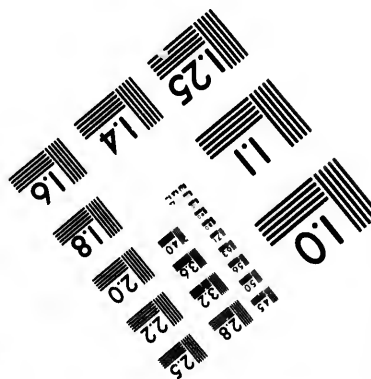
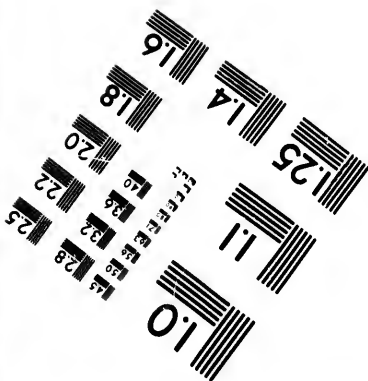
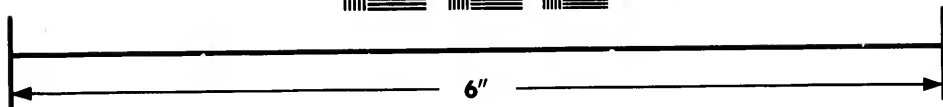
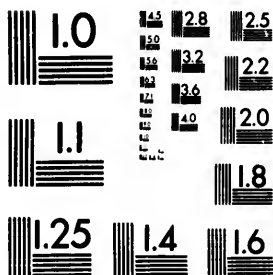


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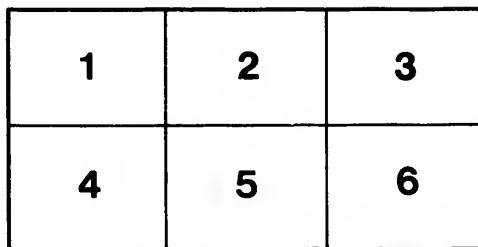
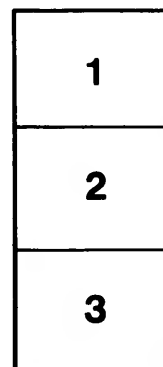
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FIRST BOOK

OF

ARITHMETIC:

FOR

The Use of Schools.

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REVISED EDITION, ADAPTED TO THE NEW DECIMAL  
CURRENCY OF CANADA.

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TORONTO:

PUBLISHED BY ROBERT McPHAIL

NATIONAL SCHOOL BOOK DEPOT, 65, KING-ST., EAST.

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# PREFACE.

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**I**N adapting this well known Treatise to the Decimal Currency, neither expense nor pains have been spared to make it worthy of universal patronage. The assistance of a gentleman has been secured, who brings to the work, besides the qualification of a Practical Accountant, a long experience as a successful Teacher. As much as possible of the old Book has been retained entire, but all the Commercial Rules have been considerably enlarged, and several important ones have been added. The arrangement, also, is more methodical, and as a whole, the book, as now presented, is perhaps one of the most complete *elementary* Treatises ever published on this Continent.

**THE PUBLISHER.**

nt, in the year  
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# ARITHMETICAL TABLES.

## ADDITION TABLE.

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<b>2 and 1 are 3</b>	<b>5 and 5 are 10</b>	<b>8 and 9 are 17</b>
2 — 2 — 4	5 — 6 — 11	8 — 10 — 18
2 — 3 — 5	5 — 7 — 12	8 — 11 — 19
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2 — 5 — 7	5 — 9 — 14	9 and 1 are 10
2 — 6 — 8	5 — 10 — 15	9 — 2 — 11
2 — 7 — 9	5 — 11 — 16	9 — 3 — 12
2 — 8 — 10	5 — 12 — 17	9 — 4 — 13
2 — 9 — 11	6 and 1 are 7	9 — 5 — 14
2 — 10 — 12	6 — 2 — 8	9 — 6 — 15
2 — 11 — 13	6 — 3 — 9	9 — 7 — 16
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<b>3 and 1 are 4</b>	6 — 5 — 11	9 — 9 — 18
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3 — 4 — 7	6 — 8 — 14	9 — 12 — 21
3 — 5 — 8	6 — 9 — 15	11 and 1 are 12
3 — 6 — 9	6 — 10 — 16	11 — 2 — 13
3 — 7 — 10	6 — 11 — 17	11 — 3 — 14
3 — 8 — 11	6 — 12 — 18	11 — 4 — 15
3 — 9 — 12	7 and 1 are 8	11 — 5 — 16
3 — 10 — 13	7 — 2 — 9	11 — 6 — 17
3 — 11 — 14	7 — 3 — 10	11 — 7 — 18
3 — 12 — 15	7 — 4 — 11	11 — 8 — 19
<b>4 and 1 are 5</b>	7 — 5 — 12	11 — 9 — 20
4 — 2 — 6	7 — 6 — 13	11 — 10 — 21
4 — 3 — 7	7 — 7 — 14	11 — 11 — 22
4 — 4 — 8	7 — 8 — 15	11 — 12 — 23
4 — 5 — 9	7 — 9 — 16	12 and 1 are 13
4 — 6 — 10	7 — 10 — 17	12 — 2 — 14
4 — 7 — 11	7 — 11 — 18	12 — 3 — 15
4 — 8 — 12	7 — 12 — 19	12 — 4 — 16
4 — 9 — 13	8 and 1 are 9	12 — 5 — 17
4 — 10 — 14	8 — 2 — 10	12 — 6 — 18
4 — 11 — 15	8 — 3 — 11	12 — 7 — 19
4 — 12 — 16	8 — 4 — 12	12 — 8 — 20
<b>5 and 1 are 6</b>	8 — 5 — 13	12 — 9 — 21
5 — 2 — 7	8 — 6 — 14	12 — 10 — 22
5 — 3 — 8	8 — 7 — 15	12 — 11 — 23
5 — 4 — 9	8 — 8 — 16	12 — 12 — 24

MULTIPLICATION TABLE.

Twice	3 times	4 times	5 times	6 times	7 times
1 are 2	1 are 3	1 are 4	1 are 5	1 are 6	1 are 7
2 — 4	2 — 6	2 — 8	2 — 10	2 — 12	2 — 14
3 — 6	3 — 9	3 — 12	3 — 15	3 — 18	3 — 21
4 — 8	4 — 12	4 — 16	4 — 20	4 — 24	4 — 28
5 — 10	5 — 15	5 — 20	5 — 25	5 — 30	5 — 35
6 — 12	6 — 18	6 — 24	6 — 30	6 — 36	6 — 42
7 — 14	7 — 21	7 — 28	7 — 35	7 — 42	7 — 49
8 — 16	8 — 24	8 — 32	8 — 40	8 — 48	8 — 56
9 — 18	9 — 27	9 — 36	9 — 45	9 — 54	9 — 63
10 — 20	10 — 30	10 — 40	10 — 50	10 — 60	10 — 70
11 — 22	11 — 33	11 — 44	11 — 55	11 — 66	11 — 77
12 — 24	12 — 36	12 — 48	12 — 60	12 — 72	12 — 84

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

EXTENDED MULTIPLICATION TABLE.

13 times	14 times	15 times	16 times	17 times	18 times	19 times
1 are 26	2 are 28	2 are 30	2 are 32	2 are 34	2 are 36	2 are 38
3 — 39	3 — 42	3 — 45	3 — 48	3 — 51	3 — 54	3 — 57
4 — 52	4 — 56	4 — 60	4 — 64	4 — 68	4 — 72	4 — 76
5 — 65	5 — 70	5 — 75	5 — 80	5 — 85	5 — 90	5 — 95
6 — 78	6 — 84	6 — 90	6 — 96	6 — 102	6 — 108	6 — 114
7 — 91	7 — 98	7 — 105	7 — 112	7 — 119	7 — 126	7 — 133
8 — 104	8 — 112	8 — 120	8 — 128	8 — 136	8 — 144	8 — 152
9 — 117	9 — 126	9 — 135	9 — 144	9 — 153	9 — 162	9 — 171

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143  
200  
240  
300  
400  
480  
500  
600  
700  
720  
800  
900  
960  
1000  
1100  
1200

PENCE TABLE.

times  
are 7  
— 14  
— 21  
— 28  
— 35  
— 42  
— 49  
— 56  
— 63  
— 70  
— 77  
— 84

d.	s.	d.	d.	s.	d.	d.	s.	d.	d.	s.	d.
12	are	1 0	35	are	2 11	57	are	4 9	79	are	6 7
13	—	1 1	36	—	3 0	58	—	4 10	80	—	6 8
14	—	1 2	37	—	3 1	59	—	4 11	81	—	6 9
15	—	1 3	38	—	3 2	60	—	5 0	82	—	6 10
16	—	1 4	39	—	3 3	61	—	5 1	83	—	6 11
17	—	1 5	40	—	3 4	62	—	5 2	84	—	7 0
18	—	1 6	41	—	3 5	63	—	5 3	85	—	7 1
19	—	1 7	42	—	3 6	64	—	5 4	86	—	7 2
20	—	1 8	43	—	3 7	65	—	5 5	87	—	7 3
21	—	1 9	44	—	3 8	66	—	5 6	88	—	7 4
22	—	1 10	45	—	3 9	67	—	5 7	89	—	7 5
23	—	1 11	46	—	3 10	68	—	5 8	90	—	7 6
24	—	2 0	47	—	3 11	69	—	5 9	91	—	7 7
25	—	2 1	48	—	4 0	70	—	5 10	92	—	7 8
26	—	2 2	49	—	4 1	71	—	5 11	93	—	7 9
27	—	2 3	50	—	4 2	72	—	6 0	94	—	7 10
28	—	2 4	51	—	4 3	73	—	6 1	95	—	7 11
29	—	2 5	52	—	4 4	74	—	6 2	96	—	8 0
30	—	2 6	53	—	4 5	75	—	6 3	97	—	8 1
31	—	2 7	54	—	4 6	76	—	6 4	98	—	8 2
32	—	2 8	55	—	4 7	77	—	6 5	99	—	8 3
33	—	2 9	56	—	4 8	78	—	6 6	100	—	8 4
34	—	2 10									

times  
— 12  
— 24  
— 36  
— 48  
— 60  
— 72  
— 84  
— 96  
— 108  
— 120  
— 132  
— 144

EXTENDED PENCE TABLE.

19 times  
2 are 34  
3 — 57  
4 — 76  
5 — 95  
6 — 114  
7 — 133  
8 — 152  
9 — 171

d.	£.	s.	d.	d.	£.	s.	d.	d.	£.	s.	d.	d.	£.	s.	d.
143	are	0 11 8	1300	are	5 8 4	2500	are	10 8 4	3700	are	15 8 4				
200	—	0 16 8	1400	—	5 16 8	2600	—	10 16 8	3800	—	15 16 8				
240	—	1 0 0	1440	—	6 0 0	2640	—	11 0 0	3840	—	16 0 0				
300	—	1 5 0	1500	—	6 5 0	2700	—	11 5 0	3900	—	16 5 0				
400	—	1 13 4	1600	—	6 13 4	2800	—	11 13 4	4000	—	16 13 4				
480	—	2 0 0	1680	—	7 0 0	2880	—	12 0 0	4080	—	17 0 0				
500	—	2 1 8	1700	—	7 1 8	2900	—	12 1 8	4200	—	17 10 0				
600	—	2 10 0	1800	—	7 10 0	3000	—	12 10 0	4300	—	17 18 4				
700	—	2 18 4	1900	—	7 18 4	3100	—	12 18 4	4320	—	18 0 0				
720	—	3 0 0	1920	—	8 0 0	3120	—	13 0 0	4400	—	18 6 8				
800	—	3 6 8	2000	—	8 6 8	3200	—	13 6 8	4500	—	18 15 0				
900	—	3 15 0	2100	—	8 15 0	3300	—	13 15 0	4560	—	19 0 0				
960	—	4 0 0	2160	—	9 0 0	3360	—	14 0 0	4700	—	19 11 8				
1000	—	4 3 4	2200	—	9 3 4	3400	—	14 3 4	4800	—	20 0 0				
1100	—	4 11 8	2300	—	9 11 8	3500	—	14 11 8	4900	—	20 8 4				
1200	—	5 0 0	2400	—	10 0 0	3600	—	15 0 0	5000	—	20 16 8				



## SIGNS USED IN ARITHMETIC.

- + named plus, signifies Addition, as  $4+2$  equal 6.  
 - named minus, signifies Subtraction, as  $5-2$  equal 3.  
 $\times$  multiplied by, signifies Multiplication, as  $4\times 2$  equal 8.  
 $\div$  divided by, signifies Division, as  $10\div 2$  equal 5.  
 = equal to, signifies Equality, as  $2+1=3$ .  
 . is to }  
 :: so is } signifies Proportion as  $1 : 2 :: 3 : 6$ .  
 : to } These figures are thus read, as 1 is to 2 so is 3 to 6.  
 $\sqrt{\quad}$  marks the Square root, as  $\sqrt{4}=2$ .  
 $\sqrt[3]{\quad}$  marks the Cube root, as  $\sqrt[3]{8}=2$ .

## MONEY.

4 farthings	=	1 penny
12 pence	=	1 shilling
20 shillings	=	1 pound
21 shillings	=	1 guinea

£ denotes pounds, s. shillings, and d. pence.

$\frac{1}{4}$  — one farthing, or one quarter of any thing.

$\frac{1}{2}$  — a halfpenny, or a half of any thing.

$\frac{3}{4}$  — three farthings, or three quarters of any thing

## AVOIRDUPOIS WEIGHT.

		marked.
16 drams (dr)	=	1 ounce oz.
16 ounces	=	1 pound lb.
28 pounds	=	1 quarter qr.
4 quarters or 112 lb.	=	1 hundred weight cwt.
20 hundred weight	=	1 ton T.

14 pounds make one stone, and 8 stone 1 hundred weight.

This weight is used for bread, meat, grocery, for goods in general, and for all the metals except gold and silver.

ARITHMETICAL TABLES.

TROY WEIGHT.

		marked.
24 grains ( <i>gr.</i> )	= 1 pennyweight,	<i>dwt.</i>
20 pennyweights	= 1 ounce,	<i>oz.</i>
12 ounces	= 1 pound,	<i>lb.</i>

This weight is used for gold, silver, jewels, and liquors.

APOTHECARIES' WEIGHT.

		marked.
20 grains	= 1 scruple	<i>scr.</i>
3 scruples	= 1 dram	<i>dr.</i>
8 drams	= 1 ounce	<i>oz.</i>
12 ounces	= 1 pound	<i>lb.</i>

Apothecaries use this weight in mixing their medicines; but they buy and sell by avoirdupois weight.

LONG MEASURE.

		marked.
12 lines	= 1 inch,	<i>in.</i>
12 inches	= 1 foot,	<i>ft.</i>
3 feet	= 1 yard,	<i>yd.</i>
5½ yards	= 1 perch,	<i>per.</i>
40 perches	= 1 furlong,	<i>fur.</i>
8 furlongs	= 1 mile,	<i>ml.</i>
3 miles	= 1 league,	<i>lg.</i>
60 Geographical miles, or	}	= 1 degree, <i>deg.</i>
69½ British miles		
360 degrees	=	the earth's circumference.

An Inch is supposed to be equal to three barley-corns in length. Seven yards Irish equal one perch. Eleven miles Irish are equal to fourteen miles English. 4 inches make one hand, used in measuring horses.

CLOTH MEASURE.

		marked.
2½ inches	= 1 nail,	<i>nl.</i>
4 nails	= 1 quarter,	<i>qr.</i>
4 quarters	= 1 yard,	<i>yd.</i>

The Flemish ell is three-quarters of a yard, the English ell is five quarters of a yard, and the French ell six-quarters of a yard.

## ARITHMETICAL TABLES.

## SQUARE OR LAND MEASURE.

144 square inches	= 1 square foot	marked. <i>sq. ft.</i>
9 square feet	= 1 square yard,	<i>sq. yd.</i>
30½ square yards	= 1 square perch,	<i>sq. per.</i>
40 square perches	= 1 rood,	<i>rd.</i>
4 roods	= 1 acre,	<i>ac.</i>
640 acres	= 1 square mile,	<i>sq. mlle.</i>

In Ireland 49 square yards make 1 square pole or perch. The square of any number is obtained by multiplying it by itself, 12 multiplied by 12 = 144, the square of 12.

## CUBIC, OR SOLID MEASURE.

1728 cubic inches	= 1 cubic foot
27 cubic feet	= 1 cubic yard
40 cubic feet of rough timber, or } 50 cubic feet of hewn timber }	= 1 ton, or load
42 cubic feet	= 1 ton of shipping

A cube is a solid figure, similar to dice, and has six equal sides. The cube of any number is obtained by multiplying it twice by itself—thus,  $12 \times 12 \times 12 = 1728$ , the cube of 12.

## MEASURE OF CAPACITY.

4 gills	= 1 pint,	marked. <i>pt.</i>
2 pints	= 1 quart,	<i>qt.</i>
4 quarts	= 1 gallon,	<i>gal.</i>
2 gallons	= 1 peck,	<i>pk.</i>
4 pecks	= 1 bushel,	<i>bush.</i>
8 bushels	= 1 quarter,	<i>qr.</i>
5 quarters	= 1 load,	<i>ld.</i>

By this measure both liquids and dry goods are measured. The gill, pint, quart, gallon, are used for liquids. The peck, bushel, quarter, load, are used for dry goods. The gallon contains 277,274 cubic inches.

The measure formerly called heaped measure is now, by Act of Parliament, declared illegal.

Ale, wine, and beer were formerly measured by different measures. In some places a barrel of beer contains 32, in some 34, and in others 36 gallons. A hogshead of ale was computed to contain 54 gallons, a hogshead of wine 48 gallons.

2 hogsheads make 1 pipe, or butt,  
2 pipes, or butts make 1 tun.

ARITHMETICAL TABLES.

WOOL WEIGHT.

marked.				marked.
<i>q. ft.</i>	7	pounds = 1 clove		<i>cl.</i>
<i>q. yd.</i>	2	cloves = 1 stone		<i>st.</i>
<i>q. per.</i>	2	stones = 1 tod		<i>td.</i>
<i>d.</i>	6½	tods = 1 wey		<i>wy.</i>
<i>c.</i>	2	weys = 1 sack		<i>sk,</i>
<i>q. mille.</i>	2	sacks = 1 last		<i>la.</i>

The square multiplied by

TIME.

	60	seconds ( <i>sec.</i> )	=	1	minute	marked.
	60	minutes	=	1	hour	<i>min.</i>
	24	hours	=	1	day	<i>hr.</i>
	7	days	=	1	week	<i>da.</i>
	12	months, or	}	=	1	year
	52	weeks and 1 day, or				
	365	days				
						<i>wk.</i>
						<i>yr.</i>

Every fourth year contains 366 days, and is called leap year.

DAYS IN EACH MONTH.

Thirty days hath September,  
 April, June, and November;  
 All the rest have thirty-one  
 February twenty-eight alone,  
 But in Leap Year twenty-nine.

DIVISIONS OF THE CIRCLE.

	60	seconds" = 1 minute	marked.
	60	minutes = 1 degree	<i>min. or</i>
	90	degrees = 1 sign	<i>deg. or °</i>
	12	signs = 1 circle of the zodiac	<i>S.</i>
			<i>C.</i>

d. The 501.  
 mel. quarter,  
 cubic inches.  
 Act of Fac.

QUANTITIES.

	12	articles	=	1	dozen	marked.
	20	articles	=	1	score	<i>doz.</i>
	144	articles	=	1	gross	<i>sc.</i>
	24	sheets paper	=	1	quire	<i>gr.</i>
	20	quires	=	1	ream	<i>qr.</i>
						<i>rm</i>

y different  
 contains 32,  
 ad of ale  
 of wine 68

## NUMERATION TABLE.

1	Units.
21	Tens.
321	Hundreds.
4,321	Thousands.
54,321	X. of Thousands.
654,321	C. of Thousands.
7,654,321	Millions.
87,654,321	X. of Millions.
987,654,321	C. of Millions.
1,987,654,321	M. of Millions.
21,987,654,321	X. M. of Millions.
321,987,654,321	C. M. of Millions.
4,321,987,654,321	Billions.

## ROMAN NOTATION.

M.	D.	C.	L.	X.	V.	I.
1000	500	100	50	10	5	1

## EXERCISES IN NUMERATION.

*Read, or write down in words the numbers signified by the following figures :*

1. 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.
2. 10, 11, 14, 16, 19, 20, 42, 18, 17.
3. 200, 420, 607, 986, 473, 247, 364.
4. 912, 874, 783, 659, 202, 604, 510.
5. 4000, 2700, 8601, 7036, 2101, 1060.
6. 1010, 7030, 4600, 9111, 4976, 5870.
7. 26012, 70101, 42100, 36100, 90201.
8. 700000, 701020, 926427, 104206.
9. 9000000, 9764268, 8202100, 5023067.
10. 2600060, 4101010, 2001000, 1402149.
11. 40000000, 29602687, 50026017, 1670020.
12. 941268767, 267602607, 401467680.
13. 296026876, 710020010, 270603050.
14. 1402360740, 3460760010, 4023601497.
15. 7042603714, 5079607906, 1704070600.
16. 81462306012, 46007687681, 94086421360.
17. 14023641201, 20860002001, 40002000202.
18. 907060206204, 240026100201, 590960126020.

## EXERCISES IN NOTATION.

*Express in Figures the following Numbers.*

1. Six,— seven,— nine,— eight,— five,— ten,— twelve,— fourteen,— sixteen.— eighteen.— twenty,— nineteen.

2. Seventy-four.— twenty-six.— thirty-one.— forty-nine,— fifty-eight.— sixty-two.— seventy-six.— seventy-seven,— ninety-seven,— eighty-four.— fifty-five.— ninety-nine.

3. One hundred.— one hundred and four.— two hundred and forty-four.— six hundred and ninety-one.— seven hundred and fifty.— nine hundred and nine.— nine hundred and ninety-nine.— eight hundred and two.

4. Four thousand.— four thousand two hundred,— five thousand three hundred and fifty-two.— six thousand seven hundred and five.— seven thousand and fifty.— nine thousand and two.— eight thousand and eighty,— six thousand seven hundred and seven.

5. Ten thousand.— fifteen thousand five hundred and sixty,— nineteen thousand and nineteen.— twenty-six thousand five hundred and ninety-five.— thirty-eight thousand and thirty-eight.— forty thousand and forty.— fifty-six thousand five hundred and two.— seventy thousand seven hundred and seventy-seven.

6. Four hundred thousand.— four hundred thousand and forty,— six hundred thousand seven hundred and seven,— nine hundred and eighty thousand.— two hundred and fifty-six thousand nine hundred and seventy-five.— seven hundred thousand seven hundred and seven.— nine hundred and sixty-four thousand two hundred and fifty-nine.

7. Six millions,— five millions four hundred and ninety-three thousand.— eight millions forty thousand four hundred and two.— seven millions four hundred and ninety-three thousand seven hundred and sixty-five.— ten millions ten thousand and ten.— twenty millions two hundred and forty thousand six hundred and six.— fifty-three millions fifty-three thousand and fifty-three.— eight hundred and fifty-three millions nine hundred and forty-eight thousand hundred and fifty-three.— two hundred and three million four hundred and six thousand five hundred and eight,— one hundred and ninety-three millions.



## SIMPLE ADDITION.

11

the number

(1)	(2)	(3)	(4)
412	243	623	854
346	325	146	236
427	678	579	875
<hr/>	<hr/>	<hr/>	<hr/>

423	(5)	(6)	(7)	(8)
134	264	450	547	856
267	368	407	653	479
<hr/>	752	679	865	627
824	865	536	276	894
	<hr/>	<hr/>	<hr/>	<hr/>

14, and add  
and 3 make  
of the 12.  
thus, 1 and  
down the 8.

(9)	(10)	(11)	(12)
246	457	47	8
78	608	602	70
604	92	68	926
40	400	720	47
7	78	79	5
<hr/>	<hr/>	<hr/>	<hr/>

3	(13)	(14)	(15)	(16)
4	5129	4268	3687	2407
5	7142	2426	4215	798
<hr/>	9687	4276	708	46
12	4312	8507	9362	7083
4	8687	2390	96	579
6	<hr/>	<hr/>	<hr/>	<hr/>
9				
<hr/>				

42	(17)	(18)	(19)	(20)
23	5126	2427	5036	780
07	1472	768	784	5708
<hr/>	6826	9412	6070	1070
162	9687	893	85	687
23	2764	4026	7507	5368
59	4279	475	687	759
84	<hr/>	<hr/>	<hr/>	<hr/>
...				



(21)	(22)	(23)	(24)
42674	24785	48763	46537
34126	65843	86270	54263
68768	26879	4687	43986
28642	43653	578	5079
65768	68754	49060	81
74387	56287	18709	641
96728	65423	70471	98076

25. How many do 7 and 4 and 8 and 24 and 62 make?
26. How many are 42 and 64 and 40 and 68 and 79?
27. How many do 67 and 79 and 93 and 104 and 65 make?
28. How many do 426 and 67 and 240 and 742 make?
29. Add together 6479 and 846 and 70 and 567 and 7426.
30. Add  $742+64+8+341+801+60+612+790+806$ .
31. Add  $7260+1404+8496+2413+16+1786+3326$ .
32. Add  $4126+27394+2687+426+876346+746897$ .
33. Add  $76876+2046+896874+6876874+4268+4276$ .
34. Add  $367068+64768+94687+6870+2489+264$ .
35. What is the amount of four hundred and sixty-three, —five thousand and sixty-four,—seventy thousand and ninety-eight,—and fifty?
36. Add together seven hundred and ninety-six,—five thousand four hundred and forty,—nine hundred and eight,—five thousand four hundred and nine,—two hundred and two thousand and fifty,—ninety-six thousand and nine,—four hundred and one.
37. How much do the following sums of money amount to, when added together, \$7966,—\$864,—\$46,—\$2048,—\$46897?
- 38.—I saw four large baskets full of apples; in one of the baskets there were four hundred and ninety-four apples, in another three hundred and sixty-eight, in another nine hundred and eighty, and in another four hundred and four, how many apples were there in the four baskets?
39. I gave John 12 apples, James 15, Patrick 20, and I had still 25 remaining; how many apples had I at first?

(24)  
46537  
54268  
43986  
5079  
81  
641  
98076

make?

79?

65 make?

make?

and 7426.

-806.

326.

897.

4276.

64.

nty-three,  
and and

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eight,—

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\$2048,—

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r apples.

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and four,

20, and 1

first?

40. In a school which I visited lately, there were six classes; in the first there were 23 boys, in the second 18, in the third 32, in the fourth 27, in the fifth 56, and in the sixth 48; can you tell me how many boys there were in the school?

41. A man walked 26 miles on Monday, 34 on Tuesday, 46 on Wednesday, 37 on Thursday, on Friday being unable to walk, he procured a horse, and rode 41 miles, and completed his journey on Saturday, having travelled that day 67 miles; how many miles did he travel during the week?

42. A gentleman planted on his property 478 oaks, 748 beeches, 64027 firs, 409 apple trees, 1764 pear trees, 878 cherry trees, and 87 peach trees; how many trees did he plant in all?

43. If James has 74 marbles, John 213, Tom 185, Henry 309, William 834, and Patrick 648; how many have they in all?

44. A farmer laid out on oxen \$348, on horses \$487, on sheep \$964, on cows \$189, on laboring utensils \$209; how much did he lay out altogether?

45. In a house there were nine windows in front, and each window had twelve panes of glass. In the rear there were six windows, and each of these windows had nine panes of glass; how many panes of glass were there in all the windows?

46. A fruiterer bought six chests of oranges. In the first chest there were 468 oranges; in the second 679; in the third 804; in the fourth 979; in the fifth 1042; in the sixth 1709; how many oranges were there in all the chests?

47. A linen draper sold 46 yards of cloth on Monday; 78 on Tuesday; 65 on Wednesday; the same quantity on Thursday; 64 on Friday; and 97 on Saturday; how many yards of cloth did he sell during the week?

48. A grocer received for goods sold on Monday \$4; on Tuesday \$6; on Wednesday \$10; on Thursday \$9; on Friday \$13; and on Saturday as much as he had received all the former days of the week; how much did he receive during the week for goods?

## SIMPLE SUBTRACTION.

Subtraction is the method of finding the difference between two numbers.

From 6237 take 4895.

**RULE WITH EXAMPLE.**—Place the less number under the greater, so that units may stand under units, tens under tens, &c. Draw a line under them. Begin at the units place, that is at the 5. Take 5 from 7 and 2 remain. Put down the 2 under the 5. Go on to the next figure, which is 9. Take 9 from 3; this cannot be done; when this is the case, add 10 to the upper figure, which will make it 13. Take 9 from 13 and 4 remain. Put down the 4. Whenever 10 has been added, as it was to the 3, one is to be added to the next figure. Thus, add 1 to 8 which makes 9. Take 9 from 2, it cannot be done; then as before, add 10 to the 2. Now take 9 from 12 and 3 remain. Put down the 3. Add 1 to four, it will make 5. Take 5 from 6 and 1 remains. Put down the 1. The sum 1342 is called the *Remainder*, the *Difference* or the *Excess*. The number from which the subtraction is made, viz., 6237, is called the *Minuend*. The number which is subtracted, viz., 4895, is called the *Subtrahend*.

$$\begin{array}{r} 6237 \\ 4895 \\ \hline 1342 \end{array}$$

## EXERCISES.

426	647	754	827	968
<u>214</u>	<u>423</u>	<u>621</u>	<u>403</u>	<u>412</u>
<u>212</u>	<u>224</u>	<u>133</u>	<u>424</u>	<u>556</u>
643	498	783	869	548
<u>411</u>	<u>132</u>	<u>172</u>	<u>217</u>	<u>213</u>
—	—	—	—	—
423	742	834	546	643
<u>279</u>	<u>489</u>	<u>478</u>	<u>298</u>	<u>169</u>
<u>144</u>	<u>253</u>	<u>356</u>	<u>248</u>	<u>474</u>

## SIMPLE SUBTRACTION.

15

582	715	934	604	540
496	268	748	257	76
<u>86</u>	<u>447</u>	<u>186</u>	<u>347</u>	<u>464</u>

(1)	(2)	(3)	(4)	(5)
462	623	821	602	714
278	147	479	146	178
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>

(6)	(7)	(8)	(9)	(10)
643	741	610	100	101
268	278	79	4	11
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>

(11)	(12)	(13)	(14)
42654	36871	73268	98643
26479	17928	47296	27896
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>

(15)	(16)	(17)	(18)
74603	91020	41021	40000
37684	12647	768	1001
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>

(19)	(20)	(21)	(22)
42681	42890	81000	45301
19697	27601	2641	20009
<u>---</u>	<u>---</u>	<u>---</u>	<u>---</u>

(23)	(24)	(25)
741026831	614102013	148120718
278904896	178906844	74198648
<u>---</u>	<u>---</u>	<u>---</u>

(26)	(27)	(28)
861264981	921002461	181201041
248600989	198007049	89890122
<u>---</u>	<u>---</u>	<u>---</u>

Difference

6237  
4895  
        
1342

9. Take  
the case,  
13. Take  
never 10  
added to  
9. Take  
10 to the  
own the 3.  
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remainder,  
om which  
Minuend.  
called the

68  
12  
56

48  
213

43  
69  
74

29. 741826421741—427984642814  
 30. 841298471312— 71489641264  
 31. 812014001013—107987862141  
 32. 431701468642— 7126142687  
 33. 614214687648—196412741689  
 34. 419000100014— 2120101706

35. From seven hundred and nine thousand four hundred and twenty-seven, take two hundred and fifty-one thousand eight hundred and seventy-two.

36. From two millions two hundred and two thousand and two, take nine hundred and ninety-six thousand and seven.

37. What is the difference between sixty-five hundred thousand and four, and twenty-nine hundred thousand seven hundred and sixty?

38. How much does sixty-four thousand two hundred and four, exceed six thousand two-hundred and forty-nine?

39. John lent James \$9071, of this sum he has received back \$999; how much has James yet to pay?

40. On a cherry-tree there were 2046 cherries, of these 1875 were gathered; how many remained?

41. Columbus discovered America in the year 1492; how many years is it from that time to 1836?

42. In a certain school there are 436 boys, of these only 264 can write; how many are unable to write?

43. In one of the National Schools there are 427 boys in another there are 249; how many more are there in the one than in the other?

44. John had 202 nuts in his pocket, but there being a hole in it, he lost 96 nuts; how many had he remaining?

45. On an apple tree there were 165 apples, the wind blew off two dozen and a half; how many were left?

46. A draper bought 4786 yards of cloth, and sold 3987 yards; how many yards has he unsold?

47. What sum added to sixty-five thousand seven hundred and ninety-six, will make one million four hundred and fifty-two thousand three hundred and thirteen?

48. I was born in the year 1828; how old shall I be in the year 1839?

In  
bro  
5  
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sun  
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58  
tow  
59  
1703  
30  
1449

49. Ireland is about 300 miles in length, and 170 miles in breadth; how much greater is the length than the breadth?

50. Ben Nevis, in Scotland, the highest mountain in the British Islands, is 4350 feet above the level of the sea; the summit of Magillieuddy's Reeks, the highest point in Ireland, is 3610; what is the difference in height between these two mountains?

51. The Shannon, the largest river in the British Isles, has a course of about 170 miles. The Amazon in South America, has a course of about 3000 miles. What is the difference in length of their course?

52. The diameter of the Sun is about 883246 miles; that of the Earth about 7912; what is the difference in the diameter of the Sun and Earth?

53. The surface of the earth is nearly 200 millions of square miles, of this it is probable that 60 millions are land; how many more square miles of water than of land are there in the earth's surface?

54. The population of London in 1831, was 1,776,566. The population of Dublin is about 203,652; how many more people are there in London than in Dublin?

55. Mont Blanc, in Switzerland, is the highest mountain in Europe, being 15,680 feet above the level of the sea. Chimborazo, the highest mountain in America, is about 21,000 feet in height. What is the difference in height between these two mountains?

56. Coals were discovered at Newcastle, A. D. 1234; how long is it from that time till the year 1836?

57. Since convicts were first sent to Botany Bay, it is now, viz., 1836, about 42 years; in what year were convicts first sent?

58. Sir Isaac Newton was born A. D. 1642, and died 1727; how old was he when he died?

59. Petersburg was founded by Peter the Great, A. D. 1703; how long is it from that time till the year 1836?

60. The art of printing was discovered about the year 1449; how long is it from that time to the year 1836?

## MIXED QUESTIONS.

1. Tom had 264 marbles ; he gave 64 to James, 75 to William, and 42 to John ; how many had he left ?

2. A merchant had 4268 yards of cloth, on Monday he sold 146 yards, on Tuesday 97, on Wednesday 246, on Thursday 198, on Friday 364, on Saturday 497 ; how much cloth had he remaining ?

3. Three regiments went to battle ; in the first there were 968 soldiers, in the second 769, and in the third 847. There were 248 men killed in the first regiment, 368 in the second, and when the regiments returned there were only 436 men in the third ; how many returned from the battle ?

4. A man had a journey of 298 miles to make ; the first day he walked 42 miles, the second 36 miles, the third 31 miles, the fourth 27 miles ; how much farther had he to go ?

5. Three vessels sailed to America with emigrants ; in the first vessel there were 126 men, 93 women, and 42 children ; in the second vessel there were 98 men, 37 women, and 26 children ; in the third vessel there were 43 men, 24 women, and 8 children. In the first vessel three persons died ; in the second two were washed overboard ; the third vessel was wrecked and all on board perished ; how many got safe to America ?

6. A little boy went to the Zoological Gardens to see the animals ; he took his hat on the ground, which contained 264 nuts ; while his attention was engaged, the monkey stole 27 of his nuts ; while he was pursuing the monkey, a squirrel made off with 16 more ; how many had he remaining ?

7. The population of Cork is about 108,000 ; of Belfast, 65,000 ; of Liverpool, 166,000 ; of Glasgow, 203,000 ; by how much does the population of London exceed all these cities, the population of it being 1,746,556 in the year 1831 ?

8. Received on Monday \$247, paid away on Tuesday \$196 ; received on Wednesday \$349 ; paid away on Thursday \$402 ; received on Friday \$687 ; paid away on Saturday \$398 ; what money had I still remaining ?

## SIMPLE MULTIPLICATION.

Multiplication teaches us to find what a number will amount to, when it is repeated a number of times.

CASE I.—When the Multiplier does not exceed 12.

Multiply 53 by 7.

**RULE WITH EXAMPLE.**—Place the number by which you are to multiply under the number to be multiplied; then say 7 times 3 make 21. Put down the 1 under the 7. Then 7 times 5 make 35, and the 2 of the 21 make 37. Put down the 37. The 53 is called the *Multiplicand*; the 7 is called the *Multiplier*; and the 371 is called the *Product*. The multiplicand and the multiplier taken together are called the *Factors*; thus 53 and 7 are factors.

$$\begin{array}{r} 53 \\ 7 \\ \hline 371 \end{array}$$

### EXERCISES.

659 2 <hr style="width: 100%;"/>	427 2 <hr style="width: 100%;"/>	642 2 <hr style="width: 100%;"/>	748 2 <hr style="width: 100%;"/>	396 2 <hr style="width: 100%;"/>
1318	854	1284	1496	792
486 8 <hr style="width: 100%;"/>	968 8 <hr style="width: 100%;"/>	687 4 <hr style="width: 100%;"/>	983 4 <hr style="width: 100%;"/>	758 5 <hr style="width: 100%;"/>
896	793	378	596	974
5	6	7	8	9
<hr style="width: 100%;"/>	<hr style="width: 100%;"/>	<hr style="width: 100%;"/>	<hr style="width: 100%;"/>	<hr style="width: 100%;"/>
4480	4758	2646	4768	8766
742 10 <hr style="width: 100%;"/>	856 11 <hr style="width: 100%;"/>	597 12 <hr style="width: 100%;"/>	903 6 <hr style="width: 100%;"/>	609 8 <hr style="width: 100%;"/>
(1) 4276 4 <hr style="width: 100%;"/>	(2) 67287 2 <hr style="width: 100%;"/>	(3) 86453 5 <hr style="width: 100%;"/>	(4) 75268 8 <hr style="width: 100%;"/>	



$$\begin{array}{r} (5) \\ 9468 \\ \underline{\quad 7} \end{array}$$

$$\begin{array}{r} (6) \\ 84076 \\ \underline{\quad 8} \end{array}$$

$$\begin{array}{r} (7) \\ 43256 \\ \underline{\quad 9} \end{array}$$

$$\begin{array}{r} (8) \\ 74879 \\ \underline{\quad 10} \end{array}$$

$$\begin{array}{r} (9) \\ 45687 \\ \underline{\quad 11} \end{array}$$

$$\begin{array}{r} (10) \\ 96854 \\ \underline{\quad 12} \end{array}$$

$$\begin{array}{r} (11) \\ 63875 \\ \underline{\quad 9} \end{array}$$

$$\begin{array}{r} (12) \\ 47389 \\ \underline{\quad 12} \end{array}$$

- |                         |    |                         |    |
|-------------------------|----|-------------------------|----|
| 13. Multiply 87546 by 4 | 4  | 22. Multiply 98327 by 2 | 2  |
| 14. —————               | 7  | 23. —————               | 7  |
| 15. —————               | 9  | 24. —————               | 4  |
| 16. —————               | 6  | 25. —————               | 8  |
| 17. —————               | 3  | 26. —————               | 6  |
| 18. —————               | 5  | 27. —————               | 5  |
| 19. —————               | 10 | 28. —————               | 9  |
| 20. —————               | 11 | 29. —————               | 12 |
| 21. —————               | 12 | 30. —————               | 11 |

CASE. II.—When the Multiplier is a Composite number.\*

Multiply 436 by 32.

RULE WITH EXAMPLE.—The multiplier, viz. 32, is formed by the two factors 4 and 8; therefore instead of multiplying by 32, you may multiply by 4, and obtain the product 1744. Multiply this product by the other factor, 8, and you obtain 13952, the product of the 436 multiplied by 32.

- |                 |                  |
|-----------------|------------------|
| 31. 426478 × 16 | 37. 368745 × 54  |
| 32. 743687 × 18 | 38. 246876 × 56  |
| 33. 968748 × 24 | 39. 784978 × 72  |
| 34. 674867 × 27 | 40. 201074 × 108 |
| 35. 643067 × 36 | 41. 436876 × 132 |
| 36. 426456 × 49 | 42. 496876 × 144 |

\* A composite number is the product of two factors; thus, 16 is a composite number, because formed of the factors 2 and 8, or 4 and 4; 21 is formed of 3 and 7; 27 of 3 and 9; 36 of 4 and 9, or 6 and 6, or 3 and 12.

CASE II.—When the Multiplier contains several figures

Multiply 3426 by 342.

RULE WITH EXAMPLE.—Place the multiplier under the multiplicand, units under units, &c. Multiply by the unit figure of the multiplier, viz. 2. Then multiply by the next figure of the multiplier, viz. 4; thus, 4 times 6 make 24, but take notice that you are to place the 4 of the 24 directly under that figure of the multiplier by which you are multiplying. Proceed in the same manner with the figure 3 of the multiplier. Then add together the products obtained.

$$\begin{array}{r} 3426 \\ 342 \\ \hline 6852 \\ 13704 \\ 10278 \\ \hline 1171692 \end{array}$$

Multiply 6487 by 230.

$$\begin{array}{r} 6487 \\ 230 \\ \hline 194610 \\ 12974 \\ \hline 1492010 \end{array}$$

Multiply 6487 by 203.

$$\begin{array}{r} 6487 \\ 203 \\ \hline 19461 \\ 129740 \\ \hline 1316861 \end{array}$$

- 43. Mult. 98476 by 642
- 44. — 758
- 45. — 295
- 46. — 496
- 47. — 857
- 48. — 4368
- 49. — 7896
- 50. — 3654

- 51. Mult. 65839 by 958
- 52. — 627
- 53. — 369
- 54. — 426
- 55. — 704
- 56. — 8743
- 57. — 6007
- 58. — 9864

59. Multiply sixty-four thousand eight hundred and fifty two, by nine hundred and eighty-seven.

60. Multiply four hundred and fifty-eight thousand six hundred and ninety-four, by eight thousand and seventy-six.

61. Multiply nine hundred and eighty-six thousand seven hundred and forty, by four hundred and nine.

62. There are 8766 hours in the year; how many hours are there in 20 years?

63. A grocer sells goods to the amount of \$56 per week; how much does he sell during the year?

64. In a flock of 643 sheep; how many feet were there?

(8)  
4879  
10

(12)  
17389  
12

by 2  
— 7  
— 4  
— 8  
— 6  
— 5  
— 9  
— 12  
— 11

number.\*

is 436  
and 4  
by 1744  
uct 8  
13952

54  
56  
72  
08  
32  
44

hus. 16 is a  
or 4 and 4;  
and 6, or 3

65. Suppose the page of a book to contain 49 lines, and each line 47 letters; how many letters does the whole page contain?

66. In 264 dozen of wine, how many bottles are there?

67. A gentleman dying gave orders in his will that his fortune should be equally divided among his five children; each received \$648; how much money did he leave?

68. Suppose that there were in the parish 896 houses, and that each house in the parish contained five persons; what would be the population of that parish?

69. A father has five children, their food and clothing costs him two pence each per day; how many pence does the support of the children come to in the year?

70. There were in a garden eight trees, and upon each tree there were 268 apples, how many apples were there upon all the trees?

71. There were 4768 geese plucked, and 17 quills got from each goose; how many quills were got from all?

72. There were 27 desks to be made for the school, and each desk required 29 nails; how many nails were required for all the desks?

73. In a school, there were six windows in the boys' room, and four in the girls' room; in each window there were eight panes of glass; how many panes of glass were there in all?

74. I knew two boys, one of them was lazy and lay in bed till nine, the other was an active little fellow who rose every morning at six, how many hours did the active boy gain in a year that the other lost?

75. How often does a clock strike in a year at the rate of 156 times a day?

76. How many pins may a boy point in 6 days who works 8 hours a day, and points 16,000 pins in an hour?

77. A gentleman bought an estate containing 5,968 acres, at the rate of \$26 per acre; how much did he pay for the estate?

78. How many miles will a person travel in 34 years, supposing he travels 9 miles per day, and there are 365 days in the year?

## SIMPLE DIVISION.

Division is the method of finding how often one number is contained in another.

CASE I.—When the Divisor does not exceed 12.

Divide 252 by 6.

RULE WITH EXAMPLE.—Put the numbers down according to the annexed example. Find how often the figure by which you are to divide, viz. 6 is contained in the first, or first and second figures; thus, 6 in 2, there are none, then 6 in 25; there are 4 sixes in 25 and 1 over. Put down the 4 under the 5. Suppose the 1 placed before the 2, which would make it 12. Say 6 in 12. There are 2 sixes in 12. Put the 2 under the 2. The number 6 is called the *Divisor*; 252 the *Dividend*; and 42 the *Quotient*.

$$6 \overline{)252}$$

$$42$$

## EXERCISES.

$$\begin{array}{r} 2)4628 \\ \hline \end{array}$$

$$2314$$

$$\begin{array}{r} 2)6824 \\ \hline \end{array}$$

$$3412$$

$$\begin{array}{r} 3)6039 \\ \hline \end{array}$$

$$2013$$

$$\begin{array}{r} 4)8408 \\ \hline \end{array}$$

$$2102$$

$$\begin{array}{r} 2)47658 \\ \hline \end{array}$$

$$23829$$

$$\begin{array}{r} 3)76389 \\ \hline \end{array}$$

$$25463$$

$$\begin{array}{r} 4)85786 \\ \hline \end{array}$$

$$21434$$

$$\begin{array}{r} 6)76590 \\ \hline \end{array}$$

$$12765$$

$$\begin{array}{r} (1) \\ 4)27645 \\ \hline \end{array}$$

$$\begin{array}{r} (2) \\ 5)68764 \\ \hline \end{array}$$

$$\begin{array}{r} (3) \\ 6)79687 \\ \hline \end{array}$$

$$\begin{array}{r} (4) \\ 7)80620 \\ \hline \end{array}$$

$$\begin{array}{r} (5) \\ 8)76426 \\ \hline \end{array}$$

$$\begin{array}{r} (6) \\ 9)28676 \\ \hline \end{array}$$

$$\begin{array}{r} (7) \\ 10)64268 \\ \hline \end{array}$$

$$\begin{array}{r} (8) \\ 11)46267 \\ \hline \end{array}$$

$$\begin{array}{r} (9) \\ 12)76426872 \\ \hline \end{array}$$

$$\begin{array}{r} (10) \\ 8)42687642 \\ \hline \end{array}$$

$$\begin{array}{r} (11) \\ 7)96402687 \\ \hline \end{array}$$

$$\begin{array}{r} (12) \\ 9)64268769 \\ \hline \end{array}$$

$$\begin{array}{r} (13) \\ 12)46876376 \\ \hline \end{array}$$

$$\begin{array}{r} (14) \\ 8)46876400 \\ \hline \end{array}$$

$$\begin{array}{r} (15) \\ 6)76002041 \\ \hline \end{array}$$

$$\begin{array}{r} (16) \\ 9)4302601 \\ \hline \end{array}$$

$$\begin{array}{r} (17) \\ 7)41260602 \\ \hline \end{array}$$

- |                          |                          |
|--------------------------|--------------------------|
| 18. Divide 56472689 by 2 | 29. Divide 74968023 by 3 |
| 19. ——— by 3             | 30. ——— by 4             |
| 20. ——— by 4             | 31. ——— by 5             |
| 21. ——— by 5             | 32. ——— by 6             |
| 22. ——— by 6             | 33. ——— by 7             |
| 23. ——— by 7             | 34. ——— by 8             |
| 24. ——— by 8             | 35. ——— by 9             |
| 25. ——— by 9             | 36. ——— by 10            |
| 26. ——— by 10            | 37. ——— by 11            |
| 27. ——— by 11            | 38. ——— by 12            |
| 28. ——— by 12            | 39. ——— by 12            |

CASE. II.—When the Divisor is a Composite number.

Divide 6789 by 28.

RULE WITH EXAMPLE.—The two factors that produce 28, are 4 and 7; divide then by 4 and by 7 as in the example. The quotient found is 242, but with two remainders, viz. 3 and 1. To obtain the complete remainder, multiply the first divisor, viz. 4, by the last remainder, viz. 3, and to the product add the first remainder, viz. 1;—thus,  $4 \times 3 + 1 = 13$  the true remainder.

$$\begin{array}{r} 4)6789 \\ \hline 7)1697 \text{ remains } 1 \\ \hline 212 \text{ remains } 3 \end{array}$$

- |                 |                  |
|-----------------|------------------|
| 40. 426478 ÷ 16 | 46. 368745 ÷ 54  |
| 41. 743687 ÷ 18 | 47. 246876 ÷ 56  |
| 42. 968746 ÷ 24 | 48. 784978 ÷ 72  |
| 43. 674867 ÷ 27 | 49. 204076 ÷ 108 |
| 44. 643967 ÷ 36 | 50. 436876 ÷ 132 |
| 45. 426456 ÷ 49 | 51. 496876 ÷ 144 |

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CASE III.—When the Divisor contains several figures.

Divide 431769 by 528.

**RULE WITH EXAMPLE.\***—Put down the sum in this form. Consider whether the divisor, viz. 528, is contained in the first three figures of the dividend, viz. 431; you see at once that it is not; mark off then four figures, viz. 4317. You are now to find how often 528 is contained in 4317; for this purpose find how often the first figure of the divisor, viz. 5, is contained in the first two figures of the dividend, viz. 43. It is contained 8 times; put the 8 on the opposite side of the dividend from the divisor. Multiply 528 by 8, and put the product under the 4317; subtract, and there remains 93; bring to this the next figure of the dividend, viz. 6. You are now to find how often the divisor, 528, is contained in your new dividend, 936; find, as you did before, how often the first figure of the divisor, 5, is contained in the first figure of the dividend, 9. It is contained once; put the one beside the 8; multiply 528 by 1, and place the product under the 936; subtract and you obtain 408; bring to this the next figure of the dividend, 9. Find, as before, how often 528 is contained in 4089. Because 5 is contained 8 times in 40, you will be inclined to try 8. Do it and you will find that you obtain the product 4224, but this is greater than the 4089 from which you have to subtract it; when this is the case you must try a smaller figure, in this case take 7.

528)4317,69(817 quotient.

4224

936

528

4089

3696

393 remainder.

(14)  
6876400

---

(17)  
1260602

---

68023 by 2  
— 3  
— 4  
— 5  
— 6  
— 7  
— 8  
— 9  
— 10  
— 11  
— 12

e number.

89

97 remains 1

12 remains 3

inder, viz. 3,  
iz. 1;—thus,

÷ 54  
÷ 56  
÷ 72  
÷ 108  
÷ 132  
÷ 144

- |                        |                        |
|------------------------|------------------------|
| 32. Divide 74236 by 42 | 56. Divide 74236 by 46 |
| 33. ——— 43             | 57. ——— 689            |
| 34. ——— 44             | 58. ——— 799            |
| 35. ——— 45             | 59. ——— 410            |

\* This is rather a difficult Rule to understand, and I think your Teacher could explain it to you, by means of a black board and a bit of chalk much better than I can hope to do by any written explanation; yet, if you pay attention, I shall do my best to make you understand it.

60. Divide 87493 by 611	76.	842786	÷	78
61. -----	77.	976842	÷	946
62. -----	78.	4.01076	÷	438
63. -----	79.	6416879	÷	648
64. -----	80.	2864976	÷	396
65. -----	81.	2876407	÷	4107
66. -----	82.	6112930	÷	7431
67. -----	83.	9809147	÷	3976
68. -----	84.	4078948	÷	4278
69. -----	85.	7198641	÷	2864
70. -----	86.	3611201	÷	1407
71. -----	87.	2480708	÷	2009
72. -----	88.	7864126	÷	7410
73. -----	89.	3092602	÷	8990
74. -----	90.	4020264	÷	9600
75. -----	91.	9687600	÷	4300

92. Divide six millions seven hundred and ninety-four thousand, by four hundred and eighty thousand six hundred and nine.

93. Divide £79648 among 274 persons.

94. What is the ninth of £6037?

95. A ship sailed in four weeks 1262 miles; how much is that per day?

96. If a vessel contains 648 gallons of water, how long will it take to discharge it all, at the rate of 18 gallons an hour?

97. The population of Ireland is about eight millions, and there are about 30 000 square miles of surface; how many persons to each mile?

98. The earth is about 93 millions of miles distant from the sun; how many days would a horse take in reaching the sun, supposing he went at the rate of 45 miles per day?

99. The rays of light come from the sun to the earth in 8½ minutes, or 495 seconds; at what rate does light move per second, the distance from the sun to the earth being 95173000 miles?

100. The circumference of the earth is about 25000 miles; how long would a man take to walk round it at the rate of 27 miles per day?

## FRACTIONS.

A FRACTION is a part of anything, and is represented by two numbers, one above the line and the other below it : thus,  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{3}{4}$ ,—read one-half, two-thirds, three-fourths.

The figure above the line is called the *numerator* ; the figure below the line is called the *denominator* ; thus, in the fraction  $\frac{4}{5}$ , read four-fifths ; the 4 is the numerator and the 5 is the denominator.

The denominator marks the number of equal parts into which the whole is divided ; the numerator shows the number of those intended to be expressed by the fraction : thus, if I say that I have  $\frac{2}{3}$  of an apple, I mean that the apple was divided into three equal parts, and that I have two of these parts.

A PROPER FRACTION is that which has its numerator *less* than its denominator, as  $\frac{1}{2}$ ,  $\frac{2}{3}$ ,  $\frac{4}{7}$ .

AN IMPROPER FRACTION is that which has its numerator *greater* than its denominator, as  $\frac{3}{2}$ ,  $\frac{7}{4}$ ,  $\frac{8}{3}$ .

A COMPOUND FRACTION is a fraction of a fraction, and is expressed by two or more fractions, as  $\frac{2}{3}$  of  $\frac{3}{4}$ , or  $\frac{1}{3}$  of  $\frac{2}{5}$  of  $\frac{4}{9}$ .

A MIXED NUMBER is a whole number with a fraction annexed, as  $2\frac{1}{2}$ ,  $4\frac{2}{3}$ ,  $16\frac{4}{5}$ .

Any whole number may be made a fraction of by writing a 1 under it for a denominator : for example, 6 may be made a fraction of by writing it thus  $\frac{6}{1}$ , or 10 thus  $\frac{10}{1}$ . The value of a fraction is not altered by multiplying or dividing both the numerator and denominator, provided both be multiplied or divided by the *same* number.

78  
946  
438  
618  
396  
4107  
7481  
3076  
4278  
2861  
1407  
2609  
7410  
8090  
9600  
4300

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## DECIMAL FRACTIONS.

A DECIMAL FRACTION is a fraction whose denominator is 10, 100, 1000, &c., or a unit with as many ciphers annexed to it as there are figures in the numerator. Thus,  $\frac{5}{10}$ ,  $\frac{25}{100}$ ,  $\frac{325}{1000}$ , are decimal fractions, and are usually written in this manner: .5, .25, .325, the denominators being omitted; but a point is placed on the left hand to distinguish them from integers. In reading them the first is called 5-tenths, the second 25-hundredths, and the third 325-thousandths.

When there are not so many figures in the numerator as there are ciphers in the denominator, as many ciphers as are necessary must be prefixed: thus  $\frac{3}{100} = .03$  and  $\frac{3}{1000} = .003$ .

Ciphers on the left hand of a decimal *decrease* its value ten-fold: thus, 5 is 5-tenths; .05 is 5-hundredths, and .005 is 5-thousandths. Ciphers on the right do not alter the value, for .5, .50, .500 are the same as  $\frac{5}{10}$ ,  $\frac{50}{100}$ ,  $\frac{500}{1000}$ , and these are of equal value.

## ADDITION.

**RULE.**—Place the numbers to be added so that the decimal points be directly under each other, and add as in Simple Addition. Insert the point in the answer directly under the other points.

Add together the following numbers:—

(1)	(2)	(3)
2.13	43.27	820.71
.426	9.042	2.006
21.2	712.417	84.213
7.63	41.007	217.072
640.072	.962	9.341
<hr/>	<hr/>	<hr/>

4. Add	4.231,	72.32,	920.74,	.9374,	376.05.
5.	723.312,	91.0006,	2.0251,	3724.7,	.00007.
6.	37.214,	.736,	7213.04,	123.476,	21.6743.
7.	800.273,	498.0009,	.296,	.0071,	4260.008.
8.	320.492,	.23687,	970.001	9.036,	41.762.

## SUBTRACTION.

RULE.—Place the numbers as in Addition; subtract as in Simple Numbers, and insert the point under the other points.

1. From 72.378 take 4.861	6. From 279.712 take 97.0076
2.     9.007     .962	7.     72.0076     1.973
3.     41.217     7.0968	8.     900.005     89.1171
4.     298.012     .9999	9.     243.21     .964213
5.     840.001     170.98	10.    462.0038    134.791

## MULTIPLICATION.

RULE.—Arrange the factors, and multiply as in Whole Numbers. Reckon the number of decimals in both factors, and point off as many from the right of the product. When the number of figures in the product is not so many as the number of decimals in both factors, as many ciphers as may be necessary to make up the deficiency must be placed at the left of the product.

Multiply 7.4 by .35.

7.4  
.35

—  
370  
222

—  
2.590

Multiply .045 by .03

.045  
.03

—  
.00135

In the above example there are five decimal places in the factors, and only three figures in the product; therefore two ciphers are placed at the left of the product to make the number of decimal places in the product equal to those in the factors.

In the above example there are three decimal places in the multiplicand and multiplier; therefore three figures are pointed off from the right of the product.

1. Mult.	.27 by	.27	7. Mult.	2300.7 by	48.003
2.	4.21	3.41	8.	704.23	.0007
3.	97.04	80.03	9.	.786	100
4.	.4102	.1004	10.	4.862	.75
5.	.700	.806	11.	200.03	.002
6.*	.879	10	12.	.00076	1000

---

### DIVISION.

**RULE.**—Divide as in Whole Numbers. Point off as many decimal places in the quotient, as the dividend has more than the divisor: if necessary place ciphers to the left of the quotient.

If the divisor has more figures than the dividend, add ciphers to the right of the dividend.

When there is a remainder, the quotient may be carried to any degree of exactness, by annexing ciphers to the remainder.

Divide 4.7614 by 3.8.

$$3.8)4.7614(1.253$$

In this case the decimals in the dividend exceed those in the divisor by three; three figures are therefore marked off in the quotient.

1. Divide	6.74 by	2.34
2.	.496	.278
3.	7.6	.734
4.	7.23	4.06
5.	.024	.001
6.†	29.6	10

Divide .7644 by 42.

$$42).7644(.0182$$

In this case the decimals in the dividend exceed those in the divisor by four; a cipher is therefore prefixed in the quotient to make four decimal places.

7. Divide	724.1 by	38.07
8.	82.03	9.0003
9.	7.624	2.001
10.	.5213	.24121
11.	31	.124689
12.	3468.9	1000

\* In order to multiply a decimal by 10, remove the point one figure to the *right*; if by 100 remove it two places, and so on.

† To divide by 10, 100, &c., remove the decimal place of the dividend as many places to the *left* as there are ciphers.

REDUCTION

To reduce numbers of a lower denomination to the decimal of a higher.

RULE.—Write the given numbers, if more than one, directly under each other, beginning with the lowest, and divide by as many of the lower as make one of the higher, annexing ciphers if necessary.

Reduce 12s. 3d. to the decimal of a pound.

$$\begin{array}{r} 12) 3.00 \\ \underline{20) 12.250} \\ .6125 \text{ Ans.} \end{array}$$

Here the shillings and pence are placed under each other, beginning with the lower; and each divided by as many of the lower as make one of the higher.

Reduce 16s. 6d. to the decimal of a pound.

$$\begin{array}{r} 4) 3.00 \\ \underline{12) 6.7500} \\ 20) 16.56250 \\ \underline{\hspace{1.5cm}} \\ .828125 \text{ Ans.} \end{array}$$

Here the farthings, pence, and shillings, are placed under each other, beginning with the lowest; each is then divided by as many of the lower as make one of the higher.

1. Reduce 19s. 5½d. to the decimal of a pound.
2. Reduce 15s. 9¼d. to the decimal of a pound.
3. Reduce 13s. 4d. to the decimal of a pound.
4. Reduce 9d. to the decimal of a pound.
5. Reduce 3 cwt. 2 qrs. 8 lbs. to the decimal of a cwt.
6. Reduce 4 feet 3 inches, to the decimal of a yard.
7. Reduce 26 min. 34 sec. to the decimal of a week.
8. Reduce 5 furlongs 3 poles, to the decimal of a mile.
9. Reduce 4¾d. to the decimal of a guinea.
10. Reduce 5 dwt. 12 grs. to the decimal of an ounce.
11. Reduce 2 roods 12 perches, to the decimal of an acre.
12. Reduce 17 yards, 1 foot, 6 inches, to the decimal of a mile.

00.7 by 48.003  
 4.23 .0007  
 86 100  
 862 .75  
 0.03 .002  
 076 1000

nt off as many  
 lend has more  
 the left of the  
 dividend, add  
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644 by 42.  
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4.1 by 38.07  
 .03 9.0003  
 24 2.001  
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 31 .124689  
 8.9 1000

point one figure  
 of the dividend

To find the value of a decimal.

**RULE.**—Multiply the decimal by as many of the next lower denomination as make one of the given denomination. Point off, from the product, as many decimal places as are in the given decimal. Proceed thus to the lowest denomination. The figures on the left of the points are the value of the decimal.

What is the value of .427 of a pound?      What is the value of .243 of a day?

$$\begin{array}{r} .427 \\ \underline{20} \\ 8.546 \\ \underline{12} \\ 6.480 \\ \underline{4} \\ 1.920 \end{array}$$

*Ans.* 8s. 6½d.

$$\begin{array}{r} .243 \\ \underline{24} \\ 5.832 \\ \underline{60} \\ 49.920 \\ \underline{60} \\ 55.200 \end{array}$$

*Ans.* 5 hrs. 49 min. 55 sec.

1. What is the value of .7634L?
2. What is the value of .3412L?
3. What is the value of .0076L?
4. What is the value of .764 cwt.?
5. What is the value of .936 lbs. avoirdupois?
6. What is the value of .007 ton?
7. What is the value of .732 shilling?
8. What is the value of .079 crown?
9. What is the value of .9218 day?
10. What is the value of .496 yard?
11. What is the value of .0796 mile?
12. What is the value of .732 lb. troy?
13. What is the value of .987 oz. avoirdupois?
14. What is the value of .987 oz. troy?
15. What is the value of .779 lbs. avoirdupois?

## DECIMAL CURRENCY.

The coins now circulating in Canada, are :

100 cents	=	1	dollar.		
50 cents	=	$\frac{1}{2}$	dollar.		
25 cents	=	$\frac{1}{4}$	dollar.		
20 cents	=	1	shilling, Halifax Currency.		
10 cents	=	1	sixpence,	"	"
5 cents	=	3	pence,	"	"
3 cents	=	$1\frac{1}{2}$	penny.	"	" nearly.
1 cent	=	$\frac{1}{2}$	penny,	"	" nearly.

The Units of the United States money are :

<i>Mills.</i>	<i>Cents.</i>	<i>Dimes.</i>	<i>Dollars. and Eagles.</i>
10 mills			= 1 cent.
10 cents			= 1 dime.
10 dimes or 100 cents,			= 1 dollar.
10 dollars			= 1 eagle.

The character \$ is used both in Canada and the United States to represent dollars, thus \$6 is six dollars.

The denominations commonly used in business are *dollars* and *cents*, thus 64 eagles, 5 dollars, 3 dimes, 7 cents, 5 mills, are more simply written and read as 645 dollars, 37½ cents.

The **RULE** for working in the Decimal Currency is the same as in Decimal Fractions. In Addition and Subtraction be careful to arrange the decimal points under each other, then *add* or *subtract*, as the case may be, as in the simple Rules.

In Multiplication and Division work as in the simple Rules, point off the decimals; then, when the *whole sum* is completed, throw away all the decimals but the two on the right hand of the point; the figures on the left side of the point will be dollars, and the two on the right will be cents.

## EXERCISES.

1. Find the sum of \$100.72½, \$25.06, and \$119.49.
2. What sum should be paid for a hat at \$5.87½, a vest at \$3.18½, and a pair of shoes at \$2.62½?

3. Find the sum to be paid for a lot of groceries at \$13.37½, a quarter of beef at \$7, a barrel of flour at \$4.56¼, and a lot of butter at \$2.06¼.

4. How much should be paid for a quire of paper at 25 cents, a bottle of ink at 12½ cents, a dozen of books at \$1.18¼, and a bunch of quills at 37½ cents.

5. Sold a barrel of sugar for \$15, a sack of coffee for \$13.05, a keg of rice for \$5.43¼, and a box of candles for \$9.08.

6. A merchant's bill was as follows; what is the amount!

Mr. Johnson,

*Bought of Thomas Smith.*

3½ yards of Cloth,	. . . . .	\$21.00
3 pairs of Stockings,	. . . . .	1.87½
1 dozen skeins of Silk,	. . . . .	.75
		<hr/>

7. Of \$225 how much remains after paying \$93.06½?

8. A lot of goods cost \$579, and sold for \$650.87½, what was gained?

9. Find the loss on Flour bought for \$372.12½, and sold for \$321.56½.

10. Multiply \$5.06¼ by 7.

11. What should be paid for 9 hundredweight of tobacco at \$10.37½ per hundredweight?

12. How much should be paid for 8 yards of cloth at \$9.56¼, and 12 yards at 87½ cents per yard?

13. What should be paid for 9 head of cattle at \$13.18¼ per head, and 7 mules at \$80.50 per head?

14. Divide \$12.75 successively by 4, 5, 6 and 7.

15. Divide \$12.75 by 3½.

16. Divide \$21.25 by 5¼.

17. If 4½ cords of wood cost \$9, what is the price of a cord?

18. What is the price of wheat per bushel when 25½ bushels sell for \$37.68¼?

19. What is the price of butter per pound when 13½ pounds sell for \$1.62?

## VULGAR FRACTIONS.

Vulgar or Common Fractions are those in which the *denominator* and *numerator* are both expressed.

### PRIME NUMBERS.

A Prime Number is one which is not the *product* of two factors; thus 7, 11, 13, &c., are *prime* because they are not divisible by any number greater than 1, without a remainder. A Composite Number is the *product* of two factors, thus 6 is composite because it is the product of 2 and 3.

*To Resolve a Composite Number into its Prime Factors.*

**RULE—1.** Divide the given number by any prime number greater than unity, that will divide it without remainder.

2. Divide the quotient in the same way continually till it becomes a prime number. Then the last quotient and the several divisors will be the prime factors required; thus

**EXAMPLE.**—Resolve 3780 into its Prime Factors.

$$\begin{array}{r}
 9)3780 \\
 \hline
 4)420 \\
 \hline
 5)105 \\
 \hline
 3)21 \\
 \hline
 7
 \end{array}$$

Giving 9, 4, 5, 3, and 7 as the prime factors of 3780.

Find the Prime Factors of the following numbers:—

(1) 735	(2) 330
(3) 510	(4) 390
(5) 550	(6) 930
(7) 1330	(8) 1610
(9) 4350	(10) 6020



## COMMON MEASURE.

A Common Measure is a prime factor common to two numbers; thus 3 is a common measure of 12 and 18, 9 is a common measure of 18 and 81.

To find the Common Measure of two or more numbers.

RULE.—Resolve each number to its prime factors, and select those which are common to *all* the numbers. Any one, or the *product* of any two or more will be a *common* measure, and the product of all the common measures will be the *Greatest Common Measure*; thus

EXAMPLE.—Find the *Common Measures* and the *Greatest Common Measure* of 330, 510 and 390.

By resolving each into its prime factors by the last rule, we find

$$\begin{array}{rcl} 330 & = & 2 \times 3 \times 5 \times 11 \\ 510 & = & 2 \times 3 \times 5 \times 17 \\ 390 & = & 2 \times 3 \times 5 \times 13 \end{array}$$

The Factors common to the three given numbers are 2, 3, and 5. The product of 2 and 3, 2 and 5, and 3 and 2 are also common measures, and  $2 \times 3 \times 5 = 30$  is the greatest common measure.

1.	Find the <i>greatest</i> common measure of	252,	180,	288
2.	“	“	“	120, 144, 168
3.	“	“	“	240, 336, 432
4.	“	“	“	392, 504, 560
5.	“	“	“	504, 567, 630
6.	“	“	“	336, 588, 756
7.	“	“	“	288, 480, 672
8.	“	“	“	460, 1035, 1150
9.	“	“	“	620, 1116, 1488
10.	“	“	“	42, 210, 126

COMMON MULTIPLE.

A Multiple is a number which contains another a number of times without a remainder ; thus, 10 is a multiple of 5. A Common Multiple of two or more numbers, is any number that contains *each of them* a number of times without a remainder ; thus, 30 is a common multiple of 10 and 6. The least Common Multiple of two or more numbers is the smallest number that contains *each of them* a number of times ; thus, 15 is the least common multiple of 3 and 5.

*To find the Least Common Multiple.*

RULE.—Set the numbers in a line, and divide two or more of them by any common measure. Set the quotients and the undivided numbers in a line and divide as before, until no two numbers in the lowest line can be divided. Multiply the *divisors* and the numbers in the lowest line together, for the least common multiple of the given numbers.

EXAMPLE.—Find the least Common Multiple of 7, 13, 28, 42, 26, 18 and 6.

Thus,

7)7 . 13 . 28 . 42 . 26 . 18 . 6
6)1 13 4 6 26 18 6
13)1 13 4 1 26 3 1
2)1 1 4 1 2 3 1
1 1 2 1 1 3 1

Then  $7 \times 6 \times 13 \times 2 \times 2 \times 3 = 6552$  the least common multiple ; that is, 6552 is the smallest number that is divisible by all the given numbers.

- |     |                                   |    |    |     |               |
|-----|-----------------------------------|----|----|-----|---------------|
| 1.  | Find the least common multiple of | 4, | 7, | 9   | and 21        |
| 2.  | "                                 | "  | "  | 3,  | 9, 12 and 15  |
| 3.  | "                                 | "  | "  | 4,  | 6, 8 and 10   |
| 4.  | "                                 | "  | "  | 6,  | 4, 12 and 20  |
| 5.  | "                                 | "  | "  | 8,  | 7, 10 and 14  |
| 6.  | "                                 | "  | "  | 5,  | 6, 10 and 24  |
| 7.  | "                                 | "  | "  | 5,  | 10, 13 and 24 |
| 8.  | "                                 | "  | "  | 2,  | 7, 13 and 15  |
| 9.  | "                                 | "  | "  | 6,  | 7, 2 and 17   |
| 10. | "                                 | "  | "  | 11, | 4, 5 and 19   |

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180, 288  
144, 168  
336, 432  
504, 560  
567, 630  
588, 756  
480, 672  
1035, 1150  
1116, 1488  
210, 126

## ON CANCELLATION.

Cancellation is a method of shortening Arithmetical operations by omitting or cancelling *common factors*, and arises out of two principles:

*First.*—The cancelling of a factor in any number is equivalent to dividing by that factor.

*Second.*—If the dividend and divisor be both divided by the same number, the quotient will not be changed.

EXAMPLE.—Divide 36 by 18. Place the divisor under the dividend, thus  
Reduce each number to its factors, thus  $36=4 \times 9$  and  $18=2 \times 9$ , then arrange the factors of 18 under those of 36, thus  
after cancelling the common factor 9, it will only remain to divide 4 by 2.

$$\begin{array}{r} 36 \\ 18 \\ \hline 4 \times 9 \\ 2 \times 9 \end{array}$$

EXAMPLE.—Divide  $60 \times 17 \times 26 \times 56$  by  $13 \times 128 \times 34 \times 30$ . Arrange them thus—

$$\begin{array}{ccccccc} & 2 & & & 2 & & 7 \\ 60 & \times & 17 & \times & 26 & \times & 56 \\ \hline 13 & \times & 128 & \times & 34 & \times & 30 \\ & & 64 & & 17 & & \\ & & 8 & & & & \\ & & & & & & 7 \\ & & & & & & \hline & & & & & & 8 \end{array}$$

Proceed thus—13 will divide 26 twice, cancel both, and place the 2 over the 26. This 2 will divide 34 seventeen times, cancel both, and place the 17 under the 34. This 17 will cancel the 17 in the dividend. 30 will divide 60 twice, cancel both and place the 2 over the 60. This 2 will divide 128 sixty-four times, cancel both, and place the 64 under the 128. Then 64 and 56 are each divisible by 8;  $56 \div 8=7$ , cancel 56 and place 7 over it; and  $64 \div 8=8$ , cancel 64, and place the 8 under it. There are now only 7 left in the dividend and 8 in the divisor; therefore  $\frac{7}{8}$  is the answer.

It will be generally found convenient to arrange the dividend on the right side of a vertical line, and the divisor on the left.

EXAMPLE.—What is the quotient of  $4 \times 8 \times 13 \times 7 \times 16$  divided by  $26 \times 14 \times 8$ ?

8 being a common factor is cancelled. 13 will divide 26 twice; cancel both, and place the 2 to the left of the 26. This 2 will divide the 16 eight times; cancel both and place 8 to the right of 16. 7 will divide 14 twice; cancel both, and place 2 to the left of 14. This 2 will divide 8 four times; cancel both, and place 4 to the right of 8. The divisor is thus entirely cancelled, and it only remains to multiply the uncanceled factors,  $4 \times 4 = 16$ , the required answer.

$$\begin{array}{r|l}
 & 4 \\
 & \times \\
 2 & 26 & 8 \\
 & \times & \times \\
 2 & 14 & 13 \\
 & \times & \times \\
 & 8 & 7 \\
 & \times & \\
 & 16 & 8 & 4
 \end{array}$$

NOTE.—A careful explanation of the process of cancellation by the teacher, at this stage, will save much future trouble, and greatly interest the pupil. The following examples appear more difficult to the eye than they are in reality; they will serve also as exercises in the use of signs. Each question should be first worked in full, and then by the Rule.

1. What is the quotient of  $42 \times 3 \times 25 \times 12$ , divided by  $28 \times 4 \times 15 \times 6$ ?

2. What is the quotient of  $125 \times 60 \times 24 \times 42$ , divided by  $25 \times 120 \times 36 \times 5$ ?

3. What is the quotient of  $44 \times 18 \times 26 \times 14$ , divided by  $11 \times 39 \times 7 \times 2$ ?

4. What is the quotient of 8 times 240 multiplied by 5 times 114, divided by 24 times 57 multiplied by 6 times 15?

5. What is the value of  $[22+8+16] \times [18+10+21]$  divided by  $[9+5+7] \times [15+8]$ ?

6. Find the value of  $[140+86-34] \times [107+19]$  divided by  $[237-141] \times [17+20-15]$ ?

7. Divide  $[[12 \times 5] - [2 \times 9]] \times [42+30]$  by  $[5 \times 8] \times [2 \times 9] \times [10+17]$ .

8. Find the quotient of  $240 \times 441 \times 16$  divided by  $175 \times 56 \times 27$ .

## REDUCTION.

CASE I.—To change an improper fraction into a whole or mixed number.

RULE.—Divide the numerator by the denominator, and if there be any remainder write the denominator under it in the form of a fraction.

EXAMPLE.—Reduce the improper fraction,  $1\frac{3}{5}^{\frac{67}{5}}$ , to a whole or mixed number.  $5)1367$   
 $273\frac{2}{5}$  Ans.

1. Reduce  $7\frac{4}{3}^{\frac{33}{3}}$  to its equivalent whole or mixed number.
2. Reduce  $5\frac{4}{1}^{\frac{63}{1}}$  to its equivalent whole or mixed number.
3. Reduce  $9\frac{7}{3}^{\frac{86}{3}}$  to its equivalent whole or mixed number.
4. Find the value of  $6\frac{4}{6}^{\frac{33}{8}^{\frac{37}{8}}}$  in whole or mixed numbers.
5. Find the value of  $3\frac{3}{8}^{\frac{63}{8}}$  in whole or mixed numbers.

Reduce the following fractions to whole or mixed number :

- |                        |                             |                           |
|------------------------|-----------------------------|---------------------------|
| 6. $\frac{8536}{43}$   | 9. $\frac{742698}{7847}$    | 12. $\frac{736201}{7638}$ |
| 7. $\frac{7982}{886}$  | 10. $\frac{969740}{2776}$   | 13. $\frac{490010}{3884}$ |
| 8. $\frac{3643}{2164}$ | 11. $\frac{492001}{487806}$ | 14. $\frac{876246}{4968}$ |

CASE II.—To reduce a mixed number to an improper fraction

RULE.—Multiply the whole number by the denominator of the fraction; add the numerator, and under the product place the denominator.

EXAMPLE.—Reduce the mixed number  $46\frac{3}{5}$  to an improper fraction.  
 $\frac{463}{5}$   
 $230 \times 5 = 1150$

Reduce the following mixed numbers to their equivalent improper fractions :

- |                     |                        |                          |
|---------------------|------------------------|--------------------------|
| 15. $7\frac{1}{2}$  | 20. $647\frac{2}{5}$   | 25. $976\frac{24}{25}$   |
| 16. $8\frac{2}{3}$  | 21. $360\frac{10}{17}$ | 26. $843\frac{31}{121}$  |
| 17. $17\frac{1}{3}$ | 22. $976\frac{31}{30}$ | 27. $687\frac{23}{111}$  |
| 18. $19\frac{1}{5}$ | 23. $842\frac{17}{16}$ | 28. $769\frac{111}{234}$ |
| 19. $27\frac{1}{7}$ | 24. $684\frac{19}{7}$  | 29. $807\frac{101}{821}$ |

CASE III.—To reduce a compound fraction to a simple fraction.

RULE.—Multiply together all the numerators for a numerator, and all the denominators for a denominator.

EXAMPLE.—Reduce the compound fraction  $\frac{2}{3}$  of  $\frac{6}{7}$  of 5 to a simple fraction.  $\frac{2 \times 6 \times 5}{3 \times 7 \times 1} = \frac{60}{21}$  Ans.

Reduce the following compound fractions to their equivalent simple ones:—

30.  $\frac{3}{6}$  of  $\frac{2}{7}$  of  $\frac{5}{7}$

31.  $\frac{7}{9} \dots \frac{3}{11} \dots \frac{3}{15}$

32.  $\frac{5}{13} \dots \frac{17}{3} \dots \frac{18}{21}$

33.  $\frac{4}{9} \dots \frac{8}{11} \dots \frac{11}{13}$

34.  $\frac{7}{17} \dots \frac{8}{19} \dots 7$

35.  $\frac{17}{23}$  of  $\frac{8}{9}$  of  $\frac{3}{25}$  of  $\frac{13}{13}$

36.  $\frac{12}{37} \dots \frac{1}{7} \dots \frac{18}{33} \dots 19\frac{1}{2}$

37.  $\frac{11}{21} \dots \frac{17}{36} \dots \frac{135}{78} \dots 24$

38.  $\frac{3}{7} \dots \frac{9}{17} \dots \frac{20}{78} \dots 32$

39.  $\frac{7}{15} \dots \frac{13}{19} \dots \frac{21}{39} \dots 27\frac{2}{3}$

CASE IV.—To reduce a fraction to its lowest terms.

RULE.—Divide the numerator and denominator by any number that will measure them; that is, that will divide them without a remainder. Do the same with the quotients as long as any number can be found to divide them.

Reduce  $\frac{144}{240}$  to its lowest terms.

Divide the fractions and the quotients by the figures placed above them.  $(2) \quad (2) \quad (3) \quad (2) \quad (2)$   
 $\frac{144}{240} = \frac{72}{120} = \frac{36}{60} = \frac{12}{20} = \frac{6}{10} = \frac{3}{5}$  Ans.

Or,

If a number be wished for that may bring the fraction to its lowest terms at once, divide the greater term by the less, and the divisor by the remainder; and so on, dividing each divisor by the last remainder till nothing remains. The last divisor is the number by which, if the numerator and denominator of the fraction be divided, the lowest term will be obtained.

Reduce  $\frac{144}{240}$  to its lowest terms.

The denominator of the fraction being 144)240(1 greater, it is divided by the numerator. The former divisor, 144, is now to be divided by the remainder, 96; the remainder, 48, is now to divide the former divisor, 96. The last divisor, 48, is the number by which, if the numerator and denominator be divided, the lowest term will be obtained: thus,  $48) \frac{144}{240} = \frac{3}{5}$ , as in former example.

$$\begin{array}{r} 144 \\ \underline{96} 144(1 \\ \quad 96 \\ \quad \underline{48} 96(2 \\ \quad \quad 96 \\ \quad \quad \underline{\quad} \end{array}$$

Reduce the following numbers to the lowest terms :

40. $\frac{48}{273}$	44. $\frac{740}{8673}$	48. $\frac{55}{9907}$
41. $\frac{36}{118}$	45. $\frac{764}{3240}$	49. $\frac{1245}{220}$
42. $\frac{176}{181}$	46. $\frac{644}{1728}$	50. $\frac{1344}{1336}$
43. $\frac{40}{160}$	47. $\frac{825}{1020}$	51. $\frac{1403}{1684}$

CASE V.—To reduce fractions to a common denominator

RULE.—Multiply each numerator by all the denominators *except its own*, for a new numerator; and multiply all the denominators together for a new denominator.

Reduce  $\frac{2}{3}$ ,  $\frac{3}{5}$ , and  $\frac{4}{7}$ , to a common denominator.

Here the first numerator, 2, is  $2 \times 5 \times 7 = 70$  } multiplied by 5 and 7 the deno-  $3 \times 3 \times 7 = 63$  } numerators  
minators of the other fractions,  $4 \times 3 \times 5 = 60$  }

Mark, that it is not multiplied  $3 \times 5 \times 7 = 105$  com. denom  
by its own denominator, 3. The same is done to the other numerators. The answer then is,  
 $\frac{70}{105}$ ;  $\frac{63}{105}$ ;  $\frac{60}{105}$ .

Reduce the following fractions to others having a common denominator.

52. $\frac{3}{4}$ , $\frac{2}{3}$ , and $\frac{4}{7}$ .	56. $\frac{17}{24}$ , $\frac{19}{28}$ , $\frac{15}{42}$ , and $\frac{13}{17}$ .
53. $\frac{5}{9}$ , $\frac{7}{8}$ , and $\frac{6}{5}$ .	57. $\frac{21}{47}$ , $\frac{18}{39}$ , $\frac{41}{59}$ , and $\frac{27}{78}$ .
54. $\frac{9}{11}$ , $\frac{7}{13}$ , and $\frac{12}{16}$ .	58. $\frac{71}{81}$ , $\frac{39}{261}$ , $\frac{410}{201}$ , and $\frac{75}{813}$ .
55. $\frac{13}{18}$ , $\frac{11}{23}$ , and $\frac{17}{27}$ .	59. $\frac{813}{451}$ , $\frac{710}{326}$ , $\frac{762}{585}$ , and $\frac{83}{221}$ .

ADDITION.

**RULE.**—Reduce compound fractions to simple fractions, and mixed numbers to improper fractions. Having done this, bring them to a common denominator. Add all the numerators together, and place, under the result, the common denominator. If the answer be an improper fraction, bring it to a mixed number.

Add together the following fractions,  $\frac{2}{3}$ ,  $\frac{3}{5}$ , and  $4\frac{1}{2}$ .

Here the mixed number  $4\frac{1}{2}$  is  $2 \times 5 \times 2 = 20$   
 first brought to the improper  $3 \times 3 \times 2 = 18$  } numerators  
 fraction  $\frac{9}{5}$ , and then all the frac-  $9 \times 3 \times 5 = 135$  }  
 tions are brought to a common  $3 \times 5 \times 2 = 30$  com. denom  
 denominator.

Therefore  $\frac{20}{30} + \frac{18}{30} + \frac{135}{30} = \frac{173}{30} = 5\frac{23}{30}$  sum required.

Add together the following fractions and mixed numbers.

- |  |   |
|--|---|
| 1. $\frac{2}{3} + \frac{3}{5} + \frac{1}{4}$                       | 7. $\frac{2}{7}$ of $\frac{6}{7} + \frac{2}{3} + \frac{2}{3}$ of $\frac{7}{8}$          |
| 2. $\frac{3}{7} + \frac{9}{11} + \frac{12}{13}$                    | 8. $\frac{4}{7} + \frac{9}{13}$ of $\frac{12}{10} + \frac{4}{3}$ of $5\frac{1}{2}$      |
| 3. $\frac{4}{7} + \frac{11}{18} + \frac{13}{23}$                   | 9. $\frac{13}{18}$ of $7\frac{2}{3}$ of $9 + \frac{2}{7}$ of $14$                       |
| 4. $\frac{7}{9} + \frac{13}{17} + \frac{14}{19} + \frac{23}{121}$  | 10. $\frac{21}{23} + \frac{11}{15}$ of $2^2 + \frac{2}{9}$ of $6\frac{2}{3}$            |
| 5. $\frac{8}{13} + \frac{11}{23} + \frac{9}{17} + \frac{14}{29}$   | 11. $\frac{17}{19}$ of $\frac{23}{19}$ of $17\frac{1}{9} + \frac{4}{7}$ of $12$         |
| 6. $\frac{21}{42} + \frac{41}{53} + \frac{71}{89} + \frac{32}{23}$ | 12. $\frac{13}{27} + \frac{19}{23}$ of $9\frac{2}{3} + \frac{11}{35}$ of $8\frac{1}{7}$ |

SUBTRACTION.

**RULE.**—Reduce the fractions to common denominators, as in Addition. Find the difference of the numerators, under which write the common denominator.

From  $\frac{12}{5}$  take  $\frac{4}{7}$ .

Here the fractions are first  $12 \times 7 = 84$  } numerators  
 brought to a common denomina-  $4 \times 15 = 60$  }  
 tor, then the 60 taken from 84,  $15 \times 7 = 105$  com. denom.  
 and the common denominator  
 written under the difference.

Therefore  $\frac{84}{105} - \frac{60}{105} = \frac{24}{105}$  the answer.



What is the difference between the following fractions ?

- |                                  |                                   |   |
|----------------------------------|-----------------------------------|---|
| 1. $\frac{4}{7} - \frac{3}{4}$   | 5. $4\frac{1}{2} - \frac{9}{16}$  | 9. $\frac{9}{11} - \frac{1}{13}$ of 1               |
| 2. $\frac{6}{11} - \frac{3}{9}$  | 6. $2\frac{7}{8} - 5\frac{1}{7}$  | 10. $\frac{11}{24} - \frac{3}{28}$ of $\frac{5}{8}$ |
| 3. $\frac{7}{15} - \frac{4}{13}$ | 7. $2\frac{1}{8} - 3\frac{2}{5}$  | 11. $169 - 14\frac{1}{7}$                           |
| 4. $\frac{9}{13} - \frac{6}{15}$ | 8. $6\frac{1}{7} - 9\frac{1}{10}$ | 12. $76\frac{1}{4} - \frac{2}{3}$ of 19             |

---

### MULTIPLICATION.

**RULE.**—Reduce the mixed numbers to improper fractions, and compound fractions to simple ones ; after this has been done multiply all the numerators together for the numerator of the product, and all the denominators together for its denominator.

Multiply  $6\frac{2}{3}$  by  $\frac{2}{3}$  of  $\frac{7}{8}$ .

Here the mixed number  $6\frac{2}{3}$  is converted into the improper fraction  $\frac{20}{3}$ , and then  $\frac{20}{3} \times \frac{14}{24} = \frac{280}{72} = 3\frac{64}{72}$  *Ans* the compound fraction  $\frac{2}{3}$  of  $\frac{7}{8}$  into the simple fraction  $\frac{14}{24}$ . The numerators and denominators being multiplied, produce the improper fraction  $\frac{280}{72}$ , which being reduced to a mixed number gives  $3\frac{64}{72}$  the answer.

Multiply together the following fractions.

- |  |  |  |
|--|--|--|
| 1. $\frac{3}{4} \times \frac{5}{8}$    | 5. $8\frac{1}{4} \times \frac{5}{12}$  | 9. $8\frac{2}{3} \times \frac{2}{3}$ of $\frac{7}{8}$      |
| 2. $\frac{7}{9} \times \frac{8}{11}$   | 6. $7 \times \frac{5}{13}$             | 10. $16 \times \frac{4}{7}$ of $\frac{5}{13}$              |
| 3. $\frac{9}{11} \times \frac{11}{12}$ | 7. $5\frac{3}{8} \times 11\frac{1}{4}$ | 11. $17\frac{2}{3} \times \frac{17}{19}$ of $7\frac{1}{2}$ |
| 4. $\frac{4}{13} \times \frac{7}{27}$  | 8. $3\frac{5}{7} \times 4\frac{5}{8}$  | 12. $24\frac{7}{15} \times \frac{13}{18}$ of 9             |

DIVISION.

**RULE.**—Prepare the fractions as in multiplication; then invert the divisor and proceed as in multiplication.

Divide  $\frac{4}{7}$  by  $\frac{3}{5}$ .  $\frac{4}{7} \div \frac{3}{5}$  inverted thus  $\frac{4 \times 5 = 20}{7 \times 3 = 21}$

- |   |  |
|---|--|
| 1. Divide $\frac{14}{5}$ by $\frac{11}{12}$ | 7. Divide $5\frac{5}{7}$ by $\frac{5}{7}$                            |
| 2. $\frac{21}{80}$ by $\frac{3}{10}$        | 8. $3\frac{31}{48}$ by $\frac{5}{12}$                                |
| 3. $\frac{15}{16}$ by $\frac{4}{5}$         | 9. $3\frac{1}{6}$ by $9\frac{1}{3}$                                  |
| 4. $\frac{31}{35}$ by $\frac{3}{8}$         | 10. $9\frac{1}{6}$ by $\frac{1}{2}$ of 7                             |
| 5. $\frac{12}{37}$ by $\frac{13}{43}$       | 11. $116\frac{4}{15}$ by $\frac{1}{3}$ of $5\frac{1}{3}$             |
| 6. $\frac{16}{351}$ by $\frac{4}{27}$       | 12. $\frac{2}{3}$ of $\frac{3}{4}$ by $\frac{1}{2}$ of $\frac{2}{3}$ |

REDUCTION, CONTINUED.

**CASE VI.**—To reduce fractions from one denomination to another.

**RULE.**—If from a lower name to a higher, multiply the denominator, as in reduction of whole numbers. If from a higher name to a lower, multiply the numerator as in reduction of whole numbers.

Reduce  $\frac{2}{3}$  of a farthing to the fraction of a pound.

Here the denominator is multiplied, as it is to be brought to a higher name.  $\frac{2}{3} \times 4 \times 12 \times 20 = \frac{2}{2880}$

Reduce  $\frac{2}{3}$  of a pound to the fraction of a penny.

Here the numerator is multiplied, as it is to be brought to a lower name.  $\frac{3}{5} \times 20 \times 12 = \frac{720}{5}$

Fractions?

- $\frac{1}{13}$  of  $\frac{1}{4}$
- $\frac{3}{28}$  of  $\frac{1}{8}$
- $14\frac{1}{2}$
- $\frac{2}{3}$  of  $19$

er fractions,  
this has been  
e numerator  
er for its de

$\frac{2}{3}$  of  $\frac{7}{8} = \frac{14}{24}$   
 $= 3\frac{2}{3}$  Ans

fraction  $\frac{14}{24}$ .  
multiplied, pro-  
duced to

ons.

- $\times \frac{2}{3}$  of  $\frac{7}{8}$
- $\times \frac{4}{7}$  of  $\frac{3}{13}$
- $\times \frac{17}{18}$  of  $7\frac{1}{2}$
- $\times \frac{1}{18}$  of  $9\frac{1}{2}$

1. Reduce  $\frac{3}{4}$  of a farthing to the fraction of a pound.
2. Reduce  $\frac{1}{4}$  of a pound to the fraction of a penny.
3. Reduce  $\frac{2}{3}$  of a shilling to the fraction of a guinea.
4. Reduce  $\frac{1}{4}$  of a shilling to the fraction of a farthing.
5. Reduce  $\frac{7}{8}$  of a farthing to the fraction of a crown.
6. Reduce  $\frac{3}{10}$  of a day to the fraction of a week.
7. Reduce  $\frac{7}{9}$  of a week to the fraction of an hour.
8. Reduce  $\frac{4}{5}$  of a nail to the fraction of a yard.
9. Reduce  $\frac{7}{8}$  of a cwt. to the fraction of a dram.
10. Reduce  $\frac{4}{5}$  of a yard to the fraction of a mile.

CASE VII.—To express any given quantity as a fraction of another quantity, considered as an integer.

RULE.—Reduce both quantities to one denomination; then make the reduced integer the denominator, and the other quantity the numerator.

What part of 1*l.* is 13*s.* 4*d.*?

Here both quantities, the 1*l.* and the 13*s.* 4*d.*, are reduced to pence; the pence in the integer, 240, is made the denominator, and the pence in the other quantity is made the numerator; the fraction,  $\frac{160}{240}$  of a pound, is, when brought to its lowest terms, equal to  $\frac{2}{3}$  of a pound.

1	l.		s.		d.
20			13		4
<u>20</u>			12		
12			<u>160</u>		
<u>240</u>					

then  $\frac{160}{240} = \frac{2}{3}$  Ans.

11. Reduce 14*s.* 6*d.* to the fraction of a pound.
12. Reduce 17*s.* 4*d.* to the fraction of a pound.
13. Reduce 5*s.* 8*d.* to the fraction of a pound.
14. Reduce 17*s.* 9*d.* to the fraction of a penny.
15. Reduce 6*s.* 7*d.* to the fraction of a farthing.
16. Reduce 7 hours 21 minutes to the fraction of a day.

17. I  
18. I  
19. I  
20. I  
  
R 1.5  
and div  
to the  
lowest  
  
Here  
to bring  
The 10  
4 of a  
to bring  
is then  
remain  
is the 7  
  
21.  
22.  
23.  
24.  
25.  
26.  
27.  
28.  
29.  
30.

- 17. Reduce 7 lbs. 3 drams to the fraction of a cwt.
- 18. Reduce 8 cwt. 2 qrs. 14 lbs. to the fraction of a tun.
- 19. Reduce 3 lbs. 9 oz. to the fraction of a dwt.
- 20. Reduce 16 hours 13 minutes to the fraction of a day.

CASE VIII.—*To find the value of a fraction.*

RULE.—Reduce the numerator to the next inferior name, and divide by the denominator; reduce the remainder, if any, to the next lower name, and divide again, and so on to the lowest name.

What is the value of  $\frac{7}{8}$  of a pound sterling?

Here the numerator, 7, is multiplied by 20, to bring it to the next inferior name, 140s. The 140s. are divided by 8, which gives 17s. and 4 of a remainder; the 4 is multiplied by 12, to bring it to the next inferior name, 48d.; it is then divided by 8, which gives 6 without any remainder. The answer then is 17s. 6d. which is the  $\frac{7}{8}$  of a pound.

$$\begin{array}{r} 7 \\ 20 \\ 8 \overline{) 140} \\ \underline{136} \phantom{0} \\ 40 \\ \underline{32} \phantom{0} \\ 80 \\ \underline{80} \\ 0 \end{array}$$

- 21. What is the value of  $\frac{4}{5}$  of a pound?
- 22. What is the value of  $\frac{5}{6}$  of a shilling?
- 23. What is the value of  $\frac{2}{3}$  of a crown?
- 24. What is the value of  $\frac{2}{11}$  of a day?
- 25. What is the value of  $\frac{12}{13}$  of a guinea?
- 26. What is the value of  $\frac{4}{9}$  of a yard, long measure?
- 27. What is the value of  $\frac{13}{16}$  of a lb. troy?
- 28. What is the value of  $\frac{13}{16}$  of a lb. avoirdupois?
- 29. What is the value of  $\frac{23}{27}$  of a cwt.?
- 30. What is the value of  $\frac{17}{21}$  of a mile?

a pound.  
penny.  
a guinea.  
a farthing  
a crown  
week.

hour.  
dram.  
mile.

fraction of  
penny.

notation; then  
and the other

s. d.

13 4  
12  
160

$\frac{2}{3}$  Ans.

1.  
1.  
1.  
7.  
ing.  
of a day.

**CASE IX.—To Reduce a Vulgar Fraction to a Decimal.**

**RULE.**—Divide the numerator by the denominator: annexing as many ciphers to the numerator as may be necessary. Point off as many decimal places in the quotient as there were ciphers annexed to the numerator.

*Reduce  $\frac{1}{2}$  to a Decimal.*

$$\begin{array}{r} 2)10 \\ \hline .5 \text{ the answer.} \end{array}$$

*Reduce  $\frac{3}{4}$  to a decimal.*

$$\begin{array}{r} 4)300 \\ \hline .75 \text{ the answer.} \end{array}$$

1. Reduce  $\frac{5}{8}$  to a decimal.

2. —  $\frac{1}{4}$  —

3. —  $\frac{7}{8}$  —

4. —  $\frac{1}{3}$  —

5. —  $\frac{5}{6}$  —

5. —  $\frac{1}{8}$  —

7. Reduce  $\frac{9}{16}$  to a decimal.

8. —  $\frac{1}{3}$  —

9. —  $\frac{16}{17}$  —

10. —  $\frac{3}{11}$  —

11. —  $\frac{275}{3843}$  —

12. —  $\frac{1}{1875}$  —

**CASE X.—To Reduce a Decimal to a Vulgar Fraction.**

**RULE.**—Make the given decimal the numerator, and place under it, for a denominator, a unit with as many ciphers as there are figures in the decimal.

*Reduce .5 to a vulgar fraction*

$$\frac{5}{10} \text{ the answer.}$$

*Reduce .078 to a vulgar frac*

$$\frac{78}{1000} \text{ the answer.}$$

1. Reduce .25 to a vulgar fr.

2. — .625 —

3. — .375 —

4. — .005 —

5. — .01 —

6. Reduce .001 to a vulgar f.

7. — .41 —

8. — .021 —

9. — .007 —

10. — .019 —

## PROMISCUOUS EXERCISES.

a Decimal.

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decimal.

answer.

o a decimal

—

—

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—

—

r Fraction.

erator, and  
ith as many

vulgar frac

answer.

to a vulgar f.

—

—

—

—

If the fractions are of different denominations, it will be necessary to bring them to the same name before they are added or subtracted.

1. What are the *factors* of 30, 60, 72, 84, 63, 18, 35, and 48?

2. Find the *greatest* common measure of 84 and 56.

3. Give the *least* common multiple of 6, 8, 15, and 21.

4. What is the quotient of  $16 \times 18 \times 24 \times 42$ , divided by  $7 \times 8 \times 36 \times 48$ ?

5. Change the improper fractions  $6\frac{4}{7}$ ,  $3\frac{3}{8}$ ,  $4\frac{2}{3}$  into mixed numbers.

6. Change the mixed numbers  $18\frac{5}{23}$ ,  $9\frac{3}{5}$ ,  $45\frac{2}{7}$  into improper fractions.

7. Reduce the compound fraction  $\frac{6}{2 \times 3}$  of  $\frac{4}{24}$  of  $\frac{1}{3}$  of 30

8. Reduce  $\frac{315}{405}$ ,  $\frac{101}{112}$ , and  $\frac{1010}{3302}$  to their lowest terms.

9. Reduce  $\frac{3}{4}$ ,  $\frac{7}{12}$ ,  $\frac{1}{2}$ , and  $\frac{5}{6}$  to a common denominator.

10. Add  $\frac{1}{6}$  of a ton to  $\frac{5}{12}$  of a cwt.

11. From  $7\frac{1}{3}$  of 2 take  $\frac{1}{3}$  of  $\frac{2}{6}$ .

12. Multiply  $2\frac{1}{4}$  of  $\frac{2}{7}$  by 70.

13. Divide  $\frac{5}{6}$  of  $\frac{7}{11}$  by  $6\frac{1}{5}$ .

14. Reduce  $\frac{7}{8}$  of a cwt. to a fraction of a dram.

15. Reduce 8 hours 36 minutes to the fraction of a day

16. What is the value of  $\frac{1}{4}$  of a pound avoirdupois?

17. What is the difference between  $\frac{2}{3}$  of a league, and  $\frac{1}{3}$  of a mile?

18. How much is 8 times  $\frac{1}{6}$  of a yard?

19. Find the result of  $[16+4] - [5+3] \times [17-3] \times [6 \times 7]$  divided by  $8 \times 6 \times 7 \times 28$ .

20. Reduce the compound fraction  $\frac{4}{3}$  of  $\frac{5}{7}$  of  $\frac{5}{6}$  of  $\frac{7}{8}$  of  $\frac{9}{10}$  by Cancellation.

21. How much is 8 times  $\frac{1}{8}$  of a pound avoirdupois?

## COMPOUND ADDITION.

**RULE WITH EXAMPLE.**—Place pounds under pounds, shillings under shillings, and pence under pence. Add the farthings, and divide by 4; the quotient is pence, the remainder is farthings and must be put under farthings. Add the pence with the last quotient, and divide by 12; the quotient is shillings, the remainder is pence, and must be put under pence. Add the shillings with the last quotient and divide by 20; the quotient is pounds, the remainder is shillings, and must be put under shillings. Add the pounds with the last quotient, as in Simple Addition.

£	s.	d.
64	12	4 $\frac{1}{4}$
86	15	6 $\frac{1}{2}$
14	16	5 $\frac{3}{4}$
34	17	9 $\frac{3}{4}$
<hr/>		
201	2	2 $\frac{1}{4}$

## EXERCISES.

(1)	£	s.	d.
	42	14	6 $\frac{1}{4}$
	26	12	4 $\frac{1}{2}$
	34	16	7
	25	13	8 $\frac{3}{4}$

(2)	£	s.	d.
	64	12	7
	36	18	4 $\frac{1}{2}$
	27	14	2 $\frac{1}{4}$
	42	11	10 $\frac{1}{2}$

(3)	£	s.	d.
	12	16	4 $\frac{3}{4}$
	16	4	6 $\frac{1}{4}$
	64	17	2 $\frac{3}{4}$
	43	12	7 $\frac{1}{2}$

(4)	£	s.	d.
	43	16	7 $\frac{3}{4}$
	65	13	4
	84	12	3 $\frac{1}{2}$
	92	11	2
	41	16	6 $\frac{3}{4}$

(5)	£	s.	d.
	65	12	4
	72	17	6 $\frac{3}{4}$
	13	8	7 $\frac{1}{2}$
	16	14	8 $\frac{1}{4}$
	72	12	4 $\frac{1}{2}$

(6)	£	s.	d.
	36	13	4 $\frac{1}{2}$
	12	8	6 $\frac{1}{4}$
	11	19	10 $\frac{1}{2}$
	17	14	8 $\frac{3}{4}$
	28	12	6 $\frac{1}{4}$

7. I bought goods for which I paid £195 16s. 6d.; I paid for packing 6s. 8d., for case 16s. 6d., for cordage 1s. 6d., for portorage 4s., for freight £1 11s. 6d., for waggon carriage 13s., for booking 9d. What was the entire cost of the goods?

8. The expenses of building a house was: architect £198, bricklayer £1762, mason £2141 16s. 6d., carpenter £2768 17s. 9d., plumber £895 14s., painter and glazier £900 15s. 5 $\frac{1}{2}$ d., paper-hanger £243 18s. 7d. What did the house cost?

9. A housekeeper paid for tea £2 16s. 7d., coffee £2 7s. 8 $\frac{3}{4}$ d., sugar £3 14s. 0d., beef £2 16s. 6d., mutton £1 17s., ham 9s. 7 $\frac{1}{2}$ d., and on various other articles £3 15s. 7 $\frac{3}{4}$ d. How much money did she lay out?

## COMPOUND SUBTRACTION.

From £64 12s. 6½*d.* take £27 18s. 8¾*d.*

RULE WITH EXAMPLE.—Place the smaller number under the greater as in Simple Subtraction. Then, 3 farthings from 2 farthings, cannot; add 4 farthings (= 1 penny,) to the 2, and 3 farthings from 6, there remain 3, place the ¾ under the farthings. Add 1 to the 8; then 9 pence from 6 pence, cannot, add 12 pence (= 1 shilling) to the 6, then 9 from 18, there remain 9, put the 9 pence under the pence. Add 1 to the 18, then 19 shillings from 12 cannot; add 20 shillings (= 1 pound) to the 12, then 19 from 32, there remain 13, place the 13 under the shillings. Carry 1 to the 7 and proceed as in Simple Subtraction.

£	s.	d.
64	12	6½
27	18	8¾
36	13	9¾

nds, shil-

£	s.	d.
64	12	4½
86	15	6½
14	16	5¾
34	17	9¾

01 2 2¼  
nt, as in

s.	d.
16	4¾
4	6¼
17	2¾
12	7½

s.	d.
13	4½
8	6¼
19	10½
14	8¾
12	6¼

; I paid for  
for porter-  
ge 13s., for  
ods?itect £198,  
nter £2768  
00 15s. 5½*d.*,  
cost?£27 7s. 8¾*d.*,  
7s., ham 9s.  
How much

## EXERCISES.

£	s.	d.
49	17	4½
17	14	2¼

£	s.	d.
64	8	3¼
27	16	7½

£	s.	d.
73	10	5½
48	18	9¾

32	3	2¼
----	---	----

36	11	7¾
----	----	----

24	11	7¾
----	----	----

(1)		
73	14	6¼
29	17	8½

(2)		
47	16	8¼
28	17	6¼

(3)		
86	17	4
27	19	0¼

(4)		
68	13	7
28	16	10¼

(5)		
94	0	0
24	17	9½

(6)		
83	17	9½
47	0	0¾

(7)		
88	18	8¼
7	19	8¾

(8)		
17	6	7
0	19	11¼

(9)		
20	11	11¼
1	17	11½

(10)		
56	12	0½
17	12	0¾

(11)		
24	19	8½
7	12	9

(12)		
48	12	8
17	19	8½



## COMPOUND MULTIPLICATION.

CASE I.—When the Multiplier does not exceed 12.

Multiply £6 12s. 4½d. by 7.

RULE WITH EXAMPLE.—Begin multiplying the farthings by 7; thus, 7 times ½ are 3½, set down ½ and carry 3 to the pence. 7 times 4d. are 2s. 4d., and 3d. carried are 2s. 7d.; set down 7 under the pence and carry 2. 7 times 12 are 84, and 2 carried are 86s., which is equal to £4 6s.; set down the 6 under the shillings, and carry 4. 7 times 6 are 42 and 4 carried make £45. Place it under the pounds

£	s.	d.
6	12	4½
		7
46	6	7½

£ s. d.	£ s. d.	£ s. d.	£ s. d.
(1) 64 7 4½	(2) 43 12 6½	(3) 57 16 8¾	(4) 79 18 4½
2	3	4	5

CASE II.—When the Multiplier exceeds 12.

Multiply £4 6s. 3d. by 423.

RULE WITH EXAMPLE.—When the multiplier, 423, is a hundred or above it, multiply the multiplicand, £4 6s. 3d., twice by 10, and the product, £31 6s., by the number of hundreds, 4; then multiply the product of the first 10, £43 2s. 6d., by the number of tens, 2; and place it under the product of the 4, £1725 0s. 0d. Multiply now the first line, £4 6s. 3d. by the number of units, 3; put the product obtained under the product of the tens, and add the products of the hundreds, the tens, and the units together for the required answer. For thousands multiply by 3 tens, and proceed in the same manner.

£	s.	d.
4	6	3
		3 × 3
		10
43	2	6 × 2
		10
431	5	0
		4
1725	0	0
	86	5 0
	12	18 9
1824	3	9

£ s. d.	£ s. d.	£ s. d.	£ s. d.
5. Mult. 64 16 7½	68	11. Mult. 467 15 8¾	by 647
6. — 86 13 4½	75	12. — 675 0 4½	698
7. — 09 12 6½	93	13. — 563 12 0¾	785
8. — 648 19 7¾	68	14. — 807 14 4¼	680
9. — 367 16 4¼	246	15. — 98 13 8¼	87
10. — 658 13 7	478	16. — 42 16 7½	45

CASE III.—*To Multiply by parts.*

Multiply 4s. 8½d. by 4½.

If the part be ¼, take a quarter of the multiplicand. If the part be ½, take a half of the multiplicand. If the part be ¾, take half and a quarter of the multiplicand, or divide the multiplicand by the under figure of the fraction, and multiply the product by the upper figure. Add the quotient thus obtained to the product obtained by multiplying the multiplicand by the whole number in the multiplier. This latter way applies to any fractional part.

s.	d.	
4	8½	
	4½	
18	10	
2	4½	half of top line
1	1	2½

ed 12.  
 urthings by  
 £ s. d.  
 6 12 4½  
 7  
 -----  
 46 6 7½  
 he pounds  
 £ s. d.  
 79 18 4½  
 5

12.  
 £ s. d.  
 1 6 3×3  
 10  
 -----  
 3 2 6×2  
 10  
 -----  
 1 5 0  
 4  
 -----  
 5 0 0  
 6 5 0  
 2 18 9  
 4 3 9

	£	s.	d.		£	s.	d.	
17. Mult.	4	2	6	by 4½	23. Mult.	7	8	9½ by 7¼
18. —	7	15	7½	7¾	24. —	4	19	3½ 9¼
19. —	28	19	8½	9¼	25. —	48	17	6½ 47½
20. —	87	13	9½	12½	26. —	59	14	7¼ 87½
21. —	874	12	10½	19¾	27. —	796	13	4½ 49¾
22. —	478	14	6½	11½	28. —	864	16	0¼ 94¾

MISCELLANEOUS EXERCISES.

29. What do 7¾ lbs of tea come to at 5s. 3¼d. per lb.?
30. What do 4 lbs. of butter come to at 1s. 1d. per lb.?
31. Patrick earns 1s. 9d. per day, what does that come to in 6 days?
32. Bought 11½ tons of hay at £3 17s. 6½d. per ton; how much did they come to?
33. A gentleman spends £1 7s. 6d. per day; how much does he spend in a year?
34. A farmer paid in rent £216 16s. 6d. every year; how much did he pay the landlord in the course of 25½ years?
35. A carpenter received 14s. 6d. per week; what did his wages amount to in a year?
36. What is the value of 568¼ ounces of gold, valued at £3 19s. 6d. per ounce?
37. Sold 8 oxen, and gained upon each £2 11s. 7½d.; how much did I gain?

d.  
 83 by 647  
 4½ 698  
 0½ 785  
 4½ 680  
 8½ 87  
 7½ 45

COMPOUND DIVISION.

CASE I.—When the Divisor does not exceed 12.

Divide £8 12s. 7½d. by 6.

RULE WITH EXAMPLE.—Proceed thus, 6 in 8 once and 2 over, set down the 1 under the 8, and carry 40s. for the 2l. to the 12; then 6 in 52, 8 times and 4 over, set down the 8 and carry 48d. for the 4s. to the 7; then 6 in 55, 9 times and 1 over set down the 9 and carry 4 farthings to the farthing, 4 and 6, 6 in 6 once; set down ¼.

£	s.	d.
6)8	12	7½
	1	8 9¼

EXERCISES.

2) 74 16 8½

£37 8 4½

3) 76 12 2¼

£25 10 8¼-2

- |           | £    | s. | d.  |      | £          | s.   | d. |         |
|-----------|------|----|-----|------|------------|------|----|---------|
| 1. Divide | 68   | 17 | 9½  | by 2 | 12. Divide | 98   | 14 | 7¼ by 7 |
| 2.        | 42   | 12 | 3½  | 3    | 13.        | 47   | 13 | 6½ 8    |
| 3.        | 69   | 18 | 7¼  | 4    | 14         | 67   | 19 | 1¼ 9    |
| 4.        | 748  | 15 | 0½  | 5    | 15.        | 864  | 1  | 7¼ 12   |
| 5.        | 176  | 19 | 10¾ | 6    | 16.        | 587  | 14 | 10½ 4   |
| 6.        | 407  | 14 | 2½  | 7    | 17         | 311  | 7  | 11¼ 5   |
| 7.        | 8647 | 17 | 11¾ | 8    | 18.        | 4000 | 18 | 0½ 10   |
| 8.        | 7508 | 13 | 6½  | 9    | 19         | 8681 | 11 | 3½ 12   |
| 9.        | 5060 | 0  | 7¼  | 10   | 20         | 7010 | 18 | 0¼ 9    |
| 10.       | 8687 | 18 | 11¾ | 11   | 21.        | 3671 | 2  | 11¼ 8   |
| 11.       | 4711 | 11 | 7½  | 12   | 22.        | 8762 | 17 | 0¼ 12   |

23. A tradesman had in the savings bank 96l. 16s. 6d.; this sum he had saved in 5 years; how much did he save on an average each year?

24. Ten men rented a house at 19l. 11s. 8d.; how much had each to pay?

25. A father left 426l. 16s. 6d. to be divided equally among his eight children; how much did each get?

26. Twelve persons subscribed 28l. 15s. 6d. per annum, for the support of a school; how much did each subscribe?

27. A piece of cloth containing nine yards was bought for 4l. 16s. 8d.; how much was that per yard?

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31.  
32.  
33.  
34.  
35.  
36.  
37.  
38.

28. Bought nine dozen bottles of wine, for which I paid 167. 17s. 9d. ; what did I pay per dozen?

29. Nine vessels imported goods, valued at 796877. 16s. ; what was the average value of each cargo?

CASE II.—When the Divisor exceeds 12.

Divide £64 7s. 8½d. by 47.

**RULE WITH EXAMPLE.**—Divide the pounds as in simple long division. Multiply the remainder, 17, by 20, adding to it the shillings, 7. Divide again as in simple division. Multiply the remainder, 18, by 12, adding to it the pence, 8. Divide again as in simple division ; multiply the remainder, 36, by 4, adding to it the farthings and divide as before. The quotient then is 17. 7s. 4¾d. with 5 of a remainder.

£	s.	d.	
47)	64	7	8½(1
	47		
	17		
	20		
47)	347	7	
	329		
	18		
	12		
47)	224	(4	
	188		
	36		
	4		
47)	146	(3	
	141		
	5	remain	

	£	s.	d.		£	s.	d.
31. Divide	47	16	4½	by 28	39. Divide	69	16
32.	78	15	6¼	37	40.	97	13
33.	487	19	7¾	146	41.	647	14
34.	798	17	0½	365	42.	876	0
35.	980	7	6¼	478	43.	993	19
36.	6427	14	9¾	942	44.	7086	8
37.	7063	0	11½	806	45.	9103	17
38.	4317	16	8¾	718	46.	7608	16

ed 12.

£	s.	d.	
6)	8	12	7½
<hr/>			
1	8	9½	
<hr/>			
farthings to			
n ¼.			
<hr/>			
2	2½		
<hr/>			
0	8½	-2	
s.	d.		
11	7¼	by 7	
13	6½	8	
19	1½	9	
1	7¼	12	
14	10½	4	
7	11¼	5	
18	0½	10	
11	3½	12	
18	0¼	9	
2	11½	8	
17	0¾	12	

967. 16s. 6d :  
 did he save on  
 ; how much  
 equally among  
 er annum, for  
 bscribe ?  
 was bought for

## CASE. III.—When the Divisor contains a fraction.

Divide £24 4s. 6½d. by 2½.

RULE WITH EXAMPLE.—Multiply both the dividend and the divisor by the under figure of the fraction, 2, adding in the upper figure 1, to the product of the divisor; and divide by short or long division as the case may require.

$$\begin{array}{r}
 \text{£ } \text{s. } \text{d.} \\
 2\frac{1}{2})24 \text{ } 4 \text{ } 6\frac{1}{2} \\
 \underline{\hspace{1em}} \hspace{1em} \underline{\hspace{1em}} \hspace{1em} \underline{\hspace{1em}} \\
 5 \text{ } 48 \text{ } 9 \text{ } 1 \\
 \underline{\hspace{1em}} \hspace{1em} \underline{\hspace{1em}} \hspace{1em} \underline{\hspace{1em}} \\
 9 \text{ } 13 \text{ } 9\frac{1}{2}
 \end{array}$$

	£	s.	d.		£	s.	d.		
47. Divide	42	14	6½	by 3½	53. Divide	64	17	6½	by 4½
48. —	64	17	7½	6¼	54. —	87	14	2¾	9¼
49. —	97	18	8¼	7¾	55. —	38	12	5¼	8¼
50. —	847	12	5½	47½	56. —	789	0	6¾	78¼
51. —	948	17	6¾	76¾	57. —	807	16	10¼	84¼
52. —	408	0	10½	43¾	58. —	978	17	6¾	96¾

59. A farmer rents a farm at 535*l.* 16*s.* 6*d.* per annum, he wishes to lay out as much every week as may pay the rent; how much must he save each week?

60. A merchant gained 140*l.* 7*s.* in 15 years; what was his average gain per year?

61. In a large town there were 4708 children educated by 56 teachers; how many pupils on an average to each teacher?

62. A manufacturer paid in wages each week 24*l.* 17*s.* 6*d.*; there were 321 workmen; how much did each man receive?

63. There are about eight hundred millions of people in the world, and it is thought that as many die in 32 years; how many die on an average in a year?

64. If so many die in a year, how many die in an hour, there being 8765 hours in a year?

65. A prize of 7257*l.* 3*s.* 6*d.* is to be divided equally among 500 sailors; what is each man's share?

66. A gentleman had an estate of 3468 acres, for which he received per annum 879*l.* 10*s.* 8*d.*; how much was it let for per acre?

## REDUCTION.

REDUCTION is the bringing of one denomination to another without altering its value.

CASE I.—*To bring from a higher to a lower.*

RULE WITH EXAMPLE.—Multiply by as many of the less as make one of the greater. Thus to bring 2*l.* to shillings, multiply 2 by 20, because there are 20*s.* in a pound.

£2
20
—
40 <i>s</i>

CASE II.—*To bring a lower to a higher.*

RULE WITH EXAMPLE.—Divide by as many of the less as make one of the greater. Thus to bring 40 shillings to pounds, divide by 20, because there are 20 shillings in a pound.

<i>s.</i>
20)40
—
£2

Bring £1 9*s.* 6½*d.* to farthings.

Multiply the 4 by 20, and add the 9*s.* to the product, this will give the number of shillings, 89*s.* Multiply then by 12 adding 6 pence, this will give the number of pence; 1074*d.* Multiply by 4, and add the two farthings to the product; this will give the number of farthings, in 4298 farthings, in 4*l.* 9*s.* 6½*d.*

£	<i>s.</i>	<i>d.</i>
4	9	6½
20		
89		
12		
1074		
4		
4298		

Bring 4298 farthings to pounds.

Divide the farthings by 4, this will give 1074 pence and 2 farthings. Divide this by 12, and 89 shillings and sixpence is obtained. Divide by 20, and the quotient is 4 pounds 9 shillings In all 4*l.* 9*s.* 6½*d.*

4298
4)4298
—
1074
12)1074
—
89
6)89
—
14
9
6½
£4 9 6½

## EXERCISES.

1. How many farthings are there in 12*l.* 7*s.* 6½*d.*?
2. In 26*l.* 9*s.* 10*d.* how many pence?
3. Reduce 36*l.* 14*s.* 9½*d.* to farthings.
4. In 247*l.* 12*s.* 8½*d.* how many halfpence?
5. How many pence are there in 276 guineas?
6. In 298 crowns, how many farthings?
7. Reduce 3648 sixpences to farthings.
8. In 42768 farthings how many pence?
9. How many pounds are there in 67890 shillings?
10. In 426876 farthings, how many pounds?
11. How many guineas are there in 35789 shillings?
12. In 68794 pence, how many crowns?
13. How many fourpences are there in 37689 shillings?
14. In 2470*l.* how many crowns?
15. How many pounds in 39076 half-crowns?
16. In 29685 twopences, how many shillings?
17. In 43687 crowns, how many threepences?
18. How many fivepences are there in 4796 crowns?
19. In 76971 halfpence, how many fourpences?
20. In 798302 pounds, how many sixpences?
21. How many crowns are there in 7968 guineas?
22. In 79201 half guineas, how many seven shilling pieces?
23. How many fivepences are there in 764 pounds?
24. In 73027 farthings, how many eightpences?
25. How many half-sovereigns are there in 7642 guineas?
26. Reduce 7632*l.* 17*s.* 0¾*d.* to farthings.
27. Reduce 3010*l.* 11*s.* 8*d.* to farthings.
28. In 7324 guineas, how many ninepences?
29. How often is three farthings contained in 742*l.* 17*s.* 9¾*d.*?
30. In 7690 fourpences, how many fivepences?

*To Reduce Halifax Currency to Decimal Currency.*

**RULE**—Multiply the pounds by 400. Multiply the shillings by 20. Reduce the pence and farthings to farthings. Multiply by five, and divide by 12. Add all the results together, and cut off two figures to the right hand for cents; thus:

Reduce £12 14s. 6½d. to Decimal Currency.

£	s.	d.
42	14	6½
400	20	4
16800	280	26
280		5
10		
\$170.90	12	130
		10

Reduce the following amounts to their equivalents in Decimal Currency.

31.	£4	7s.	8½d.		41.	£3	6s.	5½d.
32.	6	5	4¼		42.	4	7	8
33.	7	8	9½		43.	2	6	3¼
34.	6	4	2¾		44.	5	8	2¼
35.	3	7	6¼		45.	4	7	8½
36.	6	4	5¾		46.	3	7	9¼
37.	2	6	4½		47.	6	3	7¼
38.	5	7	8		48.	3	7	8¼
39.	3	6	4¼		49.	8	9	6½
40.	4	7	9		50.	3	6	4½

27. 17s. 9¼d.



## WEIGHTS AND MEASURES.

## EXERCISES.

## AVOIRDUPOIS WEIGHT.

## ADDITION.

			(1)			(2)		
<i>cwt.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>cwt.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>oz.</i>
4	2	12	7	3	16	1	14	12
2	3	14	8	1	19	2	24	15
6	1	7	4	2	27	3	13	7
3	2	24	8	1	13	2	17	13
<hr/>			<hr/>			<hr/>		
17	2	1						

## SUBTRACTION.

			(3)			(4)		
<i>cwt.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>cwt.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>oz.</i>
16	2	12	17	1	10	10	22	12
12	3	24	19	2	27	11	26	14
<hr/>			<hr/>			<hr/>		
3	2	16						

## MULTIPLICATION.

			(5)			(6)		
<i>cwt.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>cwt.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>oz.</i>
4	3	16	6	2	18	2	23	12
		4			7			9
<hr/>			<hr/>			<hr/>		
19	2	8						

## DIVISION.

			(7)			(8)		
<i>cwt.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>cwt.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>qrs.</i>	<i>lbs.</i>	<i>oz.</i>
3)19	3	8	6)14	2	17	9)19	11	15
<hr/>			<hr/>			<hr/>		
6	2	12						

9. A tobaccoist received 16 cwt. 2 qrs. 25 lbs. of tobacco and sold 12 cwt. 3 qrs. 26 lbs.; how much has he unsold?

10.  
cwt. 2  
weigh  
lb.; N  
of the

11.  
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15.  
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16.  
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17.  
14 oz.

18.  
out of

19.  
much

20.  
2 qrs.  
den?

21.  
lbs.;  
which

10. A brewer bought five bags of hops; No. 1, weighed 1 cwt. 2 qrs. 14 lb.; No. 2, weighed 1 cwt. 3 qrs. 24 lb.; No. 3, weighed 1 cwt. 1 qr. 27 lb.; No. 4, weighed 1 cwt. 3 qrs. 26 lb.; No. 5, weighed 2 cwt. 2 qrs. 25 lb.; what was the weight of the whole?

11. A grocer sold the first year he was in business, 64 cwt. 3 qrs. 26 lb. 14 oz. of sugar; the third year he was in business, he sold 8 times as much; how much did he sell in the third year?

12. Eight hogsheds contained 168 cwt. 3 qrs. 26 lb. of sugar; how much did each contain?

13. A plantation produced the first year 376 cwt. 2 qrs. 16 lbs. of sugar; the second year 473 cwt. 1 qr. 9 lbs. 15 oz.; the third year 698 cwt. 14 lbs. 12 oz.; the fourth year 568 cwt. 3 qrs. 13 oz.; the fifth year 737 cwt. 2 qrs. 13 lbs. 10 oz. 13 drams; how much sugar was produced on the plantation in these five years?

14. A grocer bought 3 hhds. of sugar, each containing 4 cwt. 1 qr. 13 lbs. The first month he sold 2 cwt. 3 qrs. 14 lb. 13 oz.; the second month he sold 2 cwt. 2 qrs. 14 c. 10 drams; the third month he sold 3 cwt. 1 qr. 11 lbs. 15 drams; how much has he on hand?

15. What is the weight of 36 hhds. of tobacco, each hhd. weighing 5 cwt. 3 qrs. 14 lbs. 13 oz.?

16. Eleven pieces of iron weighed 4 tons, 16 cwt. 3 qrs.; how much did each piece weigh?

17. Ten sacks of potatoes weighed 10 cwt. 3 qrs. 13 lbs. 14 oz.; what was the weight of each sack?

18. How many parcels, each containing  $4\frac{1}{2}$  lbs. can be made out of 2 cwt. 2 qrs. 23 lbs.?

19. If 36 bags of cotton weighed 49 cwt. 3 qrs. 13 lbs., how much did one weigh?

20. How many hogsheds of sugar, each containing 13 cwt. 2 qrs. 14 lbs., may be put on board a ship of 324 tons burden?

21. St. Paul's bell in London weighs 5 tons, 2 cwt. 1 qr. 22 lbs.; by how much does the great bell of Moscow exceed it, which weighs 198 tons, 2 cwt. 1 qr.?

oz.  
12  
15  
7  
13

oz.  
12  
14

oz.  
12  
9

oz.  
15

tobacco  
sold?

## TROY WEIGHT.

## MULTIPLICATION.

<i>lbs.</i>	<i>oz.</i>	<i>dwt.</i>	(22)	<i>lbs.</i>	<i>oz.</i>	<i>dwt.</i>	(23)	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>
18	6	14		24	3	12		43	5	11
		4				8				9
74	2	16								

## DIVISION.

<i>lbs.</i>	<i>oz.</i>	<i>dwt.</i>	(24)	<i>lbs.</i>	<i>oz.</i>	<i>dwt.</i>	(25)	<i>oz.</i>	<i>dwt.</i>	<i>grs.</i>
2)17	7	14		4)67	8	17		7)13	16	22
8	9	17								

26. A silversmith made three dozen spoons, weighing 5 lb. 9 oz. 8 dwt. ; a tea-pot, weighing 3 lb. 2 oz. 16 dwt. 16 grs. ; two pair silver candlesticks, weighing 4 lb. 6 oz. 17 dwt. ; a dozen silver forks, weighing 1 lb. 8 oz. 19 dwt. 22 grs. ; what was the weight of all the articles ?

27. Three dozen silver table spoons weighed 5 lb. 9 oz. 9 dwt., while three dozen silver tea-spoons weighed only 1 lb. 9 oz. 16 dwt. 18 grs. ; what was the difference in weight ?

28. Sold eight silver tea-pots, each weighing 3 lb. 9 oz. 18 dwt. 13 grs. ; how much did they all weigh ?

29. A silversmith received 36 lb. 8 oz. 14 dwt. 16 grs. of silver to make 12 tankards ; what would the weight of each tankard be ?

30. What is the weight of 36 ingots of silver, each ingot weighing 2 lb. 10 oz. 15 dwt. ?

31. 2 lb. 4 oz. 9 dwt. of gold cost 5*l.* 16*s.* 6*d.* ; what did it cost per dwt. ?

32. What is the weight of 3 dozen spoons, each weighing 2 oz. 3 dwt. 19 grs. ?

*ml.*  
4  
6  
7  
6  
25

*ml.*  
4  
1  
2

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length

41.  
18 perc  
averag

LONG MEASURE.

ADDITION.

			(33)			(34)		
<i>ml.</i>	<i>fur.</i>	<i>per.</i>	<i>fur.</i>	<i>per.</i>	<i>yd.</i>	<i>per.</i>	<i>yd.</i>	<i>ft.</i>
4	6	20	7	22	2	16	3	2
6	5	13	6	22	4	17	4	1
7	4	9	9	16	3	24	5	0
6	7	12	6	14	5	23	2	2
25	7	14						

SUBTRACTION.

			(35)			(36)		
<i>ml.</i>	<i>fur.</i>	<i>per.</i>	<i>fur.</i>	<i>per.</i>	<i>yd.</i>	<i>per.</i>	<i>yd.</i>	<i>ft.</i>
4	6	20	7	10	1	16	2	1
1	7	35	2	19	4	12	4	2
2	6	25						

37. A man rode 35 miles, 2 furlongs, 34 perches; walked 24 miles, 6 furlongs, 25 perches, 2 yards; then rode again 42 miles, 7 furlongs, 4 yards; then walked again 15 miles, 4 furlongs, 38 perches, 3 yards; what was the length of his journey?

38. A traveller walked on Monday 32 miles, 5 furlongs; on Tuesday he walked 27 miles, 7 furlongs, 35 perches; how much did his journey of Monday exceed that of Tuesday?

39. A mail coach travelled at the rate of 7 miles, 5 furlongs, 25 perches, per hour; how far would it go in twelve hours?

40. A surveyor who had 19 miles, 7 roods, 36 perches, of road to keep in repair, appointed 12 men to the work; what length of road had each to attend to?

41. A man travelled in nine days 150 miles, 4 furlongs, 18 perches, 3 yards; how much did he travel per day on an average?

## CLOTH MEASURE.

## MULTIPLICATION.

<i>yds.</i>	<i>qrs.</i>	<i>nls.</i>	(42)	<i>yds.</i>	<i>qrs.</i>	<i>nls.</i>	(43)	<i>yds.</i>	<i>qrs.</i>	<i>nls.</i>	
24	2	3	16	3	2	7	36	2	3	9	
98											

## DIVISION.

<i>yds.</i>	<i>qrs.</i>	<i>nls.</i>	(44)	<i>yds.</i>	<i>qrs.</i>	<i>nls.</i>	(45)	<i>yds.</i>	<i>qrs.</i>	<i>nls.</i>	
4)25	3	2	7)64	2	3	9)36	3	1			
6			1			8 $\frac{2}{3}$					

46. A tailor bought four pieces of cloth ; in the first there were 27 yds. 2 qrs. 3 nls. ; in the second, 39 yds. 2 qrs. 1 nl. in the third, 32 yds. 3 qrs. 3 nls. ; in the fourth, 47 yds. 3 qrs 2 nls. ; how much in all ?

47. A tailor, from a piece of cloth containing 37 yds. 3 qrs 2 nls., cut off 13 yds. 3 qrs. 2 nls. ; how much remained ?

48. A dozen weavers wove, each, 36 yds. 3 qrs. 3 nls. of cloth ; how much was woven by the whole ?

49. In nine pieces of cloth of equal length, there were 187 yds. 2 qrs. 3 nls. ; how much in each piece ?

50. A piece of cloth at 7s. 6d. per yard, cost 177. 12s. 6d. ; how many yards were there in it ?

51. What is the difference in length of one web of cloth measuring 36 yds. 3 qrs. 3 nls. ; and two webs, each measuring 23 yds. 2 qrs. 2 nls. ?

52. How many suits of clothes can be made from a piece containing 39 yds. 2 qrs. 3 nls. ; each suit requiring 3 yds. 1 qr. 2 nls. ?

SQUARE AND LAND MEASURE.

ADDITION.

3) <i>rs. nls.</i> 2    3 <hr style="width: 50px; margin-left: 0;"/> 9	<table border="0"> <tr> <th><i>ac.</i></th> <th><i>rd.</i></th> <th><i>per.</i></th> </tr> <tr> <td>32</td> <td>3</td> <td>16</td> </tr> <tr> <td>16</td> <td>2</td> <td>21</td> </tr> <tr> <td>76</td> <td>1</td> <td>13</td> </tr> <tr> <td>24</td> <td>2</td> <td>27</td> </tr> <tr> <td colspan="3"><hr style="width: 100%;"/></td> </tr> <tr> <td>150</td> <td>1</td> <td>37</td> </tr> </table>	<i>ac.</i>	<i>rd.</i>	<i>per.</i>	32	3	16	16	2	21	76	1	13	24	2	27	<hr style="width: 100%;"/>			150	1	37	<table border="0"> <tr> <th colspan="3">(53)</th> <th colspan="3">(54)</th> </tr> <tr> <th><i>ac.</i></th> <th><i>rd.</i></th> <th><i>per.</i></th> <th><i>ac.</i></th> <th><i>rd.</i></th> <th><i>per.</i></th> </tr> <tr> <td>46</td> <td>3</td> <td>27</td> <td>37</td> <td>2</td> <td>12</td> </tr> <tr> <td>12</td> <td>2</td> <td>16</td> <td>41</td> <td>3</td> <td>21</td> </tr> <tr> <td>61</td> <td>0</td> <td>34</td> <td>62</td> <td>1</td> <td>17</td> </tr> <tr> <td>46</td> <td>3</td> <td>17</td> <td>47</td> <td>2</td> <td>34</td> </tr> <tr> <td colspan="3"><hr style="width: 100%;"/></td> <td colspan="3"><hr style="width: 100%;"/></td> </tr> </table>	(53)			(54)			<i>ac.</i>	<i>rd.</i>	<i>per.</i>	<i>ac.</i>	<i>rd.</i>	<i>per.</i>	46	3	27	37	2	12	12	2	16	41	3	21	61	0	34	62	1	17	46	3	17	47	2	34	<hr style="width: 100%;"/>			<hr style="width: 100%;"/>		
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SUBTRACTION.

5) <i>rs. nls.</i> 3    1 <hr style="width: 50px; margin-left: 0;"/>	<table border="0"> <tr> <th colspan="3">(55)</th> <th colspan="3">(56)</th> </tr> <tr> <th><i>ac.</i></th> <th><i>rd.</i></th> <th><i>per.</i></th> <th><i>ac.</i></th> <th><i>rd.</i></th> <th><i>per.</i></th> </tr> <tr> <td>42</td> <td>1</td> <td>10</td> <td>36</td> <td>0</td> <td>20</td> </tr> <tr> <td>16</td> <td>2</td> <td>25</td> <td>13</td> <td>2</td> <td>30</td> </tr> <tr> <td colspan="3"><hr style="width: 100%;"/></td> <td colspan="3"><hr style="width: 100%;"/></td> </tr> <tr> <td>25</td> <td>2</td> <td>25</td> <td></td> <td></td> <td></td> </tr> </table>	(55)			(56)			<i>ac.</i>	<i>rd.</i>	<i>per.</i>	<i>ac.</i>	<i>rd.</i>	<i>per.</i>	42	1	10	36	0	20	16	2	25	13	2	30	<hr style="width: 100%;"/>			<hr style="width: 100%;"/>			25	2	25			
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first there  
 qrs. 1 nl.  
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. 12s. 6d. ;

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57. I bought four fields; in the first there were 6 acres, 3 roods, 12 perches; in the second 7 acres, 2 roods; in the third 9 acres and 13 perches; in the fourth 5 acres, 2 roods, 35 perches. How much in all?

58. A farmer sowed with wheat, a field containing 18 acres, 2 roods, 25 perches; and another with oats, containing 19 acres, 3 roods, 34 perches. How much larger was one field than the other?

59. Eight men cut down a field of hay; each man cut 3 acres, 2 roods, 27 perches. How much was mown?

60. Twelve men ploughed a field containing 16 acres, 3 roods, 35 perches. How much did each plough?

61. In a field containing 241 acres, 3 roods, 16 perches; 176 acres, 2 roods, 23 perches were sown with wheat; the remainder of the field was sown with barley; how much was sown with barley?

62. Bought 96 acres, 3 roods, 17 perches of land, for which I pay 176*l.*; what did I pay for it per perch?

## MEASURE OF CAPACITY.

## MULTIPLICATION.

<i>qrs.</i>	<i>bush.</i>	<i>pk.</i>	(63)	<i>qrs.</i>	<i>bush.</i>	<i>pk.</i>	(64)	<i>qrs.</i>	<i>bush.</i>	<i>pk.</i>
7	6	2		27	7	3		49	5	2
		3				7				8
<hr/>				<hr/>				<hr/>		
23	3	2								

## DIVISION.

<i>qrs.</i>	<i>bush.</i>	<i>pk.</i>	(65)	<i>qrs.</i>	<i>bush.</i>	<i>pk.</i>	(66)	<i>qrs.</i>	<i>bush.</i>	<i>pk.</i>
2)9	7	2		4)43	6	3		9)78	7	2
<hr/>				<hr/>				<hr/>		
4	7	3								

67. Sold to one man 27 qrs. 6 bushels, 3 pecks; to another 38 qrs. 4 bushels, 2 pecks; to another 49 qrs. 6 bushels; and to another 58 qrs. 7 bushels, 3 pecks; how much did I sell in all?

68. Lent a person 49 qrs. 2 bushels, 1 peck. I have received from him 32 qrs. 3 bushels, 3 pecks; how much does he still owe me?

69. John has 24 qrs. 3 bushels, 2 pecks; but Tom has 16 times as much; how much has he?

70. I received 248 qrs. 6 bushels, 3 pecks, and gave away a sixth part of it; how much did I give away?

71. What quantity of beer will be consumed in a year, at the rate of 2 gallons, 3 quarts, 1 pint per day?

72. One cask contained 23 gallons, 3 quarts, 1 pint; another 37 gallons, 2 quarts, 3 gills; how much more did the one contain than the other?

73. Nine fields produced each on an average 24 loads, 4 quarters, 7 bushels, 3 pecks; how much was the produce of the nine fields?

74. In 27 barrels there was on an average in each, 29 gallons, 3 quarts, 1 pint; how much in all?

TIME.

ADDITION.

			(75)			(76)		
<i>yrs.</i>	<i>wks.</i>	<i>dys.</i>	<i>yrs.</i>	<i>wks.</i>	<i>dys.</i>	<i>dys.</i>	<i>hrs.</i>	<i>min.</i>
24	6	3	27	36	4	35	17	6
12	16	5	43	12	4	24	18	14
41	24	4	71	43	6	52	12	5
32	13	6	27	18	5	61	13	3
<hr/>			<hr/>			<hr/>		
110	9	4						

SUBTRACTION.

			(77)			(78)		
<i>yrs.</i>	<i>wks.</i>	<i>dys.</i>	<i>yrs.</i>	<i>wks.</i>	<i>dys.</i>	<i>dys.</i>	<i>hrs.</i>	<i>min.</i>
43	4	2	32	3	4	47	12	10
24	6	5	16	7	6	17	20	40
<hr/>			<hr/>			<hr/>		
18	49	4						

79. The bricklayers were engaged about a house 23 weeks, 4 days, and 8 hours; the carpenters, 14 weeks, 6 days, and 9 hours; the painters, 12 weeks, 5 days, 7 hours, and 34 minutes; the upholsterer, 5 weeks, 10 hours, and 42 minutes; how long were these different workmen engaged about the house?

80. Two vessels sailed for America; one of them was 9 weeks, 6 days, and 14 hours on the voyage; the other got to America in 7 weeks, 5 days, and 19 hours; how much less time did the one go in than the other?

81. I can go to a certain town by the railway in 9 hours, 25 minutes, and 30 seconds; it would take me, at least, five times as long to go by the stage coach; how long would the coach take?

82. There are 365 days, 5 hours, 48 minutes, 57 seconds, in a solar year; how much is there in a twelfth of it?

83. How many seconds has a boy lived, who is 11 years old?



## REDUCTION.

## AVOIRDUPOIS WEIGHT.

1. In 7 cwt. 2 qrs. 14 lbs. ; how many pounds?
2. In 3 qrs. 13 lbs. 12 oz. ; how many ounces?
3. How many pounds are there in 1427 oz.?
4. Bought 24 bags of hops, each weighing 2 cwt. 2 qrs. 13 lbs. ; how many pounds in the whole?
5. In 3 cwt. 2 qrs. 14 lbs. of sugar ; how many parcels are there, each containing half a pound?

## TROY WEIGHT.

6. In 24 lbs. of gold ; how many pennyweights?
7. In 2468 grains of gold dust ; how many ounces?
8. In a silver snuff-box weighing 10 oz. 16 dwt. ; how many grains?
9. How many silver table spoons, each weighing 4 oz. 16 dwt., can be made out of 2 lbs. 8 oz. 13 dwt. of silver?
10. What quantity of gold will it require to make twelve gold ornaments, each weighing 1 oz. 18 dwt. 12 gr.?
11. A gentleman sent a silver tankard to a silversmith, and ordered him to make it into spoons, each to weigh 2 oz. 12 dwt. ; how many spoons did he make, the tankard weighing 4 lbs. 7 oz.?

## APOTHECARIES WEIGHT.

12. In 4 lbs. 8 oz. 4 drams, 2 scr. ; how many grains?
13. In 2487 grains, how many ounces?
14. In 7 ounces, 5 drams, 3 scruples ; how many scruples?
15. A patient is required to take daily 3 drams, 2 scruples of bark ; how long will 7 lbs. of bark last him?

## LONG MEASURE.

16. In 76 miles, 6 furlongs; how many perches?
17. In 47968 inches; how many yards?
18. From Dublin to Liverpool is about 38 leagues; how many yards is it?
19. From Dublin to Cork is about 130 miles; how often does a coach-wheel turn round between the two places, the circumference of the wheel being 12 feet?
20. From Dublin to Belfast is about 90 miles; how often does a coach-wheel turn round between the two places, the circumference of the wheel being 12 feet?

## CLOTH MEASURE.

21. In 246 yards, how many nails?
22. In 4786 nails, how many yards?
23. From a piece of linen containing 24 English ells, how many shirts can be made, each requiring  $3\frac{1}{2}$  yards?
24. How many suits may be made from 26 yds. 2 qrs. each suit containing  $3\frac{1}{2}$  yards?

## MEASURE OF CAPACITY.

25. In 24 gallons, 2 quarts, 1 pint; how many pints?
26. In 4387 pints; how many gallons?
27. In 24 loads, 5 bushels, 3 pecks; how many pecks?
28. How many bushels are there in 4796 pecks?
29. In a hog-head of wine containing 63 gallons, how many gills are there?

## TIME.

30. In 6 weeks, 3 days, 14 hours; how many hours are there?
31. In 74697 minutes; how many days?
32. How many minutes has a boy lived, who is 10 years and 6 weeks old?
33. A clock strikes 156 times during the day; how often does it strike in 6 years?

PRACTICE.

*Practice* is an easy method of applying the rules of Arithmetic to questions which occur in trade and business.

An *Aliquot Part* of a number is an *exact part*; hence, if a number be divided by an aliquot part, the quotient will be an integral number.

TABLE OF ALIQUOT PARTS.

Parts of \$1 cts.	Parts of £1 s. d.	Parts of 1 Shilling. pence.	Parts of 1 Year. months.	Parts of a Month. days.
50 = $\frac{1}{2}$	10 0 = $\frac{1}{2}$	6 = $\frac{1}{2}$	6 = $\frac{1}{2}$	15 = $\frac{1}{2}$
33 $\frac{1}{3}$ = $\frac{1}{3}$	6 8 = $\frac{1}{3}$	4 = $\frac{1}{3}$	4 = $\frac{1}{3}$	10 = $\frac{1}{3}$
25 = $\frac{1}{4}$	5 0 = $\frac{1}{4}$	3 = $\frac{1}{4}$	3 = $\frac{1}{4}$	7 $\frac{1}{2}$ = $\frac{1}{4}$
20 = $\frac{1}{5}$	4 0 = $\frac{1}{5}$	2 = $\frac{1}{5}$	2 = $\frac{1}{5}$	6 = $\frac{1}{5}$
12 $\frac{1}{2}$ = $\frac{1}{8}$	3 4 = $\frac{1}{8}$	1 $\frac{1}{2}$ = $\frac{1}{8}$	1 = $\frac{1}{12}$ or $\frac{1}{3}$ of	5 = $\frac{1}{6}$
6 $\frac{1}{2}$ = $\frac{1}{16}$	2 6 = $\frac{1}{16}$	1 = $\frac{1}{12}$	2 mo.	3 = $\frac{1}{4}$
5 = $\frac{1}{20}$	1 8 = $\frac{1}{12}$			

EXAMPLE.—What is the cost of 376 yards of cloth at \$1.75 =  $1\frac{3}{4}$  dollars per yard?

At 1 dollar per yard it would cost . . . . .	\$376 00
at 50 cents. = $\frac{1}{2}$ per yard, it would cost . . . . .	188 00
at 25 cents. = $\frac{1}{4}$ per yard, it would cost . . . . .	94 00

Total cost . . . . . \$658 00

Hence at \$1.75, =  $1\frac{3}{4}$  dollars, 376 yards will cost \$658.

1. What is the cost of 196 yards of cotton at 9 pence, =  $\frac{3}{4}$  shilling, per yard?

2. What is the cost of 425 yards of tape at 1 $\frac{1}{2}$ d. (=  $\frac{1}{8}$ s.) per yard?

3. What is the cost of 475 yards of tape at 1 $\frac{1}{3}$ d. per yard?

4. What is the cost of 354 yards of cord at 1 $\frac{1}{4}$ d. per yard?

5. At  $12\frac{1}{2}$  cents, =  $\$ \frac{1}{8}$  per yard, what will be the cost of 4756 yards of bleached shirting?

6. An agriculturist sold 19 $\frac{1}{2}$  *cwt.* of hemp at \$7.50 per hundredweight. What did it come to?

7. At 2s. 6d. =  $\mathcal{L} \frac{1}{2}$  per pair, what will be the cost of 3754 pairs of gloves?

8. If wheat is selling at 3s. 6d. per bushel, what will be the cost of 5320 bushels?

9. If broadcloth costs  $\mathcal{L}1$  7s. a yard, what will be the cost of 435 yards?

10. A farmer bought 125 acres of land at  $\$10.87\frac{1}{2}$  per acre; what did it cost him?

11. What will be the cost of 40 pounds of soap, if 1 pound costs  $6\frac{3}{4}$  cents?

12. If a yard of twisted cord costs  $2\frac{1}{4}$  cents, what will be the cost of 140 yards?

13. If one bushel of apples costs  $62\frac{1}{2}$  cents, what will be the cost of 876 bushels?

14. How much wheat would a field containing  $17\frac{1}{2}$  acres produce, allowing each acre to produce 30bu 3p.?

15. If one yard of extra-superfine cloth costs \$9.50, what will be the cost of  $85\frac{1}{2}$  yards?

16. What will be the cost of 1848 yards of linen cambrio at  $87\frac{1}{2}$  cents a yard?

17. If one yard of broadcloth cost  $\$1.87\frac{1}{2}c.$  =  $\$4\frac{1}{3}$ , what will be the cost of 696 yards?

18. If the price of one yard of cloth is \$1.75, what will be the cost of  $28\frac{1}{2}$  yards?

19. If one quart of oil costs  $14\frac{1}{2}$  cents, what will be the cost of 1hd. 2gal. 3qts.?

20. What will be the cost of 350 bushels of potatoes at 3s. 6d. =  $3\frac{1}{2}s.$  per bushel?

21. What will be the cost of 1000 quills, if every 5 quills cost  $1\frac{1}{2}$  cents?

22. If linen costs 2s. 6d. =  $2\frac{1}{2}s.$  a yard, what will be the cost of 600 yards?

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Parts of a  
Month.

days.

15	=	$\frac{1}{2}$
10	=	$\frac{1}{3}$
$7\frac{1}{2}$	=	$\frac{1}{4}$
6	=	$\frac{1}{5}$
5	=	$\frac{1}{6}$
3	=	$\frac{1}{10}$

both at \$1.75

\$376	00
188	00
94	00

\$658 00  
cost \$658.

9 pence, =

$1\frac{1}{2}d.$  (=  $\frac{1}{8}s.$ )

per yard?

per yard?

## TARE AND TRET.

**GROSS WEIGHT** means the weight both of goods and package, whether these packages be barrels, boxes, or sacks.

**TARE** is an allowance made to purchasers for the weight of the package.

**TRET** is an allowance of 4 lbs. on every 104 lbs. of goods, for waste, or  $\frac{1}{16}$  of the whole.

**CLOFF** is an allowance of 2 lbs. on every 3 cwt. made to those who retail goods for turning the scales.

**NETTLE** is what remains after part of the allowance is taken from the gross.

**CASE I.**—*When an allowance is made for the Tare per barrel, box, or sack.*

What is the net weight of 4 hhds. of sugar, each weighing 13cwt. 3qrs. 14lbs.; the tare being 1qr. 10lbs. per hoghead?

**RULE WITH EXAMPLE.**—Multiply the weight of each hoghead by 4, to find the gross weight of the whole, 55cwt. 2qrs.; then multiply the tare on each hoghead, 1qr. 10lbs. by the number of hhds. 4, and you find the tare upon the 4 hhds. to be 1cwt. 1qr. 12lbs.; place this under the gross of the 4 hhds., 55cwt. 2qrs., and subtract. The remainder, 54cwt. 0qr. 16lbs., is the net weight.

<i>cwt. qrs. lbs.</i>	<i>qr. lbs.</i>
13 3 14	1 10
4	4
55 2 0	1 1 12
1 1 12	
54 0 16	

1. What is the net weight of 9 chests of tea, each weighing 6cwt. 2qrs. 19lbs.; tare 18lbs. per chest?

2. What is the net weight of 6 chests of tea, each weighing 1cwt. 3qrs. 9lbs.; tare 18lbs. per chest?

3. What is the net weight of 7 hhds. of sugar, weighing 6cwt. 3qrs. 14lbs. gross; tare 12lbs. per hhd.?

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7. W  
1cwt. 3

8. 24  
1qr. 12

CASE II.—*When the tare is so much per Cwt.*

The gross weight of a lot of sugar is 173cwt. 3qrs. 17lbs. ; tare 16lbs. per cwt. What is the net weight?

RULE WITH EXAMPLE. — Divide *lb.* *cwt. qrs. lbs.*  
 the gross weight, 173cwt. 3qrs. 17 lbs., by the aliquot part of a cwt. ; thus, 14lbs. is the  $\frac{1}{8}$  of a cwt. ; divide by  $\frac{1}{8}$  ; again 2lbs. is the  $\frac{1}{4}$  of 14lbs. ; divide by  $\frac{1}{4}$  ; add the two quotients together, and 24cwt. 3qr. 9lbs. are obtained ; let this be taken from the gross weight, 173cwt. 3qrs. 17lbs., and 149cwt. 0qr. 8lbs. are obtained, which is the net weight. The remainders have not been attended to in this question, as they are not necessary in order to understand it.

173	3	17
21	2	26
3	0	11
24	3	9
149	0	8

4. What is the net weight of 8 hhds. of tobacco, each 3cwt 2qrs. gross ; tare 18lbs. per cwt.

5. The gross weight of 50 kegs of butter is 202cwt. 2qrs 12lbs. ; tare 15lbs. per cwt. What is the net weight?

CASE III.—*When an allowance is made both for Tare and Tret.*

What is the net weight of 4cwt. 2qrs. 14lbs gross ; tare 14 lbs per cwt. ; tret as allowed?

RULE WITH EXAMPLE.—Find the tare *cwt. qrs. lbs.*  
 by the last rule, and subtract it from the gross ; divide the remainder, or suttle, as it is called, by 26 (26 being the fourth of 104) for the tret ; this, when subtracted from the suttle, leaves the net weight required.

4	2	14	gross
		2	8
		26	4
		0	6
		17	tret
3	3	17	net

6. What is the net weight of 9hhds. of tobacco, weighing 5cwt. 2qrs. 12lbs. each ; tare 96lbs. per hhd. ; tret as usual?

7. What is the net weight of 6 chests of tea, each weighing 1cwt. 3qrs. 9lbs. ; tare 18lbs. per chest ; tret as allowed?

8. 24 barrels of rice weigh 67cwt. 2qrs. 18lbs. gross ; tare 1qr. 12lbs. per barrel ; tret as usual. What is the net weight?

## CASE IV.—When Tare, Tret, and Cloff are allowed.

What is the net weight of 4 cwt. 2 qrs. 14 lbs. gross, tare 14lbs. per cwt. ; tret as allowed ; cloff as allowed ?

**RULE WITH EXAMPLE.** Take the tare and the tret from the gross as before : divide the remainder or suttle by 168 (168 being the half of 3 cwt. or 336 lbs.) this being subtracted, leaves the net weight. The cloff may also be obtained by multiplying the cwt. by the tret suttle by 2, and divide by 3, receiving the quotient pounds : — thus,  $2 \times 3 = 6 \div 3 = 2$  lbs.

<i>cwt. qrs. lbs.</i>		
14	2	14 gross
	2	8 tare
-----		
26	0	6
		17 tret
-----		
168	3	17 suttle
		2 cloff
-----		
3	3	15 net

9. What is the net weight of 8 hhds. of sugar, each weighing 6 cwt. 3 qrs. 14 lbs. ; tare 12 lbs. per cwt. ; tret and cloff as usual ?

10. What is the net weight of 8 hhds. of tobacco, each 3 cwt. 2 qrs. gross ; tare 18 lbs. per cwt. ; tret and cloff as allowed ?

11. The gross weight of 50 casks of butter is 202 cwt. 2 qrs. 12 lbs. ; tare 15 lbs. per cwt. ; tret and cloff as allowed. What is the net weight ?

12. What is the net weight of 24 hhds. weighing gross, 47 cwt. 2 qrs. 18 lbs. ; tare 2 qrs. 18 lbs. per hhd. ; tret as usual ?

13. What is the net weight of 19 chests of tea, each weighing 2 cwt. 13 lbs. ; tare 14 lbs. per chest ; tret as allowed ?

14. What is the value of the net weight of 3 hhds. of tobacco, each weighing 4 cwt. 2 qrs. 12 lbs., gross, at £7 10s. 6d. per cwt., allowing 7 lbs. per cwt. for tare ; tret as usual, and cloff 2 lbs. per hhd. ?

15. What is the net weight of 9 hhds. of sugar, each weighing 7 cwt. 2 qrs. 13 lbs. ; tare 12 lbs. per cwt. ; tret and cloff as usual ?

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4 lbs. Ric

Wm. Jo

1 Dres  
1 blac  
6 Neck  
1 Hat  
6 pairs  
2 pairs

## BILL OF PARCELS.

A Bill is a written account of goods purchased or work performed. A Bill of Parcels is that which is delivered with the goods at the time of purchase.

## BOOKSELLER'S BILL.

TORONTO, February 21st, 1860.

Local Superintendent of Schools,

*Bought of* ROBERT McPHAIL,

5 doz. First Arithmetics, at $87\frac{1}{2}c.$ per doz.	-	\$4 37 $\frac{1}{2}$
3 doz. Third Book of Lessons, at \$1.50 per doz.	-	4 50
1 doz. Morse's Geography	- - - -	5 87 $\frac{1}{2}$
Dodd's High School Arithmetic	- - - -	1 12 $\frac{1}{2}$
Bonycastle's Algebra, 3 vols.	- - - -	3 37 $\frac{1}{2}$
		<hr/>

## GROCER'S BILL.

HAMILTON, March 1st, 1860.

Mrs. WILLIAMSON,

*Bought of* SMITH & JONES.

5 lbs. extra-fine Young Hyson at $62\frac{1}{2}c.$ per lb.	-	\$3 12 $\frac{1}{2}$
12 lbs. bright Muscovado Sugar, at $10c.$	- - - -	1 20
5 lbs. Mocha Coffee, at $25c.$	- - - -	1 25
1 barrel extra-superfine family Flour	- - - -	7 87 $\frac{1}{2}$
8 lbs. Rice, at $12\frac{1}{2}c.$ per lb.	- - - -	1 00
		<hr/>

## CLOTHIER'S BILL.

LONDON, C. W., March 3rd, 1860.

WM. JOHNSON, Esq.,

*Bought of* THORNTON & SON.

1 Dress Coat	- - - -	\$12 50
1 black satin Vest	- - - -	3 75
6 Neck-Ties at $75c.$ each	- - - -	4 50
1 Hat	- - - -	5 00
6 pairs woolen Socks, at $50c.$	- - - -	3 00
2 pairs Gloves, at $87\frac{1}{2}c.$	- - - -	1 75
		<hr/>



### SIMPLE PROPORTION.

When we have three numbers given, this rule teaches how to find a fourth number, which may have the same proportion to the third number, that the second has to the first.

Thus, if the three given numbers be 1, 2, 3, it is required to find a fourth number which will have the same proportion to 3 that the 2 has to 1; now, the 2 is double the 1; therefore, the required number must be double of the 3, that is 6. To express proportion the numbers are put down thus,  $1 : 2 :: 3 : 6$ , and are read thus, 1 is to 2 as 3 is to 6.

*CASE I.—To find out a fourth proportional to three given numbers.*

Find a fourth proportional to the numbers 4, 8, 6.

**RULE WITH EXAMPLE.**—Place them thus.  $4 : 8 :: 6$   
and multiply the second and third numbers together, and divide by the first; the quotient is 12, which bears the same proportion to 6 that 8 does to 4.

$$\begin{array}{r} 4 \overline{) 48} \\ \underline{12} \end{array}$$

*Ans.*

- To 3, 6, 12, find a fourth proportional. . . . . 24.
- To 6, 8, 3, find a fourth proportional. . . . . 4.
- To 3, 6, 8, find a fourth proportional. . . . . 16.
- To 6, 12, 4, find a fourth proportional. . . . . 8.
- To 10, 150, 68, find a fourth proportional. . . 1020.
- Find a fourth proportional to 1020, 68, 150. . . . 10.
- Find a fourth proportional to 150, 10, 1020. . . . 68.
- Find a fourth proportional to 68, 1020, 10. . . . 150.

Find a fourth proportional to the following numbers :

*Ans.*

- To 2 tons, 17 tons, and 25*l*. . . . . 21*l*. 10*s*.
- To 10 lb., 150 lb., and 5*s*. . . . . 75*s*.
- To 9 yds., 36 yds., and 18*s*. . . . . 72*s*.
- To 5 lb., 1 lb., and 15*s*. . . . . 3*s*.
- To 4 yds., 18 yds., and 2*s* . . . . . 9*s*.
- To 1 cwt., 215 cwt., and 50*s*. . . . . 10750*s*.
- To 5 tons, 50 tons, and 27*l*. . . . . 270*l*.

**RULE.**—1. Take from the question that term which is of the same nature as the answer will be, and make it the third term of the proportional.

2. If from the nature of the question the answer will be *greater* than this third term, select the *greater* of the two remaining terms for the second term of the proportional—*otherwise*, take the *less*; and the remaining term will be the *first*.

3. Reduce the first and second terms to the same denomination if necessary.

4. Find a fourth proportional by multiplying the second and third terms together and dividing by the first. The *answer* will then be in the same name as the third term.

**EXAMPLE.**—If 6 men can perform a work in 30 days, in what time ought 13 men to perform the same work?

The question has reference to *time*, select therefore the *time* term from the question for the third in the proportional. Then consider whether 13 men will require more or less time to do the work than 6 men. Of course the *more men*, the *less time*; therefore as the answer will be less than the third term, place the 6 in the second place and the remaining term 13 in the first.

The statement will be  $13 : 6 :: 30$ , and the operation will be  $30 \times 6 \div 13 = 13\frac{1}{3}$  days, the answer.

## EXERCISES.

1. If 9 acres of land sell for \$220.62 $\frac{1}{2}$ , what should 5 acres bring at the same rate?

2. If 15 tons be hauled 40 miles for a given sum, how far ought 3 tons to be hauled for the same sum?

3. How much cloth may be bought for \$73.75, when 4.25 yards of the same kind cost \$12.75?

4. If 7 masons can build a house in 28 days, in what time ought 17 masons to build the house?

5. If 5 yards of silk cost \$6.25, what should be paid for 12 *yd.* 3 *qr.* of silk, at the same rate?

6. Allowing 4 horses to consume 13bu. 3pk. of oats in a week, how much would 9 horses require for a week?

7. If the transportation of 10cwt. 100 miles cost \$25, what would be paid for the conveyance of 33cwt. 2qr. the same distance?

8. If 7 men can do a certain work in  $\frac{3}{4}$  of a day, in what time ought 9 men to do the same work?

9. If a person, by travelling 10 hours a day, perform a journey in 31 days; in how many days ought he to perform the same journey, if he travel 13 hours a day?

10. If 10 head of cattle require 20A. 2R. of pasture ground for a summer, how many acres ought 25 head to have, for the same time?

11. A cistern is filled with water, by 2 pipes, in 3h. 25m., in what time would it be filled by 5 pipes of like size?

12. A sum of money having been equally divided among 19 men, each man received \$3 $\frac{1}{4}$ . If the number of men had been 30, what would have been the share of each?

13. Allowing 15A. 30P. to produce 488bu. 2pk. of wheat, how many bushels would be raised from a field containing 40 acres, at the same rate?

14. If 25 sacks, each measuring 4bu., will contain a given quantity of corn; how many sacks, each measuring 5 $\frac{1}{2}$ bu., will contain the same quantity?

15. A post, standing in a stream, has  $\frac{1}{3}$  of its length in the earth,  $\frac{2}{3}$  in the water, and 5 feet above the water; what is the length of the post?

ANALYSIS.  $\frac{1}{3} + \frac{2}{3} = \frac{13}{15}$ ; and  $1 - \frac{13}{15} = \frac{2}{15}$ .

The post has therefore  $\frac{2}{15}$  of its length above the surface of the water;  $\frac{2}{15}$  of its length is then 5 feet;  $\frac{1}{15}$  of it is  $\frac{5}{2}$  feet, and the whole length is

$$\frac{15}{2} \text{ of } 5 \text{ feet} = \frac{75}{2} = 37\frac{1}{2} \text{ feet.}$$

The *proportion* in the question is, the part  $\frac{2}{15}$  above the water is to a *unit*, as the length 5 ft. of the part above the water is to the *entire length*.

16. A farmer sold  $\frac{1}{3}$  of his land to A,  $\frac{1}{4}$  of it to B, and the remainder, which was 100 acres, to C. How much land did the farmer own?

17. In a certain school,  $\frac{1}{4}$  of the pupils study Arithmetic,  $\frac{1}{5}$  of them study Languages, and the remaining 35 are employed on various other subjects. Required the number in the school.

18. A person failing in business owes \$5000, and is able to pay but \$2000. How much can he pay per dollar to his creditors?

19. A traveller having gone 375.5 miles on his journey, finds that  $\frac{2}{3}$  of it remains to be travelled. What was the length of his journey?

20. A gentleman who owned  $\frac{3}{4}$  of a manufactory, sold  $\frac{1}{4}$  of his share for \$3000. What was the estimated value of the whole establishment?

21. How many miles must a person walk in  $5\frac{1}{2}$  days, to accomplish a journey of 500.5 miles, at the same rate, in 13 days?

22. A bankrupt owes \$5349.75, and has property amounting to \$2300. In an equitable distribution of his property, how much will a creditor receive whose claim is \$400?

23. A borrowed of B \$500, which he kept  $3\frac{1}{2}$  years. On a subsequent occasion A lends B \$375; how long ought B to keep this latter sum in return for the accommodation he had afforded A?

24. Allowing a man to do a certain work in 3 days, and a boy to do it in 5 days; in what time ought the two together to do the work?

ANALYSIS.—The man could do  $\frac{1}{3}$ , and the boy  $\frac{1}{5}$ , of the work in 1 day; then both together could do  $\frac{1}{3} + \frac{1}{5} = \frac{8}{15}$  of the work in 1 day; hence they could do  $\frac{1}{8}$  in  $\frac{15}{8}$  of a day, and the entire work in  $1\frac{7}{8}$  of a day.

25. A can dig a ditch in 5 days, B in 6 days, and C in 8 days. In what time could the three together dig the ditch?

26. If 4 T. 13 cwt. of iron be conveyed 50 miles for \$30, how far could 9 T. 5 cwt. 3 qr. be conveyed for the same sum?

27. Two masons together build a wall in 10 days. One of them could have built the wall himself in 15 days; in what time could the other have done it?

28. A merchant bought three pieces of cloth, each containing 25 *yd.* 2 *qr.*, for \$500; and sold 50 *yd.* of it at cost. What did the 50 yards amount to?

29. If  $\frac{3}{4}$  of  $\frac{1}{5}$  of an acre of land sell for \$18.18 $\frac{1}{2}$ , what would a lot containing 7 *A.* 2 *R.* 13 *P.* bring at that rate?

30. How many yards of linen which is  $\frac{1}{2}$  *yd.* wide will be equivalent to 30 *yd.* of another kind which is  $\frac{3}{4}$  of a yard wide?

31. How many yards of carpeting which is  $\frac{1}{4}$  of a yard wide, will be required to cover a floor that measures 25 feet in length, and 20 feet in breadth?

32. A farmer has a field 100 poles in length, and 45.25 poles in width. He wishes to lay off another field to contain the same quantity of ground, and be 80 poles in length; what must be its breadth?

33. The governor of a besieged place has provision for 54 days, at the rate of 1 $\frac{1}{2}$  *lb.* of bread to each man per day, but is desirous to prolong the siege to 80 days, in expectation of succour; in that case, what must the ration of bread be?

34. A pole 6 feet high throws a shadow of 5 feet 8 inches; what is the height of a spire which throws a shadow of 156 feet?

35. If 54 men can build a house in 90 days; how many men would it require to do it in 12 days?

36. A person reaches a certain place in 18 days by walking 8 hours a day; what number of days would he have taken had he walked 12 hours a day?

37. If 14 men could make a ditch in 18 days; in what time would 34 men do it?

38. A ship was provisioned for a crew of 40 for 3 months; how long would these provisions last, if the crew were reduced to 32 men?

39. If 8 horses can subsist on a certain quantity of hay for 2 months; how long would 12 horses subsist on the same quantity?

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## COMPOUND PROPORTION.

When in order to find a fourth proportional, several circumstances require to be considered, it is called Compound Proportion.

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

*bush.*

RULE WITH EXAMPLE.—Write down for the third term that number which is of the same kind with the answer required—56 bushels. Then take two numbers of the same kind—14 horses and 20 horses—and consider, as in Simple Proportion, whether from the nature of the question, the greater or less is to be put in the first or second term. Here it is obvious that the greater must be in the second term, as 20 horses will eat more than 14 horses. Take the other two terms and proceed in the same manner. After all the terms have been put down, multiply the two first terms, 14 and 16, together; do the same with the two second terms, 20 and 24, and proceed as in Simple Proportion.

$$\begin{array}{r}
 \text{horses } 14 : 20 :: 56 : \\
 \text{days } 16 : 24 \\
 \hline
 224 \quad 480 \\
 \quad \quad 56 \\
 \hline
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 \hline
 224 \overline{)26880} (120 \text{ bus.} \\
 \underline{224} \phantom{00} \\
 448 \\
 \underline{448} \\
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 \end{array}$$

CONTRACTION.—Let the question be the same as in the last example.

After the terms have been properly arranged, the operation may often be greatly shortened by using the following method: Draw a line, and place the first terms, 14 and 16, under it, and the second and third terms, 20, 24, and 56, above it; then divide any number above the line and any below by any number which will divide both without leaving a

$$\begin{array}{r}
 10 \quad 3 \quad 4 \\
 20 \times 24 \times 56 \\
 \hline
 14 \times 16 \\
 2 \quad 2
 \end{array}$$

remainder. It will be seen that in all questions in Compound Proportion there is one term that is like the required answer, and this must be put in the third place. Then all the other terms are arranged in pairs, and it is highly important to observe that *each pair* is to be considered as entirely *independent* of every other, and therefore the number of circumstances to be considered does not increase the difficulty of stating the question.

EXAMPLE.—If 5 compositors in 16 days, working 14 hours a day, can compose 20 sheets of 24 pages each, 50 lines to a page, and 40 letters to a line;—in how many days, working 7 hours a day, can 10 compositors compose 40 sheets of 16 pages in a sheet, 60 lines in a page, and 50 letters in a line?

Here the question refers to *days*; select that term for the *third* place; then compare the several pairs for the first and second terms, thus—10 men will require *less*

time	than 5, therefore 10 is to 5 as in margin	10 : 5 :: 16
7 hours a day	will take <i>more</i> time than 14,	7 : 14
40 sheets	will require a <i>greater</i> time than 20,	20 : 40
16 pages	will require <i>less</i> time than 24 pages,	24 : 16
60 lines	will take a <i>greater</i> time than 50 lines,	50 : 60
50 letters	will take <i>more</i> time than 40 letters.	40 : 50

Having stated the question, multiply all the *second* terms and the *third* together, and divide by the product of all the *first* terms, according to the general rule; the work will stand thus, and is easily performed by Cancellation:—

$$\frac{16 \times 5 \times 14 \times 40 \times 16 \times 60 \times 50}{10 \times 7 \times 20 \times 24 \times 50 \times 40} = 32 \text{ days.}$$

NOTE.—If any of the pairs are not in the same name they must be reduced.

The teacher is recommended to make the pupil simply *state* several of the following questions on the slate or black-board, before troubling him with the operation of the mechanical part of the work; and all the questions should first be worked out *in full* and then by *Cancellation*.

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1. If 15 men build 37 rods of wall in 27 days, how many rods will 74 men build in 63 days?
2. If 8 men for 5 days' work get \$10; how much ought 32 men to get for 25 days' work?
3. If 4 men can mow 20 acres of grass in 7 days; how many acres can 12 men mow in 28 days?
4. If 6 tailors can make 10 suits of clothes in 4 days; how many suits can 20 make in 7 days?
5. A wall, 28 feet in height, was built in 15 days by 68 men; how many men working at the same rate could build a wall 32 feet high in 8 days?
6. If 12 horses in 5 days draw 44 tons of stones from a quarry; how many horses would it require to draw 132 tons in 18 days?
7. A garrison of 1500 men has provisions for 12 weeks, at the rate of 20 ounces per day to each man; how many men will the same provisions maintain for 20 weeks, allowing each man only 8 ounces per day?
8. If 50 men can do a piece of work in 100 days, working 8 hours per day; in what time will 120 men do it, working 6 hours per day?
9. What is the interest of \$1322, for  $2\frac{1}{2}$  years, at  $4\frac{1}{2}$  per cent. per annum?
10. If \$600 gain \$180 in 18 months; how much will \$103 gain in 12 months?
11. If two men can dig 125 rods of ditch in 75 days, in how many days can 18 dig 213 rods?
12. If 400 soldiers consume 5 barrels of flour in 12 days, how many soldiers will consume 15 barrels in 2 days?
13. If a person can travel 120 miles in 12 days of 8 hours, each, how far will he be able to travel in 15 days of 10 hours each?
14. If a pasture of 16 acres will feed 6 horses for 4 months how many acres will feed 12 horses for 9 months?



15. If 60 bushels of oats will feed 24 horses 40 days, how long will 30 bushels feed 48 horses?

16. If 82 men built a wall 36 feet long, 8 feet high, and 4 feet thick, in 4 days, in what time will 48 men build a wall 864 feet long, 6 feet high, and 3 feet wide?

17. If the freight of 80 tierces of sugar, each weighing  $3\frac{1}{2}$  hundred weight, for 150 miles, cost \$84, what must be paid for the freight of 30 hogsheads of sugar, each weighing 12 hundred weight, for 50 miles?

18. A family consisting of 6 persons usually drink 15.6 gallons of beer in a week; how much will they drink in 12.5 weeks, if the number be increased to 9?

19. If 12 tailors in 7 days can finish 14 suits of clothes, how many tailors in 19 days can finish the clothes of a regiment of 494 men?

20. If a garrison of 3600 men eat a certain quantity of bread in 35 days, at 24 ounces per day to each man, how many men, at the rate of 14 ounces per day, will eat twice as much in 45 days?

21. A company of 100 men drank \$80 worth of wine at 50cts. per bottle; how many men, at the same rate, will \$28 worth supply, when wine is worth 35cts. per bottle?

22. If the wages of 13 men for  $7\frac{1}{2}$  days, be \$149.76, what will be the wages of 20 men for  $15\frac{1}{2}$  days?

23. If a footman travel 264 miles in  $6\frac{3}{4}$  days of  $12\frac{1}{2}$  hours each, in how many days of  $10\frac{3}{4}$  hours each will he travel 129 $\frac{3}{4}$  miles?

24. 120 men, in 3 days of 12 hours each, can dig a trench of 30 yards long, 2 feet broad, and 4 feet deep, how many men would be required to dig a trench 50 yards long, 6 feet deep, and  $1\frac{1}{2}$  yards broad, in 9 days of 15 hours each?

25. If 40 men can perform a piece of work in 12 days, how many men will perform another piece of work three times as large, in one-fifth part of the time?

26. A person having a journey of 500 miles to perform, walks 200 miles in 8 days, walking 12 hours a day; in how

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many days, walking 10 hours a day, will he complete the remainder of the journey?

27. If 1000 men, besieged in a town, with provisions for 28 days, at the rate of 18 ounces a day for each man, be reinforced by 600 men, how many ounces a day must each man have that the provision may last them for 42 days?

28. If a bar of iron  $5ft.$  long,  $2\frac{1}{2}in.$  wide, and  $1\frac{3}{4}in.$  thick, weigh 45 lbs.; how much will a bar of the same metal weigh that is  $7ft.$  long,  $3in.$  wide, and  $2\frac{1}{2}in.$  thick?

29. Fifty thousand bricks are to be removed a given distance in 10 days. Twelve horses can remove 18 000 in 6 days; how many horses can remove the remainder in 4 days?

30. If 3 men, working 10 hours a day, can plant a field 150 rods by 210 rods in 5 days, how many men, working 12 hours a day, can plant a field measuring 192 rods by 300 rods, in 4 days?

31. If 248 men, in  $5\frac{1}{2}$  days of 11 hours each, dig a trench of 7 degrees of hardness, 232 $\frac{1}{2}$  yards long,  $3\frac{3}{4}$  wide, and  $2\frac{1}{2}$  deep; in how many days of 9 hours long, will 24 men dig a trench of 4 degrees of hardness, 337 $\frac{1}{2}$  yards long,  $5\frac{3}{4}$  wide, and  $3\frac{1}{2}$  deep?

32. If 4 men eat 64 pounds of bread in 2 weeks, how many pounds will 16 men eat in 7 weeks?

33. If 5 oxen require an acre of grass for 9 days, how many acres will 20 oxen require for  $30\frac{1}{2}$  days?

34. If a man travel 100 miles in 3 days of 13 hours each, how far might he travel in 23 days of  $14\frac{1}{4}$  hours each?

35. If the conveyance of 20*cwt.* 40 miles, cost \$15.87 $\frac{1}{2}$ , what should be charged for the conveyance of 50*cwt.* 3*qrs.* 100 miles?

36. If 2 yards of cloth, which is  $1\frac{1}{2}yd.$  wide, cost \$10.25, what should be paid for 13 yards of like quality, which is  $1yd.$  wide?

37. If 6000*lbs.* of bread will supply a garrison of 100 men for 2 months, how long will 12000*lbs.* supply three such garrisons?

## PARTITIVE PROPORTION, OR PARTNERSHIP.

Partitive Proportion is Proportion applied to dividing a given quantity into *two* or *more* parts which shall have a given ratio one to another. The terms of the given ratio or ratios are called the *proportional terms*.

**RULE.**—The *sum* of the *proportional terms* is to the *amount to be divided* as any one of the *proportional terms* is to its corresponding share.

**EXAMPLE.**—Divide \$150 among three persons, A, B and C, in the proportion of 2, 3 and 5.

Proportional Terms	}	2			
		3			
		5			
				Amount.	
Sum of the Terms,	10	:	150	:	2 to A's share.
	10	:	150	:	3 to B's share.
	10	:	150	:	5 to C's share.

then  $150 \div 10 = 15$  then  $15 \times 2 = A$ 's share ;  $15 \times 3 = B$ 's share ; and  $15 \times 5 = C$ 's share.

1. A, B, and C, enter into partnership with a capital of \$7500, of which A put in \$2500, B put in \$3000, and C put in the remainder ; at the end of the year their gain was \$3000 ; what was each one's share ?

2. Divide \$240 between three persons in such a manner that their shares shall be as the numbers 5, 4 and 3.

3. A and B have a joint stock of \$4200, of which A owns \$3000, and B \$600 ; they gain in one year \$2000 ; what is each one's share of the profits ?

4. A gentleman divided \$10000 between his son and daughter in the proportion of 3 to 2. What are their respective shares ?

5. A, B, C, and D, have \$40000 in trade, each an equal share ; at the end of a year their profits amount to \$10000 :

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what is each one's share, allowing A to receive \$50, and D \$30, out of the profits, for extra services?

6. A testator bequeathed \$15000 to his widow, daughter, and son, in the proportion of 3, 5, and 7. What were their respective shares?

7. Five persons have to share between them an estate of £20000: A is to have one-fourth, B one-eighth, C one-sixth, D one-eighth, and E what is left. What will be the share of each?

8. A merchant employed three clerks at the annual salaries of \$300, \$400, and \$500. At the end of the year, having become bankrupt, he has but \$650 to be divided equally among them. What will be the portion of each?

9. Three merchants loaded a vessel with flour; A loaded 500 barrels, B 700 barrels, and C 1000 barrels: in a storm at sea it became necessary to throw overboard 440 barrels. What was each one's share of the loss?

10. An insolvent debtor owes to A \$250, to B \$100, and to C \$300. He is able to pay \$120; what should each of the three creditors receive?

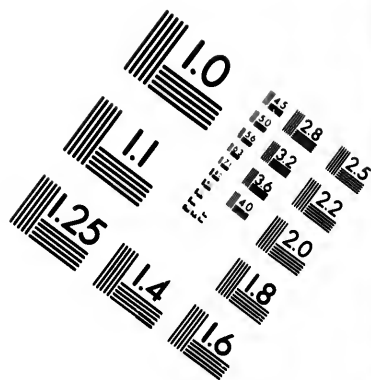
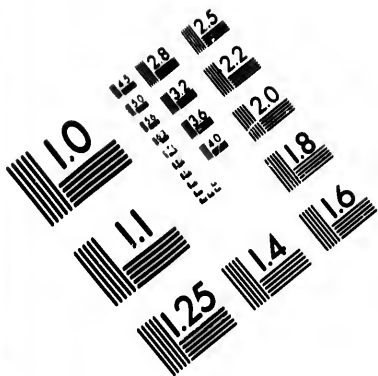
11. A man bequeathed his estate to his four sons in the following manner, viz.: to his first \$5000, to his second \$1500, to his third \$1500, to his fourth \$1000. But on settling the estate, it was found that after paying the debts and expenses, only \$12000 remained to be divided: how much should each receive?

12. It is required to divide the number 180 into three parts which shall be to one another as  $\frac{1}{2}$ ,  $\frac{2}{3}$ , and  $\frac{3}{4}$ .

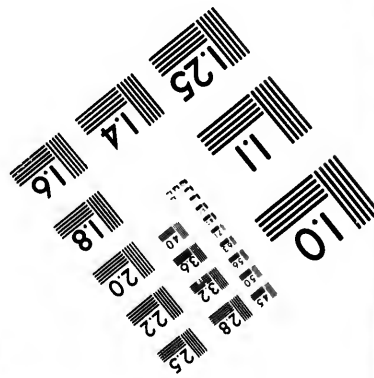
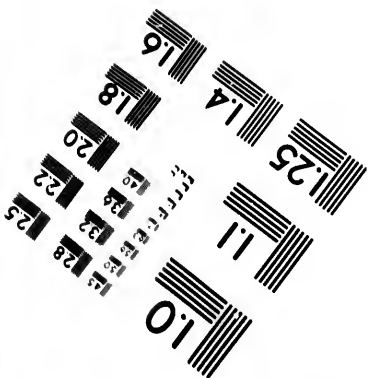
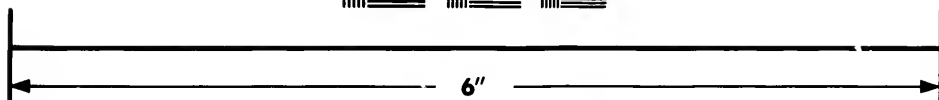
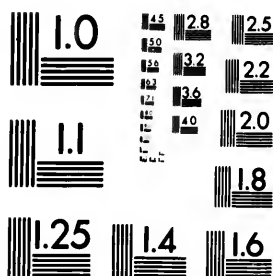
13. A widow and her two sons receive a legacy of \$4500, of which the widow is to have half, and the two sons each a quarter. But the eldest son dying, the whole is to be divided in the same proportion between the mother and youngest son. What will each receive?

14. A person proposed to divide \$1000 between his two sons in the proportion of  $\frac{1}{3}$  to  $\frac{1}{5}$ , provided either of them could ascertain the amount offered to him. What would be their respective shares?





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## COMPOUND PARTITIVE PROPORTION.

When Partners in business divide their profits in proportion both to the *amount* of capital employed, and the *time* it is continued in the business, it is called *Compound Partitive Proportion*, or Fellowship with *Time*.

**RULE.**—Multiply each term by its time, and take the *products* for the *proportional* terms, then work as before.

**EXAMPLE.**—A puts \$200 into a business for 7 months, and B \$300 for 9 months. They gain \$100; what is the share of each?

A's amount  $\$200 \times 7$  months = 1400

B's amount  $\$300 \times 9$  months = 2700

	—————	Gain.
Sum of the products	4100 : 100 :: 1400	= A's share
And as	4100 : 100 :: 2700	= B's share.

1. Three persons rent a pasture for \$20. A puts in 20 sheep for 4 months; B 36 sheep for 3 months; and C 45 sheep for 2 months. How much of the rent should accordingly be paid by each?

2. Three men hire a pasture for \$70.20 : A put in 7 horses for 3 months; B 9 horses for 5 months; and C 4 horses for 6 months. What part of the rent should each pay?

3. A, B, and C, contracted to make a road for \$5000. A furnished 30 laborers for 45 days, B 42 laborers for 34 days, and C 50 laborers for 30 days. What are their respective shares of the \$5000?

4. A commenced business with a capital of \$10000; four months afterwards B entered into partnership with him, and put in 1500 barrels of flour. At the close of the year their profits were \$5100, of which B was entitled to \$2100. What was the value of the flour per barrel?

5. A, B, and C, in partnership, have made \$400. What are their respective shares of profit, supposing A's capital in the business to have been \$500 for 10 months, B's \$900 for 1 year and 3 months, and C's \$600 for 2 years?

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## MEDIAL PROPORTION, OR ALLIGATION.

Medial Proportion is proportion applied to mixing two or more ingredients of different values for a compound of a given mean value.

### CASE I.—For Two Ingredients.

**RULE.**—Take the quantities *inversely* as the *differences* between their respective rates of value, and the given mean rate.

**EXAMPLE.**—In what proportion shall Rye at 37 cents per bushel be mixed with Oats at 25 cents per bushel, to make a compound worth 30 cents per bushel?

The difference between the Rye at 37cts. and 30 = 7  
 “ “ Oats at 25cts. and 30 = 5

Take these numbers *inversely* for the answer—thus, 5 bushels of Rye, and 7 bushels of Oats.

1. In what proportion must Corn at 40 cents a bushel, and Oats at 25 cents a bushel, be taken to form a mixture which shall be worth 33 cents a bushel?

2. In what proportion must one kind of Tea at 75 cents a pound, and another at 90 cents a pound, be taken for a mixture which shall be worth 83 cents a pound?

3. In what proportion must one kind of Coffee, at 9 cents a pound, and another at 13 cents a pound, be taken to form a mixture which shall be worth  $12\frac{1}{2}$  cents per pound?

4. In what proportion must one kind of Wine, at 90 cents a gallon, and another at 75 cents a gallon, be taken for a mixture which shall be worth  $87\frac{1}{2}$  cents per gallon?

5. A farmer wishes to purchase two different qualities of land at \$20 and \$35 per acre, in such proportion that the average rate shall be \$27.50 per acre. In what proportion must the two kinds be purchased?

6. In what proportion should Hay, at \$25 per ton, and Straw at \$12 per ton, be taken to form a mixture which shall be worth \$17 a ton?

## CASE II.—For Three or more Ingredients.

**RULE.**—The rates of the several ingredients are set one under another, with the mean rate on the left. Link together each rate which is less than the mean rate with one that is greater. The difference between *each rate* and the *mean rate* is set opposite the rate or rates with which it is connected.

**NOTE.**—As the combinations are various, most questions will be susceptible of several answers according as the terms are linked.

**EXAMPLE.**—A grocer mixes four kinds of sugar, at 5 cents, 8 cents, 13 cents, and 14 cents, to make a mixture worth 10 cents per lb. What is the proportion of each?

No. 1.		No. 2.	
[10c.]	$\begin{array}{r} 5 \\ 8 \\ 13 \\ 14 \end{array}$	$\left. \begin{array}{l} 4 \text{ lbs. at } 5\text{cts.} \\ 3 \text{ lbs. at } 8\text{cts.} \\ 2 \text{ lbs. at } 13\text{cts.} \\ 5 \text{ lbs. at } 14\text{cts.} \end{array} \right\}$	$\left. \begin{array}{l} 5 \\ 8 \\ 13 \\ 14 \end{array} \right\} \begin{array}{l} 3 \text{ lbs. at } 5\text{cts.} \\ 4 \text{ lbs. at } 8\text{cts.} \\ 5 \text{ lbs. at } 13\text{cts.} \\ 2 \text{ lbs. at } 14\text{cts.} \end{array}$

No. 3.		
[10c.]	$\begin{array}{r} 5 \\ 8 \\ 13 \\ 14 \end{array}$	$\begin{array}{l} 4 + 3 = 7 \text{ at } 5 \text{ cents} \\ 4 + 8 = 12 \text{ at } 8 \text{ cents.} \\ 5 + 2 = 7 \text{ at } 14 \text{ cents} \end{array}$

No. 4.		
[10c.]	$\begin{array}{r} 5 \\ 8 \\ 13 \\ 14 \end{array}$	$\begin{array}{l} 4 + 3 = 7 \text{ at } 5 \text{ cents.} \\ 3 \text{ at } 8 \text{ cents.} \\ 5 + 2 = 7 \text{ at } 13 \text{ cents.} \\ 5 \text{ at } 14 \text{ cents.} \end{array}$

The work may be proved—thus, take the answers of No. 1.

4 pounds at 5 cents = 20 cents.  
 3 pounds at 8 cents = 24 cents.  
 2 pounds at 13 cents = 26 cents.  
 5 pounds at 14 cents = 70 cents.

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1. What proportions of coffee, at 8 cts., 10 cts., and 14 cts. per pound, must be mixed together, so that the compound shall be worth 12 cents per pound?

2. In what proportion must rye at 37 cents, oats at 23 cents, and corn at 32 cents a bushel, be taken for a compound which shall be worth 31 cents a bushel?

3. A merchant has teas worth 40 cents, 65 cents, and 75 cents a pound, from which he wishes to make a mixture worth 60 cents a pound: what is the smallest quantity of each that he can take and express the parts by whole numbers?

4. A wine merchant mixed brandy at 30 cents per gallon, and wine at \$1 a gallon, with water, and found the compound to be worth 50 cents per gallon. In what proportion were the several ingredients taken, the water being rated at 0?

5. A farmer sold a number of colts at \$50 each, oxen at \$40, cows at \$25, calves at \$10, and realized an average price of \$30 per head. What was the smallest number he could sell of each?

6. A merchant wishes to mix three kinds of tea, at 90 cts., \$1, and \$1.50 per pound, so that the mixture shall be worth \$1.25 cents per pound. In what proportion must the different kinds be taken?

7. What is the smallest quantity of water that must be mixed with wine worth \$2.80 and \$3 per gallon, to form a mixture worth \$2.60 a gallon, when all the parts are expressed by whole numbers?

8. A farmer has one tract of land worth \$15 an acre, another worth \$22 an acre, and another worth \$25 an acre. In what proportion must he sell from the several tracts, that the average price shall be \$20 an acre?

9. A produce merchant wishes to mix rye at 36 cents, oats at 26 cents, and barley at 60 cents, so as to make a mixture worth 30 cents per bushel. What quantity of each must he take?

10. A grocer wishes to mix three kinds of coffee, at 18 cts., 20 cents, and 25 cents, to form a mixture worth 22 cents per pound. How much must he take of each?

CASE III.—When the quantity of one of the  
Simples is given.

RULE.—Find the proportional quantities as before, then as the amount of the ingredient thus found is to the given amount of the same ingredient, so is the amount of any other ingredient to its required quantity.

EXAMPLE.—What quantity of sugar at 12 cts., 10 cts., and 6 cts., must be mixed with 20 lbs. at 4 cts., to make the mixture worth 8 cts. a pound?

$$\begin{array}{r} 12 \\ 10 \\ 6 \\ 4 \end{array} \left. \begin{array}{l} 2 \\ 4 \\ 4 \\ 2 \end{array} \right\} \begin{array}{l} 2 \\ 4 \\ 4 \\ 2 \end{array}$$

2 lbs. at 4 cents, but the given quantity is 20 pounds, therefore as 2 : 20 :: any other proportional to its quantity.

1. A farmer mixes 10 bushels of wheat at 70 cts. per bushel with rye at 48 cts., corn at 36 cts., and barley at 30 cts., so that a bushel of the composition may be sold for 38 cts. What quantity of each must he take?

2. What quantity of teas at 12s., 10s., and 6s., must be mixed with 20 pounds, at 4s. a pound, to make the mixture worth 8s. a pound?

3. How much water must be mixed with 100 gallons of rum worth \$1.50 per gallon, to reduce its value to \$1.25 per gallon?

4. How many pounds of sugar at 7 cts. and 11 cts. a pound, must be mixed with 75 pounds, at 12 cents a pound, so that the mixture may be worth 10 cts. a pound?

5. A farmer mixes 20 bushels of rye at 65 cts., with barley at 51 cts., and oats at 30 cts.; how much barley and oats must be mixed with the 20 bushels of rye, that the provender may be worth 41 cts. per bushel?

6. With 95 gallons of rum at 8s., I mixed other rum at 6s. 8d. per gallon, and some water; then I found it stood me in 6s. 4d. per gallon. I demand how much rum and how much water I took?

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## CONJOINED PROPORTION.

Conjoined Proportion is a kind of Compound Proportion in which the ratio of one of the antecedents to its consequent is made to depend upon *equivalences* among the terms of Proportion.

**RULE.**—Set *equivalent* terms on the left and right of the sign = and so that terms of the same kind shall be on opposite sides in the different expressions; also set the *odd term* on the side which is opposite the other terms of the same kind. Multiply the terms on the completed side together for a dividend, and those on the incomplete side for a divisor.

**EXAMPLE.**—If 3 quarters of cloth be worth 4 gallons of wine, and 2 gallons of wine be worth 5 lbs. of tea, how many quarters of cloth will be equal in value to 12 lbs. of tea?

Arrange the terms thus; cloth 3 *qrs.* = 4 *gals.* wine.  
 wine 2 *gals.* = 5 *lbs.* tea  
 tea 12 *lbs.* = the answer required

$$\text{Then } \frac{3 \times 2 \times 12}{4 \times 5} = \frac{18}{5} = 3\frac{3}{5} \text{ quarters of cloth}$$

**EXAMPLE.**—If 10 lbs. at London are equal to 9 lbs. at Amsterdam, and 45 lbs. at Amsterdam to 49 lbs. at Bruges, and 98 lbs. at Bruges to 116 lbs. at Dantzic; how many pounds at Dantzic are equal to 112 lbs. at London?

*Stated thus*— London 10 = 9 at Amsterdam.  
 Amsterdam 45 = 49 at Bruges.  
 Bruges 98 = 116 at Dantzic.  
 Dantzic ... = 112 at London.

$$\text{Then } \frac{9 \times 49 \times 116 \times 112}{10 \times 45 \times 98} = 129.92 \text{ lbs. at Dantzic.}$$

1. If 7 bushels of wheat be worth as much as 3 cords of wood, and 9 cords of wood as much as 2 tons of hay; how many bushels of wheat should be exchanged for 5 tons of hay?

2. If 3 barrels of corn be given for 7 bushels of wheat, and 4 bushels of wheat for 13 of rye, and 15 of rye for 20 of oats; how many bushels of oats would be an equivalent for 10 barrels of corn?

3. If A can do as much work in five days as B can do in 8 days, and B as much in 4 days as C can do in 11 days; in how many days could A do the same that C could do in 20 days?

4. If  $10\frac{1}{2}$  yards of silk cost \$15.75, and \$6 will purchase 1 yard of broadcloth, and 4 yards of the cloth be bartered for 25 yards of Irish linen; how many yards of the silk would be an equivalent for 40 yards of the linen?

5. Allowing that in a certain factory 6 girls do as much work in a day as 4 boys, and 8 boys as much as 6 men; how many men would be required to do as much work as 20 girls?

6. Supposing A to earn as much money in 4 months as B earns in 6 months, and B as much in 5 months as C in 7 months, and C as much in 10 months as D in 3 months; in what time could D earn the same that A could earn in 12 months?

7. If 12 pounds in Canada be equal to 10 pounds at Amsterdam, and 100 pounds at Amsterdam be equal to 120 lbs. at Paris; how many pounds at Paris are equal to 150 pounds in Canada?

8. If 16 horses can draw as much in one day as 12 mules, and 12 mules can draw as much as 56 oxen; how many oxen would be required to do the work of 144 horses?

9. If 50 bushels of wheat be exchanged for  $80\frac{1}{2}$  bushels of rye, and 3 bushels of rye for  $4\frac{1}{2}$  bushels of corn, and 10 bushels of corn for 12 bushels 3 p ecks of oats, and  $3\frac{1}{2}$  bushels of oats be worth \$1; what is the value of 100 bushels of wheat?

10. If 1½ *tells* in Hamburg make 1 *tell* in Holland, and 7 *tells* in Holland make 4 in France, and 7 in France make 5 yards in England; how many yards in England are equivalent to 588 *cents* in Hamburg?

## PERCENTAGE, OR PROFIT AND LOSS.

Percentage is an allowance, at a certain rate, for every hundred. Per Cent is a contraction of the Latin *per centum*, and means *by the hundred*. The ratio of Percentage is the ratio of the rate per cent to 100; thus the ratio of per centage for 6 per cent is  $\frac{6}{100}$ , or .06 which is the rate for each unit of the quantity on which percentage is to be calculated.

NOTE.—To express the ratio of percentage decimally, divide the rate per cent. by 100, thus the ratio for  $2\frac{1}{2}$  per cent. is  $2.5 \div 100 = 0.025$ ; the rate for 4 per cent. is  $4 \div 100 = .04$ ; the rate for  $\frac{1}{2}$  per cent. is  $.05 \div 100 = .005$ .

CASE I.—To find the Percentage on a given number.

EXAMPLE.—Cloth which cost \$50.75 sold at a profit of  $33\frac{1}{3}$  per cent.; what amount of profit was made?

$$\text{✓ } \$50.75 \times .33\frac{1}{3} = \$16.91\frac{2}{3}, \text{ the answer.}$$

It is evident that this Rule is nothing but Simple Proportion, for the question may be stated thus.—If \$100 gain  $33\frac{1}{3}$ , what will \$50.75 gain? Hence the following

RULE.—Multiply the given number by the ratio of percentage.

1. A grocer bought a hogshhead of sugar for \$55.75, and sold it at a profit of  $12\frac{1}{2}$  per cent. What amount of profit did he make?

2. A merchant purchased a quantity of cloth at \$6.30 per yard. At what price must he sell the cloth to gain  $33\frac{1}{3}$  per cent.?

3. What would be the annual premium of insurance on a manufactory, valued at \$20,000, at  $1\frac{1}{2}$  per cent.?

4. A farmer bought land at \$44.75 per acre. At what price must he sell the land to make a profit of 25 per cent.?

5. A merchant bought silk for \$160, which on account of damage received he sold at a loss of  $5\frac{1}{2}$  per cent. What was the entire loss?

**CASE II.—To find what per Cent one Number is of another.**

**EXAMPLE.**—On an investment of \$82750, a person gained \$1397.16 $\frac{1}{2}$ ; what was the gain per cent.? This Rule also depends on Simple Proportion, and may be stated thus—

If \$82750 gain \$1397.16 $\frac{1}{2}$ , what will \$100 gain? hence the

**RULE.**—Divide the *gain or loss* by the number expressing the cause of the said gain or loss, and mult ply by 100; thus

$$\$1397.16\frac{1}{2} \div \$82750 \times 100 = 1.66 \text{ per cent.}$$

7. A person paid a tax of \$52.88 $\frac{1}{2}$  on property valued at \$3525.50; at what rate per cent. was the tax assessed?

8. The property of a village amounts to \$100000, and is to be taxed to the amount of \$2250, for public improvements. At what per centum must the tax be laid?

9. If silk were purchased at \$1.50 per yard, and sold at \$2 per yard, what would be the gain per cent.?

10. A farmer purchased land at \$37.50 p r acre, and sold the same at \$12.16 $\frac{1}{2}$  per acre. What was the per centum of profit made?

11. A merchant bought books at \$2.50 per dozen, and sold them at \$3.75 per dozen. What was his gain per cent.?

12. A merchant bought flour at \$5.75 per barrel, and sold it at \$7.16 $\frac{1}{2}$  p r barrel. How much did he gain per cent.?

**CASE III.—To find a Number to which Percentage being added at a given Rate, will amount to a certain Sum.**

**EXAMPLE.**—A drover sold a lot of cattle for \$900, which was at a profit of 20 per cent. What did he *pay* for them? This rule is also based on Simple Proportion; for example, suppose the cattle cost \$100 it is evident the selling price at the given profit would be \$100 + 20 = 120, therefore

*Supposed Sell. Price. True Sell. Price. Supposed Cost.*

$$\$120 \quad : \quad \$900 \quad : : \quad \$100 \text{ to the true cost.}$$

Now if the first term, 120, be divided by the third, 100, we obtain 1.20; hence the following

**RULE.**—Divide the given sum by 1 *plus* the *ratio*.

$$\text{Thus } 900 \div 1 + .20 = \$750.$$

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13. A grocer sells sugar at  $12\frac{1}{2}$  cents per lb. and in so doing makes a profit of 25 per cent on the cost. What did the sugar cost him per pound?

14. An agent receives a remittance of \$1200 to purchase cloth, and is to retain  $1\frac{1}{2}$  per cent on the purchase. What amount of purchase can he make?

15. A merchant having sold a lot of silks for \$1012.95, finds that his profit is at the rate of 50 per cent. What was the cost of the silks?

16. A shoemaker sold a lot of boots for \$100, which was  $83\frac{1}{2}$  per cent advance on the cost of making them. What was the cost of the boots?

**CASE IV**—To find a number from which Percentage being subtracted at a given rate, will leave a given remainder:

**EXAMPLE**.—What amount of Bank Stock can be bought for \$475, at 5 per cent discount? This is based on Simple Proportion; for example—at 5 per cent discount \$100 Bank Stock can be purchased for  $\$100 - 5 = \$95$ , therefore

<i>Supposed selling price.</i>	<i>True selling price.</i>	<i>Supposed cost.</i>
95	: 475	: : 100 to the true cost.

Now, if the first term be divided by the third we have  $95 \div 100 = .95$ ; hence the following

**RULE**.—Divide the given sum by 1 minus the ratio.

Thus  $\$475 \div .95 = \$500$ , the Stock which can be bought with \$475.

**NOTE**.—It will be seen that the only difference between *Case III* and *Case IV*, is that in the former the rate is added to 100 for the first term, and in the latter it is subtracted.

17. A miller sold a lot of damaged flour at \$3.75 per barrel, which was at a loss of  $12\frac{1}{2}$  per cent on the cost of it. What did the flour cost per barrel?

18. When rail-road stock sells at a discount of  $7\frac{1}{2}$  per cent, what amount of stock can be purchased for \$2775?

19. What amount of stock in the capital of a mining company, at  $3\frac{1}{2}$  per cent discount, may be purchased for \$1930?

### SIMPLE INTEREST.

INTEREST is the money paid for the loan of money.

The *Principal* is the sum of money lent

The *Rate* is the ratio of the principal to the interest for 1 year, thus 7 per cent signifies that \$100 will gain \$7 in 1 year.

The *Amount* is the interest added to the principal.

Thus \$100 the Principal.  
\$ 7 the Int-rest.

---

\$107 the Amount.

Hence there are four things to be considered in this Rule,—the *Principal*, *Interest*, *Time*, and *Rate*.

EXAMPLE.—What is the interest of \$325 for 12 months, at 5 per cent? It is evident that this Rule is based on the principle of Simple Proportion, thus—If \$100 produce \$5, what will \$325 produce?

Statement, 100 : 325 :: 5

Dividing the third term at once by 100 the first term, we have for the ratio .05; then the principal  $325 \times .05 =$  the interest. Hence the

RULE.—Multiply the interest by the ratio expressed in decimals, for the interest of 1 year. If the question contains years, months, and days, multiply the interest for 1 year by the number of years, and take the aliquot parts for months and days, as follows:—

EXAMPLE.—What is the interest of \$1752.96 at 6 per cent, for 2 years, 4 months, and 29 days?

\$1752.96

.06 the ratio

12  $\overline{105.1776}$  int. for 1 y.  $105.1776 \times 2$  y. = \$210.3552 for 2 y.

30  $\overline{8.7648}$  int. for 1 m.  $8.7648 \times 4$  m. = 35.0592 for 4 m.

29  $\overline{29216}$  int. for 1 d.  $29216 \times 29$  d. = 8.4726 for 29 d.

Total interest . . . \$253.8870

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1. What is the interest of \$675 for 1 year, at  $6\frac{1}{2}$  per cent?
2. What is the interest of \$871.25, for 1 year, at 7 per cent?
3. What is the interest of \$535.50, for 7 years, at 6 per cent per annum?
4. What is the interest of \$1125.885, for 4 years, at 8 per cent?
5. What is the interest of \$119.48, for 2 years 6 months, at 7 per cent?
6. What is the interest of \$250.60, for 1 year 9 months, at 6 per cent?
7. What is the interest of \$956, for 5 years and 4 months, at 9 per cent?
8. What is the interest of \$358.50, for 1 year 8 months and  $\frac{1}{2}$  days, at 7 per cent?
9. What is the interest of \$1461.75, for 4 years 9 months and 15 days, at 6 per cent?
10. What is the interest of \$1200, for 2 years 4 months and 12 days, at  $7\frac{1}{2}$  per cent?
11. What is the interest of \$4500, for 9 months and 20 days, at 5 per cent?
12. What is the interest of \$156.25, for 10 months and 18 days, at 8 per cent?
13. What is the interest of \$640, for 3 years 2 months and 9 days, at  $6\frac{1}{2}$  per cent?
14. What is the interest of \$276.50, for 11 months and 21 days, at 10 per cent?
15. What is the amount of \$378.42, for 1 year 5 months and 3 days, at 7 per cent?
16. What is the amount of \$1250, for 7 months and 21 days, at  $10\frac{1}{2}$  per cent?
17. What is the interest of \$6500, for 2 months and 10 days, at  $9\frac{1}{2}$  per cent?
18. What is the interest of \$70.50, for 10 years and 10 months, at 5 per cent?
19. What will \$8450 amount to in 60 days, at 10 per cent?

## COMMISSION, BROKERAGE, INSURANCE. BUYING AND SELLING STOCKS.

*Commission* is an allowance given to an agent or factor, for buying or selling goods or property, negotiating bills, &c.

*Brokerage* is an allowance to a broker for procuring sales, transfers of property, &c.

*Insurance* is an allowance called *premium*, given to persons who engage to make good the loss of ships, merchandise, houses, &c., that may be lost or damaged by storms, fire, &c.

*Stock* is the debt owing by government, or the capital of railroad, banking, or other companies.

**NOTE.**—The following exercises are all performed by the Rule of Simple Interest.

**EXAMPLE.**—A commission merchant sold a lot of goods for which he received \$7540; he charged  $2\frac{1}{2}$  per cent commission. What was the amount of his commission, and how much must he pay over? We find the commission as in simple percentage, by multiplying by the decimal which expresses the rate. The principal, diminished by the commission, gives the amount to be paid over.

$$\begin{array}{r}
 \$7540 \\
 \quad .025 \\
 \hline
 \$188.50 \text{ commission} \\
 \$7540 \\
 \underline{188.50} \\
 \$7351.50 \text{ amt. pd. over.}
 \end{array}$$

### EXERCISES.

1. A commission merchant receives \$1399.77 to be invested in groceries; he is to receive 3 per cent. commission on the amount of the purchase. What amount is laid out in groceries?

2. An auctioneer sold a house for \$3125, and the furniture for \$150. What was his commission at  $\frac{1}{3}$  per cent?

3. A collector of taxes receives  $4\frac{1}{2}$  per cent for collecting a tax of \$564.25. What was the amount of his percentage?

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4. A provision merchant sold on commission 750 barrels of flour at \$9.75 per barrel. What was his commission at 24 per cent?

5. I paid an attorney 6½ per cent for collecting a debt of \$7820.25. How much did I receive?

6. I am obliged to sell \$2640 in bills on the Provincial bank, upon which there is a discount of 2½ per cent. How much bankable money will I receive after deducting the brokerage, which is ½ per cent?

7. My agent in Havana purchased for me a quantity of sugar at 6¼ cents a pound, for which I allow him a commission 1½ per cent. His commission amounts to \$42.66; how many barrels of sugar of 240 lbs each did he purchase, and how much money must I send him to pay for it, including his commission?

8. What is the cost of 56 shares of Great Western Railroad stock, at 5½ per cent below par, the shares being \$100 each, and the brokerage ½ per cent?

9. What is the value of 120 shares of Montreal Bank Stock, it being at a premium of 18¼ per cent, and the par value being \$150 a share?

10. A broker purchased for Mr. A 200 shares of City Bank Stock, at a premium of 6½ per cent, and charged ¼ per cent brokerage. If the shares are \$1000 each, how much money does A pay for the stock?

11. A person wishes to invest \$3000 in bank stock, which is at a discount of 15 per cent. What amount, at par value, can he purchase?

12. How many shares of Grand Trunk Railway Stock can be bought for \$6384, at an advance of 14 per cent on the par value of \$100 a share?

13. When bank stock sells at a discount of 7½ per cent, what amount of stock, at par value, will \$3700 buy?

14. Paid \$120 for insurance on my dwelling, valued at \$7500. What was the rate per cent?

15. What would be the premium for insuring a ship and cargo, valued at \$147674, at 3½ per cent?

16. What will it cost to insure a store worth \$5640, at ½ per cent, and the stock worth \$7560, at ¼ per cent?

## COMPOUND INTEREST.

*Compound Interest* is when the interest is added to the principal at the end of the year, and on that amount the interest found for another year, and added again, and so on : that is called *interest upon interest*.

**RULE.**—Find the interest for 1 year, and add it to the principal, which call the amount for the first year ; find the interest of this amount, which add as before, for the amount of the second year, and so on for any number of years required. Subtract the original principal from the last amount, and the remainder will be the Compound Interest for the whole time.

**EXAMPLE.**—Required the amount of \$100 for 3 years at 6 per cent per annum, compound interest ?

1st Principal \$100-00    Amount \$106-00 for 1 year.  
 2d Principal 106-00    Amount 112-36 for 2 years.  
 3d Principal 112-36    Amount 119-1016 for 3 years.

1. What is the amount of \$425, for 4 years, at 5 per cent per annum, compound interest ?
2. What is the compound interest of \$500, for 4 years at 6 per cent per annum ?
3. What will \$1000 amount to in 4 years, at 7 per cent per annum, compound interest ?
4. What is the amount of \$750 for 4 years, at 6 per cent per annum, compound interest ?
5. What is the compound interest of \$876-90, for 3½ years, at 6 per cent per annum ?
6. What is the compound interest of \$500 for 2 years, at 8 per cent per annum ?
7. What is the compound interest of \$3758-56 for 3 years, at 7 per cent per annum ?
8. What is the compound interest of \$95637-50 for 7 years, at 6 per cent per annum ?

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## DISCOUNT.

*Discount* is an allowance made for the advance of money upon securities before maturity: thus, a merchant holds a customer's promissory note for \$100, payable 3 months after date, and wishing to obtain the money for it, he takes it to his banker, who gives him that amount less his charge for the advance. The sum received by the merchant is called its *present worth*.

CASE I.—*To find the Discount and Present Worth.*

RULE.—As 100 + the interest of \$100 for the time specified, is to the *sum to be discounted*, so is 100 to the *present worth* required. To find the *discount*, subtract the *present worth* from the amount to be discounted.

The common method in actual practice is (though not strictly correct) far more easy. Calculate the simple interest of the Bill for the time given, and subtract it from the amount, the result is the *present worth*.

EXAMPLE.—\$1000 bill, 12 months to run, is to be discounted at the rate of 12 per cent; what is the discount and what the present worth?

*By the Rule.*

*By the Common Method.*

112 : 1000 :: 100 = \$896 86 p. worth.      \$1000

then 1000 — 896.86 = \$103.14 discount.      .12

\$120.00 discount.

\$1000 — 120.00 = \$880.

Which makes a difference in favor of the banker by the common method, and the longer the time the greater will the difference be: but as bankers only discount bills of 2 or 3 months, the difference between the true and the common method is not noticed; it becomes very important, however, in negotiating long loans on Mortgage or other Securities, as will be seen by the following exercises.

**NOTE.**—To prove the correctness of the true method above, it is evident the banker makes 12 per cent on the money he retains, and the merchant 12 per cent on the money he receives: calculate both, and adding them together you will find the sum will correspond with the interest of the whole \$1000 at the given rate and time.

**EXERCISES.**—Discount the following securities by the true method and then by the common method. What are the net proceeds or present value?

1.	A Bill of	\$250	at 2 months,	at 12 per cent p. ann		
2.	—	375	3	—	20	—
3.	—	490	4	—	18	—
4.	—	565	2½	—	15	—
5.	—	876	3½	—	24	—
6.	—	972	2	—	30	—
7.	A Mortgage of	1200	3 years,	at 4 per cent per ann'm		
8.	—	3600	4½	—	5	—
9.	—	5720	5½	—	3	—
10.	—	9360	2½	—	2½	—
11.	A Debenture of	1000	20	—	2	—
12.	—	6470	11	—	2½	—
13.	—	9260	7½	—	3	—

**CASE II.**—When the money to be invested, the rate per cent, and the time are fixed, to find the amount the Security must be drawn for.

**RULE.**—Find the interest of \$100 at the given rate and time, add it to 100 for the amount, then say—As 100: the money to be invested :: amount of 100.

**EXAMPLE.**—For what sum must a bill at 2 months be drawn, so that when discounted at 18 per cent its net proceeds or present worth shall be \$375?

As 100 : 375 :: 103 to \$386.25 the amount of the bill.

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**EXERCISES**—Various persons place the following sums in the hands of a broker for investment, in the manner, and at the rates and times, as below. he succeeds in finding parties who consent to give the securities necessary to exactly occupy the respective sums. Required the amount for which each security must be drawn?

14.	In a Bill at	2 months.	at 12 per cent,	\$425
15.	—	4	— 18	— 996
16.	—	3	— 24	— 786
17.	—	6	— 30	— 874
18.	In a Mortgage at 3 years.	at 4½	—	4962
19.	—	5	— 3½	— 5264
20.	—	4½	— 2½	— 6425
21.	In a Debenture at 21	.	1½	— 10800
22.	—	12½	— 2½	— 12619
23.	—	18½	— 3½	— 16000

**CASE III.**—When the present worth, the amount, and the time is known, to find what rate has been charged.

**RULE**—Subtract the principal from the amount, divide by the time, the quotient is the interest made in one year, then—As the given principal : 100 :: this quotient to the rate per cent.

**EXAMPLE.**—Securities to the amount of \$1650, for 5 years, when sold, produce \$1200; what was the rate charged?

$$\begin{array}{r} \$1650 \\ 1200 \\ \hline 5)450 \end{array}$$

Then as 1200 : 100 :: 90 = 7½ per cent.

**FIND THE RATE PER CENT.**

24.	Securities amt'g. to \$1800 for 4 years.	sell for	\$1480
25.	—	650 5 months	— 600
26.	—	576 1	— 566
27.	—	362 1½	— 341

## BARTER

*Barter* is the exchanging of one commodity for another, and directs merchants and traders how to make the exchange without loss to either party.

**RULE.**—Find the value of the commodity whose quantity is given: then find what quantity of the other at the proposed rate can be bought for the same money, and it gives the answer.

**EXAMPLE.**—What quantity of flax at 9 cts. per lb. must be given in barter for 12 lbs. of indigo. at \$2.19 per lb. if 12 lbs. indigo at \$2 19 per lb. comes to \$26 28: therefore as 9cts. : 1lb. :: \$26.28cts. : 292 $\frac{2}{3}$ lbs. the answer.

1. How much wheat at \$1.25 a bushel must be given in barter for 50 bushels of rye at 70 cents a bushel?

2. How much rice at 28s per cwt. may be bartered for 3 $\frac{1}{2}$  cwt. of raisins at 5*d.* per lb.?

3. How much tea at 95 cents per lb. must be bartered for 78 gallons of brandy. at \$2.45 per gallon?

4. A had 8 $\frac{1}{2}$  cwt. of sugar at 12 cts. per lb., for which B gave him 18 cwt. of flour; what was the flour rated at per pound?

5. B bartered 3 hhds. of brandy containing 69 gals. each. at \$1.35 per gallon, to C for 125 yds. of cloth; what was the cloth per yard?

6. D gives E 250 yards of drugget. at 30 cts. per yard. for 319 lbs of pepper; what does the pepper stand him in per pound?

7. A had 41 cwt. of rice. at \$4.20 per cwt., for which B gave him \$80 in money. and the rest in sugar at 12 $\frac{1}{2}$  cts. per lb.: how much sugar did A receive?

8. A farmer had 120 bushels of wheat at \$1.50 per bushel. for which B gave him 100 bushels of barley. at 65 cts. per bushel. and the balance in oats at 40 cents per bushel; what quantity of oats did the farmer receive?

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INVOLUTION.

When a number is multiplied by itself, the product is called the power, and the number multiplied the root. Thus  $2 \times 2 = 4$  : here 4 is the square or second power of the root 2. Again,  $2 \times 2 \times 2 = 8$  : here 8 is the cube or third power of the root 2. Again,  $2 \times 2 \times 2 \times 2 = 16$ , here 16 is the fourth power of the root 2.

1. Find the second power of 8.
2. Required the third power of 13.
3. Raise 32 to the fourth power.
4. Involve 19 to the fifth power.
5. Involve 38 to the sixth power.

EVOLUTION.

EVOLUTION is the method of finding the roots of numbers.

EXTRACTION OF THE SECOND OR SQUARE ROOT.

To extract the square root of any given number is to find a number, when multiplied by itself, will produce the given number.

What is the square root of 106929 ?

RULE WITH EXAMPLE.—Divide the given number into periods of two figures each, by placing a point over the unit figure, and over every alternate figure towards the left. Find the square root, 3 of the first period 10, and place it in the quotient. Subtract the square of it, 9, from the first period, and to the remainder annex the next period, 69, for

$$\begin{array}{r}
 106929 \quad (327 \\
 \underline{9} \\
 62) \underline{169} \\
 \underline{124} \\
 647) \underline{4529} \\
 \underline{4529}
 \end{array}$$

a dividend. Double the root already found, 3, for a divisor, and supposing the unit figure, 9, omitted, find how often it, viz. 6, is contained in the dividend. It is contained 2 times; place the 2 then *both* in the quotient and the divisor. Multiply by it, 2, the divisor, 62, and subtract the product, 124, from the dividend. Bring down another period, and proceed thus till all the periods are brought down.

If there be a remainder after all the periods are used, periods of ciphers may be annexed; when the result will be decimals. Should there be decimals in the given number, still the pointing is to begin from the unit's place of the *integers*, and a point to be placed over every alternate figure both right and left.

The square root of a fraction is found by extracting the square root of the numerator for a new numerator, and the root of the denominator for a new denominator; if, however, this cannot be done, let the fraction be reduced to a decimal, and the root extracted as before.

1. What is the square root of 30976?
2. What is the square root of 622521?
3. What is the square root of 1234321?
4. What is the square root of 2052.09?
5. What is the square root of 4795.25731?
6. What is the square root of 24674.1264?
7. What is the square root of  $\frac{49}{144}$ ?
8. What is the square root of  $\frac{196}{1369}$ ?

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### EXTRACTION OF THE THIRD, OR CUBE ROOT.

To extract the Cube Root of any given number is to find a number which, when multiplied twice by itself, will produce the given number.

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Find the Cube Root of 12812904.

**RULE WITH EXAMPLE.**—Divide the given number into periods of three figures, beginning at the place of units. Place the cube root of the first period 2, in the quotient, and subtract its cube 8, from the first period, and bring down the next period for a dividend, which is 4812; to find a divisor, multiply the

$$\begin{aligned} 2 \times 2 &= 4 \times 300 = 1200 \\ 2 \times 3 &= 6 \times 30 = 180 \\ 3 \times 3 &= 9 \end{aligned}$$

$$\begin{array}{r} 1389 \times 3 = 4167 \\ \hline 645904 \end{array}$$

$$\begin{aligned} 23^2 \times 300 &= 158700 \\ 23 \times 4 \times 30 &= 2760 \\ 4^2 &= 16 \end{aligned}$$

$$\begin{array}{r} 161476 \times 4 = 645904 \\ \hline 0 \end{array}$$

square of the figure placed in the quotient by 300, = 1200, find how often this is contained in the dividend, viz. 3 times, place the 3 in the quotient for the second figures of the root. Multiply the part of the root formerly found, viz. 2, by the last figure placed in the root, viz. 3, and the product by 30, = 180; add this and the square of the last figure placed in the root to the divisor, viz. 1200; multiply the sum of these, 1389, by the last figure placed in the root, 3, and subtract the product, 4167, from the dividend, 4812; bring down another period for a new dividend, and proceed in the same manner.

In order to extract the cube root of a vulgar fraction reduce it to a decimal, and then extract the root.

In mixed numbers reduce the fractional part to a decimal.

Find the cube root of the following numbers :—

1. of	373248	6. of	52734.375
2. —	51872	7. —	7834.8748
3. —	389017	8. —	.053157376
4. —	1092727	9. —	$\frac{4}{7}$
5. —	84604519	10. —	$\frac{7}{1}$

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## DUODECIMAL MULTIPLICATION

This rule is made use of by artificers in measuring their work. The dimensions are taken in feet, inches, and parts. The foot is divided into 12 parts called inches; the inch into 12 parts called seconds; the seconds into 12 parts called thirds; and the thirds into 12 parts called fourths. Three seconds are marked thus, 3''; thirds, thus, 3''' ; and fourths thus, 4''''.

Multiply 7 feet 6½ inches by 2 feet 5½ inches.

**RULE WITH EXAMPLE.**—Place the multiplier under the multiplicand, feet under feet, inches under inches, &c. Multiply the multiplicand, beginning at the lowest term, 9, by the highest term in the multiplier, 2, carrying by 12; then multiply by the next lower term in the multiplier, viz. 5 inches, taking care, however, to put the product one place towards the right hand. Do the same with the next lower term, and so on. Add the different products together.

<i>ft. in. "</i>	<i>ft. in. "</i>
7 6 9*	7 6 9*
2 5 8	2 5 8
15 1 6	15 1 6
3 1 9 9	3 1 9 9
1 10 8 3	1 10 8 3
18 5 2'' 5''' 3''''	18 5 2'' 5''' 3''''

1. Multiply 7 feet 9 inches, by 5 feet 6 inches.
2. Multiply 9 feet 5 inches 3'', by 4 feet 8 inches 6''.
3. Multiply 12 feet 8 inches 7'', by 8 feet 4 inches 9''.

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\* Instead of ½ inches 9' are put down, because they are equivalent. The same is done with the ½ inch.

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5. M  
6. M  
  
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4. Multiply 46 feet 11 inches 8". by 12 feet 7".
5. Multiply 87 feet 9½ inches. by 11 feet 10½ inches.
6. Multiply 687 feet 7¾ inches, by 24 feet 10½ inches.

*To find the superficial content multiply the length by the breadth.*

7. Find the content of a board 8 feet 4 inches long and 3 feet 4 inches broad.

8. Find the area of a table 10 feet 9 inches long, and 6 feet 4 inches broad.

9. What is the price of a marble slab, the length of which is 6 feet 4 inches, the breadth 3 feet 2 inches, at 7s. per foot?

10. Required the area of a square, the side of it being 23 feet 9 inches?

11. A grave-stone was charged at 5s. 2d. per foot: what was the price of it, the length of it being 7 feet 2 inches, the breadth 3 feet 6 inches?

12. How much will it cost to pave a court-yard at 7s. 8d. per foot, the length of it being 26 feet 9 inches, the breadth 12 feet 4 inches?

*To find the solid content multiply the length, breadth, and thickness together.*

13. What is the solid content of a block of marble 9 feet 2 inches long, 5 feet 8 inches broad, and 2 feet 3 inches thick?

14. Required the solid content of a box 6½ feet long, 4¾ feet broad, and 3½ feet deep?

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15. A log of mahogany is 72 feet  $7\frac{1}{2}$  inches long, 5 feet 9 inches broad, and 8 feet  $6\frac{1}{2}$  inches thick. Required its solid content?

16. What would it cost having a cellar dug 18 feet 4 inches long, 12 feet 9 inches broad, and 9 feet 6 inches deep, at 6*d.*, per solid yard?

17. Required the solid content of a log of beech, 27 feet 6 inches long, 2 feet 5 inches broad, and 1 foot 2 inches thick?

18. What is the value of a block of granite 8 feet 9 inches long, 3 feet 7 inches broad, and 4 feet 2 inches thick, at 7*s* 6*d.* the solid foot?

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# MENTAL ARITHMETIC.

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**I.—To find the value of 12 articles, the price of one being given.**

**RULES.**—Reckon every penny in the price a shilling, and every farthing three pence.

Because the value of 12 articles at 1*d.* each is 12*d.*, or 1*s.*

	<i>Ans.</i>		<i>Ans.</i>
12 @ 6 <i>d.</i> each	6 <i>s.</i>	24 @ 7 <i>d.</i> each	14 <i>s.</i>
12 — 8 <i>d.</i> —	8 <i>s.</i>	24 — 6½ <i>d.</i> —	12 <i>s.</i> 6 <i>d.</i>
12 — 13 <i>d.</i> —	13 <i>s.</i>	36 — 9 <i>d.</i> —	27 <i>s.</i>
12 — 4½ <i>d.</i> —	4 <i>s.</i> 3 <i>d.</i>	36 — 10½ <i>d.</i> —	31 <i>s.</i> 6 <i>d.</i>
12 — 5½ <i>d.</i> —	5 <i>s.</i> 6 <i>d.</i>	12 — 1 <i>s.</i> 4½ <i>d.</i> —	16 <i>s.</i> 3 <i>d.</i>
12 — 7½ <i>d.</i> —	7 <i>s.</i> 9 <i>d.</i>	12 — 1 <i>s.</i> 7½ <i>d.</i> —	19 <i>s.</i> 9 <i>d.</i>
12 — 15½ <i>d.</i> —	15 <i>s.</i> 3 <i>d.</i>	24 — 1 <i>s.</i> 3 <i>d.</i> —	30 <i>s.</i>
12 — 16½ <i>d.</i> —	16 <i>s.</i> 6 <i>d.</i>	24 — 2 <i>s.</i> 1 <i>d.</i> —	50 <i>s.</i>
12 — 17½ <i>d.</i> —	17 <i>s.</i> 9 <i>d.</i>	48 — 1 <i>s.</i> 3 <i>d.</i> —	60 <i>s.</i>
12 — 19½ <i>d.</i> —	19 <i>s.</i> 6 <i>d.</i>	72 — 1 <i>s.</i> 8 <i>d.</i> —	120 <i>s.</i>
120 — 3 <i>d.</i> —	30 <i>s.</i>	720 — 5 <i>d.</i> —	300 <i>s.</i>
120* — 7 <i>d.</i> —	70 <i>s.</i>	800 — 7 <i>d.</i> —	490 <i>s.</i>
240 — 8 <i>d.</i> —	160 <i>s.</i>	900 — 6 <i>d.</i> —	480 <i>s.</i>
360 — 7 <i>d.</i> —	210 <i>s.</i>	1080 — 7 <i>d.</i> —	630 <i>s.</i>
480 — 9 <i>d.</i> —	360 <i>s.</i>	1200 — 8 <i>d.</i> —	800 <i>s.</i>
600 — 11 <i>d.</i> —	550 <i>s.</i>	1320 — 9 <i>d.</i> —	990 <i>s.</i>

When there are a few over or under the dozen, calculate for a dozen, and add or subtract as may be required.

	<i>Ans.</i>		<i>Ans.</i>
13 @ 4 <i>d.</i> each	4 <i>s.</i> 4 <i>d.</i>	25 @ 4 <i>d.</i> each	8 <i>s.</i> 4 <i>d.</i>
14 — 5 <i>d.</i> —	5 <i>s.</i> 10 <i>d.</i>	25 — 9 <i>d.</i> —	19 <i>s.</i> 6 <i>d.</i>
11 — 6 <i>d.</i> —	5 <i>s.</i> 6 <i>d.</i>	23 — 3 <i>d.</i> —	5 <i>s.</i> 9 <i>d.</i>
10 — 6 <i>d.</i> —	5 <i>s.</i>	22 — 7 <i>d.</i> —	12 <i>s.</i> 10 <i>d.</i>
9 — 8 <i>d.</i> —	6 <i>s.</i>	37 — 1 <i>s.</i> 3 <i>d.</i> —	46 <i>s.</i> 3 <i>d.</i>
15 — 10 <i>d.</i> —	12 <i>s.</i> 6 <i>d.</i>	35 — 1 <i>s.</i> 4 <i>d.</i> —	46 <i>s.</i> 8 <i>d.</i>

\* In this case find the answer for one dozen and take it ten times.

II.—To find the price of a gross, the price of one article being given.

RULE.—Reckon the pence in the price of one article as shillings, and the number of pence in these shillings will be the price of a gross in shillings.

Because taking the pence in the price as shillings is the same as multiplying by 12, and taking these shillings as pence again is the same as multiplying by 12 another time, and  $12 \times 12 = 144 = 1$  gross.

	<i>Ans.</i>			<i>Ans.</i>
1 gross @ 4d. each	48s.		1 gross @ 8½d. each	99s.
1 — — 2½d. —	30s.		1 — — 9½d. —	114s.
1 — — 3¼d. —	39s.		1 — — 11½d. —	141s.
1 — — 7¼d. —	93s.		1 — — 12¼d. —	147s.

III.—To find the price per score, the price of one article being given.

RULE.—Reckon a pound for every shilling in the price. Thus, there being 20 cwt. in a ton, the price of 1 ton at 7s 6d. per cwt. is 7l. 10s.

	<i>Ans.</i>		<i>Ans.</i>	
20 lbs. @ 4s. per lb.	4l.		*200 lbs. @ 6s. per lb.	60l.
20 — — 5s. 6d. —	5l. 10s.		200 — — 5s. 6d. —	55l.
40 — — 6s. 3d. —	12l. 10s.		400 — — 7s. 3d. —	145l.
60 — — 2s. 3d. —	6l. 15s.		600 — — 9s. 9d. —	292l. 10s.
80 — — 4s. 6d. —	18l.		800 — — 12s. —	480l.
100 — — 5s. 3d. —	26l. 5s.		1000 — — 2s. 3d. —	112l. 10s.

IV.—To find the value of 100 articles, the price of one being given.

RULE.—For every farthing in the price take as many pence and twice as many shillings. Thus, 100 pencils at 1½d. each is 12s. 6d., 6 being the number of farthings.

\* In this case find the value of one score, and take it ten times for the answer.

Because, by taking a penny for every farthing is the same as multiplying by 4, and taking 2 shillings for every farthing is the same as multiplying by 96, and  $96 \div 4 = 100$ .

	<i>Ans.</i>		<i>Ans.</i>
100 @ 2 <i>d.</i> each	16 <i>s.</i> 8 <i>d.</i>	100 @ 4½ <i>d.</i> each	37 <i>s.</i> 6 <i>d.</i>
100 — 2¼ <i>d.</i> —	18 <i>s.</i> 9 <i>d.</i>	100 — 5¼ <i>d.</i> —	47 <i>s.</i> 11 <i>d.</i>
100 — 3½ <i>d.</i> —	29 <i>s.</i> 2 <i>d.</i>	100 — 6¼ <i>d.</i> —	52 <i>s.</i> 1 <i>d.</i>

V.—To find the price of one article, the rate per dozen being given.

RULE.—Reckon a penny for every shilling in the rate per dozen.

	<i>Ans.</i>		<i>Ans.</i>
1 @ 12 <i>s.</i> per doz.	12 <i>d.</i>	1 @ 4 <i>s.</i> 3 <i>d.</i> per doz.	4½ <i>d.</i>
1 — 4 <i>s.</i> —	4 <i>d.</i>	1 — 7 <i>s.</i> 6 <i>d.</i> —	7½ <i>d.</i>
1 — 7 <i>s.</i> —	7 <i>d.</i>	1 — 10 <i>s.</i> 9 <i>d.</i> —	10¾ <i>d.</i>
1 — 13 <i>s.</i> —	13 <i>d.</i>	2 — 4 <i>s.</i> 3 <i>d.</i> —	8½ <i>d.</i>
1 — 14 <i>s.</i> —	14 <i>d.</i>	2 — 7 <i>s.</i> 6 <i>d.</i> —	22½ <i>d.</i>
1 — 18 <i>s.</i> —	18 <i>d.</i>	6 — 8 <i>s.</i> —	4 <i>s.</i>
1 — 6 <i>s.</i> —	12 <i>d.</i>	13 — 9 <i>s.</i> —	9 <i>s.</i> 9 <i>d.</i>
1 — 8 <i>s.</i> —	24 <i>d.</i>	11 — 7 <i>s.</i> —	6 <i>s.</i> 5 <i>d.</i>

VI.—To find the price of one article, the price per gross being given.

RULE.—Reckon the shillings of the price as pence, and divide them by 12.

Because taking the shillings as pence and dividing them by 12 is equal to dividing twice by 12, or 144.

	<i>Ans.</i>		<i>Ans.</i>
1 @ 48 <i>s.</i> per gross	4 <i>d.</i>	1 @ 90 <i>s.</i> per gross	8½ <i>d.</i>
1 — 30 <i>s.</i> —	2½ <i>d.</i>	1 — 114 <i>s.</i> —	9½ <i>d.</i>
1 — 39 <i>s.</i> —	3¼ <i>d.</i>	1 — 141 <i>s.</i> —	11¾ <i>d.</i>
1 — 93 <i>s.</i> —	7¾ <i>d.</i>	1 — 147 <i>s.</i> —	12¾ <i>d.</i>

VII.—To find the value of a single article at a certain rate per score.

RULE.—Reckon a shilling for every pound in the price.

	<i>Ans.</i>		<i>Ans.</i>
1 @ 4 <i>l.</i>	per score 4 <i>s.</i>	2 @ 4 <i>l.</i>	5 <i>s.</i> per score 8 <i>s.</i> 6 <i>d.</i>
1—9 <i>l.</i>	— 9 <i>s.</i>	1—7 <i>l.</i>	7 <i>s.</i> 6 <i>d.</i> — 7 <i>s.</i> 4½ <i>d.</i>
1—9 <i>l.</i> 10 <i>s.</i>	— 9 <i>s.</i> 6 <i>d.</i>	1—6 <i>l.</i> 17 <i>s.</i> 6 <i>d.</i>	— 6 <i>s.</i> 10½ <i>d.</i>
1—14 <i>l.</i> 15 <i>s.</i>	— 14 <i>s.</i> 9 <i>d.</i>	1—3 <i>l.</i> 13 <i>s.</i> 4 <i>d.</i>	— 3 <i>s.</i> 8 <i>d.</i>
1—27 <i>l.</i> 5 <i>s.</i>	— 27 <i>s.</i> 3 <i>d.</i>	1—7 <i>l.</i> 6 <i>s.</i> 8 <i>d.</i>	— 7 <i>s.</i> 4 <i>d.</i>
1—30 <i>l.</i> 16 <i>s.</i>	— 30 <i>s.</i> 9 <i>d.</i>	21—2 <i>l.</i> 10 <i>s.</i>	— 2 <i>l.</i> 12 <i>s.</i> 6 <i>d.</i>
4—35 <i>l.</i> 15 <i>s.</i> 10 <i>d.</i>	— 7 <i>l.</i> 3 <i>s.</i> 2 <i>d.</i>	40—8 <i>l.</i> 17 <i>s.</i> 4 <i>d.</i>	— 17 <i>l.</i> 14 <i>s.</i> 8 <i>d.</i>
5—36 <i>l.</i> 16 <i>s.</i> 8 <i>d.</i>	— 9 <i>l.</i> 4 <i>s.</i> 2 <i>d.</i>	60—3 <i>l.</i> 15 <i>s.</i> 2½ <i>d.</i>	— 11 <i>l.</i> 5 <i>s.</i> 6¾ <i>d.</i>
10—42 <i>l.</i> 18 <i>s.</i> 6 <i>d.</i>	— 21 <i>l.</i> 9 <i>s.</i> 3 <i>d.</i>	80—2 <i>l.</i> 5 <i>s.</i> 1 <i>d.</i>	— 9 <i>l.</i> 0 <i>s.</i> 4 <i>d.</i>

VIII.—To find the value of any number of articles when the price is given in pence or shillings.

RULE.—If the price be in pence, consider the number of articles as pence, and multiply by the pence in the price. If the price be in shillings, consider the number of articles as shillings, and multiply by the shillings in the price. Thus, 96 articles at 3*d.* each is 2*l.*, because 96 pence is 8*s.*, and  $8 \times 3 = 24$ . Again, 80 articles at 3*s.* each is 12*l.*, because 80*s.* is 4*l.*, and  $4 \times 3 = 12$ .

	<i>Ans.</i>		<i>Ans.</i>
36 @ 3 <i>d.</i> each	9 <i>s.</i>	40 @ 3 <i>s.</i> each	6 <i>l.</i>
60 — 5 <i>d.</i> —	25 <i>s.</i>	100 — 7 <i>s.</i> —	35 <i>l.</i>
120 — 7 <i>d.</i> —	70 <i>s.</i>	140 — 10 <i>s.</i> —	70 <i>l.</i>
144 — 8 <i>d.</i> —	96 <i>s.</i>	300 — 8 <i>s.</i> —	120 <i>l.</i>
54 — 6 <i>d.</i> —	27 <i>s.</i>	180 — 12 <i>s.</i> —	108 <i>l.</i>
66½ — 4 <i>d.</i> —	2 <i>s.</i> 1 <i>d.</i>	900 — 6 <i>s.</i> —	270 <i>l.</i>
100½ — 8 <i>d.</i> —	67 <i>s.</i>	86 — 10 <i>s.</i> —	43 <i>l.</i>
58½ — 9 <i>d.</i> —	44 <i>s.</i> 0¾ <i>d.</i>	165 — 4 <i>s.</i> —	33 <i>l.</i>

## ANSWERS.

## NUMERATION.

- 1.] One—Two—Three—Four—Five—Six—Seven—Eight—Nine—Cipher.
- 2.] Ten—Eleven—Fourteen—Sixteen—Nineteen—Twenty—Forty-two—Eighteen—Seventeen.
- 3.] Two hundred—Four hundred and twenty—Six hundred and seven—Nine hundred and eighty-six—Four hundred and seventy-three—Two hundred and forty-seven—Three hundred and sixty-four.
- 4.] Nine hundred and twelve—Eight hundred and seventy-four—Seven hundred and eighty-three—Six hundred and fifty—Two hundred and two—Six hundred and four—Five hundred and ten.
- 5.] Four thousand—Two thousand seven hundred—Eight thousand six hundred and one—Seven thousand and thirty-six—Two thousand one hundred and one—One thousand and sixty.
- 6.] One thousand and ten—Seven thousand and thirty—Four thousand six hundred—Nine thousand one hundred and eleven—Four thousand and seventy-six—Five thousand eight hundred and seventy.
- 7.] Twenty-six thousand and twelve—Seventy thousand one hundred and one—Forty-two thousand one hundred—Thirty-six thousand one hundred—Ninety thousand two hundred and one.

ertain rate

e price.

Ans.

ore 8s. 6d.  
7s. 4½d.  
6s. 10½d  
3s. 8d.  
7s. 4d.  
7. 12s. 6d.  
77. 14s. 8d.  
117. 5s. 6¾d  
97. 0s. 4d.

articles when

number of  
price. If  
articles as  
price. Thus,  
is 8s., and  
because 80s

Ans.

each 6l.  
— 35l.  
— 70l.  
— 120l.  
— 108l.  
— 270l.  
— 43l.  
— 33l.

- 3.] Seven hundred thousand—Seven hundred and one thousand and twenty—Nine hundred and twenty-six thousand four hundred and twenty-seven—One hundred and four thousand two hundred and six.
- 9.] Nine millions—Nine millions seven hundred and sixty-four thousand two hundred and sixty-eight—Eight millions two hundred and two thousand one hundred—Five millions twenty-three thousand and sixty-seven.
- 10.] Two millions six hundred thousand and sixty—Four millions one hundred and one thousand and ten—Two millions four thousand—One million four hundred and two thousand one hundred and forty-nine.
- 11.] Forty millions—Twenty-nine millions six hundred and two thousand six hundred and eighty-seven—Fifty millions twenty-six thousand and seventeen—One million six hundred and seventy thousand and twenty.
- 12.] Nine hundred and forty-one millions two hundred and sixty-eight thousand seven hundred and sixty-seven—Two hundred and sixty-seven millions six hundred and two thousand six hundred and seven—Four hundred and one million four hundred and sixty-seven thousand six hundred and eighty.
- 13.] Two hundred and ninety-six millions twenty-six thousand eight hundred and seventy-six—Seven hundred and ten millions twenty thousand and ten—Two hundred and seventy millions six hundred and three thousand and fifty.
- 14.] One thousand four hundred and two millions three hundred and sixty thousand seven hundred and forty—Three thousand four hundred and sixty millions seven hundred and sixty thousand and ten—Four thousand and twenty three millions six hundred and one thousand four hundred and ninety-seven.
- 15.] Seven thousand and forty-two millions six hundred and three thousand seven hundred and fourteen—Five thousand and seventy-nine millions six hundred and seven thousand nine hundred and six—One thousand seven hundred and four millions seventy thousand six hundred.

16.]

17.]

18.]

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- 16.] Eighty-one thousand four hundred and sixty-two millions three hundred and six thousand and twelve—Forty-six thousand and seven millions six hundred and eighty-seven thousand six hundred and eighty-one—Ninety-four thousand and eighty-six millions four hundred and twenty-one thousand three hundred and sixty.
- 17.] Fourteen thousand and twenty-three millions six hundred and forty-one thousand two hundred and one—Twenty thousand eight hundred and sixty millions two thousand and one—Forty thousand and two millions two hundred and two.
- 18.] Nine hundred and seven thousand and sixty millions two hundred and six thousand two hundred and four—Two hundred and forty thousand and twenty-six millions one hundred thousand two hundred and one—Five hundred and ninety thousand nine hundred and sixty millions one hundred and twenty-six thousand and twenty.

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 NOTATION.

- 1.] 6—7—9—8—5—10—12—14—16—18—20—19.
- 2.] 74—26—31—49—58—62—76—77—97—84—55—99.
- 3.] 100—104—244—691—750—909—999—892.
- 4.] 4000—4200—5352—6705—7050—9002—8080—6707.
- 5.] 10000—15560—19019—26595—38038—40040—56502—70777.
- 6.] 400000—400010—600707—980000—256975—700707—964259.
- 7.] 6000000—5493900—8040102—7493765—10010010—2024004—5303353—85394863—29340508—993050000.

## SIMPLE ADDITION.

1.	1185	25.	105
2.	1246	26.	293
3.	1348	27.	√408
4.	1465	28.	1475
5.	2249	29.	15388
6.	2072	30.	4257
7.	2311	31.	27731
8.	2856	32.	1658286
9.	975	33.	7861214
10.	1635	34.	636146
11.	1516	35.	75675
12.	1056	36.	311013
13.	34957	37.	\$57821
14.	21867	38.	2246
15.	18068	39.	72
16.	10913	40.	204
17.	30154	41.	251
18.	18001	42.	68391
19.	20169	43.	2263
20.	14372	44.	\$2197
21.	411093	45.	162
22.	351624	46.	5681
23.	278538	47.	415
24.	248363	48.	\$84

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## SIMPLE SUBTRACTION.

105	184	31.	704026138872
293	476	32.	424575325955
✓408	342	33.	417801945959
1475	456	34.	416879998308
15388	536	35.	457555
4257	375	36.	1205995
27731	463	37.	3599244
58286	531	38.	57955
61214	96	39.	\$8072
36146	90	40.	171
75675	16175	41.	344
11013	18943	42.	172
57821	25972	43.	178
2246	70747	44.	106
72	36919	45.	135
204	78373	46.	799
251	40253	47.	1386517
68391	38999	48.	11
2263	22984	49.	130
\$2197	15289	50.	740
162	78359	51.	2830
5681	25292	52.	875334
415	462121935	53.	.40 millions.
\$84	435195169	54.	1572914
	73922070	55.	5320
	612603992	56.	602
	722995412	57.	1794
	91310919	58.	85
	313841778927	59.	134
	769508830048	60.	32

MIXED QUESTIONS IN ADDITION AND  
SUBTRACTION.

- |    |                |    |                    |
|----|----------------|----|--------------------|
| 1. | 83 left.       | 5. | 415 got safe.      |
| 2. | 2720 remain.   | 6. | 221 remain.        |
| 3. | 1557 returned. | 7. | 1244556 exceeds by |
| 4. | 162 to go.     | 8. | \$287 remaining.   |
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SIMPLE MULTIPLICATION

- |     |         |     |          |
|-----|---------|-----|----------|
| 1.  | 17104   | 23. | 688289   |
| 2.  | 131574  | 24. | 393308   |
| 3.  | 432265  | 25. | 786616   |
| 4.  | 225804  | 26. | 589962   |
| 5.  | 66276   | 27. | 491635   |
| 6.  | 672108  | 28. | 884943   |
| 7.  | 389304  | 29. | 1179924  |
| 8.  | 748790  | 30. | 1081597  |
| 9.  | 502557  | 31. | 6823648  |
| 10. | 1102248 | 32. | 13386366 |
| 11. | 574875  | 33. | 23249952 |
| 12. | 508668  | 34. | 18221409 |
| 13. | 350184  | 35. | 23150412 |
| 14. | 612822  | 36. | 20896344 |
| 15. | 787914  | 37. | 19912236 |
| 16. | 525276  | 38. | 13825056 |
| 17. | 262638  | 39. | 56518416 |
| 18. | 437730  | 40. | 22039992 |
| 19. | 875460  | 41. | 57667632 |
| 20. | 963806  | 42. | 71550144 |
| 21. | 105052  | 43. | 63221592 |
| 22. | 196654  | 44. | 74644808 |

ND

t safe.  
main.  
ceeds by  
aining.

45.	29050420	62.	175320
46.	48844096	63.	\$2912
47.	84393932	64.	2592 feet.
48.	430143168	65.	2303 letters.
49.	777566496	66.	3168 bottles.
50.	359831304	67.	\$3240
51.	63073762	68.	4480 pop.
52.	41281053	69.	3650 pence.
53.	24294591	70.	2144
54.	28047414	71.	81056
55.	46350656	72.	783
56.	575630377	73.	80
57.	395494873	74.	1095 hours.
58.	649435896	75.	56940
59.	64008924	76.	768000
60.	3704412714	77.	\$155160
61.	403576660	78.	111690 miles.

688289  
393308  
786616  
589962  
491635  
884943  
1179924  
1081597  
6823648  
13386366  
23249952  
18221409  
23150412  
20896344  
19912230  
13825056  
56518416  
22039992  
57667632  
71550144  
63221592  
74644808

## SIMPLE DIVISION.

1.	6911—1	12.	7140973—5
2.	13752—4	13.	3906406—4
3.	13281—1	14.	5859550
4.	11517—1	15.	12667006—5
5.	9553—2	16.	478066—7
6.	3186—2	17.	5894371—5
7.	6426—8	18.	28236344—1
8.	4206—1	19.	18824229—2
9.	6368906	20.	14118172—1
10.	5335955—2	21.	11294537—4
11.	13771812—3	22.	9412114—5

23.	8067527	56	1613—38
24.	7059086— 1	57.	107—513
25.	6274743— 2	58.	92—728
26.	6647268— 9	59.	181—26
27.	5133880— 9	60.	143—30
28.	4706057— 5	61.	280—43
29.	37484011— 1	62.	149—387
30.	24989341—	63.	123—319
31.	18742905— 3	64.	355—73
32.	14993604— 3	65.	211—295
33.	12494670— 3	66.	204—91
34.	10709717— 4	67.	174—55
35.	9371002— 7	68.	141—295
36.	8329780— 3	69.	118—553
37.	7496802— 3	70.	209—41
38.	6815274— 9	71.	532—155
39.	6247335— 3	72.	101—816
40.	26654—14	73.	167—396
41.	41315—17	74.	216—355
42.	40364—12	75.	127—533
43.	24995— 2	76.	10804—74
44.	17862—35	77.	1032—570
45.	8703— 9	78.	9591—218
46.	6828—33	79.	9902—383
47.	4408—28	80.	7234—312
48.	10902—34	81.	700—1507
49.	1889—64	82.	857—1713
50.	3309—83	83.	3186—11
51.	3450—76	84.	953—2014
52.	1767—22	85.	2513—1409
53.	1726—18	86.	2587—1292
54.	1687— 8	87.	954—308
55.	1640—31	88.	1061—2116

## ANSWERS.

125

13-38	89.	875-2602	95.	45- 2
07-513	90.	418-7464	96.	36 hours.
92-728	91.	2252-4000	97.	266-20000
81-26	92.	14-65474	98.	2066666- 30
43-30	93.	200-188	99.	192268- 310
80-43	94.	670- 7	100.	925- 23

## DECIMAL FRACTIONS.

## ADDITION.

04-91	1.	671.458	5.	4541.03777
74-55	2.	806.698	6.	7396.1403
41-295	3.	1133.372	7.	5558.5850
118-555	4.	1374.2784	8.	1341.58517

## SUBTRACTION.

101-816	1.	67.517	6.	182.7044
167-396	2.	8.045	7.	70.0346
216-355	3.	34.1202	8.	810.8879
127-533	4.	297.0121	9.	242.245787
804-74	5.	669.021	10.	327.2158

## MULTIPLICATION.

032-570	1.	.0729	7.	110440.5021
591-218	2.	14.3561	8.	.492961
902-383	3.	7766.1112	9.	78.6
234-312	4.	.01118408	10.	3.6465
00-1507	5.	.5642	11.	.40006
557-1713	6.	8.79	12.	.76

## DIVISION.

513-1409	1.	2.8803+	7.	19.0292+
587-1292	2.	1.784+	8.	9.114+
951-308	3.	10.354+	9.	3.81009+
51-2116	4.	1.7807+	10.	2 161+
	5.	.024	11.	248.618+
	6.	2.96	12.	3.4689

ANSWERS.

REDUCTION.

CASE I.

1.	£.9729+
2.	£.790625
3.	£.6666+
4.	£0375
5.	cwt. 3.57142
6.	yard 1.4166+
7.	week .00263
8.	mile .63437
9.	guinea .0188
10.	ounce .275
11.	acre .575
12.	mile .00994

CASE II.

1.	15s. 3d.
2.	6s. 9½d.
3.	1½d.
4.	3qrs. 1lb. 9oz. 1dr.
5.	14oz. 15dr.
6.	15lbs. 10oz. 14dr.
7.	8½d.
8.	4½d.
9.	22hrs. 7min. 23sec.
10.	1qr. 3als. 2 in.
11.	25 per. 2 yds. 1ft. 9in.
12.	8oz. 15dwt. 16gr.
13.	15 drams.
14.	19dwt. 17gr.
15.	12oz. 7dr.

DECIMAL CURRENCY.

	\$	cts.		\$	cts.
1.	215	27½	11.	93	87½
2.	11	68½	12.	87	00
3.	27	00	13.	682	18½
4.	1	93½	14.	\$3	18½
5.	42	56½		2	12½
6.	23	62½	15.		3
7.	231	93½	16.		4
8.	71	87½	17.		2
9.	50	56½	18.		1
10.	35	43½	19.		0

PRIME NUMBERS.

1.	5	7	3	7	6.	2	3	5	31
2.	2	3	5	11	7.	2	5	7	19
3.	2	3	5	17	8.	2	5	7	23
4.	5	2	3	13	9.	2	3	5	5
5.	5	2	5	11	10.	2	2	5	7

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COMMON MEASURE.

L	36		6.	64
2.	24		7.	96
3.	48		8.	115
4.	56		9.	124
5.	63		10.	42

COMMON MULTIPLE.

1.	252		6.	120
2.	180		7.	1500
3.	120		8.	2730
4.	60		9.	714
5.	280		10.	4180

CANCELLATION.

1.	3 $\frac{3}{4}$		5.	4 $\frac{1}{2}$
2.	14		6.	11 $\frac{1}{11}$
3.	48		7.	7 $\frac{1}{2}$
4.	8 $\frac{1}{2}$		8.	6 $\frac{1}{2}$

VULGAR FRACTIONS.

REDUCTION.—CASE I.

1.	2487 $\frac{2}{3}$		8.	1 $\frac{1339}{2153}$
2.	604 $\frac{1}{2}$		9.	96 $\frac{1731}{1634}$
3.	227 $\frac{25}{43}$		10.	351
4.	92 $\frac{21}{303}$		11.	1 $\frac{4401}{38766}$
5.	93 $\frac{38}{80}$		12.	104 $\frac{1451}{1634}$
6.	199 $\frac{29}{13}$		13.	130 $\frac{1992}{3734}$
7.	11 $\frac{502}{80}$		14.	176 $\frac{1871}{1974}$

9oz. 1dr.  
z. 14dr.

in. 23sec.  
2 in.  
ls. 1ft. 9in.  
t. 16dr.

gr.

\$	cts.
93	87 $\frac{1}{2}$
87	00
682	18 $\frac{1}{2}$
2	55
1	82 $\frac{1}{2}$
3	64
4	0 $\frac{1}{2}$
2	00
1	50
0	12

31	
19	
23	
5	20
7	41

CASE II.		CASE III.	
15.	$\frac{15}{2}$	30.	$\frac{30}{294}$
16.	$\frac{26}{3}$	31.	$\frac{168}{1485}$
17.	$\frac{89}{5}$	32.	$\frac{1615}{819}$
18.	$\frac{178}{9}$	33.	$\frac{352}{1188}$
19.	$\frac{193}{7}$	34.	$\frac{392}{323}$
20.	$\frac{9707}{15}$	35.	$\frac{5304}{98325}$
21.	$\frac{6130}{17}$	36.	$\frac{33048}{68376}$
22.	$\frac{29301}{30}$	37.	$\frac{605880}{58968}$
23.	$\frac{30329}{36}$	38.	$\frac{25056}{9282}$
24.	$\frac{18487}{27}$	39.	$\frac{261807}{55575}$
25.	$\frac{123000}{126}$		
		CASE IV.	
26.	$\frac{354934}{421}$	40.	$\frac{3}{17}$
27.	$\frac{70285}{111}$	41.	$\frac{23}{68}$
28.	$\frac{180057}{234}$	42.	$\frac{4}{11}$
29.	$\frac{501248}{621}$	43.	$\frac{3}{10}$

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1188  
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323  
5304  
98325  
33048  
68376  
605880  
58968  
25056  
9282  
261807  
55575

44.  $\frac{148}{1735}$   
 45.  $\frac{191}{1310}$   
 46.  $\frac{161}{432}$   
 47.  $\frac{55}{128}$   
 48.  $\frac{1}{180}$   
 49.  $\frac{249}{44}$   
 54.  $\frac{2223}{2717}$   $\frac{1463}{2717}$   $\frac{1716}{2717}$   
 55.  $\frac{8073}{9936}$   $\frac{4752}{9936}$   $\frac{6624}{9936}$   
 56.  $\frac{315588}{445536}$   $\frac{325584}{445536}$   $\frac{159150}{445536}$   $\frac{310704}{445536}$   
 57.  $\frac{370938}{8435466}$   $\frac{3893292}{8435466}$   $\frac{5861934}{8435466}$   $\frac{2919969}{8435466}$   
 58.  $\frac{10561057803}{12048530733}$   $\frac{1800355167}{12048530733}$   $\frac{7046929530}{12048530733}$   $\frac{1111488075}{12048530733}$   
 59.  $\frac{1738284398040}{857382543080}$   $\frac{201170391800}{857382543080}$   $\frac{666658671252}{857382543080}$   
 $\frac{98700070840}{857382543080}$

50.  $\frac{7}{8}$   
 51.  $\frac{11}{13}$

CASE V.

52.  $\frac{63}{84}$   $\frac{56}{84}$   $\frac{48}{84}$   
 53.  $\frac{30}{648}$   $\frac{567}{648}$   $\frac{432}{648}$

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ADDITION.

1.  $\frac{196}{137}$       7.  $\frac{1874}{10028}$   
 2.  $\frac{2170}{1001}$       8.  $\frac{314192}{1122}$   
 3.  $\frac{2107}{358}$       9.  $\frac{53315}{878}$   
 4.  $\frac{2169113}{15137}$       10.  $\frac{49783}{57513}$   
 5.  $\frac{1194875}{108237}$       11.  $\frac{1419759}{10653}$   
 6.  $\frac{3126945}{4556622}$       12.  $\frac{1173424}{138433}$

SUBTRACTION.

1.	$\frac{5}{28}$	6.	$2\frac{1}{3}$
2.	$\frac{31}{99}$	7.	$1\frac{1}{8}$
3.	$\frac{31}{195}$	8.	$2\frac{37}{76}$
4.	$\frac{93}{247}$	9.	$7\frac{3}{4}$
5.	$8\frac{3}{4}$	10.	$1\frac{53}{112}$
		11.	$15\frac{1}{4}$
		12.	$63\frac{7}{8}$

MULTIPLICATION.

1.	$\frac{15}{32}$	6.	$2\frac{9}{13}$
2.	$\frac{56}{99}$	7.	$60\frac{1}{4}$
3.	$\frac{1}{2}$	8.	$17\frac{3}{8}$
4.	$\frac{16}{351}$	9.	$5\frac{1}{8}$
5.	$3\frac{1}{8}$	10.	$5\frac{1}{11}$
		11.	$115\frac{256}{283}$
		12.	$181\frac{611}{936}$

DIVISION.

1.	$3\frac{7}{55}$	7.	$6$
2.	$\frac{7}{8}$	8.	$8\frac{3}{4}$
3.	$1\frac{11}{81}$	9.	$1\frac{9}{17}$
4.	$2\frac{64}{105}$	10.	$2\frac{13}{21}$
5.	$\frac{11}{11}$	11.	$65\frac{3}{4}$
6.	$\frac{1}{8}$	12.	$\frac{1}{2}$

REDUCTION, CONTINUED.

CASE VI.

1.	$\frac{3}{1000} \text{ £}$	3.	$\frac{4}{105}$ guinea.
2.	$\frac{1}{1000}$	4.	$\frac{193}{7}$ farthing
		5.	$\frac{7}{1180}$ crown.

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1.  
2.

$2\frac{1}{3}$   
 $1\frac{1}{4}$   
 $2\frac{3}{8}$   
 $73$   


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 $143$

$1\frac{1}{2}$   
 $15\frac{1}{2}$   
 $63\frac{1}{2}$

$2\frac{2}{3}$   
 $60\frac{1}{2}$   
 $17\frac{1}{2}$   
 $5\frac{1}{2}$   
 $55\frac{1}{2}$

$115\frac{25}{83}$   
 $181\frac{11}{33}$

$8$   
 $8\frac{1}{2}$   
 $\frac{19}{27}$   
 $2\frac{1}{2}$   
 $65\frac{1}{2}$   
 $\frac{1}{2}$

$\frac{4}{65}$  guinea.  
 $\frac{9}{7}$  farthing  
 $\frac{7}{100}$  crown.

6.  $\frac{3}{70}$  week.  
 7.  $1\frac{17}{8}$  hour.  
 8.  $\frac{4}{80}$  yard.  
 9.  $200\frac{704}{8}$  dram.  
 10.  $3\frac{4}{100}$  mile.

CASE VII.

11.  $\frac{29}{40}$  £  
 12.  $\frac{13}{15}$  £  
 13.  $\frac{91}{320}$  £  
 14.  $2\frac{1}{4}$  d.  
 15.  $3\frac{1}{1}$  farthing.  
 16.  $\frac{49}{160}$  day.  
 17.  $\frac{1795}{28072}$  cwt.  
 18.  $154\frac{56}{1}$  ounces.  
 19.  $\frac{900}{1}$  dwt.  
 20.  $\frac{973}{1440}$  day.

CASE VIII.

21. 17s.  $1\frac{1}{2}$  - $\frac{1}{4}$ d.  
 22. 10d.  
 23. 4s.  
 24. 19h. 38min.  $10\frac{10}{11}$  sec.  
 25. 11s.  $10\frac{1}{2}$  - $\frac{1}{2}$ d.  
 26. 1ft. 4in.  
 27. 9oz. 15dwt.  
 28. 13 ounces.  
 29. 3qr. 11lb 6oz  $8\frac{3}{4}$  dr.  
 30. 5fur. 26per. 3yd. 2ft.

CASE IX.

1. .625  
 2. .25

3. .875  
 4. .333+  
 5. .833+  
 6. .166+  
 7. .5625  
 8. .0133+  
 9. .9411+  
 10. .7272+  
 11. .0715+  
 12. .00053+

CASE X.

1.  $\frac{1}{2}$   
 2.  $\frac{5}{8}$   
 3.  $\frac{3}{4}$   
 4.  $\frac{1}{200}$   
 5.  $\frac{1}{100}$   
 6.  $\frac{1}{1000}$   
 7.  $\frac{41}{160}$   
 8.  $\frac{21}{1000}$   
 9.  $\frac{7}{1000}$   
 10.  $\frac{19}{1000}$

PROMISCUOUS EXERCISES.

1.  $[2 \times 3 \times 5]$   $[2 \times 3 \times 11]$   
 $[2 \times 2 \times 2 \times 3 \times 3]$   $[2 \times 2 \times 3]$   
 $+7]$   $[3 \times 3 \times 7]$   $[2 \times 3 \times 3]$   
 $[5 \times 7]$   $[2 \times 2 \times 2 \times 2 \times 3]$   
 2. 28  
 3. 840  
 4. 3  
 5.  $91\frac{1}{2}$   $40\frac{1}{2}$   $85\frac{1}{2}$

ANSWERS.

6.	$\frac{206}{20}$	$\frac{89}{9}$	$\frac{321}{7}$	14.	$200704$	
7.	4			15.	$\frac{43}{1500}$ of a day.	
8.	$\frac{7}{9}$	$\frac{1}{3}$	$\frac{1}{8}$	16.	13oz. 11 $\frac{1}{2}$ drams.	
9.	$\frac{9}{12}$	$\frac{6}{12}$	$\frac{7}{12}$	$\frac{10}{12}$	$\frac{1}{2}$ of a mile.	
10.	9cwt. 1qr. 5lb. 8 $\frac{3}{4}$ oz.				18.	7yards 2quarters.
11.	14 $\frac{3}{5}$			19.	$\frac{3}{4}$	
12.	44			20.	$\frac{1}{4}$	
13.	$\frac{7}{125}$			21.	7 $\frac{1}{2}$ ounces.	

ADDITION OF MONEY.

	£	s.	d.		£	s.	d.
1.	129	17	2 $\frac{1}{2}$	6.	107	9	0 $\frac{1}{2}$
2.	171	17	0 $\frac{1}{4}$	7.	503	10	5
3.	137	10	3 $\frac{1}{2}$	8.	11912	2	3 $\frac{1}{2}$
4.	3.8	10	0	9.	17	17	1
5.	241	5	7				

SUBTRACTION OF MONEY.

	£	s.	d.		£	s.	d.
1.	48	16	9 $\frac{3}{4}$	7.	80	18	11 $\frac{1}{2}$
2.	18	19	2 $\frac{1}{4}$	8.	16	6	7 $\frac{1}{4}$
3.	58	18	3 $\frac{1}{4}$	9.	18	14	0
4.	39	16	8 $\frac{3}{4}$	10.	38	19	11 $\frac{1}{2}$
5.	69	2	2 $\frac{1}{4}$	11.	17	6	11 $\frac{1}{2}$
6.	36	17	8 $\frac{1}{4}$	12.	30	12	11 $\frac{1}{2}$

MULTIPLICATION OF MONEY.

	£	s.	d.		£	s.	d.
1.	128	14	8 $\frac{1}{2}$	7.	6475	6	4 $\frac{1}{2}$
2.	130	17	7 $\frac{1}{2}$	8.	44130	15	11
3.	231	6	11	9.	90483	3	1 $\frac{1}{2}$
4.	399	11	9 $\frac{1}{4}$	10.	314848	12	10
5.	4408	10	6	11.	302657	16	9 $\frac{1}{4}$
6.	6500	3	1 $\frac{1}{2}$	12.	410410	15	4

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13.	£442428	0	0 $\frac{1}{2}$	26.	£5208	9	5 $\frac{1}{2}$
14.	54953	14	2	27.	3264	7	9
15.	8585	10	9 $\frac{1}{2}$	28.	81637	4	4 $\frac{1}{2}$
16.	1927	8	1 $\frac{1}{2}$	29.	2	0	8 $\frac{1}{2}$
17.	18	11	3	30.		4	4
18.	60	13	10	31.		10	6
19.	268	2	5 $\frac{1}{2}$	32.	45	4	7 $\frac{1}{2}$
20.	1096	2	4 $\frac{1}{2}$	33.	501	17	6
21.	9102	8	7 $\frac{1}{2}$	34.	6386	11	11 $\frac{1}{2}$
22.	5505	7	2 $\frac{1}{2}$	35.	37	14	0
23.	53	18	8 $\frac{1}{2}$	36.	2003	1	7 $\frac{1}{2}$
24.	47	7	2 $\frac{1}{2}$	37.	20	13	0
25.	2321	13	2 $\frac{1}{2}$				

## DIVISION OF MONEY.

£ s. d.  
07 9 0 $\frac{1}{2}$   
03 10 5  
12 2 3 $\frac{1}{2}$   
17 17 1

£ s. d.  
0 18 11 $\frac{1}{2}$   
6 6 7 $\frac{1}{2}$   
8 14 6  
8 19 11 $\frac{1}{2}$   
7 6 11 $\frac{1}{2}$   
0 12 11 $\frac{1}{2}$

£ s. d.  
6475 6 4 $\frac{1}{2}$   
4130 15 11  
0483 3 1 $\frac{1}{2}$   
4848 12 10  
2657 16 9 $\frac{1}{2}$   
0410 15 4

	£	s.	d.		£	s.	d.
1.	34	8	10 $\frac{1}{2}$	18.	400	1	9 $\frac{1}{2}$ — $\frac{6}{16}$
2.	14	4	1— $\frac{1}{3}$	19.	723	9	3 $\frac{1}{2}$ — $\frac{17}{12}$
3.	17	9	7 $\frac{1}{2}$ — $\frac{3}{4}$	20.	778	19	9 $\frac{1}{2}$ — $\frac{6}{8}$
4.	149	15	0— $\frac{2}{3}$	21.	458	17	10 $\frac{1}{2}$ — $\frac{6}{4}$
5.	29	9	11 $\frac{1}{2}$ — $\frac{1}{8}$	22.	730	4	9— $\frac{3}{12}$
6.	58	4	10 $\frac{1}{2}$ — $\frac{4}{7}$	23.	19	7	3 $\frac{1}{2}$ — $\frac{2}{3}$
7.	1080	19	8 $\frac{1}{2}$ — $\frac{7}{8}$	24.	4	13	5 $\frac{1}{2}$ — $\frac{4}{16}$
8.	834	5	11 $\frac{1}{2}$ — $\frac{5}{8}$	25.	53	7	0 $\frac{1}{2}$
9.	506	0	0 $\frac{1}{2}$ — $\frac{9}{16}$	26.	2	7	11 $\frac{1}{2}$
10.	789	16	3 $\frac{1}{2}$	27.	0	10	8 $\frac{1}{2}$ — $\frac{5}{8}$
11.	392	12	7 $\frac{1}{2}$ — $\frac{6}{12}$	28.	1	17	6 $\frac{1}{2}$ — $\frac{1}{8}$
12.	14	2	1— $\frac{1}{7}$	29.	8854	4	0
13.	5	19	2 $\frac{1}{2}$ — $\frac{2}{8}$	31.	1	14	1 $\frac{1}{2}$ —14
14.	7	11	0— $\frac{5}{8}$	32.	2	2	6 $\frac{1}{2}$ —34
15.	72	0	1 $\frac{1}{2}$ — $\frac{7}{12}$	33.	3	6	10—95
16.	97	19	1 $\frac{1}{2}$	34.	2	3	9 $\frac{1}{2}$ —33
17.	62	5	7— $\frac{1}{2}$	35.	2	1	0—457

36.	£5 16 5½—531	52.	£9 8 0¼—185
37.	8 15 3—454	53.	13 13 2
38.	6 0 3¼—109	54.	9 4 7¼—9
39.	17 9 1¾—¾	55.	4 11 11¼—39
40.	1 5 8¼—62	56.	10 1 9½—109
41.	3 6 1—111	57.	9 10 9¼—201
42.	3 5 10¾—194	58.	10 3 3¾—495
43.	2 0 7¾—184	59.	11 9 6½—16
44.	9 0 6½—136	60.	979 2 8
45.	10 7 1½—387	61.	85½
46.	10 0 5¾—609	62.	0 16 6—12
47.	12 4 1¾—3	63.	25000000 die.
48.	10 7 7¼—3	64.	2852—2220
49.	12 12 8¾—15	65.	14 10 3¼—388
50.	17 16 10½—86	66.	0 5 0¼—1916
51.	12 7 3—54		

## REDUCTION.

1.	11882 farthings.	15.	£1884 10s.
2.	63478 pence.	16.	4947s. 6d.
3.	350150 farthings.	17.	873740 threepences.
4.	118865 halfpence.	18.	57552 fivepences.
5.	69552 pence.	19.	9621 fourpences 1½d.
6.	71520 farthings.	20.	31932080 sixpences.
7.	87552 farthings.	21.	33465 cr. 3s.
8.	10692 pence.	22.	118801½ seven shillings.
9.	£3394 10s.	23.	36672 fivepences.
10.	£444 13s. 3d.	24.	2282 eightpences ¾d.
11.	1751 gs. 18s.	25.	10018 half sovs. 2s.
12.	1146 cr. 2s. 10d.	26.	7327539 farthings.
13.	11307 fourpences.	27.	2890160 farthings.
14.	9880 crowns.	28.	205072 ninepences.

0½—185  
 2  
 7½—9  
 11¼—39  
 9½—109  
 9¼—201  
 3¾—495  
 6½—16  
 8  
 6—12  
 00000 die.  
 852—2220  
 8½—388  
 0¼—1916

29.	237725 three farthings.	40.	17.55
30.	6152 fivepences.	41.	13.29½
31.	17.54	42.	17.53
32.	25.08	43.	9.25
33.	29.75	44.	21.64
34.	24.84	45.	17.54
35.	13.50	46.	13.56
36.	24.89½	47.	24.72
37.	9.27½	48.	13.53
38.	21.53½	49.	33.90
39.	13.27	50.	13.27

WEIGHTS AND MEASURES.

AVOIRDUPOIS WEIGHT.

	cwt.	qrs.	lbs.	oz.	dr.
1.	29	1	19	0	0
2.	2	2	14	15	0
3.	6	2	11	0	0
4.	0	7	23	14	0
5.	46	2	14	0	0
6.	6	1	17	12	0
7.	2	1	21	8	0
8.	0	2	4	6	12½
9.	3	2	27	0	0
10.	9	3	4	0	0
11.	619	3	19	0	0
12.	21	0	13	12	0
13.	2854	1	27	2	13
14.	4	1	12	3	7
15.	211	3	1	4	0

pences.  
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16.	8 cwt. 3 qrs. $5\frac{1}{11}$ lbs.
17.	1 cwt. 3 qrs. 26 lbs. 9 oz. $6\frac{4}{10}$ dr
18.	$67\frac{3}{8}$ parcels.
19.	1 cwt. 1 qr. 15 lbs. 2 oz. $3\frac{9}{16}$ dr.
20.	475 hogsheds. 910 rem.
21.	192 tons. 19cwt. 3qrs. 6lbs.

## TROY WEIGHT.

	lbs.	oz.	dwts.	grs.
22.	194	4	16	0
23.	0	389	10	6
24.	16	11	4	6
25.	0	6	5	$6\frac{7}{8}$
26.	15	4	1	14
27.	3	11	11	6
28.	30	7	8	8
29.	3	0	14	$13\frac{4}{13}$
30.	104	3	0	0
31.	$25 - \frac{1333}{569}d.$			
32.	6	6	16	12

## LONG MEASURE.

	mls.	fur.	per.	yds.	ft.	in
33.	0	29	36	3	0	0
34.	0	2	2	4	2	0
35.	0	4	30	$2\frac{1}{2}$	0	0
36.	0	0	3	$2\frac{1}{2}$	2	0
37.	118	5	18	$3\frac{1}{2}$	0	0
38.	4	5	5	0	0	0
39.	92	3	20	0	0	0
40.	1	5	13	0	0	0
41.	16	5	33	0	2	10



## CLOTH MEASURE.

42.	118yds.	0qrs.	2uls.	48.	443yds.	1qrs.	0uls.
43.	330	0	3	49.	20	3	$1\frac{2}{3}$
44.	9	0	$3\frac{2}{7}$	50.	47yds.		
45.	4	0	$1\frac{1}{2}$	51.	10	1	1
46.	148	0	1	52.	11— $\frac{3}{4}$	suits.	
47.	19	0	0				

## SQUARE OR LAND MEASURE.

53.	167ac.	2rd.	14per.	58.	1ac.	1rd.	9per
54.	189	2	4	59.	29	1	16
55.	22	1	30	60.	1	1	$26\frac{3}{15}$
56.	24	2	30	61.	65	0	33
57.	29	0	21	62.	2s.	$3\frac{1}{4}$ d.	—4267.

## MEASURE OF CAPACITY.

63.	195qrs.	6bush.	1pks.	69.	244qrs.	3bush.	0pks.
64.	397	4	0	70.	41	3	$3\frac{1}{8}$
65.	10	7	$2\frac{1}{2}$	71.	1049gals.	1qt.	1pt.
66.	8	6	$0\frac{3}{8}$	72.	13gals.	2qts.	1pt. 3gls
67.	175	1	0	73.	224lds.	4qrs.	5bsh. 3pks
68.	16	6	2	74.	806gals.	2qts.	1pt.

## TIME.

75.	173yrs.	7wks.	5dvs.	80.	2wks.	0dvs.	19hrs.
76.	177dys.	12hrs.	28min.	81.	47hrs.	7min.	30sec.
77.	15yrs.	47wks.	5dvs.	82.	30ds.	10hrs.	29m. $4\frac{2}{12}$ a.
78.	29dys.	15hrs.	30min.	83.	347126307	seconds.	
79.	56wks.	2ds.	11hrs.	16m.			

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REDUCTION.

AVOIRDUPOIS WEIGHT.

- |    |              |    |              |
|----|--------------|----|--------------|
| 1. | 854 lbs.     | 4. | 7032 lbs.    |
| 2. | 1564 oz.     | 5. | 812 parcels. |
| 3. | 89 lb. 3 oz. |    |              |

TROY WEIGHT.

- |     |                     |
|-----|---------------------|
| 6.  | 5760 Awt.           |
| 7.  | 5 oz. 2 dwt. 20 gr. |
| 8.  | 5184 gr.            |
| 9.  | 6 spoons.           |
| 10. | 28 oz. 2 dwt. 0 gr. |
| 11. | 21 spoons.          |

CLOTH MEASURE.

- |     |                 |
|-----|-----------------|
| 21. | 3036 nails.     |
| 22. | 299 yds. 2 nls. |
| 23. | 8 shirts.—8     |
| 24. | 7 suits.—8      |

APOTHECARIES WEIGHT.

- |     |                      |
|-----|----------------------|
| 12. | 27100 grains.        |
| 13. | 5oz. 1dr. 1scr. 7gr. |
| 14. | 186 scruples.        |
| 15. | 252 days.            |

MEASURE OF CAPACITY.

- |     |                     |
|-----|---------------------|
| 25. | 197 pints.          |
| 26. | 585gals. 3qts. 1pt. |
| 27. | 3863 pecks.         |
| 28. | 1199 bushels.       |
| 29. | 2016 gills.         |

LONG MEASURE.

- |     |                       |
|-----|-----------------------|
| 16. | 24500 perches.        |
| 17. | 1332 yds. 1 ft. 4 in. |
| 18. | 200640 yards.         |
| 19. | 57200 times.          |
| 20. | 39600 times.          |

TIME.

- |     |                    |
|-----|--------------------|
| 30. | 1094 hours.        |
| 31. | 51dys. 20hrs. 57m. |
| 32. | 5316480 minutes.   |
| 33. | 341640 times.      |

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PRACTICE.

1.	£7 7 0	12.	\$3 15
2.	2 13 1½	13.	\$547.50
3.	2 9 5¼	14.	538 bushels ½ peck.
4.	1 16 10½	15.	\$812.25
5.	\$594.50	16.	\$1617.00
6.	\$148.12½	17.	\$3393 00
7.	£469 5 0	18.	\$135.37½
8.	931 0 0	19.	\$38 13½
9.	587 5 0	20.	£61 5 0
10.	\$1359.37½	21.	\$3 00
11.	\$2.70	22.	£82 10 0

TARE AND TRET.

1.	49cwt. 2qrs. 9lbs. net.	8.	56cwt. 3qrs. 7½lbs.
2.	10 0 2	9.	46 3 21½
3.	50 3 3½	10.	22 1 24
4.	23 2 0	11.	167 2 25½
5.	175 1 25	12.	30 2 9
6.	41 0 12	13.	36 1 14
7.	9 2 15	14.	£98 7s. 9d.
		15.	58cwt. 2qrs. 5½lbs.

BILLS OF PARCELS.

1.	\$19.25	2.	\$14.45	3.	\$30.50
----	---------	----	---------	----	---------

SIMPLE PROPORTION.

1.	\$128.12½	9.	23¼ days.
2.	20 miles.	10.	51 acres 1 rood.
3.	24 583 yards.	11.	1 hour 22 min.
4.	111½ days.	12.	\$2.058
5.	\$15.93	13.	1062¾ bushels
6.	30.937 bushels.	14.	28½ sacks.
7.	\$83.75	15.	37½ feet.
8.	7¼ day.	16.	240 acres.

17.	96 pupils.	29.	\$229.80
18.	40 cents.	30.	45 yards.
19.	600.08 miles.	31.	74 $\frac{4}{7}$ yards.
20.	\$18000.	32.	56.5625 poles.
21.	183.516 miles.	33.	1 $\frac{1}{2}$ lbs per day.
22.	\$171.97	34.	165 feet 2.8 in.
23.	4 $\frac{1}{2}$ years.	35.	405 men.
24.	1 $\frac{1}{2}$ days.	36.	12 days.
25.	2 $\frac{2}{5}$ days.	37.	7 day 9 hours
26.	25.033 miles.	38.	3 $\frac{1}{2}$ months.
27.	30 days.	39.	1 $\frac{1}{2}$ months.
28.	\$326.79		

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 COMPOUND PROPORTION

1.	\$425.91	20.	9600 men.
2.	\$200.00	21.	50 men.
3.	\$240.00	22.	\$471.04
4.	58 $\frac{1}{4}$ suits.	23.	3 $\frac{1}{2}$ days.
5.	145 men.	24.	180 men.
6.	10 horses.	25.	600 men.
7.	2200 men.	26.	14 $\frac{2}{3}$ days.
8.	55 $\frac{1}{2}$ days.	27.	7 $\frac{1}{2}$ ounces.
9.	\$148.72 $\frac{1}{2}$	28.	95.04 lbs.
10.	\$20.60	29.	32 horses.
11.	16 $\frac{1}{2}$ days.	30.	5 men.
12.	7200 men.	31.	135.535 days
13.	187 $\frac{1}{2}$ miles.	32.	896 lbs.
14.	72 acres.	33.	13 $\frac{2}{3}$ acres.
15.	10 days.	34.	1205 $\frac{1}{2}$ miles.
16.	92 $\frac{1}{2}$ days.	35.	\$100.70
17.	\$3600	36.	\$77.72
18.	292 $\frac{1}{2}$ gallons.	37.	1 $\frac{1}{2}$ months.
19.	156 tailors.		

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## PARTITIVE PROPORTION.

- |                                |   |
|--------------------------------|---|
| 1. A \$1000, B \$1200, C \$800 | 8. \$162.50, \$216.66,                                  |
| 2. \$100, \$80, \$60           | \$270.83  |
| 3. A \$1714.28, B \$285.71     | 9. 100, 140, 200  |
| 4. \$6000, \$4000              | 10. \$161.53, \$64.61,                                  |
| 5. \$4030, \$3980, \$3980,     | \$193.84  |
| \$4010                         | 11. \$3333.33, \$3000,                                  |
| 6. \$3000, \$5000, \$7000      | \$3000, \$2666.66                                       |
| 7. \$5000, \$2500, \$3333,     | 12. $46\frac{2}{3}$ , $62\frac{1}{3}$ , $70\frac{2}{3}$ |
| \$2500 and \$6666              | 13. \$1500 son, \$3000 wi.                              |
|                                | 14. \$400, \$600  |

## COMPOUND PARTITIVE PROPORTION.

- |                                    |                        |
|------------------------------------|------------------------|
| 1. \$5.75, \$7.77, \$6.47          | 4. \$7                 |
| 2. \$16.38, \$35.10, \$18.72       | 5. \$60.79', \$164.13' |
| 3. \$1577.84, \$1669.99, \$1753.15 | \$175.07'              |

## MEDIAL PROPORTION.

## CASE I.

- |                                  |   |
|----------------------------------|---|
| 1. 8bush. corn, 7bush. oats.     | 3. $\frac{1}{2}$ lb of first, $3\frac{1}{2}$ lbs second |
| 2. 7lbs of first, 8lbs of second | 4. $12\frac{1}{2}$ gals. $2\frac{1}{2}$ gals.           |
|                                  | 5. $7\frac{1}{2}$ acres of each.                        |
|                                  | 6. 5 tons hay, 8 tons straw                             |

## CASE II.

1. 1lb at 8 cts., 1 at 10 cts., 3 at 14 cts.
2. 8 bushels rye, 7 bushels oats, 8 bushels corn.
3. 1lb of each.
4. 5 gallons brandy, 7 gallons wine, 5 gallons water.
5. 1 calf, 2 cows, 1 ox, 1 colt.
6. 25lbs at 90 cts, 25lbs at \$1, and 60lbs at \$1.50.
7. 3 gallons of water.
8. 7 acres at \$15, 5 acres at \$22, 5 acres at \$25.
9. 4 at 36 cts, 36 at 26 cts, and 4 at 60 cts.
10. 1 at 18 cts, 1 at 20 cts, 2 at 25 cts.

CASE III.

1. 10bush. at 70cts., 2½ at 48cts., 12½ at 36cts., 40 at 30cts.
2. 20lbs. of each.
3. 20 gallons of water.
4. 75lbs. of each.
5. 20 bushels of barley, 61  $\frac{9}{11}$  bushels of oats.
6. 95 gallons of rum at 6s. 8d, and 30 gallons of water.

CONJOINED PROPORTION.

- |  |  |  |
|--|--|--|
| <ol style="list-style-type: none"> <li>1. 52½ bushels.</li> <li>2. 101 <math>\frac{1}{5}</math></li> <li>3. 4 <math>\frac{6}{11}</math></li> <li>4. 27 <math>\frac{1}{5}</math></li> <li>5. 10 men.</li> </ol> |  | <ol style="list-style-type: none"> <li>6. 7 <math>\frac{1}{2}</math> months.</li> <li>7. 150 lbs.</li> <li>8. 144</li> <li>9. \$92.37</li> <li>10. 200 yards.</li> </ol> |
|--|--|--|

PERCENTAGE.

- |   |  |   |
|---|--|---|
| <ol style="list-style-type: none"> <li>1. \$6 96</li> <li>2. 8 40</li> <li>3. 300 00</li> <li>4. 55 93</li> <li>5. 8 80</li> <li>7. 1½ per cent.</li> <li>8. 2 <math>\frac{1}{4}</math></li> <li>9. 33 <math>\frac{1}{2}</math></li> <li>10. 12 <math>\frac{1}{2}</math></li> </ol> |  | <ol style="list-style-type: none"> <li>11. 50 per cent.</li> <li>12. 25</li> <li>13. 10 cents.</li> <li>14. \$1185 18</li> <li>15. 675 30</li> <li>16. 300 00</li> <li>17. 4 28 <math>\frac{1}{2}</math></li> <li>18. 3000 00</li> <li>19. 2000 00</li> </ol> |
|---|--|---|

SIMPLE INTEREST.

- |  |  |   |
|--|--|---|
| <ol style="list-style-type: none"> <li>1. \$43 87 <math>\frac{1}{2}</math></li> <li>2. 60 98</li> <li>3. 224 91</li> <li>4. 360 28</li> <li>5. 20 90</li> <li>6. 26 31</li> <li>7. 458 88</li> <li>8. 42 24 <math>\frac{1}{2}</math></li> <li>9. 420 25</li> <li>10. 213 00</li> </ol> |  | <ol style="list-style-type: none"> <li>11. \$181 25</li> <li>12. 11 04</li> <li>13. 132 77</li> <li>14. 26 95</li> <li>15. 416 16</li> <li>16. 1334 21</li> <li>17. 120 06</li> <li>18. 40 09</li> <li>19. 8590 83</li> </ol> |
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COMMISSION, INSURANCE, BROKERAGE.

1.	\$1359 00	9.	\$21375 00
2.	34 83	10.	2135 00
3.	115 39	11.	3529 41
4.	164 53	12.	56 shares.
5.	6835 28	13.	\$4000 00
6.	2558 16	14.	1 $\frac{2}{3}$ per cent.
7. 158 bar.	2412 66	15.	\$5168 59
8.	5320 00	16.	89 55

COMPOUND INTEREST:

1.	\$516 59	5.	\$198 83
2.	131 23	6.	83 20
3.	1310 79	7.	845 83
4.	946 85	8.	48165 93

DISCOUNT.

1.	\$214 09	15.	\$1055 76
2.	357 14	16.	853 16
3.	462 26	17.	1005 10
4.	547 88	18.	5831 87
5.	822 53	19.	6119 40
6.	925 71	20.	7175 92
7.	1071 42	21.	14202 00
8.	2938 77	22.	16562 437
9.	4948 09	23.	26500 00
10.	8809 41	24.	6 $\frac{1}{2}$ +per cent.]
11.	714 28	25.	20 —
12.	5186 37	26.	21 $\frac{1}{3}$ + —
13.	7621 39	27.	49 $\frac{1}{3}$ + —
14.	474 30		

BARTER.

1.	28 bushels.	5.	\$223 56
2.	5cwt. 3qrs. 9 $\frac{1}{2}$ lbs.	6.	23 $\frac{1}{2}$ cents.
3.	201.21 pounds.	7.	737.6 pounds.
4.	.05 $\frac{1}{2}$	8.	287 $\frac{1}{2}$ bushels.]

## ANSWERS.

## INVOLUTION.

1.	64	4.	2476099
2.	2197	5.	1291467969
3.	1048576		

## EVOLUTION.

1.	176	6.	157.08
2.	789	7.	$\frac{7}{12}$
3.	1111	8.	$\frac{14}{37}$
4.	45.8		
5.	69.247+		

## CUBE ROOT.

1.	72	6.	37.5
2.	38	7.	19.86+
3.	73	8.	.376
4.	103	9.	.829+
5.	439	10.	1.93+

## DUODECIMAL MULTIPLICATION.

	ft.	in.	"	'''	''''	9.	£7 Os. $4\frac{1}{2}-\frac{3}{4}$ f.
1.	42	7	6	0	0	10.	564ft. 0in. 9"
2.	44	5	2	7	6	11.	£6 9s. $7\frac{1}{8}$ f.
3.	106	9	0	9	8	12.	£126 9s. $4\frac{1}{4}-\frac{1}{2}$ f.
4.	565	11	4	9	8	13.	116 ft. 10 in. 6"
5.	1040	8	4	4	6	14.	100 ft. 4 in. 1" 6"
6.	17105	2	3	4	6	15.	3419ft. 2in. 7" 2''' 10'''' 6''''
7.	27	9	4	0	0	16.	£2 1s. $1\frac{1}{4}$ d.
8.	68	1	0	0	0	17.	77 ft. 6in. 5"
						18.	£48 19s. $9\frac{3}{4}-\frac{1}{4}$

THE END.



2476099  
01467969

7.08

$\frac{1}{7}$

37.5  
9.86+  
.376  
.829+  
1.93+

$-\frac{1}{2}$  f.

9"

f.

$\frac{1}{4}-\frac{1}{2}$  f.

0 in. 6"

1" 6"

10''' 6'''

$\frac{1}{4}$ d.

1. 5"

$9\frac{3}{4}-\frac{1}{4}$

