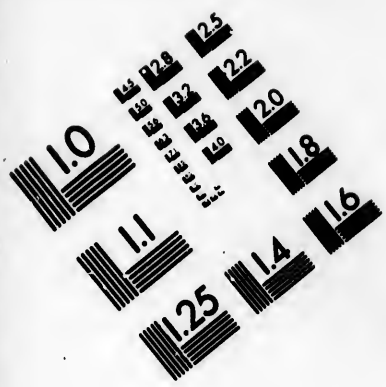

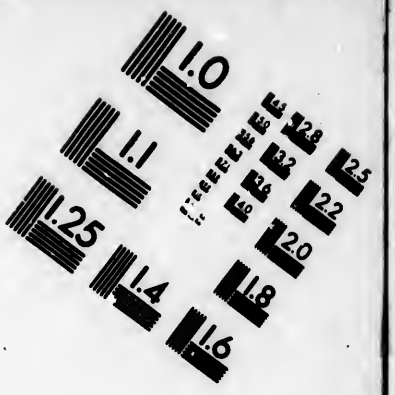

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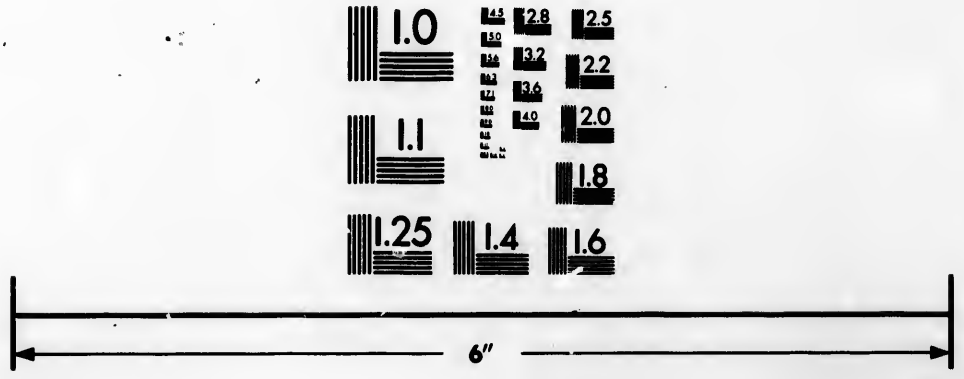

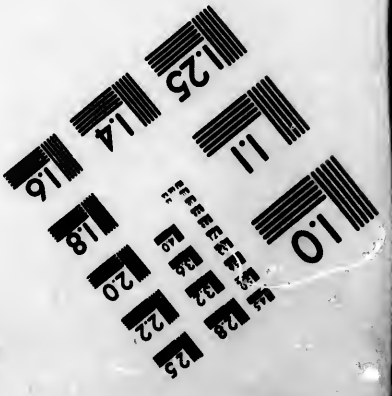

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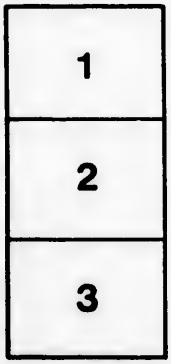

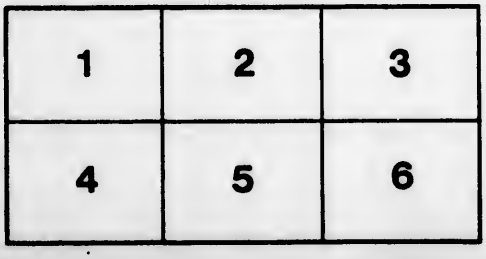

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THE

ACCOUNTANT'S GUIDE,

THE

ELEMENTARY [illegible]

IN CANADA.

BY WILLIAM MORRIS

PUBLISHED

BY THE AUTHORITY OF THE PARLIAMENT OF
LOWER CANADA.

QUEBEC:
1833.

NOTICE.

Having encountered many difficulties during ten years as a Teacher in Quebec for want of a proper initiating book of arithmetic, I was induced to compile the following work, which it is believed is suited to supply the existing demand of Elementary schools in that department.

My object has been to select only that which is useful and esssential to a good Accountant, Measurer and Book-Keeper. The arrangement is designed to meet the present state of our schools; and to facilitate the acquisition of common Arithmetic in the shortest time of which the study admits.

The public are indebted to the liberality of the Provincial Legislature for the sum of *fifty pounds*, which they voted toward the expenses of the publication, that the price might be so reduced, that all the children may be supplied with a copy. If the work should advance the cause of Education in our Elementary schools, the beneficence of the Parliament will be repaid, and the object of the Compiler will be fully attained.

WILLIAM MORRIS.

Quebec, 13th June, 1833.

CONTENTS.

ARITHMETIC.

QUESTION. What is Arithmetic?

ANSWER. Arithmetic is the art of reckoning by numbers; and consists of five principal rules; namely, Notation or Numeration, Addition, Subtraction, Multiplication, and Division.

Q. How are numbers expressed?

A. All numbers are expressed by the ten following figures:

1	2	3	4	5	6	7	8	9	10	0
one, or unit,	two,	three,	four,	five,	six,	seven,	eight,	nine,	ten,	cypher.

NUMERATION AND NOTATION.

Q. What is Notation?

A. Notation is the method of writing down a number in figures.

Q. What is Numeration?

A. Numeration is the art of reading a number expressed in figures.

Q. How must numbers be read?

A. From the left hand toward the right hand.

Q. How does the value of figures increase?

A. In a ten-fold proportion from the right hand toward the left; thus, the first figure on the right hand signifies so many units; in the second place it represents so many tens; and, in the third place, so many hundreds.

Q. What is the use of the cypher?

A. The cypher serves to bring figures to their proper places, by supplying vacant places. Thus, 7, seven; 70, seventy; 700, seven hundred; 770, seven hundred and seventy; 777, seven hundred and seventy-seven.

Q. Repeat your

NUMERATION TABLE.

Hundreds of millions.	Tens of millions.	Millions.	Hundreds of thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
9.	8	7,	6	5	4,	3	2	1

A. Units, one; tens, twenty-one; hundreds, three hundred and twenty-one; thousands, four thousand three hundred and twenty-one; tens of thousands, fifty-four thousand three hundred and twenty-one; hundreds of thousands, six hundred and fifty-four thousand, three hundred and twenty-one; millions, seven million, six hundred and fifty-four thousand, three hundred and twenty-one; tens of millions, eighty seven millions, six hundred and fifty-four thousand, three hundred and twenty-one; hundreds of millions, nine hundred and eighty-seven millions, six hundred and fifty-four thousand, three hundred and twenty-one.

Examples.

Write down in *Figures* the following numbers:

1. Twenty-three? Ans. 23.
2. Two hundred and fifty-four.
3. One thousand eight hundred and thirty-two.
4. Twenty-five thousand, eight hundred and fifty-six.
5. One hundred and twenty-three thousand, one hundred and twenty-three.
6. Eight hundred thousand, seven hundred and six.
7. Four millions, nine hundred and forty-one thousand four hundred.
8. Twenty-seven millions, one hundred fifty-seven thousand, eight hundred thirty-two.
9. Seven hundred and twenty-two millions, two hundred thirty-one thousand, five hundred and four.

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

Write down in *Words* the following numbers:

11. 35.		Ans. Thirty five.
12. 59	15. 2017	18. 2071909.
13. 172	16. 20760	19. 70054008.
14. 909	17. 754058	20. 123456789.

ADDITION.

Q. What is Addition?

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

Q. Repeat your Addition Table.

A. One and one are two, 1 and 2 are 3, 1 and 3 are 4, and so on.

Addition Table.

	1	2	3	4	5	6	7	8	9
1 and =	2	3	4	5	6	7	8	9	10
2 „ =	3	4	5	6	7	8	9	10	11
3 „ =	4	5	6	7	8	9	10	11	12
4 „ =	5	6	7	8	9	10	11	12	13
5 „ =	6	7	8	9	10	11	12	13	14
6 „ =	7	8	9	10	11	12	13	14	15
7 „ =	8	9	10	11	12	13	14	15	16
8 „ =	9	10	11	12	13	14	15	16	17
9 „ =	10	11	12	13	14	15	16	17	18

Q. Repeat your

MONEY TABLE.

A. 4 Farthings make 1 penny,
12 Pence make 1 shilling,
and 20 Shillings make 1 pound sterling.

NOTE.—£ stands for pounds.
s. stands for shillings.
and *d.* stands for pence.
¼ signifies one farthing.
½ signifies two farthings or a halfpenny.
¾ signifies three farthings.

Q. Repeat the following

Tables.

FARTHINGS.		PENCE.						SHILLINGS.		
qrs.	*d.*	*d.*		*s.*	*d.*	*d.*		*s.*		£ *s.*
4 make	1	12 make		1	0	70 make	5 10	20 make		1 0
5 „	1¼	18 „		1	6	72 „	6 0	30 „		1 10
6 „	1½	20 „		1	8	80 „	6 8	40 „		2 0
7 „	1¾	24 „		2	0	84 „	7 0	50 „		2 10
8 „	2	30 „		2	6	90 „	7 6	60 „		3 0
9 „	2¼	36 „		3	0	96 „	8 0	70 „		3 10
10 „	2½	40 „		3	4	100 „	8 4	80 „		4 0
11 „	2¾	48 „		4	0	108 „	9 0	90 „		4 10
12 „	3	50 „		4	2	110 „	9 2	100 „		5 0
		60 „		5	0	120 „	10 0			

Rule.—First place the numbers of a like denomination under each other; that is to say, pounds under pounds, shillings under shillings, pence under pence, and farthings under farthings.

Farthings' COLUMN.—Add up this column, beginning at the bottom, and, by the help of the farthing table, find how many pence it contains; if there be any farthings over, set them down under this column, and carry the pence to the next column.

Pence COLUMN.—Add up this column with the pence which you carried from the farthings, and by the help of the pence table find how many shillings it contains; if there be any pence over, set them down under this column, and carry the shillings to the next column.

Shillings' COLUMN.—Add up the units of this column to the top, then descend by the next column to the bottom, counting every one ten—then, by the help of the shilling table, find how many pounds it contains; if there be any shillings over, set them down under this column, and carry the pounds to the next column.

Pounds' COLUMN.—Add up each column, and if the sum exceed 10, put down the excess, or what is over, and carry one; but if it exceed 20, put down the excess, and carry 2; if 30, carry 3; 40, carry 4, and so on.

Examples.

	£	s.	d.
1. Add together	24	13	$2\frac{1}{4}$
	1	12	$4\frac{1}{4}$
	132	2	$5\frac{3}{4}$
	60	15	$2\frac{1}{4}$
Ans.	£219	3	$2\frac{3}{4}$

Farthings.—1 and 3 are 4, and 2 are 6, and 1 are 7—7 farthings are $1\frac{3}{4}d.$; set down $\frac{3}{4}$, and carry 1 to the pence.

Pence.—1 carried and 2 are 3, and 5 are 8, and 4 are 12, and 2 are 14—14*d.* are 1*s.* 2*d.*; set down 2*d.*, and carry 1 to the shillings.

Shillings.—1 carried and 5 are 6, and 2 are 8, and 2 are 10, and 3 are 13, and 10 are 23, and 10 are 33, and 10 are 43—43*s.* are £2 3*s.*; set down 3, and carry 2 to the pounds.

Pounds.—2 carried and 2 are 4, and 1 are 5, and 4 are 9; set down 9; 6 and 3 are 9, and 2 are 11; set down 1, and carry 1 to the next column; 1 carried and 1 are 2, set down 2. Total in words, Two hundred and nineteen pounds, three shillings, and two-pence three farthings.

	£	s.	d.
2.	26	12	$3\frac{1}{4}$
	10	13	$2\frac{1}{2}$
	12	3	$1\frac{3}{4}$
	11	2	2

	£	s.	d.
3.	27	11	$4\frac{1}{2}$
	29	10	$2\frac{1}{2}$
	13	14	$3\frac{1}{2}$
	10	4	$4\frac{1}{2}$

	£	s.	d.
4.	30	12	$4\frac{1}{2}$
	22	14	$2\frac{1}{2}$
	14	15	3
	19	10	$3\frac{3}{4}$

	£	s.	d.
5.	121	13	$3\frac{3}{4}$
	133	10	$2\frac{1}{4}$
	120	12	$1\frac{1}{2}$
	102	14	$6\frac{3}{4}$

	£	s.	d.
6.	241	14	$3\frac{1}{4}$
	253	11	$10\frac{1}{2}$
	142	17	$2\frac{1}{2}$
	240	13	2

	£	s.	d.
7.	372	10	$4\frac{1}{2}$
	121	11	$3\frac{1}{2}$
	327	16	$9\frac{1}{4}$
	172	14	3

8. Place the following sums of money properly under each other, and add them together, namely, £178 3*s.* $4\frac{1}{2}$*d.* £27 5*s.* 7*d.*+£234 4*s.* $6\frac{1}{4}$*d.*+£30 2*s.* 3*d.*

Ans. £469 15*s.* $8\frac{3}{4}$*d.*

9. Add together £1734 16*s.* $2\frac{1}{4}$*d.*+£123 14*s.* $1\frac{1}{2}$*d.*+£14 1*s.* $10\frac{3}{4}$*d.*+£239 18*s.* $6\frac{1}{2}$*d.* Ans. £2112 10*s.* 9*d.*

10. Add together £3109 0*s.* 11*d.*+£798 13*s.* $4\frac{1}{2}$*d.*+£9146 13*s.* 7*d.*+£874 0*s.* 8*d.*+£9146 3*s.* 4*d.*+£8749 13*s.* 5*d.*+£8735 19*s.* 9*d.* Ans. £40560 5*s.* $0\frac{1}{2}$*d.*

11. Add together £38456 13*s.* $2\frac{1}{2}$*d.*+£1403 10*s.* $4\frac{1}{4}$*d.*+£130 0*s.* $10\frac{1}{2}$*d.*+£123 18*s.* $2\frac{1}{2}$*d.*+£21 4*s.* 9*d.*+£213 2*s.* $7\frac{3}{4}$*d.*+£241 1*s.* 3*d.*

Ans. £45589 11*s.* $3\frac{1}{2}$*d.*

12. Add together £30745 17*s.* $4\frac{1}{2}$*d.*+£3170 0*s.* 7*d.*+£21074 10*s.* 0*d.*+£753 0*s.* 0*d.*+—£39875 1*s.* 10*d.*+£29 19*s.* $11\frac{3}{4}$*d.* Ans. £95648 9*s.* $4\frac{1}{2}$d.

13. Suppose that A is indebted to B £34 13*s.* 7*d.*, and to C £1730, to D £9 19*s.* 2*d.*, to E £134 0*s.* 7*d.*,

to F 17*s.* 2*d.*, and to G 9*d.* What is the amount of A's whole debt? Ans. £1909 11*s.* 3*d.*

14. Suppose that B owes A £75 17*s.*; C owes 15*s.* 5*d.*; D owes £21 13*s.* 6½*d.*; E owes 9½*d.*; F owes £796 0*s.* 3*d.*; and G owes £17 13*s.* 10*d.* What is due to A by all of them? Ans. £912 0*s.* 10*d.*

15. A owes to B for tea £13 10*s.*; for cheese £17 13*s.* 5*d.*; for cotton £208 17*s.*; for Indian chintz £86 and 7*d.*; for his acceptance of a bill £300; for factorage £15 17*s.* 3¾*d.*; also for insurance and other charges £30 10*s.* 4½*d.* How much is A's whole debt to B?

Ans. £672 8*s.* 8½*d.*

16. A corn factor pays for wheat £37 15*s.* 8*d.*; for rye £11 16*s.* 3*d.*; for oats £96 and 7½*d.*; for barley £53 12*s.*; also for peas and beans £10; he has also paid for carriage and other petty charges £3 17*s.* 5¾*d.*; and for insurance £11 3¾*d.* Now, supposing his commission on the whole is £7 3*s.* 0½*d.*, for how much must he draw upon his employer to clear the account?

Ans. £231 5*s.* 4½*d.*

17. A merchant has in cash £148 17*s.* 8*d.*; wine to the value of £718 11*s.* 8*d.*; rum £398 18*s.* 5½*d.*; brandy £178 19*s.* 11*d.*; gin £918 13*s.* 11*d.*; tea £518 11*s.* 11*d.*; sugar £315 19*s.* 8½*d.*; various other goods £317 19*s.* 8*d.* What is the worth of his stock?

Ans. £3516 12*s.* 11*d.*

18. A bankrupt owed to one of his creditors £784 18*s.* 11*d.*; to another £315 17*s.* 8*d.*; to another £88 0*s.* 11¾*d.*; to another £778 15*s.* 8*d.*; to another £785 18*s.* 11¼*d.*; to another £13 8*s.* 6½*d.*; to another £57 18*s.*; to another £318; to another £154 11*d.* Required his whole debt? Ans. £3296 18*s.* 8½*d.*

SUBTRACTION.

Q. What is subtraction?

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

Q. Repeat your

Subtraction Table.

		0 = 1	1 = 2	2 = 3	3 = 4	4 = 5	5 = 6	6 = 7	7 = 8	8 = 9	9 = 10
1	from	1	2	3	4	5	6	7	8	9	10
2	„	2	3	4	5	6	7	8	9	10	11
3	„	3	4	5	6	7	8	9	10	11	12
4	„	4	5	6	7	8	9	10	11	12	13
5	„	5	6	7	8	9	10	11	12	13	14
6	„	6	7	8	9	10	11	12	13	14	15
7	„	7	8	9	10	11	12	13	14	15	16
8	„	8	9	10	11	12	13	14	15	16	17
9	„	9	10	11	12	13	14	15	16	17	18

Rule.—Set the less number under the greater, observing to write pounds under pounds, shillings under shillings, pence under pence, and farthings under farthings, as in addition; then begin at the right hand, or the farthings, and subtract each number of the under line from that of the like name in the upper: but if it be too great, subtract it from the value of one of the next higher name, add the remainder to the upper number, and write the sum below; and in this case carry one to the under figure of the next name.

Examples.

		10	20	12	4
		£	s.	d.	
1.	From	438	15	7½	
	Take	278	17	9½	
Ans.		£159	17	9¾	

Farthings.—Take 2 farthings from 1 farthing I cannot, 2 farthings from 4 farthings and 2 remain—2 and 1 are 3 farthings, set down $\frac{3}{4}$, and carry 1 to the pence.

Pence.—1 carried and 9 are 10, take 10 from 7, I cannot, 10 from 12 and 2 remain—2 and 7 are 9; set down 9, and carry 1 to the shillings.

Shillings.—1 carried and 17 are 18; take 18 from 15 I cannot; 18 from 20 and 2 remain—2 and 15 are 17; set down 17 and carry 1 to the pounds.

Pounds.—1 carried to 8 are 9; take 9 from 8 I cannot, 9 from 10 and 1 remains—1 and 8 are 9; set down 9 and carry 1 to the next column; 1 carried and 7 are 8; take 8 from 3 I cannot; 8 from 10 and 2 remain—2 and 3 are 5; set down 5, and carry 1 to the next column; 1 carried and 2 are 3—take 3 from 4, and 1 remains; set down 1.

Remainder in words, one hundred and fifty-nine pounds, seventeen shillings and nine-pence three farthings.

2.	From	£547	13	10	3.	From	£7864	17	$4\frac{3}{4}$
	Take	326	10	9		Take	5412	11	$1\frac{1}{2}$
4.	„	£21384	2	$7\frac{1}{2}$	5.	„	£721384	3	$7\frac{1}{2}$
	„	10120	1	$2\frac{3}{4}$		„	120123	0	$4\frac{1}{2}$
6.	„	£53907	11	$5\frac{1}{2}$	7.	„	£38597	12	$1\frac{1}{2}$
	„	21302	10	$10\frac{1}{2}$		„	13270	10	$8\frac{3}{4}$
8.	„	£32975	16	$4\frac{1}{2}$	9.	„	£57384	13	7
	„	12264	17	$9\frac{3}{4}$		„	27172	18	$10\frac{1}{2}$
10.	„	£75432	3	$8\frac{3}{4}$	11.	„	£37921	10	$2\frac{1}{2}$
	„	14129	1	$7\frac{1}{2}$		„	12737	8	$1\frac{1}{2}$

12.	From	£37205	13	9½	13.	From	£75032	0	4½
	Take	17921	17	9½		Take	17392	16	6½
14.	„	£12754	19	7	15.	„	£9999	0	0
	„	139	11	10		„	0	0	¼

16. What is the difference between £73 0*s.* 5½*d.* and £19 13*s.* 10*d.* Ans. £53 6*s.* 7½*d.*

17. A lends to B £100. How much is B in his debt, after A has received £73 12*s.* 4¾*d.*? Ans. £26 7*s.* 7¼*d.*

18. Subtract £17 2*s.* 6*d.* from £500, and tell me the remainder? Ans. £482 17*s.* 6*d.*

19. If £482 17*s.* 6*d.* be taken from £500, what will be the remainder? Ans. £17 2*s.* 6*d.*

20. If I owe my friend £700, and I pay him £50 2*s.* 9½*d.* on account, what will remain due?
Ans. £649 17*s.* 2½*d.*

21. What is the difference between £99 19*s.* 11¾*d.* and £100? Ans. ¼.

22. Take one farthing from £100.
Ans. £99 19*s.* 11¾*d.*

23. A merchant has in cash £474 8*s.* 9*d.*; goods, value £3443 15*s.*; a house worth £713 11*s.*; a ship £574; another £315; debts due to him £957 18*s.* 11½*d.* Now he owes to A £115 7*s.* 8*d.*; to B £327 18*s.* 4¾*d.*; to C £74 13*s.* 4*d.* I demand his net stock?
Ans. £5960 14*s.* 3¾*d.*

24. A borrowed from B, at sundry times, the following sums, viz. £781, £63 15*s.*, £52 10*s.*, £565; and has paid as follows, at different times in cash, £330 10*s.*, £54 13*s.* 4*d.*, £67 10*s.*; in goods £54 18*s.* 6*d.*, £73 15*s.* 8*d.*; by a draft on John Steele, £63. What is A still due? Ans. £817 17*s.* 6*d.*

25. Suppose that my rent for half a year is £10 12*s.*; and that I have laid out, for the land tax, 14*s.* 6*d.*, and for several repairs £1 3*s.* 3¼*d.*, what have I to pay of my half year's rent? Ans. £8 14*s.* 2¾*d.*

MULTIPLICATION.

Q. What is Multiplication?

A. Multiplication teaches how to increase the greater of two Numbers given, as often as there are units in the less; and compendiously performs the office of many additions.

Q. Repeat your

Multiplication Table.

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

Rule 1.—When the multiplier is not greater than 12, write it under the pence of the multiplicand, and in multiplying, put down the overplus of farthings, pence, and shillings, and carry as in addition.

Examples.

		£	s.	d.	
1.	Multiply	14	16	7¼	Multiplicand
	by			7	Multiplier
		£103	16	2¾	Product.

Farthings.—7 times 1 are 7—7 farthings are $1\frac{3}{4}d.$; set down $\frac{3}{4}$, and carry 1 to the pence.

Pence.—7 times 7 are 49, and 1 carried are 50—50*d.* are 4*s.* 2*d.*; set down 2, and carry 4 to the shillings.

Shillings.—7 times 16 are 112, and 4 are 116—116*s.* are £5 16*s.*; set down 16 and carry 5 to the pounds.

Pounds.—7 times 4 are 28, and 5 carried are 33; set down 3, and carry 3.—7 times 1 are 7, and 3 carried are 10; set down 10. Product in words, one hundred and three pounds, sixteen shillings, and two-pence three farthings.

		£	s.	d.			£	s.	d.
2.	Multiply	124321	2	$4\frac{1}{4}$	3.	Multiply	23434	5	$5\frac{1}{2}$
	by			2		by			2
4.	,,	234204	4	$2\frac{1}{4}$	5.	,,	135246	5	41
	,,			3		,,			3
6.	,,	432510	5	$3\frac{1}{2}$	7.	,,	274321	6	$2\frac{3}{4}$
	,,			4		,,			4
8.	,,	34523	12	$6\frac{1}{2}$	9.	,,	273534	13	$3\frac{1}{2}$
	,,			5		,,			5
10.	,,	417383	11	$3\frac{1}{2}$	11.	,,	543210	14	$4\frac{3}{4}$
	,,			6		,,			6
12.	,,	350214	15	$4\frac{1}{4}$	13.	,,	215438	16	$2\frac{1}{2}$
	,,			7		,,			7

		£	s.	d.			£	s.	d
14.	Multiply	521403	6	$7\frac{3}{4}$	15.	Multiply	483025	7	$10\frac{1}{2}$
	by			8		by			8
16.	„	378210	0	$10\frac{1}{2}$	17.	„	321457	17	$4\frac{1}{2}$
	„			9		„			9
18.	„	527032	7	$3\frac{3}{4}$	19.	„	382721	14	$3\frac{3}{4}$
	„			10		„			10
20.	„	387204	15	$2\frac{1}{2}$	21.	„	432579	10	4
	„			11		„			11
22.	„	521432	13	$4\frac{1}{2}$	23.	„	732173	4	$10\frac{1}{2}$
	„			12		„			12

To multiply by any number greater than 12, observe the following

Rule.—Multiply the top line by 10, and that product again by the same number, until you have as many lines as there are figures in the multiplier; then multiply the 1st line by the last figure, the second line by the 2nd figure, and so on; add these products together, and the sum will be the product of the number given.

Examples.

24. What is the price of 345 yards of cloth, at £2 12*s.* 7½*d.* per yard?

1st line	£2	12	7½	×5	
			10		
2nd line	26	6	3	×4	
			10		
3rd line	263	2	6	×3	
			3		
	789	7	6	price of 300	yards.
	105	5	0	price of 40	„
	13	3	1½	price of 5	„
Ans.	£907	15	7½	price of 345	yards.

For 13, multiply by 10, and add 3 times the top line.
14, multiply by 10, and add 4 times the top line, &c.
24, multiply by 10 and by 2, and add 4 times the top line.
35, multiply by 10 and by 3, and 5 times the top line.
46, multiply by 10 and by 4, and 6 times the top line.
127, by 10 and by 10, twice the second line and 7 times the top line.
394, by 10 and by 10, 3 times the 3rd line, 9 times the 2nd, and 4 times the top line.

N. B.—The pupil should be exercised for a few minutes in the plan above, before he enters on the following questions:—

What is the price of

25. 13 lb of sugar, at 1*s.* 3*d.* per lb? Ans. 16*s.* 3*d.*
26. 14 moidores, at £1 7*s.* each? Ans. £18 18*s.*
27. 15 pistoles, at 17*s.* 6*d.* each? Ans. £13 2*s.* 6*d.*
28. 16 cwt. of cheese, at £1 18*s.* 8*d.* per cwt.? Ans. £30 18*s.* 8*d.*

29. 18 cwt. of tobacco, at £5 11*s.* 4*d.* per cwt.?
Ans. £100 4*s.*

30. 20 cwt. of hops, at £4 7*s.* 2*d.* per cwt.?
Ans. £87 3*s.* 4*d.*

31. 21 cwt. of hemp, at £1 12*s.* per cwt.?
Ans. £33 12*s.*

32. 22 tons of hay, at £1 2*s.* per cwt?
Ans. £24 4*s.*

33. 25 yds. of broad cloth, at 9*s.* 2*d.* per yard?
Ans. £11 9*s.* 2*d.*

34. 28 yds. of superfine do. at 19*s.* 4*d.* per yard?
Ans. £27 1*s.* 4*d.*

35. 32 yds. serge, at 3*s.* 7*d.* per yard?
Ans. £5 14*s.* 8*d.*

36. 48 acres of land, at £2 3*s.* per acre?
Ans. £103 4*s.*

37. 66 gallons of rum, at 8*s.* 10*d.* per gal.?
Ans. £29 3*s.*

38. 84 qrs. of wheat, at £1 12*s.* 8*d.* per qr.?
Ans. £137 4*s.*

39. 106 qrs. of barley, at 14*s.* 7¼*d.* per qr.?
Ans. £77 8*s.* 0½*d.*

40. 127 cwt. of hops, at £3 0*s.* 2*d.* per cwt.?
Ans. £382 1*s.* 2*d.*

41. 224 lb of tea, at 7*s.* 3¼*d.* per lb?
Ans. £81 8*s.* 8*d.*

42. 336 lb of do. at 5*s.* 2¾*d.* per lb?
Ans. £87 17*s.*

43. 532 firkins of butter, at £2 15*s.* 6*d.* per firkin?
Ans. £1476 6*s.*

44. 941 cwt. of sugar, at £7 0*s.* 4*d.* per cwt.?
Ans. £6602 13*s.* 8*d.*

45. 3918 yds. of brown cloth, at 12*s.* 6*d.* per yard?
Ans. £2448 15*s.*

46. 6874 sets of buckles, at 15*s.* 6*d.* per set?
Ans. £5327 7*s.*

47. 9674 yds. of velvet, at 14*s.* 10*d.* per yard?
Ans. £7174 17*s.* 8*d.*

48. 10,000 yds. of shalloon, at 11½*d.* per yard?
Ans. £479 3*s.* 4*d.*

Rule 3.—To multiply a whole number by a number consisting of two or more figures. Place the multiplier under the multiplicand, then multiply by each figure separately, observing to put the first figure of every product under its multiplier. Add these products together, and the sum will be the total product required.

Examples.

49. Multiply 472035 by 20034? Ans. 9456749190.

Multiply	472035	Multiplicand
by	20034	Multiplier
	1888140	
	1416105	
	944070	
Ans.	9456749190	Product.

50. Multiply 273580961 by 23? Ans. 6292362103.
51. Multiply 402097316 by 195? Ans. 78408976620.
52. Multiply 82164973 by 3027?
Ans. 248713373271.
53. Multiply 16358724 by 704006?
Ans. 11516639848344.
54. How many letters are there in a page of a book which contains 45 lines, each line 59 letters?
Ans. 2655 letters.
55. How many grains of wheat will fill 987 bushels, when 1 bushel contains 675000?
Ans. 666225000 grains.
56. How many strokes does the hammer of a clock strike in a year of 365 days, at 156 strokes in a day?
Ans. 56940 strokes.
57. How many feet will reach from Quebec to Montreal, if the distance be 180 miles, and 5280 feet in a mile?
Ans. 950400 feet.

DIVISION.

Q. What is Division?

A. Division is the method of finding how often one number is contained in another. The first number is called the Divisor, the second the Dividend, and the result the Quotient.

Q. Repeat your

Division Table.

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

Rule 1.—When the divisor is not greater than 12, place the divisor on the left hand of the dividend, with a curve line between them; then find how often the divisor is contained in the dividend, and place the numbers under the figures divided; observing to reduce the remainder in each name, if any, into the next inferior denomination, adding the given number of that name, and so continue to divide in the same manner to the lowest name placing the last remainder, if any, on the right.

Examples.

1. Divide £6207 3*s.* 8½*d.* by 5.

	£	*s.*	*d.*
5)	6207	3	8½
Ans.	£1241	8	8½ — 2 over.

Pounds.—5 into 6, once and 1 over—set down 1, and carry 10—10 and 2 are 12, 5 into 12, twice and 2 over—set down 2, and carry 20—20 and 0 are 20, 5 into 20, 4 times—set down 4—5 into 7, once and 2 over—set down 1, and carry 40 to the shillings.

Shillings.—40 carried and 3 are 43, 5 into 43, 8 times and 3 over—set down 8, and carry 36 to the pence.

Pence.—36 carried and 8 are 44, 5 into 44, 8 times and 4 over—set down 8, and carry 16 to the farthings.

Farthings.—16 carried and 1 are 17, 5 into 17, 3 times and 2 over—set down ¾, and 2 over on the right.

	£	*s.*	*d.*
2.	2)2468	10	4
3.	2)26845	4	10
4.	3)36390	12	9
5.	3)43687	2	3
6.	4)48408	16	8
7.	4)57385	5	4
8.	5)56126	6	4½
9.	5)62716	7	3½
10.	6)78459	6	3
11.	6)84037	7	4½

	£	s.	d.
12.	7)834576	2	3¾
13.	7)321407	4	5¾
14.	8)123729	7	4
15.	8)786909	7	8¼
16.	9)387542	6	7½
17.	9)307200	4	1¾
18.	10)527343	12	10¼
19.	10)321785	5	8½
20.	11)387503	16	8¾
21.	11)87927	9	5½
22.	12)32040	0	4¾
23.	12)87980	0	10½

Rule 2.—To divide by any number greater than 12. First; draw a curve line on each side of the dividend, and put the divisor on the left hand side; make a small table, by multiplying the divisor by the 9 digits, 1, 2, 3, &c. respectively placing the products with their multipliers in horizontal rows under the divisor. 2d. If the first figure of the dividend be *greater* than the first figures of the divisor, count off as many figures from the left hand of the dividend as there are figures in the divisor; but if the first figures be *less*, count 1 figure more from the dividend for the *first member*. Look in the table for that product which is next less than the first member, and place it under the said member, and the figure which stands on the same line with the product, must be placed on the right hand of the dividend for the 1st quotient figure. Subtract the said product from the first member of the dividend, and bring down the next figure of the dividend to the remainder for a *second member;* proceed with this member the same as before, and so continue till all the figures of the pounds are brought down. Multiply the remainder from the pounds, if any,

by 20, adding in the shillings of the dividend, and divide as before. Multiply the remainder from the shillings, if any, by 12, adding in the pence of the dividend, and divide again. Multiply the remainder from the pence, if any, by 4, adding in the farthings, and when divided once more the operation will be finished.

Examples.

24. Divide £375683 17*s.* 3½*d.* by 234.

DIVISOR.	DIVIDEND. £	*s.*	*d.*	QUOTIENT. £	*s.*	*d.*
1 . . 234)	375683	17	3½	(1605	9	8¾—32 rem.
2 . . 468	234'''					
3 . . 702	1416					
4 . . 936	1404					
5 . . 1170	1283					
6 . . 1404	1170					
7 . . 1638	113 remainder from the pounds.					
8 . . 1872	20					
9 . . 2106	234) 2277 (9*s.*					
	2106					
	171 remainder from the shillings.					
	12					
	234) 2055 (8*d.*					
	1872					
	183 remainder from the pence.					
	4					
	234) 734 (¾					
	702					
	32 remainder.					

Ans. £1605 9*s.* 8¾*d.*=32 remain.

25. Divide £14693 4*s*. 6½*d*. by 13?
Ans. £1130 4*s*. 11½*d*.—$\frac{4}{13}$.

26. Divide £17934 10*s*. 7¼*d*. by 14?
Ans. £1281 9*d*.—$\frac{5}{14}$.

27. Divide £37846 17*s*. 10¾*d*. by 16?
Ans. £2365 8*s*. 7¾*d*.—$\frac{11}{16}$.

28. Divide 5 7384 19*s*. 7½*d*. by 23?
Ans. £2494 19*s*. 11¾*d*.—$\frac{3}{23}$.

29. Divide £138457 14*s*. 2¼*d*. by 57?
Ans. £2429 1*s*. 7¾*d*.—$\frac{1}{2}\frac{8}{5}$.

30. Divide £137586 13*s*. 5½*d*. by 124?
Ans. £1109 11*s*. 4¾—$\frac{1}{1}\frac{8}{2}\frac{3}{4}$.

31. Divide £321204 19*s*. 11½*d*. by 674?
Ans. £476 11*s*. 3½*d*.—$\frac{4}{6}\frac{4}{7}\frac{8}{4}$.

32. Divide £1875486 13*s*. 5¼*d*. by 5374?
Ans. £348 19*s*. 10*d*.—$\frac{5}{5}\frac{2}{3}\frac{0}{7}\frac{7}{4}$.

33. Divide £49 14*s*. 6*d*. equally between 39 men?
Ans. £1 5*s*. 6*d*.

34. If 27 cwt. of sugar cost £47 18*s*. 9*d*., what cost 1 cwt.? Ans. £1 15*s*. 3¾*d*.—15 over.

35. If 72 yds. of cloth cost £85 5*s*. 6*d*., what cost 1 yard? Ans. £1 3*s*. 8¼*d*.

36. A prize of £7257 3*s*. 6*d*. is to be equally divided amongst 500 sailors. What is each man's share?
Ans. £14 10*s*. 3¼*d*.

37. If a gentleman's income be £500 a year, what is he worth each day, counting 365 days in a year?
Ans. £1 7*s*. 4¾*d*.

38. If a farm of 57 acres is let at £55 4*s*. 4½*d*., what is the rent per acre? Ans. 19*s*. 4½*d*.

39. If 6 men's wages for a year be £577 11*s*., what does each man earn per day? Ans. 4*s*. 6*d*.

SHOP ACCOUNTS.

Q. How are Shop Accounts calculated?

A. Shop accounts are generally calculated by Multiplication or Division; but when any doubts of correctness exist, accountants use both methods, in order to prove their work.

Q. What is meant by aliquot parts?

A. One number is said to be an aliquot or even part of another, when it divides it without a remainder: thus, 3 is an aliquot part of 12, because 3 divides 12 without a remainder; the following is a

Money Table of Aliquot Parts.

		OF 1*d.*	OF 1*s.*	OF £1.		OF £1.
$\frac{1}{4}$*d.*	1*s.*	$\frac{1}{4}$	OR, $\frac{1}{48}$	OR, $\frac{1}{000}$	1*s.*	1*s.* $\frac{1}{20}$
$\frac{1}{2}$	,,	$\frac{1}{2}$	,, $\frac{1}{24}$	,, $\frac{1}{480}$	1*s.* 3*d.*	,, $\frac{1}{16}$
1	,,	,,	,, $\frac{1}{12}$	,, $\frac{1}{240}$	1 8	,, $\frac{1}{12}$
$1\frac{1}{2}$	,,	,,	,, $\frac{1}{8}$	,, $\frac{1}{160}$	2 0	,, $\frac{1}{10}$
2	,,	,,	,, $\frac{1}{6}$	,, $\frac{1}{120}$	2 6	,, $\frac{1}{8}$
3	,,	,,	,, $\frac{1}{4}$	,, $\frac{1}{80}$	3 4	,, $\frac{1}{6}$
4	,,	,,	,, $\frac{1}{3}$	,, $\frac{1}{60}$	4 0	,, $\frac{1}{5}$
6	,,	,,	,, $\frac{1}{2}$	,, $\frac{1}{40}$	5 0	,, $\frac{1}{4}$
8	,,	,,	,, ,,	,, $\frac{1}{30}$	6 8	,, $\frac{1}{3}$
10	,,	,,	,, ,,	,, $\frac{1}{24}$	10 0	,, $\frac{1}{2}$

Rule 1.—If the given price or rate be an aliquot part of a penny, shilling, or pound, divide the quantity by the aliquot part, which gives the answer in pence, shillings, or pounds respectively: if the answer be found in shillings, divide by 20, to bring it to pounds; but if the answer be in pence, divide by 12, and then by 20.

N. B.—It is expected that the pupil will work each of the following questions by multiplication and division, as in the following

Examples.

1. What cost 100 lb of sugar, at 4*d.* per lb?

BY MULTIPLICATION.

£	*s.*	*d.*
0	0	4
		10
0	3	4
		10
Ans. £1	13	4

BY DIVISION.

s.

4*d.* is $\frac{1}{3}$ = 100 lb at 4*d.*

20) 0 33 4

Ans. £1 13 4

			d.		£	*s.*	*d.*
2.	16	yds. at	$0\frac{1}{4}$	Ans.	0	0	4
3.	26	„	$0\frac{1}{2}$	„	0	1	1
4.	37	„	1	„	0	3	1
5.	49	„	$1\frac{1}{2}$	„	0	6	$1\frac{1}{2}$
6.	57	„	2	„	0	9	6
7.	68	„	3	„	0	17	0
8.	74	„	4	„	1	4	8
9.	89	„	6	„	2	4	6
10.	90	„	8	„	3	0	0
11.	100	„ 1	0	„	4	3	4
12.	24	„ 1	0	„	1	4	0
13.	36	„ 1	3	„	2	5	0
14.	48	„ 2	0	„	4	16	0
15.	60	„ 2	6	„	7	10	0
16.	72	„ 3	4	„	12	0	0
17.	80	„ 4	0	„	16	0	0
18.	84	„ 5	0	„	21	0	0
19.	90	„ 6	8	„	30	0	0
20.	100	„ 10	0	„	50	0	0

Rule 2.—If the given price be not an aliquot part of a penny, shilling, or pound, take an aliquot part less than the price; and if the remainder be not an aliquot

part, take a part less than it, and so on, till all the parts together be equal to the given price; then add the values of all these parts together, and the sum will be the whole value at the given price.

Examples.

1. What cost 95 yds. at 6*s.* 6*d.* per yard?

BY MULTIPLICATION.

£	s.	d.	
0	6	6	× 5
		10	
3	5	0	
		9	
29	5	0	
1	12	6	
Ans. £30	17	6	

BY DIVISION.

95 at 6*s.* 6*d.*

s.	d.		£	s.	d.
5	0	is ½ =	23	15	0
1	0	is ⅕ =	4	15	0
	6	is ½ =	2	7	6
6	6	=	£30	17	6 Ans.

				s.			£	s.	d.
2.	121	yds.	at	0	¾	d. per yard?	Ans.	0	7	6¾
3.	127	,,		1	¼	,,	,,	0	13	2¾
4.	132	,,		2	¾	,,	,,	1	10	3
5.	147	,,		7	½	,,	,,	4	11	10½
6.	153	,,		9	¾	,,	,,	6	4	3¾
7.	159	,,		11	½	,,	,,	7	12	4½
8.	163	,,	1	2	½	,,	,,	9	16	11½
9.	175	,,	3	7	¾	,,	,,	31	18	0¼
10.	177	,,	6	9	½	,,	,,	60	2	1½
11.	183	,,	7	7	½	,,	,,	69	15	4½
12.	200	,,	8	7	½	,,	,,	86	0	10
13.	217	,,	9	6	¾	,,	,,	103	15	0¾
14.	237	,,	10	5	½	,,	,,	123	18	7½
15.	376	,,	11	4	½	,,	,,	213	17	0
16.	483	,,	12	9	½	,,	,,	308	18	4½
17.	596	,,	15	6	¾	,,	,,	463	15	3
18.	683	,,	17	9	½	,,	,,	607	11	8½
19.	999	,,	18	10	¾	,,	,,	943	16	11¼
20.	2000	,,	19	11	¾	,,	,,	1997	18	4

Rule 3.—When the quantity given consists of several denominations, as Tons, Hundreds, Quarters, and Pounds; multiply the price by the first or highest name, and take parts for the lower denominations, as follows:

Weight Table of Aliquot Parts.

			of 1 lb.		of 1 qr.		of 1 cwt.		of 1 ton.
0¼	lb	1s	¼	=	1/112	=	1/448	=	1/2000
0½	„	„	½	=	1/56	=	1/224	=	1/4480
1	„	„	„		1/28	=	1/112	=	1/2240
2	„	„	„		1/14	=	1/56	=	1/1120
3	„	„	„		1/7	=	1/28	=	1/560
4	„	„	„		¼	=	1/16	=	1/320
7	„	„	„		„	=	¼	=	1/160
8	„	„	„		½	=	⅛	=	1/280
14	„	„	„				1/7	=	1/140
16	„	„	„				¼	=	1/80
1qr.	„	„	„		„		½	=	1/40
2qrs.	„	„	„		„				1/20
1cwt.	„	„	„		„				1/10
2	„	„	„		„				⅕
4	„	„	„		„				¼
5	„	„	„		„				½
10	„	„	„		„				1

Examples.

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

£	*s*.	*d*.		Cwt.	qr.	lb.
3	17	6				
		5				
£19	7	6				
		5				
96	17	6	price of	25	0	0
2qrs.=½ of 1cwt.=	1	18	9	price of	0	2	0
14lb =¼ of 2qrs.=	0	9	8¼	price of	0	0	14
Ans. £99	5	11¼	price of	25	2	14.	

2. What cost 13cwt. 1qr. 7lb of molasses, at £1 12*s*. 4*d*. per cwt.? Ans. £21 10*s*. 5¼*d*.

3. What cost 18cwt. 2qr. 8lb of pearl ashes, at £2 5*s*. 6*d*. per cwt.? Ans. £42 5*s*.

4. What cost 21cwt. 3qr. 14lb of starch, at £2 16*s*. 8*d*. per cwt.? Ans. £61 19*s*. 7*d*.

5. What cost 32cwt. 1qr. 16lb of soap, at £3 5*s*. 11*d*. per cwt.? Ans. £106 15*s*. 2¾*d*.

6. What cost 43cwt. 2qr. 21lb of madder, at £3 19*s*. 4*d*. per cwt.? £173 5*s*. 10½*d*.

7. What cost 17cwt. 1qr. 11lb of cheese, at £3 14*s*. 8*d*. per cwt.? Ans. £64 15*s*. 4*d*.

8. What cost 85cwt. 1qr. 10lb of butter, at £4 6*s*. 4*d*. per cwt.? Ans. £368 7*s*. 7½*d*.

9. What cost 72cwt. 1qr. 18lb of hops, at £4 5*s*. 8*d*. per cwt.? Ans. £310 3*s*. 2*d*.

10. What cost 27cwt. 2qrs. 15lb of raisins, at £2 6*s*. 8*d*. per cwt.? Ans. £64 9*s*. 7*d*.

11. What cost 78cwt. 3qrs. 12lb of currants, at £2 17*s*. 9*d*. per cwt.? Ans. £227 14*s*.

12. What cost 56cwt. 1qr. 17lb of sugar, at £2 15*s.* 9*d.* per cwt.? Ans. £157 4*s.* 4½*d.*

13. What cost 97cwt. 15lb of tobacco, at £3 17*s.* 10*d.* per cwt.? Ans. £378 3*d.*

14. What cost 37cwt. 2qrs. 13lb of sugar, at £4 14*s.* 6*d.* per cwt.? Ans. £177 14*s.* 8½*d.*

15. What cost 15cwt. 1qr. 10lb of sugar, at £3 14*s.* 6*d.* per cwt.? Ans. £57 2*s.* 9*d.*

16. What cost 172cwt. 3qrs. 12lb of madder, at £4 15*s.* 4*d.* per cwt.? Ans. £823 19*s.* 0¼*d.*

17. What cost 53cwt. 17lb of soap, at £3 11*s.* 6*d.* per cwt.? Ans. £190 4*d.*

18. What cost 45tons 17cwt. 2qrs. of iron, at £7 18*s.* 4*d.* per ton? Ans. £363 3*s.* 6½*d.*

REDUCTION.

Q. What is Reduction?

A. Reduction is the changing or reducing monies, weights, and measures, &c. out of one denomination into other numbers of another denomination, but equal to the same in value.

Q. How are all great names brought into small?

A. *Multiply* by so many of the less as make one of the greater.

Q. How are all small names brought into great?

A. *Divide* by so many of the less as make one of the greater.

Money.

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

Pounds multiplied by 20, are shillings;
Shillings multiplied by 12, are pence;
Pence multiplied by 4, are farthings;
Pence multiplied by 2, are halfpence.

Farthings divided by 2, are halfpence;
Farthings divided by 4, are pence;
Pence divided by 12, are shillings;
Shillings divided by 20, are pounds.

Examples.

1. In £21 10*s*. 6½*d*., how many shillings, pence, and farthings?

£	*s*.	*d*.
21	10	6½

Multiply by 20 and add in the 10*s*.

Shillings = 430

Multiply by 12 and add in the 6*d*.

Pence = 5166

Multiply by 4 and add in the ½*d*.

Farthings = 20666

A. 430*s*. 5166*d*. 20666qrs.

2. In 20666 farthings, how many pence, shillings, and pounds?

4) 20666 farthings

12) 5166½ pence

20) 430 6½ shillings.

£21 10 6½

Proof of the first.

£	*s*.	*d*.
A. 5166*d*.	430*s*.	21 10 6½.

3. In £8, how many shillings? Ans. 160*s*.
4. In 160 shillings, how many pounds? Ans. £8.
5. In £12, how many farthings? Ans. 11520far.
6. In 11520 farthings, how many pounds? Ans. £12.
7. In £17 5*s*. 3¼*d*., how many farthings?
Ans. 16573.
8. In 16573 farthings, how many pounds?
Ans. £17 5*s*. 3¼*d*.
9. In £36 7*s*. 9*d*., how many pence?
Ans. 8733 pence.
10. In 8733*d*., how many pounds? Ans. £36 7*s*. 9*d*.
11. £375 17*s*. 10¾*d*., how many farthings?
Ans. 360859.
12. In 360859 farthings, how many pounds?
Ans. £375 17*s*. 10¾*d*.

13. In 100 crowns of 5*s.* each, how many farthings?
Ans. 24000 far.

14. In 36 guineas of 21*s.* each, how many pence?
Ans. 9072*d.*

15. In 9072*d.*, how many guineas of 21*s.* each?
Ans. 36 guineas.

TROY WEIGHT.

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

Pounds troy multiplied by 12, are ounces.
Ounces „ multiplied by 20, are pennyweights.
Pennyweights multiplied by 24, are grains.

Grains divided by 24, are pennyweights.
Pennyweights divided by 20, are ounces.
Ounces divided by 12, are pounds troy.

Examples.

1. In 1 lb troy, how many grains?

1 lb.
12
12 ounces.
20
240 pennyweights.
24
960
480
Ans. 5760 grains.

2. In 5760 grains how many pounds troy?

24) 5760 (grains.
48
240
96
96
0
20) 240 pennyweights.
12) 12 ounces.
Ans. 1 pound troy.

3. In 2 lbs. how many grains? Ans. 11520 grs.
4. Reduce 11520 grains into pounds? Ans. 2 lbs.
5. How many grains are there in 37 lbs.?
Ans. 213120 grs.
6. In 213120 grains, how many lbs.? Ans. 37 lbs.
7. In 484 lb 11 oz. 17 dwts. 23 grs., how many grains? Ans. 2793551 grs.
8. Reduce 2793551 grs. into pounds?
Ans. 484 lb. 11 oz. 17 dwts. 23 grs.

AVOIRDUPOIS WEIGHT.

16	Drams	make 1	Ounce.
16	Ounces	make 1	Pound.
14	Pounds	make 1	Stone.
2	Stone or 28 lb	make 1	Quarter.
4	Qrs. or 112 lb	make 1	Hundred wt.
20	Hundred wt.	make 1	Ton.

Tons multiplied by 20, are hundreds.
Hundreds multiplied by 4, are quarters.
Quarters multiplied by 28, are pounds.
Pound multiplied by 16, are ounces.
Ounces multiplied by 16, are drams.

Drams divided by 16, are ounces.
Ounces divided by 16, are pounds.
Pounds divided by 28, are quarters.
Quarters divided by 4, are hundreds.
Hundreds divided by 20, are tons.

Examples.

1. In 1 ton, how many drams?

1 ton.
20
—
20 hundreds.
4
—
80 quarters.
28
—
640
160
—
2240 pounds.
16
—
13440
2240
—
35840
16
—
215040
35840
—
Ans. £573440 drams.
—

2. Reduce 573440 drams into tons.

16) 573440 drams.
48 ——
——35840
93
80
——
134
128
——
64
64
——
0
16) 35840 ounces.
——
28) 2240 pounds.
——
4) 80 quarters.
——
20) 20 hundreds.
——
Ans. 1 ton.
——

3. In 15 tons how many pounds? Ans. 33600lbs.
4. Reduce 33600lbs. into tons. Ans. 15 tons.
5. In 27cwt. 2qrs. 12lb, how many lbs.?
Ans. 3092lbs.
6. Reduce 3092lbs. into cwts.
Ans. 27cwt. 2qrs. 12lb.
7. In 3 qrs. 14lb, how many ounces?
Ans. 1568 ounces.

8. Reduce 1568 ounces into quarters.

Ans. 3qrs. 14lbs.

9. In 35 tons, 17cwt. 1qr. 23lb. 7oz. 13drs., how many drams? Ans. 20571005drs.

10. Reduce 20571005drs. into tons.

Ans. 25ts. 17cwt. 1qr. 23lb. 7oz. 13drs.

CLOTH MEASURE.

2¼	Inches	make 1	Nail.
4	Nails	make 1	Quarter of a yard.
3	Quarters	make 1	Flemish ell.
4	Quarters	make 1	Yard.
5	Quarters	make 1	English ell.
6	Quarters	make 1	French ell.

Yards multiplied by 4, are quarters.
Quarters multiplied by 4, are nails.

Nails divided by 4, are quarters.
Quarters divided by 4, are yards.

Examples.

1. In 1 yard, how many nails?

1 yard.
4
—
4 quarters.
4
—
Ans. 16 nails.
—

2. Reduce 16 nails into yards?

4) 16 nails.
—
4) 4 quarters.
—
Ans. 1 yard.
—

3. In 37 yds., how many nails? Ans. 592 nails.
4. How many yds. are in 592 nails? Ans. 37 yds.
5. Reduce 15 yds. 3qrs. 1 n. to nails. ? Ans. 253 nails.
6. How many yds. are there in 253 nails?
Ans. 15yds. 3qrs. 1nl.
7. In 73 ells Flemish, how many qrs. ? Ans. 219qrs.
8. In 73 ells English, how many qrs. ? Ans. 365qrs.
9. In 73 ells French, how many qrs. ? Ans. 438qrs.
10. Reduce 352 nails into ells English?
Ans. 17 ells, 3qrs.

LONG MEASURE.

12	Lines	make 1	Inch.
12	Inches	make 1	Foot.
3	Feet	make 1	Yard.
5½	Yards	make 1	Pole or Rod.
40	Poles	make 1	Furlong.
8	Furlongs	make 1	Mile.
3	Miles	make 1	League.
69½	Miles	make 1	Degree.

Leagues multiplied by 3, are miles—miles multiplied by 8, are furlongs—furlongs multiplied by 40, are poles—poles multiplied by 5½, are yards—yards multiplied by 3, are feet—feet multiplied by 12, are inches.

Inches divided by 12, are feet—feet divided by 3, are yards—half-yards divided by 11, are poles—poles divided by 40, are furlongs—furlongs divided by 8, are miles—miles divided by 3, are leagues.

Examples.

1. In 1 mile, how many inches?

1
8
8 furlongs.
40
½ of = 320 poles.
5½
1600
160
1760 yards.
3
5280 feet.
12
Ans. 63360 inches.

2. In 63360 inches, how many miles?

12) 63360 inches.
3) 5280 feet.
5½ 1760 yards.
2 2
11) 3520
40) 320 poles.
8) 8 furlongs.
Ans. 1 mile.

3. In 273 miles, how many inches?
Ans. 17297280 inches.

4. Reduce 17297280 inches, how many miles?
Ans. 273 miles.

5. Reduce 5 m. 6 fur. 3 yds. into inches?
Ans. 364428 inches.

6. In 364428 inches, how many miles?
Ans. 5m. 6f. 3yds.

7. Reduce 2m. 1f. 8pls. 3yrds. 2inch. into inches?
Ans. 136334 inches.

8. In 136334 inc'. ;, how many miles?
Ans. 2 m. 1 f. 8 p. 3 yds. 2 inch.

LAND MEASURE.

144	Square inches	make 1	Square Foot.
9	Square feet	make 1	Square Yard.
30¼	Square yards	make 1	Sq. Pole or Perch.
40	Poles	make 1	Rood.
4	Roods, or 10 chains	make 1	Acre.

Acres multiplied by 4, are roods—roods multiplied by 40, are perches.

Perches divided by 40, are roods—roods divided by 4, are acres.

Examples.

1. In 1 acre, how many perches?

1 acre.
4
4 roods.
40
Ans. 160 perches.

2. In 160 perches, how many acres?

40) 160 perches.
4) 4 roods.
Ans. 1 acre.

3. In 15 acres, how many poles or perches?
Ans. 2400 poles.

4. How many acres are there in 2400 poles?
Ans. 15 acres.

5. Reduce 27a. 1r. 32p. into poles.
Ans. 4392 poles

6. Reduce 4392 poles into acres. Ans. 27a. 1r. 32p

LIQUID MEASURE.

2	Glasses	make 1	Gill.
4	Gills	make 1	Pint.
2	Pints	make 1	Quart
4	Quarts	make 1	Gallon.

42 Gallons make 1 Tierce.
63 Gallons make 1 Hogshead.
126 Gallons make 1 Pipe.
252 Gallons make 1 Tun.

Tuns multiplied by 4, are hogsheads—tuns multiplied by 2, are pipes or butts—pipes multiplied by 2, are hogsheads—hogsheads multiplied by 63, are gallons—gallons multiplied by 4, are quarts—quarts multiplied by 2, are pints—pints multiplied by 4, are gills.

Gills divided by 4, are pints—pints divided by 2, are quarts—quarts divided by 4, are gallons—gallons divided by 63, are hogsheads—hogsheads divided by 2, are pipes—hogsheads divided by 4, are tuns.

Examples.

1. In 1 tun, how many glasses?

1 tun.
4
4 hogsheads.
63
252 gallons.
4
1008 quarts.
2
2016 pints.
4
8064 gills.
2
Ans. 16128 glasses.

2. In 16128 glasses, how many tuns?

2) 16128 glasses.
4) 8064 gills.
2) 2016 pints.
4) 1008 quarts.
63) 252 gallons.
252 (4
4) 4 hogsheads.
Ans. 1 tun.

3. In 19 hogsheads, how many pints?

Ans. 9576 pints.

4. How many hogsheads are there in 9576 pints?

Ans. 19 hhd.

5. Reduce 13 t. 1 p. 1 hhd. 17 gal. 5 pts. into pints.

Ans. 27861 pints.

6. Reduce 27861 pints into tuns.

Ans. 13t. 1 p. 1 hhd. 17 gal. 5 pts.

DRY MEASURE.

2	Pints	make 1	Quart.
4	Quarts	make 1	Gallon.
2	Gallons	make 1	Peck.
4	Pecks	make 1	Bushel.
8	Bushels	make 1	Quarter.
5	Quarters	make 1	Load.
2	Loads	make 1	Last.

Lasts multiplied by 80, are bushels—bushels multiplied by 4, are pecks—pecks divided by 4, are bushels—bushels divided by 80, are lasts.

Examples.

1. In 1 last, how many pecks?

1 last.
80
—
80 bushels.
4
—
Ans. 320 pecks.
—

2. In 320 pecks, how many lasts?

4) 320 pecks.
—
80) 80 bushels.
—
Ans. 1 last.
—

3. In 128 bushels, how many pecks?

Ans. 512 pecks.

4. In 512 pecks, how many bushels?
Ans. 128 bushels.
5. In 20 lasts, 3 bush. 3 pecks, how many pecks?
Ans. 6415 pecks.
6. Reduce 6415 pecks into lasts?
Ans. 20 l. 3 b. 3 pks.

TIME.

60 Seconds . . .	make 1	Minute.
60 Minutes . .	make 1	Hour.
24 Hours . . .	make 1	Day.
7 Days . .	make 1	Week.
4 Weeks . . .	make 1	Lunar month.
13 Lunar months, / 12 Calendar months, or / 365 Days, . . .	make 1	Common year.
365d. 5h. 48m. 48s. .	make 1	Solar year.
365d. 6h. . .	make 1	Julian year.
366 Days . . .	make 1	Leap year.

Years multiplied by $365\frac{1}{4}$, are days—days multiplied by 24, are hours—hours multiplied by 60, are minutes—minutes multiplied by 60, are seconds—seconds divided by 60, are minutes—minutes divided by 60, are hours—hours divided by 24, are days—days divided by $365\frac{1}{4}$, are years.

Examples.

1. In 1 year, how many seconds?

1 year.
$365\frac{1}{4}$
$365\frac{1}{4}$ days.
24
1460
730
6 is the $\frac{1}{4}$ of 24.
8766 hours.
60
525960 minutes.
As. 31557600 seconds.

2. In 31557600 seconds, how many years?

60) 31557600 sec.
60) 525960 min.
24) 8766 hrs.
$365\frac{1}{4}$) $365\frac{1}{4}$ days.
4 4
1461) 1461 (1
1461
Ans. 1 year.

3. In 13 years, how many days? Ans. $4748\frac{1}{4}$ days.
4. Reduce $4748\frac{1}{4}$ days into years. Ans. 13 years.
5. In 28 years, how many hours? Ans. 245448 hours.
6. Reduce 245448 hours into years. Ans. 28 years.
7. In 10yrs. 26days. 12h., how many minutes?
Ans. 5297760 min.
8. In 5297760 minutes, how many years?
Ans. 10yrs. 26ds. 12hs.
9. How many days since the birth of Christ, this year being 1832? Ans. 669138 days.
10. How many years are there in 669138 days?
Ans. 1832 years.

NOTE.—In questions which are performed by Multiplication and Division, the operation may often be abridged, by simply adding or subtracting a part of the given number—thus,

To reduce sterling into currency, multiply by 60, and divide by 54—or add $\frac{1}{9}$.

To reduce currency into sterling, multiply by 54, and divide by 60—or deduct $\frac{1}{10}$.

To reduce guineas into pounds, add $\frac{1}{20}$.

To reduce pounds into guineas, deduct $\frac{1}{21}$.

To reduce ells English into yards, add $\frac{1}{4}$.

To reduce yards into ells English, deduct $\frac{1}{5}$, &c. &c.

Examples.

1. In £9 ster. how many pounds currency?

$\frac{1}{6}$) £9 sterling.

1

Ans. £10 currency.

2. In £10 currency, how many pounds sterling?

$\frac{1}{10}$) £10 currency.

1

Ans. £9 sterling.

3. In £18 ster. how many pounds currency?

Ans. £20 curr.

4. Reduce £20 curr. into sterl. Ans. £18 sterl.

5. How much currency must be paid for an English bill of £100? Ans. £111 2*s*. 2½*d*.

6. How much sterl. is equal to £111 2*s*. 2½*d*. curr.?

Ans. £100 sterl.

7. How much must be paid in Quebec, to receive in London £180? Ans. £200.

8. How much sterl. must be paid in London to receive in Quebec £200? Ans. £180.

9. In 20 guineas how many pounds? Ans. £21.

10. Reduce £21 into guineas. Ans. 20gs.

11. In 20 ells English, how many yards?

Ans. 25 yards.

12. Reduce 25 yards into ells English. Ans. 20 ells.

THE RULE OF THREE DIRECT.

Q. What is taught by the Rule of Three?

A. The Rule of Three teaches, by three numbers given to find a fourth, which shall have the same proportion to the third, as the second has to the first.

Q. When is the proportion said to be direct?

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

Examples.

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

Ans. £1 3*d.*

	lb	*d.*		lb
If	1	: $4\frac{1}{2}$	: :	54
		4		18
		—		—
farthings		18		432
				54
				—
			4)	972 farthings.
				—
			12)	243 pence.
				—
			2,0)	2,0 3
				—
Ans.				£1 0 3

2. If 4 yards of cloth cost 3*s.*, what will 24yds. cost?

Ans. 18*s.*

3. If 24 yds. of cloth cost 18*s.*, what will 4yds. cost?

Ans. 3*s.*

4. If I buy 4 yds. of cloth for 3*s*., how many yards will 18*s*. buy? Ans. 24yds.

5. If 24 yds. cost 18*s*., how many will I get for 3*s*.?
Ans. 4yds.

6. If 1 yard cost 15*s*. 6*d*., what will 32yds. cost?
Ans. £24 16*s*.

7. If 32yds. cost £24 16*s*., what is the value of 1 yrd.?
Ans. 15*s*. 6*d*.

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

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

10. Bought 17cwt. 1qr. 14lb of iron, at 3½*d*. per lb. what was the price of the whole? Ans. £26 7*s*. 0½,

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

12. How many yards of cloth may be bought for £21 11*s*. 1½*d*., when 3½yds. cost £2 14*s*. 3*d*.?
Ans. 27yds. 3qrs. 1$\frac{3}{11}$nl.

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

14. 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*s*. 4*d*.

15. If 504 Flemish ells, 2qrs. cost £283 17*s*. 6*d*., what is the cost of 14yds.? Ans. £10 10*s*.

16. If 1 English ell, 2qrs. cost 4*s*. 7*d*., what will 39½yds. cost at the same rate? Ans. £5 3*s*. 5¼*d*. . ¼.

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

18. A draper bought 420yds. of broad cloth, at the rate of 14*s*. 10¾*d*. per ell English, what was the whole amount? Ans. £250 5*s*.

19. What must be paid for 7 casks of prunes, each weighing 2cwt. 1qr. 14lb, at £2 19*s*. 8*d*. per cwt.?
Ans. £49 11*s*. 11½*d*.

20. At £19 19*s*. 11¾*d*. the ton, what will 19 tons, 19cwt. 3qrs. 27½lb come to, at that rate?
Ans. £399 19*s*. 5$\frac{1}{1}\frac{4}{0}\frac{4}{1}\frac{1}{2}$*d*.

THE RULE OF THREE INVERSE.

Q. What is Inverse proportion?

A. Inverse proportion 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.—State the question, and reduce the terms as in the rule of three *direct*; then multiply the first and second terms together, and divide their product by the third: the quotient will be the answer, as in the last rule.

Examples.

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

m.	d.	m.
If 8	: 12	:: 16
	8	

16) 96 (6 days. Ans.
96

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. How many sovereigns, of 20*s.* each, are equivalent to 240 pieces of 12*s.* each? Ans. 144.

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

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

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

7. If I have a right to keep 45 sheep on a common 20 days, how long may I keep 50 upon it? Ans. 18 days.

8. If 1000 soldiers have provisions for 3 months, how many must be sent away, that the provisions may last 5 months? Ans. 400.

9. A courier makes a journey in 24 days, by traveling 12 hours a day: how many days will he be in going the same journey, traveling 16 hours a day? Ans. 18 days.

10. How much will line a cloke, 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.

THE DOUBLE RULE OF THREE.

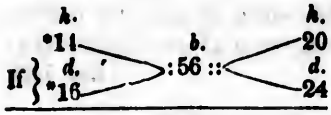
Q. What is the Double Rule of Three?

A. The Double Rule of Three has *five* terms given, three of supposition and two of demand, to find a *sixth*, in the same proportion with the terms of demand, as that of the terms of supposition. It is performed by two statings of the single rule of three.

Rule.—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 kind* as the term required, 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 the stating is direct, mark the *first* term with an asterisk: when inverse, mark the third term*, then multiply the *marked* terms together for a divisor, and multiply *all the other terms* for a dividend; divide, and the quotient will be the answer.

Examples.

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



	56
	20
14	1120
16	24
84	4480
14	2240
224)	26880 (120 *b.* Ans.
	224
	448
	448
	0

*Examine the statings, thus:

1st.

If 14 horses eat 56 bushels, 20 horses, being more, will eat more; the stating is, therefore, Direct.

2nd.

If 16 days consume 56 bushels, 24 days, being more, will consume more; the stating is, therefore, Direct.

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

Ans. 200 men.

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

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

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

6. If a carrier charges £2 2*s.* for the carriage of 3 cwt., 150 miles; how much ought he to charge for the carriage of 7 cwt. 3 qrs. 14lb., 50 miles?

Ans. £1 16*s.* 9*d.*

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

Ans. 480.

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

9. If I pay £14 10*s*. for the carriage of 60 cwt. 20 miles, what weight can I have carried 30 miles for £5 8*s*. 9*d*.? Ans. 15 cwt.

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

SIMPLE INTEREST.

Q. What is Simple Interest?

A. Simple Interest is the premium allowed for the loan of money for a given time.

The money lent, is called . .	*The Principal.*
The premium for the loan of £100 for 1 year, is called . .	*The Rate per Cent.*
The Principal and Interest together, is called . . .	*The Amount.*

Rule.—To find the interest of any sum of money, for any given time; multiply the principal by the rate per cent., and the product divided by 100 will give the interest for 1 year; multiply the interest for 1 year by the number of years given, to which add the interest of the given months and days, if any, which may be found by taking the aliquot parts of a year's interest, and their sum will be the interest required.

Examples.

1. What is the interest of £384 2*s*. 6*d*. for 5 yrs. 7 m. 15 days, at the rate of 5 per cent. per annum?

	£	*s*.	*d*.	
	384	2	6	Principal.
			5	
1,00)	£19,20	12	6	
	20			
s.	4,12			
	12			
d.	1,50			
	4			
gr.	2,00			
	£19	4	1½	Interest for 1 year.
			5	
	96	0	7½	Interest for 5 years.
6 mo. = ½ year	= 9	12	0½	Interest for 0 6 months.
1 mo. = ⅙ of 6m.	= 1	12	0	Interest for 0 1 „
15 dys. = ½ of 1m.	= 0	16	0	Interest for 0 0 15 days.
Ans.	£108	0	8½	Intst. for yrs. 5 7 15

2. What is the interest of £375 for 1 year, at 5 per cent. per annum? Ans. £18 15*s*.

3. What is the interest of £945 10*s*. for 1 year, at £4 per cent. per annum? Ans. £37 16*s*. 4¾*d*.

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

5. What is the interest of £257 5*s*. 1*d*. at £4 per cent. per annum, for 1 year and 9 months? Ans. £18 1½*d*.

6. What is the interest of £479 5*s.* for 5¼ years, at £5 per cent. per annum? Ans. £125 16*s.* 0¾*d.*

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

8. What is the interest of £730 for 7 yrs. 7 mo. 15 days, at 4 per cent. per annum? Ans.

COMPOUND INTEREST.

Q. What is Compound Interest?

A. Compound Interest is that which arises 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.

Examples.

1. What is the Compound Interest of £720, for 4 years, at 5 per cent. per annum?

of 100	£	*s.*	*d.*	
5 is $\frac{1}{20}$)	720	0	0	1st year's princip.
	36	0	0	1st year's interest.
$\frac{1}{20}$)	756	0	0	2nd year's princip.
	37	16	0	2nd year's interest.
$\frac{1}{20}$)	793	16	0	3rd year's princip.
	39	13	9½	3rd year's interest.
$\frac{1}{20}$)	833	9	9½	4th year's princip.
	41	13	5¾	4th year's interest.
	875	3	3¼	the whole *Amount.*
	720	0	0	given sum subtracted.
Ans.	155	3	3¼	Compound Interest reqd

2. What is the compound interest of £500, forborn 3 years, at £5 per cent. per annum? Ans. £78 16*s.* 3*d.*

3. What is the amount of £400 in 3½ years, at £5 per cent. per annum, compound interest?

Ans. £474 12*s.* 6¼*d.*

4. What will £650 amount to in 5 years, at 5 per cent. per annum, compound interest? Ans. £829 11*s.* 7½*d.*

5. What is the amount of £550 10*s.* for 3½ years, at £6 per cent. per annum, compound interest?

Ans. £675 6*s.* 5*d.*

6. What is the compound interest of £674 for 4 years and 9 months, at £6 per cent. per annum?

Ans. £243 18*s.* 8*d.*

VULGAR FRACTIONS.

Q. What is a fraction?

A. A fraction is a part of a thing, and is expressed or written with two numbers, with a line between them; the upper number is called the numerator, and the lower the denominator—thus, $\frac{4}{12}$ Numerator. Denominator.

Q. What do the numerator and denominator show?

A. The denominator shows into how many equal parts the whole thing is divided; and the numerator expresses how many of these parts the fraction contains; thus the fraction $\frac{1}{12}$ of a shilling, shows the shilling to be divided into 12 parts, and the numerator 1, expresses 1 of these parts, or 1 penny, $\frac{2}{12}s.$ signifies 2*d.*; $\frac{3}{12}$, =3*d.*; $\frac{4}{12}$=4*d.*, and so on for any other quantity; thus $\frac{2}{12}$ of a foot signifies 2 inches, $\frac{3}{12}$=3 inch. $\frac{4}{12}$=4 inch., &c.

Q. What is a proper fraction?

A. A proper fraction, is one whose numerator is *less* than the denominator. as $\frac{1}{4}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{11}{12}$, &c.

Q. What is an improper fraction?

A. An improper fraction, is one whose numerator is either equal to, or greater than its denominator: as $\frac{4}{4}$, $\frac{5}{4}$, $\frac{8}{4}$, $\frac{14}{12}$, &c.

Q. What is a mixed number?

A. A mixed number is composed of a whole number and a fraction: as $1\frac{2}{3}$, $17\frac{1}{2}$, $8\frac{7}{11}$, &c.

ADDITION OF FRACTIONS.

Rule 1.—When the fractions have the same common denominator, add their numerators together, and place the sum over the denominator, if *less* than it; but if it be *greater*, divide the sum by the denominator, set down the remainder, and carry the quotient to the whole numbers, if any.

NOTE.—If the remaining fraction can be divided by any number that can be discovered by inspection, divide it, and it will give an *equivalent* fraction in lower terms.

Examples.

1. Add $14\frac{1}{10}$ yds. $13\frac{2}{10}$, $17\frac{3}{10}$, $24\frac{9}{10}$ together.

Yds.

$14\frac{1}{10}$ 1
$13\frac{2}{10}$ 2
$17\frac{3}{10}$ 3
$24\frac{9}{10}$ . . . . 9 } Numerators.

Ans. yds. $69\frac{1}{2}$

10) 15 ($1\frac{1}{2}$ yards.
10

5) $\frac{5}{10}=\frac{1}{2}$

2. Add $14\frac{1}{4}$, $16\frac{3}{4}$, $20\frac{1}{4}$ yards together.

Ans. $51\frac{1}{4}$ yds.

3. Add $18\frac{1}{8}$, $12\frac{3}{8}$, $19\frac{5}{8}$, $20\frac{7}{8}$ yds. together.

Ans. 71 yds.

4. Add $142\frac{1}{10}$, $6\frac{3}{10}$, $20\frac{11}{10}$, $81\frac{17}{10}$ yds. together.

Ans. $250\frac{3}{5}$ yds.

5. Add together $27\frac{1}{23}$, $18\frac{7}{23}$, $20\frac{11}{23}$, 187 yds. together.
Ans. $252\frac{19}{23}$ yds.

6. Add $17\frac{3}{50}$, $87\frac{1}{50}$, $146\frac{17}{50}$, $50\frac{1}{50}$, and $3\frac{11}{50}$.
Ans. $305\frac{13}{50}$ yds.

Rule 2.—When the fractions have not a common denominator, arrange the denominators in a line, and divide any two or more of them by any common divisor, placing the quotients and the undivided numbers below; proceed with them in the same manner, and repeat the process till there remain not any two numbers commensurable; then multiply the undivided numbers by the quotients and divisors, and the last product will be the *least* common denominator—then divide this common denominator by each of the denominators of the given fraction, and multiply the quotient by the numerator, setting down the product opposite each fraction—add these products together, and proceed as in the last examples.

Examples.

7. Add together $12\frac{1}{2}$ yds. $14\frac{1}{3}$, $15\frac{1}{6}$, $18\frac{3}{4}$, and $17\frac{1}{10}$.

(To find the least Com. Denom.)

2) 2 . 3 . 6 . 4 . 10

3) 1 . 3 . 3 . 2 . 5

1 . 1 . 1 . 2 . 5

2

10

3

30

2

C. D. 60

yds.	60 C. den.
$12\frac{1}{2}$	30
$14\frac{1}{3}$	20
$15\frac{1}{6}$	10
$18\frac{3}{4}$	45
$17\frac{1}{10}$	6

Ans. $77\frac{17}{30}$ yds.

60) 111($1\frac{1}{30}$ yds.
60

3) $\frac{41}{60}=\frac{17}{20}$.

8. Add $40\frac{3}{4}$, $27\frac{1}{2}$, $34\frac{1}{8}$, $43\frac{3}{16}$, and $39\frac{1}{4}$ yards.
Ans. $185\frac{9}{16}$ yds.

9. Add $150\frac{1}{2}$ lb. $139\frac{3}{4}$, $162\frac{2}{3}$, and $170\frac{1}{8}$ lb. together.
Ans. $623\frac{1}{24}$ lb.

10. Add $16\frac{1}{2}$, $19\frac{3}{4}$, $13\frac{3}{4}$, $20\frac{1}{8}$, $25\frac{1}{16}$, $30\frac{4}{8}$, and $11\frac{1}{4}$ lb.
Ans. $136\frac{37}{48}$ lb.

11. Add $124\frac{1}{6}$, $104\frac{2}{3}$, $79\frac{1}{2}$, and 17 together.
Ans.

12. Add $132\frac{17}{25}$, $507\frac{1}{5}$, $384\frac{4}{7}$, and $18\frac{3}{21}$.
Ans.

SUBTRACTION OF FRACTIONS.

Rule.—Prepare the fractions the same as for Addition, when necessary; then subtract the one numerator from the other, and set the remainder over the common denominator, for the difference of the fraction sought.

NOTE. When the numerator of the fractional part in the *subtrahend* is greater than the other numerator, subtract it from the common denominator, and add the remainder to the other numerator—set down the fraction, and carry 1.

Examples.

1. From $18\frac{1}{2}$ yards of cloth take $14\frac{5}{8}$ yards.

	yds.	C. D.
From	$18\frac{1}{2}$ . . .	$\frac{4}{8}$
Take	$14\frac{5}{8}$ . . .	5
Ans.	$3\frac{7}{8}$ yds.	$\frac{7}{8}$

2. What is the difference between $20\frac{3}{4}$ and $16\frac{1}{2}$?
Ans. $4\frac{1}{2}$.

3. What is the difference between $37\frac{4}{5}$ and $29\frac{3}{5}$?
Ans. $8\frac{1}{5}$.

4. From $26\frac{7}{11}$ take $18\frac{1}{2}$. Ans. $8\frac{3}{22}$.

5. If $59\frac{7}{15}$ be taken from $102\frac{1}{3}$, what will remain?
Ans. $42\frac{4}{5}$.

6. Lent £123 7/10, and received £27 1/2, what is yet due?
£Ans. 96 1/5 5.

7. Borrowed £37 3/16, and paid 84 1/2; what do I yet owe? Ans. £2 3 4/16.

MULTIPLICATION OF FRACTIONS.

Rule.—Multiply all the numerators together for a numerator, and all the denominators together for a denominator, which will give the product required.

NOTE.—If there be a mixed number, multiply the whole number by the denominator of the fraction, adding in the numerator, and place the sum over the denominator.

Examples.

1. Required the product of $3\frac{1}{2}$ and $\frac{4}{5}$.

$3\frac{1}{2}$

$\frac{7}{2} - \frac{4}{5}$

10) 28 ($2\frac{4}{5}$ Ans.
20

$2) \frac{8}{10} - \frac{4}{5}$

2. Required the product of $\frac{3}{4}$ and $\frac{2}{5}$. Ans. $\frac{6}{20}$.
3. Required the product of $\frac{4}{7}$ and $\frac{5}{8}$. Ans. $\frac{20}{56}$.
4. Required the product of $\frac{3}{7}$, $\frac{4}{5}$, and $1\frac{1}{2}$. Ans. $\frac{18}{70}$.
5. Required the continued product of $\frac{2}{3}$, $3\frac{1}{4}$, 5, and $\frac{3}{4}$ of $\frac{3}{5}$. Ans. 4 7/8.
6. What is the $\frac{1}{3}$ of £20? Ans. £6 13*s.* 4*d.*
7. What is the $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of £20? Ans. £5.
8. What is the $\frac{7}{8}$ of a guinea of 21*s.*? Ans. 18*s.* $4\frac{1}{2}$*d.*
9. How much is the $\frac{1}{2}$ of $\frac{2}{4}$ of $\frac{1}{4}$ of $\frac{4}{5}$ of an apple?
Ans. $\frac{1}{4}$ of an apple.

10. How much is the $\frac{7}{9}$ of 1 cwt. weight?
Ans. 3 qrs. $3\frac{1}{9}$ lb.

11. Multiply $14\frac{7}{12}$ feet by $8\frac{3}{4}$ feet? Ans. $127\frac{11}{16}$ feet.

DIVISION OF FRACTIONS.

Rule.—Prepare the given numbers, if they require it, by the last rule; then multiply the numerator of the dividend by the denominator of the divisor for a numerator; and multiply the numerator of the divisor by the denominator of the dividend for a denominator.

Examples.

1. Divide $\frac{5}{6}$ by $\frac{3}{12}$.

$\frac{5}{6}$ $\frac{3}{12}$

18) 75 ($4\frac{1}{6}$ Ans.
72

4) $\frac{3}{12}$ $\frac{1}{6}$

2. It is required to divide $\frac{12}{25}$ by $\frac{4}{5}$. Ans. $\frac{4}{5}$.
3. It is required to divide $\frac{7}{16}$ by $\frac{3}{4}$. Ans. $\frac{7}{12}$.
4. It is required to divide $\frac{14}{5}$ by $\frac{7}{4}$. Ans. $1\frac{1}{3}$.
5. It is required to divide $\frac{5}{6}$ by $\frac{15}{7}$. Ans. $\frac{7}{18}$.
6. It is required to divide $\frac{12}{35}$ by $\frac{3}{5}$. Ans. $\frac{4}{7}$.
7. It is required to divide $\frac{2}{7}$ by $\frac{8}{3}$. Ans. $\frac{10}{21}$.
8. It is required to divide $\frac{9}{16}$ by 3. Ans. $\frac{3}{16}$.
9. It is required to divide $\frac{3}{5}$ by 2. Ans. $\frac{3}{10}$.
10. It is required to divide $7\frac{1}{3}$ by $9\frac{5}{9}$. Ans. $\frac{33}{43}$.
11. It is required to divide $\frac{2}{5}$ of $\frac{1}{3}$ by $\frac{5}{7}$ of $7\frac{3}{5}$.
Ans. $\frac{7}{171}$.
12. It is required to divide $5205\frac{1}{2}$ by $\frac{1}{2}$ of 91.
Ans. $71\frac{1}{2}$.

THE RULE OF THREE IN FRACTIONS.

Rule.—Reduce the whole, or mixed numbers, if any, to fractions—then state the question as in the Rule of Three, in whole numbers; then having considered whether the question is *direct* or *inverse*, perform the operation, according to the rule already given under the head of each respectively.

Examples.

1. If $3\frac{1}{2}$ yards of cloth cost £$4\frac{1}{3}$, what cost $18\frac{1}{4}$ yards?

yds. £

$3\frac{1}{2} : 4\frac{1}{3} :: 18\frac{1}{4}$

$\frac{7}{2}$ $\frac{13}{3}$ $\frac{73}{4}$

7 91
3 13
21 273
5 91
105 1183
2
105) 2366 (£22 10*s.* 8*d.* Ans.
210
266
210
56
20
105) 1120 (10*s.*
105
70
12
105) 840 (8*d.*
840

2. If $\frac{3}{8}$ of a yard cost £$\frac{1}{5}$, what will $\frac{4}{10}$ of a yard cost?
Ans. 15*s*.

3. If $\frac{1}{7}$ yrd. cost £$\frac{3}{5}$, what will $\frac{1}{12}$ yrd. cost?
Ans. 14*s*. 8*d*.

4. If $\frac{3}{4}$ of a yard cost 7$\frac{1}{4}$*s*., what will 10$\frac{1}{2}$ yrd. cost?
Ans. £4 19*s*. 10$\frac{1}{2}$*d*.

5. If $\frac{7}{8}$ lb. cost $\frac{3}{4}$*s*., how much will $\frac{1}{5}$*s*. buy?
Ans. $1\frac{1}{17}$ lb.

6. If 48 men can build a wall in 24$\frac{1}{2}$ days, how many men can do the same in 192 days? Ans. $6\frac{1}{8}$ men.

7. If $\frac{3}{4}$ yrd. of Holland cost £$\frac{1}{3}$, what will 12$\frac{2}{3}$ ells cost at the same rate? Ans. £7 8$\frac{3}{4}$*d*. . $\frac{5}{6}$.

8. If 3$\frac{1}{4}$ yards of cloth, that is 1$\frac{1}{3}$ yard wide, be sufficient to make a cloak, how much that is $\frac{1}{4}$ of a yard wide, will make another of the same size? Ans. 4$\frac{7}{8}$ yds.

9. 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 9$\frac{1}{2}$*d*. . $\frac{4}{25}$.

10. 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$\frac{8}{35}$ miles.

11. If $\frac{9}{10}$ of a cwt. cost £14 4*s*., what is the value of 7$\frac{1}{2}$ cwt.? Ans. £118 6*s*. 8*d*.

12. What quantity of shalloon that is $\frac{3}{4}$ of a yard wide, will line 7$\frac{1}{2}$ yards of cloth, that is 1$\frac{1}{2}$ yrd. wide?
Ans. 15 yds.

DECIMAL FRACTIONS.

Q. What is a Decimal Fraction?

A. A decimal fraction is that which has for its denominator 1, with as many ciphers annexed as the numerator has places; and it is usually expressed by setting down the numerator only, with a point before it, on the left hand. Thus, $\frac{4}{10}$ is .4, and $\frac{24}{100}$ is .24, and $\frac{74}{1000}$ is .074, &c. &c.

ADDITION OF DECIMALS.

Rule.—Set down the numbers in such order that the separating points may stand exactly under each other, then add up the columns, and place the point in the *sum* directly under the other points.

Examples.

1 Add together 14.25+121.372+107.380+.26.

14 . 25
121 . 372
107 . 380
. 26

Ans. 243 . 262

2. What is the sum of 276. +39.213+72014.9+417. and 5032? Ans. 7779.113.

3. Add together 7530.+16.201+3·0142+957.13. Ans. 8506.3452.

4. Add together 1.5+35.07+121.321+23.17. Ans. 181.061.

SUBTRACTION OF DECIMALS.

Rule.—Place the numbers under each other as in addition; then subtract and point off the decimals as in the last rule.

Examples.

1. What is the difference between 91.73 and 2.138.

91 . 73
2 . 138

Ans. 89 . 592 the difference.

2. Find the difference between 1.9185 and 2. 73.
Ans. 0.8115.

3. Subtract 4.90142 from 214.81.
Ans. 209.90858.

4. Find the difference between 2714 and ·916.
Ans. 2713.084.

MULTIPLICATION OF DECIMALS.

Rule.—Place the factors under each other, and multiply them together. Then point off in the product just as many places of decimals as there are decimals in both factors. But if there be not so many figures in the product, supply the defect by prefixing cyphers.

Examples.

1. Multiply 24.5 by 1.6.

24 . 5
1 . 6
147 . 0
245
Ans. 39 . 20 the Product.

2. Multiply 79 . 347 by 23 . 15. Ans. 1836 . 88305.
3. Multiply . 63478 by . 8204. Ans. . 520773512.
4. Multiply . 385746 by . 00464. Ans. .00178986144.

DIVISION OF DECIMALS.

Rule.—Divide as in the rule of division, and point off in the quotient as many places for decimals, as the decimal places in the dividend exceed those in the divisor.

Examples.

1. Divide 34.80 by 1.5.

```
1.5) 34.80 (23.2 Ans.
     30
     ----
      48
      45
     ----
       30
       30
     ----
```

2. Divide 123.70536 by 54.25. Ans. 2.2802.
3. Divide 12 by .7854. Ans. 15.278.
4. Divide 4195.68 by 100. Ans. 41.9568.

REDUCTION OF DECIMALS.

TO REDUCE A FRACTION TO A DECIMAL.

Rule.—Divide the numerator by the denominator annexing cyphers to the numerator as far as necessary, so shall the quotient be the decimal required.

Examples.

1. Reduce $\frac{1}{4}$ to a decimal.

```
4) 100
   ---
   .25 Ans.
   ---
```

2. Reduce $\frac{1}{2}$ to a decimal. Ans. .5.
3. Reduce $\frac{3}{4}$ to a decimal. Ans. .75.
4. Reduce $\frac{5}{8}$ to a decimal. Ans. .625.
5. Reduce $\frac{3}{25}$ to a decimal. Ans. .12.

6. Reduce $\frac{1}{32}$ to a decimal. Ans. .031350.
7. Reduce 9*s.* to the decimal of a pound. Ans. ·45.
8. Reduce 9*d.* to the decimal of a shilling. Ans. ·75.
9. Reduce $\frac{1}{4}$ to the decimal of a penny. Ans. ·25.

TO REDUCE A DECIMAL TO ITS PROPER VALUE.

Rule.—Multiply the given decimal by the number of parts of the next inferior denomination, cutting off the decimals from the product; then multiply the remainder by the next inferior denomination; thus proceeding, till you have taken in the least known parts of an integer.

Examples.

1. What is the value of .8323 of a £?

·8323
20
s. 16.6460
12
d. 7.7520 Ans. 16*s.* 7¾*d.*
4
¾·008

2. What is the value of ·775 of a £? Ans. 15*s.* 6*d.*
3. What is the value of ·625 shillings? Ans. 7½*d.*
4. What is the value of £·8635? Ans. 17*s.* 3·24*d.*
5. What is the value of ·4694 lb. troy?
Ans. 5 oz. 12 d. 15·744 grs.
6. What is the value of ·6875 yds.? Ans. 2 qrs. 3 nls.
7. What is the value of ·5625 of a foot?
Ans. 6¾ inches.
8. What is the value of ·625 of a cwt.?
Ans. 2 qrs. 14 lb.

DUODECIMALS.

Q. What is Duodecimals?

A. Duodecimals is a rule used by workmen and artificers, in computing the contents of their work.

Rule.—Under the multiplicand write the corresponding terms of the multiplier; multiply by the feet in the multiplier, observing to carry one for every twelve, from each lower denomination to the next superior; in the same manner multiply by the inches in the multiplier, setting the result from each term one place farther to the right; proceed in like manner with the remaining denominator, and the sum of the products will be the total product.

Examples.

1. Multiply 7 ft. 9 inch. by 3 ft. 6 inch.

	7	9	
	3	6	
	23	3	
3	10	6	
feet 27	1	6	Ans.

	ft.	in.		ft.	in.		ft.	in.	pts.		
2. Multiply	8	5	by	4	7	Ans.	38	6	11		
3. Multiply	9	8	by	7	6	„	72	6	0		
4. Multiply	8	1	by	3	5	„	27	7	5		
5. Multiply	7	6	by	5	9	„	43	1	6		
6. Multiply	4	7	by	3	10	„	17	6	10		
7. Multiply	75	7	by	9	8	„	730	7	8		
8. Multiply	97	8	by	8	9	„	854	7	0		
9. Multiply 7 ft. 5 in. 9 pt. by 3 ft. 5 in. 3 pt.						„	25	8	6	2	3
10. Multiply 10 ft. 4 in. 5 pt. by 7 ft. 8 in. 6 pt.						„	79	11	0	6	6

INVOLUTION.

Q. What is Involution?

A. Involution is the multiplying any number by itself, and that product by the former multiplier; and the products which arise are called powers.

Table of the Squares and Cubes of the nine digits.

Roots.....	1	2	3	4	5	6	7	8	9
Squares...	1	4	9	16	25	36	49	64	81
Cubes.....	1	8	27	64	125	216	343	512	729

Examples.

1. What is the fifth power of 8?

8	Root or 1st power.
8	
64	Square or 2nd power.
8	
512	Cube or 3rd power.
8	
4096	Biquadrate or 4th power.
8	
32768	Sursolid or 5th power.

2. What is the square of .085? Ans. .007225.
3. What is the cube of 25.4? Ans. 16387.064.
4. What is the biquadrate of 1.2? Ans. 2.0736.

EVOLUTION.

Q. What is Evolution?

A. Evolution is the method of finding the first powers or roots of any given numbers: and it is commonly called extraction of the square, cube, biquadrate, sursolid, roots, &c.

THE SQUARE ROOT.

Q. What is the extraction of the Square Root?

A. To extract the square root, is to find out such a number as being multiplied by itself, the product will be equal to the given number.

Rule.—Divide the given number into periods of two figures each, beginning at the right hand; find the greatest square in the first period on the left hand, and set its root on the right hand of the given number, after the manner of a quotient figure in division; then subtract the square thus found from the said period, and to the remainder annex the two figures of the next following period, for a dividend—double the root above mentioned for a divisor, and find how often it is contained in the said dividend, exclusive of the right hand figure, and set that quotient figure both in the quotient and divisor. Multiply the whole augmented divisor by this last quotient figure, and subtract the product from the said dividend, bringing down to it the next period of the given numbers for a new dividend, and proceed as before.

NOTE.—When the figures of the whole number are exhausted, if there be a remainder, periods of ciphers may be used at pleasure to continue the extraction; but the figures produced in the quotient will be decimals.

Examples.

1. What is the square root of 119025?

```
          119025
            9        (345 the root. Ans.
        ----------
64)       290
          256
        ----------
685)      3425
          3425
        ----------
```

2. What is the square root of 106929? Ans. 327.
3. What is the square root of 22071204? Ans. 4698.
4. What is the square root of 17.3056? Ans. 4.16.
5. What is the square root of ·000729? Ans. .027.
6. What is the square root of 3? Ans. 1.732050.
7. What is the square root of 5? Ans. 2.236068.
8. What is the square root of 6? Ans. 2.449489.
9. What is the square root of 10? Ans. 3.162277.
10. What is the square root of 12? Ans. 3.464101.

THE CUBE ROOT.

Q. What is the extraction of the Cube Root?

A. To extract the cube root, is to find out a number, which being multiplied into itself, and then into that product, produceth the given number.

Rule.—Divide the given number into periods of *three* figures each, beginning at units' place; find the greatest cube in the first period, and subtract it therefrom; put the root in the quotient, and bring down the figures in the next period to the remainder, for a *Resolvend;* multiply the square of the root found by 300, for a divisor, and annex to the root the number of times which that is contained in the *Resolvend;* add 30 times

the preceding figure, or figures, multiplied by the last, and the square of the last, to the divisor; and multiply the sum by the last for a *Subtrahend:* subtract it from the *Resolvend*, and repeat the process as far as necessary.

Examples.

1. What is the cube root of 99252847?

$$
\begin{array}{rl}
 & 99252847 \\
4^3=64 & (463 \\
\hline
4^2\times 300=4800) & 35252 \text{ Resolvend.} \\
\hline
 & 720=4\times 30\times 6 \\
 & 36=6^2 \\
 & 4800 \\
\hline
 & 5556 \\
 & 6 \\
\hline
 & 33336 \text{ Subtrahend.} \\
\hline
46^2\times 300=634800) & 1916847 \text{ Resolvend.} \\
\hline
 & 4140=46\times 30\times 3 \\
 & 9=3^2 \\
 & 634800 \\
\hline
 & 638949 \\
 & 3 \\
\hline
 & 1916847 \text{ Subtrahend.}
\end{array}
$$

2. What is the cube root of 389017? Ans. 73.
3. What is the cube root of 673373097125? Ans. 8765.
4. What is the cube root of 12.977875? Ans. 2.35.

PRACTICAL GEOMETRY.

Practical Geometry is a mechanical method of describing mathematical figures by means of a ruler and compasses, or other instruments proper for the purpose.

1. A *point* is that which has no parts, or dimensions; as A.

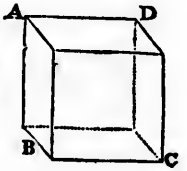
2. A *line* is length without breadth; and its bounds or extremes are points.

3. A right, or straight line, is that which lies evenly between its extreme points; as A B.

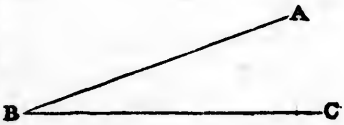
4. A *superficies* is that which has length and breadth only; and its bounds or extremes are lines; as A B C D.

5. A *plane*, or *plane superficies*, is that which is every where perfectly flat and even.

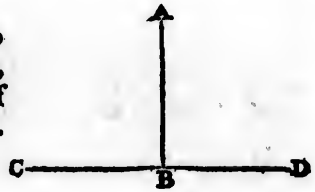
6. A *body* or solid, is that which has length, breadth, and thickness, and its bounds or extremes are superficies; as A B C D.



7. A *plane rectilineal angle* is the inclination or opening of two right lines, which meet in a point without cutting each other; as A B C.



8. One right line is said to be *perpendicular* to another, when the angles on each side of it are equal. Thus A B is perp. to C D.

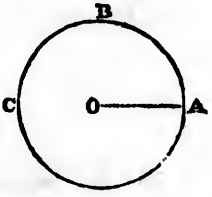


9. A *right angle* is that which is formed by two right lines, that are perpendicular to each other; as A B C.

10. An *acute angle* is that which is less than a right angle; as A B C.

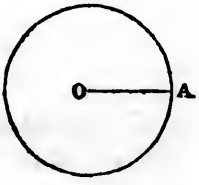
11. An *obtuse angle* is that which is greater than a right angle; as A B C.

12. A *circle* is a plane figure, formed by the revolution of a right line about one of its extremities, which remain fixed; as,

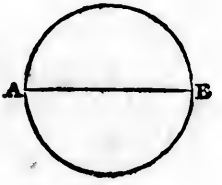


13. The *centre* of a circle is the point O, about which it is described; and the circumference is the line or boundary A B C A, by which it is contained.

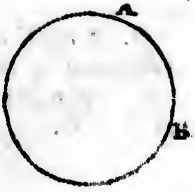
14. The *radius* of a circle is a right line drawn from the centre to the circumference; as O A.



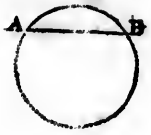
15. The *diameter* of a circle is a right line passing through the centre, and terminated on each side by the circumference; as A B.



16. An *arc* of a circle is any part of its periphery, or circumference; as A B.

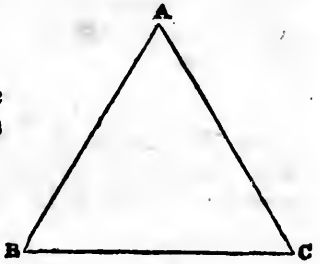


17. A *chord* is a right line which joins the extremities of an arc; as A B.

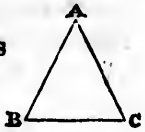


18. All plane figures, bounded by three right lines, are called *triangles*; and receive different denominations according to the nature of their sides and angles.

19. An *equilateral triangle* is that which has all its sides equal; as A B C.

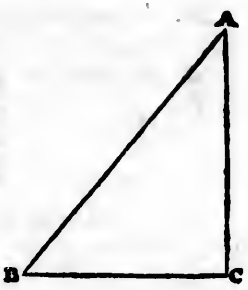


20. An isosceles triangle is that which has only two of its sides equal, as A B C.

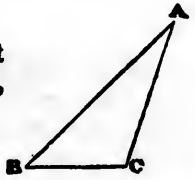


21. A *scalene triangle* is that which has all its three sides unequal; as A B C.

22. A *right-angled triangle* is that which has one right angle; the side opposite to the right angle being called the hypothenuse, and the other two sides the legs; as A B C.



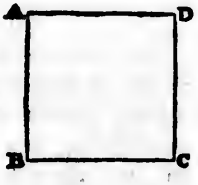
23. An *obtuse-angled triangle* is that which has one obtuse angle; as A B C, and C is the obtuse angle.



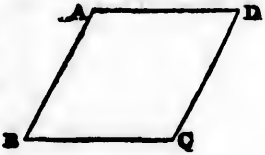
24. An *acute-angled triangle* is that which has all its angles acute; as A B C.

25. All plane figures, bounded by four right lines, are called *quadrangles*, or *quadrilaterals*; and receive different names according to the nature of their sides and angles.

26. A *square* is a quadrilateral, whose sides are all equal, and its angles all right angles; as A B C D.



27. A *rhombus* is a quadrilateral, whose sides are all equal, but its angles are not right angles; as A B C D.



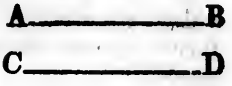
28. A *parallelogram* is a quadrilateral, whose opposite sides are parallel; as A B C D.

29. A *rectangle* is a parallelogram, whose angles are all right angles; as A B C D.

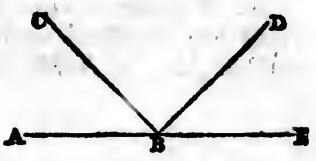
30. A *rhomboid* is a parallelogram, whose angles are not right angles; as A B C D.

31. All other four-sided figures, besides these, are called *trapeziums*.

32. *Parallel right lines* are such as are every where at an equal distance from each other; thus A B is parallel to C D.

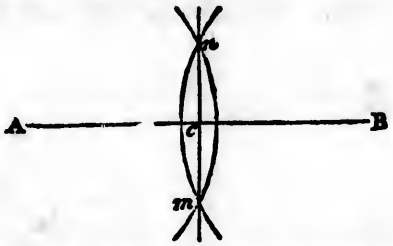


33. An angle is usually denoted by three letters, the one which stands at the angular point being always to be read in the middle; as A B C, C B D, D B E, &c.



Problem 1.

To divide a given line A B into two equal parts.

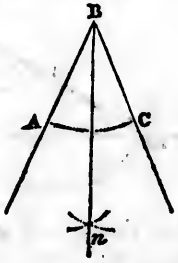


1. From the points A and B, as centres, with any distance greater than half of A B, describe arcs cutting each other in *n* and *m*.

2. Through these points draw the line *n c m*, and the point *c*, where it cuts A B, will be the middle of the line, as required.

Problem 2.

To divide a given angle A B C into two equal parts.



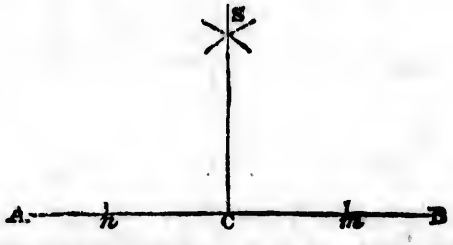
1. From the point B, with any radius, describe the arc A C; and from the points A, C, with the same, or any other radius, describe arcs cutting each other in *n*.

2. Then through the point *n*, draw the line B *n*, and it will bisect the angle A B C, as was required.

Problem 3.

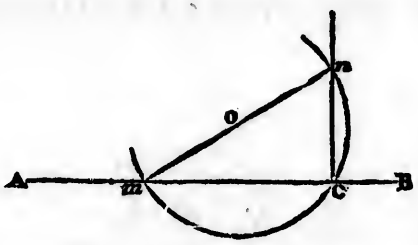
From a given point C, in a given right line A B, to erect a perpendicular.

Case 1.—When the point is in or near the middle of the line.



1. On each side of the point *c* take any two equal distances *c n*, *c m*.
2. From *n* and *m*, with any radius greater than *n c* or *m c*, describe arcs cutting each other in S.
3. Then, through the point S draw the line S *c*, and it will be the perpendicular required.

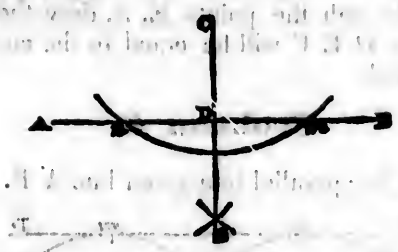
Case 2.—When the point is at, or near the end of the line.



1. Suppose *c* to be the given point, then take any point *o*, out of the line, and with the radius or distance *o c*, describe the arc *m c n*, cutting A B in *m* and *c*.
2. Through the centre *o*, and the point *m*, draw the line *m o n*, cutting the arc *m c n* in *n*.
3. Then from the point *n* draw the line *n c*, and it will be the perpendicular required.

Problem 4.

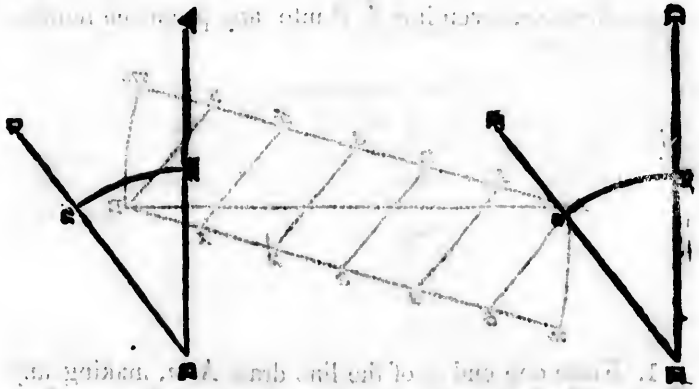
From a given point C, without a given line A B, to let fall a perpendicular.



1. From the point C, with any radius, describe the arc *n m*, cutting A B in *n* and *m*.
2. From the points *n m*, with the same or any other radius, describe two arcs cutting each other in S.
3. Then through the points C, S, draw the line C D S, and C D will be the perpendicular required.

Problem 5.

At a given point E, to make an angle equal to a given angle A B C.



1. From the point B, with any radius, describe the arc *n m*, cutting the legs B A, B C in the points *m n*.

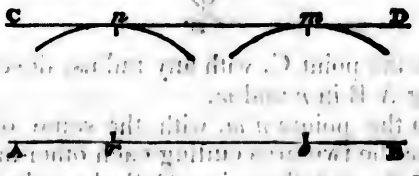
2. Draw the line E D; and from the point E, with the same radius as before, describe the arc *r s*.

3. Take the distance *m n*, on the former arc, and apply it to the arc *r s*, from *r* to *s*.

4. Then through the points E, S, draw the line E F, and the angle D E F will be equal to the angle A B C, as was required.

Problem 6.

To draw a line parallel to a given line A B.

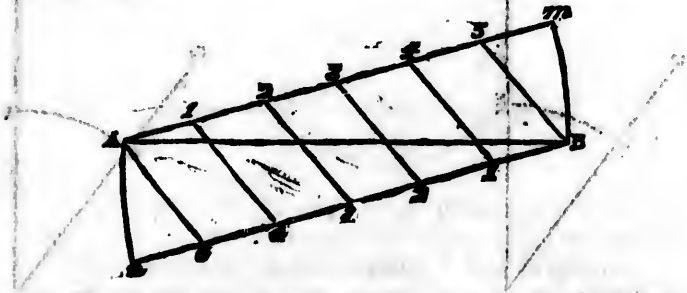


1. From any two points *r*, *s*, in the line A B with any radius describe the arcs *n m*.

2. Then draw the line C D, to touch these arcs, without cutting them, and it will be parallel to A B, as was required.

Problem 7.

To divide a given line A B into any proposed number of equal parts.



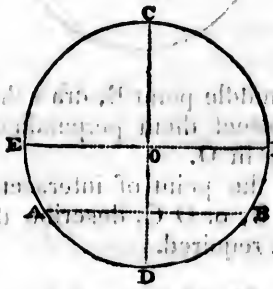
1. From one end A of the line draw A *m*, making any angle with A B; and from the other end B, draw B *n*, making an equal angle A B *n*.

2. In each of the lines A *m*, B *n*, beginning at A and B, set off as many equal parts, of any convenient length, as A B is to be divided into.

3. Then join the points A, 5; 1, 4; 2, 3, &c., and A B will be divided as was required.

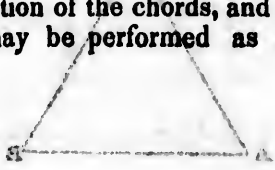
Problem 8.

To find the centre of a given circle, or of one already described.



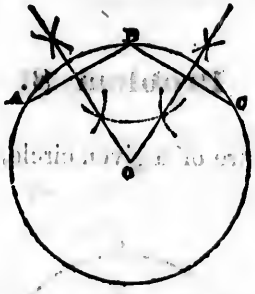
1. Draw any chord A B, and bisect it with the perpendicular C D.

2. Bisect C D, in like manner, with the chord E F, and their intersection, *o*, will be the centre required; observing that the bisection of the chords, and the raising of the perpendicular, may be performed as in problems 1st and 3rd.



Problem 9.

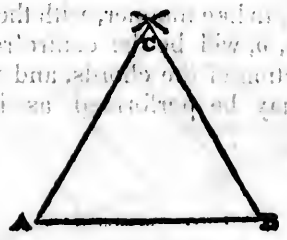
To describe the circumference of a circle through any three given points A, B, C, provided they are not in a right line.



1. From the middle point B, draw the lines or chords B A, B C; and bisect them perpendicularly, with lines meeting each other in O.
2. Then from the point of intersection, O, with the distance O A, O B, or O C, describe the circle A B C, and it will be that required.

Problem 10.

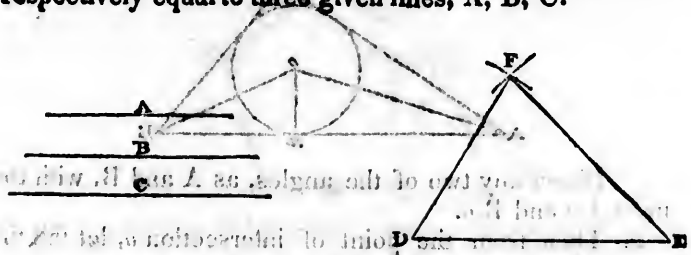
Upon a given right line A B, to make an equilateral triangle.



1. From the points A and B, with a radius equal to A B, describe arcs cutting each other in C.
2. Draw the lines A C, B C, and the figure A C B will be the triangle required.

Problem 11.

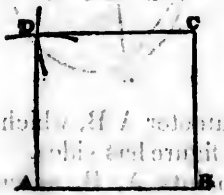
To make a triangle, the three sides of which shall be respectively equal to three given lines, A, B, C.



1. Draw a line D E equal to one of the given lines C.
2. From the point D, with a radius equal to A, describe an arc; and from the point E, with a radius equal to B, describe another arc, cutting the former in F.
3. Then draw the lines D F, E F, and D F E, will be the triangle required.

Problem 12.

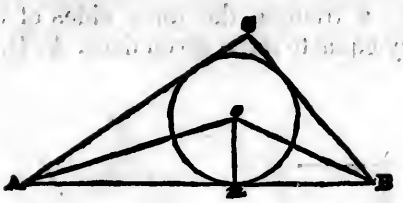
Upon a given line A B to describe a square.



1. From the point B, draw B C perpendicular, and equal to A B.
2. From the points A and C, with the radius A B, or C B, describe two arcs cutting each other in B, and draw the lines A D, C D, and the figure A B C D will be the square required.

Problem 13.

In a given triangle, A B C, to inscribe a circle.

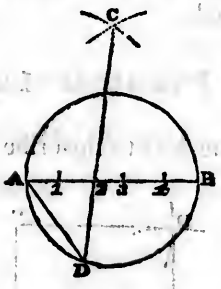


Bisect any two of the angles, as A and B, with the lines A *o* and B *o*.

2. Then from the point of intersection *o*, let fall the perpendicular *o n* upon either of the sides, and it will be the radius of the circle required.

Problem 14.

In a given circle, to inscribe any regular polygon.



1. Draw the diameter A B, which divide into as many equal parts as the figure has sides.

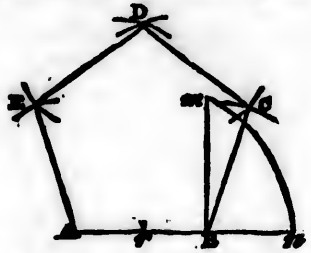
2. From the points A, B, as centres, and with the radius A B, describe arcs crossing each other in C.

3. From the point C, through the second division of the diameter, draw the line C D; then, if the points A, D, be joined, the line A D will be the side of the polygon required.

NOTE.—It is to be observed that in the construction here given, A D is the side of a pentagon, or a figure of *five* sides.

Problem 15.

On a given line A B, to make a regular pentagon.



1. Produce A B towards *n*, and at the point B make the perpendicular B *m* equal to A B.

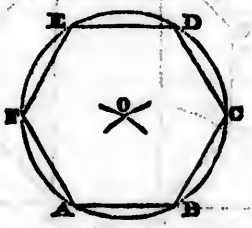
2. Bisect A B in *r*, and from *r* as a centre, with the radius *r m* describe the arc *m*, *n*, cut ing the produced line A B in *n*.

3. From the points A and B, with the radius A *n*, describe arcs cutting each other in D, and from the points A D and B D, with the radius A B, describe arcs cutting each other in C and E.

4. Then if the line B C, C D, D E, and E A be drawn, A B C D E will be the pentagon required.

Problem 16.

On a given line A B to make a regular hexagon.

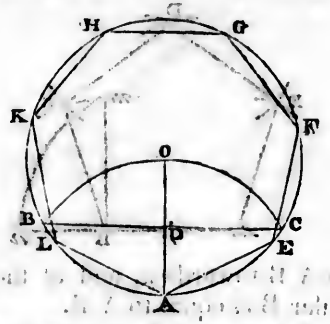


1. From the points A, B, as centres, with the radius A B, describe arcs cutting each other in O; and from the point O, with the distance O A or O B, describe the circle A B C D E F.

2. Then if the line A B be applied six times round the circumference, it will form the hexagon required.

Problem 17.

In a given circle to inscribe a regular heptagon.

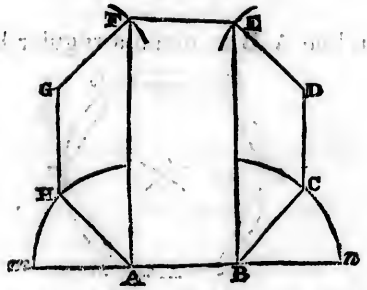


1. From any point A in the circumference, with the radius A O of the circle, describe the arc B O C, cutting the circumference in B and C.

2. Draw the chord B C, cutting O A in D, and B D, or C D, carried seven times round the circle from A, will form the heptagon required.

Problem 18.

On a given line A B, to form a regular octagon.



1. On the extremities of the given line A B erect the indefinite perpendiculars A F and B E.

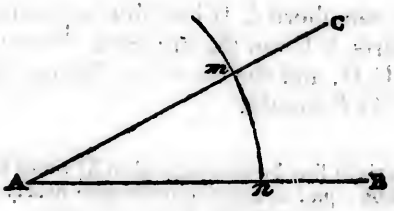
2. Produce A B both ways to *m* and *n*, and bisect the angles *m* A F and *n* B E with the lines A H and B C.

3. Make A H and B C each equal to A B, and draw H G, C D parallel to A F or B E, and make each of them equal to A B.

4. From G, D, as centres, with a radius equal to A B, describe arcs crossing A F, B E, in F and E; then if G F, F E and E D be drawn, A B C D E F G H will be the octagon required.

Problem 19.

To make an angle of any proposed number of degrees.



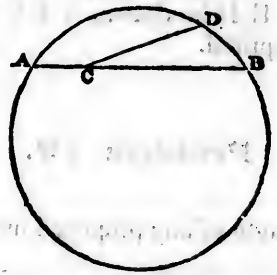
1. Draw any line A B; and having taken the first 60 degrees from the scale of chords, describe, with radius, the arc *n m*.

2. Take in like manner the chord of the proposed number of degrees from the same scale, and apply it from *n* to *m*.

3. Then, if the line A C be drawn from the point A through *m*, the angle C A B will be that required.

Problem 20.

To find a right line that shall be nearly equal to any given arc A D B of a circle.



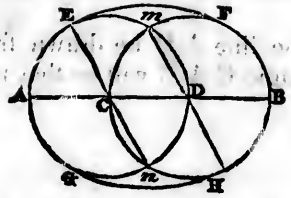
1. Divide the chord A B into four equal parts, and set one of the parts A C, on the arc from B to D.

2. Draw C D, and the double of this line will be equal to the arc A D B nearly.

NOTE.—If a right line be made equal to $3\frac{1}{7}$ times the diameter of a circle, it will be equal to the circumference nearly.

Problem 21.

Upon a given line A B, to describe an oval, or a figure resembling an ellipse.



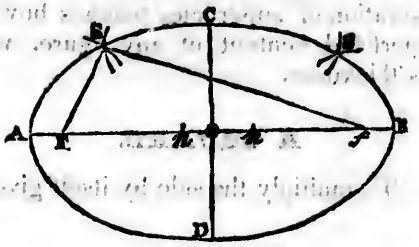
1. Divide A B into three equal parts A C, C D, D B; and from the points C, D, with the radii C A, D B, describe the circles A G D E and C H E F.

2. Through the intersections m, n, and centres C, D, draw the lines m H, E n; and from the points n, m, with

the radii *n* E, *m* H, describe the arcs E F, H G, and A G H B F E will be the oval required.

Or thus:

The transverse and conjugate diameters being given.



1. Draw the transverse and conjugate diameters, A B, C D, bisecting each other perpendicularly in the centre O.

2. With the radius A O, and centre C, describe arcs cutting A B in F *f*; and these two points will be the foci of the ellipse.

3. Take any number of points *n*, *n*, &c. in the transverse diameter A B, and with the radii, A *n*, *n* B, and centres F *f*, describe arcs intersecting each other in S, S, &c.

4. Through the points S, S, &c. draw the curve A S C S H D, and it will be the circumference required; or, having found the foci, F *f*, as before, take a thread, of the length of the transverse diameter, and put it round two pins fixed at the points F *f*; then stretch the thread F S *f* to its greatest extent, and it will reach to the point S in the curve; and by moving a pencil round within the thread, keeping it always stretched, it will trace out the curve required.

MENSURATION OF SUPERFICIES.

Q. What is Mensuration of Superficies?

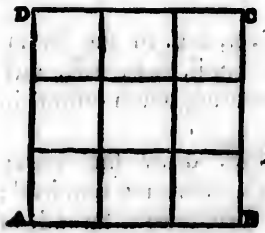
A. Mensuration of superficies teaches how to find the area or superficial content of any figure, without any regard to its thickness.

A SQUARE.

Rule.—To multiply the side by itself gives the area.

Examples.

1. What is the area of the square A B C D, whose side is 3 feet?



3 feet.
3
—
Ans. 9 sq. ft.

NOTE.—If each of the sides of the square A B C D be divided into 3 parts, and the opposite points be connected, it will appear obvious that the square A B C D will contain 9 small squares, or 9 square feet.

2. What is the area of a square whose side is 4 feet?
Ans. 16 feet.

3. How many square yards in a square, whose side is 20 feet? Ans. 44 yds. 4 feet.

4. How many square yards in a square, whose side is 31 feet? Ans. 106 yds. 7 feet.

5. How many acres in a square field, whose side is 50 poles? Ans. 15 ac. 2 roods, 20 poles.

6. How many acres in a square field, whose side is 80 poles? Ans. 40 acres.

OF A RECTANGLE.

Rule.—Multiply the length by the breadth, gives the area.

Examples.

1. Required the area of the rectangle A B C D, whose length A B is 13.75 chains, and breadth B C 9.5 chains.

13.75=A B.
9.5

6875
12375

10) 130.625

acres 13.0625
4

roods 0.2500
40

poles 10.0000

Ans. 13 ac. 0 ro. 10 po.

2. Required the area of a rectangular board, whose length is 12 feet, and breadth 2 feet. Ans. 24 feet.

3. Required the area of a rectangular board, whose length is $12\frac{1}{2}$ feet, and the breadth 10 inches.

Ans. $10\frac{5}{12}$ sq. feet.

4. Required the superficial content of a rectangular field, whose length is 12.25 chains, and breadth 8.5 chains. Ans. 10 ac. 1 ro. 26 po.

5. How many square yards of painting in a partition, whose length is 20 feet, and height 8 feet?

Ans. 17 yds. 7 feet.

6. What is the area of a rectangle, whose length is 14 feet, 6 inches, and breadth 4 feet, 9 inches?

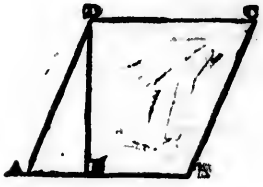
Ans. 68 ft. 126 sq. in.

OF A RHOMBUS.

Rule.—Multiply the side by the perpendicular breadth, and the product will be the area.

Examples.

1. Required the area of the rhombus A B C D, whose side A B is 12 ft. 6 in. and its perpendicular breadth D E 9 ft. 3 in.



	ft.	in.	
	12	6	=A B
	9	3	=D E
	112	6	
	3	1	6
Ans. Feet	115	7	6 p.

2. What is the area of a rhombus, whose side is 14 feet, and perpendicular breadth 5 feet? Ans. 70 feet.

3. Required the area of a rhombus, the length of whose side is 12 ft. 9 in. and its height 10 ft. 6 in.

Ans. 133 ft. 10 in. 6 p.

4. Required the content of a rhombus, the side being 4 ft. 10 in. and the perpendicular 18 inches.

Ans. 7 ft. 3 in.

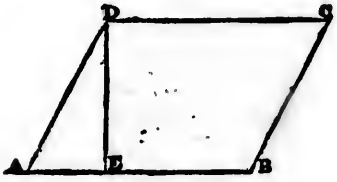
5. Find the content of a piece of land in the form of a rhombus, its length being 6.20 chains, the perpendicular 5.45 ch. Ans. 3 ac. 1 ro. 20 po.

OF A RHOMBOID.

Rule.—Multiply the length by the perpendicular height gives the area.

Examples.

1. What is the area of the rhomb[illegible] D, whose length A B is 10.52 chains, and its pe[illegible]ar height D E 7.63 chains?



10.52 = A B
7.63

3156
6312
7364

10)80.2676

acres 8.02676
4

roods 0.10704
40

poles 4.28160

Ans. 8 a. 0 r. 4 p.

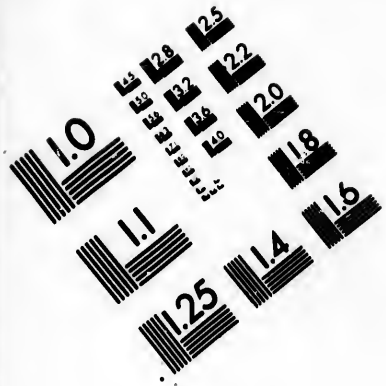
2. Required the area of a rhomboid, whose length is 10.51 chains, and breadth 4.28 chains.

Ans 4 ac. 1 ro. 39 po.

3. What is the area of a rhomboid, whose length is 7 ft. 9 in. and height 3 ft. 6 in.? Ans. 27 ft. 18 sq. in.

4. How many square yards in a rhomboid, whose length is 37 ft. and height 5 ft. 3 in.?

Ans. $21\frac{7}{12}$ sq. yds.



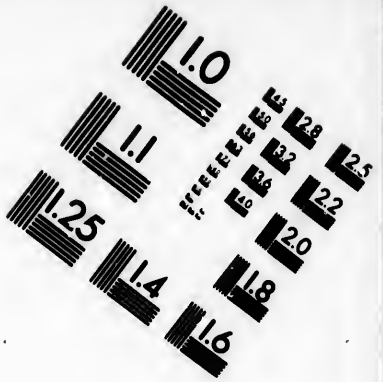
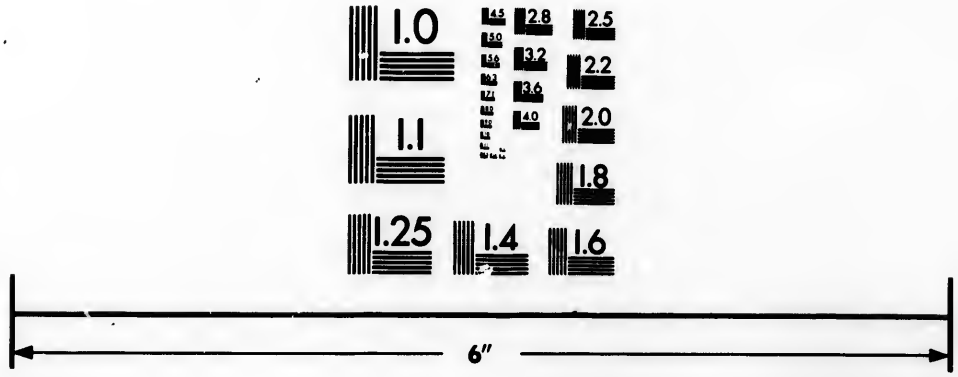


IMAGE EVALUATION TEST TARGET (MT-3)



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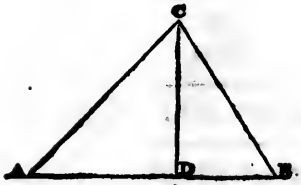
OF A TRIANGLE.

Rule 1.—Multiply the base by the perpendicular height, and take half the product for the area.

Examples.

1. Required the area of the triangle A B C, whose base A B is 10 ft. 9 in. and its perpendicular height D C 7 ft 3 in.



ft.	in.		
10	9	= 10.75	= A B
7	3	= 7.25	= C D

5375
2150
7525

2) 77.9375

feet 38.96875
144

387500
387500
96875

sq. in. 139.50000

Ans. 38 ft. 139 sq. in.

2. What is the area of a triangle, whose base is 20 ft. and the perpendicular 5 feet? Ans. 50 ft.

3. How many square yards in a triangle, whose base is 40 feet, and the perpendicular 30 feet?
Ans. 66⅔ sq. yrds.

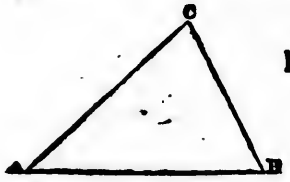
4. Required the area of a triangle, whose base is 12.25 chains, and height 8.5 chains. Ans. 5 ac. 33 po.

Rule 2.—When the three sides are given: Add all the three sides together, and take half that sum; next sub-

tract each side severally from the said half sum, then multiply that half sum and the three remainders together, and extract the square root of the product for the area of the triangle.

Examples.

1. Required the area of the triangle A B C, whose three sides B C, C A, A B, are 13. 14. and 15 feet respectively.



13=B C
14=C A
15=A B

	—	21	21	21
2)	42	13	14	15
	—	—	—	—
half sum	21	8 1st rem.	7 2nd rem.	6 3rd rem.

8 1st rem.

168

7 2nd rem.

1176

6 3rd rem.

7056

64 (84 sq. feet.

164) 656

656

2. Required the area of a triangle whose sides are 20, 30 and 40 feet. Ans. 290.4737 sq. feet.

3. Required the area of an equilateral triangle, each of whose equal sides is 25 chains. Ans. 27.0632 acres.

4. Required the area of an isosceles triangle, whose base is 20, and each of its equal sides 15. Ans. 111.803.

5. Required the area of a right-angled triangle whose hypotenuse is 50 and the other two sides 30 and 40. Ans. 600.

6. How many acres are there in the triangle, whose three sides are 380, 420, and 765 yards.

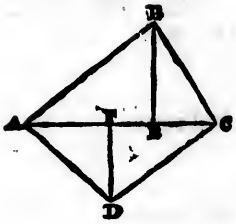
Ans. 9 ac. 0 ro. 38 po.

OF A TRAPEZIUM.

Rule.—Add the two perpendiculars together, multiply that sum by the diagonal, and take half the product for the area.

Examples.

1. Required the area of the trapezium A B C D, whose diagonal A C is 84, the perpendicular B E 28, and the perpendicular D F 21.



28=B E
21=D F

49
84

196
392

2) 4116

Ans. 2058 area of the trapezium A B C D.

2. Required the area of a trapezium whose diagonal is 40 and the two perpendiculars 20 and 10. Ans. 600.

3. Required the area of a trapezium whose diagonal is $80\frac{1}{2}$, and the two perpendiculars $24\frac{1}{2}$ and $30\frac{1}{10}$.

Ans. 2197.65.

4. What is the area of a trapezium, whose diagonal is 108 ft. 6 in. and the perpendiculars 56 ft. 3 in. and 60 ft. 9 in.? Ans. 6347 ft. 36 sq. in.

5. How many square yards of paving are there in a trapezium, whose diagonal is 65 feet, and the two perpendiculars, 28 and $33\frac{1}{2}$ feet respectively?

Ans. 222.083 sq. yds.

6. How many acres are there in the trapezium, whose diagonal is 4.75 chains, and the two perpendiculars falling on it, 2.25 and 3.6 chains respectively?

Ans. 13 ac. 3 ro. 23 po.

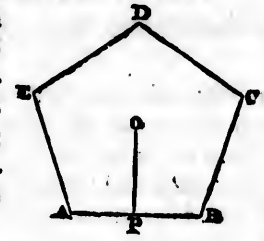
OF REGULAR POLYGONS.

Rule.—When the side and perpendicular are given, multiply the length of one of the sides by the number of sides which the figure contains, then multiply that product by the perpendicular, and take half of the last product for the area; but if the side only be given, square the side, and multiply it by the tabular number found opposite its name in the following table, and the product will be the area.

No. of SIDES.	NAMES.	TABULAR NUMBER.
3	Trigon	0.4330127
4	Tetragon . . .	1.0000000
5	Pentagon . . .	1.7204774
6	Hexagon . . .	2.5980762
7	Heptagon . . .	3.6339126
8	Octagon . . .	4.8284272
9	Nonagon . . .	6.1818240
10	Decagon . . .	7.6942088
11	Hendecagon . .	9.3656411
12	Dodecagon . .	11.1961524

Examples.

1. Required the area of the regular pentagon A B C D E, one of whose sides being 25 feet, and the perpendicular O P from its centre 17.2 feet.



Side A B= 25
No. of sides= 5
125
Perpr. O P=17.2
250
875
125
2) 2150.0
Ans. 1075 feet.

Or, thus:
25 side A B.
25
125
50
625
1.72 tabular number.
1250
4375
625
Ans. 1075.00

2. Required the area of a hexagon, one of whose equal sides is 14.6 feet, and the perpendicular from the centre 12.64 feet? Ans. 553.632 sqr. feet.

3. Required the area of a heptagon, one of whose equal sides is 19.38, and the perpendicular from the centre 20. Ans. 1356.6.

4. Required the area of an octagon, one of whose equal sides is 9.941, and the perpendicular from the centre 12. Ans. 477.168.

5. Required the area of a regular octagon, each of whose equal sides is 16. Ans. 1236.0773.

6. Required the area of a regular decagon, each of its equal sides being $20\frac{1}{2}$. Ans. 3233.491125.

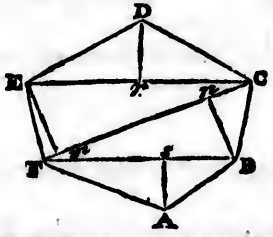
OF IRREGULAR RIGHT-LINED FIGURES.

Rule.—Divide the figure into triangles and trapeziums, and find the areas of each of them separately, then

add these areas together, and their sum will give the area of the whole figure.

Examples.

1. Required the area of the irregular right-lined figure A B C D E F, the dimensions of which are as follows: F B=20.75, F C=27.48, E C=18.5, B n=14.25, E m=9.35, D r=12.8, and A s=8.6.



of A B F. $20.75 \times 8.6 = 178.450 \div 2 = 89.225$ area
of D E C. $18.5 \times 12.8 = 236.80 \div 2 = 118.40$ area
of F B C E. $14.25+9.35=23.60 \times 27.48=648.5280 \div 2=324.264$ area
of A B C D E F. Ans. 531.889 area

2. Required the area of an irregular hexagon, like that in the last example, supposing the dimensions of the different lines to be the halves of those before given.

OF A CIRCLE.

Rule 1.—Multiply the diameter by 3.1416—gives the circumference.

2. Divide the circumference by 3.1416—gives the diameter.

3. Square the diameter, and multiply it by .7854—gives the area.

4. Square the circumference, and multiply it by .07958—gives the area.

5. Divide the area by .7854, and extract the square root—gives the diameter.

6. Divide the area by .07958, and extract the square root—gives the circumference.

Examples.

1. What is the circumference and area of a circle, whose diameter is 3 feet?

3.1416		.7854	
3	feet diameter.	3×3= 9	square of diameter.
Ans. 9.4248	feet circumf.	Ans. 7.0686	sq. ft. = area.

2. If the diameter be 26, what is the circumference?
Ans. 81.6816.

3. If the circumference be 75, what is the diameter?
Ans. 23.873.

4. What is the circumference, when the diameter is 7?
Ans. 21.9912.

5. What is the diameter of a circle, whose circumference is 50? Ans. 15.9156.

6. What is the area of a circle, whose diameter is $5\frac{1}{2}$ feet? Ans. 23.758350 feet.

7. How many square yards are there in a circle, whose circumference is $10\frac{3}{4}$ yds.? Ans. 9.19646375.

8. How many square yards are there in a circle, whose radius is $15\frac{1}{4}$ feet? Ans. 81.1798.

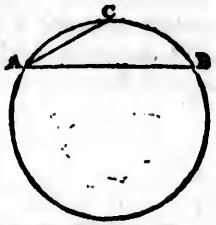
9. How many square feet are there in a circle, whose circumference is $20\frac{1}{10}$ yards? Ans. 289.36.

10. It is required to find the radius of a circle, whose area is an acre. Ans. $39\frac{1}{4}$ yrds.

Rule 7.—To find the length of any arc of a circle: Multiply the chord of half the arc by 8, from that product subtract the chord of the whole arc, and one-third of the remainder will be the length of the arc nearly; or multiply the decimal .01745 by the degrees in the given arc, and that product by the radius of the circle, for the length of the arc.

Examples.

1. The chord A B of the whole arc A B C is 48.74, and the chord A C of half the arc 30.25, what is the length of the arc?



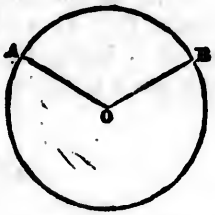
30.25
8

242.00
48.74

3) 193.26

Ans. 64.42 length of the arc A B C.

2. Required the length of the arc A B, which contains 60 degrees, and the radius B O of the circle being 7 feet.



.01745
60

1.04700
7

Ans. 7.32900 feet the arc A B.

3. The chord of the whole arc is 30, and the chord of half the arc is 17, what is the length of the arc?

Ans. $35\frac{1}{3}$.

4. The chord of the whole arc is $50\frac{4}{5}$, and the chord of half the arc is $30\frac{3}{5}$, what is the length of the arc?

Ans. 64.6.

5. What is the length of an arc of 30 degrees, the radius of its circle being 9 feet? Ans. 4.7115.

6. What is the length of an arc of $12\frac{1}{6}$ degrees, the radius being 10 feet? Ans. 2.1231.

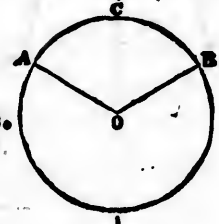
Rule 8.—To find the area of a sector of a circle: Multiply the radius of the circle, by half the length of the

arc of the sector, and the product will be the area: or, as 260 degrees is to the number of degrees in the arc of the sector, so is the area of the circle to the area of the sector.

Examples.

1. What is the area of the sector O B C A O, the radius O A being 10 feet, and the arc A C B, 18 feet?

2. Required the area of the sector, the arc A C B being 30 degrees, and the diameter 3 feet.



1st Example.

10 = A O
9 = ½ A C B

90 feet area of O B C A O.

2d Example.

.7854 × 9 = 7.0686 = area of the circle.

Ans. 360 : 30 : : 7.0686 : .58905 area of the sector.

3. What is the area of a sector, whose arc contains 18 degrees, the diameter being 3 feet? Ans. .35343.

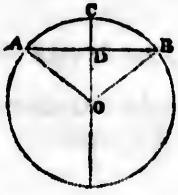
4. What is the area of a sector, whose radius is 10, and arc 20? Ans. 100.

5. Required the area of a sector, whose radius is 25, and its arc containing 147° 29′. Ans. 804.3986.

Rule 9.—To find the area of a segment of a circle: Find the area of the sector, having the same arc as the segment; then find the area of the triangle formed by the chord of the segment and the two radii of the sector, and the *sum* or *difference* of these areas, according as the segment is greater or less than a semicircle, will be the area of the segment required.

Examples.

1. The chord A B is 24, and the height or versed sine C D of half the arc A C B is 5; what is the area of the segment A B C A?



First find the requisites thus:

$\sqrt{AD^2+DC^2}=AC$ 13 the chord of half the arc.
$AC^2\div 5=CE$ 33.8 the diameter of the circle
$CE\div 2=CO$ 16.9 the radius of the circle.
$AC\times 8-AB\div 3=ACB$ 26.666 the length of the arc.
$CO-CD=DO$ 11.9 the perp. of the $\triangle$ AOB.

DO = 11.9	13.333 half the arc ACB
AB = 12	16.9 the radius.
142.8 area of $\triangle$ OAB.	119997
	79998
	13333
	From 225.3277 area of the sector OBCAO.
	Take 142.8 area of the $\triangle$, OAB.
	Rem. 82.5277 area of the segment ABCA.

2. Required the area of a segment. its chord being 12, and the radius of the circle 10. Ans. 16.3504.

3. What is the area of a segment, whose versed sine is 18, and the diameter of the circle 50? Ans. 636.375.

4. Required the area of a segment, whose chord is 16, and the diameter 20. Ans. 44.728.

5. What is the area of a segment of a circle, whose arc is 60°, and the diameter of the circle 10 feet?

Ans. 2.2647.

6. Required the area of the segment of a circle, whose versed sine is 5, and the diameter of the circle 20 feet.

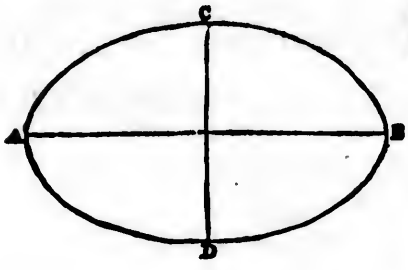
Ans. 61.4184.

OF AN ELLIPSIS OR OVAL.

Rule.—Multiply the transverse diameter by the congregate, and this product again by .7854, and the result will be the area.

Examples.

1. Required the area of an ellipsis, whose tranverse diameter A B is 24, and the congregate C D, 18.



A B 24 = transverse diameter.
C D 18 = conjugate diameter.

192
24

432
.7854

1.728
2160
3456
3024

Ans. 339.2928 = area of the ellipse.

2. Required the area of an ellipse, whose transverse and conjugate diameters are 70 and 50. Ans. 2748.9.

3. Find the erea of an oval, whose two axes are 24 and 18. Ans. 339.2928.

MENSURATION OF SOLIDS.

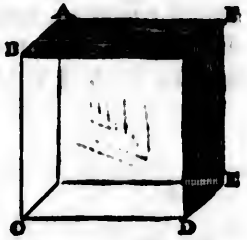
Q. What is Mensuration of solids?

A. Mensuration of solids teaches how to find the whole capacity or content of any solid, considered under the triple dimensions of length, breadth, and thickness.

Definitions.

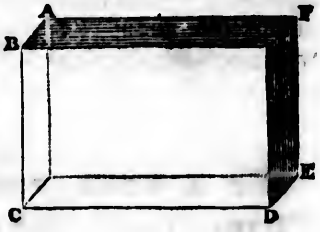
Q. What is a cube?

A. A cube is a solid contained by six equal square sides, or faces, as A D.



Q. What is a parallelopiped?

A. A parallelopiped is a solid contained by six rectangular plane faces, every opposite two of which are equal and parallel; as A D.



Q. What is a prism?

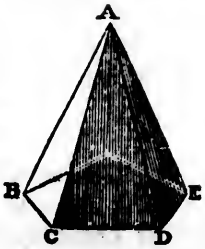
A. A prism is a solid, whose ends are two equal, parallel, and similar plane figures, and its sides parallelograms; as A B C D E A.

Q. What is a cylinder?

A. A cylinder is a solid, whose surface is circular, and its ends two circular planes, as A C.

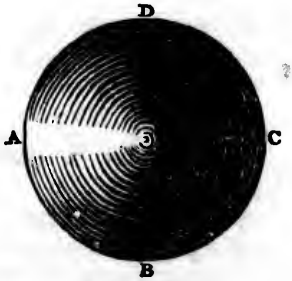
Q. What is a pyramid?

A. A pyramid is a solid, whose sides are all triangles, meeting in a point as the vertex, and the base any plane figure; as A B C D E A.



Q. What is a sphere?

A. A sphere or globe is a solid described by the revolution of a semicircle about its diameter, which remains fixed, as A B C D.



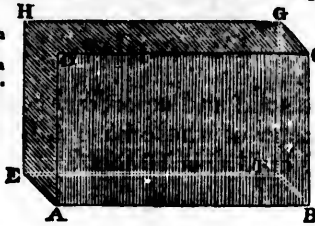
OF A CUBE, PRISM OR CYLINDER.

Rule 1.—To find the *solid* content of a cube, prism, or cylinder: find the area of the base, or end, and multiply it by the height or length of the figure, gives the solid content.

Rule 2.—To find the *superficial* content of a cube, prism, or cylinder: Multiply the perimeter or circumference of the base or end of the figure, by the height or length of the cube, prism, or cylinder, to which product add the areas of the two ends, if required, gives the whole surface of the figure.

Examples.

1. What is the solid and superficial content of a parallelopiped A B C G H E, whose length A B is 8 feet, its breadth A E $4\frac{1}{2}$ feet, and its depth A D $6\frac{3}{4}$ feet.



4.5 breadth A E.
6.75 depth A D.

225
315
270

30.375 area of the end.
8 length A B.

Ans. 243.000 feet solid content.

9 twice the breadth.
13.5 twice the depth.

22.5 perimeter.
8

180.0 area of the body.
60.75

Ans. 240.75 ft. superf. content.

3. What is the superficial content of a cube, the length of each side being 20 feet? Ans. 2400 feet.

3. What is the superficial content of a triangular prism, whose length is 20 feet, and each side of its end or base 18 inches? Ans. 91.948 feet.

4. Find the convex surface of a round prism, or cylinder, whose length is 20 feet, and the diameter of its base 2 feet. Ans. 125.664.

5. What is the solid content of a centre, whose side is 24 inches? Ans. 13824.

6. How many cubic feet are in a block of marble, its length being 3 ft. 2 in., breadth 2 ft. 8 in., and thickness 2 ft. 6 in.? Ans. $21\frac{1}{3}$ feet.

7. Required the solidity of a triangular prism, whose length is 10 feet, and the three sides of its triangular end or base at 3, 4, 5 feet. Ans. 60.

8. Required the content of a round pillar or cylinder, whose length is 20 feet, and circumference 5 ft. 6 in. Ans. 48.1459.

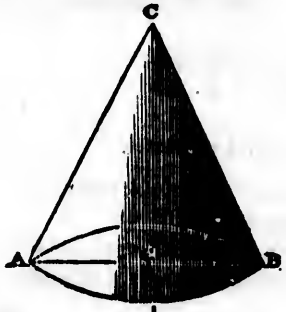
OF A PYRAMID OR CONE.

Rule 1.—To find the *solid* content of a pyramid or cone: Multiply the area of the base by one-third of the perpendicular height, gives the solid content.

Rule 2.—To find the superficial content of a pyramid or cone: Multiply the perimeter of the base by half the slant height, to which add the area of the base, if requisite, gives the superficial content.

Examples.

1. What is the solid and superficial content of the cone A B C, the diameter of whose base A B is 6 feet, and the slant height A C or B C is 10 feet?



$A C^2 = 10 \times 10 = 100$
$\frac{1}{2} A B = 3 \times 3 = 9$

$\sqrt{2}$ 91

perp. o C = 9.5393

.7854
$A B^2 = 6 \times 6 =$ 36

47124
23562

28.2744 area of the base.
multiplied by 3.1797 $\frac{1}{2}$ of the perp. O C.

Ans. 89.9041 feet solid cont.

3.1416
6

18.8496 circumfer.
5 $\frac{1}{2}$ slant ht.

94.2480 area of the body.
28.2744 area of the base.

Ans. 122.5224 feet sup. content

2. What is the superficial content of a triangular pyramid, the slant height being 20 feet, and each side of the base 3 feet? Ans. 90 feet.

3. Required the surface of a cone, the slant height being 50 feet, and the diameter of the base $8\frac{1}{2}$ feet.
Ans. 667.59.

4. Required the solidity of a square pyramid, each side of its base being 30, and its perpendicular height 25.
Ans. 7500.

5. Find the solid content of a triangular pyramid, whose perpendicular height is 30, and each side of the base 3.
Ans. 38.97117.

6. What is the content of a pentagonal pyramid, its height being 12 feet, and each side of its base 2 feet?
Ans. 27.5276.

7. Required the content of a cone, its height being $10\frac{1}{2}$ feet, and the circumference of its base 9 feet.
Ans. 22.56093.

OF THE FRUSTUM OF A PYRAMID OR CONE.

Rule 1.—To the areas of the two ends of the frustum add the square root of their product, and this sum being multiplied by a third of the height, will give the *solidity*.

Rule 2.—Multiply the sum of the perimeters or circumference of the two ends, by the slant height of the frustum, and half the product will give the *superficial* content.

Examples.

1. Required the solid and superficial content of the frustum of the cone E A B D, the diameter of whose greater end A B is 5 feet, that of the less end E D 3 feet, and the perpendicular height, S S, 9 feet.

Note 1.—When the slant height is not given, it may be found by extracting the square root of the sum of the squares of the perpendicular height and difference of the radii;

Thus:

A S=2½ − E S=1½= 1
9² = 9 × 9 = 81

√ 82

9.0553 slant ht.

A B=5 × 3.1416= 15.7080
E D=3 × 3.1416= 9.4248

25.1328 sum of circ.
× 9.0553 slant ht.

Ans. 226.58504 sup con.

.7854
5 × 5= 25

39270
15708

area of A B=19.6350

.7854
3 × 3= 9

area of E D= 7.0686

19.6350
7.0686

√² 138.79196100

11.781 square root of product.
19.6350 area of A B.
7.0686 area of E D.

38.4846
⅓ of perp. 3

Ans. 115.4538 solid content.

Note 2.—To the superficial content add the areas of both ends, if the whole surface be required.

2. What is the solidity of the frustum of a cone, the diameter of the greater end being 4 feet, and of the less end 2 feet, and the altitude 9 feet? Ans. 65.9736.

3. What is the solidity of the frustum of a sqare pyramid, one side of the greater end being 18 inches, that of the less end 15 inches, and the height 60 inches?

Ans. 9.479 cu. ft.

4. What is the solidity of the frustum of an hexagonal pyramid, the side of whose greater end is 3 feet, that of the less end 2 feet, and the length 12 feet?

Ans. 197.453776 cu. ft.

5. What is the superficial content of the frustum of a square pyramid, whose slant height is 10 feet, one side of the greater end being 3 ft. 4 in. and of the less end 2 ft. 2 in.? Ans. 110 ft.

6. To find the convex surface of the frustum of a cone, the slant height of the frustum being 12½ feet, and the circumference of the two ends 6 and 8.4 feet.

Ans. 90 feet.

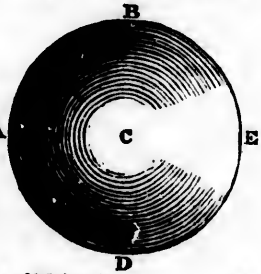
OF A SPHERE OR GLOBE.

Rule 1.—To find the *solid* content of a sphere: Cube the diameter, and multiply it by .5236, and the product will be the solidity.

Rule 2.—To find the *superficial* content of a sphere: Square the diameter, and multiply it by 3.1416, or multiply the diameter by the circumference—either of these methods will give the superficial content.

Examples.

1. What is the solid and superficial content of the sphere A D E B, whose diameter A E is 17 inches?



$17^3 = 4913$
.5236
29478
14739
9826
24565
Ans. 2572.4468 solid inches.

$17^2 = 289$
3.1416
1734
289
1156
289
867
Ans. 907.9224 sup. cont.

2. What is the solidity of a sphere, whose diameter is $1\frac{1}{3}$ feet? Ans. 1.2411.

3. What is the solidity of the earth, supposing it to be perfectly spherical, its diameter being $7957\frac{3}{4}$ miles?
Ans. 263858149120 cu. m.

4. What is the convex superficies of a sphere, whose diameter is $1\frac{1}{3}$ feet, and the circumference 4.1888 feet?
Ans. 5.58506 sq. feet.

5. If the diameter, or axis of the earth, be $7957\frac{3}{4}$ miles; what is the whole surface, supposing it to be a perfect sphere? Ans. 198944286.35235 sq. miles.

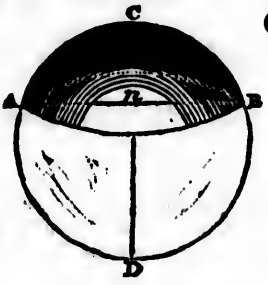
OF THE SEGMENT OF A SPHERE.

Rule 1.—To three times the square of the radius of its base add the square of its height; and this sum multiplied by the height, and the product again by .5236, will give the *solidity*.

Rule 2.—Multiply the circumference of the whole sphere by the height of the segment, and the product will be the *superficial* content.

Examples.

1. What is the solid and superficial content of the segment C A B, the radius A n being 7 inches, the height C n 4 inches, and the diameter of the whole sphere C D $16\frac{1}{4}$ inches?



A n=7
7
49
3
147
16=n C²
163
4=n C.
652
× .5236
341.3872 inch. solid content.

C D=16.25
3.1416
9750
1625
6500
1625
4875
51.05.1000
4
Ans. 204.204 inches sup. content.

2. What is the solidity of the segment of a sphere, the diameter of whose base is 20, and its height 9?
Ans. 1795.4244.

3. What is the content of a spherical segment, whose height is 4 inches, and the radius of its base 8?
Ans. 435.6352 cu. in.

4. What is the superficial content of the segment of a sphere, whose height is $4\frac{1}{2}$ inches, and the diameter of the whole sphere is 21 inches? Ans. 296.8812 sq. in.

5. What is the convex surface of a spherical zone, whose breadth is 4 inches, and the diameter of the sphere, from which it was cut, 25 inches?
Ans 314.16 sq. inches.

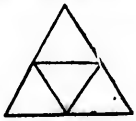
OF THE REGULAR BODIES.

The whole number of regular bodies which can possibly be formed is five, viz.:

1. The *Tetraedron*, which has four equal triangular faces.
2. The *Hexaedron*, which has six equal square faces.
3. The *Octaedron*, which has eight equal triangular faces.
4. The *Dodecaedron*, which has twelve equal pentagonal faces.
5. The *Icosaedron*, which has twenty equal triangular faces.

NOTE.—If the following figures be made of pasteboard, and the lines be cut half through, so that the parts may be turned up and glued together, they will represent the *five regular bodies*

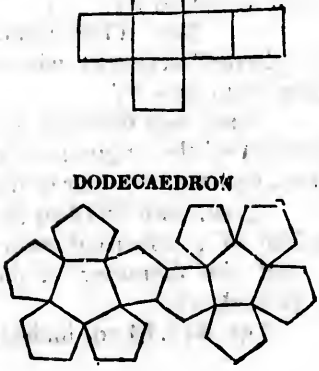
TETRAEDRON.



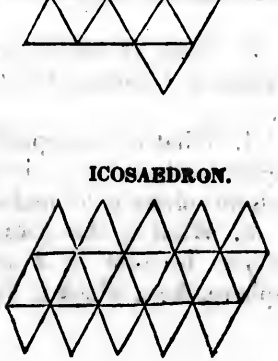
HEXAEDRON.

OCTAEDRON.

DODECAEDRON.



ICOSAEDRON.



Table

OF THE SURFACES AND SOLIDITIES OF THE REGULAR BODIES, WHEN THE LINEAR EDGE IS 1.

No. of SIDES.	NAMES.	SURFACES.	SOLIDITIES.
4	Tetraedron . .	1.73205	0.11785
6	Hexaedron	6.0000	1.0000
8	Octaedron . .	3.46410	0.47140
12	Dodecaedron .	20.64578	7.66312
20	Icosaedron . . .	8.66025	2.18169

Rule 1.—To find the superficies: Multiply the *square* of the linear edge by the tabular area, opposite its name, and the product will be the superficial content.

Rule 2.—To find the solidity: Multiply the *cube* of the linear edge, by the tabular solidity, opposite its name, and the product will be the solid content.

Examples.

1. What is the superficial and solid content of a Tetraedron, whose linear edge is 4?

Tabular area	1.73205	Tab. solidity	0.11785
$4^2 =$	16	$4^3 =$	64
	1039230		47140
	173205		70710
Ans.	17.71280 sup. content.		7.54240 solid content.

2. Required the solidity of a tetraedron, whose linear edge is 6. Ans. 25.452.

3. What is the superficial content of an octaedron, whose linear side is 4? Ans. 55.4256.

4. The linear side of a dodecaedron being 3, what is the solidity? Ans. 206.90424.

5. What is the solid content of an icosaedron, whose side is 3? Ans. 58.90563

ARTIFICERS' WORK.

Artificers estimate, or compute the value of their works by different measures, viz.:

Glazing, *Masons'* flat work, and some parts of joiners' work, are computed at so much per *square foot.*

Painters', *Plasterers'*, *Pavers'*, and some descriptions of joiners' work, are estimated by the *square yard.*

Roofs, *Floors*, *Partitions*, &c., by the square of 100 feet.

Bricklayers' work, by the square rod, containing 272¼ feet.

NOTE 1.—The roof of a house is said to be *of a true pitch*, when the rafters are ¾ of the breadth of the building. In this case, therefore, the breadth must be accounted equal to the breadth and half breadth of the building.

NOTE 2.—Bricklayers compute their work at the rate of a brick and a half thick; therefore, if the thickness of a wall be more or less, it must be reduced to the standard thickness by multiplying the area of the wall by the number of half bricks in the thickness, and dividing the product by 3.

Examples.

1. A certain house has 3 tiers of windows, 3 in a tier, the height of the first tier being 7 feet 10 inches, the second 6 feet 8 inches, and the third 5 feet 4 inches;

and the breadth of each window is 3 feet 11 inches What will the glazing cost at 14 d. per square feet.

ft.	in.	
7	10	
6	8	
5	4	
19	10	the whole height.
3	11	
	3	
11	9	the whole breadth.

	ft.	in.		
	19	10		
		11		
in.	218	2		
6 = ½ =	9	11		
3 = ¼ =	4	11	6"	
s.	£233	0	6	d. at 14
1 = 1/12 =	11	13		
d.2 = 1/6 =	1	18	10	
value of 6" =	0	0	0½	
Ans.	£13	11	10½	

2. What is the price of 8 squares of glass, each measuring 4 feet 10 inches long, and 2 feet 11 inches broad, at 4⅛*d.* per square feet? Ans. £1 18*s.* 9*d.*

3. What is the value of 8 squares, each measuring 3 feet by 1 feet 6 inches, at 7¾*d.* per square foot?

Ans. £1 3*s.* 3*d.*

4. What is the price of a marble slab, 5 feet 7 inches long, and 1 foot 10 inches broad, at 6*s.* per square foot?

Ans. £3 1*s.* 5*d.*

5. What will be the expense of ceiling a room, the length of which is 74 feet 9 inches, and the width 11 feet 6 inches, at 3*s.* 10½*d.* per square yard?

Ans. £18 10*s.* 1*d.*

6. What will the paving of a court-yard cost, at 4¾*d.* per square yard, the length being 58 feet 6 inches, and the breadth 54 feet 9 inches? Ans. £7 0*s.* 10*d.*

7. The circuit of a room is 97 feet 8 inches, and the height 9 feet 10 inches, what is this charge for painting it, at 2*s.* 8¾*d.* per rquare yard? Ans. £14 11*s.* 2*d.*

8. What is the expense of a piece of wainscot 8 feet 3 inches long, and 6 feet 6 inches broad, at 6*s*. 7½*d*. per square yard? Ans. £1 19*s*. 5*d*.

9. In a piece of partitioning 173 feet 10 inches long, and 10 feet 7 inches in height, how many squares?
Ans. 18 sqr. 39 ft. 8' 10"

10. If a house measures within the walls 52 feet 8 inches in length, and 30 feet 6 inches in breadth, the roof being of a true pitch; what will it cost roofing at 10*s*. 6*d*. per square? Ans. £12 12*s*. 11¾*d*.

11. How many rods are there in a wall 62½ feet long 14 feet 8 inches high, and 2½ bricks thick, counting each rod 272 feet? Ans. 5 rods 167 ft.

BOOK KEEPING,

BY SINGLE ENTRY.

Question. What is Book keeping?

Answer. Book keeping is the art of recording pecuniary or commercial transactions in a regular and systematic manner.

Q. What are the names of the books usually kept?

A. The Day-Book, the Cash-Book, the Ledger, and the Bill-Book.

Q. What is the Day-Book?

A. The Day-Book contains first an inventory of the existing state of the merchants' affairs: after which are entered, in the regular order of time, the daily transactions of goods bought and sold, where it must be observed that Dr. or Debtor, is placed after the name of any person for money or goods which he receives; and Cr. or Creditor, for whatever the merchant receives from him.

Q. What is the Cash-Book?

A. The Cash-Book contains the particulars of all money transactions. Cash is debited, on the left hand side, to all sums received; and credited, on the right hand side, by all sums paid. The excess of the Dr. side above the Cr. shows the balance or amount of cash in chest.

Q. What is the Ledger?

A. In the Ledger are collected the dispersed accounts of each person from the Day-Book and Cash-Book, and entered in a concise manner in one folio; the sums in which he is Dr. being arranged on the left hand, and those in which he is Cr. on the right hand page of the folio; the balance of each is ascertained by taking the difference between the Dr. and Cr. sides.

Q. What is the Bill-Book?

A. In the Bill-Book are copied the particulars of all Bills of Exchange, whether *Receivable or Payable.*

DAY BOOK.

Inventory.

1832.		£.	s.	d.
Jan'y 1.	I have in ready money,	1500	„	„
	Bills receivable, No. 1, on S. Johnston, due 29th inst.	24	3	9
	Tea, 3 chests, wt. 2cwt. 3qrs. 10lb. at 6s. 2d. per lb.	98	1	„
	Raw Sugar, 2hhds. wt. 27ct. 3qr. 18lb. at 3£. 14s. 8d. per cwt.	104	4	„
	James Taylor owes me on bond, dated August 14, 1828, with interest, at £5 per Ct. per ann.	70	„	„
		1796	8	9
	I owe as follows:			
	John Herdson, a balance of accounts,	37	5	10
	Bernard Mason, for purchase of my house, by auction, to be paid 1st Feb. next, £800			
	Duty on do. at £5 per ct. 40	840	„	„
	Bills payable, viz. No. 1, Wm. Homes' bill to H. Williams or order, accepted by me, due 19th inst.	45	10	„
		922	15	10
„ 5	Allen, Wild, & Co. Leeds, Cr.			
	By 3 pieces superfine blue cloth, each 36 yds. at 25s. 6d. per yard,	137	14	„
	„ 2 pieces narrow brown, 84 yds. at 4s. 9d.	19	19	„
	„ Wrappers,	0	5	6
		157	18	6
„ 8	Bernard Mason, Dr.			
	To 2 st. raw sugar at 9½ per lb.	1	2	2
	To 3¼ lbs. green tea, at 8s. 6d. per lb.	1	7	7½
	„ 3¾ yds. blue cloth, at 28s.	5	5	0
		7	14	9½

		£.	s.	d.
Jan'y 9.	Samuel Fletcher, Cr.			
	By Kent hops, 1ct. 1qr. 5lbs. at £5 7s. 0d.	6	18	6
	,, Worcester, do. 1 2 0 at 5 11 6	8	7	3
	Six months' credit, or £5 per Ct. discount for present payment.			
		15	5	9
,, 10	Simmonds & Co. Liverpool, Cr.			
	By yellow soap. 2cwt. at 76s.	7	12	0
	,, 12 doz. candles, at 8s. 6d.	5	2	0
	,, 4 doz. mould do. at 11s. 3d.	2	5	0
		14	19	0
,, 14	William Tomlinson, Dr.			
	To narrow cloth, 7 yds. at 5s. 6d.	1	18	6
	,, callico, 15 yds. at 0s. 8½ per yd.	0	10	7½
		2	9	1½
,, 19	Hazard and Jones, Dr.			
	To 1¼ st. yellow soap, at 9d. per lb.	0	15	9
	,, ½ st. mottled do. at 9½d.	0	5	6½
	,, 9 lb. candles, at 9d.	0	6	9
	,, 3 lb. moulds, at 1s. 0½d.	0	3	1½
		1	11	2
,, 23	James Sanderson, Cr.			
	By goods, as per invoice,	7	3	6
,, 28	Hazard and Jones, Dr.			
	To 17½ lbs. loaf sugar, at 1s. 1d.	0	18	11½
	,, 12 lbs. raw, do. at 10d.	0	10	0
	,, 1¼ lbs. Congou tea, at 7s. 6d.	0	9	4½
	,, ½ lb. Hyson, at 12s.	0	6	0
,, 31	John Herdson, Dr.			
	To Hops, 10 lbs. at 1s. 1d. p.	0	10	10
	,, ½ ream cap paper, at 7d. per quire,	0	5	10
		0	16	8

		£.	s.	d.
Feb. 1	William Tomlinson, Dr.			
	To 2 st. yellow soap, at 9d. per lb.	1	1	0
	„ 6 lbs. mould candles, at 1s. 1d.	0	6	6
	„ 16 lbs. lump sugar, at 1s. 0½d.	0	16	8
		2	4	2
4	James Taylor, Dr.			
	To half a year's interest on £70, at 5 per cent. per ann.	1	15	0
5	William Tomlinson, Dr.			
	To 1 piece sup. blue cloth, 36 yds. at 27s. 6d.	49	10	0
	For bill at 1 month.			
10	James Sanderson, Cr.			
	By cheese, 25Ct. 3qrs. 17lbs. at £3, 2s. 6d. per cwt.	80	18	2¼
10	Allen, Wild, & Co. Leeds, Dr.			
	To my acceptance of their Bill at 2 mon. drawn 3d Jan. B. P. Book, No. 2,	80	0	0
12	Oats' Purveyance, in partnership with J. Henderson, Dr.			
	To cash for oats purchased by me,	26	11	0
	Do. do. by Henderson,	449	0	3
	Do. for warehouse room, &c.	1	13	8
	Cr.	477	4	11
	By cash received for oats sold,	507	9	2
	Do. do. by J. H.	55	2	8
	Dr.	562	11	10
	To Profit, ½ (£42, 13s. 5½d.) being my share,	85	6	11
	„ J. H. ½ (£42, 13 5½) being his share,			

1832.			£.	s.	d.
Feb. 12	John Henderson,	Dr.			
	To cash advanced him on oats' concern,		433	17	0
	„ Oats sold and reeceived for by him,		55	2	8
		Cr.	488	19	8
	By oats purchased by him,		449	0	3
	„ his share of profit,		42	13	5½
			491	13	8½

CASH BOOK.

1832.	Cash, Dr.	F.	£.	s.	d.	1332.	Contra, Cr.	F.	£.	s.	d.
Jan. 1	To stock,		1500	—	—	Jan. 9.	By S. Fletcher, paid him bill No. 1.		24	3	9
	" Bills Receivable, No. 1, on S. Johnson,		24	3	9		" His acc't. 15l. 5s. 9d. less 15s. 3d.				
" 9	" S. Fletcher, cheque on Smith & Co.		9	13	3		Discount, 14l. 10s. 6d		—	—	—
							Diff. see Dr. side, 9l. 13s. 3d.		—	—	—
						" 19	" Bills payable No. 1. W. Holmes's,		45	10	—
						" 31	" T. Henderson, bal. of accts. (ab. 4d.)		37	5	6
							Balance,		1426	17	9
			1533	17	0				1533	17	0
Feb. 1	To balance, per opposite,		1426	17	9	Feb. 1.	By Bernard Mason, (total, 832l. 5s. 2½d. abt. 5s. 2½d.)		832	0	0
" 4	" W. Tomlinson, (abat. 3½,)		4	13	0	" 8	" W. Tomlinson, pd. to J. Sims, by his order,		10	0	0
	" J. Taylor, ½ year's int. on 70l.		1	15	0	" 16	James Sanderson, 88l. 1s. 8¾d. abtmt. 1s. 8¾d.		88	0	0
	" W. Tomlinson, bill on Jones & Co. Lon. No. 2, due 10 May,		60	0	0						
	Should have been at 1 mo. debit him with discount 10s.		—	—	—		Balance,		565	12	11¼
	His account 491. 10, diff. 10s. see Cr. side,		—	—	—						
" 12	To Hazard & Jones's Assignee, composition on 3l. 15s. 6d. at 12s. 6d in the £. Loss, 1l. 8s. 3¾.		2	7	2¼						
			1495	12	11¼				1495	12	11¼

Index to the Ledger.

A. Allen, Wild, & Co.
B. Bills payable.
F. Fletcher, Samuel.
H. Henderson, John.
Hazard & Jones.
M. Mason, Bernard.
O. Oats' Purveyance.
S. Stock,
Simmonds & Co.
Sanderson, James,
T. Taylor, James,
Tomlinson, Wm.

LEDGER.

1832.	STOCK, Dr.	£.	s.	d.	1832.	CONTRA, Cr.	£.	s.	d.
Jan. 1	To sundries, amount of my debts,	922	15	10	Jan. 1	By sundries, amount of property,	1796	8	9
Feb.12	" Balance acc't,	460	18	0¼					

1832.	JAMES TAYLOR, Dr.		£.	s.	d.	1832.	CONTRA, Cr.		£.	s.	d.
Jan. 1	To money on bond,		70	00	"	Feb. 4	By cash for interest,	cb 1	1	15	0
	" Half a yr's interest,		1	15	"		" Balance,		70	"	"
			71	15	"				71	15	"

1832.	JOHN HENDERSON, Dr.		£.	s.	d.	1832.	CONTRA, Cr.		£.	s.	d.
Jan.31	To cash, 37l. 5s. 6d. abt. 4d.		37	5	10	Jan. 1	By balance of acc'ts,		37	5	10
	" Sundries,			16	8	Feb.12	By sundries on oats' concern,		491	13	8½
Feb.12	" Do. on oats' concern,		488	19	8						
	Balance,		1	17	4½						
			491	13	8½				491	13	8½

1832.	BERNARD MASON, Dr.		£.	s.	d.	1832.	CONTRA, Cr.		£.	s.	d.
Jan. 8	To sundries,		7	14	9½	Jan. 1	By purchase of house, and duty, due February 1st.		840	0	0
	" Cash, 832, abat. 5s. 2½d.		832	5	2½						
			840	00	"				840	0	0

1831.	BILLS PAYABLE, Dr.	c.b	£.	s.	d.	1832.	CONTRA, Cr.		£.	s.	d.
Jan.19	To cash,	1	45	10	"	Jan. 1	By Holmes's bill, No.1		45	10	0
Feb.12	Balance, ffo.		80	00	"	Feb.10	Allen, Wild, & Co's. bill, No. 2, bb.	1	80	"	0

1832.	ALLEN, WILD, & Co. Dr.		£.	s.	d.	1832.	CONTRA, Cr.		£.	s.	d.
Feb.10	To bills payable,		80	00	'	Jan. 5	By cloth,		157	18	6
" 12	" Balance, ffo	3	77	18	6						
			157	18	6				157	18	6

1832.	SAMUEL FLETCHER, Dr.		£.	s.	d.
Jan. 9	To bill and discount on hops, c. b.	1	24	19	0
			24	19	0

1832.	CONTRA, Cr.		£.	s.	d.
Jan. 9	By hops,		15	5	9
	Cheque on Smith and Co.		9	13	3
			24	19	0

	SIMMONDS & Co. Dr.				
Feb.12	To balance, ffo.	3	14	19	0

	CONTRA, Cr.				
Jan.10	By goods,		14	19	0

1832.	WM. TOMLINSON, Dr.				
Jan.14	To goods,		2	9	1½
Feb. 1	Do.		2	4	2
			4	13	3½
" 5	To cloth,		49	10	0
" 8	" Cash, 10l. disc. 10s.		10	10	"
			60	"	"

1832.	CONTRA. Cr.				
Feb. 1	By cash, c. b.	1	4	13	0
	Abatement, c. b.	1	0	0	3½
			4	13	3½
" 8	By bill,		60	"	"
			60	"	"

1832.	HAZARD & JONES, Dr.				
Jan.19	To soap and candles,		1	11	2
" 28	" Sugar and tea,		2	4	4
			3	15	6

1832.	CONTRA, Cr.				
Feb.12	By cash for composition,		2	7	2½
	Remainder lost,		1	8	3½
			3	15	6

1830.	JA'S SANDERSON, Dr.				
Feb.10	To cash, 88l. abat. 1s. 8¼.		88	1	8¼

1832.	CONTRA, Cr.				
Jan.23	By goods,		7	3	6
Feb.10	" Cheese,		80	18	2¼
			88	1	8¼

1830.	Oats' Purveyance in Co. with J. Herdson, Dr.				
Feb.12	To sundries,		477	4	11
	Profit,				
	½ to self, 421.13s. 5½d.				
	½ T. H. 421.13s. 5½d		85	6	11
			562	11	10

1832.	CONTRA. Cr.				
Feb.12	By sundries,		562	11	10
			562	11	10

1832.	GENERAL Dr.				
Feb.12	To cash in hand,		565	12	11¼
	James Taylor owes me		70	"	"
			635	12	11¼

1832.	BALANCE, Cr.				
Feb.12	By T. Herdson, I owe,		1	17	4½
	Bills payable,		80	"	"
	Allen, Wild, & Co.		77	18	6
	Simmonds & Co.		14	19	0
	Stock acc't. debited,		460	18	0¾
			635	12	11¼

£.	s.	d.
15	5	9
9	13	3
24	19	0
14	19	0
4	13	0
0	0	3½
4	13	3½
60	"	"
60	"	"
2	7	2¼
1	8	3¾
3	15	6
7	3	6
80	18	2¼
88	1	8¼
562	11	10
562	11	10
1	17	4½
80	"	"
77	18	6
14	19	0
460	18	0¾
635	12	11½