.

Multiplying several figures by several, and the product to be produced in one line only.

RULE. Multiply the units of the multiplicand by the units of the multiplier, setting down the units of the product, and carry the tens; next multiply the tens in the multiplicand by the units of the multiplier, to which add the product of the units of the multiplicand multiplied by the tens in the multiplier, and the tens carried; then multiply the hundreds in the multiplicand by the units of the multiplier, adding the product of the tens in the multiplicand multiplied by the tens in the multiplier, and the units of the multiplicand by the hundreds in the multiplier; and so proceed till you have multiplied the multiplicand all through, by every figure in the multiplier.

EXAMPLES.

	Common way.
Multiply.....35234	35234
by.....52424	52424
Product, 1847107216	140936
	70468
	140936
	70468
	176170
	1847107216

A COLLECTION OF QUESTIONS.

1. What is the value of 14 barrels of soap, at $4\frac{1}{2}$d per lb. each barrel containing 254 lb. ? *Ans.* £66 : 13 : 6.

2. A and B trade together ; A puts in £320 for 5 months, B £460 for 3 months, and they gain £100 ; what must each man receive ?

Ans. A £53 : 13 : $9\frac{270}{298}$, and B £46 : 6 : $2\frac{28}{298}$.

3. How many yards of cloth, at 17s. 6d per yard, can I have for 13 cwt. 2 qrs. of wool, at 14d. per lb.

Ans. 100 yards, $3\frac{1}{2}$ qrs.

4. If I buy 1000 ells of Flemish linen for £90, at what may I sell it per ell in London, to gain £10 by the whole ?

Ans. 3s. 4d. per ell.

5. A has 648 yards of cloth, at 14s. per yard, ready money, but in barter will have 16s. ; B has wine at £42 per ton, ready money : the question is, how much wine must be given for the cloth, and what is the price of a ton of wine in barter ?

Ans. £48 the ton, and 10 tons, 3 hhds. $12\frac{5}{8}$ gals. of wine must be given for the cloth.

6. A jeweller sold jewels to the value of £1200, for which he received in part 876 French pistoles, at 16s. 6d. each ; what sum remains unpaid ? *Ans.* £177 : 6.

7. An oilman bought 417 cwt. 1 qr. 15 lb., gross weight, of train oil, tare 20 lb. per 112 lb. how many neat gallons were there, allowing $7\frac{1}{2}$ lb. to a gallon ? *Ans.* 5120 gallons.

8. If I buy a yard of cloth for 14s. 6d. and sell it for 16s. 9d, what do I gain per cent ? *Ans.* £15 : 10 : $4\frac{24}{174}$.

9. Bought 27 bags of ginger, each weighing gross 84¼ lb., tare at 1⅜ lb. per bag, tret 4 lb. per 104 lb, what do they come to at 8½d. per lb.? *Ans.* £76 : 13 : 2½.

10. If ⅔ of an ounce cost ⅞ of a shilling, what will ⅚ of a lb. cost? *Ans.* 17s. 6d.

11. If ⅚ of a gallon cost ⅝ of a pound, what will ⅝ of a tun cost? *Ans.* £105.

12. A gentleman spends one day with another, £1 : 7 : 10½, and at the year's end layeth up £340, what is his yearly income? *Ans.* £848 : 14 : 4½.

13. A has 13 fother of lead to send abroad, each being 19¼ times 112 lb. B has 39 casks of tin, each 388 lb how many ounces difference is there in the weight of these commodities? *Ans.* 212160 oz.

14. A captain and 160 sailors took a prize worth £1360, of which the captain had ⅕ for his share, and the rest was equally divided among the sailors, what was each man's part?

Ans. The captain had £272, and each sailor £6 : 16.

15. At what rate per cent. will £956 amount to £1314 : 10, in 7½ years, at simple interest? *Ans.* 5 per cent.

16. A hath 24 cows, worth 72s. each, and B 7 horses, worth £13 a piece, how much will make good the difference, in case they interchange their said drove of cattle?

Ans. £4 : 12.

17. A man dies and leaves £120 to be given to three persons, viz. A, B, C; to A a share unknown; B twice as much as A, and C as much as A and B; what was the share of each? *Ans.* A £20, B £40, and C £60.

18. £1000 is to be divided among three men, in such a manner, that if A has £3, B shall have £5, and C £8; how much must each man have?

Ans. A £187 : 10, B £312 : 10, and C £500.

19. A piece of wainscot is 8 feet 6½ inches long, and 2 feet 9¾ inches broad, what is the superficial content?

Ans. 24 feet 0 : 3″ : 4 : 6.

20. If 360 men be in garrison, and have provisions for 6 months, but hearing of no relief at the end of 5 months, how many men must depart that the provisions may last so much the longer? *Ans.* 288 men.

21. The less of 2 numbers is 187, their difference 34, the square of their product is required? *Ans.* 1707920929.

22. A butcher sends his man with £216 to a fair to buy cattle; oxen at £11, cows at 40s., colts at £1 : 5, and hogs at £1 : 15 each, and of each a like number, how many of each sort did he buy? *Ans.* 13 of each sort, and £8 over.

23. What number added to $11\frac{5}{7}$ will produce $36\frac{3}{6}\frac{3}{1}\frac{7}{6}$?

Ans. $24\frac{5}{6}\frac{1}{1}\frac{5}{6}$.

24. What number multiplied by $\frac{3}{7}$ will produce $11\frac{9}{17}$?

Ans. $26\frac{4}{5}\frac{6}{1}$.

25. What is the value of 179 hogsheads of tobacco, each weighing 13 cwt. at £2 : 7 : 1 per cwt.?

Ans. £5478 : 2 : 11.

26. My factor sends me word he has bought goods to the value of £500 : 13 : 6, upon my account, what will his commission come to at $3\frac{1}{2}$ per cent.?

Ans. £17 : 10 : 5 2 qrs. $\frac{6}{7}\frac{8}{0}\frac{}{0}$.

27. If $\frac{1}{3}$ of 6 be three, what will $\frac{1}{4}$ of 20 be? *Ans.* $7\frac{1}{2}$.

28. What is the decimal of 3 qrs. 14 lb. of a cwt.?

Ans. ,875.

29. How many lb. of sugar, at $4\frac{1}{2}$d. per lb. must be given in barter for 60 gross of inkle, at 8s. 8d. per gross?

Ans. $1386\frac{2}{3}$ lb.

30. If I buy yarn for 9d. the lb. and sell it again for $13\frac{1}{2}$d. per lb., what is the gain per cent.? *Ans.* £50.

31. A tobacconist would mix 20 lb. of tobacco at 9d. per lb. with 60 lb. at 12d. per lb., 40 lb. at 18d. per lb., and with 12 lb. at 2s. per lb., what is a pound of this mixture worth?

Ans. 1s. $2\frac{1}{4}$d. $\frac{9}{1}\frac{}{1}$.

32. What is the difference between twice eight and twenty, and twice twenty-eight; as also, between twice five and fifty, and twice fifty-five? *Ans.* 20 and 50.

33. Whereas a noble and a mark just 15 yards did buy; how many ells of the same cloth for £50 had I?

Ans. 600 ells.

34. A broker bought for his principal, in the year 1720, £400 capital stock in the South Sea, at £650 per cent., and sold it again when it was worth but £130 per cent.; how much was lost in the whole? *Ans.* £2080.

35. C hath candles at 6s. per dozen, ready money, but in barter will have 6s. 6d. per dozen ; D hath cotton at 9d. per lb. ready money. I demand what price the cotton must be at in barter; also, how much cotton must be bartered for 100 doz. of candles ?

Ans. The cotton at 9d. 3 qrs. per lb., and 7 cwt. 0 qrs. 16 lb. of cotton must be given for 100 doz. candles.

36. If a clerk's salary be £73 a year, what is that per day ?

Ans. 4s.

37. B hath an estate of £53 per annum, and payeth 5s. 10d. to the subsidy, what must C pay, whose estate is worth £100 per annum ? *Ans.* 11s. 0d. $\frac{4}{53}$.

38. If I buy 100 yards of riband at 3 yards for a shilling, and 100 more at 2 yards for a shilling, and sell it at the rate of 5 yards for 2 shillings, whether do I gain or lose, and how much ? *Ans.* Lose 3s. 4d.

39. What number is that, from which if you take $\frac{3}{5}$, the remainder will be $\frac{1}{8}$? *Ans.* $\frac{2}{40}$.

40. A farmer is willing to make a mixture of rye at 4s. a bushel, barley at 3s., and oats at 2s. ; how much must he take of each to sell it at 2s. 6d. the bushel ?

Ans. 6 of rye, 6 of barley, and 24 of oats.

41. If $\frac{3}{8}$ of a ship be worth £3740, what is the worth of the whole ? *Ans.* £9973 : 6 : 8.

42. Bought a cask of wine for £62 : 8, how many gallons were in the same, when a gallon was valued at 5s. 4d. ?

Ans. 234.

43. A merry young fellow in a short time got the better of $\frac{1}{5}$ of his fortune ; by advice of his friends, he gave £2200 for an exempt's place in the guards ; his profusion continued till he had no more than 880 guineas left, which he found by computation, was $\frac{3}{20}$ part of his money after the commission was bought ; pray what was his fortune at first ?

Ans. £10450.

44. Four men have a sum of money to be divided amongst them, in such a manner, that the first shall have $\frac{1}{3}$ of it, the second $\frac{1}{4}$, the third $\frac{1}{6}$, and the fourth the remainder, which is £28, what is the sum ? *Ans.* £112.

45. What is the amount of £1000 for $3\frac{1}{2}$ years, at $4\frac{1}{4}$ per cent, simple interest? *Ans.* £1261 : 5.

46. Sold goods amounting to the value of £700 at two 4 months, what is the present worth, at 5 per cent., simple interest? *Ans.* £682 : 19 : $5\frac{1}{4}\frac{1}{1}\frac{7}{8}\frac{7}{9}\frac{}{1}$.

47. A room 30 feet long, and 18 feet wide, is to be covered with painted cloth, how many yards of $\frac{3}{4}$ wide will cover it? *Ans.* 80 yards.

48. Betty told her brother George, that though her fortune, on her marriage, took £19312 out of her family, it was but $\frac{2}{5}$ of two years' rent, Heaven be praised! of his yearly income; pray what was that? *Ans* 16093 : 6 : 8 a year.

49. A gentleman having 50s. to pay among his labourers for a day's work, would give to every boy 6d., to every woman 8d., and to every man 16d.; the number of boys, women, and men, was the same. I demand the number of each? *Ans.* 20 of each.

50. A stone that measures 4 feet 6 inches long, 2 feet 9 inches broad, and 3 feet 4 inches deep, how many solid feet doth it contain? *Ans.* 41 feet 3 inches.

51. What does the whole pay of a man-of-war's crew, of 640 sailors, amount to for 32 months' service, each man's pay being 22s. 6d. per month? *Ans.* £23040.

52. A traveller would change 500 French crowns, at 4s. 6d. per crown, into sterling money, but he must pay a halfpenny per crown for change; how much must he receive? *Ans.* £111 : 9 : 2.

53. B and C traded together, and gained £100; B put in £640, C put in so much that he might receive £60 of the gain. I demand how much C put in? *Ans* £960.

54. Of what principal sum did £20 interest arise in one year, at the rate of 5 per cent. per annum? *Ans.* £400.

55. In 672 Spanish gilders of 2s. each, how many French pistoles, at 17s. 6d. per piece? *Ans.* $76\frac{2}{3}\frac{8}{5}$.

56. From 7 cheeses, each weighing 1 cwt. 2 qrs. 5 lb., how many allowances for seamen may be cut, each weighing 5 oz. 7 drams? *Ans.* $356\frac{3}{8}\frac{5}{7}$.

57. If 48 taken from 120 leaves 72, and 72 taken from 91 leaves 19, and 7 taken from thence leaves 12, what number

is that, out of which when you have taken 48, 72, 19, and 7, leaves 12 ? *Ans.* 158.

58. A farmer ignorant of numbers, ordered £500 to be divided among his five sons, thus :—Give A, says he, $\frac{1}{3}$, B $\frac{1}{4}$, C $\frac{1}{5}$, D $\frac{1}{6}$, and E $\frac{1}{7}$ part; divide this equitably among them, according to their father's intention.

Ans. A £152$\frac{232}{459}$, B £114$\frac{174}{459}$, C £91$\frac{231}{459}$, D £76$\frac{116}{459}$, E £65$\frac{165}{459}$.

59. When first the marriage knot was tied
Between my wife and me,
My age did hers as far exceed,
As three times three does three ;
But when ten years, and half ten years,
We man and wife had been,
Her age came then as near to mine,
As eight is to sixteen.

Ques. What was each of our ages when we were married.
Ans. 45 years the man, 15 the woman?

A Table for finding the Interest of any sum of Money, for any number of months, weeks or days, at any rate per cent.

Year.	Calen. Month.			Week.			Day.		
£	£	s.	d.	£	s.	d.	£	s.	d.
1	0	1	8	0	0	4½	0	0	0½
2	0	3	4	0	0	9	0	0	1¼
3	0	5	0	0	1	1¾	0	0	2
4	0	6	8	0	1	6	0	0	2½
5	0	8	4	0	1	11	0	0	3¼
6	0	10	0	0	2	3¾	0	0	4
7	0	11	8	0	2	8¼	0	0	4½
8	0	13	4	0	3	1	0	0	5¼
9	0	15	0	0	3	5½	0	0	6
10	0	16	8	0	3	10¼	0	0	6½
20	1	13	4	0	7	8¼	0	1	1¼
30	2	10	0	0	11	6½	0	1	7¾
40	3	6	8	0	15	4½	0	2	2¼
50	4	3	4	0	19	2¾	0	2	9
60	5	0	0	1	3	1	0	3	3½
70	5	16	8	1	6	11	0	3	10
80	6	13	4	1	10	9¼	0	4	4½
90	7	10	0	1	14	7¼	0	4	11¼
100	8	6	8	1	18	5½	0	5	5¾
200	16	13	4	3	16	11	0	10	11½
300	25	0	0	5	15	4½	0	16	5¼
400	33	6	8	7	13	10	1	1	11
500	41	13	4	9	12	3½	1	7	4¾
600	50	0	0	11	10	9	1	12	10½
700	58	6	8	13	9	2¾	1	18	4¼
800	66	13	4	15	7	8¼	2	3	10
900	75	0	0	17	6	1¾	2	9	3¾
1000	83	6	8	19	4	7¼	2	14	9½
2000	166	13	4	38	9	2¾	5	9	7
3000	250	0	0	57	13	10	8	4	4½
4000	333	6	8	76	18	5½	10	19	2
5000	416	13	4	96	3	0¾	13	13	11½
6000	500	0	0	115	7	8¼	16	8	9
7000	583	6	8	134	12	3½	19	3	6¾
8000	666	13	4	153	16	11	21	18	4¼
9000	750	0	0	173	1	6¼	24	13	1¾
10000	833	6	8	192	6	1¾	27	7	11¼
20000	1666	13	4	384	12	3½	54	15	10½
30000	2500	0	0	576	18	5¼	82	3	10

RULE. Multiply the principal by the rate per cent., and the number of months, weeks or days, which are required, cut off two figures on the right hand side of the product, and collect from the table the several sums against the different numbers, which when added, will make the number remaining. Add the several sums together, and it will give the interest required.

N. B. For every 10 that is cut off in months, add twopence; for every ten cut off in weeks, add a halfpenny; and for every 40 in the days, 1 farthing.

EXAMPLES.

1. What is the interest of £2467 : 10, for 10 months, at 4 per cent. per annum?

2467 : 10	900=75 : 0 : 0
4	80= 6 : 13 : 4
9870 : 0	7= 0 : 11 : 8
10	987=82 : 5 : 0
987|00	

2. What is the interest of £2467 10s. for 12 weeks, at 5 per cent.?

2467 : 10	1000=19 : 4 : $7\frac{1}{4}$
5	400= 7 : 13 : 10
12337 : 10	80= 1 : 10 : $9\frac{1}{4}$
12	50= 0 : 0 : $2\frac{1}{2}$
1480|50 : 0	1480|50=28 : 9 : 5

3. What is the interest of £2467 10s., 50 days, at 6 per cent.?

2467 : 10	7000=19 : 3 : $6\frac{1}{2}$
6	400= 1 : 1 : 11
14805 : 0	2= 0 : 0 : $1\frac{1}{4}$
50	50= 0 : 0 : $0\frac{1}{4}$
7402|50 : 0	7402|50=20 : 5 : 7

To find what an Estate, from one to £60,000 per annum will come to for one day.

RULE 1. Collect the annual rent or income from the table for 1 year, against which take the several sums for one day, add them together, and it will give the answer.

An estate of £376 per annum, what is that per day?

300=0 : 16 : $5\frac{1}{4}$
70=0 : 3 : 10
6=0 : 0 : 4

376=1 : 0 : $7\frac{1}{4}$

To find the amount of any income, salary, or servants' wages, for any number of months, weeks, or days.

RULE. Multiply the yearly income or salary by the number of months, weeks, or days, and collect the product from the table.

What will £270 per annum come to for 11 months, for 3 weeks, and for 6 days?

	For 11 months.		For 3 weeks.
270	2000=166 : 13 : 4	270	800=15 : 7 : $8\frac{1}{4}$
11	900= 75 : 0 : 0	3	10= 0 : 3 : $10\frac{1}{4}$
2970	70= 5 : 16 : 8	810	= 15 : 11 : $6\frac{1}{2}$
	2970=247 : 10 : 0		

	For 6 days.	For the whole time.
270	1000=2 : 14 : $9\frac{1}{2}$	247 : 10 : 0
6	600=1 : 12 : $10\frac{1}{2}$	15 : 11 : $6\frac{1}{2}$
1620	20=0 : 1 : $1\frac{1}{4}$	4 : 8 : $9\frac{1}{4}$
	1620=4 : 8 : $9\frac{1}{4}$	267 : 10 : $3\frac{3}{4}$

A COMPENDIUM OF BOOK-KEEPING,

BY SINGLE ENTRY.

BOOK-KEEPING is the art of recording the transactions of persons in business, so as to exhibit a state of their affairs in a concise and satisfactory manner.

Books may be kept either by *Single* or by *Double Entry*, but *Single Entry* is the method chiefly used in retail business.

The books found most expedient in Single Entry, are the *Day-Book*, the *Cash-Book*, the *Ledger*, and the *Bill-Book*.

The Day-Book begins with an account of the trader's property, debts, &c.; and are entered in the order of their occurrence, the daily transactions of goods bought and sold.

The Cash-Book is a register of all money transactions. On the left-hand page, *Cash* is made *Debtor* to all sums received; and on the right, *Cash* is made *Creditor* by all sums paid.

The Ledger collects together the scattered accounts in the Day-Book and Cash-Book, and places the Debtors and Creditors upon opposite pages of the same folio; and a reference is made to the folio of the books from which the respective accounts are extracted, by figures placed in a column against the sums. References are also made in the Day-Book and Cash-Book, to the folios in the Ledger, where the amounts are collected. This process is called *posting*, and the following general rule should be remembered by the learner, when engaged in transferring the register of mercantile proceedings from the previous books to the Ledger:—

The person from whom you purchase goods, or from whom you receive money, is *Creditor;* and, on the contrary, the person to whom you sell goods, or to whom you pay money, is *Debtor*.

In the Bill-Book are inserted the particulars of all *Bills of Exchange;* and it is sometimes found expedient to keep for this purpose two books, into one of which are copied *Bills Receivable*, or such as come into the tradesman's possession, and are drawn upon some other person; in the other book are entered *Bills Payable*, which are those that are drawn upon and accepted by the tradesman himself.

DAY-BOOK. (Folio 1.)

Folio of Ledger.	January 1st, 1837.	£	s.	d.
1	I commenced business with a capital of Five Hundred Pounds in Cash.....	500	0	0
	2d			
	*Bennet and Sons, London,** Cr.			
	By 2 hhds. of sugar, cwt. qr. lb. cwt. qr. lb.			
	13 1 4 1 2 0			
	12 3 16 1 1 6			
	gross wt. 26 0 20			
	tare 2 3 6			
	neat wt. 23 1 14 at 63s. per cwt.	73	12	7
	2 chests of tea			
	cwt. qr. lb. lb.			
	1 0 15 25			
	1 0 12 25			
	2 0 27			
	1 22			
	1 3 5 at 6s. per lb.	60	6	0
1		133	18	7
	3d			
	Hall and Scott, Liverpool, Cr.			
	By soap, 1 cwt. at 68s.....	3	8	0
	candles, 10 dozen at 7s. 9d.....	3	17	6
1		7	5	6
	6th			
	Ward, William, Dr.			
	To 1 cwt. of sugar, at 70s.....	3	10	0
	14 lb. of tea, at 8s.....	5		0
	¼ cwt. of soap, at 74s.....	0	10	6
1		10	0	6
	8th			
	Cooper, William, Dr.			
2	To 1 sugar hogshead.....	0	6	6

* The student may be directed to fill up this and similar blanks in this Book and the Ledger with the names and places familiar to him.

(Folio 2.) DAY-BOOK.

		£	s.	d.
	January 9th, 1837.			
	Johnson, Richard, *Dr.*			
	To 2 dozen of candles, at 8s. 3d.....	0	16	6
	½ cwt. of soap, at 74s..	1	17	0
	½ cwt. of sugar, at 70s.....	1	15	0
2		4	8	6
	10th			
	Ward, William, *Dr.*			
	To sugar, 1 cask,			
	cwt. qr. lb.			
	gross wt. 5 2 10 cask....	0	5	0
	tare 2 10			
	neat 5 0 0 at 68s.....	17	0	0
1		17	5	0
	12th			
	Smith, John, *Dr.*			
	To 14 lb. of sugar.....	0	9	0
	12 lb. of candles.....	0	8	6
	7 lb. of soap.....	0	4	9
	1 lb. of tea.....	0	8	3
2		1	10	6
	14th			
	Hall and Scott, Liverpool, *Cr.*			
1	By 2 cwt. soap, at 68s.....	6	16	0
	17th			
	Newton, John, *Dr.*			
	To 21 lb. of soap, at 74s. per cwt...	0	13	10
	2 dozen of candles, at 8s. 3d.....	0	16	6
2		1	10	4
	19th			
	Smith, John, *Dr.*			
	To 14 lb. of sugar.....	0	9	0
	½ lb. of tea.....	0	4	2
2		0	13	2
	21st			
	Smith, John, *Dr.*			
	To 28 lb. of sugar.	0	18	0
	12 lb. of candles.....	0	8	3
2		1	6	3

DAY-BOOK. (Folio 3.)

		£	s.	d.
	January 23d, 1837.			
	Yates & Lane, Bradford, Cr.			
	By 4 pieces of superfine cloth, each 36 yards, at 24s. per yard.....	172	16	0
2				
	23d.			
	Edwards, Benj. Manchester, Cr.			
	By 2 pieces of calico, each 24 yards, at 1s. per yard....	2	8	0
3				
	23d.			
	Smith, John, Dr.			
	To 14 lb. of soap	0	9	6
2				
	24th.			
	Johnson, Richard, Dr.			
	To 2 dozen of candles, at 8s. 3d.	0	16	6
	1 cwt. soap, at 74s.	3	14	0
	1½ cwt. of sugar, at 70s..	5	5	0
2		9	15	6
	24th.			
	Smith, John, Dr.			
	To 1 lb. of tea.....	0	8	3
2				
	26th.			
	Mason, Edward, Dr.			
	To 3 pieces of superfine cloth, each 36 yards, at 27s. per yard....	145	16	0
	2 pieces of calico, each 24 yards, at 1s. 2d per yard,	2	16	0
3		148	12	0
	27th.			
	Parker, Thomas, Dr.			
3	To 1 piece of superfine cloth, 36 yards, at 28s	50	8	0
	31st.			
	Bills Payable, Cr.			
3	By Yates & Lane's Bill at 2 months, due April 2	172	16	0
	Inventory, January 31st, 1837.			
	cwt. qr. lb.			
	Raw sugar, 14 3 14 at 63s.....	46	17	1
	Tea, 1 2 16½ at 6s. per lb.	55	7	0
	Soap, 0 3 14 at 68s.....	2	19	6
	Candles, 2 dozen, at 7s. 9d.....	0	15	6
3		105	19	1

1837.	*Dr.* CASH.		£	*s.*	*d.*
Jan. 1.	To Cash for amount of Capital	1	500	0	0
6	William Cooper	2	0	6	6
	Bernard & Co., Bill on Banks & Co., London, due March 6.	1	133	18	0
10	William Ward, Bill at 2 months	1	27	5	6
14	Richard Johnson, Cash, (abated 6d.)	2	4	8	0
21	John Smith, Cash, (abated 5d.)	2	3	9	6
23	John Newton (on account)	2	0	15	9
30	Edward Mason, Bill at 6 weeks	3	150	0	0
31	Thomas Parker, Cash on account	3	10	0	0
	My acceptance at 2 months brought from Bill-Book, folio	1	172	16	0
			1002	18	6

1837.	CASH *Cr.*		£	*s.*	*d.*
Jan. 2.	By Bernard & Co., Cash	1	480	0	0
6	Bennett & Sons, London, Bill at 2 months, dated January 4, (abated 7d.)	1	133	18	0
10	A sugar cask		0	5	0
	Bernard & Co., W. Ward's Bill due March 13	1	27	5	6
16	Hall & Scott, Cash, (abated 1s. 6d.)	1	14	0	0
23	Benjamin Edwards, Cash,	3	2	8	0
30	Postage of a letter		0	1	6
	Edward Mason, Cash out of Bill	3	1	8	0
31	Yates & Lane, my acceptance	2	172	16	0
	Balance on hand, Bill due March 16		150	0	0
	Cash		20	16	6
			1002	18	6

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(Folio 1.) **LEDGER.** (Folio 1.)

1837	*Dr.* STOCK.		£	s.	d.	1837	STOCK *Cr.*		£.	s.	d.
Jan. 31	To balance account.....	3	423	7	11	Jan. 1	By amount of Capital.....	1	500	0	0
	Amount of inventory.....	3	105	19	1		Balance, being the profit on the transactions of this month		29	7	0
			529	7	0				529	7	0
1837	*Dr. Bernard & Co.*					1837	*Bankers,* *Cr.*				
Jan. 2	To Cash.....	1	480	0	0	Jan. 6	By Bill due March 6.....	1	133	18	0
10	Bill due March 13.....	1	27	5	6		Commission		1	5	0
	Interest		2	7	7		Balance	3	374	10	1
			509	13	1				509	13	1
1837	*Dr. Bennett & Sons,*					1837	*London,* *Cr.*				
Jan. 6	To Bill.....	1	133	18	0	Jan. 2	By Goods.....	1	133	18	7
	Abated.....		0	0	7						
			133	18	7						
1837	*Dr. Hall & Scott,*					1837	*Liverpool,* *Cr.*				
Jan. 16	To Cash.....	1	14	0	0	Jan. 3	By Goods	1	7	5	6
	Abated.....		0	1	6	14	Ditto	2	6	16	0
			14	1	6				14	1	6
	Dr. William Ward.						*Cr.*				
1837	To Goods.....	1	10	0	6	1837	By Bill at 2 months.....	1	27	5	6
Jan. 6	Ditto.....	2	17	5	0	Jan. 10					
10			27	5	6						

(Folio 2.) **LEDGER.**

	Dr. William Ward.				*Cr.*		
1837 Jan. 6	To Goods	1	10 0 6	1837 Jan. 10	By Bill at 2 months	1	27 5 6
10	Ditto	2	17 5 0				
			27 5 6				

1836 Jan 7	*Dr. William Cooper,* To Goods	1	£ s. d. 0 6 6	1837 Jan. 6	*Cr.* By Cash	1	£ s. d. 0 6 6
1836 Jan. 7	*Dr, Richard Johnson,* To Goods	2	4 8 6	1837 Jan. 14	*Cr.* By Cash	1	4 8 0
					Abated		0 0 6
							4 8 6
Jan. 24	Ditto	3	9 15 6		Balance	3	9 15 6
1837 Jan. 12	*Dr. John Smith,* To Goods	2	1 10 6	1837 Jan. 21	*Cr.* By Cash		3 9 6
19	Ditto	2	0 13 2		Abated		0 0 5
21	Ditto	2	1 6 3				
			3 9 11				3 9 11
23	Ditto	3	0 9 6				
24	Ditto	3	0 8 3				
			0 17 9		Balance	3	0 17 9
1837 Jan. 17	*Dr. John Newton,* To Goods	2	1 10 4	1837 Jan. 23	*Cr.* By Cash	1	0 15 0
					Balance	3	0 15 4
							1 10 4
1837 Jan. 31	*Dr. Yates and Lane,* To Bill	1	172 16 0	1837 Jan. 23	*Bradford,* *Cr.* By Goods	3	172 16 0

(Folio 3.) **LEDGER.** (Folio 3.)

			£ s. d.				£ s. d.
1837 Jan 23	*Dr. Benj. Edwards,* To Cash.....	1	2 8 0	1837 Jan. 23	*Manchester,* Cr. By Goods.....	3	2 8 0
1837 Jan. 26	*Dr. Edward Mason,* To Goods.....	3	148 12 0	1837 Jan. 30	Cr. By Bill.....	1	150 0 0
30	Cash	1	1 8 0				
			150 0 0				
1837 Jan. 27	*Dr. Thomas Parker,* To Goods	3	50 8 0	1837 Jan. 31	Cr. By Cash	1	10 0 0
					Balance.....	3	40 8 0
							50 8 0
1837	*Dr. Bills payable,* Balance	3	172 16 0	1837 Jan. 31	Cr. By Yates & Lane's Bill.....	3	172 16 0
	GENERAL.				BALANCE.		
1837 Jan. 31	*Dr. Balance,* £ s. d.	1			*Balance,* Cr. £ s. d.		
	To Bill due March 16..150 0 0				By Bills payable due		
	deduct discount 0 18 1		149 1 11		April 2. .....172 16 0	3	
	To Cash	1	20 16 6		deduct discount 1 8 10		171 7 2
	Bernard & Co. owe.....	1	374 10 1		By 1 month's rent.....		1 10 0
	Richard Johnson.....	2	9 15 6		Stock account.....	1	423 7 11
	John Smith,.....	2	0 17 9				
	John Newton.....	3	0 15 4				
	Thomas Parker	3	40 8 0				
			596 5 1				596 5 1

Richard Johnson.....	2	0	17	9	By 1 month's rent.....		1 10 0
John Smith,.....	2	0	17	9	Stock account.....	1	423 7 11
John Newton.....	3	0	15	4			
Thomas Parker	3	40	8	0			
		596	5	1			596 5 1