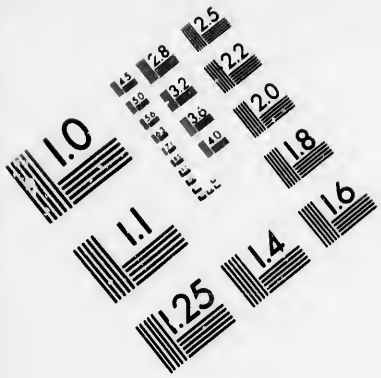

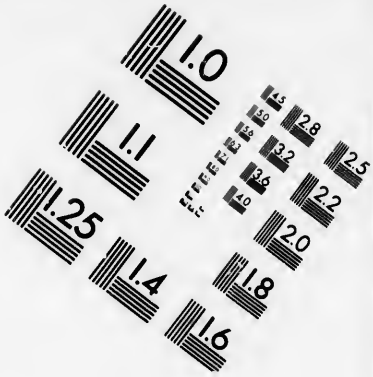

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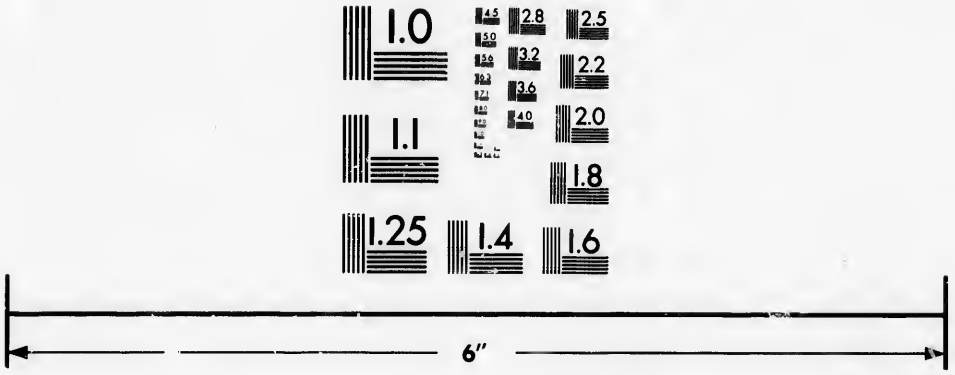
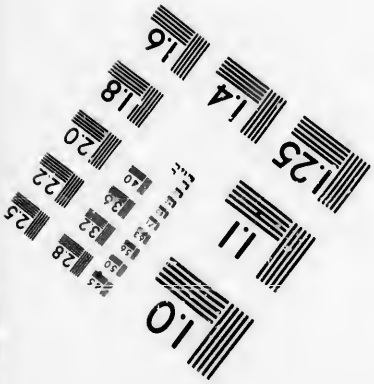
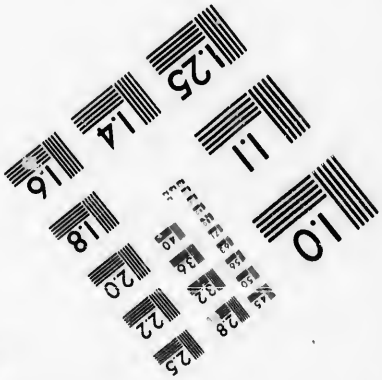
TEST TARGET (MT-3)







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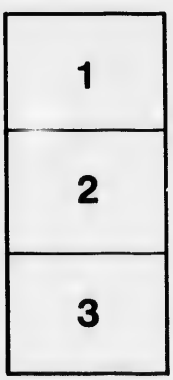

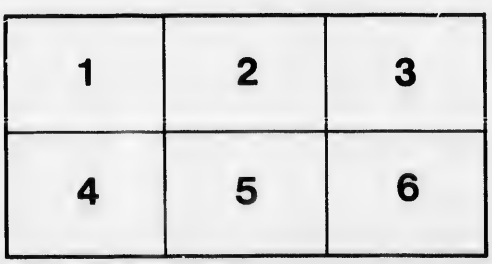

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TO

ADVANCED ARITHMETIC

FOR

CANADIAN SCHOOLS.

BY

BARNARD SMITH, M.A.,

St. Peter's College, Cambridge,

AND

ARCHIBALD McMURCHY, M.A.,

University College, Toronto.

TORONTO:

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1874.

KEY

TO

ADVANCED ARITHMETIC.

SIMPLE MULTIPLICATION.

Ex. V. (p. 28.)

(1)

87298
46

523788
349192

4015708

(2)

16097
59

144873
80485

949723

(3)

296897
83

890691
2375176

24642451

(5)

840607
80

67248560

(6)

175
189

1575
1400
175

33075

(7)

6298
769

56682
37788
44086

4843162

(9)

25607
5004

102428
128035

128137428

(10)

78847
8803

236541
630776
630776

694090141

(12)

234578
18

1876624
234578

4222404

234578
29

2111202
469156

6802762

234578
53

703734
1172890

12432634

924846
67
6473922
5549076
61964682

924846
95
4624230
8323614
87860370

924846
430
27745380
3699384
397683780

2846067
206
17076402
5692134
586289802

2846067
1008
22768536
2846067
2868835536

2846067
907
19922469
25614603
2581382769

8409631
21711
8409631
8409631
58867417
8409631
16819262
182581498641

8409631
7009
75686679
58867417
58943103679

8409631
8435
42048155
25228893
33638524
67277048
70935237485

8409631
7980
672770480
75686679
58867417
67108855380

(13)
1754
9306
10524
5262
15786
16522724

47506
4500
23753000
190024
213777000

149570
15790
13461300
104699
74785
14957
2361710300

554768
39314
2219072
554768
1664304
4992912
1664304

815085
20048
6520680
3260340
1630170
16340824080

123456789
987654321

123456789
246913578
370370367
493827156
617283945
740740734
864197523
987654312
1111111101

121932631112635269

57298492692
700809050321

57298492692
114596985384
171895478076
286492463460
515686434228
458387941536
401089448844

401553022483052787541 32

(14)

9487352
4731246

56924112
37949408
18974704
9487352
28462056
66411464
37949408

44886996200592

38015732
400700065

190078660
228094392
266110124
152062928

15232906283422580

574585614865
2837154309

5171270533785
1723756844595
2298342459460
287292807 4325
574585614865
4022099304055
1723756844595
459668491892 0
1149171229730

1630188053103649203285

(15)

4342760
599999

39084840
39084840
39084840
39084840
39084840
21713800

2605651657240

17376872
7399078

139014976
121638104
156391848
156391848
52130616
121638104

1285728313240 16

650090
3008

5200720
1950270

1955470720

76008765
9009009

684078885
684078885
684078885

6847636479638 85

(16)

12	3781	6565	
17	3782	6786	
84	7562	39390	
12	30248	52520	
204	26467	45955	
19	11343	39390	
1836	14299742	44550090	
204	3783	9898	
3876	42899226	356400720	
	114397936	400950810	
	100098194	356400720	
	42899226	400950810	
	54095923986	440956790820	

(17)

20470	
1030	
614100	
20470	
21084100	
2958	
476	
17748	
20706	
11832	
1408008	

SIMPLE DIVISION.

Ex. VI. (p. 36.)

(1)

27) 14683059 (543817
135

118
108

103
81

220
216

45
27

189
189
---

(2)

44) 817286228 (18574687
44

377
352

252
220

328
308

206
176

302
264

382
352

308
308
---

(3)

59) 54906734 (930622
531

180
177

367
354

133
118

154
118

36

(4)

```
96 ) 6848734752 ( 71340987
     672
     ---
     128
      96
     ---
     327
     288
     ---
     393
     384
     ---
      947
      864
      ---
      835
      768
      ---
       672
       672
       ---
```

(5)

```
87 ) 70865432 ( 814545
     696
     ---
     126
      87
     ---
     395
     348
     ---
     474
     435
     ---
     393
     348
     ---
     452
     435
     ---
      17
```

(6)

```
55 ) 649305745 ( 11805559
     55
     --
     99
     55
     --
     443
     440
     ---
      305
      275
      ---
      307
      275
      ---
      324
      275
      ---
      495
      495
      ---
```

(7)

```
123 ) 28894545 ( 234915
      246
      ---
      429
      369
      ---
      604
      492
      ---
      1125
      1107
      ----
       184
       123
       ---
       615
       615
       ---
```

(8)

```
615 ) 433418175 ( 704745
      4305
      ----
      2918
      2460
      ----
      4581
      4305
      ----
      2767
      2460
      ----
      3075
      3075
      ----
```

(9)

```
189 ) 1674918 ( 8862
      1512
      ----
      1629
      1512
      ----
      1171
      1134
      ----
       378
       378
       ---
```

(10)

779) 31884740 (40930
3116

7247
7011

2364
2337

270

(11)

907) 536819741 (591863
4535

8331
8163

1689
907

7827
7256

5714
5442

2721
2721
---

(12)

5016,0) 111111111111,1 (22151337
10032

10791
10032

7591
5016

25751
25080

6711
5016

16951

16951
15048

19031
15048

39831
35112

47191

(13)

144,0) 823546080,0 (5719070
720

1035
1008

274
144

1306
1296

1008
1008
---

(14)

7575) 57380625 (7575
53025

43556
37875

56812
53025

37875
37875
---

(15)

5406) 353008972662 (65299477
32436

28648
27030

16189
10812

53777
48654

51232
48654

25786
21624

41626

41626
37842

37842
37842
---

(16)

```
2468 ) 599961567212 ( 243096259
       4936
       -----
       10636
        9872
       -----
         7641
         7404
         ----
          23756
          22212
          -----
           15447
           14808
           -----
            6392
            4936
            ----
             14561
             12340
             -----
              22212
              22212
              -----
```

(17)

```
789,0000 ) 2679953,4687 ( 3396
           2367
           ----
           3129
           2367
           ----
            7625
            7101
            ----
             5243
             4734
             ----
              5094687
```

(18)

```
3851 ) 57111104051 ( 14830261
       3851
       ----
       18601
       15404
       -----
        31971
        30808
        -----
         11630
         11553
         -----
          7740
          7702
          ----
           3851
           3851
           ----
```

(19)

```
1111 ) 10000000000000000 ( 9000900090009
       9999
       ----
        10000
        9999
        ----
         10000
         9999
         ----
          10000
          9999
          ----
           1
```

```
11111 ) 10000000000000000 ( 900009000090
        99999
        -----
         100000
         99999
         -----
          100000
          99999
          -----
           10
```

(20)

1646,00) 6343945,67 (3854
4938

14059
13168

8914
8230

6845
6584

26167

(21)

90009) 67157148872 (746115
630063

415084
360036

550488
540054

104343
90009

14334.
90009

533382
450045

83337

(22)

200563) 1220225292 (6084
1203378

1684729
1604504

802252
802252

(23)

8496427) 7428927415293 (874359
67971416

63178581
59474989

37035925
33985708

30502172
25489281

50128919
42482135

76467843
76467843

(24)

79094451) 60435674536845 (764095
553661157

506955883
474566706

323691775
316377804

751397284
711850059

395472255
395472255

(25)

5578) 65358547823 (11717201
5578

9578
5578

40005
39046

9594
5578

40167
39046

11218
11156

6223
5578

645

(26)

687637943) 3968901531620 (5771
3438189715

5307118166
4813465701

4936525652
4813465301

1230600510
687637943

542062567

(27)

3854) 152181255 (39486
11562

36561
34686

18752
15416

33365
30832

25335
23124

2211

(28)

4093) 143255 (35
12279

20465
20465
---

(29)

72) 203534191 (2826863
144

595
576

193
144

494
432

621
576

459
432

271

271
216

55

72 { 8 | 203534191—7 } 55
   { 9 | 25441773—6 }

2826863, with rem. 55.

NOTE.—Nos. 1, 2, 4, 6 should be done in the same way.

(30)

78936
873

236808
552552
631488
613

68911741

(31)

855856651
2705

86783) 855853946 (9862
781047

748069
694264

538054
520698

173566
173566

(32)

24
11

264) 3060 (11 days and 156 miles over.
264

420
264

156

(33)

126) 4380000 (34761.90
378

600
504

960
882

780
756

240
126

1140
1034

60

(34)

51) 7000000 (137254.90
51

190
153

370
357

130
102

280
255

250
204

460
459

10

∴ diff. of cost per mile =
$137254.90 − $34761.90
= $102493 nearly.

(34)

1377) 94405914 (68559.12
8262
11785
11016
7699
6885
8141
6885
12564
12393
1710
1377
3330
2754
576

352) 24777430 (70390.42
2464
1374
1056
3183
3168
1500
1408
920
704
216

∴ diff. of cost per mile = \$70390.42 − \$68559.12 nearly, = \$1831.30 nearly.

MISCELLANEOUS QUESTIONS.

Ex. VII. (p. 38).

I.

(1)

603
48
4824
2412
28944

(2)

Nine millions, ninety thousand, nine hundred and nine.

Ninety thousand, nine hundred and nine.

9090909
90909
9181818

9090909
90909
9000000

1876570
822936
1053634

(3)

Son's age = 73 years − 37 years = 36 years.

(4)

$15\times37153-73474-67152\div4+40734\times2$
$=557295-73474-16788+81468$
$=483821-16788+81468$
$=467033+81468$
$=548501.$

(5)

1396091
1111566
252047
330857
80857
124288
34816
101000

3431522

II.

(2)

45) 18675 (415
180
67
45
225
225

5,0) 7925,0
1585

∴ in one year the deaths amount to
$415+1585=2000;$
∴ number of years required $=10000\div2000=5.$

(3)

700409000000000000.

(4)

Since $494871-94853=400018,$
$45079-3177=41902,$
$54312-3987=50325,$
$1763+231=1994,$
$378\times379=143641,$

the expression is equal to

$400018+41902-50325-1994+143641$
$=441920-50325-1994+143641$
$=391595-1994+1436341$
$=389601+143641$
$=533242.$

(5)

Number required $=528\times36+44$
$=19008+44$
$=19052.$

III.

(2)

$$
\begin{array}{r}
15683 \\
9892 \\
\hline
85\,)\,25575\,(\,300 \\
255 \\
\hline
75
\end{array}
$$

(3)

$$
\begin{array}{r}
813215640 \\
46536 \\
\hline
62513\,)\,813169104\,(\,13008 \\
62513 \\
\hline
188039 \\
187539 \\
\hline
500104 \\
500104 \\
\hline
\end{array}
$$

(4)

$(7854-4913)\times 3=2941\times 3=8823,$
$(20374-12530)\div 53=7844\div 53=148,$
$(395456-2364)\div 556=393092\div 556=707;$

$\therefore$ the expression is equal to

$$
\begin{aligned}
&8823-148-6+707 \\
&=8675-6+707 \\
&=8669+707 \\
&=9376.
\end{aligned}
$$

(5)

A, B and C score 108 runs,
B and C score 90 runs,
A and C score 51 runs;

$\therefore$ A scores (108−90) runs=18 runs,
B scores (108−51) runs=57 runs;
$\therefore$ A and B score (18+57) runs=75 runs.
$\therefore$ C scores (108−75) runs=33 runs.

IV.

(2)

Son's age will be (50−21) years=29 years,
Father's age will be (50+21) years=71 years.

(3)

100100101;

One billion and ten millions, one hundred and one thousand and ten.

(5)

Ans. 4549205.

V.

(1)

478
146

2868
1912
478

69788

99) 4843 (48
396

883
792

91

(2)

Number = 163 × 430 ÷ 86
= 70090 ÷ 86
= 815.

(3)

In each 12 persons, 2 speak English, 3 speak French, and 7 speak English and French;

∴ in 120000 persons,
20000 speak English,
30000 speak French,
70000 speak English and French.

(4)

His property = \$(10000 + 15000 + 5500 × 4 + 3750 × 3 + 4563 + 599)
= \$(10000 + 15000 + 22000 + 11250 + 4563 + 599)
= \$63412.

(5)

Divisor = (9281 − 373) ÷ 17
= 8908 ÷ 17
= 524.

VI.

(1) MDLXIII. and $\overline{\text{IX}}$.

(3) Divisor = 97 + 665 + 91 = 853;

∴ dividend = 853 × 665 + 97
= 567245 + 97
= 567342.

(4) Two hundred and seventy thousand, one hundred and thirty; twenty-six thousand, seven hundred and eighty-four; 10234.

8) 10234

1279—2 remainder;

∴ 6 is the number required.

(5) Two years since eldest son's age $= \frac{58}{2} = 29$;

$\therefore$ eldest son's age now $= 31$,

youngest son's age $= \frac{60+31}{7} = \frac{91}{7} = 13$;

daughter's age $= 60-(31+13)$

$= 60-44$

$= 16$.

REDUCTION.

Ex. VIII. (p. 57.)

(1)

$878.28
100

87828 cents.

(2)

£
57
20

1140s.
12

13680d.

(3)

s. d.
8 4½
12

100d.
2

201 half pence.

(4)

£ s. d.
83 15 6¼
20

1675s.
12

20106d.
4

80425q.

$1027.87
100.

102787 cents.

£ s.
15 12
20

312s.
12

3744d.

£ s. d.
1 0 3¾
20

20s. 243
12 4

243 975q.

£ s. d.
393 0 11½
20

7860s.
12

94331d.
2

188663 half pence.

(5)

738 half-crowns.
30

22140*d.*
4

88560*q.*

570 crowns.
5

2850*s.*
3

8550 four penny-pieces.

(6)

4 | 5673542—*q.*
12 | 1418385—2*q.*
2,0 | 11819,8—9*d.*
5909—18*s.*

Ans. £5909 18*s.* 9½*d.*

(7)

£
25
8

200 half-crowns.
5

1000 six pences.
6

4 | 6000 *d.*

1500 four pences.

(8)

lbs.	oz.	dwt.	grs.
59	7	14	19
12			
715 oz.			
20			
14314 dwt.			
24			
343555 grs.			

24 { 4 | 37400157 grs.
6 | 9350039—1 } 21
2,0 | 155833,9—5
12 | 77916 —19 dwt.
6493—0

Ans. 6493 lbs. 19 dwt. 21 grs.

(9)

56332005 scruples.
20

24 { 4 | 1126640100
6 | 281660025 —0 } 12 grs.
2,0 | 4694333,7—3
12 | 2347166 —17 dwt.
195597 —2 oz.

Ans. 195597 lbs. Troy, 2 oz., 17 dwt., 12 grs.

536 lbs.
12

6432 oz.
8

51456 drams.
3

154368 scs.

(10)

tons.	cwt.	qrs.	lbs.
7	15	2	16
20			
155 cwt.			
4			
622 qrs.			
25			
15566			
16			
249056 oz.			

		drs.	
16	4	7563241—1	9
	4	1890810—2	
16	4	472702—2	14
	4	118175—3	
25	5	29543—3	18
	5	5908 3	
	4	1181—3	
	2,0	29,5.1	
		14,15	

	tons.	cwt.	qr.	lbs.	oz.	dr.
Ans.	14	15	1	18	14	9

(11)

		oz.	
16	4	5838297—1	9
	4	1459574—2	
28	4	364893—1	25
	7	91223—6	
	4	13031—3 qrs.	
	2,0	325,7—17 cwt.	
		162.	

tons.	cwt.	qr.	lbs.	drs.
33	17	3	27	15
20				
677				
4				
2711				
28				
75935				
16				
1214960 oz.				
16				
19439375 drs.				

Ans. 162 tons. 17 cwt. 3 qrs. 25 lbs. 9 oz.

(12)

lbs.	oz.	sc.
17	2	2
12		
206 oz.		
8		
1648		
3		
4946 sc.		

4946 sc.
20
98920 grs.

grs. apoth. grs. troy
34678=34678
the grain being the same in each measure.

24 { 4 | 34678—2 ; 6 | 8669—5 } 22 grs.
2,0 | 144,4—4 dwt.
72

Ans. 72 oz. 4 dwt. 22 grs.

(13)

mi.	fur.	po.
3	7	8
8		
31 fur.		
40		
1248 poles.		
$5\frac{1}{2}$		
6240		
624		
6864 yds.		

miles.
573
1760
34380
4011
573
1008480 yds.
3
3025440 ft.
12
36305280 inches.

74 mi. 3 fur. 4 yds.
8
595 fur.
40
33800 poles.
$5\frac{1}{2}$
119004
11900
130904 yds.
3
392712 ft.
12
4712544 in.

(14)

inches
12 | 1364428—4 in.
3 | 113702—2 ft.
37900
2
11 | 75800—10 half-yards.
4,0 | 689,0—10 po.
8 | 172 —4 fur.
3 | 21
7

lea. fur. po. yds. ft. in.
Ans. 7 4 10 5 2 4

(15)

4 lea. 2 mi. 2 in.
3
14 mi.
1760
840
98
14
24640 yds.

24640 yds.
3
73920 ft.
12
887042 in.
3
2661126 barleycorns.

(16)

fur. yds.
7 200
220

22 { 2 | 1740—0 } 2 yds.
{ 11 | 870—1 }
79

Ans. 79 chains, 2 yds.

cub. span. cub. in.
6 1 = 6 9
18

12 | 117—9 in.
9

Ans. 9 feet, 9 inches.

(17)

yds. qr.
84 1
4
337 qrs.
4
1348 na.

Eng. ells. qr.
56 1
5
281 qrs.
4
1124 na.

(18)

Fr. ells. qr.
83 3
6
501 qrs.
4
2004 na.

Fl. ells. qr.
73 1
3
220 qrs.
4
880 na.

(19)

ac. ro.
35 2
4
142 ro.
40
5680 po.

ac. ro.
56 2
4
226 ro.
40
9040 po.
30¼
271200
2260
273460 sq. yds.

(20)

ro. po. yds.
3 37 26
40
157 po.
30¼
4736
39¼
4775¼ sq. yds.
9
42977¼ sq. ft.
144
171908
171908
42977
36
6188724 sq. inches

(21)

ac.	po.
3	30
4	
12 ro.	
40	
510 po.	
$30\frac{1}{4}$	
15300	
$127\frac{1}{2}$	
$15427\frac{1}{2}$ sq. yds.	
9	
$138847\frac{1}{2}$ sq. ft.	

ac.	ro.
15	3
4	
63 ro.	
25000	
315000	
126	
1575000 sq. links	

po.

4,0 | 5000,0

4 | 1250 —2

312

Ans. 312 ac. 2ro.

(22)

c. yds.

29
27
203
58
783 c. ft.

1728) 158279 (91 c. ft.
15552
2759
1728
1031

c. ft.

27 { 3 | 91—1 ; 9 | 30—3 } 10 c.ft.

3

Ans. 3 c. yds. 10 c. ft. 1031 c. in.

(23)

c. yds.	c. in.
17	1001
27	
119	
34	
459 c. ft.	
1728	
3672	
918	
3213	
459	
1001	
794153 c. in.	

c. yds.	c. ft.
26	19
27	
201	
52	
721 c. ft.	
1728	
5768	
1442	
5047	
721	
1245888 c. in.	

(24)

galls.
563
4
2252 qts.
2
4504 pts.

gills.

4 | 365843—3 gills.

2 | 91460

4 | 45730—2 qts.

11432

Ans. 11432 galls. 2 qts. 3 gills.

(25)

bush. pks.
760 3
4

3043 pks.
2

6086 galls.
4

24344 qts.

(26)

chald.
250
36

1500
750

9000 bush.

(27)

reams. quires.
56 19
20

1139 quires.
24

4556
2278

27336 sheets.

(28)

wks. dys. hrs.
36 5 17
7

257 d.
24

1045
514

6185 hrs.

6185 hrs.
60

371100 min.
60

22266000 sec.

4	2875646
2	718911—2 qts.
4	359455—1 gal.
	89863—3 pks.

Ans. 89863 bush. 3 pks. 1 gal. 2 qts.

pks.

	4	186043—3 pks.
36	3	46510— 1
	12	15503—11
		1291

34 bush.

Ans. 1291 chald. 34 bush. 3 pks.

sheets.

24	4	52073— 1
	6	13018— 4
2,0		2169 quires.
		108

17 sheets.

Ans. 108 reams, 9 quires, 17 sheets.

mo. hrs. sec.
1 23 59
30

30 days.
24

143
60

743 hrs.

743 hrs.
60

44580 min.
60

2674859 sec.

(29)

half-pints.

2 | 1336381

2 | 668190½ pints.

4 | 334095¼ quarts.

36 { 4 | 83523¾ gallons.
   { 9 | 20880 9/16

2320 1/576 barrels.

(30)

dys. hrs.
365 6 = 365¼ days.

yrs. dys
27 245
365¼
135
162
81
6¼
245
10106¾
24
40424
20212
18
242562 hrs.
60
14553720 min.
60
873223200 sec.

(31)

	dys.	hrs.
In August there remain	26	3
In September there are	30	
In October there are	31	
In November there are	30	
In December there are	31	
In January there are	31	
In February there are	28	
To March 3rd, 6 A. M.	2	6
	209	9

dys. hrs.
209 9
24
845
418
5025 hrs.
60
301500 min.
60
18090000 sec.

COMPOUND MULTIPLICATION.

Ex. XI. (p. 67.)

(4)

£	s.	d.	
2579	0	0¾	
		13	
30948	0	9	for 12
		12	
371376	9	0	for 144
7737	0	2¼	for 3
379113	9	2¼	for 147

£	s.	d.	
2579	0	0¾	
		12	
30948	0	9	for 12
		12	
371376	9	0	for 144
28369	0	8¼	for 11
399745	9	8¼	for 155

£	s.	d.	
2579	0	$0\frac{3}{4}$	
		10	
25790	0	$7\frac{1}{2}$	for 10
		10	
257900	6	3	for 100
		4	
1031601	5	0	for 400
180530	4	$4\frac{1}{2}$	for 70
10316	0	3	for 4
1222447	9	$7\frac{1}{2}$	for 474

£	s.	d.	
2579	0	$0\frac{3}{4}$	
		10	
25790	0	$7\frac{1}{2}$	for 10
		10	
257900	6	3	for 100
		10	
2579003	2	6	for 1000
		2	
5158006	5	0	for 2000
773700	18	9	for 300
77370	1	$10\frac{1}{2}$	for 30
2579	0	$0\frac{3}{4}$	for 1
6011656	5	$8\frac{1}{4}$	for 2331

(5)

lbs.	oz.	dwts.	grs.	
86	7	16	11	
			8	
693	2	11	16	
lbs.	oz.	dwts.	grs.	
86	7	10	11	
			4	
346	7	5	20	for 4
			9	
3119	5	12	12	for 36

(6)

tons.	cwt.	qrs.	lbs.	oz.	
3	0	0	24	13	
				11	
33	2	2	22	15	

(7)

lbs.	oz.	drs.	sc.	
45	7	3	2	
			12	
547	5	4	0	
lbs.	oz.	drs.	sc.	
45	7	3	2	
			11	
501	10	0	1	for 11
			6	
3011	0	2	0	for 66
91	2	7	1	for 2
3102	3	1	1	for 68

(8)

yds.	qr.	na.	
67	1	2	
		9	
606	1	2	

(Continued on next page.)

(Ex. 6 continued.)

tons.	cwt.	qrs.	lbs.	oz.	
3	0	0	24	13	
				7	
21	1	2	23	11	for 7
				10	
210	17	1	11	14	for 70
18	1	1	23	14	for 6
228	18	3	10	12	for 76

(9)

fur.	po.	yds.	ft.	in.	
		70	2	10	
				7	
2	10	1	1	10	

mi.	fur.	po.	yds.	ft.	in.	
			70	2	10	
					4	
1	11	$2\frac{1}{2}$	2		4	for 4
					7	
1	1	1	$0\frac{1}{2}$	1	4	for 28
		12	4	2	10	for 1
1	1	14	0	1	2	for 29

(10)

ac.	r.	po.	yds.	ft.	
16	3	38	27	2	
				11	
186	3	27	$26\frac{3}{4}$	4	
ac.	r.	po.	yds.	ft.	
16	3	38	27	2	
				4	
67	3	35	$17\frac{1}{4}$	8	for 4
				4	
271	3	22	$11\frac{1}{2}$	5	for 16
				7	
1903	0	36	23	8	for 112

(Ex. 8 continued.)

yds.	qr.	na.	
67	1	2	
		5	
336	3	2	for 5
		10	
3368	3	0	for 50
202	0	2	for 3
3570	3	2	for 53

(11)

ac.	r.	p.	
380	3	32	
		12	
4571	1	24	
ac.	r.	p.	
380	3	32	
		10	
3809	2	0	for 10
		10	
38095	0	0	for 100
2285	2	32	for 6
40380	2	32	for 106

(12)

gals.	qts.	
57	3	
	10	
577	2	
gals.	qts.	
57	3	
	10	
577	2	for 10
	10	
5775	0	for 100

(Continued on next page.)

(12 continued.)

gals.	qts.	
5775	0	for 100
	2	
11550	0	for 200
2887	2	for 50
404	1	for 7
14841	3	for 257

(13)

lds.	qrs.	bus.	pks.	
	76	5	2	
			12	
184	0	2	0	for 12
15	1	5	2	for 1
199	1	7	2	for 13

lbs.	qrs.	bus.	pks.	
	76	5	2	
			6	
92	0	1	0	for 6
			4	
368	0	4	0	for 24
			10	
3681	0	0	0	for 240.

(14)

yr.	w.	d.	h.	m.	
	5	6	18	14	
				11	
1	13	4	8	34	

yr.	w.	d.	h.	m.	
	5	6	18	14	
				10	
1	7	4	14	20	for 10
				10	
11	24	3	23	20	for 100

yr.	w	d.	h.	m.	
11	24	3	23	20	for 100
				3	
34	21	4	22	0	for 300
3	22	6	19	0	for 30
1	1	4	20	6	for 9
38	46	2	13	6	for 339

(15)

tuns	pi.	hhd.	gals.	pt.	
		84	43	1	
				9	
190	1	0	10	1	for 9
				3	
571	1	0	30	3	for 27

hhds.	gals.	pt.	
84	43	1	
		10	
846	53	2	for 10
		10	
8468	28	4	for 100
		3	
25405	22	4	for 300
5081	4	4	for 60
338	46	4	for 4
30825	10	4	for 364

(16)

bar.	gals.	qts.	pts.	
43	14	1	1	
			4	
173	17	2	0	for 4
			9	
1561	13	2	0	for 36
130	4	0	1	for 3
1691	17	2	1	for 39

(Continued on next page.)

(16 continued.)

bar.	gals.	qts.	pts.	
43	13	1	1	
			10	
433	25	3	0	for 10
			10	
4337	5	2	0	for 100

bar.	gals.	qts.	pts.	
4337	5	2	0	for 100
			7	
30360	2	2	0	for 700
2602	10	2	0	for 60
173	17	2	0	for 4
33135	30	2	0	for 764

(17)

£	s.	d.	
1	0	$9\frac{1}{2}$	
		10	
10	7	11	for 10
		6	
62	7	6	for 60
7	5	$6\frac{1}{2}$	for 7
69	13	$0\frac{1}{2}$	cost of lambs.

£	s.	d.	
2	2	$11\frac{1}{4}$	
		10	
21	9	$4\frac{1}{2}$	for 10
		7	
150	5	$7\frac{1}{2}$	for 70
6	8	$9\frac{3}{4}$	for 3
156	14	$5\frac{1}{4}$	cost of sheep.

£	s.	d.	
37	0	$2\frac{3}{4}$	
		4	
148	0	11	cost of cows.

(18)

7 chests.
18

126 drawers.
8

1008 divisions.

$25.25
1008

202
2525

$25452

£	s.	
38	17	
	5	
194	5	for 5
	3	
582	15	for 15
77	14	for 2
660	9	cost of horses.

£	s.	d.	
69	13	$0\frac{1}{2}$	cost of lambs.
156	14	$5\frac{1}{4}$	cost of sheep.
148	0	11	cost of cows.
660	9	0	cost of horses
18	7	6	expenses.
1053	4	$10\frac{3}{4}$	whole outlay.

COMPOUND DIVISION.

Ex. XII. (p. 69.)

(3)

	lbs.	oz.	dwt.	grs.	lbs.
29)	459	4	4	22	(15
	29				
	169				
	145				
	24				
	12				
	292	(10 oz.			
	290				
	2				
	20				
	45	(1 dwt.			
	29				
	16				
	24				
	406	(14 grs.			
	29				
	116				
	116				

Ans. 15 lbs., 10 oz., 1 dwt., 14 grs.

(4)

	lbs.	oz.	drs.	sc.
68)	15511	3	6	2 (228
	136			
	191			
	136			
	551			
	544			
	7			
	12			
	87	(1 oz.		
	68			
	19			
	8			
	158	(2 drs.		
	136			
	22			
	3			
	68	(1 sc.		

Ans. 228 lbs., 1 oz., 2 drs., 1sc.

(5)

	£	*s.*	*d.*	
754)	1288	1	8	(£1
	754			
	534			
	20			
754)	10681	(14*s.*		
	754			
	3141			
	3016			
	125			
		125		
		12		
754)		1508	(2*d.*	
		1508		

Ans. £1 14*s.* 2*d.*

(6)

per. po. yds. ft. in.

35) 2 10 1 1 10 (2 po.
40
—
90
70
—
20
5½
—
111 (3 yds
105
—
6
3
—
19 (0 ft.
12
—
238

238 (6 in.
210
—
28

Ans. 2 po., 3 yds., $6\frac{3}{35}$ in.

(7)

£ *s.* *d.*

139) 165 15 8¾ (£1
139
—
26
20
—
139) 535 (3*s.*
417
—
118
12
—
139) 1424 (10*d.*
1390
—
34
4
—
139) 139 (1*q.*
139
—

Ans. £1 3*s.* 10¼*d.*

(8)

£

744) 2728 (£3
2232
—
496
20
—
744) 9920 (13*s.*
744
—
2480
2232
—
248
12
—
744) 2976 (4*d.*
2976
—

Ans. £3 13*s.* 4*d.*

(9)

cu. yds., cu. in. cu. yds.

798) 1738 1236 (2
1596
—
142
27
—
994
284
—
3834 (4 cu. ft.
3192
—
642
1728
—
6372
1284
—
4494
642
—
1110612 (1392 in.

1110612 (1392 in.
798
—
3126
2394
—
7321
7182
—
2392
1596
—
796

Ans. 2 cu. yds., 4 cu. ft., $1392\frac{796}{798}$ cu. in.

(10)

£ s. d.
74) 37 3 1
20
74) 743 (10*s.*
740
3
12
74) 37 (0*d.*
4
74) 148 (2*q.*
148

Ans. 10*s.* 0½*d.*

(11)

tuns. gals.
102) 266 33 (2 tuns.
204
62
2
124 (1 pipe.
102
22
2
44 (0 hhd.
63
165
264
2805 (27 gals.
204
765
714
51
4
204 (2qt.
204

Ans. 2 tuns, 1 pipe, 27 gals., 2 qts.

(12)

£ s. d.
6352) 492710 1 8 (£77
44464
48070
44464
3606
20
6352) 72121 (11*s.*
69872
2249
12
6352) 26996 (4*d.*
25408
1588
4
6352) 6352 (1*q.*
6352

Ans. £77 11*s.* 4½*d.*

(13)

217) $61411 ($283
434
1801
1736
651
651

Ans. $283

(14)

2737) £1746
20
2737) 34920 (12*s.*
32844
2076
12
2737) 24912 (9*d.*
24633
279

Ans. 12*s.* $9\frac{279}{2737}$*d.*

(15)

£ *s.* *d.*
9416) 130264 9 6 (£13
9416
36104
28248
7856
20
9416) 157129 (16*s.*
9416
62969
56496
6473
12
9416) 77682 (8*d.*
75328
2354
4
9416) 9416 (1*q.*
9416

Ans. £13 6*s.* $8\frac{1}{4}$*d.*

(16)

cwt. lbs.
75) 1283 4 (17 cwt.
75
533
525
8
100
804 (10 lbs.
750
54
16
864 11 oz.
825
39
16
624 (8 drs.
600
24

cwt. lbs. oz. dwt.
Ans. 17 10 11 $8\frac{24}{75}$

(17)

cwt. qrs. lbs.
53) 178 3 14 (3 cwt.
159
19
4
53) 79 (1 qr.
53
26
25
144
52
664 (12 lbs.
636
28
16
448
448 (8 oz.
424
24
16
384 ($7\frac{13}{53}$ drs.
371
13

cwt. qrs. lbs. oz. drs.
Ans. 3 1 12 8 $7\frac{13}{53}$

(18)

mo. d.
26) 206 4 (7 mo.
182

24
28

196
48
---
26) 676 (26d.
52

156
156

Ans. 7 mo., 26 d.

(19)

d. h. m.
47) 684 8 9 (14d.
47

214
188

26
24

112
52
---
47) 632 (13 h.
47

162
141

21
60
---
47) 1269 (27 m.
94

329
329

Ans. 14 d., 13 h., 27 m.

(20)

cwt. lbs. oz.
456) 15 27 11
4
---
60 qrs.
28

507
120
---
456) 1707 (3 lbs.
1368

339
16

2045
339
---
456) 5435 (11 oz.
5016

419
16

2514

2514
419
---
456) 6704 (14 drs.
456

2144
1824

320

$\therefore$ since $\frac{320}{456}=\frac{40}{57}$,

Ans. = 3 lbs., 11 oz., $14\frac{40}{57}$ drs.

(21)

cwt.
963) 76
100

7600 (7 lbs.
6741

859
16

13744 (14 oz.
963

4114
3852

262
16

4192 (4
3852

340

Ans. 7 lbs., 4 oz., $4\frac{340}{963}$ drs.

(22)

ac. r. po.
26) 75 3 39 (2 ac.
52
—
23
4
—
26) 95 (3 ro.
78
—
17
40
—
26) 719 (27 p.
52
—
199
182
—
17
$30\frac{1}{4}$
—
510
$4\frac{1}{4}$
—
26) $514\frac{1}{4}$ (19 sq. yds.
26
—
$254\frac{1}{4}$
234
—
$20\frac{1}{4}$
9
—
26) $182\frac{1}{4}$ (7 sq. ft.
182
—
$\frac{1}{4}$
144
—
26) 36 1 sq. in.
26
—
10

ac. r. p. sq. yds. sq. ft., sq. in.
Ans. 2 3 27 19 7 $1\frac{5}{13}$

(24)

yds. qrs. na.
903) 91 2 1
4
—
366
4
—
903) 1465 (1 na.
903
—
562
Ans. $1\frac{562}{903}$ na.

(25)

qrs. bu. pks.
107) 97 3 3
8
—
107) 779 (7 bus.
749
—
30
4
—
107) 123 (1 pk.
107
—
16
Ans. 7 bus., $1\frac{16}{107}$ pk.

(26)

637) 455455 ($715
4459
—
955
637
—
3185
3185
—
Ans. $715.

(23)

ac. r.
147) 13 1
4
—
53 r.
40
—
147) 2120 (14 p.
147
—
650
588
—
62
$30\frac{1}{4}$
—
1860
$15\frac{1}{2}$
—
147) $1875\frac{1}{2}$ (12 s. yd.
1764
—
$111\frac{1}{2}$
9
—
147) $1003\frac{1}{2}$ (6 sq. ft
882
—
$121\frac{1}{2}$
144
—
484
484
121
72
—
147) 17496 (119 s. in.
147
—
279
147
—
1326
1323
—
3

Ans. 14 po., 12 sq. yds., 6 sq. ft. $119\frac{1}{4\frac{1}{9}}$ sq. in.

Ex. XIII. (p. 71.)

(1)

s.	*d.*
1	4½
12	
16	
2	
33	

£	*s.*	*d.*
2	12	3
20		
52		
12		
627		
2		
1254		

33 { 3 | 1254 ; 11 | 418

Ans. 38

(2)

£	*s.*	*d.*
2	8	7¾
20		
48		
12		
583		
4		
2335		

£	*s.*	*d.*
55	18	10½
20		
1118		
12		
13426		
4		

2335) 53705 (23 *Ans.*
4670
7005
7005

(3)

£	*s.*	*d.*
1	10	6¼
20		
30		
12		
366		
4		
1465		

£	*s.*	*d.*
160	4	8¼
20		
3204		
12		
38456		
4		

1465) 153825 (105 *Ans.*
1465
7325
7325

(4)

£	*s.*	*d.*
2	11	5¼
20		
51		
12		
617		
4		
2469		

£	*s.*	*d.*
401	4	3
20		
8024		
12		
96291		
4		

2469) 385164 (156 *Ans.*
2469
13826
12345
14814
14814

(5)

cwt.	qrs.	lbs.
1	2	17
4		
6		
25		
167		

cwt.	qrs.	lbs.
44	2	11
4		
178		
25		
901		
356		
4461		

167) 4461 ($26\frac{119}{169}$ *Ans.*
334
1121
1002
119

(6)

yds.	qrs.	na.
7	2	1
4		
30		
4		
121		

yds.	qr.
272	1
4	
1089	
4	

121) 4356 (36 *Ans.*
363
726
726

(7)

bus.	pks.
143	3
4	
575	

bus.	pks.
9487	2
4	

575) 37950 (66 *Ans.*
3450
3450
3450

(8)

ac.	ro.	po.
4	3	27
4		
19		
40		
787		

ac.	ro.	po.
1416	2	16
4		
5666		
40		

787) 226656 (288 *Ans.*
1574
6925
6296
6296
6296

(9)

fur.	yds.	ft.	in.
7	87	1	5
220			
1627			
3			
4882			
12			
58589			

lea.	mi.	yds.
57	1	956
3		
172		
1760		
10320		
1204		
172		
956		
303676		
3		
911028		
12		

58589) 10932336 (186
58589
507343
468712
386316
351534
34782

$\therefore$ *Ans.* $= 186\frac{34782}{58589}$.

MISCELLANEOUS EXAMPLES.

Ex. XVI. (p. 77).

I.

(1)

27 cwt., 2 qrs., 2 lbs. = 2752 lbs.; ∴ no. of parcels = $\frac{2752}{8}$ = 344.

(3)

13750
912

27500
13750
123750

$125400

(4)

Gain on 1 yard = $1.66 − $1.27 = 39 cents; whole gain =

1763
39

15867
5289

$687.57

(5)

£14 × 52 = £728 year's income.
£128.10 × 4 = £514 year's expenses.

214 saving each year.
8

£1712 *Ans.*

(6)

250) 45000 (180
250

2000
2000

∴ No. of gallons of water added = 180 − 126 = 54.

II.

(1)

	£	s.	d.
49 × 7 × 7	1844	2	8½
	263	8	11½
	37	12	8½

(2)

9) $32324.58

3591.62 val. f.
8

$28732.96 val. h.

(3)

cub. in.
12 | 4203239040
12 | 350269920
12 | 29189160
1728
3 | 2432430 cu. ft.
9 | 810810
27
90090 cub. yds.

also 1 load = 2560 pints, and 2560 pints × 7000 = 17920000 grains.

(4)

	£	s.	d.
5	3	13	9
		14	9

	s.	d.		£	s.	d.
therefore	14	9 × 3 =	2	4	3	
	14	9 × 2 =	1	9	6	

(5)

pipes. galls. galls. quarts. doz. doz.

$\frac{2}{3}$ of $2 = \frac{4 \times 126}{3} = 4 \times 42 = 4 \times 42 \times 4 = \frac{4 \times 42 \times 4}{12} = 56,$

pipes. galls. pts. doz. doz. doz.

and $\frac{1}{3}$ of $2 = 2 \times 42 = 2 \times 42 \times 8 = \frac{2 \times 42 \times 8}{12} = 7 \times 8 = 56.$

(6)

£ s.
10 8
20
---
52) 208 (4*s.*
208

∴ 4*s.* × 7 = 28*s.* *Ans.*

III.

(1)

lbs. av.
56
7000

24	6	392000—2	8 grs.
	4	65333—1	
	2,0	1633,3—13 dwts.	
	12	816	
		68	

lbs. dwts. grs.
Ans. 68 13 8

(2)

56	8	$7535.36
	7	941.92
		134.56 cost of one [piece

$\frac{\$134.56}{1.16} = 116$ yards.

(3)

$6\frac{1}{2}d. + 1\frac{1}{4}d. = 7\frac{3}{4}d.$ whole cost per lb.
$7\frac{3}{4}d \times 100 = £3\ 4s.\ 7d.$ cost per cwt.;
∴ £4 10*s.* − £3 4*s.* 7*d.* = £1 5*s.* 5*d.* *Ans.*

(5)

Reckoning 365 days in 1851, we find his expenses were \$2847, and therefore his income was \$2847+\$1411.56=\$4258.56.

(6)

If the first person has 1 share
the second person must have 2 shares,
the third person must have 6 shares,
the fourth person must have 24 shares;
therefore, dividing the whole into (24+6+2+1) or 33
we have $\frac{198}{33}$=6 dollars.
therefore, 6, 12, 36, 144 are the numbers.

IV.

(2)

1st case $\frac{12}{11}$ is selling price of a stamp.

2d case $\frac{13}{12}$ is selling price of a stamp.

∴ gain in first case × 11=gain in 2d case × 12.

(3)

$$\text{Value of each}=\frac{s.\ 95\times 20}{100}=\frac{s.\ 95}{5}=s.\ 19.$$

(5)

$\frac{20864}{128}$=163 gallons bought.

$\frac{25920}{180}$=144 gallons sold.

∴ 163−144=19 gallons leaked.

(6)

ac.	ro.
24	0
17	3
6	1
4	
25 ro.	
40	
1000 po.	

(7)

dys. hrs. hrs.
365 6=8766

8766
1851
8766
43830
70128
8766
16225866 hours.

V.

(2)

miles. barleycorns. barleycorns.
$25000 = (25000 \times 1760 \times 3 \times 12 \times 3) = 4752000000.$

(3)

$86 \times 12 = 1032$ cents, cost of one dozen.
$\therefore \frac{41520}{1032} = 40\frac{10}{43}$ dozen.

(4)

It makes $2\frac{1}{2}$ vibrations in one second;
therefore, in 24 hours it makes $24 \times 60 \times 60 \times 2\frac{1}{2} = 216000$ vibrations.

(5)

247) $859.56 ($3.48
741
1185
988
1976
1976

(6)

£	c.	m.		£	f.	c.	m.
(23	4	6)	× 12 =	276	5	5	2
(18	0	1)	× 6 =	108	0	0	6
			amount =	384	5	5	8

therefore, $3.48 = price per gallon with duty.

6 | $3.48

.58 duty per gall.

VI.

(1)

£ *s.* *d.*
2793461) 130524465 4 6 (£46
11173844
18786025
16760766
2025259
20
2793461) 40505184 (14*s.*
2793461
12570574

12570574
11173844
1396730
12
2793461) 16760766 (6*d.*
16760766

Ans. £46 14*s.* 6*d.*

(2)

1 mi., 467 yds., 1 ft.=6682 ft., and $\frac{6682}{514}$=13 ft.=4 yds., 1 ft.

(3)

Half a ton=1000 lbs.;
∴ (1000 × 11 cents=11000 cents;
∴ he gains 10−$90=$20.

(4)

galls.	s.	£	s.	d.
10	cost 10×12 =	6	0	0
15	" 15×14½=	10	17	6
18	" 18×15¾=	14	3	6
43		31	1	0
		2	5	6
		33	6	6

∴ he must sell the mixture at rate of $\frac{£33\ 6s.\ 6d.}{43}$ =15s. 6d.

(5)

By the question, 16 women's shares=48 children's,
12 men's shares =72 children's;
therefore we may take the money to be divided among (30+48+72) children=150 children.
Now $198÷150=$1.32, child's share;
∴ $1.32×3=$3.96, woman's share,
$1.32×6=$7.92, man's share.

(6)

£2 2s.+£1 1s.+14s.=£3 17s.=77s., £1636 5s.=32725s.;
therefore, he will have $\frac{32725}{77}=\frac{4675}{11}$=325 qrs. of each.

VII.

(1)

1852, 1856, 1860 being leap years,
number of days in the 10 years=(10×365+3) days=3653 days;
∴ (3653×24×60) min.=(87672×60) min.=5260320 minutes.

(2)

27

	tons.	cwt.	qrs.	lbs.
3	425	15	2	12
9	141	18	2	4
	15	15	1	14⅓

28

	mi.	fur.	po.
4	1361	4	28
7	340	3	7
	48	5	1

(3)

110 yards are contained 16 times in 1760 yards;
$\therefore 5 \times 16 = 80$ feet $= 26\frac{2}{3}$ yards.

(4)

Number of seconds $= \frac{200000000000000}{192000}$;

therefore, number of days $= \frac{200000000000}{192 \times 60 \times 60 \times 24} = \frac{200000000}{192 \times 6 \times 6 \times 24}$
$= \frac{25000000}{192 \times 6 \times 6 \times 3} = \frac{6250000}{192 \times 27} = \frac{781250}{24 \times 27} = \frac{390625}{12 \times 27} = \frac{390625}{324}$
$= 1205\frac{205}{324}$.

(5)

$\$480.60 \div 45 = \$10.68$, share of each.
$\$10.68 \times 20 = \$213.60$, share of 20.
$\$480.60 - \$213.60 = \$267$ to be divided among 15;
$\$267 \div 13 = \$17.80$, share of each.

(6)

$60480 share of third son.
7560

68040 share of second son.
24000

92040 share of eldest son;
$60480 + $68040 + $92040 = $220560, sum left by the father.

VIII.

(2)

ton	cwt.	qr.	lbs.
1	3	1	= 2325

315) 2325 (7
2205

120
16

1920 (6
1890

30
16

480 (0

Ans. 7 lbs., 6 oz., $\frac{4}{7}$ drs.

(3)

s.
7000 per hour.
9

63000 per day.
67

441000
378000

2,0) 422100,0

£211050 in 67 days.

(4)

In 1852 there were 366 days.
Now $\$9.63 \times 366 = \$3524.58$;
$\therefore \$3524.58 + \$200 = \$3724.58$, his income.

(5)

(1)

£	f.	c.	m.
896	5	4	7
391	5	3	8
23	0	9	6
£1311	1	8	1

(2)

£	f.	c.	m.
896	5	4	7
391	5	3	8
£505	0	0	9

(3)

mills.
23096
248

184768
92384
46192

5727808 = £5727, 8 f., 0 c., 8 m.

(6)

$\frac{1}{5}$ of £90 = £72, sum the house is rated at. Now upon each £ I pay in the course of the year
$(9+10+14+8+19)d. = 60d.$;
$\therefore (72 \times 60)d. = 6 \times 60)s. =$ £18 amount of rates;
$\therefore$ £90 + £18 = £108, whole cost of house.

IX.

(1)

In the year 1851 he had lived 171 days. Now between Jan. 1, 1770, and June 1, 1851, he had lived, since 1800 was not a leap year,

$(365 \times 62 + 366 \times 19 + 171)$ days = 29755 days.
Now (30000 − 29755) days = 245 days.
and reckoning back from Jan. 1, 1770, we find that the day required was May 1, 1769.

(2)

100 miles=(100 × 1760 × 3) feet=528000 feet;

$\therefore \frac{528000}{10}$=52800 revolutions of fore-wheel,

$\frac{528000}{16}$=33000 revolutions of hind-wheel,

52800
33000
19800 *Ans.*

(3)

$4\frac{1}{2}$ miles=($4\frac{1}{2}$ × 1760 × 3) feet,=23760 feet,

1142) 23760 (20
2284
920

$\therefore 20\frac{920}{1142}=20\frac{460}{571}$ number of seconds required.

(4)

1+2+3+4+5+6+7+8+9+10+11+12=78,

$\therefore$ 2 × 78=156 strikes in 24 hours;

also (1+2+3+4) × 24=10 × 24=240 chimes in 24 hours;

$\therefore$ (156+240) × 365=396 × 365=144540 times in all.

(5)

16 mi.=(16 × 1760 × 3) ft.=84480 ft.,

(110 × $3\frac{1}{2}$) ft.=$\frac{550}{2}$ ft.=275 ft. he walks per minute.

also $\frac{84480}{275}=\frac{16896}{55}=\frac{1536}{5}=307\frac{1}{5}$;

therefore it takes $307\frac{1}{5}$ minntes, or 5 hrs., 7 min., 12 sec. to walk the distance.

(6)

The men work 55 hours in the week, the boys work 77 hours in the week;

$\therefore$ (55 × 6)*d.*=330*d.*=wages received by each man weekly,

(330 × 60)*d.*=19800*d.*=wages of all the men weekly,

also (77 × 2 × 45)*d.*=6930*d.*=wages of the boys weekly;

$\therefore$ (19800+6930)*d.*=26730*d.* total of weekly wages;

$\therefore \frac{26730 \times 52}{12}$*s.*=(8910 × 13)*s.*=115830*s.*=£5791 10*s.* annual wages.

X.

(1)

2 oz., 16 dwts.=56 dwts.
100 oz., 16 dwts.=2016 dwts.

therefore number of spoons$=\frac{2016}{56}=\frac{252}{7}=36.$

(2)

	£	s.	
135 guin.=	1227	15	yield of estate for 5 years,
	141	15	what he lays by.
	£1086	0	what he may spend in 5 years.

Now 1848 was a leap year, therefore, in the 5 years there were
(365+366+365+365+365) days=1826 days.

and $\frac{1086}{1826}$ £$=\frac{543}{913}$£$=11s.\ 10\frac{1}{2}d.\ \frac{870}{913}q.$ what he may spend daily.

(3)

19 years$=(19\times365\frac{1}{4})$ days$=\frac{19\times365\frac{1}{4}}{29\frac{1}{2}}$ lunar months.

$$=\frac{19\times1461}{59}=\frac{27759}{59\times2}=235\tfrac{29}{118}.$$

(4)

I talent=219000 grs.$=\frac{219000}{24\times20}$oz.;

therefore value of a talent$=\frac{219000\times120}{24\times20\times100}$\$=\$547.50.

(5)

$\$1.27\times56=\$71.12,$
also $\$266.88+\$17.04=\$283.92,$
$\therefore\ \$283.92-\$71.12=\$212.80,$ the price for which he has to sell the remainder.

Now he had (7×27) yds.$=189$ yds. at first;
therefore, he has $(189=56)$ yds.$=133$ yds. to sell,
the price of each yard will then be
$\$212.80\div133=\$1.60.$

(6)

18 times the number of men=number of pence the men earned.
20 times the number of men=number of pence the women earned.
24 times the number of men=number of pence the boys earned.

$\therefore$ 62 times the number of men = number of pence earned by all;

also (£7 15*s.*) $\div$ 5 = £1 11*s.* = (31 $\times$ 12)*d.*,

therefore, number of men $= \frac{31 \times 12}{62} = \frac{12}{2} = 6$;

therefore, number of woman $= 6 \times 2 = 12$,

and number of boys $= 6 \times 3 = 18$.

GREATEST COMMON MEASURE.

Ex. XVII. (p. 84.)

(1)

16) 72 (4
64
—
8) 16 (2
16
—

$\therefore$ 8 is G. C. M.

(2)

30) 75 (2
60
—
15) 30 (2
30
—

$\therefore$ 15 is G. C. M.

(3)

63) 99 (1
63
—
36) 63 (1
36
—
27) 36 (1
27
—
9) 27 (3
27
—

$\therefore$ 9 is G. C. M.

(4)

55) 121 (2
110
—
11) 55 (5
55
—

$\therefore$ 11 is G. C. M.

(5)

128) 324 (2
256
—
68) 128 (1
68
—
60) 68 (1
60
—
8) 60 (7
56
—
4) 8 (2
8
—

$\therefore$ 4 is G. C. M.

(6)

120) 320 (2
240
—
80) 120 (1
80
—
40) 80 (2
80
—

$\therefore$ 40 is G. C. M.

(7)

272) 425 (1
272
153) 272 (1
153
119) 153 (1
119
34) 119 (3
102
17) 34 (2
34

∴ 17 is G. C. M.

(8)

394) 672 (1
394
278) 394 (1
278
116) 278 (2
232
46) 116 (2
92
24) 46 (1
24
22) 24 (1
22
2) 22 (11
22

∴ 2 is G. C. M.

(9)

720) 860 (1
720
140) 720 (5
700
20) 140 (7
140

∴ 20 is G. C. M.

(10)

825) 960 (1
825
135) 825 (6
810
15) 135 (9
135

∴ 15 is G. C. M.

(11)

775) 1800 (2
1550
250) 775 (3
750
25) 250 (10
250

∴ 25 is G. C. M.

(12)

856) 963 (1
856
80) 856 (10
80
56) 80 (1
56
24) 56 (2
48
8) 24 (3
24

∴ 8 is G. C. M.

(13)

176) 1000 (5
880
—
120) 176 (1
120
—
56) 120 (2
112
—
8) 56 (7
56
—

∴ 8 is G. C. M.

(14)

1236) 1632 (1
1236
—
396) 1236 (3
1188
—
48) 396 (8
384
—
12) 48 (4
48
—

∴ 12 is G. C. M.

(15)

6409) 7395 (1
6409
—
986) 6409 (6
5916
—
493) 986 (2
986
—

∴ 493 is G. C. M.

(16)

689) 1573 (2
1378
—
195) 689 (3
585
—
104) 195 (1
104
—
91) 104 (1
91
—
13) 91) 7
91
—

∴ 13 it G. C. M.

(17)

1729) 5850 (3
5187
—
663) 1729 (2
1326
—
403) 663 (1
403
—
260) 403 (1
260
—
143) 260 (1
143
—
117) 143 (1
117
—
26) 117 (4
104
—
13) 26 (2
26
—

∴ 13 is G. C. M.

(18)

5210) 5718 (1
5210
---
508) 5210 (10
508
---
130) 508 (3
390
---
118) 130 (1
118
---
12) 118 (9
108
---
10) 12 (1
10
---
2) 10 (5
10

∴ 2 is G. C. M.

(19)

2023) 7581 (3
6069

1512) 2023 (1
1512
---
511) 1512 (2
1022
---
490) 511 (1
490
---
21) 490 (23
42

70
63
---
7) 21 (3
21

∴ 7 is G. C. M.

(20)

468) 1266 (2
936
---
330) 468 (1
330
---
138) 330 (2
276
---
54) 138 (2
108
---
30) 54 (1
30
---
24) 30 (1
24
---
6) 24 (4
24

∴ 6 is G. C. M.

(21)

2484) 2628 (1
2484
---
144) 2484 (17
144

1044
1008
---
36) 144 (4
144

∴ 36 is G. C. M.

(22)

2268) 3444 (1
2268
1176) 2268 (1
1176
1092) 1176 (1
1092
84) 1092 (13
84
252
252

∴ 84 is G. C. M.

(23)

5544) 6552 (1
5544
1008) 5544 (5
5040
504) 1008 (2
1008

∴ 504 is G. C. M.

(24)

2573) 4067 (1
2573
1494) 2573 (1
1494
1079) 1494 (1
1079
415) 1079 (2
830
249) 415 (1
249
166) 249 (1
166
83) 166 (2
166

∴ 83 is G. C. M.

(25)

10395) 16819 (1
10395
6424) 10395 (1
6424
3971) 6424 (1
3971
2453) 3971 (1
2435
1518) 2435 (1
1518
935) 1518 (1
935
583) 935 (1
583
352) 583 (1
352
231) 352 (1
231
121) 231 (1
121
110) 121 (1
110
11) 110 (10
110

∴ 11 is G. C. M.

(26)
80934) 110331 (1
80934
29397) 80934 (2
58794
22140) 29397 (1
22140
7257) 22140 (2
21771
369) 7257 (19
369
3567
3321
246) 369 (1
246
123) 246 (2
246
∴ 123 is G. C. M.

(27)
1242) 2323 (1
1242
1081) 1242 (1
1081
161) 1081 (6
966
115) 161 (1
115
46) 115 (2
92
23) 46 (2
46
∴ 23 is G. C. M.

(28)
13536) 23148 (1
13536
9612) 13536 (1
9612
3924) 9612 (2
7848
1764) 3924 (2
3528
396) 1764 (4
1584
180) 396 (2
360
36) 180 (5
180
∴ 36 is G. C .M.

(29)

42237) 75582 (1
42237
33345) 42237 (1
33345
8892) 33345 (3
26676
6669) 8892 (1
6669
2223) 6669 (3
6669

∴ 2223 is G. C. M.

(30)

285714) 999999 (3
857142
142857) 285714 (2
285714

∴ 142857 is G. C. M.

(31)

10353) 14877 (1
10353
4524) 10353 (2
9048
1305) 4524 (3
3915
609) 1305 (2
1218
87) 609 (7
609

∴ 87 is G. C. M.

(32)

30599) 271469 (8
244792
26677) 30599 (1
26677
3922) 26677 (6
23532
3145) 3922 (1
3145
777) 3145 (4
3108
37) 777 (21
74
37
37

∴ 37 is G. C. M.

(33)

14) 18 (1
14
—
4) 14 (3
12
—
2) 4 (2
4

∴ 2 is G. C. M. of 14 and 18.

2) 24 (12
24
—

. 2 is G. C. M. required.

(34)

16) 24 (1
16
—
8) 16 (2
16
—

∴ 8 is G. C. M. of 16 and 24.

8) 74 (9
72
—
2) 8 (4
8
—

∴ 2 is G. C. M. required.

8) 48 (6
48
—

∴ is G. C. M. of 16, 24 and 48.

(35)

13) 52 (4
52

∴ 13 is G. C. M. of 13 and 52.

13) 78 (6
78
—

∴ 13 is G. C. M. required

13) 416 (32
39
—
26
26
—

∴ 13 is G. C. M. of 13, 52 and 416.

(36)

837) 1134 (1
837
—
297) 837 (2
594
—
243) 297 (1
243
—
54) 243 (4
216
—
27) 54 (2
54
—

∴ 27 is G. C. M. of 837 and 1134.

27) 1347 (49
108
—
267
243
—
24) 27 (1
24
—
3) 24 (8
24
—

∴ 3 is G. C. M. required.

(37)

805) 1311 (1
805
506) 805 (1
506
299) 506 (1
299
207) 299 (1
207
92) 207 (2
184
23) 92 (4
92

∴ 23 is G. C. M. of 805 and 1311. —

23) 1978 (86
184
138
138

∴ 23 is G. C. M. required.

(38)

28) 84 (3
84

∴ 28 is G. C. M. of 28 and 84.

28) 154 (5
140
14) 28 (2
28

14 is G. C. M. of 28, 84 and 154.

14) 343 (24
28
63
56
7) 14 (2
14

∴ 7 is G. C. M. required.

(39)

504) 5292 (10
504
252) 504 (2
504

∴ 252 is G. C. M. of 504 and 5292.

252) 1520 (6
1512
8) 252 (31
24
12
8
4) 8 (2
8

∴ 4 is G. C. M. required. —

$$
\begin{array}{r}
\quad (40) \\
396\,)\,5184\,(\,13 \\
\quad 396 \\
\hline
\quad 1224 \\
\quad 1188 \\
\hline
\quad 36\,)\,396\,(\,11 \\
\quad\quad 36 \\
\hline
\quad\quad 36 \\
\quad\quad 36 \\
\hline
\end{array}
$$

$\therefore$ 36 is G. C. M. of 396 and 5184.

$$
\begin{array}{r}
36\,)\,6914\,(\,192 \\
\quad 36 \\
\hline
\quad 331 \\
\quad 324 \\
\hline
\quad\quad 74 \\
\quad\quad 72 \\
\hline
\quad\quad\quad 2\,)\,36\,(\,18 \\
\quad\quad\quad\quad 36 \\
\hline
\end{array}
$$

$\therefore$ 2 is G. C. M. required.

LEAST COMMON MULTIPLE.

Ex. XVIII. (p. 88.)

$$
\begin{array}{r}
\quad (1) \\
16\,)\,24\,(\,1 \\
\quad 16 \\
\hline
\quad\quad 8\,)\,16\,(\,2 \\
\quad\quad\quad 16 \\
\hline
\end{array}
$$

$\therefore$ 8 is the G. C. M. of 16 and 24;

$$\therefore \text{L. C. M.} = \frac{16 \times 24}{8} = \frac{384}{8} = 48.$$

$$
\begin{array}{r}
\quad\quad (2) \\
36\,)\,75\,(\,2 \\
\quad 72 \\
\hline
\quad\quad 3\,)\,36\,(\,12 \\
\quad\quad\quad 36 \\
\hline
\end{array}
$$

$\therefore$ 3 is the G. C. M. of 36 and 75

$$\therefore \text{L. C. M.} = \frac{36 \times 75}{3} = \frac{2700}{3} = 900.$$

$$
\begin{array}{r}
\quad (3) \\
7\,)\,15\,(\,2 \\
\quad 14 \\
\hline
\quad\quad 1\,)\,7\,(\,7 \\
\quad\quad\quad 7 \\
\hline
\end{array}
$$

$\therefore$ 1 is the G. C. M. of 7 and 15.

$$\therefore \text{L. C. M.} = \frac{7 \times 15}{1} = 105.$$

(4)
28) 35 (1
28
—
7) 28 (4
28
—

$\therefore$ 7 is the G. C. M. of 28 and 35;

$\therefore$ L. C. M. $= \frac{28 \times 35}{7} = \frac{980}{7} = 140.$

(5)
319) 407 (1
319
—
88) 319 (3
264
—
55) 88 (1
55
—
33) 55 (1
33
—
22) 33 (1
22
—
11) 22 (2
22
—

$\therefore$ 11 is the G. C. M. of 319 and 407;

$\therefore$ L. C. M. $= \frac{319 \times 407}{11} = \frac{129833}{11} = 11803.$

(6)
333) 504 (1
333
—
171) 333 (1
171
—
162) 171 (1
162
—
9) 162 (18
9
—
72
72
—

$\therefore$ 9 is the G. C. M. of 333 and 504;

$\therefore$ L. C. M. $= \frac{333 \times 504}{9} = \frac{167832}{9}$

$= 18648.$

(7)
799) 2961 (3
2397
564) 799 (1
564
235) 564 (2
470
94) 235 (2
188
47) 94 (2
94

∴ 47 is the G. C. M. of 2961 and 799;

∴ L. C. M. $=\frac{2961 \times 796}{47}=\frac{2365839}{47}=50337.$

(8)
7568) 9504 (1
7568
1936) 7568 (3
5808
1760) 1936 (1
1760
176) 1760 (10
1760

∴ 176 is the G. C. M. of 7568 and 9504;

∴ L. C. M. $=\frac{7568 \times 9504}{176}=\frac{71926272}{176}=408672.$

(9)
4662) 5476 (1
4662
814) 4662 (5
4070
592) 814 (1
592
222) 592 (2
444
148) 222 (1
148
74) 148 (2
148

∴ 74 is the G. C. M. of 4662 and 5476;

∴ L. C. M. $=\frac{4662 \times 5476}{74}=\frac{25529112}{74}=344988.$

(10)
6327) 23997 (3
18981
5016) 6327 (1
5016
1311) 5016 (3
3933
1083) 1311 (1
1083
228) 1083 (4
912
171) 228 (1
171
57) 171 (3
171

∴ 57 is the G. C. M. 6327 and 23997;

∴ L. C. M. $= \frac{6327 \times 23997}{57} = \frac{151829019}{57} = 2663667.$

(11)
5415) 30105 (5
27075
3030) 5415 (1
3030
2385) 3030 (1
2385
645) 2385 (3
1935
450) 645 (1
450
195) 450 (2
390
60) 195 (3
180
15) 60 (4
60

∴ 15 is the G. C. M. of 5415 and 30105;

∴ L. C. M. $= \frac{5415 \times 30105}{15} = \frac{163018575}{15} = 10867905.$

(12)

$$
\begin{array}{r|l}
15863 & 21489 \\
 & 15863 \\
\hline
 & 5626 \\
\end{array}
\qquad
\begin{array}{r|l}
5626 & 15863 \\
 & 11252 \\
\hline
 & 4611 \\
\end{array}
\qquad
\begin{array}{r|l}
4611 & 5626 \\
 & 4611 \\
\hline
 & 1015 \\
\end{array}
\qquad
\begin{array}{r|l}
1015 & 4611 \\
 & 4060 \\
\hline
 & 551 \\
\end{array}
\qquad
\begin{array}{r|l}
551 & 1015 \\
 & 551 \\
\hline
 & 464 \\
\end{array}
\qquad
\begin{array}{r|l}
464 & 551 \\
 & 461 \\
\hline
 & 87 \\
\end{array}
\qquad
\begin{array}{r|l}
87 & 464 \\
 & 435 \\
\hline
 & 29 \\
\end{array}
\qquad
\begin{array}{r|l}
29 & 87 \\
 & 87 \\
\hline
 & \\
\end{array}
$$

$\therefore$ 29 is the G. C. M. of 15863 and 21489;

$\therefore$ L. C. M. $= \frac{15863 \times 21489}{29} = \frac{340880207}{29}$

$= 11754483.$

(13)

2	12,	8,	9
2	6,	4,	9
3	3,	2,	9
	1,	2,	3

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 2 \times 3 = 72.$

(14)

2	8,	12,	16
2	4,	6,	8
2	2,	3,	4
	1,	3,	2

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 3 \times 2 = 48.$

(15)

2	6,	10,	15
3	3,	5,	15
5	1,	5,	5
	1,	1,	1

$\therefore$ L. C. M. $= 2 \times 3 \times 5 = 30.$

(16)

2	8,	12,	20
2	4,	6,	10
	2,	3,	5

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 3 \times 5 = 120.$

(17)

3	27, 24, 15
	9, 8, 5

$\therefore$ L. C. M. $= 3 \times 9 \times 8 \times 5 = 1080$.

(18)

2	12, 51, 68
2	6, 51, 34
3	3, 51, 17
17	1, 17, 17
	1, 1, 1

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 17 = 204$.

(19)

19	19, 29, 38
	1, 29, 2

$\therefore$ L. C. M. $= 19 \times 29 \times 2 = 1102$.

(20)

2	24, 48, 64, 192
2	12, 24, 32, 96
2	6, 12, 16, 48
2	3, 6, 8, 24
2	3, 3, 4, 12
2	3, 3, 2, 6
3	3, 3, 1, 3
	1, 1, 1, 1

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 192$.

(21)

2	63, 12, 84, 14
2	63, 6, 42, 7
3	63, 3, 21, 7
7	21, 1, 7, 7
	3, 1, 1, 1

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 7 \times 3 = 252$.

(22)

3	5, 7, 9, 11, 15
5	5, 7, 3, 11, 5
	1, 7, 3, 11, 1

$\therefore$ L. C. M. $= 3 \times 5 \times 7 \times 3 \times 11 = 3465$.

(23)

2	6, 15, 24, 25
3	3, 15, 12, 25
5	1, 5, 4, 25
	1, 1, 4, 5

$\therefore$ L. C. M. $= 2 \times 3 \times 5 \times 4 \times 5 = 600$.

(24)

2	12, 18, 30, 48, 60
2	6, 9, 15, 24, 30
3	3, 9, 15, 12, 15
5	1, 3, 5, 4, 5
	1, 3, 1, 4, 1

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 5 \times 3 \times 4 = 720$.

(25)

3	15, 35, 63, 72
3	5, 35, 21, 24
5	5, 35, 7, 8
7	1, 7, 7, 8
	1, 1, 1, 8

$\therefore$ L. C. M. $= 3 \times 3 \times 5 \times 7 \times 8 = 2520$.

(26)

2	9, 12, 14, 210
3	9, 6, 7, 105
7	3, 2, 7, 35
	3, 2, 1, 5

$\therefore$ L. C. M. $= 2 \times 3 \times 7 \times 3 \times 2 \times 5$ 1260.

(27)

2	54, 81, 63, 14
3	27, 81, 63, 7
3	9, 27, 21, 7
3	3, 9, 7, 7
7	1, 3, 7, 7
	1, 3, 1, 1

$\therefore$ L. C. M. $= 2 \times 3 \times 3 \times 3 \times 7 \times 3 = 1134$.

(28)

2	24, 10, 32, 45, 25
2	12, 5, 16, 45, 25
2	6, 5, 8, 45, 25
3	3, 5, 4, 45, 25
5	1, 5, 4, 15, 25
	1, 1, 4, 3, 5

$\therefore$ L. C. M. $= 2 \times 2 \times 2 \times 3 \times 5 \times 4 \times 3 \times 5 = 7200$.

(29)

2	1, 2, 3, 4, 5, 6, 7, 8, 9
2	1, 1, 3, 2, 5, 3, 7, 4, 9
3	1, 1, 3, 1, 5, 3, 7, 2, 9
	1, 1, 1, 1, 5, 1, 7, 2, 3

$\therefore$ L. C. M. $= 2 \times 2 \times 3 \times 5 \times 7 \times 2 \times 3 = 2520$.

(30)

2	7, 8, 9, 18, 24, 72, 144
2	7, 4, 9, 9, 12, 36, 72
2	7, 2, 9, 9, 6, 18, 36
3	7, 1, 9, 9, 3, 9, 18
3	7, 1, 3, 3, 1, 3, 6
	7, 1, 1, 1, 1, 1, 2

$\therefore$ L. C. M. $= 2\times2\times2\times3\times3\times7\times2 = 1008$.

(31)

2	12, 20, 24, 54, 81, 63, 14
2	6, 10, 12, 27, 81, 63, 7
3	3, 5, [illegible], 27, 81, 63, 7
3	1, 5, 2, 9, 27, 21, 7
3	1, 5, 2, 3, 9, 7, 7
7	1, 5, 2, 1, 3, 7, 7
	1, 5, 2, 1, 3, 1, 1

$\therefore$ L. C. M. $= 2\times2\times3\times3\times3\times7\times5\times2\times3 = 22680$.

(32)

3	225, 255, 289, 1023, 4095
3	75, 85, 289, 341, 1365
5	25, 85, 289, 341, 455
5	5, 17, 289, 341, 91
7	1, 17, 289, 341, 91
13	1, 17, 289, 341, 13
17	1, 17, 289, 341, 1
	1, 1, 17, 341, 1

$\therefore$ L. C. M. $= 3\times3\times5\times5\times7\times13\times17\times17\times341 = 2017790775$.

VULGAR FRACTIONS.

Ex. XXIV. (p. 95.)

NOTE.—In the following Examples, common factors are struck out of numerator and denominator.

(8)

$$\frac{7}{9}\text{ of }12\tfrac{1}{2}\text{ of }\frac{4}{5}\text{ of }\frac{5}{6}\text{ of }\frac{3}{8}\text{ of }9=\frac{7}{9}\text{ of }\frac{25}{2}\text{ of }\frac{4}{5}\text{ of }\frac{5}{6}\text{ of }\frac{3}{8}\text{ of }9$$

$$=\frac{7\times25\times4\times5\times3\times9}{9\times2\times5\times2\times3\times2\times4}=\frac{175}{8}.$$

(9)

$$\frac{5}{18}\text{ of }\frac{7}{3}\text{ of }\frac{36}{10}\text{ of }\frac{9}{4}\text{ of }\frac{3}{10}\text{ of }2\text{ of }\frac{8}{27}=\frac{5\times7\times36\times9\times3\times2\times8}{18\times3\times10\times4\times10\times27}$$
$$=\frac{5\times7\times18\times2\times9\times3\times2\times4\times2}{18\times3\times5\times2\times4\times5\times2\times3\times9}=\frac{14}{15}.$$

(10)

$$\frac{5}{7}\text{ of }\frac{3}{8}\text{ of }\frac{6}{7}\text{ of }70\frac{2}{9}\text{ of }\frac{3}{40}\text{ of }1\frac{7}{11}\text{ of }147$$
$$=\frac{5}{7}\text{ of }\frac{3}{8}\text{ of }\frac{6}{7}\text{ of }\frac{632}{9}\text{ of }\frac{3}{40}\text{ of }\frac{18}{11}\text{ of }147$$
$$=\frac{5\times3\times6\times632\times3\times18\times147}{7\times8\times7\times9\times40\times11}$$
$$=\frac{5\times3\times2\times3\times8\times79\times3\times9\times2\times7\times7\times3}{7\times2\times2\times2\times7\times9\times8\times5\times11}$$
$$=\frac{3\times3\times79\times3\times3}{2\times11}=\frac{6399}{22}.$$

Ex. XXV. (p. 96.)

In each of the following Examples we divide the numerator and denominator by their G. C. M.

Thus in (1) $\frac{4}{8}=\frac{4}{4\times2}=\frac{1}{2}$ (dividing by 4, the G. C. M.);

or, as we shall write it in the following Examples,

$$\frac{4}{8}=\frac{4\div4}{8\div4}=\frac{1}{2}.$$

(13)
$$\frac{825}{2709}=\frac{825\div3}{2709\div3}=\frac{275}{903}.$$

(14)
$$\frac{630}{936}=\frac{630\div18}{936\div18}=\frac{35}{52}.$$

(15)
$$\frac{324}{612}=\frac{324\div36}{612\div36}=\frac{9}{17}.$$

(16)
$$\frac{936}{2368}=\frac{936\div8}{2368\div8}=\frac{117}{296}.$$

(17)
$$\frac{5184}{6912}=\frac{5184\div1728}{6912\div1728}=\frac{3}{4}.$$

(18)
$$\frac{3444}{3556}=\frac{3444\div28}{3556\div28}=\frac{123}{127}.$$

(19)

$$\frac{7845}{96780}=\frac{7845\div15}{96780\div15}=\frac{523}{6452}.$$

(20)

$$\frac{2472}{3264}=\frac{2472\div24}{3264\div24}=\frac{103}{136}.$$

(21)

$$\frac{625}{9000}=\frac{625\div125}{9000\div125}=\frac{5}{72}.$$

(22)

$$\frac{81}{4872}=\frac{81\div3}{4872\div3}=\frac{27}{1624}.$$

(23)

$$\frac{1632}{2976}=\frac{1632\div96}{2976\div96}=\frac{17}{31}.$$

(24)

$$\frac{10265}{14371}=\frac{10265\div2053}{14371\div2053}=\frac{5}{7}.$$

(25)

$$\frac{4301}{95897}=\frac{4301\div17}{95897\div17}=\frac{253}{5641}.$$

(26)

$$\frac{55247}{74841}=\frac{55247\div101}{74841\div101}=\frac{547}{741}.$$

(27)

$$\frac{6093}{9174}=\frac{6093\div3}{9174\div3}=\frac{2031}{3058}.$$

(28)

$$\frac{10812}{22800}=\frac{10812\div12}{22800\div12}=\frac{901}{1900}.$$

(29)

$$\frac{25194}{88179}=\frac{25194\div12597}{88179\div12597}=\frac{2}{7}.$$

(30)

$$\frac{374192}{575680}=\frac{374192\div28784}{575680\div28784}=\frac{13}{20}.$$

(31)

$$\frac{114135}{220661}=\frac{114135\div7609}{220661\div7609}=\frac{15}{29}.$$

(32)

$$\frac{128352}{238368}=\frac{128352\div18336}{238368\div18336}=\frac{7}{13}.$$

Ex. XXVI. (p. 98.)

(1)

$\frac{1}{2}, \frac{2}{3}, \frac{4}{5}$. 30 is the L. C. M. of the denominators;

$\therefore$ fractions become $\frac{1\times15}{2\times15}, \frac{2\times10}{3\times10}, \frac{4\times6}{5\times6}$, or $\frac{15}{30}, \frac{20}{30}, \frac{24}{30}$.

(2)

$\frac{2}{5}, \frac{7}{8}$. 40 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{2\times8}{5\times8}, \frac{7\times5}{8\times5}$, or $\frac{16}{40}, \frac{35}{40}$.

(3)

$\frac{2}{3}, \frac{3}{4}, \frac{5}{6}$. 12 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{2\times4}{3\times4}, \frac{3\times3}{4\times3}, \frac{5\times2}{6\times2}$, or $\frac{8}{12}, \frac{9}{12}, \frac{10}{12}$.

(4)

$\frac{2}{9}, \frac{5}{27}$. 27 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{2\times3}{9\times3}, \frac{5}{27}$, or $\frac{6}{27}, \frac{5}{27}$.

(5)

$\frac{3}{7}, \frac{5}{14}, \frac{11}{28}$. 28 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{3\times4}{7\times4}, \frac{5\times2}{14\times2}, \frac{11}{28}$, or $\frac{12}{28}, \frac{10}{28}, \frac{11}{28}$.

(6)

$\frac{1}{2}, \frac{3}{4}, \frac{5}{9}$. 36 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{1\times18}{2\times18}, \frac{3\times9}{4\times9}, \frac{5\times4}{9\times4}$, or $\frac{18}{36}, \frac{27}{36}, \frac{20}{36}$.

(7)

$\frac{7}{8}, \frac{11}{12}, \frac{17}{18}$. 72 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{7\times9}{8\times9}, \frac{11\times6}{12\times6}, \frac{17\times4}{18\times4}$, or $\frac{63}{72}, \frac{66}{72}, \frac{68}{72}$.

(8)

$\frac{5}{12}, \frac{7}{16}, \frac{13}{24}$. 48 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{5\times4}{12\times4}, \frac{7\times3}{16\times3}, \frac{13\times2}{24\times2}$, or $\frac{20}{48}, \frac{21}{48}, \frac{26}{48}$.

(9)

$\frac{5}{6}, \frac{9}{10}, \frac{14}{15}$. 30 is L. C. M. of denominators;

$\therefore$ fractions become $\frac{5\times5}{6\times5}, \frac{9\times3}{10\times3}, \frac{14\times2}{15\times2}$, or $\frac{25}{30}, \frac{27}{30}, \frac{28}{30}$.

(10)

$\frac{2}{5}, \frac{2}{3}, \frac{5}{9}, \frac{7}{10}$. 90 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{2\times18}{5\times18}, \frac{2\times30}{3\times30}, \frac{5\times10}{9\times10}, \frac{7\times9}{10\times9}, \text{ or } \frac{36}{90}, \frac{60}{90}, \frac{50}{90}, \frac{63}{90}.$$

(11)

$\frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}$. 24 is L. C. M. of denminators;

$\therefore$ fractions become

$$\frac{2\times8}{3\times8}, \frac{3\times6}{4\times6}, \frac{5\times4}{6\times4}, \frac{7\times3}{8\times3}, \text{ or } \frac{16}{24}, \frac{18}{24}, \frac{20}{24}, \frac{21}{24}.$$

(12)

$\frac{1}{7}, \frac{4}{11}, \frac{7}{13}, \frac{2}{3}$. 3003 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{1\times429}{7\times429}, \frac{4\times273}{11\times273}, \frac{7\times231}{13\times231}, \frac{2\times1001}{3\times1001}, \text{ or } \frac{429}{3003}, \frac{1092}{3003}, \frac{1617}{3003}, \frac{2002}{3003}.$$

(13)

$\frac{3}{5}, \frac{35}{80}, \frac{14}{200}$. 400 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{3\times80}{5\times80}, \frac{35\times5}{80\times5}, \frac{14\times2}{200\times2}, \text{ or } \frac{240}{400}, \frac{175}{400}, \frac{28}{400}.$$

(14)

$\frac{7}{12}, \frac{6}{7}, \frac{20}{63}, \frac{13}{84}$. 252 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{7\times21}{12\times21}, \frac{6\times36}{7\times36}, \frac{20\times4}{63\times4}, \frac{13\times3}{84\times3}, \text{ or } \frac{147}{252}, \frac{216}{252}, \frac{80}{252}, \frac{39}{252}.$$

(15)

$\frac{7}{9}, \frac{5}{11}, \frac{13}{18}, \frac{3}{22}, \frac{1}{36}$. 396 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{7\times44}{9\times44}, \frac{5\times36}{11\times36}, \frac{13\times22}{18\times22}, \frac{3\times18}{22\times18}, \frac{1\times11}{36\times11},$$

or $\frac{308}{396}, \frac{180}{396}, \frac{286}{396}, \frac{54}{396}, \frac{11}{396}$.

(16)

$\frac{1}{3}, \frac{7}{8}, \frac{5}{6}, \frac{9}{14}, \frac{3}{28}, \frac{17}{32}$. 672 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{1\times224}{3\times224}, \frac{7\times84}{8\times84}, \frac{5\times112}{6\times112}, \frac{9\times48}{14\times48}, \frac{3\times24}{28\times24}, \frac{17\times21}{32\times21},$$

or $\frac{224}{672}, \frac{588}{672}, \frac{560}{672}, \frac{432}{672}, \frac{72}{672}, \frac{357}{672}$.

(17)

$\frac{2}{3}, \frac{4}{9}, \frac{7}{27}, \frac{8}{81}, \frac{16}{243}, \frac{31}{729}$. 729 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{2\times243}{3\times243}, \frac{4\times81}{9\times81}, \frac{7\times27}{27\times27}, \frac{8\times9}{81\times9}, \frac{16\times3}{243\times3}, \frac{31}{279},$$

or $\frac{486}{729}, \frac{324}{729}, \frac{189}{729}, \frac{72}{729}, \frac{48}{729}, \frac{31}{729}$.

(18)

$\frac{9}{10}, \frac{9}{100}, \frac{9}{1000}, \frac{9}{10000}$. 10000 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{9\times1000}{10\times1000}, \frac{9\times100}{100\times100}, \frac{9\times10}{1000\times10}, \frac{9}{10000},$$

or $\frac{9000}{10000}, \frac{900}{10000}, \frac{90}{10000}, \frac{9}{10000}$.

(19)

$\frac{31}{60}, \frac{17}{90}, \frac{13}{25}, \frac{1}{105}, \frac{5}{9}$. 6300 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{31\times105}{60\times105}, \frac{17\times70}{90\times70}, \frac{13\times252}{25\times252}, \frac{1\times60}{105\times60}, \frac{5\times700}{9\times700}$$

or $\frac{3255}{6300}, \frac{1190}{6300}, \frac{3276}{6300}, \frac{60}{6300}, \frac{3500}{6300}$.

(20)

$\frac{31}{54}, \frac{11}{28}, \frac{53}{63}, \frac{3}{12}$. 756 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{31\times14}{54\times14}, \frac{11\times27}{28\times27}, \frac{53\times12}{63\times12}, \frac{3\times63}{12\times63}, \text{ or } \frac{434}{756}, \frac{297}{756}, \frac{636}{756}, \frac{189}{756}.$$

Ex. XXVII. (p. 98.)

(1)

$\frac{3}{5}, \frac{8}{9}, \frac{7}{10}$. 90 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{3\times18}{5\times18}, \frac{8\times10}{9\times10}, \frac{7\times9}{10\times9}, \text{ or } \frac{54}{90}, \frac{80}{90}, \frac{63}{90};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{8}{9}, \frac{7}{10}, \frac{3}{5}.$$

(2)

$\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}$. 24 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{1\times12}{2\times12}, \frac{3\times6}{4\times6}, \frac{5\times4}{6\times4}, \frac{7\times3}{8\times3}, \text{ or } \frac{12}{24}, \frac{18}{24}, \frac{20}{24}, \frac{21}{24};$$

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{7}{8}, \frac{5}{6}, \frac{3}{4}, \frac{1}{2}.$$

(3)

$\frac{1}{5}$ of $\frac{3}{8}$, $\frac{7}{12}$, $\frac{4}{3}$ of $\frac{6}{7}$, or $\frac{3}{40}$, $\frac{7}{12}$, $\frac{8}{7}$. 840 is L. C. M. of denrs;

∴ fractions become

$$\frac{3\times21}{40\times21}, \frac{7\times70}{12\times70}, \frac{8\times120}{7\times120}, \text{ or } \frac{63}{840}, \frac{490}{840}, \frac{960}{840};$$

∴ in order of magnitude the fractions stand thus,

$$\frac{4}{3} \text{ of } \frac{6}{7}, \frac{7}{12}, \frac{1}{5} \text{ of } \frac{3}{8}.$$

(4)

$\frac{5}{12}$, $\frac{3}{16}$, $\frac{10}{21}$, $\frac{31}{60}$. 1680 is L. C. M. of denominators;

∴ fractions become

$$\frac{5\times140}{12\times140}, \frac{3\times105}{16\times105}, \frac{10\times80}{21\times80}, \frac{31\times28}{60\times28},$$

or $\frac{700}{1680}, \frac{315}{1680}, \frac{800}{1680}, \frac{868}{1680}$;

∴ in order of magnitude the fractions stand thus,

$$\frac{31}{60}, \frac{10}{21}, \frac{5}{12}, \frac{3}{16}.$$

(5)

$\frac{3}{7}$, $\frac{7}{13}$, $\frac{9}{22}$, $\frac{8}{11}$, $\frac{21}{26}$, 2002 is L. C. M. of denominators;

∴ fractions become

$$\frac{3\times286}{7\times286}, \frac{7\times154}{13\times154}, \frac{9\times91}{22\times91}, \frac{8\times182}{11\times182}, \frac{21\times77}{26\times77},$$

or $\frac{858}{2002}, \frac{1078}{2002}, \frac{819}{2002}, \frac{1456}{2002}, \frac{1617}{2002}$;

∴ in order of magnitude the fractions stand thus,

$$\frac{21}{26}, \frac{8}{11}, \frac{7}{13}, \frac{3}{7}, \frac{9}{22}.$$

(6)

$\frac{3}{7}$ of $\frac{5}{8}$ of 4, $\frac{2}{11}$ of $\frac{3}{5}$ of 5, $\frac{1}{6}$ of $\frac{1}{2}$ of $4\frac{4}{4}$, $\frac{14}{28}$, or $\frac{15}{14}$, $\frac{6}{11}$, $\frac{19}{48}$, $\frac{1}{2}$.

3696 is L. C. M. of denominators; ∴ fractions become

$\frac{15\times264}{14\times264}$, $\frac{6\times336}{11\times336}$, $\frac{19\times77}{48\times77}$, $\frac{1\times1848}{2\times1848}$, or $\frac{3960}{3696}$, $\frac{2016}{3696}$, $\frac{1463}{3696}$, $\frac{1848}{3696}$;

∴ in order of magnitude the fractions stand thus,

$\frac{3}{7}$ of $\frac{5}{8}$ of 4, $\frac{2}{11}$ of $\frac{3}{5}$ of 5, $\frac{14}{28}$, $\frac{1}{6}$ of $\frac{1}{2}$ of $4\frac{4}{4}$.

(7)

$\frac{3}{8}$, $\frac{27}{32}$, $\frac{9}{16}$, $\frac{7}{10}$, $\frac{27}{40}$. 160 is L. C. M. of denominators;

∴ fractions become

$\frac{3\times20}{8\times20}$, $\frac{27\times5}{32\times5}$, $\frac{9\times10}{16\times10}$, $\frac{7\times16}{10\times16}$, $\frac{27\times4}{40\times4}$,

or $\frac{60}{160}$, $\frac{135}{160}$, $\frac{90}{160}$, $\frac{112}{160}$, $\frac{108}{160}$;

∴ in order of magnitude the fractions stand thus,

$\frac{27}{32}$, $\frac{7}{10}$, $\frac{27}{40}$, $\frac{9}{16}$, $\frac{3}{8}$.

(8)

$\frac{15}{4}$, $3\frac{1}{3}$, $\frac{2}{7}$ of $9\frac{2}{5}$, or $\frac{15}{4}$, $\frac{10}{3}$, $\frac{94}{35}$.

420 is L. C. M. of denominators; ∴ fractions become

$\frac{15\times105}{4\times105}$, $\frac{10\times140}{3\times140}$, $\frac{94\times12}{35\times12}$, or $\frac{1575}{420}$, $\frac{1400}{420}$, $\frac{1128}{420}$;

∴ in order of magnitude the fractions stand thus,

$\frac{15}{4}$, $3\frac{1}{3}$, $\frac{2}{7}$ of $9\frac{2}{5}$.

(9)

$\frac{6}{7}$, $\frac{13}{28}$, $1\frac{4}{9}$, $\frac{5}{8}$, $\frac{29}{56}$, or $\frac{6}{7}$, $\frac{13}{28}$, $\frac{13}{9}$, $\frac{5}{8}$, $\frac{29}{56}$.

504 is L. C. M. of denominators; ∴ fractions become

$\frac{6\times72}{7\times72}$, $\frac{13\times18}{28\times18}$, $\frac{13\times56}{9\times56}$, $\frac{5\times63}{8\times63}$, $\frac{29\times9}{56\times9}$,

or $\frac{432}{504}$, $\frac{234}{504}$, $\frac{728}{504}$, $\frac{315}{504}$, $\frac{261}{504}$;

∴ in order of magnitude the fractions stand thus,

$1\frac{4}{9}$, $\frac{6}{7}$, $\frac{5}{8}$, $\frac{29}{56}$, $\frac{13}{28}$.

(10)

$\frac{8}{9}, \frac{3}{11}, \frac{7}{18}, \frac{9}{22}, \frac{5}{36}$. 396 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{8\times44}{9\times44}, \frac{3\times36}{11\times36}, \frac{7\times22}{18\times22}, \frac{9\times18}{22\times18}, \frac{5\times11}{36\times11},$$

or $\frac{352}{396}, \frac{108}{396}, \frac{154}{396}, \frac{162}{396}, \frac{55}{396}$;

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{8}{9}, \frac{9}{22}, \frac{7}{18}, \frac{3}{11}, \frac{5}{36}.$$

(11)

$\frac{51}{76}, \frac{113}{152}, 1\frac{1}{38}, \frac{401}{448}, \frac{700}{748}$, or $\frac{51}{76}, \frac{113}{152}, \frac{39}{38}, \frac{401}{448}, \frac{700}{748}$.

1591744 is L. C. M. of denominators; $\therefore$ fractions become

$$\frac{51\times20944}{76\times20944}, \frac{113\times10472}{152\times10472}, \frac{39\times41888}{38\times41888}, \frac{401\times3553}{448\times3553}, \frac{700\times2128}{748\times2128},$$

or $\frac{1068144}{1591744}, \frac{1183336}{1591744}, \frac{1633632}{1591744}, \frac{1424753}{1591744}, \frac{1489600}{1591744}$;

$\therefore$ in order of magnitude the fractions stand thus,

$$1\frac{1}{38}, \frac{700}{748}, \frac{401}{448}, \frac{113}{152}, \frac{51}{76}.$$

(12)

$\frac{15}{4}$, $3\frac{1}{5}$, $\frac{2}{7}$ of $9\frac{3}{5}$, $\frac{2}{7}$ of $\frac{5}{9}$ of $\frac{4}{5}$, or $\frac{15}{4}, \frac{10}{3}, \frac{94}{35}, \frac{8}{63}$.

1260 is L. C. M. of denominators; $\therefore$ fractions become;

$$\frac{15\times315}{4\times315}, \frac{10\times420}{3\times420}, \frac{94\times36}{35\times36}, \frac{8\times20}{63\times20},$$

or $\frac{4725}{1260}, \frac{4200}{1260}, \frac{3384}{1260}, \frac{160}{1260}$;

$\therefore$ in order of magnitude the fractions stand thus,

$$\frac{15}{4}, 3\frac{1}{5}, \frac{2}{7} \text{ of } 9\frac{3}{5}, \frac{2}{7} \text{ of } \frac{5}{9} \text{ of } \frac{4}{5}.$$

(13)

$\frac{3}{4}$, $\frac{7}{12}$, $\frac{2}{3}$, $\frac{1}{6}$, and $\frac{1}{2}$. 12 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{3\times3}{4\times3}, \frac{7}{12}, \frac{2\times4}{3\times4}, \frac{1\times2}{6\times2}, \frac{1\times6}{2\times6}, \text{ or } \frac{9}{12}, \frac{7}{12}, \frac{8}{12}, \frac{2}{12}, \frac{6}{12};$$

$\therefore \frac{3}{4}$ is the greatest fraction and $\frac{1}{6}$ the least.

(14)

$\frac{11}{12}$, $\frac{29}{30}$, $\frac{17}{18}$, $\frac{7}{16}$, $\frac{47}{48}$. 720 is L. C. M. of denominators;

$\therefore$ fractions become

$$\frac{11\times60}{12\times60}, \frac{29\times24}{30\times24}, \frac{17\times40}{18\times40}, \frac{7\times45}{16\times45}, \frac{47\times15}{48\times15},$$

or $\frac{660}{720}, \frac{696}{720}, \frac{680}{720}, \frac{315}{720}, \frac{705}{720}$;

$\therefore \frac{47}{48}$ is the greatest fraction and $\frac{7}{16}$ the least.

ADDITION OF VULGAR FRACTIONS.

Ex. XXVIII. (p. 100.)

(13)

$$\frac{2}{3}+\frac{5}{6}+\frac{7}{12}=\frac{2\times4}{3\times4}+\frac{5\times2}{6\times2}+\frac{7}{12}=\frac{8}{12}+\frac{10}{12}+\frac{7}{12}=\frac{25}{12}=2\tfrac{1}{12}.$$

(14)

$$\frac{3}{5}+\frac{2}{7}+\frac{1}{3}=\frac{3\times7\times3}{7\times5\times3}+\frac{2\times5\times3}{5\times7\times3}+\frac{1\times5\times7}{3\times5\times7}=\frac{63}{105}+\frac{30}{105}+\frac{35}{105}$$

$$=\frac{128}{105}=1\tfrac{23}{105}.$$

(15)

$$\frac{1}{2}+\frac{2}{5}+\frac{1}{10}=\frac{1\times5}{2\times5}+\frac{2\times2}{5\times2}+\frac{1}{10}=\frac{5}{10}+\frac{4}{10}+\frac{1}{10}=\frac{10}{10}=1.$$

(16)

$$\frac{5}{12}+\frac{1}{8}+\frac{7}{24}=\frac{5\times2}{12\times2}+\frac{1\times3}{8\times3}+\frac{7}{24}=\frac{10}{24}+\frac{3}{24}+\frac{7}{24}=\frac{20}{24}=\frac{5}{6}.$$

(17)

$$\frac{2}{5}+\frac{3}{8}+\frac{7}{12}=\frac{2\times24}{5\times24}+\frac{3\times15}{8\times15}+\frac{7\times10}{12\times10}=\frac{48}{120}+\frac{45}{120}+\frac{70}{120}=\frac{163}{120}=1\tfrac{43}{120}.$$

(18)

$$\frac{3}{4}+\frac{4}{7}+\frac{7}{9}=\frac{3\times7\times9}{4\times7\times9}+\frac{4\times4\times9}{7\times4\times9}+\frac{7\times4\times7}{9\times4\times7}$$

$$=\frac{189}{252}+\frac{144}{252}+\frac{196}{252}=\frac{529}{252}=2\tfrac{25}{252}.$$

(19)

$$\frac{1}{2}+\frac{5}{6}+\frac{3}{21}=\frac{1\times21}{2\times21}+\frac{5\times7}{6\times7}+\frac{3\times2}{21\times2}=\frac{21}{42}+\frac{35}{42}+\frac{6}{42}=\frac{62}{42}=1\tfrac{20}{42}=1\tfrac{10}{21}.$$

(20)

$$\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}=\frac{1\times30}{2\times30}+\frac{1\times20}{3\times20}+\frac{1\times15}{4\times15}+\frac{1\times12}{5\times12}$$

$$=\frac{30}{60}+\frac{20}{60}+\frac{15}{60}+\frac{12}{60}=\frac{77}{60}=1\tfrac{17}{60}.$$

(21)

$$\frac{5}{7}+\frac{6}{45}+\frac{9}{35}=\frac{5\times45}{7\times45}+\frac{6\times7}{45\times7}+\frac{9\times9}{35\times9}$$

$$=\frac{225}{315}+\frac{42}{315}+\frac{81}{315}=\frac{348}{315}=1\tfrac{33}{315}=1\tfrac{11}{105}.$$

(22)

$$\frac{3}{6}+2\tfrac{1}{7}+13\tfrac{3}{10}=15+\frac{1}{2}+\frac{1}{7}+\frac{3}{10}=15+\frac{1\times35}{2\times35}+\frac{1\times10}{7\times10}+\frac{3\times7}{10\times7}$$

$$=15+\frac{35}{70}+\frac{10}{70}+\frac{21}{70}=15+\frac{66}{70}=15\tfrac{33}{35}.$$

(23)

$$\frac{3}{5}+\frac{4}{5}\text{ of }\frac{1}{3}+9\tfrac{3}{20}=9+\frac{3}{5}+\frac{4}{15}+\frac{3}{20}=9+\frac{3\times12}{5\times12}+\frac{4\times4}{15\times4}+\frac{3\times3}{20\times3}$$

$$=9+\frac{36}{60}+\frac{16}{60}+\frac{9}{60}=9+\frac{61}{60}=10\tfrac{1}{60}.$$

(24)

$$\frac{1}{3}\text{ of }\frac{3}{4}\text{ of }\frac{4}{5}+5\tfrac{1}{2}+\frac{2}{19}=\frac{1}{5}+5\tfrac{1}{2}+\frac{2}{19}=5+\frac{1}{5}+\frac{1}{2}+\frac{2}{19}$$
$$=5+\frac{1\times 38}{190}+\frac{1\times 95}{190}+\frac{2\times 10}{190}$$
$$=5+\frac{38}{190}+\frac{95}{190}+\frac{20}{190}=5+\frac{153}{190}=5\tfrac{153}{190}.$$

(25)

$$\frac{7}{5}+\frac{4}{3}+\frac{1}{6}+\frac{11}{30}=\frac{7\times 6}{5\times 6}+\frac{4\times 10}{3\times 10}+\frac{1\times 5}{6\times 5}+\frac{11}{30}$$
$$=\frac{42}{30}+\frac{40}{30}+\frac{5}{30}+\frac{11}{30}=\frac{98}{30}=3\tfrac{8}{15}.$$

(26)

$$\frac{10}{14}+\frac{2}{15}+\frac{18}{70}=\frac{5}{7}+\frac{2}{15}+\frac{9}{35}=\frac{5\times 15}{7\times 15}+\frac{2\times 7}{15\times 7}+\frac{9\times 3}{35\times 3}$$
$$=\frac{75}{105}+\frac{14}{105}+\frac{27}{105}=\frac{116}{105}=1\tfrac{11}{105}.$$

(27)

$$\frac{4}{5}+\frac{7}{10}+\frac{4}{7}+\frac{2}{21}=\frac{4\times 42}{5\times 42}+\frac{7\times 21}{10\times 21}+\frac{4\times 30}{7\times 30}+\frac{2\times 10}{21\times 10}$$
$$=\frac{168}{210}+\frac{147}{210}+\frac{120}{210}+\frac{20}{210}=\frac{455}{210}=2\tfrac{35}{210}=2\tfrac{1}{6}.$$

(28)

$$\frac{1}{8}+\frac{7}{12}+\frac{5}{9}+\frac{9}{20}=\frac{1\times 45}{8\times 45}+\frac{7\times 30}{12\times 30}+\frac{5\times 40}{9\times 40}+\frac{9\times 18}{20\times 18}$$
$$=\frac{45}{360}+\frac{210}{360}+\frac{200}{360}+\frac{162}{360}=\frac{617}{360}=1\tfrac{257}{360}.$$

(29)

$$\frac{1}{5}+6\tfrac{1}{5}+\frac{4}{7}\text{ of }\frac{1}{3}=6+\frac{1}{5}+\frac{4}{5}+\frac{4}{21}=6+\frac{5}{5}+\frac{4}{21}=6+1+\frac{4}{21}=7\tfrac{4}{21}.$$

(30)

$$100\tfrac{2}{5}+64\tfrac{4}{9}+\frac{3}{5}\text{ of }701=100+64+420+\frac{2}{5}+\frac{5}{9}+\frac{3}{5}$$
$$\left(\text{since }\frac{3}{5}\text{ of }701=\frac{2103}{5}=420\tfrac{3}{5}\right),\ =584+\frac{5}{5}+\frac{5}{9}=585\tfrac{5}{9}.$$

(31)

$$261\tfrac{1}{3}+174\tfrac{3}{4}+\frac{5}{6}\text{ of }10\tfrac{1}{2}=261+174+8+\frac{1}{3}+\frac{3}{4}+\frac{3}{4}$$

$$\left(\text{since }\frac{5}{7}\text{ of }10\tfrac{1}{2}=\frac{5\times21}{6\times2}=\frac{35}{4}=8\tfrac{3}{4}\right),$$

$$=443+\frac{1}{3}+\frac{6}{4}=443+\frac{1}{3}+1\tfrac{1}{2}=444+\frac{2}{6}+\frac{3}{6}=444\tfrac{5}{6}.$$

(32)

$$387\tfrac{1}{2}+285\tfrac{1}{4}+394\tfrac{1}{3}+\frac{2}{5}\text{ of }3704$$

$$=387+285+394+1481+\frac{1}{2}+\frac{1}{4}+\frac{1}{3}+\frac{3}{5}$$

$$\left(\text{since }\frac{2}{5}\text{ of }3704=\frac{7408}{5}=1481\tfrac{3}{5}\right),$$

$$=2547+\frac{1\times30}{2\times30}+\frac{1\times15}{4\times15}+\frac{1\times20}{3\times20}+\frac{3\times12}{5\times12}$$

$$=2547+\frac{30}{60}+\frac{15}{60}+\frac{20}{60}+\frac{36}{60}$$

$$=2547+\frac{101}{60}=2547+1\tfrac{41}{60}=2548\tfrac{41}{60}.$$

(33)

$$\frac{11}{10}+\frac{11}{100}+\frac{11}{1000}+\frac{11}{10000}=\frac{11\times1000}{10\times1000}+\frac{11\times100}{100\times100}+\frac{11\times10}{1000\times10}+\frac{11}{10000}$$

$$=\frac{11000+1100+110+11}{10000}=\frac{12221}{10000}=1\tfrac{2221}{10000}.$$

(34)

$$\frac{11}{12}+\frac{17}{18}+\frac{29}{30}+\frac{47}{48}+\frac{59}{60}$$

$$=\frac{11\times60}{12\times60}+\frac{17\times40}{18\times40}+\frac{29\times24}{30\times24}+\frac{47\times15}{48\times15}+\frac{59\times12}{60\times12}$$

$$=\frac{660+680+696+705+708}{720}=\frac{3449}{720}=4\tfrac{569}{720}.$$

(35)

$$\frac{1}{2}+\frac{1}{9}+\frac{3}{17}+\frac{29}{38}+\frac{33}{34} \quad \text{(5814 is L. C. M. of denominators)}$$

$$=\frac{1\times2907}{2\times2907}+\frac{1\times646}{9\times646}+\frac{3\times342}{17\times342}+\frac{29\times153}{38\times153}+\frac{33\times171}{34\times171}$$

$$=\frac{2907+646+1026+4437+5643}{5814}=\frac{14659}{5814}=2\tfrac{3}{5}\tfrac{3}{8}\tfrac{1}{14}.$$

(36)

$$2\tfrac{11}{17}+6\tfrac{3}{34}+\frac{16}{51}+\frac{1}{3} \text{ of } \frac{16}{17}+\frac{29}{68}+\frac{1}{3} \text{ of } 2\tfrac{3}{4}$$

$$=2+6+\frac{11}{17}+\frac{21}{34}+\frac{16}{51}+\frac{16}{51}+\frac{29}{68}+\frac{11}{12}$$

$$=8+\frac{11\times12}{17\times12}+\frac{21\times6}{34\times6}+\frac{32\times4}{51\times4}+\frac{29\times3}{68\times3}+\frac{11\times17}{12\times17}$$

$$=8+\frac{132+126+128+87+187}{204}=8+\frac{660}{204}=8+3\tfrac{48}{204}=11\tfrac{4}{17}.$$

(37)

$$2\tfrac{2}{3}+3\tfrac{3}{4}+4\tfrac{4}{5}+5\tfrac{5}{6}+6\tfrac{6}{7}=2+3+4+5+6+\frac{2}{3}+\frac{3}{4}+\frac{4}{5}+\frac{5}{6}+\frac{6}{7}$$

$$=20+\frac{2\times140+3\times105+4\times84+5\times70+6\times60}{420}$$

$$=20+\frac{280+315+336+350+360}{420}$$

$$=20+\frac{1641}{420}=20+3\tfrac{381}{420}=23\tfrac{127}{140}.$$

(38)

$$1\tfrac{1}{7}+3\tfrac{1}{10}+\frac{13}{15}+7\tfrac{5}{16}+\frac{9}{28}+\frac{2}{7} \text{ of } \frac{1}{5}$$

$$=1+3+7+\frac{4}{7}+\frac{1}{10}+\frac{13}{15}+\frac{5}{16}+\frac{9}{28}+\frac{2}{35}$$

$$=11+\frac{4\times240+1\times168+13\times112+5\times105+9\times60+2\times48}{1680}$$

$$=11+\frac{960+168+1456+525+540+96}{1680}$$

$$=11+\frac{3745}{1680}=11+2\tfrac{385}{1680}=13\tfrac{11}{48}.$$

(39)

$$5\tfrac{1}{6}+\frac{8}{9}\text{ of }\frac{6}{7}\text{ of }3\tfrac{1}{2}+9\tfrac{3}{10}+\frac{3}{7}\text{ of }\frac{5}{8}\text{ of }4$$

$$=5+2+9+1+\frac{1}{6}+\frac{2}{3}+\frac{3}{10}+\frac{1}{14}$$

$$\left(\text{since }\frac{8}{9}\text{ of }\frac{6}{7}\text{ of }\frac{7}{2}=2\tfrac{2}{3},\text{ and }\frac{3}{7}\text{ of }\frac{5}{8}\text{ of }4=\frac{15}{14}=1\tfrac{1}{14}\right),$$

$$=17+\frac{1\times35+2\times70+3\times21+1\times15}{210}=17+\frac{35+140+63+15}{210}$$

$$=17+\frac{253}{210}=17+1\tfrac{43}{210}=18\tfrac{43}{210}.$$

(40)

$$\frac{5}{8}\text{ of }12+\frac{3}{5}\text{ of }\frac{8}{9}+3\tfrac{3}{8}\text{ of }1\tfrac{8}{9}\text{ of }\frac{14}{153}-\frac{13}{15}\text{ of }3\tfrac{3}{4}\text{ of }\frac{1}{81}\text{ of }1\tfrac{1}{26}$$

$$=\frac{15}{2}+\frac{8}{15}+\frac{7}{12}+\frac{1}{24}=\frac{15\times60+8\times8+7\times10+1\times5}{120}$$

$$=\frac{900+64+70+5}{120}=\frac{1039}{120}=8\tfrac{79}{120}.$$

(41)

$$270\tfrac{3}{4}+650\tfrac{3}{20}+5000\tfrac{1}{4}+53\tfrac{4}{5}+1\tfrac{1}{20}$$

$$=270+650+5000+53+1+\frac{3}{4}+\frac{3}{20}+\frac{1}{4}+\frac{4}{5}+\frac{1}{20}$$

$$=5974+\frac{15+3+5+16+1}{20}=5974+\frac{40}{20}=5974+2=5976.$$

(42)

$$\frac{1}{2}\text{ of }\frac{3}{4}+\frac{7}{31}\text{ of }\left(1+\frac{15}{16}\right)+\frac{31}{32}+\frac{63}{64}\text{ of }\left(1+\frac{1}{2}\right)$$

$$=\frac{3}{8}+\frac{7}{31}\text{ of }\frac{31}{16}+\frac{31}{32}+\frac{63}{64}\text{ of }\frac{3}{2}=\frac{3}{8}+\frac{7}{16}+\frac{31}{32}+\frac{189}{128}$$

$$=\frac{3\times16+7\times8+31\times4+189}{128}$$

$$=\frac{48+56+124+189}{128}=\frac{417}{128}=3\tfrac{33}{128}.$$

SUBTRACTION OF VULGAR FRACTIONS.

Ex. XXIX. (p. 102.)

(10)

$$13\tfrac{5}{12}-9\tfrac{7}{13}=13\tfrac{7}{12}-10\tfrac{7}{13}=3+\frac{17}{12}-\frac{7}{13}$$

$$=3+\frac{17\times13}{12\times13}-\frac{7\times12}{13\times12}=3+\frac{221-84}{156}=3\tfrac{137}{156}.$$

(11)

$$50\tfrac{1}{16}-47\tfrac{1}{24}=3+\frac{1}{16}-\frac{1}{24}=3+\frac{1\times3}{16\times3}-\frac{1\times2}{24\times2}=3+\frac{3-2}{48}=3\tfrac{1}{48}.$$

(12)

$$42-30\tfrac{5}{12}=42+1-31\tfrac{5}{12}=11+1-\frac{5}{12}=11+\frac{12}{12}-\frac{5}{12}=11\tfrac{7}{12}.$$

(13)

$$15\tfrac{32}{729}-1\tfrac{16}{243}=15+1+\frac{32}{729}-2\tfrac{16}{243}$$

$$=13+\frac{761}{729}-\frac{16}{243}=13+\frac{761}{729}-\frac{48}{729}=13\tfrac{713}{729}.$$

(14)

$$90\tfrac{10}{111}-25\tfrac{12}{125}=90+1+\frac{10}{111}-26\tfrac{12}{125}=64+\frac{121}{111}-\frac{12}{125}$$

$$=64+\frac{121\times125}{111\times125}-\frac{12\times111}{111\times125}=64+\frac{15125-1332}{13875}=64\tfrac{13793}{13875}.$$

(15)

$$21-1\tfrac{179}{298}=21+1-2\tfrac{179}{298}=19+\frac{298}{298}-\frac{179}{298}=19+\frac{298-179}{298}=19\tfrac{119}{298}.$$

(16)

$$127-\frac{2}{7}\text{ of }14=125-4=121.$$

(17)

$$46\tfrac{5}{8}-15\tfrac{1}{6}=31+\frac{5}{8}-\frac{1}{6}=31+\frac{5\times3}{8\times3}-\frac{1\times4}{6\times4}=31+\frac{15-4}{24}=31\tfrac{11}{24}.$$

(18)

$$\frac{13}{56}-\frac{5}{28}\text{ of }1\tfrac{1}{6}=\frac{13}{56}-\frac{3}{14}=\frac{13}{56}-\frac{3\times4}{14\times4}=\frac{13-12}{56}=\frac{1}{56}.$$

(19)

$$\frac{1}{2}\text{ of }\frac{4}{5}\text{ of }\frac{3}{4}-\frac{2}{9}\text{ of }\frac{3}{4}=\frac{3}{10}-\frac{1}{6}=\frac{3\times3}{10\times3}-\frac{1\times5}{6\times5}=\frac{9-5}{30}=\frac{4}{30}=\frac{2}{15}.$$

(20)

$$\frac{3}{7}\text{ of }\frac{2}{9}\text{ of }\frac{4}{5}\text{ of }8\tfrac{3}{4}-\frac{5}{8}\text{ of }\frac{4}{5}\text{ of }\frac{11}{18}\text{ of }1\tfrac{7}{11}$$
$$=\frac{2}{3}-\frac{1}{2}=\frac{2\times2}{3\times2}-\frac{1\times3}{2\times3}=\frac{4-3}{6}=\frac{1}{6}.$$

(21)

$$\frac{5}{8}\text{ of }\frac{4}{10}-\frac{7}{9}\text{ of }\frac{4}{21}=\frac{1}{4}-\frac{4}{27}=\frac{1\times27}{4\times27}-\frac{4\times4}{27\times4}=\frac{27-16}{108}=\frac{11}{108},$$
$$\frac{5}{6}\text{ of }\frac{2}{15}-\frac{3}{8}\text{ of }\frac{4}{18}=\frac{1}{9}-\frac{1}{12}=\frac{1\times4}{9\times4}-\frac{1\times3}{12\times3}=\frac{4-3}{36}=\frac{1}{36};$$
$$\therefore\text{ difference}=\frac{11}{108}-\frac{1}{36}=\frac{11}{108}-\frac{1\times3}{36\times3}=\frac{11-3}{108}=\frac{8}{108}=\frac{2}{27}.$$

(22)

$$\frac{8}{15}\text{ of }\frac{5}{6}+2\tfrac{7}{8}=\frac{4}{9}+2\tfrac{7}{8}=+2\frac{4\times8}{9\times8}+\frac{7\times9}{8\times9}=2+\frac{32+63}{72}=2+\frac{95}{72};$$
$$\therefore\text{ required result}=2+\frac{95}{72}-\frac{5}{9}=2+\frac{95}{72}-\frac{5\times8}{9\times8}=2+\frac{95-40}{72}=2\tfrac{55}{72}.$$

(23)

$$11\tfrac{2}{3}+8\tfrac{7}{9}=19+\frac{2}{3}+\frac{7}{9}=19+\frac{6}{9}+\frac{7}{9}=19+\frac{13}{9};$$
$$\therefore\text{ result}=19+\frac{13}{9}-9\tfrac{13}{22}=10+\frac{13\times22}{9\times22}-\frac{19\times9}{9\times22}$$
$$=10+\frac{286-171}{198}=10\tfrac{115}{198}.$$

(24)

Difference of two first fractions

$$=5\tfrac{3}{32}-2\tfrac{2}{7}=3+\frac{23\times 7}{32\times 7}-\frac{2\times 32}{7\times 32}=3+\frac{161-64}{224}=3+\frac{97}{224}.$$

Sum of

$$\frac{5}{8}+\frac{5}{14}+\frac{1}{6}=\frac{5\times 21}{8\times 21}+\frac{5\times 12}{14\times 12}+\frac{1\times 28}{6\times 28}$$

$$=\frac{105+60+28}{168}=\frac{193}{168}=1\tfrac{25}{168};$$

$$\therefore \text{result}=3\tfrac{97}{224}-1\tfrac{25}{168}=2+\frac{97}{224}-\frac{25}{168}=2+\frac{97\times 3}{224\times 3}+\frac{25\times 4}{168\times 4}$$

$$=2+\frac{291-100}{672}=2\tfrac{191}{672}.$$

(25)

$$\text{Sum of fractions}=1\tfrac{1}{26}+\frac{9}{13}=\frac{27}{26}+\frac{9}{13}=\frac{27+18}{26}=\frac{45}{26},$$

$$\text{difference of fractions}=\frac{27-28}{26}=\frac{9}{26}.$$

Now $\frac{45}{26}=\frac{9}{26}\times 5$; $\therefore$ sum=5 times difference.

MULTIPLICATION OF VULGAR FRACTIONS.

Ex. XXX. (p. 104.)

(10)

$$\frac{1}{2}\text{ of }\frac{2}{3}\times 5\tfrac{3}{8}\text{ of }3=\frac{1\times 2\times 43\times 3}{2\times 3\times 8}=\frac{43}{8}=5\tfrac{3}{8}.$$

(11)

$$\frac{12}{13}\text{ of }3\tfrac{3}{8}\times 1\tfrac{1}{33}\text{ of }\frac{39}{51}\text{ of }\frac{3}{8}$$

$$=\frac{12\times 11\times 34\times 39\times 3}{13\times 3\times 33\times 51\times 8}=\frac{4\times 3\times 11\times 2\times 17\times 3\times 13\times 3}{13\times 3\times 3\times 11\times 3\times 17\times 4\times 2}=1.$$

(12)

$$\frac{11}{15} \text{ of } 1\tfrac{3}{22} \text{ of } \frac{1}{70} \times \frac{7}{12} \text{ of } 37\tfrac{14}{35} \text{ of } 3\tfrac{1}{8} \text{ of } \frac{1}{11}$$

$$= \frac{11 \times 25 \times 1 \times 7 \times 1309 \times 25 \times 1}{15 \times 22 \times 70 \times 12 \times 35 \times 8 \times 11}$$

$$= \frac{11 \times 5 \times 5 \times 7 \times 11 \times 7 \times 17 \times 5 \times 5}{5 \times 3 \times 2 \times 11 \times 2 \times 5 \times 7 \times 12 \times 5 \times 7 \times 8 \times 11}$$

$$= \frac{17 \times 5}{3 \times 2 \times 2 \times 12 \times 8} = \frac{85}{1152}.$$

(13)

$$\frac{3}{8} \text{ of } 2\tfrac{1}{16} \text{ of } 1\tfrac{1}{63} \text{ of } 3\tfrac{5}{87} \times \frac{3}{11} \text{ of } \frac{10}{19} = \frac{3 \times 33 \times 64 \times 266 \times 3 \times 10}{8 \times 16 \times 63 \times 87 \times 11 \times 19}$$

$$= \frac{3 \times 3 \times 11 \times 8 \times 8 \times 2 \times 7 \times 19 \times 3 \times 2 \times 5}{8 \times 8 \times 2 \times 7 \times 3 \times 3 \times 3 \times 29 \times 11 \times 19} = \frac{10}{29}.$$

(14)

$$5\tfrac{2}{19} \text{ of } 3\tfrac{1}{4} \text{ of } \frac{8}{117} \text{ of } 34 \times \frac{3}{194} \text{ of } \frac{9}{68} \text{ of } 1\tfrac{1}{3} \times 19$$

$$= \frac{97 \times 13 \times 8 \times 34 \times 3 \times 9 \times 4 \times 19}{19 \times 4 \times 117 \times 194 \times 68 \times 3}$$

$$= \frac{97 \times 13 \times 4 \times 2 \times 2 \times 17 \times 3 \times 9 \times 2 \times 2 \times 19}{19 \times 2 \times 2 \times 9 \times 13 \times 2 \times 97 \times 4 \times 17 \times 3} = 2.$$

(15)

$$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} = \frac{1 \times 2 \times 3 \times 4 \times 5}{2 \times 3 \times 4 \times 5 \times 6} = \frac{1}{6}.$$

(16)

$$\frac{15}{64} \times \frac{16}{27} \times \frac{11}{10} \times \frac{72}{385} \times \frac{21}{85} = \frac{15 \times 16 \times 11 \times 72 \times 21}{64 \times 27 \times 10 \times 385 \times 85}$$

$$= \frac{5 \times 3 \times 16 \times 11 \times 4 \times 2 \times 9 \times 3 \times 7}{4 \times 16 \times 3 \times 9 \times 2 \times 5 \times 11 \times 5 \times 7 \times 5 \times 17}$$

$$= \frac{3}{5 \times 5 \times 17} = \frac{3}{425}.$$

(17)

$$1\tfrac{15}{16}\times 2\tfrac{2}{3} \text{ of } 1\tfrac{7}{37}\times\frac{33}{42}\times\frac{19}{328}\times 5\tfrac{1}{22} \text{ of } 49\times\frac{3}{76}$$

$$=\frac{32\times 8\times 44\times 33\times 19\times 111\times 49\times 3}{15\times 3\times 37\times 42\times 328\times 22\times 76}$$

$$=\frac{4\times 8\times 2\times 2\times 2\times 11\times 4\times 3\times 11\times 19\times 3\times 37\times 7\times 7\times 3}{5\times 3\times 3\times 37\times 2\times 3\times 7\times 8\times 41\times 2\times 11\times 4\times 19}$$

$$=\frac{2\times 4\times 11\times 7}{5\times 41}=\frac{616}{205}=3\tfrac{1}{205}.$$

(18)

$$\frac{5}{6}\times 2\tfrac{3}{4}\times 3\tfrac{5}{11}\times 5\tfrac{2}{19}\times 6\tfrac{1}{194}=\frac{5\times 11\times 38\times 97\times 1165}{6\times 4\times 11\times 19\times 194}$$

$$=\frac{5\times 11\times 2\times 19\times 97\times 1165}{2\times 3\times 4\times 11\times 19\times 2\times 97}=\frac{5\times 1165}{2\times 3\times 4}=\frac{5825}{24}=242\tfrac{17}{24}.$$

(19)

$$\frac{95}{116}\times\frac{17}{21}\times\frac{87}{153}\times\frac{126}{190}\times\frac{4}{7} \text{ of } 1\tfrac{2}{5}=\frac{95\times 17\times 87\times 126\times 4\times 7}{116\times 21\times 153\times 190\times 7\times 5}$$

$$=\frac{5\times 19\times 17\times 3\times 29\times 9\times 2\times 7\times 4\times 7}{4\times 29\times 3\times 7\times 9\times 17\times 19\times 2\times 5\times 7\times 5}=\frac{1}{5}.$$

(20)

$$\frac{147}{196}\times\frac{1764}{1491}\times\frac{355}{529}\times\frac{207}{507}\times 1\tfrac{110}{189}=\frac{147\times 1764\times 355\times 207\times 299}{196\times 1491\times 529\times 507\times 189}$$

$$=\frac{49\times 3\times 4\times 441\times 5\times 71\times 9\times 23\times 13\times 23}{49\times 4\times 7\times 213\times 23\times 23\times 13\times 39\times 9\times 21}=\frac{3\times 441\times 5\times 71}{7\times 213\times 39\times 21}$$

$$=\frac{3\times 3\times 7\times 21\times 5\times 71}{7\times 3\times 71\times 3\times 13\times 21}=\frac{5}{13}.$$

DIVISION OF VULGAR FRACTIONS.

Ex. XXXI. (p. 106.)

(10)

$$3\tfrac{3}{4} \text{ of } 3\tfrac{1}{3} \text{ of } \frac{1}{2}\div 75=\frac{15}{4}\times\frac{10}{3}\times\frac{1}{2}\times\frac{1}{75}$$

$$=\frac{15\times 5\times 2}{4\times 3\times 2\times 5\times 15}=\frac{1}{4\times 3}=\frac{1}{12}.$$

(11)

$$3\tfrac{1}{5} \text{ of } 5\tfrac{5}{8} \text{ of } 3\tfrac{5}{9} \div 9\tfrac{3}{4} \text{ of } \frac{8}{33} \text{ of } 7\tfrac{1}{8} = \frac{16}{5} \times \frac{45}{8} \times \frac{32}{9} \times \frac{4}{39} \times \frac{33}{8} \times \frac{3}{22}$$

$$= \frac{4\times4\times5\times9\times4\times8\times4\times3\times11\times3}{5\times8\times9\times3\times13\times4\times2\times2\times11} = \frac{4\times4\times3}{13} = \frac{48}{13} = 3\tfrac{9}{13}.$$

(12)

$$119 \div \frac{7}{9} = 119 \times \frac{9}{7} = \frac{7\times17\times9}{7} = 17\times9 = 153.$$

(13)

$$\frac{3}{8} \text{ of } \frac{6}{7} \text{ of } 80\tfrac{1}{9} \text{ of } 9 \div \frac{3}{7} \text{ of } \frac{2}{9} \text{ of } \frac{4}{5} \text{ of } 8\tfrac{3}{4}$$

$$= \frac{3}{8} \times \frac{6}{7} \times \frac{721}{9} \times \frac{9}{1} \times \frac{7}{3} \times \frac{9}{2} \times \frac{5}{4} \times \frac{4}{35}$$

$$= \frac{3\times2\times3\times7\times103\times9\times7\times9\times5\times4}{8\times7\times9\times3\times2\times4\times5\times7} = \frac{3\times103\times9}{8} = \frac{2781}{8} = 347\tfrac{5}{8}$$

(14)

$$\frac{5}{8} \text{ of } \frac{4}{5} \text{ of } \frac{11}{18} \text{ of } 1\tfrac{7}{11} \div \frac{6}{17} \text{ of } \frac{95}{114} \text{ of } \frac{33}{44} \text{ of } 1\tfrac{6}{11}$$

$$= \frac{5}{8} \times \frac{4}{5} \times \frac{11}{18} \times \frac{18}{11} \times \frac{17}{6} \times \frac{114}{95} \times \frac{44}{33} \times \frac{11}{17} = \frac{4\times114\times44\times11}{8\times6\times95\times33}$$

(striking out common factors);

$$= \frac{4\times2\times3\times19\times2\times2\times11\times11}{4\times2\times3\times2\times5\times19\times3\times11} = \frac{2\times11}{5\times3} = \frac{22}{15} = 1\tfrac{7}{15}.$$

(15)

Product of $2\frac{1}{2}$ and $3\frac{7}{8} = \frac{5}{2} \times \frac{31}{8} = \frac{155}{16}$;

quotient of $2\frac{1}{2}$ by $3\frac{7}{8} = \frac{5}{2} \times \frac{8}{31} = \frac{20}{31}$;

therefore, comparing the fractions $\frac{155}{16}$ and $\frac{20}{31}$, they become $\frac{155\times31}{16\times31}$ and $\frac{20\times16}{31\times16}$, or $\frac{4805}{496}$ and $\frac{320}{496}$.

(16)

$$\frac{\frac{3}{4}}{1\frac{7}{8}}=\frac{\frac{3}{4}}{\frac{15}{8}}=\frac{3}{4}\times\frac{8}{15}=\frac{3\times4\times2}{4\times3\times5}=\frac{2}{5}$$

(17)

$$\frac{\frac{14}{27}}{2\frac{1}{3}}=\frac{\frac{14}{27}}{\frac{7}{3}}=\frac{14}{27}\times\frac{3}{7}=\frac{7\times2\times3}{9\times3\times7}=\frac{2}{9}.$$

(18)

$$\frac{2\frac{1}{2}}{\frac{5}{9}}=\frac{\frac{35}{12}}{\frac{5}{9}}=\frac{35}{12}\times\frac{9}{5}=\frac{5\times7\times3\times3}{3\times4\times5}=\frac{7\times3}{4}=\frac{21}{4}=5\frac{1}{4}.$$

(19)

$$\frac{\frac{6}{11}}{\frac{10}{99}}=\frac{6}{11}\times\frac{99}{10}=\frac{2\times3\times11\times9}{11\times2\times5}=\frac{27}{5}=5\frac{2}{5}.$$

(20)

$$\frac{13\frac{1}{3}}{20}=\frac{\frac{40}{3}}{\frac{29}{1}}=\frac{40}{3}\times\frac{1}{20}=\frac{20\times2}{3\times20}=\frac{2}{3}.$$

(21)

$$\frac{56}{1\frac{5}{9}}=\frac{\frac{56}{1}}{\frac{14}{9}}=\frac{56}{1}\times\frac{9}{14}=\frac{4\times14\times9}{14}=36.$$

(22)

$$\frac{13\frac{9}{10}}{1\frac{1}{4}}=\frac{\frac{139}{10}}{\frac{25}{14}}=\frac{139}{10}\times\frac{14}{25}=\frac{139\times2\times7}{2\times5\times25}=\frac{139\times7}{5\times25}=\frac{973}{125}=7\frac{98}{125}.$$

REDUCTION OF FRACTIONS.

Ex. XXXII. (p. 108.)

(3)

$2\frac{3}{7}$ of \$1.68 $= \frac{17 \times \$1.68}{7} = \$4.28$;

$\frac{5}{7}$ of £2 3*s.* 9*d.* $= \frac{£10\ 18s.\ 9d.}{7} =$ £1 11*s.* 3*d.*;

$\frac{8}{21}$ of 9 tons $= \frac{24}{7}$ tons $=3$ tons, 8 cwt., 2 qrs., 7 lbs.

(4)

$1\frac{3}{5}$ of £1 2*s.* 9*d.* $= \frac{£9\ 2s.}{5} =$ £1 16*s.* $4\frac{8}{4}d.\ \frac{1}{8}q.$;

$\frac{4}{14}$ of $\frac{11}{18}$ of \$21 $=$ \$3.66$\frac{2}{3}$; $\frac{1}{3}$ of $\frac{3}{5}$ of 9*s.* $10\frac{1}{2}d. = 1s.\ 11\frac{1}{2}d.\ \frac{4}{6}q.$

(5)

$3\frac{1}{12}$ of 2*s.* 6*d.* $= 7s.\ 6d. + \frac{30}{12}d. = 7s.\ 6d. + 2\frac{1}{2}d. = 7s.\ 8\frac{1}{2}d.$;

$\frac{2}{3}$ of $\frac{4}{21}$ of 10*s.* 6*d.* $= \frac{2 \times 4 \times 21}{3 \times 21}$ sixpences $= 1s.\ 4d.$

(6)

$\frac{5}{16}$ of cwt. $= \frac{500 \text{ lbs.}}{16} = 1$ qr., 6 lbs.,

$\frac{3}{4}$ of lb. Avoird. $= \frac{3 \times 16}{4}$ oz. $= 12$ oz.;

$\frac{4}{5}$ of a mile $= \frac{4 \times 8}{5}$ fur. $= 6$ fur., 88 yds.;

$\frac{5}{8}$ of an acre $= \frac{5 \times 4}{8}$ ro. $= 2\frac{1}{2}$ ro.

(7)

$\frac{5}{11}$ of a mile $= \frac{5 \times 1760}{11}$ yds. $= 800$ yds. $= 3$ fur., 25 po., $2\frac{1}{2}$ yds.;

$\frac{3}{10}$ of a day $= \frac{3 \times 24}{10}$ hrs. $= 7$ hrs., 12′;

$\frac{2}{7}$ of 3 cwt., 1 qr., 11 lbs. $= \frac{6 \text{ cwt., } 2 \text{ qrs., } 22 \text{ lbs.}}{7} = 3$ qrs., 21 lbs.

(8)

$7\frac{3}{5}$ lbs. Av. $= 7$ lbs. $+ \frac{3 \times 16}{5}$ oz. $= 7$ lbs., 9 oz., $9\frac{3}{5}$ drs.;

$1\frac{2}{4}$ lb. Troy $= 1$ lb. $+ \frac{3 \times 12}{4} = 1$ lb., 9 oz.;

$4\frac{5}{19}$ of an ac. $= 4$ ac. $+ \frac{20}{19}$ ro. $=$ 4ac., 1 ro., 2 po., 3 yds., 1 ft. $94\frac{14}{19}$ in.

(10)

$\frac{7}{8}$ of $\frac{3}{5}$ of $10\frac{2}{3}$ hrs. $= \frac{7 \times 3 \times 32}{8 \times 5 \times 3}$ hrs. $= 5$ hrs., 36′;

$\frac{7\frac{1}{8}}{8\frac{1}{7}}$ of $\frac{5\frac{1}{7}}{7\frac{1}{5}}$ of \$5 $= \left(\frac{57}{8} \times \frac{7}{57} \times \frac{36}{7} \times \frac{5}{36} \times 5\right)$\$ $=$ \$3.12$\frac{1}{2}$.

(11)

$\frac{\frac{4}{49}}{\frac{5}{14}}$ of £16 8*s*. $1\frac{1}{2}d. = \frac{4}{49} \times \frac{14}{5} \times \frac{3}{4}$ of £16 8*s*. $1\frac{1}{2}d.$

$= \frac{2 \times 3}{5 \times 7}$ of £16 8*s*. $1\frac{1}{2}d. = \frac{£14\ 1s.\ 3d.}{5} =$ £2 16*s*. 3*d*.;

$\frac{3}{7}$ of $1\frac{2}{5}$ of $12\frac{1}{2}$ of $\frac{3}{44}$ of \$2 $\times \frac{3}{44} = \frac{\$3 \times 7 \times 25 \times 3 \times 2 \times 3}{7 \times 5 \times 2 \times 44 \times 44}$

$= \frac{\$27 \times 5}{44 \times 44} = 6\frac{17}{484}$ cts.

(13)

$19\frac{3}{4}$ of 5 lbs., 8 oz., 6 dwt. $= \frac{79}{4}$ of 5 lbs., 8 oz., 6 dwts.

$= 79 \times 1$ lb., 5 oz., 12 grs. $= 112$ lbs., 4 oz., 18 dwts., 12 grs.;

$= 2\frac{3}{5}$ 8 mls., 14 po., $2\frac{7}{2}$ ft. $\div 8\frac{4}{5} = \frac{12}{5}$ of 8 mls., 14 po. $2\frac{7}{2}$ ft. $\times \frac{5}{44}$

$= \frac{3}{11}$ of 8mls., 14 po., $2\frac{7}{2}$ ft. $=$ 2 mls., 1 fur., 22 po., $\frac{31}{44}$ ft.

(16)

$\frac{5}{28}$ of $\frac{11}{18}$ of \$2.52 $= 27\frac{1}{2}$ cts.; $\frac{5}{8}s. = 12\frac{1}{2}$ cts.; $\frac{1}{12}$ of 60 cts. $= 5$ cts.

$\therefore$ value $= (27\frac{1}{2} + 12\frac{1}{2} + 5)$ cts. $= 45$ cts.

(18)

$\frac{\frac{3}{4}+\frac{2}{3}}{\frac{17}{3}}$ of 6 tons $=\frac{17}{12}\times\frac{3}{17}\times 6$ tons $=1$ ton, 10 cwt.;

$\frac{7}{16}$ of 4 cwts. $=\frac{7}{4}$ of a cwt. $=1$ cwt., 3 qrs.;

$\frac{4}{5}$ qrs. $=20$ lbs.; $\therefore$ value $=1$ ton, 10 cwts., $+1$ cwt., 3 qrs. $+20$ lbs. $=1$ ton, 11 cwts., 3 qrs., 20 lbs.

(19)

$\frac{3}{5}$ ton $=12$ cwt.; $\frac{5}{8}$ cwt. $=2$ qrs., 12 lbs., 8 oz.;

$\frac{2}{3}$ lb. $=10$ oz., $10\frac{2}{3}$ drs.; $\therefore$ value $=12$ cwts., 13 lbs., 2 oz., $10\frac{2}{3}$ drs.

(20)

$\frac{3}{8}$ lb. Troy $=$ 4 oz., 10 dwts.

$\frac{5}{6}$ lb. Troy $=$ 10 oz.

14 oz., 10 dwts.

$\frac{8}{9}$ oz. Troy $=$ 17 dwts., $18\frac{2}{3}$ grs.

Value $=$ 1 lb., 1 oz., 12 dwts., $5\frac{1}{3}$ grs.

(21)

	fur.	po.	yds.
$\frac{7}{10}$ mile $=$	5	24	
$\frac{5}{8}$ fur. $=$		25	
	4	39	
$\frac{4}{11}$ po. $=$			2
Value $=$	4	39	2

(22)

	c. ft.	c. in.
$\frac{9}{111}$ cub. yds. $=$	2	$326\frac{34}{37}$
$2\frac{7}{8}$ cub. ft. $=$	2	1512
Value $=$	5	$110\frac{34}{37}$

(23)

	bus.	pk.
$\frac{2}{3}$ of a qr. $=$	5	$1\frac{1}{3}$
$\frac{3}{4}$ bus. $=$		3
	6	$0\frac{1}{3}$
$\frac{1}{6}$ qr. $=$	1	$1\frac{1}{3}$
Value $=$	4	3

(24)

$\frac{3}{5}$ of 7 fur., 27 po., 3 yds., 9 in. $= \frac{23 \text{ fur., } 7 \text{ po., } 9 \text{ yds., } 2 \text{ ft. } 3 \text{ in.}}{5}$

$= 4$ fur., 25 po., 4 yds., 0 ft., $5\frac{3}{5}$ in.

$\frac{5}{7}$ of 5 mi., 3 fur., 39 po., $4\frac{1}{5}$ yds. $= \frac{27 \text{ mi., } 3 \text{ fur., } 37 \text{ po., } 4\frac{1}{2} \text{ yds.}}{7}$

	mi.	fur.	po.	yds.	in.
$=$	3	7	15	3	0
		4	25	4	$5\frac{3}{5}$
Value $=$	4	4	1	$1\frac{1}{2}$	$5\frac{3}{5}$

(25)

$7\frac{3}{5}$ of $365\frac{1}{4}$ days $= \frac{37}{5}$ of $\frac{1461}{4}$ days $= \frac{54057}{20}$ days

$= 2702$ days, 20 h., 24.

$3\frac{3}{10}$ of $\frac{5}{6}$ wks. $= \frac{39 \times 5 \times 7}{10 \times 6}$ days $= \frac{13 \times 7}{2 \times 2}$ days $= \frac{91}{4}$ days

$= 22$ days, 18 h.

$\frac{3}{4}$ of $5\frac{5}{9}$ hrs. $= \frac{3 \times 50}{4 \times 9}$ hrs. $= 4$ hrs., 10 m.

$\therefore$ value required $= 2725$ days, 18 hrs., 34 m.

(26)

	ac.	ro.	po.	yds.
$\frac{1}{11}$ of 91 ac., 3 ro., 36 po., $2\frac{3}{4}$ yds. $=$	8	1	17	25
$\frac{3}{5}$ of 6 ac., 2 ro., 17 po., $25\frac{1}{3}$ yds.				
$= \frac{19 \text{ ac., } 3 \text{ ro., } 13 \text{ po., } 15\frac{1}{2} \text{ yds.}}{5} =$	3	3	34	$21\frac{1}{4}$
Value required $=$	4	1	23	$3\frac{3}{4}$

Ex. XXXIII. (p. 109.)

(6)

3 ro., $27\frac{1}{2}$ po., $= 147\frac{1}{2}$ po. $= \frac{295}{2}$ po., and 1 ac. $= (1 \times 4 \times 40)$ po.;

$\therefore$ fraction $= \frac{295}{2 \times 4 \times 40} = \frac{59}{2 \times 4 \times 8} = \frac{59}{64}$.

$26\frac{2}{5}$ sq. yds. $= \frac{132}{5}$ sq. yds., and 2 ac. $= (2 \times 4840)$ sq. yds.;

$\therefore$ fraction $= \frac{132}{5 \times 2 \times 4840} = \frac{12}{10 \times 440} = \frac{3}{1100}$.

(7)

126 yds., 2 ft., 6 in.=4566 in., and 1 mile=$(1760\times3\times12)$ in.;

$$\therefore \text{fraction}=\frac{4566}{1760\times3\times12}=\frac{761}{1760\times6}=\frac{761}{10560}.$$

6 c. ft., 100 c. in.=10468 c. in., and 1 c. yd.=(27×1728) c. in.;

$$\therefore \text{fraction}=\frac{10468}{27\times1728}=\frac{2617}{27\times432}=\frac{2617}{11664}.$$

(8)

2 qrs., $2\frac{2}{3}$ na.=$10\frac{2}{3}$ na.=$\frac{32}{3}$ na.; and 1 Eng. ell=(5×4) na.;

$$\therefore \text{fraction}=\frac{32}{3\times5\times4}=\frac{8}{15}.$$

8 h., 3 m.=483 m., and 1 day=(24×60) m.;

$$\therefore \text{fraction}=\frac{483}{24\times60}=\frac{161}{480}.$$

(9)

2 ac., 1 ro.=9 ro., and 9 ac., 2 ro.=38 ro.;

$$\therefore \text{fraction}=\frac{9}{38}.$$

1540 yds., 2 ft., 9in.=55473 in., and 2 miles=$(2\times1760\times3\times12)$ in.;

$$\therefore \text{fraction}=\frac{55473}{2\times1760\times3\times12}=\frac{18491}{24\times1760}=\frac{1681}{24\times160}=\frac{1681}{3840}.$$

(10)

1 ft. $\frac{7}{8}$ in.=$144\frac{7}{8}$ sq. in.=$\frac{1159}{8}$ sq. in., and 1 sq. yd.=(9×144) sq. in.;

$$\therefore \text{fraction}=\frac{1159}{9\times144\times8}=\frac{1159}{10368}.$$

2 qts. $1\frac{1}{2}$ pt.=$5\frac{1}{2}$ pts.=$\frac{11}{2}$ pts., and 1 bar.=(36×8) pts.;

$$\therefore \text{fraction}=\frac{11}{2\times36\times8}=\frac{11}{576}.$$

(11)

2 wks., 5 d., 7 h., 27 m.=27807m., and 1 day=(24×60) m.;

$$\therefore \text{ fraction}=\frac{27807}{24\times60}=\frac{9269}{480}.$$

1 ro., 20 po.=60 po., and 1 ac.=(4×40) po.;

$$\therefore \text{ fraction}=\frac{60}{4\times40}=\frac{6}{16}=\frac{3}{8}.$$

(12)

4 bus., $2\frac{2}{3}$ qts.=$130\frac{2}{3}$ qts.=$\frac{1172}{9}$ qt., and 1 ld.=$(5\times8\times4\times8)$ qts.

$$\therefore \text{ fraction}=\frac{1172}{9\times5\times8\times4\times8}=\frac{293}{9\times40\times8}=\frac{293}{2880}.$$

3 quires, 7 sheets=79 sheets, and 1 ream=(20×24) sheets;

$$\therefore \text{ fraction}=\frac{79}{20\times24}=\frac{79}{480}.$$

(15)

6 ft., $3\frac{5}{8}$ in.=$75\frac{5}{8}$ in., and 13 ft., $8\frac{9}{10}$ in.=$164\frac{9}{10}$ in.;

$$\therefore \text{ fraction}=\frac{75\frac{5}{8}}{164\frac{9}{10}}=\frac{605\times10}{1649\times8}=\frac{605\times5}{1649\times4}=\frac{3025}{6596}.$$

$1\frac{1}{2}$ yds.=$\frac{3\times3\times12}{2}$ in., and $1\frac{1}{2}$ in.=$\frac{3}{2}$ in.;

$$\therefore \text{ fraction}=\frac{3\times3\times12\times2}{2\times3}=\frac{36}{1}.$$

(18)

1 lb. Troy=5760 grs.; $\therefore$ 1 oz. Troy=$\frac{5760}{12}$ grs.

1 lb. av.=7000 grs.; $\therefore$ 1 oz. av.=$\frac{7000}{16}$ grs.;

$$\therefore \text{ fraction}=\frac{5760\times16}{7000\times12}=\frac{576\times4}{700\times3}=\frac{192}{175}.$$

(19)

$\frac{3}{7}$ of a pole$=\frac{3}{7}$ po., and 1 league$=(3\times8\times40)$ po.;

$\therefore$ fraction$=\frac{3}{7\times3\times8\times40}=\frac{1}{2240}$.

$3\frac{7}{8}$ fur.$=\frac{31}{8}$ fur., and $2\frac{7}{8}$ miles$=23$ fur.;

$\therefore$ fraction$=\frac{31}{8\times23}=\frac{31}{184}$

(20)

$\frac{3}{5}$ of $7\frac{1}{2}$ of $16\frac{1}{2}$ yds.$=\frac{3\times15\times33}{5\times2\times2}$ yds.$=\frac{3\times3\times33}{4}$ yds., and 1 fur.$=220$ yds.;

$\therefore$ fraction$=\frac{3\times3\times33}{4\times220}=\frac{27}{80}$.

(21)

$\frac{7}{8}$ of a lb. av.$=\left(\frac{7}{8}\times7000\right)$ grs.$=(7\times875)$ grs., and 2 lbs. Troy $=(2\times5760)$ grs.;

$\therefore$ fraction$=\frac{7\times875}{2\times5760}=\frac{7\times175}{2\times1152}=\frac{1225}{2304}$.

(22)

$\frac{16}{23}$ of a sq. inch$=\frac{16}{23}$ sq. in., and 1 sq. yd.$=(9\times144)$ sq. in.;

$\therefore$ fraction$=\frac{16}{23\times9\times144}=\frac{1}{23\times9\times9}=\frac{1}{1863}$.

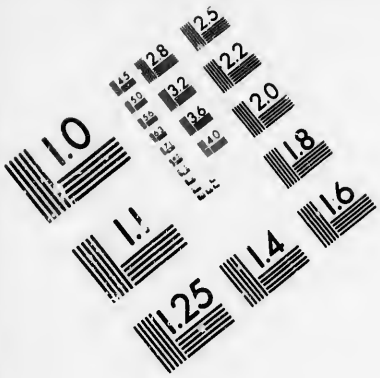
$\frac{1}{5}$ of a yd.$=\frac{4}{5}$ qrs., and 1 Eng. ell$=5$ qrs.;

$\therefore$ fraction$=\frac{4}{5\times5}=\frac{4}{25}$.

(26)

$\frac{1}{2}$ of $5\frac{2}{5}$ sec.$=\frac{14}{5}$ sec., and 3 wks., 4 days$=25$ days $=(25\times24\times60\times60)$ sec.;

$\therefore$ fraction$=\frac{14}{5\times25\times24\times60\times60}=\frac{7}{5400000}$.



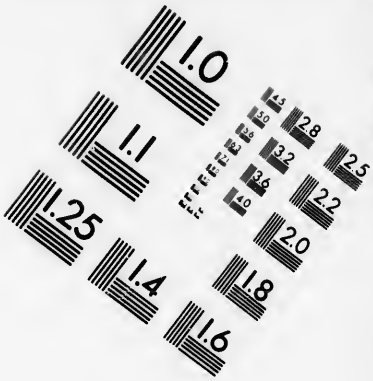
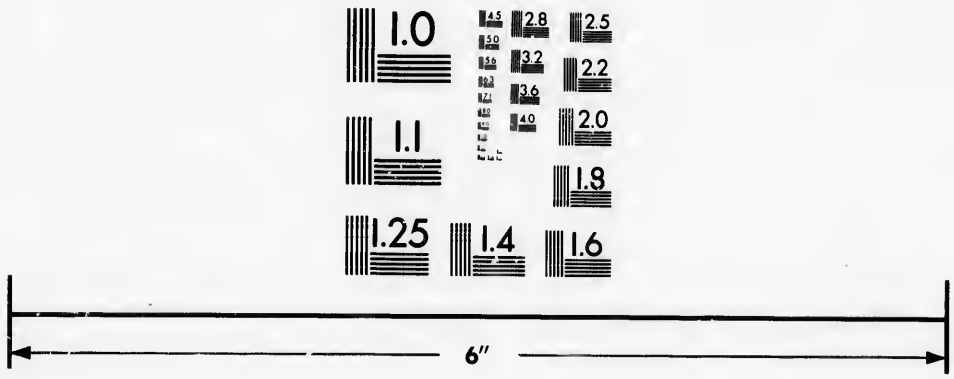
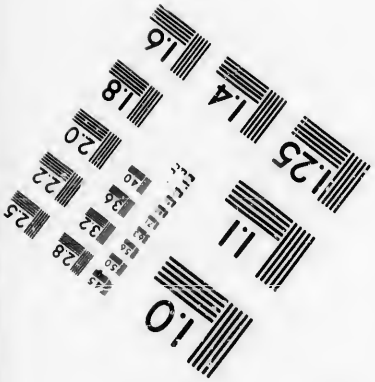
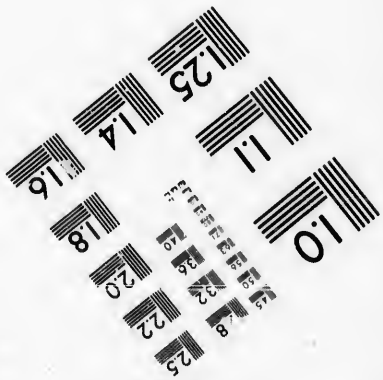


IMAGE EVALUATION TEST TARGET (MT-3)







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(27)

$25\frac{3}{11}$ po. $=\frac{284}{11}$ po., and $\frac{1}{3}$ acre $=\frac{4\times 40}{3}$ po.;

$$\therefore \text{fraction}=\frac{284\times 3}{11\times 4\times 40}=\frac{71\times 3}{11\times 40}=\frac{213}{440}.$$

(28)

$\frac{7}{183}$ of 28 days $=\frac{7\times 28\times 24\times 60}{183}$ min.;

$$\therefore \text{fraction}=\frac{\frac{7}{183}\times 28\times 24\times 60}{\frac{1}{30}}=\frac{7\times 28\times 24\times 60\times 30}{183}$$

$$=\frac{7\times 28\times 24\times 60\times 10}{61}=\frac{2822400}{61}.$$

(29)

$3\frac{1}{4}$ hhds. $=\frac{13}{4}$ hhds., and $\frac{1}{3}$ of 4 tuns $=\frac{4\times 4}{3}$ hhds.;

$$\therefore \text{fraction}=\frac{13\times 3}{4\times 4\times 4}=\frac{39}{64}.$$

(30)

$\frac{3}{14}$ of $\frac{7}{3}$ of a pole $=\left(\frac{3}{14}\times\frac{7}{3}\times\frac{11}{2}\times 3\right)$ feet $=\frac{33}{4}$ feet.

3 fathoms $=(3\times 6)$ feet;

$$\therefore \text{fraction}=\frac{33}{4\times 3\times 6}=\frac{11}{24}.$$

(31)

1 ton, 10 cwt.
3 qrs., 14 lbs.
1 ton, 9 cwt, 0 qrs., 14 lbs. $=3262$ lbs.,

and $2\frac{1}{2}$ cwt. $=(\frac{5}{2}\times 112)$ lbs. $=280$ lbs.;

$$\therefore \text{fraction}=\frac{3262}{280}=\frac{1631}{140}=\frac{233}{20}.$$

QUESTIONS AND EXAMPLES IN FRACTIONS.

XXXIV. (p. 113.)

I.

(2)

$\frac{2\frac{1}{2}}{5}$ of $7\frac{3}{4}=\frac{5}{\frac{2}{5}}$ of $\frac{31}{4}=\frac{5}{2}\times\frac{1}{5}\times\frac{31}{4}=\frac{31}{8}$, $1\frac{1}{8}\div 2\frac{1}{8}=\frac{7}{4}\div\frac{17}{8}=\frac{7}{4}\times\frac{8}{17}=\frac{14}{17}$;

$\therefore$ sum $=\frac{31}{8}+\frac{14}{17}=\frac{31\times 17+14\times 8}{8\times 17}=\frac{527+112}{136}=\frac{639}{136}=4\frac{95}{136}$,

difference $=\frac{527-112}{136}=\frac{415}{136}=3\frac{7}{136}$.

Also sum of $5\frac{1}{8}+\frac{2}{3}$ of $3\frac{1}{2}+\frac{3}{4}\div\frac{6}{7}$

$=5\frac{1}{8}\div 2\frac{1}{8}+\frac{7}{8}=7+\frac{1}{8}+\frac{1}{3}+\frac{7}{8}=7+\frac{8}{8}+\frac{1}{3}=8\frac{1}{3}$.

(3)

(1) $\left(\frac{3}{4}+\frac{7}{6}\text{ of }5\frac{1}{2}\right)\times\left(\frac{5}{6}+\frac{2}{3}+3\frac{3}{4}\right)=\left(\frac{3}{4}+\frac{7}{6}\times\frac{11}{2}\right)\times\left(3+\frac{5}{6}+\frac{2}{3}+\frac{3}{4}\right)$

$=\left(\frac{9}{12}+\frac{77}{12}\right)\times\left(3+\frac{10}{12}+\frac{8}{12}+\frac{9}{12}\right)=\frac{86}{12}\times 3\frac{7}{12}=\frac{43}{6}\times 3\frac{3}{4}$

$=\frac{43}{6}\times\frac{21}{4}=\frac{43\times 3\times 7}{2\times 3\times 4}=\frac{301}{8}=37\frac{5}{8}$.

(2) $3\frac{1}{126}$ of $3\frac{4}{7}\div\frac{47}{345}$ of $9=\frac{376}{125}$ of $\frac{25}{7}\times\frac{345}{47\times 9}$

$=\frac{8\times 47}{5\times 25}\times\frac{25}{7}\times\frac{5\times 3\times 23}{47\times 3\times 3}=\frac{8\times 23}{7\times 3}=\frac{184}{21}=8\frac{16}{21}$.

(3) $\frac{3\frac{3}{4}}{4\frac{2}{7}}-\frac{3\frac{3}{5}}{4\frac{1}{4}}+\frac{\frac{4}{7}}{2\frac{1}{2}}=\frac{\frac{15}{4}}{\frac{30}{7}}-\frac{\frac{17}{5}}{\frac{17}{4}}+\frac{\frac{4}{7}}{\frac{5}{2}}=\frac{15\times 7}{4\times 30}-\frac{17\times 4}{5\times 17}+\frac{4\times 2}{7\times 5}=\frac{7}{8}-\frac{4}{5}+\frac{8}{35}$

$=\frac{7\times 35-4\times 7\times 8+8\times 8}{8\times 35}=\frac{245-224+64}{280}=\frac{85}{280}=\frac{17}{56}$.

(1) $$\frac{4\frac{1}{3}\times 4\frac{1}{3}\times 4\frac{1}{3}-1}{4\frac{1}{3}\times 4\frac{1}{3}-1}=\frac{\frac{13}{3}\times\frac{13}{3}\times\frac{13}{3}-1}{\frac{13}{3}\times\frac{13}{3}-1}=\frac{\frac{2197}{27}-1}{\frac{169}{9}-1}=\frac{\frac{2197-27}{27}}{\frac{169-9}{9}}$$

$$=\frac{2170}{27}\times\frac{9}{160}=\frac{217\times 9}{9\times 3\times 16}=\frac{217}{48}=4\tfrac{25}{48}.$$

(3) $$3+\frac{1}{7+\frac{1}{16}}=3+\frac{1}{\frac{112+1}{16}}=3+\frac{16}{113}=\frac{339+16}{113}=\frac{355}{113}=3\tfrac{16}{113}.$$

(4)

$$\frac{2+4+6}{3+5+7}=\frac{12}{15}=\frac{4}{5}.$$

Now $\frac{2}{3}$, $\frac{4}{5}$, $\frac{6}{7}$, are equivalent to $\frac{70}{105}$, $\frac{84}{105}$, $\frac{90}{105}$;

$\therefore \frac{2+4+6}{3+5+7}$ does lie between the greatest and least of the fractions $\frac{2}{3}$, $\frac{4}{5}$, $\frac{6}{7}$, since $\frac{2}{3}$ is the least, and $\frac{6}{7}$ the greatest.

(5)

By the question, the smaller number

$$=20\tfrac{11}{15}-15\tfrac{4}{15}=5+\frac{11\times 7-4\times 3}{105}=5+\frac{77-12}{105}=5\tfrac{65}{105}=5\tfrac{13}{21}.$$

II.

(2)

By the question, the number $=41\frac{1}{4}-19\frac{1}{2}=21\frac{3}{4}$.

By the question,

$$\text{number}=3\tfrac{1}{2}\text{ of }\frac{4}{5}\div 2\tfrac{4}{10}\text{ of }\frac{4}{13}=\frac{7}{2}\times\frac{4}{5}\div\frac{24}{10}\text{ of }\frac{4}{13}$$

$$=\frac{7}{2}\times\frac{4}{5}\times\frac{10}{24}\times\frac{13}{4}=\frac{7\times 4\times 2\times 5\times 13}{2\times 5\times 24\times 4}=\frac{91}{24}=3\tfrac{19}{24}.$$

(3)

$$\frac{93208}{13786}=\frac{93208\div 122}{13786\div 122}=\frac{764}{113};\qquad \frac{95469}{359784}=\frac{95469\div 789}{359784\div 789}=\frac{121}{456}.$$

(4)

(1) $\dfrac{2\frac{1}{2}}{3\frac{1}{4}}+\dfrac{1\frac{1}{2}-\frac{5}{6}}{1\frac{1}{4}+\frac{5}{6}}-1\frac{2}{19}=\dfrac{\frac{5}{2}}{\frac{13}{4}}+\dfrac{\frac{3}{2}-\frac{5}{6}}{\frac{5}{4}+\frac{5}{6}}-\frac{41}{39}=\frac{5}{2}\times\frac{4}{13}+\frac{4}{6}\times\frac{12}{25}-\frac{41}{39}$

$=\dfrac{10}{13}+\dfrac{8}{25}-\dfrac{41}{39}=\dfrac{10\times3\times25+8\times39-41\times25}{25\times39}$

$=\dfrac{750+312-1025}{975}=\dfrac{37}{975}$.

(2) $3\frac{3}{5}$ of $5\frac{1}{2}$ of $\dfrac{7}{9}-\dfrac{1}{3}$ of $\dfrac{5}{12}=\dfrac{17\times11\times7}{5\times2\times9}-\dfrac{5}{3\times12}=\dfrac{1309}{90}-\dfrac{5}{36}$

$=\dfrac{2618-25}{180}=\dfrac{2593}{180}=14\frac{73}{180}$.

(3) $\left(\dfrac{2}{19}+\dfrac{1}{13}\right)\div\left(3-\dfrac{1}{3}\right)\times\left(\dfrac{1}{3}+\dfrac{1}{5}\right)=\dfrac{26+19}{19\times13}\div\dfrac{8}{3}\times\dfrac{8}{15}$

$=\dfrac{45}{19\times13}\times\dfrac{3}{8}\times\dfrac{8}{15}=\dfrac{9}{247}$.

(4) $\dfrac{3}{14}$ of $\dfrac{4\frac{5}{9}}{6\frac{1}{6}}$ of $\dfrac{6\frac{8}{11}}{11\frac{2}{7}}=\dfrac{3}{14}$ of $\dfrac{41}{9}\times\dfrac{6}{37}$ of $\dfrac{74}{11}\times\dfrac{7}{32}$

$=\dfrac{3\times41\times2\times3\times2\times37\times7}{2\times7\times3\times3\times37\times11\times2\times41}=\dfrac{1}{11}$.

(5)

Product of $2\frac{2}{15}$ and $2\frac{5}{8}=\dfrac{32}{15}\times\dfrac{21}{8}=\dfrac{4\times7}{5}$;

Difference of $2\frac{3}{5}$ and $2\frac{1}{4}=\dfrac{3}{5}-\dfrac{1}{4}=\dfrac{12}{20}-\dfrac{5}{20}=\dfrac{7}{20}$;

quotient $=\dfrac{4\times7}{5}\div\dfrac{7}{20}=\dfrac{4\times7\times20}{5\times7}=16$.

III.

(2)

(1) $275\frac{1}{3}+62\frac{11}{120}+1031\frac{1}{5}+\dfrac{7}{8}$ of $4150\frac{1}{7}$

$=275+62+1031+3631+\dfrac{1}{3}+\dfrac{11}{120}+\dfrac{1}{5}+\dfrac{3}{8}$

$=4999+\dfrac{40+11+24+45}{120}=4999+\dfrac{120}{120}=4999+1=5000$.

(2) $\frac{32}{51}+\frac{112}{85}\times\frac{189}{207}\div 1\frac{1}{2}\frac{3}{3}=\frac{32\times 85\times 189\times 23}{51\times 112\times 207\times 36}=\frac{5}{18}$.

(3) $\frac{1}{3\frac{3}{5}}-\frac{2\frac{1}{4}}{9}+\frac{3\frac{5}{8}}{2}+\frac{\frac{4}{7}}{4\frac{1}{7}}=\frac{5}{16}-\frac{9}{36}+\frac{29}{16}+\frac{4}{32}=\frac{5}{16}-\frac{1}{4}+\frac{29}{16}+\frac{2}{16}$

$=\frac{5-4+29+2}{16}=\frac{32}{16}=2$.

(4) $\frac{4\frac{1}{4}-3\frac{5}{8}}{4\frac{1}{4}+3\frac{3}{8}}+\frac{3-2\frac{1}{3}}{4-3\frac{1}{4}}=\frac{\frac{7}{8}}{7\frac{5}{8}}+\frac{\frac{2}{3}}{\frac{3}{4}}=\frac{7}{8}\times\frac{8}{61}+\frac{2}{3}\times\frac{4}{3}=\frac{7}{61}+\frac{8}{9}=1_{5}\frac{2}{4}\frac{}{9}$.

(3)

$\frac{1}{3}$ of $4=\frac{4}{3}$, and $\frac{1}{4}$ of $5=\frac{5}{4}$.

Now $\frac{4}{3}$ and $\frac{5}{4}$ are equivalent to $\frac{16}{12}$ and $\frac{15}{12}$;

$\therefore \frac{1}{3}$ of 4 is the greater by $\frac{1}{12}$.

(4)

Sum of fractions $\frac{3}{7}+\frac{4}{13}=\frac{39+28}{91}=\frac{67}{91}$,

product of $\frac{9}{11}$ and $\frac{13}{14}=\frac{9\times 13}{11\times 14}$;

$\therefore$ quotient in lowest terms

$=\frac{67}{91}\times\frac{11\times 14}{9\times 13}=\frac{67\times 11\times 7\times 2}{7\times 13\times 9\times 13}=\frac{67\times 11\times 2}{13\times 9\times 13}=\frac{1474}{1521}$.

(5)

By the question, number $=1_{6}\frac{8}{3}+\left(\frac{8}{9}-\frac{3}{7}\right)-\frac{2}{15}\div 2\frac{1}{2}$

$=\frac{71}{63}+\frac{29}{63}-\frac{4}{75}=\frac{100}{63}-\frac{4}{75}=\frac{2500-84}{1575}=\frac{2416}{1575}=1_{1}\frac{8}{5}\frac{4}{7}\frac{1}{5}$.

IV.

(1)

$\frac{4}{7}$ of $\frac{1}{2}+1\frac{1}{9}=\frac{2}{7}+\frac{10}{9}=\frac{18+70}{63}=\frac{88}{63}$.

Difference of $\frac{4}{11}$ and $\frac{1}{5}=\frac{20-11}{55}=\frac{9}{55}$;

$\therefore$ product$=\frac{88}{63}\times\frac{9}{55}=\frac{8\times11\times9}{9\times7\times5\times11}=\frac{8}{35}$.

(2)

(1) $\frac{3}{4}\times\frac{7}{11}\times8\frac{1}{5}\div\frac{2}{5}\left(7\frac{3}{4}+\frac{5}{2}\right)=\frac{3}{4}\times\frac{7}{11}\times\frac{41}{5}\div\frac{2}{5}$ of $7\frac{1}{4}\frac{3}{4}$

$=\frac{3}{4}\times\frac{7}{11}\times\frac{41}{5}\div\frac{2}{5}$ of $\frac{41}{4}=\frac{3\times7\times41\times5\times4}{4\times11\times5\times2\times41}=\frac{3\times7}{11\times2}=\frac{21}{22}$.

(2) $\frac{1}{8}-\frac{1}{12}+\frac{1}{15}-\frac{1}{20}=\frac{15-10+8-6}{120}=\frac{23-16}{120}=\frac{7}{120}$.

(3) $\frac{27968}{37376}=\frac{27968\div64}{37376\div64}=\frac{437}{584}$.

(4) $\frac{1}{13}$ of $(1+5\frac{1}{2})+\frac{5}{6}$ of $\frac{1}{27}$ of $(7-2\frac{2}{5})-\frac{1}{3}$

$=\frac{1}{13}$ of $6\frac{1}{2}+\frac{5}{6}$ of $\frac{1}{27}$ of $4\frac{3}{5}-\frac{1}{3}=\frac{1}{13}\times\frac{13}{2}+\frac{5}{6}\times\frac{1}{27}\times\frac{23}{5}-\frac{1}{3}$

$=\frac{1}{2}+\frac{23}{162}-\frac{1}{3}=\frac{81+23-54}{162}=\frac{50}{162}=\frac{25}{81}$.

(5) $\dfrac{\frac{10}{3}+\frac{5}{6}-\frac{20}{21}}{\frac{5}{6}-\frac{4}{7}}=\dfrac{\frac{140+35-40}{42}}{\frac{35-24}{42}}=\frac{135}{11}=12\frac{3}{11}$.

(3)

Number$=3\frac{1}{4}-\frac{3}{4}$ of $\left(\frac{1}{3}+\frac{1}{5}-\frac{4}{15}+\frac{1}{9}\right)=\frac{13}{4}-\frac{3}{4}$ of $\left(\frac{15+9-12+5}{45}\right)$

$=\frac{13}{4}-\frac{3}{4}\times\frac{17}{45}=\frac{13}{4}-\frac{17}{60}=\frac{195-17}{60}=\frac{178}{60}=2\frac{29}{30}$;

and number$=\frac{64}{315}\times\frac{1}{4}\times\frac{1}{6}\times\frac{1}{8}=\frac{1}{315\times3}=\frac{1}{945}$.

(4)

After paying away $\frac{1}{3}$ of my money, $\frac{2}{3}$ remains;

after paying away $\frac{1}{2}$ of $\frac{2}{3}$ of my money, $\frac{2}{3}-\frac{1}{2}$ of $\frac{2}{3}$,

or $\frac{1}{3}$ remains;

after paying away $\frac{1}{4}$ of $\frac{1}{3}$ of my money, $\frac{1}{3}-\frac{1}{12}$, or $\frac{1}{4}$ remains.

(5)

Sum of fractions $=5\frac{1}{3}+5\frac{1}{4}=10\frac{7}{12}$, difference of fractions

$=5\frac{1}{3}-5\frac{1}{4}=\frac{1}{12}$;

$\therefore$ product $=10\frac{7}{12}\times\frac{1}{12}=\frac{127}{144}$, quotient $=10\frac{7}{12}\div\frac{1}{12}=127$;

$\therefore$ quotient is 144 times as great as product.

V.

(1)

$$\frac{2+3}{4+5}\div\frac{4+3\frac{1}{2}}{5+5\frac{1}{2}}=\frac{4}{8}\div\frac{7\frac{1}{2}}{10\frac{1}{2}}=\frac{5}{9}\div\frac{15}{21}=\frac{5}{9}\times\frac{7}{5}=\frac{7}{9}.$$

Sum of $\frac{1}{2}$, $1\frac{3}{7}$, and $\frac{5}{6}$

$$=1+\frac{1}{2}+\frac{3}{7}+\frac{5}{6}=1+\frac{21+18+35}{42}=1+\frac{74}{42}=1+\frac{37}{21}=\frac{58}{21},$$

difference of $\frac{4}{15}$ and $\frac{3}{20}=\frac{16-9}{60}=\frac{7}{60}$; $\therefore$ product $=\frac{58}{21}\times\frac{7}{60}=\frac{29}{90}$;

$\therefore$ quotient $=\frac{29}{90}\div\frac{11}{18}$ of $1\frac{1}{5}=\frac{29}{90}\times\frac{18}{11}\times\frac{15}{29}=\frac{3}{11}$.

(2)

(1) $\left(\frac{5}{2}-\frac{2}{5}\right)\div\left(\frac{4}{3}-\frac{3}{4}\right)=\frac{25-4}{10}\div\frac{16-9}{12}=\frac{21}{10}\times\frac{12}{7}=\frac{3\times6}{5}=\frac{18}{5}=3\frac{3}{5}$.

(2) $$\frac{\frac{41}{162}-\frac{9}{49}-\frac{3}{54}}{\frac{4}{9}+\frac{1}{2}-\frac{13}{14}}=\frac{\frac{41}{162}-\frac{9}{49}-\frac{9}{162}}{\frac{4}{9}+\frac{7}{14}-\frac{13}{14}}=\frac{\frac{32}{162}-\frac{9}{49}}{\frac{4}{9}-\frac{6}{14}}=\frac{\frac{16}{81}-\frac{9}{49}}{\frac{4}{9}-\frac{3}{7}}=\frac{\frac{784-729}{81\times49}}{\frac{28-27}{9\times7}}$$

$$=\frac{55\times9\times7}{81\times49}=\frac{55}{9\times7}=\frac{55}{63}.$$

(3) $$\frac{2}{5}\text{ of }\frac{13}{16}-\frac{1\frac{2}{3}}{6\frac{2}{3}}\text{ of }\frac{19}{20}+\frac{3}{7}\text{ of }\frac{6\frac{5}{12}}{3\frac{7}{8}}$$

$$=\frac{13}{40}-\frac{1}{4}\text{ of }\frac{19}{20}+\frac{3}{7}\text{ of }\frac{7}{4}=\frac{13}{40}-\frac{19}{80}+\frac{3}{4}=\frac{26-19+60}{80}=\frac{67}{80}.$$

(4) $$\frac{3}{5}\frac{\frac{5}{8}}{\frac{8}{9}}+\frac{\frac{5}{8}}{2\frac{1}{2}\times1\frac{1}{3}}\times\frac{1}{80}=\frac{3}{5}\times\frac{9}{8}+\frac{5}{8}\times\frac{2}{5}\times\frac{3}{4}\times\frac{1}{80}$$

$$=\frac{27}{40}+\frac{3}{1280}=\frac{864+3}{1280}=\frac{867}{1280}.$$

(5) $$2\frac{1}{2}\times\frac{1}{3\frac{1}{3}+\frac{1}{4\frac{1}{4}}}=\frac{5}{2}\times\frac{1}{\frac{10}{3}+\frac{4}{17}}=\frac{5}{2}\times\frac{3\times17}{170+12}=\frac{5\times3\times17}{2\times182}=\frac{255}{364}.$$

(6) $$\frac{\frac{5}{7}\text{ of }\frac{3}{10}+\frac{1}{4}\text{ of }\frac{8}{21}}{\frac{2}{3}\text{ of }\frac{9}{14}-\frac{5}{6}\text{ of }\frac{2}{15}}=\frac{\frac{3}{14}+\frac{2}{21}}{\frac{3}{7}-\frac{1}{9}}=\frac{\frac{9+4}{42}}{\frac{27-7}{63}}=\frac{13}{42}\times\frac{63}{20}=\frac{13\times3}{2\times20}=\frac{39}{40}.$$

(7) $$\frac{11\frac{5}{7}-7\frac{5}{11}}{3\frac{1}{2}+5\frac{5}{22}}=\frac{4\frac{20}{77}}{8\frac{16}{22}}=\frac{328}{77}\times\frac{22}{192}=\frac{8\times41\times2\times11}{7\times11\times8\times2\times12}=\frac{41}{84}.$$

(3)

Sum of $\frac{3}{4}$, $\frac{7}{6}$ and $\frac{29}{12}=\frac{9}{12}+\frac{14}{12}+\frac{29}{12}=\frac{52}{12}=4\frac{1}{3}$;

$\therefore\frac{2}{3}$ is the fraction required.

(4)

$\frac{3}{8}, \frac{5}{12}, \frac{4}{9}, \frac{7}{20}$, are equivalent to $\frac{135}{360}, \frac{150}{360}, \frac{160}{360}, \frac{126}{360}$;

$\therefore$ sum of the greatest and least $=\frac{286}{360}$, sum of the other two $=\frac{285}{360}$; $\therefore$ difference $=\frac{1}{360}$.

(5)

The man gives away $\frac{1}{2}$ of $\frac{3}{8}$ or $\frac{3}{16}$;

$\therefore$ he has left $\frac{3}{8}-\frac{3}{16}=\frac{6}{16}-\frac{3}{16}=\frac{3}{16}$.

VI.

(2)

(1) $\frac{4}{5}$ of $\frac{1}{2}-\frac{2}{3}$ of $\frac{9}{17}+\frac{3}{5}$ of $1\frac{1}{17}=\frac{2}{5}-\frac{18}{51}+\frac{81}{85}$

$$=\frac{2\times 51-18\times 5+81\times 3}{255}=\frac{102-90+243}{255}=\frac{255}{255}=1.$$

(2) $\frac{2\frac{3}{4}+3\frac{3}{5}}{4\frac{1}{8}+5\frac{1}{4}}+\frac{3\frac{3}{8}}{10\frac{1}{4}}=\frac{5\frac{23}{40}}{9\frac{9}{40}}+\frac{3\frac{3}{8}}{10\frac{1}{2}}=\frac{123}{189}+\frac{11\times 2}{21\times 3}=\frac{41}{63}+\frac{22}{63}=\frac{63}{63}=1.$

(3) $\left\{\frac{5}{7}\times\frac{2}{9}\times 13\frac{1}{2}\right\}\div\left\{\frac{1}{9}\times\frac{3}{7}+40\right\}$

$$=\left\{\frac{5\times 2\times 27}{7\times 9\times 2}\right\}\div\left\{\frac{1+840}{21}\right\}=\frac{15}{7}\times\frac{21}{841}=\frac{45}{841}.$$

(4) $\frac{2\frac{4}{11}}{2\frac{3}{5}}\div\frac{2\frac{7}{11}}{8\frac{7}{10}}=\left(\frac{26}{11}\times\frac{5}{13}\right)\div\left(\frac{29}{11}\times\frac{10}{87}\right)=\frac{2\times 5}{11}\times\frac{11\times 3}{10}=3.$

(3)

$\frac{2}{3}$ of $\frac{5}{9}$ of $\frac{81}{141}$ of $1\frac{1}{5}=\frac{2\times 5\times 9\times 3\times 3\times 2\times 3}{3\times 9\times 3\times 47\times 5}=\frac{2\times 2\times 3}{47}=\frac{12}{47}$.

two

(5)

$$3\tfrac{1}{3}\times 3\tfrac{1}{10}=\frac{28}{9}\times\frac{31}{10}=\frac{14\times 31}{9\times 5}=\frac{434}{45};\quad \frac{20\frac{1}{4}}{3}\div\frac{41\frac{1}{2}}{4}=\frac{83}{12}\times\frac{8}{83}=\frac{2}{3};$$

$$\therefore \text{ sum of fractions} = \frac{434}{45}+\frac{30}{45}=\frac{464}{45},$$

$$\text{difference of fractions} = \frac{434}{45}-\frac{30}{45}=\frac{404}{45},$$

$$\text{difference of these results}=\frac{60}{45}=\frac{4}{3}=1\tfrac{1}{3}.$$

(6)

$$\text{Number}=3\tfrac{23}{420}-\frac{31}{35}-\frac{10}{21}=\frac{1487}{420}-\frac{372}{420}-\frac{200}{420}=\frac{915}{420}=\frac{61}{28}=2\tfrac{5}{28}.$$

$$\text{and number}=\frac{4}{15}\times 2\tfrac{1}{16}=\frac{4}{15}\times\frac{33}{16}=\frac{11}{20}.$$

VII.

(2)

(1) $$\frac{\frac{3}{4}}{\frac{5}{4}}+\frac{2\frac{1}{4}-\frac{3}{7}}{5\frac{1}{4}+\frac{1}{14}}-\frac{2}{3\frac{1}{7}}=\frac{3}{5}+\frac{1\frac{23}{28}}{5\frac{11}{28}}-\frac{2\times 7}{25}=\frac{3}{5}+\frac{51}{149}-\frac{14}{25}$$

$$=\frac{15}{25}+\frac{51}{149}-\frac{14}{25}=\frac{1}{25}+\frac{51}{149}=\frac{149+1275}{3725}=\frac{1424}{3725}.$$

(2) $$2\tfrac{1}{6}+3\tfrac{3}{8}+\frac{9}{14}+\frac{1}{15}+6\tfrac{17}{20}=11+\frac{1}{6}+\frac{3}{8}+\frac{9}{14}+\frac{1}{15}+\frac{17}{20}$$

$$=11+\frac{10}{60}+\frac{21}{56}+\frac{36}{56}+\frac{4}{60}+\frac{51}{60}=11+\frac{65}{60}+\frac{57}{56}$$

$$=13+\frac{1}{12}+\frac{1}{56}=13+\frac{14+3}{168}=13\tfrac{17}{168}.$$

(3) $$(3\tfrac{1}{4}\text{ of }4\tfrac{1}{3})\div\left(2\tfrac{1}{2}-\frac{1}{3}\right)\text{ of }\left(3\tfrac{1}{2}-\frac{1}{4}\right)$$

$$=\frac{13}{4}\times\frac{13}{3}\div 2\tfrac{1}{6}\text{ of }3\tfrac{1}{4}=\frac{13\times 13}{4\times 3}\times\frac{6}{13}\times\frac{4}{13}=\frac{6}{3}=2.$$

(4) $\left(\frac{1}{26}\text{ of }3\frac{1}{4}\right)+\left(\frac{3}{8}\div\frac{27}{64}\right)-\left(\frac{1}{1\frac{1}{7}}-\frac{1\frac{1}{3}}{3}\right)\div\left(2-\frac{5}{9}\right)$

$=\frac{1}{8}+\frac{8}{9}-\left(\frac{7}{8}-\frac{4}{9}\right)\div\frac{13}{9}=\frac{1}{8}+\frac{8}{9}-\frac{63-32}{8\times9}\times\frac{9}{13}$

$=\frac{1}{8}+\frac{8}{9}-\left(\frac{7}{8}-\frac{4}{9}\right)\div\frac{13}{9}=\frac{1}{8}+\frac{8}{9}-\frac{63-32}{8\times9}\times\frac{9}{13}$

$=\frac{117+832-279}{936}=\frac{670}{936}=\frac{335}{468}$.

(3)

$$\frac{\frac{2}{3}\text{ of }\frac{5}{7}\text{ of }\frac{35}{9}}{\frac{1}{7}\text{ of }\frac{2}{3}\text{ of }\frac{84}{81}}=\frac{2\times5\times5}{3\times9}\times\frac{7\times3\times9\times9}{2\times2\times7\times6}=\frac{5\times5\times9}{2\times6}=\frac{75}{4},$$

sum of $10\frac{3}{4}+3\frac{9}{10}+7\frac{3}{25}\frac{4}{}$

$=20+\frac{75}{100}+\frac{90}{100}+\frac{96}{100}=20+\frac{261}{100}=\frac{2261}{100}$;

$\therefore$ difference required $=\frac{2261}{100}-\frac{75}{4}=\frac{2261-1875}{100}=\frac{386}{100}=3\frac{43}{50}$.

(4)

$\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}=\frac{30+20+15+12}{60}=\frac{77}{60}$, $2-\frac{77}{60}=\frac{120-77}{60}=\frac{43}{60}$,

$\frac{43}{60}\times\frac{2}{3}\text{ of }\frac{27}{40}\text{ of }8=\frac{43\times2\times3\times3\times3\times8}{3\times2\times10\times3\times8\times5}=\frac{129}{50}$;

$\therefore$ fraction required $=\frac{\frac{128}{50}}{\frac{99}{1}}=\frac{129}{50\times99}=\frac{43}{1650}$.

(5)

Whole number $-\left(\frac{1}{8}+\frac{2}{10}+\frac{3}{20}\right)$ of number $=126$;

$\therefore$ whole number $-\frac{19}{40}$ of number $=126$;

$\therefore\frac{21}{40}$ of number $=126$; $\therefore\frac{1}{40}$ of number $=6$; $\therefore$ number $=240$;

therefore, one obtained 30; two others, each 24; three others, each 12. Also by question, 21 number scored by last $=126$; therefore number scored by him $=6$; therefore, number scored by the remaining four, each $=30$.

MULTIPLICATION OF DECIMALS.

Ex. XXXVIII. (p. 123)

(1)

3·8
42
—
76
152
—
159·6

(2)

417
·417
—
2919
417
1668
—
173 889

(3)

2·052
·0031
—
2052
6156
—
·0063612

·916
4·07
—
6412
3664
—
3·72812

(4)

81·4632
·0378
—
6517056
5702424
2443896
—
3·07930896

or $81\cdot4633 \times \cdot0378$

$$=\frac{814632}{10000}\times\frac{378}{10000}$$

$$=\frac{307930896}{100000000}=3\cdot07930896.$$

(5)

27·35
7·70071
—
2735
19145
19145
19145
—
210·6144185

or $27\cdot35 \times 7\cdot70071$

$$=\frac{2735}{100}\times\frac{770071}{100000}$$

$$=\frac{2106144185}{10000000}=210\cdot6144185.$$

(6)

·04375
·0754
—
17500
21875
30625
—
·003298750

or $\cdot04375 \times \cdot0754$

$$=\frac{4375}{100000}\times\frac{754}{10000}$$

$$=\frac{3298750}{1000000000}=\cdot00329875.$$

(7)

·0046
7·85
———
230
368
322
———
·036110

or $\cdot0046 \times 7\cdot85$

$$= \frac{46}{10000} \times \frac{785}{100}$$

$$= \frac{36110}{1000000} = \cdot03611.$$

(8)

·00846
·00324
———
3384
1692
2538
———————
·0000274104

or $\cdot00846 \times \cdot00324$

$$= \frac{846}{100000} \times \frac{324}{100000}$$

$$= \frac{274104}{10000000000} = \cdot0000274104.$$

(9)

·314
·0021
———
314
628
———————
·0006594

or $\cdot314 \times \cdot0021$

$$= \frac{314}{1000} \times \frac{21}{10000}$$

$$= \frac{6594}{10000000} = \cdot0006594.$$

(10)

·009
·00846
———
54
36
72
———————
·00007614

or $\cdot009 \times \cdot00846$

$$= \frac{9}{1000} \times \frac{846}{100000}$$

$$= \frac{7614}{100000000} = \cdot00007614.$$

(11)

·009207
6·056
———
55242
46035
55242
———————
·055757592

or $\cdot009207 \times 6\cdot056$

$$= \frac{9207}{1000000} \times \frac{6056}{1000}$$

$$= \frac{55757592}{1000000000} = \cdot055757592.$$

(12)

·00984
29
8532
1896
·27492

or $\cdot00948 \times 29$

$$= \frac{948}{100000} \times \frac{29}{1}$$

$$= \frac{27492}{100000} = \cdot27492.$$

(13)

1
·01
·01
·001
·00001
100
·00100

or $1 \times \cdot01 \times \cdot001 \times 100$

$$= 1 \times \frac{1}{100} \times \frac{1}{1000} \times 100$$

$$= \frac{100}{100000} = \frac{1}{1000} = \cdot001.$$

(14)

7·6
·071
76
532
·5396
2·1
5396
10792
1·13316
29
1019844
226632
32·86164

(15)

·007
700
4·900
760·3
147
294
343
3725·47
·00416
2235282
372547
1490188
15·4979552
100000
1549795·52

DIVISION OF DECIMALS.

Ex. XXXIX. (p. 126.)

(1)

$$\begin{array}{r} 5{\cdot}16 \;)\; 10{\cdot}836 \;(\; 2{\cdot}1 \\ 10\;32 \\ \hline 516 \\ 516 \\ \hline \end{array}$$

$$10{\cdot}836 \div 5{\cdot}16 = \frac{10836}{1000} \times \frac{100}{516} = \frac{10836}{516} \times \frac{1}{10} = \frac{21}{10} = 2{\cdot}1.$$

$$\begin{array}{r} {\cdot}381 \;)\; 34{\cdot}96818 \;(\; 91{\cdot}78 \\ 34\;29 \\ \hline 678 \\ 381 \\ \hline 2971 \\ 2667 \\ \hline 3048 \\ 3048 \\ \hline \end{array}$$

$$34{\cdot}96818 \div {\cdot}381 = \frac{3496818}{100000} \times \frac{1000}{381} = \frac{3496818}{381} \times \frac{1}{100} = \frac{9178}{100} = 91{\cdot}78.$$

(2)

$$\begin{array}{r} 1{\cdot}003 \;)\; {\cdot}025075 \;(\; {\cdot}025 \\ 2006 \\ \hline 5015 \\ 5015 \\ \hline \end{array}$$

$${\cdot}025075 \div 1{\cdot}003 = \frac{25075}{1000000} \times \frac{1000}{1003} = \frac{25075}{1003} \times \frac{1}{1000} = \frac{25}{1000} = 0{\cdot}25.$$

$$\begin{array}{r} {\cdot}0012 \;)\; {\cdot}02916 \;(\; 24{\cdot}3 \\ 24 \\ \hline 51 \\ 48 \\ \hline 36 \\ 36 \\ \hline \end{array}$$

$${\cdot}02916 \div {\cdot}0012 = \frac{2916}{100000} \times \frac{10000}{12} = \frac{2916}{12} \times \frac{1}{10} = \frac{243}{10} = 24{\cdot}3.$$

(3)

$$27) \cdot 00081 (\cdot 00003$$
$$81$$

$$\cdot 00081 \div 27 = \frac{81}{100000} \times \frac{1}{27} = \frac{3}{100000} = \cdot 00003.$$

$$4 \cdot 735) 1 \cdot 770890 (\cdot 374$$
$$1\ 4205$$
$$35039$$
$$33145$$
$$18940$$
$$18940$$

$$1\ 77089 \div 4 \cdot 735 = \frac{177089}{100000} \times \frac{1000}{4735} = \frac{1770890}{4735} \times \frac{1}{1000} = \frac{374}{1000} = \cdot 374.$$

(4)

$$\cdot 1) 1 \cdot 0 (10 \qquad 1 \div \cdot 1 = 1 \times \frac{10}{1} = 10.$$
$$1\ 0$$

$$\cdot 01) 1 \cdot 00 (100 \qquad 1 \div \cdot 01 = 1 \times \frac{100}{1} = 100.$$
$$1\ 00$$

$$\cdot 0001) 1 \cdot 0000 (10000 \qquad 1 \div \cdot 0001 = 1 \times \frac{10000}{1} = 10000.$$
$$1\ 0000$$

(5)

$$\cdot 126) 31 \cdot 500 (250$$
$$252$$
$$630$$
$$630$$

$$31 \cdot 5 \div \cdot 126 = \frac{315}{10} \times \frac{1000}{126} = \frac{31500}{126} = 250.$$

$$\cdot 32) 5 \cdot 2000 (16 \cdot 25 \qquad 5 \cdot 2 \div \cdot 32 = \frac{52}{10} \times \frac{100}{32}$$
$$32 \qquad 80$$
$$200 \qquad 64$$
$$192 \qquad 160$$
$$80 \qquad 160$$
$$= \frac{52000}{32} \times \frac{1}{100} = \frac{1625}{100} = 16 \cdot 25.$$

(6)

$$\begin{array}{r|l} \cdot0625 & 3217\cdot0000\ (\ 51472 \\ & 3125 \\ & \hline & 920 \\ & 625 \\ & \hline & 2950 \\ & 2500 \\ & \hline & 4500 \\ & 4375 \\ & \hline & 1250 \\ & 1250 \\ & \hline \end{array}$$

$$3217 \div \cdot0625 = \frac{3217 \times 10000}{625} = \frac{32170000}{625} = 51472.$$

$$\begin{array}{r|l} 6250 & \cdot0321700000\ (\ \cdot0000051472 \end{array}$$

$$\cdot03217 \div 6250 \frac{3217}{100000} \times \frac{1}{6250} = \frac{32170000}{625} \times \frac{1}{10000000000} = \frac{51472}{10000000000} = \cdot0000051472.$$

(7)

$$\begin{array}{r|l} 81\cdot34 & 4\cdot63638\ (\ \cdot057 \\ & 4\ 0670 \\ & \hline & 56938 \\ & 56938 \\ & \hline \end{array}$$

$$4\cdot63638 \div 81\cdot34 = \frac{463638}{100000} \times \frac{100}{8134} = \frac{57}{1000} = \cdot057.$$

(21)

$$\begin{array}{r|l|l} 8\cdot7 & 32\cdot50000\ (\ 3\cdot7356 & \\ & 261 & \\ & \hline & 640 & \\ & 609 & \\ & \hline & 310 & \\ & 261 & \\ & \hline & 490 & 550 \\ & 435 & 522 \\ & \hline & 550 & 28 \end{array}$$

$$32\cdot5 \div 8\cdot7 = \frac{325}{10} \times \frac{10}{87} = \frac{3250000}{87} \times \frac{1}{10000} = \frac{37356....}{10000} = 3\cdot7356....$$

$1{\cdot}7\ )\ {\cdot}02000\ (\ {\cdot}0117$

17

30
17

130
119

11

$${\cdot}02 \div 1{\cdot}7 = \frac{2}{100} \times \frac{10}{17}$$

$$= \frac{2000}{17} \times \frac{1}{10000}$$

$$= \frac{117....}{10000} = {\cdot}0117....$$

$${\cdot}013\ )\ 1{\cdot}0000000\ (\ 76{\cdot}9230$$

91

90 30
78 26

120 40
117 39

30 1

$$1 \div {\cdot}013 = \frac{1}{1} \times \frac{1000}{13}$$

$$= \frac{10000000}{13} \times \frac{1}{10000}$$

$$= \frac{769230...}{10000} = 76{\cdot}9230....$$

(22)

$${\cdot}0063\ )\ {\cdot}00938400\ (\ 1{\cdot}4895$$

63

308
252 600
567

564 330
504 315

600

$${\cdot}009384 \div {\cdot}0063$$

$$= \frac{9384}{1000000} \times \frac{10000}{63}$$

$$= \frac{938400}{63} \times \frac{1}{10000}$$

$$= \frac{14895....}{1000} = 1{\cdot}4895....$$

$$1{\cdot}02\ )\ 51846{\cdot}734000\ (\ 50830{\cdot}1313$$

510

846 320
816 306

307 140
306 102

134 380
102 306

320 74

$$51846{\cdot}734 \div 1{\cdot}02$$

$$= \frac{51846734}{1000} \times \frac{100}{102}$$

$$= \frac{51846734000}{102} \times \frac{1}{10000}$$

$$= \frac{50830\,1313....}{10000}$$

$$= 50830{\cdot}1313....$$

(23)

$$\begin{array}{r|l} .023 & 7380.9640000 \;(\; 320911.4782 \\ & 69 \\ & \hline 48 \\ & 46 \\ & \hline 209 \\ & 207 \\ & \hline 26 \\ & 23 \\ & \hline 34 \end{array} \qquad \begin{array}{l} 34 \\ 23 \\ \hline 110 \\ 92 \\ \hline 180 \\ 161 \\ \hline 190 \\ 184 \\ \hline 60 \\ 46 \\ \hline 14 \end{array}$$

$7380.964 \div .023$

$$= \frac{7380964}{1000} \times \frac{1000}{23}$$

$$= \frac{7380964000}{23} \times \frac{1}{10000}$$

$$= \frac{3209114782....}{10000}$$

$$= 320911.4782....$$

$$\begin{array}{r|l} 3.42 & 6.500000 \;(\; 1.9005 \\ & 342 \\ & \hline 3080 \\ & 3078 \\ & \hline 2000 \\ & 1710 \\ & \hline 290 \end{array}$$

$6.5 \div 3.42 = \frac{65}{10} \times \frac{100}{342}$

$$= \frac{6500000}{342} \times \frac{1}{10000} = 1.9005....$$

$$\begin{array}{r|l} 19 & 25.0000 \;(\; 1.3157 \\ & 19 \\ & \hline 60 \\ & 57 \\ & \hline 30 \\ & 19 \\ & \hline 110 \\ & 95 \\ & \hline 150 \\ & 133 \\ & \hline 17 \end{array}$$

$25 \div 19 = \frac{250000}{19} \times \frac{1}{10000}$

$$= \frac{13157. \;..}{10000} = 1.3157....$$

(24)

$$\begin{array}{r|l} .01257 & 176432.76 \;(\; 14036019.0930 \\ & 1257 \\ & \hline 5073 \\ & 5028 \\ & \hline 4527 \\ & 3771 \\ & \hline 7566 \\ & 7542 \\ & \hline 2400 \\ & 1257 \\ & \hline 11430 \\ & 11313 \\ & \hline 11700 \\ & 11313 \\ & \hline 3870 \\ & 3771 \\ & \hline 990 \end{array}$$

$176432.76 \div .01257$

$$= \frac{17643276}{100} \times \frac{100000}{1257}$$

$$= \frac{176432760000000}{1257} \times \frac{1}{10000}$$

$$= \frac{140360190930....}{10000}$$

$$= 14036019.0930....$$

$$6535496\cdot2\ )\ 7457\cdot13450\ (\ \cdot0011$$
$$65354962$$
$$\overline{}$$
$$91163830$$
$$65354962$$
$$\overline{}$$

$$7457\cdot1345\div6535496\cdot2=\frac{74571345}{10000}\times\frac{10}{65354962}$$
$$=\frac{745713450}{65354962}\times\frac{1}{10000}=\frac{11\ldots.}{10000}=\cdot0011\ldots.$$

(25)

$$2\cdot9\ )\ 37\cdot24000\ (\ 12\cdot8413$$
$$29$$
$$\overline{}$$
$$82$$
$$58$$
$$\overline{}$$
$$244$$
$$232$$
$$\overline{}$$
$$120$$
$$116$$
$$\overline{}$$
$$40$$

$$40$$
$$29$$
$$\overline{}$$
$$110$$
$$87$$
$$\overline{}$$

$$37\cdot24\div2\cdot9$$
$$=\frac{3724}{100}\times\frac{10}{29}$$
$$=\frac{3724000}{29}\times\frac{1}{10000}$$
$$=\frac{128413\ldots.}{10000}$$
$$=12\cdot8413\ldots.$$

$$27\cdot53\ )\ \cdot071900\ (\ \cdot0026$$
$$5506$$
$$\overline{}$$
$$16840$$
$$16518$$
$$\overline{}$$

$$\cdot0719\div27\cdot53=\frac{719}{10000}\times\frac{100}{2753}$$
$$=\frac{26\ldots.}{10000}=\cdot0026\ldots.$$

(26)

$$157\ )\ \cdot0029202\ (\ \cdot0000186$$
$$157$$
$$\overline{}$$
$$1350$$
$$1256$$
$$\overline{}$$
$$942$$
$$942$$
$$\overline{}$$

$$\cdot0029202\div157$$
$$=\frac{29202}{10000000}\times\frac{1}{157}$$
$$=\frac{186}{10000000}=\cdot0000186.$$

$$1\cdot57\ )\ \cdot0029202\ (\ \cdot00186$$

$$\cdot0029202\div1\cdot57=\frac{29202}{10000000}\times\frac{100}{157}=\frac{186}{100000}=\cdot00186.$$

(27)

1953125) 5005·00000000 (·00256256
3906250
10987500
9765625
12218750
11718750
5000000
3906250
10937500
9765625
11718750
11718750

$5005 \div 1953125 = \frac{500500000000}{1953125} \times \frac{1}{100000000} = \frac{256256}{100000000} = \cdot 00256256.$

195·3125) 50·05 (·256256

$50\cdot05 \div 195\cdot3125 = \frac{5005}{100} \times \frac{10000}{1953125} = \frac{500500000000}{1953125} \times \frac{1}{1000000}$

$= \frac{256256}{1000000} = \cdot 256256.$

·0001953125) ·05005 (256·256

$\cdot05005 \div \cdot0001953125 = \frac{5005}{100000} \times \frac{10000000000}{1953125}$

$= \frac{500500000000}{1953125} \times \frac{1}{1000} = \frac{256256}{1000} = 256\cdot256.$

(28)

$7\frac{1}{2}$ of $\frac{1}{5} + \frac{17}{25} = \frac{3}{2} + \frac{17}{25} = \frac{109}{50} = \frac{218}{100} = 2\cdot18.$

·0005) 2·1800 (4360;

$\frac{428}{515}$ of $\frac{5}{4}$ of $\frac{5253}{18190} = \frac{107 \times 4 \times 5 \times 51 \times 103}{103 \times 5 \times 4 \times 170 \times 107} = \frac{51}{170} = \frac{3 \times 70}{17 \times 10}$

$= \frac{3}{10} = \cdot 3,$

$\therefore 31\cdot008 \div \cdot3 = 103\cdot36;$

$16\frac{2}{3} = \frac{50}{3} = \frac{100}{6}$, and $\cdot7575 \div \frac{100}{6} = \frac{\cdot7575 \times 6}{100} = \frac{4\cdot5450}{100} = \cdot04545.$

Ex. XL. (p. 129.)

(1)

4 | 1·00
·25

4 | 3·00
·75

8 | 5·000
·625

25 { 5 | 9·0
5 | 1·80
·36

16 { 8 | 2·000
2 | ·6250
·3125

20 { 10 | 19 0
2 | 1.90
·95

(2)

128 { 4 | 66·0
4 | 16·5
4 | 4·125
2 | 1·03125
·515625

125 { 5 | 54·0
5 | 10·8
5 | 2·16
·432

200 { 100 | 570
2 | 5·7
2·85

125 { 5 | 170
5 | 34
5 | 6 8
1·36

160 { 4 | 1·0
4 | ·25
10 | ·0625
·00625

(3)

64 { 4 | 11·00
4 | 2·75
4 | ·6875
·171875

∴ *Ans.* = 6·171875.

240 { 10 | 57
4 | 5·7
6 | 1·425
·2375

256 { 4 | 13
4 | 3·25
4 | ·8125
4 | ·203125
·05078125

512 { 4 | 3·00
4 | ·75
4 | ·1875
4 | ·046875
2 | ·01171875
·005859375

(Continued on next page.)

(3 continued.)

$$\frac{588}{78125}=\frac{117{\cdot}6}{15625}=\frac{23{\cdot}52}{3125}=\frac{4{\cdot}704}{625}=\frac{{\cdot}9408}{125}=\frac{{\cdot}18816}{25}=\frac{{\cdot}037632}{5}$$

$$={\cdot}0075264;$$

$$\therefore Ans.=15{\cdot}0075264.$$

(4)

$$3\tfrac{1}{8} \text{ of } \frac{1}{512}=\frac{29}{8\times512}=\frac{3{\cdot}625}{512}=\frac{{\cdot}453125}{64}=\frac{{\cdot}056640625}{8}$$

$$={\cdot}007080078125.$$

(5)

$$\frac{1}{2}+\frac{1}{4}+\frac{1}{16}+\frac{1}{32}=\frac{16+8+2+1}{32}=\frac{27}{32}=\frac{6{\cdot}75}{8}={\cdot}84375.$$

(6)

$$\frac{1}{64}\times{\cdot}0064=\frac{1}{64}\times\frac{64}{10000}=\frac{1}{10000}={\cdot}0001.$$

(7)

$$\frac{3}{5}+{\cdot}061={\cdot}6+{\cdot}061={\cdot}661.$$

(8)

$$\frac{1}{2}+\frac{1}{5}-\frac{1}{8}=\frac{20+8-5}{40}=\frac{23}{40}=\frac{2{\cdot}3}{4}={\cdot}575.$$

(9)

$$\frac{47\frac{3}{8}}{94} \text{ of } \frac{11\frac{3}{4}}{7{\cdot}5}=\frac{47{\cdot}625}{94}\times\frac{47}{4\times7{\cdot}5}=\frac{47{\cdot}625}{2\times30}=\frac{4{\cdot}7625}{6}={\cdot}79375.$$

(10)

$$\frac{7{\cdot}75}{9} \text{ of } \frac{2\frac{1}{2}}{2\frac{7}{9}} \text{ of } \frac{20}{31}=\frac{7{\cdot}75}{9} \text{ of } \frac{\frac{5}{2}}{\frac{25}{9}} \text{ of } \frac{20}{31}$$

$$=\frac{7{\cdot}75\times5\times9\times20}{9\times2\times25\times31}=\frac{7{\cdot}75\times10}{5\times31}=\frac{7{\cdot}75\times2}{31}=\frac{15{\cdot}5}{31}={\cdot}5.$$

(11)

$$5\frac{5}{640} \div \cdot75 \text{ of } \frac{6}{5} \text{ of } 7\tfrac{1}{2} = 5\frac{\cdot625}{80} + \cdot75 \times \frac{6}{5} \times \frac{15}{2}$$

$$= 5\frac{\cdot078125}{10} + \cdot75 \times 9 = 5\cdot0078125 + 6\cdot75 = 11\cdot7578125$$

(12)

$$3\frac{4}{25} + \frac{33}{110} + 81\frac{37}{1000} + \frac{7\frac{1}{2}}{3\frac{1}{3}} = 3\frac{\cdot8}{5} + \frac{3}{10} + 81\frac{37}{1000} + \frac{31\times8}{31\times4}$$

$$= 3\cdot16 + \cdot3 + 81\cdot037 + 2 = 86\cdot497.$$

(13)

$$\frac{\frac{247}{5}}{\frac{7}{7}} + \frac{1512}{108} + \frac{17}{7\frac{2}{3}} + 200\frac{7}{10} + \frac{11}{62\cdot5}$$

$$= \frac{1729}{5} + \frac{168}{12} + \frac{17\times9}{68} + 200\frac{7}{10} + \frac{110}{625}$$

$$= 345\cdot8 + 14 + \frac{9}{4} + 200\cdot7 + \frac{4\cdot4}{25}$$

$$345\cdot8 + 14 + 2\cdot25 + 200\cdot7 + \cdot176 = 562\cdot926.$$

Ex. XLI. (p. 132.)

(1)

$9 \mid 5\cdot0$

$\cdot\dot{5}\dot{5}\ldots.$

$7 \mid 3\cdot$

$\cdot\dot{4}2857\dot{1}4\ldots.$

$11 \mid 2\cdot00$

$\cdot\dot{1}\dot{8}\dot{1}\dot{8}\ldots.$

$37 \overline{)} 1\cdot000 (\ \cdot\dot{0}2\dot{7}\ldots.$

74

260

259

1

(2)

$$\frac{17}{30} = \frac{1\cdot7}{3} = \cdot5\dot{6}6\ldots.; \quad \frac{368}{495} = \frac{73\cdot6}{99} = \frac{8\cdot1\dot{7}7\ldots.}{11} = \cdot\dot{7}4\dot{3}4\dot{3}\ldots.;$$

$$\frac{16}{81} = \frac{1\cdot\dot{7}7\ldots.}{9} = \cdot\dot{1}97530864\dot{;}$$

$333 \overline{)} 52\cdot000 (\ \cdot1\dot{5}6\dot{;}$

333

1870

1665

2050

1998

52

$$\therefore 15\frac{52}{333} = 15\cdot\dot{1}5\dot{6}.$$

(3)

$$\frac{3231}{3520}=\frac{323{\cdot}1}{352}=\frac{29{\cdot}3\dot{7}\dot{2}72....}{32}=\frac{7{\cdot}34\dot{3}1\dot{8}18....}{8}={\cdot}91789\dot{7}\dot{7}2.$$

3367) 962·000000 (·285714,
6734

28860
26936

19240
16835

24050
23569

4810
3367

14430
13468

962

$\therefore 7\frac{962}{3367}=7{\cdot}2\dot{8}5\dot{7}1\dot{4}$;

$\frac{17}{99000}=\frac{{\cdot}017}{99}=\frac{{\cdot}00154}{9}$

$={\cdot}000\dot{1}\dot{7}.$

(4)

9768) 83·000000000 (·008497133
78144

48560
39072

94880
87912

69680
68376

13040
9768

32720
29304

34160
29304

4856

$\therefore 24\frac{83}{9768}=24{\cdot}008\dot{4}97133$;

$17\frac{13}{700}=17\frac{{\cdot}13}{7}$

$=17{\cdot}01\dot{8}57\dot{1}4\dot{2}$;

$2\frac{139868}{833325}=2\frac{27973{\cdot}6}{166665}$

$2\frac{5594{\cdot}72}{33333}$.

33333) 5594·7200000 (·1678432

33333

226142
199998

261440
233331

281090
266664

144260
133332

109280 92810
99999 66666

92810 26144

$$\therefore 2\frac{139868}{833325} = 2\cdot\dot{1}678432\dot{.}$$

(5)

19) 1·00 (·05263,
95

50
38

120
114

60
57

3

hence $\frac{1}{19} = \cdot 05263\frac{3}{19}$; $\therefore \frac{3}{19} = \cdot 15789\frac{2}{19}$;
" $\frac{1}{19} = \cdot 0526315789\frac{2}{19}$; $\therefore \frac{2}{19} = \cdot 473684210\ldots$
" $\frac{1}{19} = \cdot\dot{0}52631578947368421\dot{.}$

23) 100 (·043478,
92

80
69

110
92

180 190
161 184

190 6

hence $\frac{1}{23} = \cdot 043478\frac{6}{23}$; $\therefore \frac{6}{23} = \cdot 260869\frac{13}{23}$;
" $\frac{1}{23} = \cdot 0434782608691\frac{3}{23}$;
$\frac{13}{23} = 565217391304\ldots.$;
$\therefore \frac{1}{23} = \cdot\dot{0}43478260869565217391\dot{3}.$

29) 100 (·03448,
87
---
130 hence $\frac{1}{29}$ = ·03448$\frac{8}{29}$; ∴ $\frac{8}{29}$ = ·27586$\frac{6}{29}$;
116 " $\frac{1}{29}$ = ·0344827586$\frac{6}{29}$; ∴ $\frac{6}{29}$ = ·2068965517$\frac{7}{29}$;
---
140 " $\frac{1}{29}$ = ·03448275862068965517$\frac{7}{29}$;
116 ∴ $\frac{7}{29}$ = ·2413793103 .....;
---
240 " $\frac{1}{29}$ = $\dot{\cdot}$0344827586206896551724137931$\dot{}$.
232

8

31) 100 (·032258,
93
---
70 hence $\frac{1}{31}$ = ·032258$\frac{2}{31}$; ∴ $\frac{2}{31}$ = ·064516$\frac{4}{31}$;
62 " $\frac{1}{31}$ = ·032258064516$\frac{4}{31}$; ∴ $\frac{4}{31}$ = ·12903.....;
---
80 " $\frac{1}{31}$ = $\dot{\cdot}$032258064516129$\dot{}$.
62
---
180 250
155 248
--- ---
250 2

(6)

$\dot{\cdot}\dot{7} = \frac{7}{9}$; $\dot{\cdot}0\dot{7} = \frac{7-0}{90} = \frac{7}{90}$; $\dot{\cdot}2\dot{2}\dot{7} = \frac{227-2}{990} = \frac{225}{990} = \frac{25}{110} = \frac{5}{22}$.

(7)

$\dot{\cdot}5\dot{8}\dot{3} = \frac{583-5}{990} = \frac{578}{990} = \frac{289}{495}$; $\dot{\cdot}1\dot{3}\dot{5} = \frac{135}{999} = \frac{45}{333} = \frac{15}{111} = \frac{5}{37}$;

$\dot{\cdot}2\dot{6}3 = \frac{263-26}{900} = \frac{237}{900} = \frac{79}{300}$.

(8)

$\dot{\cdot}00\dot{1}\dot{8}\dot{5} = \frac{185}{99900} = \frac{37}{19980}$; $3\cdot\dot{0}2\dot{4} = 3\frac{24}{999} = 3\frac{8}{333} = \frac{1007}{333}$;

$\dot{\cdot}01\dot{2}3\dot{6} = \frac{1236-12}{99000} = \frac{1224}{99000} = \frac{153}{12375} = \frac{17}{1375}$.

(9)

$$\dot{1}42857\dot{1}=\frac{142857}{999999}=\frac{15873}{111111}=\frac{5291}{37037}=\frac{481}{3367};$$

$$\cdot 397916\dot{6}=\frac{397916-39791}{900000}=\frac{358125}{900000}=\frac{71625}{180000}$$
$$=\frac{14325}{36000}=\frac{2865}{7200}=\frac{573}{1440}=\frac{191}{480};$$

$$\cdot 382\dot{1}42857\dot{1}=\frac{382142857-382}{999999000}=\frac{382142475}{999999000}=\frac{42600275}{111111000}$$
$$=\frac{3860025}{10101000}=\frac{772005}{2020200}=\frac{154401}{404040}=\frac{51467}{134680}.$$

(10)

$$\cdot 307692\dot{3}=\frac{307692}{999999}=\frac{102564}{333333}=\frac{9324}{30303}=\frac{1036}{3367};$$

$$\cdot 6307692\dot{3}=\frac{6307693-6}{9999990}=\frac{6307686}{9999990}=\frac{2102562}{3333330}$$
$$=\frac{191142}{303030}=\frac{21238}{33670}=\frac{10619}{16835}=\frac{41}{65};$$

$$2\cdot 7857142\dot{3}=2\frac{7857142-7}{9999990}=2\frac{7857135}{9999990}=2\frac{2619045}{3333330}=2\frac{238095}{303030}$$
$$=2\frac{79365}{101010}=2\frac{15873}{20202}=2\frac{5291}{6734}=2\frac{481\times 11}{481\times 14}=2\frac{11}{14}=\frac{39}{14}.$$

(11)

$$\cdot 342\dot{7}5\dot{3}=\frac{342753-342}{999000}=\frac{342411}{999000}=\frac{114137}{333000};$$

$$\cdot 03132\dot{1}3\dot{2}=\frac{3132132-3132}{99900000}=\frac{3129000}{99900000}=\frac{1043}{33300};$$

$$8\cdot 02083\dot{3}=8\frac{2083-208}{90000}=8\frac{1875}{90000}=8\frac{375}{18000}=8\frac{75}{3600}=8\frac{15}{720}$$
$$=8\frac{1}{48}=\frac{385}{48}.$$

(12)

$$85\cdot 60806\dot{3}=85\frac{60806-6080}{90000}=85\frac{54726}{90000}=85\frac{9121}{15000}$$
$$=\frac{1275000+9121}{15000}=\frac{1284121}{15000};$$

(Continued on next page.)

(12 continued.)

$$3\cdot\dot{6}428571\dot{}=3\frac{6428571-6}{9999990}=3\frac{6428565}{9999990}=3\frac{714285}{1111110}$$

$$=3\frac{79365\times 9}{79365\times 14}=3\frac{9}{14}=\frac{51}{14};$$

$$127\cdot00022095\dot{}=127\frac{22095-220}{99000000}=127\frac{21875}{99000000}$$

$$=127\frac{4375}{19800000}=127\frac{875}{3960000}=127\frac{175}{792000}=127\frac{35}{158400}$$

$$=127\frac{7}{31680}=\frac{4023367}{31680}.$$

Ex. XLII. (p. 134.)

(1)

2·418418418
1·166666667
3·009009009
·735444444
24·042

31·371538538

$\therefore$ *Ans.* = 31·371538.

(2)

234·6666666667
9·9288888889
·0123456789
·0044004400
456·

700·6123016745

$\therefore$ *Ans.* = 700·612301.

(3)

6·45
·3333333

6·1166667

$\therefore$ *Ans.* = 6·116666.

7·72727272
6·04545454

1·68181818

$\therefore$ *Ans.* = 16·81818.

309·
·94724724

308·05275276

$\therefore$ *Ans.* = 308·052752.

(4)

$$\frac{49}{52}+\frac{278}{390}+\frac{7}{12}=\frac{49\times 15+278\times 2+7\times 65}{780}$$

$$=\frac{735+556+475}{780}=\frac{1746}{780}=\frac{174\cdot6}{78}=\frac{29\cdot1}{13}=2\cdot\dot{2}384615\dot{};$$

$$18\frac{1}{12}-4\frac{5}{14}=18\cdot083333333-4\cdot357142857=13\cdot\dot{7}26190476\dot{}.$$

(5)

$$2{\cdot}\dot{3}\times 5{\cdot}\dot{6}=2\tfrac{3}{9}\times 5\tfrac{6}{9}=\frac{7\times 17}{9}=\frac{119}{9}=13{\cdot}\dot{2};$$

$$\cdot 7\dot{5}7\dot{5}\times\cdot 3\dot{6}\dot{6}=\frac{7575-75}{9900}\times\frac{366-36}{900}=\frac{75}{99}\times\frac{330}{900}$$

$$=\frac{75\times 33}{99\times 90}=\frac{5}{3\times 6}=\frac{2{\cdot}5}{9}=\cdot 2\dot{7}.$$

(6)

$$\cdot 40\dot{6}\times 62=\frac{406-40}{900}\times 62=\frac{366\times 62}{900}=\frac{122\times 62}{300}$$

$$=\frac{7564}{300}=\frac{75{\cdot}64}{3}=25{\cdot}21\dot{3};$$

$$825\times\cdot\dot{3}\dot{6}=825\times\frac{36}{99}=\frac{825\times 4}{11}=75\times 4=300.$$

(7)

$$7{\cdot}5\dot{2}\times 48{\cdot}\dot{3}=7\tfrac{47}{90}\times 48\tfrac{1}{3}=\frac{677\times 145}{90\times 3}=\frac{98165}{90\times 3}$$

$$=\frac{9816{\cdot}5}{9\times 3}=\frac{1090{\cdot}7\dot{2}}{3}=363{\cdot}5\dot{7}40;$$

$$368\times\cdot\dot{6}=368\times\frac{2}{3}=\frac{736}{3}=245{\cdot}\dot{3}$$

(8)

$$3{\cdot}1\dot{4}\dot{5}\times\cdot\dot{4}2\dot{9}\dot{7}=3\frac{144}{990}\times\frac{4293}{9990}=\frac{3114\times 4293}{990\times 9990}=\frac{13368402}{9890100}=1{\cdot}35169\ldots.$$

$$20\tfrac{4}{7}\times\cdot\dot{8}\dot{4}=\frac{144}{7}\times\frac{84}{99}=\frac{16\times 12}{11}=\frac{192}{11}=17{\cdot}\dot{4}\dot{5}.$$

(9)

$$195{\cdot}0\dot{2}\div 4=48{\cdot}7\dot{5};$$

$$\cdot 3759\dot{2}\div\cdot 0\dot{5}=\frac{37592-37}{99900}\times\frac{90}{5}=\frac{37555\times 90}{99900\times 5}$$

$$=\frac{7511}{1110}=\frac{203\times 37}{30\times 37}=\frac{20{\cdot}3}{3}=6{\cdot}7\dot{6}.$$

(10)

$$54 \div \dot{1}\dot{7} = 54 \div \frac{16}{90} = \frac{54 \times 90}{16} = \frac{27 \times 90}{8} = \frac{2430}{8} = 303{\cdot}75;$$

$$13{\cdot}\dot{2} \div 5{\cdot}\dot{6} = 13\tfrac{2}{3} \div 5\tfrac{2}{3} = \frac{119}{9} \times \frac{3}{17} = \frac{7}{3} = 2{\cdot}\dot{3}.$$

(11)

$$411{\cdot}\dot{3}5\dot{1}\dot{9} \div 58{\cdot}\dot{7}6\dot{4}\dot{5} = 411\frac{3516}{9990} = 58\frac{7638}{9990}$$

$$= \frac{4109406}{9990} \times \frac{9990}{587058} = \frac{4109406}{587058} = 7;$$

$$2{\cdot}16595\dot{\ } \div {\cdot}0\dot{4} = 2\frac{14936}{90000} \times \frac{90}{4} = \frac{194936}{4 \times 1000} = \frac{48734}{1000} = 48{\cdot}734;$$

$${\cdot}6559903\dot{\ } \div 48{\cdot}76 = \frac{6553344}{9990000} \times \frac{100}{4876}$$

$$= \frac{1344 \times 4876}{99900 \times 4876} = \frac{13{\cdot}44}{999} = {\cdot}0134\ldots.$$

REDUCTION OF DECIMALS.

Ex. XLIII. (p. 136.)

(4)

league.
·875
3
2·625 mi.
1760
37500
4375
625
1100 000 yds.

Ans. 2 mi., 1100 yds.

days.
2·5384375
24
21537500
10768750
12·9225000 hrs.
60
55·3500 m.
60
21·00 sec.

Ans. 2 days., 12 hrs., 55 m., 21 sec.

(Continued on next page.)

(4 continued.)

lbs Troy.
·6
12
7·2 oz.
20
4·0 dwts.

Ans. 7 oz., 4 dwts.

(5)

cwt.
·85076
4
3·40304 qrs.
25
201520
80608
10 07600 lbs.
16
1 21600 oz.

Ans. 3 qrs., 10 lbs., 1·216 oz.

cwt.
·07325
4
·29300 qrs.
25
146500
58600
7·32500 lbs.
16
5.20000 oz.

Ans. 7 lbs., 5·2 oz.

mile.
·045
8
·360 fur.
40
14·400 po
5½
2000
200
2 200 yds.
36
7·200 in.

Ans. 14 po., 2 yds., 7·2 in.

(6)

tons.
4·16525
20
3·30500 cwt.
4
1·22000 qrs.
25
5·50000 lbs.
16
8·00000 oz.

Ans. 4 tons., 3 cwt., 1 qr., 5 lbs., 8 oz.

(7)

qrs.
2·46875
8
3·75000 bush.
4
3·00000 pks.

Ans. 2 qrs., 3 bus., 3 pks.

cwt.
3·625
4
2·500 qrs.
25
12·500 lbs.

Ans. 3 cwt., 2 qrs., 12 lbs., 8 oz.

lbs. Troy.
3·8343
12
10·0116 oz.
20
·2320 dwts.
24
9280
4640
5·5680 grs.

Ans. 3 lbs., 10 oz., 5·568 grs.

acre.
·05
4
·20 ro.
40
8·00 po.

Ans. 8 sq. poles.

lbs.
4·106
346
24636
16424
12318
1420·676 lbs.
16
10·816 oz.

Ans. 1420 lbs., 10·816 oz.
=14 cwt., 20 lbs., 10·816 oz.

(8)

ac.
3·8375
4

3·3500 ro.
40

14·0000 po.

Ans. 3 ac., 3 ro., 14 po.

gall.
3·5
18

280
35

63·0 gall.

Ans. 63 gallons.

(11)

ro.
2·25
14

00
225

31·50 ro.
40

20·00 po.

Ans. 7 ac., 3 ro., 20 po.

yards.
2·0396
2290

1835640
40792
40792

4670·6840 yds.
3

2·0520 ft.

Ans. 2 m., 1150 yds., 2·052 ft.

(9)

fur.
·25
40

37·000 po.

Ans. 37 poles.

lun. mo.
·34375
28

275000
68750

9·62500 days.
24

250000
125000

15·00000 hrs.

Ans. 9 days, 15 hours.

(12)

sq. ft.
4·751
25

23755
9502

118·775 sq. ft.
144

3100
3100
775

111·600 sq. in.

Ans. 13 s. yds., 1 s. ft., 111·6 s. in.

(Continued on next page.)

(12 continued.)

miles.	
2·009943	1·999360 yds.
2	3
4·019886 mi.	2·998080 ft.
8	12
·159088 fur.	11·976960 in.
40	
6·363520 po.	
$5\frac{1}{2}$	
1817600	
181760	
1·999360 yds.	

Ans. 4 mi., 6 po., 1 yd., 2 ft., 11·97696 in.

(13)

$$\cdot\dot{3}8\dot{3} \text{ of } \$1 = \frac{383-38}{900} \text{ of } \$1 = \frac{345}{900} \text{ of } \$1 = 38\tfrac{1}{3} \text{ cents};$$

$$\cdot\dot{4}7083 \text{ of } \$4 = \frac{47083-4708}{90000} \text{ of } \$4 = \$\frac{42375\times 4}{90000} = \$1.88\tfrac{1}{3};$$

$$\cdot\dot{4}69\dot{4} \text{ of 1 lb. Troy} = \frac{4694-469}{9000} \text{ of lb. Troy}$$

$$= \frac{4225}{9000} \text{ lb. Troy} = \frac{169\times 12}{360} \text{ oz.}$$

$$= \frac{169}{30} \text{ oz.} = 5 \text{ oz., 12 dwts., 16 grs.}$$

(14)

$$\cdot 5\dot{7}4\dot{0} \text{ of } 27s. = \frac{5740-574}{9000} \text{ of } 27s. = \frac{5166\times 27s.}{9000} = 15s.\ 3{\cdot}976d.;$$

$$\cdot 1\dot{3}\dot{8} \text{ of } 10s.\ 6d. = \frac{138-13}{900} \text{ of } 126d. = \frac{125\times 126}{900}d. = \frac{35}{2}d. = 1s.\ 5\tfrac{1}{2}d.;$$

$$2{\cdot}\dot{6} \text{ of } 5s. = 2\tfrac{6}{9} \text{ of } 5s. = 2\tfrac{2}{3} \text{ of } 5s. = \frac{40}{3}s. = 13s.\ 4d.$$

(15)

$4\cdot\dot{0}5$ of $1\frac{1}{2}$ sq. yds. $=\left(4\frac{5}{90}\times\frac{3}{2}\right)$ sq. yds.

$=\left(4\frac{1}{18}\times\frac{3}{2}\right)$ sq. yds. $=\frac{73}{12}$ sq. yds. $=6$ sq. yds., 108 sq. in.;

$\cdot\dot{1}6\dot{3}$ of $2\frac{1}{2}$ miles $=\frac{163-16}{900}$ of $2\frac{1}{2}$ miles

$=\left(\frac{147}{900}\times\frac{5}{2}\right)$ miles $=\frac{147}{180\times2}$ miles.

$=\frac{49}{120}$ miles $=3$ fur., 10 po., 3 yds., 2 ft.;

$4\cdot\dot{9}\dot{0}$ of 4 days, 3 hrs. $=4\frac{90}{99}$ of 99 hrs.

$=\frac{396+90}{99}$ of 99 hrs. $=486$ hrs. $=20$ days, 6 hrs.

(16)

$3\cdot24\dot{2}$ of $2\frac{1}{2}$ acres $=\left(3\frac{242-24}{900}\times\frac{5}{2}\right)$ acres.

$=\left(3\frac{109}{450}\times\frac{5}{2}\right)$ acres $=\frac{1459}{180}$ acres $=8\frac{19}{180}$ acres;

$\frac{\cdot093\dot{1}\dot{8}}{\cdot5681}$ of $2\frac{1}{12}$ of 2·5 days $=\left(\frac{9318-93}{99000}\times\frac{9900}{5681-56}\times\frac{25}{12}\times\frac{5}{2}\right)$ days

$=\left(\frac{9225}{10}\times\frac{1}{5625}\times\frac{25}{12}\times\frac{5}{2}\right)$ days $=\frac{41}{48}$ days $=20$ hrs., 30 min.

(17)

£
·77777
20
15·55540*s.*
12
6·6480*d.*

s.	*d.*
15	6·648
8	6·648
Ans. 7	0

cents.
·70323
48
562584
281292
$3·375504

cents.
3·5646
24
142584
71292
85·5504 cents.

$3·375504
·855504
$2·52 *Ans.*

(18)

$\cdot\dot{2}68$ cwt. $\cdot056\dot{2}$ ton $\cdot57\dot{8}6$ qrs.

$=\frac{268-26}{900}$ cwt. $=\frac{562-56}{9000}$ ton. $=\frac{5786-578}{9000}$ qr.

$=\frac{242\times100}{900}$ lbs. $=\frac{506\times2000}{9000}$ lbs. $=\frac{5208\times25}{9000}$ lbs.

$=26\frac{8}{9}$ lbs. $=112\frac{4}{9}$ lbs. $=14\frac{7}{9}$ lbs.

therefore, value $=26\frac{8}{9}$ lbs. $+112\frac{4}{9}$ lbs. $-14\frac{7}{9}$ lbs. $=1$ cwt., $12\frac{5}{9}$ lbs.

(19)

£

·634375

20

12·68750*s*.

12

8·250000*d*.

4

1·000000*q*.

s.

·025

25

125

50

·625*s*.

12

7·500*d*.

4

2·000*q*.

$\cdot\dot{3}1\dot{6}$ of 30*s*.

$=\frac{316-31}{900}$ of 30*s*.

$=\frac{285}{30}s.=\frac{19}{2}s.$

9*s*. 6*d*.

therefore, value $=12s.\ 8\frac{1}{4}d+7\frac{1}{2}d+9s.\ 6d.=£1.\ 2s.\ 9\frac{3}{4}d.$

(20)

$2\cdot\dot{8}\dot{1}$ of $365\frac{1}{4}$ days $=\left(2\frac{8}{9}\frac{1}{9}\times\frac{1461}{4}\right)$ days.

$=\left(\frac{31\times1461}{11\times4}\right)$ days $=147$ wks., 0 days, 8 hrs., 10 min., $54\frac{6}{11}$ sec.

wks.

5·75

7

5·25 days.

24

6·00 hrs.

$\frac{8}{9}$ of $5\frac{5}{9}$ hrs. $=\frac{3\times50}{4\times9}$ hrs.

$=\frac{25}{6}$ hrs. $=4$ hrs., 10 min.

therefore value

$=147$ wks., 0 days, 8 hrs., 10 min., $54\frac{6}{11}$ sec.

$+5$ wks., 5 days, 6 hrs., -4 hrs., 10 min.

152 wks., 5 days, 10 hrs., 0 min., $54\frac{6}{11}$ sec.

(21)

$\frac{7}{9}$ of $\frac{3}{14}$ of 3 ac. $= \frac{7 \times 3 \times 3}{9 \times 14}$ ac. $= \frac{1}{2}$ ac. $= 2$ ro.

sq. yds.
2·00875
9
·07875 sq. ft.
144
31500
31500
7875
11·34000 sq. in.

·02$\dot{2}\dot{7}$ of $3\frac{1}{2}$ sq. ft.
$= \left(\frac{225}{9900} \times \frac{7}{2}\right)$ sq. ft.
$= \frac{225 \times 7 \times 144}{9900 \times 2}$ sq. in.
$= \frac{5 \times 7 \times 18}{55}$ sq. in.
$= 11\frac{5}{11}$ sq. in.

therefore, value $= 2$ ro. $- 2$ sq. yds., $11\frac{17}{50}$ sq. in. $+ 11\frac{5}{11}$ sq. in.
$= 1$ ro., 39 po., $28\frac{1}{4}$ sq. yds., $0\frac{63}{550}$ sq. in.

Ex. XLIV. (p. 139.)

(6)

$5\frac{1}{2}$	41
2	2
11	82·00
4,0	7·45
8	2·18$\dot{1}\dot{6}\dot{3}$
	·27329545

4,0	30·0
8	1·75
3	·21875
	·072916

(7)

144 { 12	73·000
12	6·083
9	2·50694
	·2785493827160

4,0	20·0
4	3·5
	·875

(8)

$$24\begin{cases}4 & 18{\cdot}0\\ 6 & 4{\cdot}5\\ 7 & 4{\cdot}75\end{cases}\qquad\cdot67857142\dot{}$$

$$24\begin{cases}6{,}0 & 11{\cdot}0\\ 6{,}0 & \cdot183\dot{}\\ 4 & \cdot03055\dot{}\\ 6 & \cdot0076388\dot{}\\ 5 & \cdot001273148\dot{}\end{cases}\qquad\cdot0002546296\dot{}$$

(9)

$2\frac{1}{8}$ inches$=\frac{17}{8}$ inches,

$2\frac{1}{8}$ miles$=(\frac{11}{5}\times1760\times3\times12)$ inches,

$=(11\times352\times3\times12)$ inches;

therefore fraction$=\dfrac{17}{8\times11\times352\times3\times12}=\dfrac{17}{1115136}=\cdot000015.$

(10)

$3\frac{4}{7}$ pks.$=\frac{15}{4}$ pks. and $3\frac{1}{2}$ qrs.$=(7\times16)$ pks.;

therefore fraction$=\dfrac{15}{4\times7\times16}=\dfrac{3{\cdot}75}{7\times16}=\dfrac{\cdot9375}{7\times4}$

$=\dfrac{\cdot234375}{7}=\cdot033482142857\dot{}$;

$27\frac{1}{2}$ galls.$=110$ qts. and $1\frac{1}{3}$ qts.$=\frac{4}{3}$ qts.;

therefore fraction$=\dfrac{110\times3}{4}=\dfrac{330}{4}=82{\cdot}5.$

(11)

$5\frac{3}{4}$ yds.$=23$ qrs., and 2 F. ells$=12$ qrs.,

therefore fraction$=\frac{23}{12}=1{\cdot}916\dot{}$;

1 ton, $2\frac{1}{4}$ cwt.$=22\frac{1}{4}$ cwt.$=89$ qrs., and 1 cwt., $2\frac{1}{4}$ qrs.,$=\frac{9}{4}$ qrs.,

therefore fraction$=\dfrac{89\times4}{25}=\dfrac{356}{25}=\dfrac{71{\cdot}2}{5}=14{\cdot}24.$

(12)

3 wks., $5\frac{1}{4}$ d. $=26\frac{1}{4}$ days, 630 hrs., and $5\frac{1}{2}$ hrs. $=\frac{11}{2}$ hrs.,

therefore fraction $=\frac{630\times 2}{11}=\frac{1260}{11}=114\cdot\dot{5}\dot{4}$;

1 min., $2\frac{1}{4}$ sec. $=62\frac{1}{4}$ sec. $=\frac{249}{4}$ sec.,

$\frac{1}{236}$ of a lun. month $=(\frac{1}{236}\times 29\frac{1}{2}\times 24\times 60\times 60)$ sec.

$=(29\frac{1}{2}\times 24\times 12\times 12)$ sec.,

therefore fraction $=\frac{249}{4\times 59\times 12\times 144}=\frac{249}{407808}=\cdot 00061\ldots$.

(13)

3 reams $=(3\times 20\times 24)$ sheets $=1440$ sheets;

therefore fraction $=\frac{1440}{19}=75\cdot 789\ldots\ldots$

$3\frac{1}{2}$ acres $=(\frac{7}{2}\times 4\times 40\times 30\frac{1}{4})$ sq. yds. $=(7\times 20\times 121)$ sq. yds.;

$\therefore$ fraction $=\frac{7\times 20\times 121}{\frac{13}{4}}=\frac{7\times 80\times 121}{13}=\frac{67760}{13}=5212\cdot\dot{3}07692\dot{}$.

(14)

$$1760\begin{cases}10 & 33\\ 4 & 3\cdot 3\\ 4 & \cdot 825\\ 11 & \cdot 20625\\ & \cdot 01875\end{cases}$$

3*s.* $5\frac{11}{200}d.=41\frac{11}{200}d.=\frac{8211}{200}d.$; 4*s.* $3d.=51d.$;

therefore fraction $=\frac{8211}{200\times 51}=\frac{161}{200}=\cdot 805$.

7*s.* $8\frac{1242}{10000}d.=92\frac{1242}{10000}d.=\frac{921942}{10000}d.$; 10*s.* $6d.=126d.$;

therefore fraction $=\frac{921942}{126\times 10000}=\frac{7317}{10000}=\cdot 7317$.

(15)

The fraction $=\frac{21}{100}=\cdot 13125$;

$$3\begin{cases}2\cdot 0\\ 2,0\ \ 6\cdot\dot{6}\dot{6}\\ \cdot 3\dot{3}\end{cases}$$

(16)

The fraction $=\frac{15}{49}=\cdot306122\ldots.$;

2 qrs. $=(2\times8\times4)$ pks.,

therefore fraction $=\dfrac{7}{8\times2\times8\times4}=\dfrac{\cdot875}{8\times8}=\dfrac{\cdot109375}{8}$

$=\cdot013671875.$

(17)

$\frac{9}{40}$ of a guinea $=9s.$ and £2 $=40s.$,

therefore fraction $=\dfrac{9}{40}=\cdot225$;

$\frac{21}{15000}$ of a year $=\dfrac{21\times365}{15000}$ days,

therefore fraction $=\dfrac{7\times73}{1000}=\cdot511.$

(18)

$\frac{3}{7}$ of $\frac{1}{10}$ of 40 yds. $=\dfrac{3\times40}{7\times10}$ yds. $=\dfrac{12}{7}$ yds.

$\frac{1}{5}$ of 2 miles $=\dfrac{1760\times2}{5}$ yds. $=(352\times2)$ yds.,

therefore fraction $=\dfrac{12}{7\times352\times2}=\dfrac{3}{7\times88\times2}=\dfrac{3}{1232}=\cdot00243\ldots$;

$\frac{1}{4}$ of $3\frac{1}{2}$ sq. yds. $=\left(\dfrac{1}{4}\times\dfrac{7}{2}\right)$ sq. yds. $=\dfrac{7}{8}$ sq. yds.;

2 ac., 1 ro. $=9$ ro. $=(9\times40\times30\frac{1}{4})$ sq. yds. $=(9\times10\times121)$ sq. yds.,

therefore fraction $=\dfrac{7}{8\times9\times10\times121}=\dfrac{7}{87120}=\cdot000080\ldots.$

(19)

$\frac{3}{5}$ of $4\frac{1}{9}$ hrs. $=\dfrac{3\times40}{5\times9}$ hrs. $=\dfrac{8}{3}$ hrs;

$365\frac{1}{4}$ days $=\dfrac{1461\times24}{4}$ hrs. $=(1461\times6)$ hrs.,

therefore fraction $=\dfrac{8}{3\times1461\times6}=\dfrac{4}{13149}=\cdot000304\ldots.$,

$9\frac{5}{11}$ of $\frac{11}{15}$ pks. $=\dfrac{105\times11}{11\times15}$ pks. $=7$ pks.;

$3\frac{1}{3}$ qrs. $=\left(\dfrac{10}{3}\times8\times4\right)$ pks. $=\dfrac{320}{3}$ pks.;

therefore fraction $=\dfrac{21}{320}=\dfrac{2\cdot625}{40}=\cdot065625.$

(20)

3 lbs., 6 oz. Troy = 42 oz. = (42 × 20 × 24) grs.;
10 lbs. av. = (10 × 7000) grs.,

therefore fraction $= \frac{42 \times 20 \times 24}{10 \times 7000} = \frac{6 \times 20 \times 24}{10000} = \frac{2880}{10000} = \cdot 288$;

$\frac{1}{5}$ oz. av. $= \left(\frac{1}{5} \times \frac{1}{16} \times 7000\right)$ grs. $= \frac{175}{2}$ grs;

$\frac{1}{3}$ oz. Troy $= \left(\frac{1}{3} \times 20 \times 24\right)$ grs. $= 160$ grs.;

therefore fraction $= \frac{175}{2 \times 160} = \frac{21 \cdot 875}{40} = \cdot 546875$.

(21)

$\frac{3}{5}$ day + $\frac{2}{3}$ hour + $\frac{4}{5}$ of 6 hours $= \left(\frac{3 \times 24}{5} + \frac{2}{3} + \frac{24}{5}\right)$ hours $= \frac{298}{15}$ hours,

and 1 week $= 7 \times 24$ hours;

therefore fraction $= \frac{298}{15 \times 24 \times 7} = \frac{29 \cdot 8}{3 \times 12 \times 7} = \frac{\cdot 827777}{7}$

$= \cdot 11825396\dot{}$.

(22)

$\cdot 83$ of \$1.92 = \$1.5936, $\cdot 0\dot{5}$ of \$5.04 = \$0.25$\dot{2}\dot{5}$, 1·8 of \$1·20 = \$2·16;

$\therefore$ value = \$4.008$1\dot{4}\dot{5}$;

fraction $= \frac{4 \cdot 008\dot{1}\dot{4}\dot{5}}{2 \cdot 52} = 1 \cdot 5906\ldots$.

(23)

5½ cwt. = 22 qrs.,

therefore 22 qrs. + 3·125 qrs. = 25·125 qrs.,

and a ton = (20 × 4) qrs.;

therefore fraction $= \frac{25 \cdot 125}{20 \times 4} = \frac{2 \cdot 5125}{8} = \cdot 3140625$.

(24)

(1) 12 | 6·0
2,0 | ·50
·025

$\therefore$ 6*d.* = 2 c. 5 m.

and 2 c. 5 m. = £ 0·25
20
·500*s*
12
6·000*d.*

(2) 12 | 10·0
2,0 | ·833̇
·0416̇

∴ 10*d.* = 4 c. $1\frac{6}{9}$ m. = 4 c. $1\frac{2}{3}$ m.

(3) 4 | 2·0
12 | 4·5
2,0 | ·375
·01875

∴ $4\frac{1}{2}d.$ = 1c. $8\frac{3}{4}$ m.

(4) 2,0 | 5·0
·25

∴ 5*s.* = 2 fl. 5 c.

(5) 12 | 6·0
2,0 | 10·5
·525

∴ 10*s.* 6*d.* = 5 fl. 2 c. 5 m.

(6) 2,0 | 16·0
·8

∴ 16*s.* = 8 fl.

(7) 12 | 6·0
2,0 | 12·5
5·625

∴ £5 12*s.* 6*d.* = £5 6 fl. 2 c. 5 m.

c. m. £
and 4 $1\frac{2}{3}$ = ·041̇6
20
·833̇*s.*
12
10 000*d.*

c. m. £
and 1 $8\frac{1}{4}$ = ·01875
20
·37500*s.*
12
4·50000*d.*
4
2·00000*q.*

fl. c. £
and 2 5 = ·25
20
5·00*s.*

fl. c. m. £
and 5 2 5 = ·525
20
10·500*s.*
12
6 000*d.*

fl. £
and 8 = ·8
20
16·0*s.*

£ fl. c. m. £
and 5 6 2 5 = 5·625
20
12·500*s.*
12
6·000*d.*

(8) 12 | 4·0
2,0 | 7·33̇
54·366̇

∴ £54. 7*s*. 4*d*.=£54. $3\frac{2}{3}$ f.

£ f. £
and 54 $3\frac{2}{3}$=54·36̇
20
7·3̇
12
4·0*d*.

(9) 4 | 2·0
12 | 7·5
2,0 | 19·625
20·98125

∴ £20. 19*s*. $12\frac{1}{2}$*d*.=£20. 9 f. 8 c. $1\frac{1}{4}$ m.

£ f. c. m. £
and 20 9 8 $1\frac{1}{4}$=20·98125
20
19·62500*s*.
12
7·50000*d*.
4
2·00000*q*.

(10) 4 | 3·00
12 | 4·75
2,0 | 15·39583̇
·7697916̇

∴ 15*s*. $4\frac{3}{4}$*d*.=7 f. 6 c. 9·7916̇ m.

f. c. m. £
and 7 6 9·7916=·76·97916̇
20
15·395893̇*s*.
12
4·750000*d*.
4
3·000000*q*.

(11) 12 | 8·16
2,0 | 14.68
·734

∴14*s*. 8·16 *d*.=7 f. 3 c. 4 m.

f. c. m. £
and 7 3 4=·734
20
14·680*s*.
12
8·160*d*.

(12) 12 | 11·088
2,0 | 15·924
2·7962

∴ £2. 15*s*. 11·088*d*=£2. 7 f. 9 c. $6\frac{1}{5}$ m.

£ f. c. m. £
and 2 7 9 $6\frac{1}{5}$=2·7962
20
15·924*s*.
12
11·088*d*.

(13)

4	3·04	
12	11·76	
2,0	·98	
	3·049	

£ c. m. £
and 3 4 9=3·049
20
·980*s.*
12
11·760*d.*
4
3·040*q.*

∴ £3. 0*s.* 11*d.* 3·04*q.*=£3. 4 c. 9 m.

QUESTIONS AND EXAMPLES IN DECIMALS.

Ex. XLV. (p. 141.)

I.

(1)

$$\cdot0625=\frac{625}{10000}=\frac{25}{400}=\frac{1}{16};\quad 3\cdot14159=\frac{314159}{100000};$$

$$20\tfrac{5}{14}=20\cdot\dot{3}571428\dot{5}71$$

$$17\tfrac{1}{12}=\frac{17\cdot08\dot{3}}{3\cdot2738095\dot{2}38}$$

(2)

$$10\tfrac{3}{8}+1\tfrac{5}{40}+\frac{7}{10}+\frac{13}{16}=11+\frac{3}{8}+\frac{1}{8}+\frac{7}{10}+\frac{13}{16}$$

$$=11+\frac{30+10+56+65}{80}=11+\frac{161}{80}=13\tfrac{1}{80}=13\cdot0125.$$

Again,

$$10\tfrac{3}{8}+1\tfrac{5}{40}+\frac{7}{10}+\frac{13}{16}=10\cdot375+1\cdot125+\cdot7+\cdot8125=13\cdot0125.$$

(3)

573·005	573·005	573·005
·000754	·000754	·000754
573·005754	573·004246	2292020
		2865025
		4011035
		·432045770

(Continued on next page.)

(3 continued.)

$$\begin{array}{r|l} \cdot000754 & 573\cdot0050000\ (\ 759953\cdot5\ldots. \\ & 5278 \\ & \hline & 4520 \\ & 3770 \\ & \hline & 7505 \\ & 6786 \\ & \hline & 7190 \\ & 6786 \\ & \hline & 4040 \\ & 3770 \\ & \hline & 2700 \qquad 4380 \\ & 2262 \qquad 3770 \\ & \hline & 4380 \qquad 610 \end{array}$$

Proofs of the above:

$$573\cdot005+\cdot000754=\frac{573005}{1000}+\frac{754}{1000000}=\frac{573005000+754}{1000000}$$

$$=\frac{573005754}{1000000}=573\cdot005754;$$

$$573\cdot005-\cdot000754=\frac{573005000-754}{1000000}=\frac{573004246}{1000000}=573\cdot004246;$$

$$573\cdot005\times\cdot000754=\frac{573005}{1000}\times\frac{754}{1000000}=\frac{432045770}{1000000000}=\cdot43204577;$$

$$573\cdot005\div\cdot000754=\frac{573005}{1000}\times\frac{1000000}{754}$$

$$=\frac{5730050000}{754}\times\frac{1}{10}=759953\cdot5\ldots.$$

Again,

$$\begin{array}{r} 1\cdot015 \\ \cdot01015 \\ \hline 1\cdot02515 \end{array}$$

$$\begin{array}{r} 1\cdot015 \\ \cdot01015 \\ \hline 1\cdot00485 \end{array}$$

$$\begin{array}{r} 1\cdot015 \\ \cdot01015 \\ \hline 5075 \\ 1015 \\ 1015 \\ \hline \cdot01030225 \end{array}$$

$$\begin{array}{r|l} \cdot01015 & 1\cdot01500\ (\ 100 \\ & 1015 \\ & \hline & 00 \end{array}$$

(Continued on next page.)

(3 continued.)

Proofs of the above:

$$1{\cdot}015+{\cdot}01015=\frac{1015}{1000}+\frac{1015}{100000}=\frac{101500+1015}{100000}=\frac{102515}{100000}=1{\cdot}02515;$$

$$1{\cdot}015-{\cdot}01015=\frac{101500-1015}{100000}=\frac{100485}{100000}=1{\cdot}00485;$$

$$1{\cdot}015\times{\cdot}01015=\frac{1015}{1000}\times\frac{1015}{100000}=\frac{1030225}{100000000}={\cdot}01030225;$$

$$1{\cdot}015\div{\cdot}01015=\frac{1015}{1000}\times\frac{100000}{1015}=\frac{100000}{1000}=100.$$

(4)

$$\frac{4}{6144}=\frac{1}{1536}=\frac{1}{8\times192}=\frac{1}{8\times8\times24}=\frac{1}{2^3\times2^3\times2^3\times3}$$

and therefore, since each factor of the denominator is not a power of 2 or 5, the fraction is not convertible into a terminating decimal.

(5)

(1) $2\frac{1}{3}+72\frac{5}{8}+316\frac{1}{6}+2{\cdot}875=390+\frac{1}{3}+\frac{5}{8}+\frac{1}{6}+2\,875$

$$=390+\frac{27}{24}+2{\cdot}875=391+\frac{1}{8}+2{\cdot}875=391+{\cdot}125+2{\cdot}875=394.$$

(2) ${\cdot}026649\div2\frac{15}{16}={\cdot}026649\times\frac{16}{47}={\cdot}00567\times16={\cdot}009072.$

(3) $\frac{1-{\cdot}05}{5+{\cdot}5}\times\frac{3-{\cdot}8}{3{\cdot}8}\div\frac{1}{10}=\frac{{\cdot}95}{5{\cdot}5}\times\frac{2{\cdot}2}{3{\cdot}8}\times\frac{10}{1}$

$$=\frac{19\times{\cdot}05}{11\times{\cdot}5}\times\frac{11\times{\cdot}2}{19\times{\cdot}2}\times\frac{10}{1}=\frac{{\cdot}05\times10}{{\cdot}5}=\frac{{\cdot}5}{{\cdot}5}=1.$$

(4) $({\cdot}18+{\cdot}009)\div{\cdot}016={\cdot}189\div{\cdot}016=\frac{189}{1000}\times\frac{1000}{16}=\frac{189}{16}=11{\cdot}8125.$

(6)

$$\frac{48\frac{1}{7}}{1085\frac{7}{10}}\div\frac{7\frac{3}{11}}{174\frac{3}{17}}=\frac{\frac{340}{7}}{\frac{10857}{10}}\div\frac{\frac{80}{11}}{\frac{2961}{17}}=\frac{340\times10}{7\times10857}\div\frac{80\times17}{11\times2961}$$

$$=\frac{340\times10\times11\times2961}{7\times10857\times80\times17}=\frac{17\times4\times5\times10\times11\times141\times3\times7}{7\times141\times77\times2\times4\times10\times17}$$

$$=\frac{5\times3}{7\times2}=\frac{15}{7\times2}=\frac{7{\cdot}5}{7}=1{\cdot}0\dot{7}1428\dot{5};$$

$$91{\cdot}8\dot{5}3\div87{\cdot}5\dot{6}=91\frac{853}{999}\div87\frac{51}{90}=\frac{91762}{999}\times\frac{90}{7881}=\frac{917620}{111\times7881}$$

$$=\frac{97620}{874791}=1{\cdot}048\ldots.=1{\cdot}05 \text{ nearly.}$$

II.

(1)

$\cdot000700409$; $\frac{121345}{10000}=\frac{24269}{2000}$; $\cdot0032546$.

(2)

Three hundred and ninety-seven thousand and eight, and four hundred and five thousand and nine millionths; 397008405·009; 397·008405009. Three hundred and ninety-seven millions, eight thousand four hundred and five, and nine thousandths. Three hundred and ninety-seven, and eight millions four hundred and five thousand and nine thousand millionths.

(3)

$\frac{5}{8}=\cdot625$

$\frac{7}{16}=\cdot4375$

$\frac{3}{4}=\cdot75$

$\cdot09375$

$$125\left\{\begin{array}{l|l} & 2{\cdot}46 \\ \hline 5 & 4{\cdot}36625 \\ 5 & \cdot87325 \\ 5 & \cdot17465 \end{array}\right.$$

decimal required $\cdot03493$

(4)

1·05
10·5
525
105
11·025

$$=\frac{11025}{1000}=\frac{2205}{200}=\frac{441}{40},$$

$$1620\left\{\begin{array}{l|l} 9 & \cdot 8727588 \\ 9 & \cdot 0969732 \\ 2 & \cdot 0107748 \\ 10 & \cdot 0053874 \end{array}\right.$$

·00053874

$$\frac{\cdot 0003\times\cdot 004}{\cdot 006}=\frac{\cdot 0000012}{\cdot 006}=\cdot 0002;$$

$$\frac{1}{16}+\frac{9}{400}-\frac{13}{625}=\frac{625+225-208}{10000}=\frac{642}{10000}=\cdot 0642.$$

(5)

(1)

23) 21·0 (·91304....
207
30
23
70
69
100
92
8

$$\therefore \frac{1}{10000} \text{ of } \frac{21}{23}=\cdot 000091304....$$

(2) $(2\frac{1}{2}+6)\div\left(3\frac{1}{2}-\frac{1}{8}\right)=\frac{17}{2}\div\frac{27}{8}=\frac{17\times 8}{2\times 27}=\frac{68}{27}=\frac{22\cdot\dot{6}}{9}=2\cdot\dot{5}1\dot{8}.$

(3) $$\frac{4\cdot 4+\frac{3}{5}}{7\cdot 375+\frac{3}{4}-\frac{1}{8}}=\frac{4\cdot 4+\cdot 6}{7\cdot 375+\cdot 75-\cdot 125}=\frac{5}{8\cdot 125-\cdot 125}=\frac{5}{8}=\cdot 625.$$

(4) $2\frac{1}{3000}=2\frac{\cdot 001}{3}=2\cdot 000\dot{3}3\dot{3}$

$1\frac{5}{1600}=1\frac{\cdot 05}{16}=1\cdot 003125$

$5\frac{1}{6000}=5\frac{\cdot 001}{6}=5\cdot 000\dot{1}6\dot{7}$

$2\cdot 000875$

10 0045

(6)

3132·458) 7823·6572 (2·4976096088
6264916

15587412
12529832

30575800
28192122

23836780
21927206

19095740
18794748

30099200

30099200
28192122

19070780
18794748

27603200
25059664

25435360
25059664

375696

III.

(1)

1200·21) 684·1197 (·57
600105

840147
840147

·0120021) 684·1197000 (57000
600105

840147
840147

·047) 594·270000 (12644·042....
47

124
94

302
282

207
188

190

190
188

200
188

120
94

26

(2)

(1) $\dfrac{\cdot 015 \times 2\cdot 1}{\cdot 035} = \dfrac{\frac{15}{1000} \times \frac{21}{10}}{\frac{35}{1000}} = \dfrac{15 \times 21 \times 1000}{1000 \times 10 \times 35} = \dfrac{3 \times 3}{10} = \dfrac{9}{10} = \cdot 9.$

(2) $\dfrac{3\frac{1}{2} - \cdot 04}{5 - \cdot 0625} = \dfrac{\frac{7}{2} - \frac{4}{100}}{5 - \frac{625}{10000}} = \dfrac{\frac{350-4}{100}}{\frac{50000-625}{10000}} = \dfrac{34600}{49375} = \dfrac{6920}{9875} = \dfrac{1384}{1975}$

$= \cdot 7007....$

(3) $\frac{3}{5}+\cdot14+\frac{3}{4}$ of $1\cdot0784=\frac{3}{5}+\frac{14}{100}+\frac{3}{4}$ of $\frac{10784}{10000}$

$=\frac{74}{100}+\frac{3\times2696}{10000}=\frac{7400+8088}{10000}=\frac{15488}{10000}=1\cdot5488,$

and $\frac{15488}{10000}=\frac{1936}{1250}=\frac{968}{625}.$

(4) $\left(\frac{1}{4}-\frac{1}{9}\right)\times\left(\frac{3}{5}+1\frac{1}{2}\right)=\frac{5}{36}\times\frac{21}{10}=\frac{7}{24}=\frac{3\cdot5}{12}=\cdot2916\dot{6}.$

(5)

$5\cdot8\dot{1}\times\cdot4583\dot{3}=5\frac{8}{9}\frac{1}{9}\times\frac{4583-458}{9000}=\frac{576\times4125}{99\times9000}=\frac{576\times375}{9\times9000}$

$=\frac{64\times375}{9000}=\frac{24000}{9000}=\frac{8}{3}=2\cdot\dot{6};$

$1\cdot1\dot{3}\div\cdot000\dot{1}3\dot{2}=1\frac{1}{9}\frac{3}{0}\div\frac{132}{999900}=\frac{102}{90}\times\frac{999900}{132}=\frac{102\times9090}{9\times12}$

$=\frac{102\times1010}{12}=17\times505=8585,$

$\frac{91}{560}=\frac{13}{80}$, and since $80=2\times2\times2\times10$, the fraction will be reducible to a terminating decimal.

(4)

$1\frac{1}{1}\frac{1}{2}+2\frac{2}{1}\frac{2}{5}+3\frac{3}{2}\frac{3}{0}+4\frac{4}{2}\frac{4}{7}=10+\frac{22}{60}+\frac{4}{27}=10+\frac{11}{30}+\frac{4}{27}=10\frac{13}{27}\frac{9}{0}.$

Again, $1\frac{1}{1}\frac{1}{2}=1\cdot083\dot{3}$

$2\frac{2}{1}\frac{2}{5}=2\cdot133\dot{3}$

$3\frac{3}{2}\frac{3}{0}=3\cdot15$

$4\frac{4}{2}\frac{4}{7}=4\cdot1\dot{4}8\dot{1}48$

$10\cdot5\dot{1}4\dot{8}14=10\frac{5143}{9990}=10\frac{37\times139}{37\times270}=10\frac{139}{270}.$

(5)

He walks $(60-13\cdot95)$ miles$=46\cdot05$ miles in three days,

$3\ |\ 46\cdot05$

he walks 15·35 miles each day.

(6)

He sells $\cdot1\dot{7}$ of $\cdot1875$ or $\frac{16}{90}$ of $\cdot1875$:

therefore, he has left $\left(1-\frac{16}{90}\right)$ of 1875

$$=\frac{74}{90} \text{ of } \cdot1875=\frac{74\times1875}{90\times10000}=\frac{74\times125}{6\times10000}=\frac{74}{6\times80}=\frac{37}{240}.$$

IV.

(1)

$$\begin{array}{r} 1\cdot23 \\ \cdot123 \\ \cdot0123 \\ \cdot00123 \\ 123\cdot \\ \hline 124\cdot36653 \end{array}$$

$$=\frac{12436653}{100000}$$

$31\cdot\dot{4}5\dot{7}=31\frac{457}{999}$,

and $\frac{494}{15}-31\frac{457}{999}=32\frac{14}{15}-31\frac{457}{999}$

$$=1\frac{4662-2285}{4995}=1\frac{2377}{4995}.$$

(2)

3006005; three hundred thousand, six hundred and five-tenths.

(3)

$5\times\cdot05=\cdot25$; $1\cdot5\times\cdot75=1\cdot125$; $2\cdot625\div5=\cdot525$;

therefore, in order of magnitude they stand thus:

$1\cdot5\times\cdot75$; $2\cdot625\div5$; $5\times\cdot05$.

(4)

$$\cdot0\dot{1}4\dot{7}\times\cdot33\dot{3}=\frac{147}{9990}\times\frac{1}{3}=\frac{49}{9990}=\cdot00\dot{4}9\dot{};$$

$$\cdot12693\dot{}\div19\cdot3\dot{9}=\frac{11424}{90000}\div19\tfrac{39}{99}=\frac{3808}{30000}\div19\tfrac{13}{33}=\frac{3808\times33}{30000\times640}$$

$$=\frac{476\times11}{10000\times80}=\frac{5236}{800000}=\cdot006545;$$

(Continued on next page.)

(4 continued.)

$$\begin{array}{r|l} \cdot 245 & 132790\cdot000 \ (\ 542000 \\ & 1225 \\ \hline & 1029 \\ & 980 \\ \hline & 490 \\ & 490 \\ \hline & 000 \end{array}$$

$$\cdot014904 \div 3\tfrac{6}{25} = \frac{\cdot014904 \times 25}{81} = \frac{\cdot001656 \times 25}{9} = \cdot000184 \times 25 = \cdot0046;$$

$$\begin{array}{r|l} 3\cdot05 & 61061\cdot00 \ (\ 20020 \\ & 610 \\ \hline & 610 \\ & 610 \\ \hline & 0 \end{array} \qquad \begin{array}{r|l} 305000 & 6106\cdot10000 \ (\ \cdot02002 \\ & 610000 \\ \hline & 610000 \\ & 610000 \\ \hline & \end{array}$$

(5)

$$\begin{array}{l} \cdot90438 \\ \cdot90437532 \\ \hline \cdot00000468 \end{array} \qquad \begin{array}{l} \cdot90437532 \\ \cdot90437 \\ \hline \cdot00000532 \end{array}$$

and since of these differences ·00000468 is the less, it follows that the statement in the question is correct.

To find an approximate value of the expression.

$$\left\{\frac{1}{5} - \frac{1}{3\times5^3} + \frac{1}{5\times5^5} - \frac{1}{7\times5^7} + \&c.\right\} - \frac{4}{239},$$

we have $\frac{1}{5} = \cdot2$; $\frac{1}{3\times5^3} = \frac{\cdot2}{3\times25} = \frac{\cdot008}{3} = \cdot002667$;

$\frac{1}{5\times5^5} = \frac{\cdot008}{5\times25} = \frac{\cdot00032}{5} = \cdot000064$; $\frac{1}{7\times5^7} = \frac{\cdot000064}{7\times5}$

$= \cdot000002$ nearly;

the last result shows us that we may neglect the rest of the series, and we get

$$16\times\left\{\cdot2 - \cdot002667 + \cdot000064 - \cdot000002\right\} - \frac{4}{239}$$

$$= (16\times\cdot197395) - \cdot01673 = 3\cdot15832 - \cdot01673 = 3\cdot14159.$$

(6)

After the first sale he has remaining

$$\cdot 85 \text{ or } \frac{17}{20} \text{ of the estate;}$$

therefore, after the second sale he has

$$\left(1-\frac{5}{17}\right) \text{ of } \frac{17}{20}=\frac{12}{17} \text{ of } \frac{17}{20}=\frac{12}{20}=\frac{3}{5}.$$

V.

(1)

$$\frac{1}{2}(6\tfrac{1}{2}+2\tfrac{2}{3}-3)=\frac{1}{2}(5\tfrac{7}{6})=\frac{1}{2}\times\frac{37}{6}=\frac{37}{12}=3\cdot08\dot{3};$$

$$\frac{8978}{3125}=\frac{1795\cdot6}{625}=\frac{359\cdot12}{125}=\frac{71\cdot824}{25}=\frac{14\cdot3648}{5}=2\cdot87296;$$

$$3\tfrac{5}{8}\times\left(3\tfrac{1}{4}-\frac{2}{3}\right) \text{ of } \frac{6}{7}=\frac{29}{8}\times\frac{39-8}{12}\times\frac{6}{7}$$

$$=\frac{29\times31\times6}{8\times12\times7}=\frac{899}{8\times2\times7}=\frac{112\cdot375}{2\times7}=\frac{56\cdot1875}{7}=8\cdot0267857142\dot{8}.$$

(2)

(1) $$\frac{4\cdot255\times\cdot032}{\cdot00016}=\frac{4\cdot255\times\cdot016\times2}{\cdot016\times\cdot01}=\frac{4\cdot255\times2}{\cdot01}=\frac{8\cdot51}{\cdot01}=851.$$

(2) $$\left(\frac{1}{2}+\frac{1}{4}+\frac{1}{6}+\frac{1}{8}+\frac{1}{10}\right)\div\left(\frac{1}{3}+\frac{1}{5}+\frac{1}{9}+\frac{1}{15}\right)$$

$$=\frac{60+30+20+15+12}{120}\div\frac{30+18+10+6}{90}=\frac{137}{120}\times\frac{90}{64}$$

$$=\frac{137\times3}{4\times64}=\frac{411}{4\times64}=\frac{102\cdot75}{64}=\frac{12\cdot84375}{8}=1\cdot60546875.$$

(3) $$\left(\frac{9}{11} \text{ of } 75\tfrac{1}{5}-3\tfrac{1}{8}\right)+(2\cdot5625+7\tfrac{1}{4})$$

$$=\left(\frac{9}{11} \text{ of } 35\cdot2-3\cdot125\right)+(2\cdot5625+7\cdot25)=9\times3\cdot2-3\cdot125+9\cdot8125$$

$$=28\cdot8-3\cdot125+9\cdot8125=25\cdot675+9\cdot8125=35\cdot4875.$$

(4) $\cdot 59\dot{3} \div 1\cdot 78 \times \cdot\dot{3}\dot{6} - \cdot 072 = \frac{534}{900} \times \frac{100}{178} \times \frac{36}{99} \times \frac{1000}{72} = \frac{3 \times 1000}{9 \times 99 \times 2}$

$= \frac{500}{3 \times 99} = \frac{45\cdot 45}{3 \times 9} = \frac{5\cdot 05}{3} = 1\cdot \dot{6}8350\dot{1}.$

(4)

$$1 = 1\cdot 00000000$$
$$\frac{1}{1} = 1\cdot 00000000$$
$$\frac{1}{1\times 2} = \cdot 50000000$$
$$\frac{1}{1\times 2\times 3} = \cdot 16666667$$
$$\frac{1}{1\times 2\times 3\times 4} = \cdot 04166667$$
$$\frac{1}{1\times 2\times 3\times 4\times 5} = \cdot 00833333$$
$$\frac{1}{1\times 2\times 3\times 4\times 5\times 6} = \cdot 00138889$$
$$\frac{1}{1\times 2\times 3\times 4\times 5\times 6\times 7} = \cdot 00019841$$
$$\frac{1}{1\times 2\times 3\times 4\times 5\times 6\times 7\times 8} = \cdot 00002480$$
$$\frac{1}{1\times 2\times 3\times 4\times 5\times 6\times 7\times 8\times 9} = \cdot 00000275$$
$$\frac{1}{1\times 2\times 3\times 4\times 5\times 6\times 7\times 8\times 9\times 10} = \cdot 00000027$$
$$\frac{1}{1\times 2\times 3\times 4\times 5\times 6\times 7\times 8\times 9\times 10\times 11} = \cdot 00000002$$

$$\therefore \text{ sum} = 2\cdot 71828181$$

$$\frac{1}{10^3} \times \left(1 - \frac{3}{10^2} + \frac{3\times 4}{1\times 2} \times \frac{1}{10^4} + \frac{3\times 4\times 5}{1\times 2\times 3} \times \frac{1}{10^6}\right)$$

$$= \frac{1}{10^3} \times \left(1 - \frac{3}{100} + \frac{6}{10000} + \frac{10}{1000000}\right)$$

$$= \frac{1}{10^3} \times \left(\frac{100000 - 3000 + 60 + 1}{100000}\right)$$

$$= \frac{97061}{1000 \times 100000} = \frac{97061}{100000000} = \cdot 00097061.$$

(5)

111·454) 883345·0000 (7925·7 miles nearly
780178
1031670
1003086
285840
222908
629320
557270
720500

(6)

·12555556
4·16363636
9·45777778
13·74696970

VI.

(1)

404·04
·030303
121212
121212
121212
12·24362412

$$\dot{3}45 \times \frac{\cdot 111}{4\cdot 3} = \frac{345}{999} \times \frac{111}{1000} \times \frac{10}{43}$$

$$= \frac{345}{9 \times 100 \times 43} = \frac{115}{3 \times 100 \times 43}$$

$$= \frac{1\cdot 15}{129} = \cdot 0089147\ldots.$$

6593) ·04813489963 (·0730091
45151
19838
19779
59996
59337
6593
6593

·006593) ·04813489963 (7·30091

(2)

20·5
2·05
22·55

20·5
2·05
18·45

$$\therefore \frac{22\cdot 55}{18\cdot 45} = \frac{2255}{1845} = \frac{451}{369}.$$

(3)

$$\frac{123{\cdot}48}{1033{\cdot}2}=\frac{12348}{103320}=\frac{1029}{8610}=\frac{343}{2870}=\frac{49}{410};$$

$$\frac{36{\cdot}595}{5{\cdot}7980}=\frac{36595}{5798}=\frac{13\times2815}{13\times446}=\frac{2815}{446}=6\tfrac{139}{446}.$$

(4)

$$\frac{{\cdot}375\times{\cdot}375-{\cdot}025\times{\cdot}025}{{\cdot}375-{\cdot}025}=\frac{{\cdot}140625-{\cdot}000625}{{\cdot}375-{\cdot}025}=\frac{{\cdot}14}{{\cdot}35}=\frac{14}{35}=\frac{2}{5};$$

$$3+\cfrac{1}{7+\cfrac{1}{16}}=3+\frac{1}{\frac{113}{16}}=3\tfrac{16}{113},$$

and 113) 16·00 (·14159....

113

470
452

180
113

670
565

1050
1017

33

$\therefore 3\tfrac{16}{113}=3{\cdot}14159$ nearly;

$$\dot{\cdot}1293\dot{1}31=\frac{12931-129}{99000}$$

$$=\frac{12802}{99000}=\frac{6401}{49500}.$$

(5)

$$1\tfrac{1}{24}+\frac{5}{8}+\frac{13}{36}=1+\frac{21+45+26}{72}=1\tfrac{92}{72}=2\tfrac{20}{72};$$

therefore, to make this equal to 3, we must add

$$\frac{52}{72}=\frac{13}{18}=\frac{6{\cdot}5}{9}=\dot{\cdot}72\dot{.}$$

(6)

$$\text{Dividend}=2\tfrac{1}{2}\times{\cdot}15=\frac{35\times{\cdot}15}{12}=\frac{35\times{\cdot}05}{4}=\frac{17{\cdot}5}{4}={\cdot}4375.$$

VII.

(1)

In 1 day A and B can do $\frac{2}{3}$ of the work

" A and C " $\frac{1}{2}$ " "

" B and C " $\frac{1}{3}$ " "

$\therefore$ 2 A and 2 B and 2 C do $\frac{2}{3}+\frac{1}{2}+\frac{1}{3}=\frac{3}{2}$;

$\therefore$ A, B and C do $\frac{3}{4}$;

$\therefore$ C does $\frac{3}{4}-\frac{2}{3}$, or $\frac{1}{12}$; $\therefore$ C does the work in 12 days;

B does $\frac{3}{4}-\frac{2}{4}$, or $\frac{1}{4}$; $\therefore$ B " " 4 " ;

A does $\frac{3}{4}-\frac{1}{3}$, or $\frac{5}{12}$; $\therefore$ A " " $2\frac{1}{5}$ " ;

Again, in $\frac{1}{5}^2$ days A earns \$1.44; $\therefore$ A earns 60 cents daily;

" 4 " B " \$1.44; $\therefore$ B " 36 "

" 12 " C " \$1.44; $\therefore$ C " 12 "

(2)

2500+300+4200=9700;

$\therefore$ share of first town=\$2544$\times\frac{25}{97}$=\$655$\frac{55}{97}$;

share of second town=\$2544$\times\frac{30}{97}$=786$\frac{78}{97}$;

share of third town=\$2544$\times\frac{42}{97}$=\$1101$\frac{54}{97}$;

share of each person=\$$\frac{2544}{9700}$=26$\frac{22}{97}$ cents.

(3)

One man's wages=$\frac{£76\ 13s.\ 4d.}{25\times16}$=3*s.* 4*d.*

$\therefore$ a boy's wages=23*d.*

$\therefore$ Number of boys=$\frac{£103\ 10s.}{23\times24}=\frac{24840}{552}$=45.

(4)

He rows $1\frac{1}{2}$ miles with the stream in 20′,

" " without the stream in 30′;

∴ he could row 1 mile without the stream in 20′;

∴ stream flows $\frac{1}{2}$ mile in 20′;

∴ in 60′ the stream flows $1\frac{1}{2}$ miles.

Again, without stream he rows $1\frac{1}{2}$ miles in 30′; but in 30′ the stream carries him back $\frac{3}{4}$ mile;

∴ he will be 30′ in making this up, and so will take 60′ to row back.

(5)

In 1 day A does $\frac{1}{4}$, B $\frac{1}{5}$; ∴ the boy does $\frac{1}{4}-\frac{1}{5}=\frac{1}{20}$

A's share $=\$\frac{7.20}{2}=\$3.60$,

B's " $=\$7.20\times\frac{2}{5}=\$2.88$

boy's " $=\$7.20-(3.60+2.88)=72$ cents.

(6)

A lb. costs $\frac{74\times3+56\times5}{8}$ cts. $=\frac{502}{8}$ cts. $=62\frac{1}{4}$ cts.;

∴ 2 lbs. cost $2\times62\frac{1}{4}$ cts. $=\$1.25\frac{1}{2}$.

PRACTICE.

Ex. XLVI. (p. 148.)

(13)

	£	s.	d.	
2 qrs. $=\frac{1}{2}$ cwt.	2	5	6	= value of 1 cwt.
			5	
	11	7	6	= value of 5 cwt.
14 lbs. $=\frac{1}{4}$ of 2 qrs.	1	2	9	= value of 2 qrs.
		5	$8\frac{1}{4}$	= value of 14 lbs.
	£12	15	$11\frac{1}{4}$	= value of 5 cwt., 2 qrs., 14 lbs.

(14)

	£	s.	d.	
2 qrs.=½ cwt.	6	7	8	=value of 1 cwt.
			3	
	19	3	0	=value of 3 cwt.
			11	
	210	13	0	=value of 33 cwt.
1 qr.=½ of 2 qrs.	3	3	10	=value of 2 qrs.
7 lbs.=¼ of 1 qr.	1	14	11	=value of 1 qr.
		7	$11\frac{3}{4}$	=value of 7 lbs.
	£215	16	$8\frac{3}{4}$	=value of 33 cwt., 3 qrs., 7 lbs.

(15)

	£	s.	d.		
2 qrs.=½ cwt.	1	4	6		=value of 1 cwt.
			8		
	9	16	0		=value of 8 cwt.
			9		
	88	4	0		=value of 72 cwt.
1 qr.=½ of 2 qrs.		12	3		=value of 2 qrs.
14 lbs.=½ of 1 qr.		6	$1\frac{1}{3}$		=value of 1 qr.
2 lbs.=⅐ of 14 lbs.		3	$0\frac{3}{4}$		=value of 14 lbs.
1 lb.=½ of 2 lbs.			$5\frac{1}{4}$		=value of 2 lbs.
			$2\frac{1}{2}$	$\frac{1}{2}q.$	=value of 1 lb.
	£89	6	$1-\frac{1}{2}q.$		=value of 72 cwt., 3 qrs., 17 lbs.

(16)

	£	s.	d.		
2 qrs.=½ cwt.	7	13	6		=value of 1 cwt.
			6		
	46	1	0		=value of 6 cwt.
			10		
	460	10	0		=value of 60 cwt.
1 qr.=½ of 2 qrs	3	16	9		=value of 2 qrs.
7 lbs.=¼ of 1 qr.	1	18	$4\frac{1}{2}$		=value of 1 qr.
4 lbs.=⅐ of 1 qr.		9	$7\frac{1}{7}$		=value of 7 lbs.
1 lb. =¼ of 4 lbs.		5	$5\frac{1}{14}$		=value of 4 lbs.
		1	$4\frac{5}{56}$		=value of 1 lb.
	£467	1	$6\frac{3}{4}$	$\frac{3}{7}q.$	=value of 60 cwt., 3 qrs., 12 lbs.

(17)

	£	s.	d.	
2 qrs. = ½ cwt.	3	7	6	= value of 1 cwt.
			3	
	10	2	6	= value of 3 cwt.
14 lbs. = ¼ of 2 qrs.	1	13	9	= value of 2 qrs.
2 lbs. = ⅐ of 14 lbs.		8	5¼	= value of 14 lbs.
		1	2¼	6/7 q. = value of 2 lbs.
	£12	5	10½	6/7 q. = value of 3 cwt., 2 qrs., **16 lbs.**

(18)

	£	s.	d.	
1 ft. = ⅓ of 1 yard	0	5	7½	= value of 1 yard.
			9	
	2	10	7½	= value of 9 yards.
1 ft. = ⅓ of 1 yard		1	10½	= value of 1 foot.
6 in. = ½ of 1 foot.		1	10½	= value of 1 foot.
4 in. = ⅓ of 1 foot.			11¼	= value of 6 inches.
			7½	= value of 4 inches.
	£2	15	11¼	= value of 9 yds., 2 ft., **10 in.**

(19)

	£	s.	d.	
8 lbs. = 1/14 of a cwt.	3	15	7¾	= value of 1 cwt.
			4	
	15	2	7	= value of 4 cwt.
			10	
	151	5	10	= value of 40 cwt.
subtracting	3	15	7¾	= value of 1 cwt.
	147	10	2¼	= value of 39 cwt.
2 lbs. = ¼ of 8 lbs.		5	4 17/20	= value of 8 lbs.
		1	4 47/224	= value of 2 lbs.
	£147	16	11¼	1/20 q. = value of 39 cwt., **10 lbs.**

(20)

	£	s.	d.	
14 lbs. = ½ of 1 qr.	1	17	8¼	= cost of 1 qr.
			12	
	22	12	3	= cost of 12 qrs.
			10	
	226	2	6	= cost of 120 qrs. or 30 cwt.
	3	15	4½	= cost of 2 qrs.
	229	17	10½	= cost of 30 cwt., 2 qrs.
		18	10⅜	= cost of 14 lbs.
	£230	16	8½	½q. = cost of 30 cwt., 2 qrs., 14 lbs.

(21)

	£	s.	d.	
5 dwts. = ¼ of 1 oz.	0	5	10	= value of 1 oz.
			3	
	0	17	6	= value of 3 oz.
			5	
	4	7	6	= value of 15 oz.
1 dwt. = ⅙ of 5 dwts.		1	5½	= value of 5 dwts.
12 grs. = ½ of 1 dwt.			3½	= value of 1 dwt.
4 grs. = ⅓ of 12 grs.			1¾	= value of 12 grs.
1 gr. = ¼ of 4 grs.			7/12	= value of 4 grs.
			7/24	= value of 1 gr.
	£4	9	5¼	1½q. = val. of 15 oz., 6 dwts., 17 grs.

(24)

24 lbs.	@ 12 cts.	=	$2.88
7¾ lbs.	@ 75 cts.	=	5.81¼
4⅜ lbs.	@ 32 cts.	=	1.40
5 lbs.	@ 7 cts.	=	.35
20½ lbs.	@ 11½ cts.	=	2.35¾
17½ lbs.	@ 19 cts.	=	3.32½
			$16.12½

MISCELLANEOUS QUESTIONS AND EXAMPLES.

Ex. XLVII. (p. 157.)

I.

(1)

$$34{\cdot}17 \div 3\tfrac{1}{4} = \frac{34{\cdot}17 \times 4}{13} = \frac{136{\cdot}68}{13} = 10{\cdot}\dot{5}1384615\dot{}.$$

(2)

Value in £$=£\frac{1556{\cdot}85}{24{\cdot}25}=£64{\cdot}2=£64.\ 4s.$

(3)

$\frac{1}{3}+\frac{1}{6}+\frac{1}{14}+\frac{3}{56}=\frac{3}{6}+\frac{7}{56}=\frac{1}{2}+\frac{1}{8}=\frac{5}{8}={\cdot}625.$

(4)

$\frac{6}{7}$ of the estate = \$4818.50
$\frac{1}{7}$ of the estate = 963.70
the whole estate = 6745.90
therefore $\frac{1}{5}$ of the estate = 1349.18
$\frac{2}{5}$ of the estate = 2698.36

(5)

17 cents in the \$ is $\frac{17}{100}$ of any debt;
therefore amount received $=\frac{17}{100}$ of \$17658 = **\$3001.86.**

(6)

He sells $\frac{2}{7}$ of $\frac{5}{16}$ of $\frac{3}{4}$ of the estate;

therefore $\frac{5\times3}{7\times8\times14}$ of the estate $=£\frac{965}{8}$;

therefore the estate $=£\frac{965\times7\times8\times14}{5\times3\times8}$;

therefore $\frac{1}{8}$ of $\frac{3}{16}$ of the estate $=£\frac{965\times7\times14\times3}{5\times3\times5\times16}$

$=£\frac{193\times49}{5\times8}=£\frac{9457}{40}=£236\frac{17}{40}=£236.\ 8s.\ 6d.$

(7)

The wife earns as much as 2 children,
the man earns as much as 6 children;

therefore $(2+6+3)\times$(what each child earns) = **\$24.75**;
therefore each child earns $\frac{1}{11}$ of \$24.75 = \$2.25;
therefore the man earns $\$2.25\times6=\$13.50$;

(8)

25 fr. 56 cent. = 2556 cent.;

therefore 1 florin = $\frac{1}{12}$ of 2556 cent. = 213 cent. = 2 fr. 13 cent.

(9)

If 5 men in 6 weeks earn \$405

1 man in 6 weeks earns 81

1 man in 1 week earns 13.50

4 men in 1 week earn 54

therefore number of weeks = \$540 ÷ \$54 = 10 weeks.

II.

(1)

1 franc = $\frac{1}{20}$ of £1. = $\frac{240}{20}$ of 1 shilling = $\frac{10}{13}$ of a shilling.

(2)

1 yard = $\frac{32}{35}$ metre,

1760 yards = $\frac{32 \times 1760}{35}$ metres,

therefore $\frac{3}{8}$ of $\frac{1}{4}$ of a mile = $\frac{2 \times 14 \times 32 \times 1760}{3 \times 9 \times 35}$ metres

= $\frac{45056}{27}$ metres = $1668\frac{20}{27}$ metres.

(3)

For 28 cattle they pay \$192;

therefore for 1 they pay \$$\frac{192}{28}$;

therefore for 8 cattle A should pay \$$\frac{192 \times 8}{28}$ = \$$\frac{768}{7}$ = \$$54\frac{6}{7}$,

and for 9 cattle B pays \$$\frac{192 \times 9}{28}$ = \$$61\frac{5}{7}$,

and for 11 cattle C pays \$$\frac{192 \times 11}{28}$ = \$$75\frac{3}{7}$.

(4)

4	3·0
12	3·75
10	·3125
	·03125

12·5) ·03125 (·0025
250
625
625
——

(5)

$288000 has to produce $12000;

therefore $1 must produce $\$\frac{12000}{288000}=\$\frac{1}{24}=4\frac{1}{6}$ cts.

(6)

Circumference of the wheel=(5 × 3·14159) feet;

therefore number of revolutions made by the wheel in 10 miles$=\frac{10\times1760\times3}{5\times3\cdot14159}=\frac{10560}{3\cdot14159}=3361\cdot3\ldots.$

(7)

s.	*d.*	£	*s.*	*d.*	
4	$9\times7\frac{1}{6}$	=1	14	$0\frac{1}{2}$	=value of wheat
5	$3\times9\frac{1}{4}$	=2	8	$6\frac{3}{4}$	=value of malt
2	$4\times6\frac{3}{5}$	=0	14	$6\frac{3}{5}$	=value of oats
		£4	17	$1\frac{17}{30}$	=rent.

Also, to find what he would pay in decimal coinage, we have

36 { 4	17·00
9	4·25
12	1·472
2,0	17·122685
	4·856134259

therefore he would pay £4, 8 fl., 5 c., 6·134259 m.

(8)

A can do $\frac{1}{10}$ part of the work in 1 hour,

B can do $\frac{1}{12}$ part of the work in 1 hour;

A and B will do $(\frac{1}{10}+\frac{1}{12})$ or $\frac{11}{60}$ in 1 hour;

therefore they will complete the work in $\frac{60}{11}$ hours or $5\frac{5}{11}$ hours.

(9)

The first set in 1 hour dig $\frac{12}{10}$ of a load,

the second set in 1 hour dig $\frac{9}{10}$ of a load;

therefore both sets in 1 hour dig $(\frac{12}{10}+\frac{9}{10})$, or $\frac{27}{20}$ of a load;

therefore they dig 100 loads in $(100\div\frac{27}{20})$ hours,

i. e. in $\frac{2000}{27}$ hours, or $74\frac{2}{27}$ hours.

III.

(1)

	tons	cwt.	qrs.	lbs.
4	28	4	3	0
9	7	1	0	21
36	15	2	21	

2 qrs. $=\frac{1}{2}$ cwt.

14 lbs. $=\frac{1}{4}$ of 2 qrs.

\$36.16
15
542.40
18.08
9.04
4.52
\$574.04

(2)

25	1·00
12	8·04
3	2·67
2	186·89
11	93·445
22	8·495

and 8·495 chains=8 chains, 4 chainlets, 9 links, 5 linklets.

(3)

$25\frac{1}{2}$ francs=£1=45 pauls, 6 baiocchi=$45\frac{3}{10}$ pauls;

therefore 1 franc$=\left(\frac{459}{10}\div\frac{51}{2}\right)$ pauls;

therefore 20 francs$=\frac{459\times2\times20}{10\times51}$ pauls=36 pauls.

(4)

£2514$\frac{3}{8}$ produces £83$\frac{3}{16}$;

therefore £1 produces £(83$\frac{3}{16}$ ÷ 2514$\frac{3}{8}$)

$$= £\left(\frac{1341}{16} \times \frac{8}{20115}\right) = £\frac{1}{30} = 8d.;$$

and, therefore, £115$\frac{5}{8}$ pays $(115\frac{5}{8} \times 8)d. = 925d. =$ **£3 17*s*. 1*d*.**

(5)

$4800 gains $432 in 7 months,

4800 " 1 " $\frac{7}{432}$ months,

1 " 1 " $\frac{7 \times 4800}{432}$ months,

1512 " 1 " $\frac{7 \times 100}{9 \times 1512}$ months,

1512 " 97$\frac{1}{5}$ " $\frac{100}{9 \times 216} \times \frac{486}{5}$ months $= \frac{20}{4}$ months

$= 5$ months.

(6)

Average length of year $= \left(365 + \frac{97}{400}\right)$ days

$= \left(365 + \frac{97}{4}\right)$ days $= 365{\cdot}2425$ days.

(7)

15 horses + 148 sheep eat as much as

$(3 \times 84 + 148)$ sheep, or 400 sheep;

10 horses + 132 sheep eat as much as

$(2 \times 84 + 132)$ sheep, or 300 sheep;

Then 400 sheep in 1 day cost £$\frac{75\frac{3}{4}}{9}$,

1 " 1 " £$\frac{303}{9 \times 4 \times 400}$,

1 " 8 " £$\frac{101 \times 8}{3 \times 4 \times 400}$,

300 " 8 " £$\frac{100 \times 2 \times 300}{3 \times 400} = £\frac{101}{2} =$ **£50 .10*s*.**

(8)

A does $\frac{1}{6}$ of the work in 1 hour,
B does $\frac{1}{12}$ of the work in 1 hour;

A, B and C do $\frac{1}{2\frac{1}{2}}$ or $\frac{2}{5}$ of the work in 1 hour;

therefore C does in 1 hour $(\frac{2}{5}-\frac{1}{6}-\frac{1}{12})$ or $\frac{3}{20}$,
in 5 hours C does $\frac{3}{4}$ of the work,
and in 9 hours B does $\frac{9}{12}$, *i. e.* $\frac{3}{4}$ of the work.

(9)

The capital but in by both persons $=\$(2400+4080)=\$6480$;
therefore $\frac{2400}{6480}$ = first person's share of profits;
therefore first share $=\$\frac{10}{27}\times 1800=\$666\frac{2}{3}$,
second share $=\$1800-\$666\frac{2}{3}=\$1133\frac{1}{3}$.

IV.

(1)

$729\times 37=26973$.

(2)

$$\frac{1}{5}\text{ of }\$0.24+\frac{2}{7}\text{ of }\$1.20+\frac{4}{9}\text{ of }\$5.04=\left(\frac{24}{5}+\frac{240}{7}+\frac{672}{3}\right)\text{cts.}$$

$$=\frac{27624}{105}\text{ cts.;}$$

$$\text{therefore fraction}=\frac{27624}{105\times 120\times 100}=\frac{1151}{525\times 100}=\frac{11{\cdot}51}{525}$$

$$=\frac{2{\cdot}302}{105}=\frac{{\cdot}4604}{21}=\frac{{\cdot}15346}{7}=\cdot 0219238095.$$

(3)

Area of base $=\frac{1}{2}$ circumference $\times\frac{1}{2}$ diameter
$=\frac{1}{2}\times 3\frac{1}{7}$ diameter $\times\frac{1}{2}$ diameter $=\frac{1}{2}\times 3\frac{1}{7}\times 2$ ft. $\times\frac{1}{2}\times 2$ ft.
$=\frac{1\times 22\times 2\times 2}{2\times 7\times 2}$ sq. ft. $=\frac{22}{7}$ sq. ft.;

therefore content of column $=\left(\frac{22}{7}\times 15\right)$ cub. ft.;

therefore cost $=\left(\frac{22\times 15\times 31}{7\times 2}\right)s.=£36\ 19s.\ 8\frac{1}{2}d.\ \frac{3}{7}q.$

(4)

The men do the work in (12×6) hours$=72$ hours;
therefore, if the day is 8 hours long, they will take
$\left(\frac{72}{8}\right)$ days$=9$ days.

(5)

s.	d.		£	s.	d.	
4	3	$\times 10=$	2	2	6	=value of tea
1	$3\frac{1}{2}$	$\times 18=$	1	3	3	=value of coffee
0	$4\frac{1}{4}$	$\times 23=$	0	8	$1\frac{3}{4}$	=value of sugar
0	$7\frac{3}{4}$	$\times 16=$	0	10	4	=value of candles

24	2	4	4	$2\frac{3}{4}$	=entire cost
	7	2	2	$1\frac{3}{8}$	
		0	6	$0\frac{1}{5}\frac{1}{6}$	=share of each person.

(6)

$(2375\frac{3}{4} \times 40)d.=95030d.=$£395 19$s.$ 2$d.$,

and 2$s.$ $3\frac{7}{8}d \times 1000000=\left(\frac{223}{8} \times 1000000\right)d.$

$=(27875000)d.=$£116145 16$s.$ 8$d.$

(7)

Area covered in each revolution$=(6\frac{1}{2} \times 2\frac{1}{4})$ sq. ft.,
area covered in all the revolutions

$=\left(10 \times 12 \times \frac{13}{2} \times \frac{9}{4}\right)$ sq. ft.$=(195 \times 9)$ sq. ft.$=195$ sq. yds.

(8)

C's share$=\frac{3}{5}$ B's share, A's share$=\frac{5}{4}$ B's share;
therefore $\frac{5}{4}$ B's share$+$B's share$+\frac{3}{5}$ B's share$=$\$1400;
therefore $\frac{37}{12}$ B's share$=$\$1400;

therefore B's share$=$\$$\frac{1400 \times 12}{35}=$\$480,

C's share$=\frac{3}{5}$ of \$480$=$\$320,
A's share$=\frac{5}{4}$ of \$480$=$\$600.

(9)

Take 3 gallons of the mixture.

These consist of 2 parts brandy and 1 part rum,

and they cost the merchant ($10.80+$2.52) or $13.32.

He then sells them for $5.40 × 3, or $16.20;

therefore he gains on 3 gallons of the mixture $2.88;

therefore on each gallon he gains $\frac{288}{3}$ cts.=96 cts.

V.

(1)

550974÷1472=374 with remainder 446.

(2)

$\frac{6}{45}$, $\frac{5}{7}$, $\frac{9}{35}$, L. C. D. is 315,

and the fractions become

$$\frac{6\times7}{45\times7},\ \frac{5\times45}{7\times45},\ \frac{9\times9}{35\times9},\ \text{or}\ \frac{42}{315},\ \frac{225}{315},\ \frac{81}{315},$$

and their sum $=\frac{42+225+81}{315}=\frac{348}{315}=1\frac{11}{105}$.

(3)

1 oz, avoird. $=\frac{7000}{16}$ grs. Troy $=\frac{7000}{16\times20\times24\times12\times40}$ of 40 lbs. Troy

$=\frac{7000}{16\times20\times24\times12\times40}$ of 1869 sovereigns

$=\frac{70\times1869}{16\times2\times24\times12\times4}$ sovereigns

$=\frac{21805}{6144}$ sovereigns $=3\frac{3373}{6144}$ sovereigns.

(4)

Value for 1 year $=(27500000\times45)s.$,

value for $\frac{1}{4}$ year $=£\frac{27500000\times45}{4\times20}=£(1718750\times9)=£15468750.$

(5)

The first set in 1 hour mow $\frac{4}{3}$ acres,
the second set in 1 hour mow $\frac{8}{5}$ acres;
therefore together in 1 hour they mow $\frac{44}{15}$ acres;
therefore they mow 44 acres in 15 hours,
and 11 acres in $\frac{15}{4}$ hours, or $3\frac{3}{4}$ hours.

(6)

He does the work in $(8\frac{1}{2} \times 6)$ hours, or 51 hours;
therefore if he has to finish it in 5 days,
he must work each day $\frac{51}{5}$ hours, or 10 hrs., 12 min.

(7)

1 man $= \frac{11}{7}$ woman,

11 men + 7 women $= \left(\frac{121}{7} + 7\right)$ women $= \frac{170}{7}$ women.

Now, by the question,
1 woman does the work in (11×17) days;
therefore 170 women do the work in $\left(\frac{11 \times 17}{170}\right)$ days;
therefore $\frac{170}{7}$ women do the work in $\frac{11 \times 17 \times 7}{170}$ days;
therefore the time required is $\frac{77}{10}$ days, or $7\frac{7}{10}$ days.

(8)

Debts amount to \$5835.12 and the estate is worth \$4377.45.
If the bankrupt has \$1 he pays $\frac{1}{5835.12}$ of debts.
as he has \$4377.45 he pays $\frac{437745}{583512}$ of debts;
therefore he pays $.75\frac{9}{1}\frac{3}{8}\frac{5}{6}\frac{5}{2}\frac{}{6}$ in the \$.

Also, A receives $\frac{4}{5}\frac{3}{8}\frac{7}{3}\frac{7}{6}\frac{4}{1}\frac{5}{2}$ of \$2475 $= \$1856.72\frac{3}{4}\frac{9}{8}\frac{5}{6}\frac{3}{2}\frac{}{6}$
B " " \$1953.60 $= \$1465.57\frac{3}{2}\frac{2}{4}\frac{5}{3}\frac{9}{1}\frac{}{3}$
C " " \$1406.52 $= \$1055.15\frac{3}{4}\frac{6}{8}\frac{7}{6}\frac{5}{2}\frac{5}{6}$.

(9)

420 thalers=(420 × 3) shillings

$$=£\frac{420\times 3}{20}=\frac{420\times 3\times 24}{20}\text{ francs}=1512\text{ francs.}$$

VI.

(1)

£10 17*s.* $6\frac{3}{4}$*d.* × 8764=£95335 17*s.* 9*d.*

(2)

For every 55 cents in his assets he owes 100 cents;

therefore his debts=$\frac{100}{55}$ of his assets=$\frac{20}{11}$ of \$2603

$$=\frac{52060}{11}=\$4732\tfrac{8}{11}.$$

(3)

True length=$10\frac{1}{2}$ yds.−$(10\frac{1}{2}\times\frac{2}{3})$ in.=$10\frac{1}{2}$ yds.−7 in.

=10 yd. 11 in.

(4)

6 oz. of almonds cost $\frac{6\times 10}{16}$ cts.=$3\frac{3}{4}$ cts.,

$\frac{3}{4}$ lb. of raisins cost $\frac{3\times 11}{4}$ cts.=$8\frac{1}{4}$ cts.;

therefore whole cost=$(3\frac{3}{4}+8\frac{1}{4})$ cts.=12 cts.

(5)

5 cwt., 3 qrs., 14 lbs.=589 lbs;

therefore price=3534 cts.,

3534 cts.,−1178 cts.=2356 cts.;

therefore price of each lb.=$\frac{2356}{589}$ cts.=4 cts.

(6)

The sugar costs him	\$54.80
he pays for expenses	2.74
he has to gain	8.22
therefore he must sell it for	\$65.76

Now 10 cwt., 3 qrs., 21 lbs.=1096 lbs., and \$65.76=6576 cts.;

therefore price of each lb.=$\frac{6576}{1096}$ cts.=6 cts.

(7)

Length of pole$=(35\times12)$ in.$=420$ in.

Now in 24 hrs. the snail creeps up 15 in.;

therefore in (24×26) hrs. the snail creeps up (15×26) in., or 390 in.;

therefore he has $(420-390)$ in., or 30 in. to get up.

And he goes over 1 in. in $\frac{12}{31}$ hrs.

and over 30 in. in $\frac{12\times30}{31}$ hrs.;

therefore he reaches the top in $\left(24\times26+\frac{12\times30}{31}\right)$ hrs.

or in $(624+11\frac{19}{31})$ hrs. $=635\frac{19}{31}$.

(8)

	£	s.	d.	
Wages of 3 foremen weekly	= 6	6	0	
" 10 shopmen weekly	=10	10	0	
" 5 assistants weekly	= 4	7	6	
total amount of wages	=21	3	6	
weekly profits	=54	6	5	
difference	=33	2	11	
			10	
	331	9	2	for 10 weeks
			5	
	1657	5	10	for 50 weeks
	66	5	10	for 2 weeks
annual income	=1723	11	8	for 1 year
annual outgoings	= 723	11	8	
net profit	=1000	0	0	

VII.

(1)

$\frac{3}{5}$ of $\frac{1}{4}$ of 6 dollars$=\frac{2\times6}{3\times4}=\$1$;

therefore fraction$=\frac{100}{23750}=\frac{2}{475}=\cdot0042\ldots$.

(2)

£5 6*s.* 3¼*d.*=5101*q.*, £85 0*s.* 4*d.*=81616*q.*;

therefore number=$\frac{81616}{5101}$=16.

Again, (4+2+1) times the third part=£34 13*s.*,

or 7 times the third part=£34 13*s.*;

therefore third part= £4 19*s.*,

second part= £9 18*s.*,

first part=£19 16*s.*

(3)

days.

365·25 =length of civil year

365·242264=true length of year

·007736=annual defect.

Since, therefore, $\frac{7736}{1000000}$ of 1 day is the defect each year,

number of years required=$\frac{1000000}{7736}=\frac{125000}{967}=129\frac{767}{967}$.

(4)

1 man mows 300 acres in (15×17) days,

1 man mows 1 acre in $\frac{15\times17}{300}$ days,

27 men mow 167 acres in $\frac{15\times17\times167}{300\times27}$ days

$=\frac{2839}{540}$ days=$5\frac{139}{540}$ days.

(5)

6 times the work may be done in 12 days by 120 men;

therefore 6 times the work may be done in $\frac{12}{10}$ days by 1200

(6)

¾ of ⅘ of ⅓=⅕;

therefore value of my share was \$6000

and ⅕ of the ship's value is \$5000

therefore value of part remaining is \$1000

(7)

Since \$900 has \$675 to meet it, \$1 has $\$\frac{675}{900}$ or $\frac{3}{4}$ to meet it,

also claim of third creditor will be \$(900−125−375), or \$400;

therefore he receives $\frac{3}{4}$ of \$400 or \$300.

(8)

\$13 × number of workmen in first class = wages of first class,

\$20 × number of workmen in first class = wages of second class,

\$88 × number of workmen in first class = wages of third class;

therefore \$121 × number of workmen in first class = wages of all = \$847;

therefore number of workmen in first class $= \frac{847}{121} = 7$;

therefore number of workmen = 7+14+77 = 98.

(9)

£	francs.		francs.	cents.
1	= 25$\frac{1}{4}$	=	25	25
400	= (10000+100)	=	10100	0
5		=	126	25
$\frac{1}{8}$		=	8	41$\frac{2}{8}$
therefore £405 6*s.* 8*d.*		=	10234	66$\frac{2}{8}$

VIII.

(1)

13 lbs. 9 oz. = 165 oz.

	£	*s.*	*d.*	
2 dwts. = $\frac{1}{10}$ of 1 oz.	3	5	0	
			10	
	32	10	0	= cost of 10 oz.
			10	
	325	0	0	= cost of 100 oz.
	195	0	0	= cost of 60 oz.
	16	5	0	= cost of 5 oz.
	536	5	0	= cost of 165 oz.
1 dwt. = $\frac{1}{2}$ of 1 dwt.	0	6	6	= cost of 2 dwts.
	0	3	3	= cost of 1 dwt.
	£536	14	9	= value required.

(2)

£1 11*s.* $6\frac{1}{4}d.$ = 1513*q.*, 2 florins = 96*q.*;

therefore number $= \frac{1513}{96} = 15\frac{73}{96}$.

(3)

3 kreutzers = 1 penny,

1 kreutzer $= \frac{1}{3 \times 240}$ of £1.

5 kreutzers $= \frac{5 \times 12}{3 \times 240}$ of a guilden $= \frac{1}{12}$ of a guilden.

(4)

12*s.* 4*d.* is $\frac{37}{60}$ of £1;

therefore he first receives $\frac{37}{60}$ of £296 = £182 10*s.* 8*d.*,

the deficiency is then £113 9*s.* 4*d.*;

and since 3*s.* 9*d.* is $\frac{3}{160}$ of £1,

he next receives $\frac{3}{160}$ of £113 9*s.* 4*d.* = £21 5*s.* 6*d.*;

therefore in all he receives £203 16*s.* 2*d.*

(5)

12 ft., $4\frac{1}{2}$ in. = $148\frac{1}{2}$ in. = $\frac{297}{2}$ in.,

1 mile = $(1760 \times 3 \times 12)$ in.;

therefore fraction $= \frac{297}{1760 \times 3 \times 12 \times 2}$

$= \frac{9 \times 11 \times 3}{11 \times 160 \times 3 \times 12 \times 2} = \frac{3}{1280}$,

and $\frac{3}{1280} = \frac{\cdot375}{160} = \frac{\cdot046875}{20} = \cdot00234375$.

(6)

Income tax = $(200 \times 7)d.$ = 2800 halfpence,

and he has to save 3 halfpence on each lb.;

therefore number of lbs. of sugar $= \frac{2800}{3} = 933\frac{1}{3}$ lbs.;

therefore he must use 9 cwt., $33\frac{1}{3}$ lbs. of sugar.

(7)

B's work in 24 hours = A's work in 20 hours;

therefore A could do $\frac{1}{2}$ the work in (12 + 20) hours, or in 32 hours;

therefore C does $\frac{1}{2}$ the work in $(\frac{9}{5} \times 32)$ hours,

or in $57\frac{3}{5}$ hours.

(8)

$\frac{3}{5}$ of £1 = $\frac{3}{5}$ of £1 = $\frac{1}{8}$ of £1 = 6*s*. 8*d*.

(9)

$\$14400 \times 52 = \$748800$ annual earnings

$\$3723.40 \times 52 = \$193616.80$ annual expenses

10 | 942416.80
94241.68

848175.12
115880.08

$\$732295.04$ net profit.

IX.

(1)

$$\frac{9275}{371} + \frac{1522842}{719} = 25 + 2118 = 2143.$$

(2)

$$\frac{2}{5} = \frac{2 \cdot 0}{5} = \cdot 4,$$

$$\frac{75}{1875} = \frac{15}{375} = \frac{3}{75} = \frac{1}{25} = \frac{1 \cdot 00}{25} = \cdot 04.$$

(3)

$$\frac{1}{3} - \frac{1}{6} - \frac{1}{24} = \frac{8-4-1}{24} = \frac{3}{24} = \frac{1}{8};$$

and since $8 = 2 \times 2 \times 2$, the fraction will become a finite decimal.

Again, $\frac{\frac{1}{3}+\frac{1}{4}}{\frac{1}{2}+\frac{1}{3}}$ of $\$1 = \frac{\frac{7}{12}}{\frac{5}{6}}$ of $\$1 = \frac{7 \times 6}{5 \times 12}$ of $\$1 = \frac{7}{10}$ of $\$1 = 70$ cts.

(4)

$(\frac{2}{3}-\frac{1}{2})$ of the term $=13\frac{1}{3}$ days;

therefore $\frac{1}{6}$ of the term $=13\frac{1}{3}$ days;

therefore the term $=(13\frac{1}{3}\times 6)$ days $=80$ days.

(5)

4	2·0
12	6·5
2,0	17·5416

£19·877083

Ans. £19 8 f. 7 c. 7 m. with ·083 m. over,

and $\cdot 08\dot{3}$ m. $=\frac{83-8}{900}$ m. $=\frac{75}{900}$ m. $=\frac{1}{12}$ m.

(6)

	s.	*d.*	
$3d.\times 2\frac{1}{6}=$	0	$6\frac{1}{2}$	=price of milk
$2s.\times\frac{1}{12}=$	0	2	=price of lemon
$1s.\times\frac{1}{8}=$	0	$1\frac{1}{2}$	=price of 2 eggs
$13s.\times\frac{1}{8}=$	1	$7\frac{1}{2}$	=price of rum
$24s.\ 8d.\times\frac{1}{16}=$	1	$6\frac{1}{2}$	=price of brandy
	4	0	=whole cost.

(7)

The English hen while eating a pint of barley lays 10 eggs, and these are equivalent to 15 Cochin China eggs. Consequently the English hen lays 15 eggs to the other hen's 12 eggs, and is the more economical layer.

(8)

$(20\times 3\times 1\frac{1}{2}\times 4)$ cub. ft. $=360$ cub. ft. =content of first trench,

$(30\times 3\times 2\frac{1}{4}\times 5)$ cub. ft. $=\frac{2025}{2}$ cub. ft. =content of second trench,

(Continued on next page.)

(8 continued.)

cub. ft. hrs. men.

therefore since 360 are dug in 30 by 72

$$1 \quad \text{“} \quad 30 \quad \text{“} \quad \frac{72}{360}$$

$$1 \quad \text{“} \quad 1 \quad \text{“} \quad \frac{72 \times 30}{360}$$

$$1 \quad \text{“} \quad 135 \quad \text{“} \quad \frac{72 \times 30}{135 \times 360}$$

$$\frac{2025}{2} \quad \text{“} \quad 135 \quad \text{“} \quad \frac{72 \times 30 \times 2025}{2 \times 135 \times 360}$$

therefore number of men $= \frac{3 \times 2025}{135} = \frac{2025}{45} = \frac{405}{9} = 45.$

(9)

Wages of men $= \$(420 \times 14{\cdot}40) = \$6048$,

therefore wages of boys $= \$(7200 - 6048) = \$1152$;

therefore number of boys $= \frac{11520}{72} = 160.$

X.

(1)

$\frac{3}{5} + {\cdot}061 = {\cdot}6 + {\cdot}061 = {\cdot}661$; ${\cdot}02 - {\cdot}003 = {\cdot}017$; ${\cdot}0672 \div {\cdot}006 = 11{\cdot}2.$

(2)

$\frac{2}{3}$ of $\frac{7}{11} - \frac{1}{2}$ of $\frac{5}{6} = \frac{14}{33} - \frac{5}{12} = \frac{1}{132}$,

and $\frac{1}{132} \times \left(\frac{3}{7} \text{ of } \frac{5}{8}\right) = \frac{3 \times 5}{132 \times 7 \times 8} = \frac{5}{2464}.$

(3)

4	2·0
12	7·5
2,0	10·625
	£25·53125

therefore £25 10*s.* 7½*d.* = £25 5 fl. 3c. 1¼ m. = 255 fl 3c. 1¼ m.

(4)

men. days.

Since 6 in $\frac{15}{2}$ earn \$90

1 in $\frac{15}{2}$ earns \$15

1 in 1 earns \$2

10 in 1 earn \$20

10 in $\frac{47}{4}$ earn \$235.

(5)

Number of yards $= \frac{34560}{52}$

$= 664\frac{8}{13}$.

(6)

Gas consumed in 1 hour $= (10 \times 4 \times 60 \times 60)$ cub. in.;

therefore cost $= \frac{10 \times 4 \times 60 \times 60 \times 6}{1728 \times 1000} s. = \frac{6 \times 6 \times 6}{432} s. = \frac{216}{432} s.$

$= \frac{1}{2} s. = 6d.$

(7)

\$1.20
89
\$82.80
90 price 3 pks.
\$83.70

Also 8 qrs., 6 bush., 2 pks. $= 70\frac{1}{2}$ pks.;

therefore price $= (423 \div 70\frac{1}{2}) s.$

$= \frac{423 \times 2}{141} s. = (3 \times 2) s. = 6s.$

(8)

men. cub yds. hrs.

Since 36 dig $72 \times 8 \times 12$ in 8×16,

1 digs 1 in $\frac{8 \times 16 \times 36}{72 \times 18 \times 12}$,

32 dig $64 \times 27 \times 18$ in $\frac{8 \times 16 \times 36 \times 64 \times 27 \times 18}{32 \times 72 \times 18 \times 12}$;

therefore number of hours $= \frac{8 \times 16 \times 27 \times 18}{18 \times 12} = 2 \times 16 \times 9$;

therefore number of days $= \frac{2 \times 16 \times 9}{12} = 2 \times 4 \times 3 = 24.$

(9)

Area of sheet $=(66 \times 30)$ sq. inches;

therefore each sheet will give a strip (66×30) linear inches in length and 1 linear inch broad;

therefore number required $=\dfrac{25000 \times 1760 \times 3 \times 12}{66 \times 30}$

$=25000 \times 16 \times 2 = 800000$ sheets.

XI.

(1)

$\frac{11}{13} = \cdot\dot{0}82706766917293233\dot{}$, value $= \$24.81\frac{27}{13}$.

(2)

If \$1 pays a rate of 2 cents, \$3070 pay a rate of (3070×2) cents $=\$61.40$.

(3)

If $2\frac{1}{2}$ lbs. cost 20 cts., 1 lb. will cost 8 cts.,

also 2 tons, 16 cwt., 17 lbs. $=5617$ lbs.;

therefore price required $=(5617 \times 8)$ cts. $=\$449.36$.

(4)

It must be sold for \$36.96;

therefore price per lb. $=\dfrac{3696}{10000}$ cts. $= \cdot 3696$ cts.

(5)

$\cdot 00003551136\dot{} = \dfrac{3551136 - 35511}{99000000000}$;

therefore value in inches $= \dfrac{3515625 \times 1760 \times 3 \times 12}{99000000000}$ in.

$= \dfrac{3515625 \times 160 \times 4}{1000000000}$ in. $= \dfrac{2250000000}{1000000000}$ in.

$= 2{\cdot}25$ in. $= 2\frac{1}{4}$ in.

(6)

$5s. = 60d.$ and $2\frac{2}{5}d. = 2{\cdot}4d.$;

therefore $5s. = \dfrac{60}{2{\cdot}4} = 25$, $2s.\ 6d. = \frac{1}{2}$ of $5s. = 12{\cdot}5$,

(Continued on next page.)

(6 continued.)

$1s.=\frac{1}{5}$ of $5s.=5$, $6d.=\frac{1}{2}$ of $1s.=2{\cdot}5$, $4d.=\frac{1}{3}$ of $1s.=1{\cdot}\dot{6}$,
$3d.=\frac{1}{4}$ of $1s.=1{\cdot}25$.

Also, $\frac{1}{10}$ of $2\frac{2}{5}d.=\frac{1}{5}\frac{2}{0}d.=\frac{6}{25}d.$;

therefore in this unit of money one halfpenny $=\frac{\frac{1}{2}}{\frac{6}{25}}$
$=\frac{25}{12}=2{\cdot}08\dot{3}$.

(7)

$4s.\ 3\frac{1}{2}d.=5{\cdot}42$ fr., or $\frac{258}{5}d.=\frac{542}{109}$ fr.;

therefore $1d.=\frac{542\times5}{258\times100}$ fr.;

therefore £1 $=\frac{542\times5\times240}{258\times100}$ fr. $=\frac{1084}{43}$ fr. $=25\frac{2}{43}$ fr.

Also, when unit of money is $\frac{6}{25}d.$,

a dollar $=\frac{258}{5}\div\frac{6}{25}=\frac{258\times25}{5\times6}=215$ units,

a franc $=\left(\frac{258}{5}\div\frac{542}{100}\right)\div\frac{6}{25}=\frac{258\times100\times25}{5\times542\times6}$
$=\frac{215\times100}{542}=\frac{10750}{271}=39\frac{181}{271}$ units.

(8)

A and B do $\frac{1}{6}$ daily, B and C do $\frac{1}{7}$ daily;

therefore, taking these successively from the work done by A, B and C daily, we have

A's work daily $=\frac{1}{4}-\frac{1}{7}$, C's work daily $=\frac{1}{4}-\frac{1}{6}$;

therefore A and C do daily $\frac{1}{4}-\frac{1}{7}+\frac{1}{4}-\frac{1}{6}$, or $\frac{4}{21}$ of the work;

therefore A and C do it in $\frac{21}{4}$ days, or $5\frac{1}{4}$ days.

(9)

$(20\times12)d.\times$ number of sovereigns = value of the sovereigns in pence,

$(12\times3)d.\times$ number of sovereigns = value of the shillings in pence,

$4d.\times$ number of sovereigns = value of the pence;

therefore $(240+36+4)d.\times$ number of sovereigns = value of coins in pence;

therefore $280d.\times$ number of sovereigns $=(280\times20\times12)d$;

therefore number of sovereigns $=\frac{280\times20\times12}{280}=240$,

number of shillings $=240\times3=720$,

number of pence $=240\times4=960$.

RULE OF THREE.

Ex. XLIX. (p. 177.)

(15)

7*d.* : £10 1*s.* 3*d.* :: £1 : half year's income;

therefore half year's income $= £\frac{2415}{7} = £345$;

therefore year's income = £690.

Let the scholar do the above question as follows:

£10 1*s.* 3*d.* = 2415*d.*

Since 7*d.* tax gives £1 income;

$\therefore$ 1*d.* tax gives £$\frac{1}{7}$ income;

$\therefore$ 2415*d.* tax gives £$\frac{2415}{7}$ = £345.

The same method may be adopted in every case.

(17)

56$\frac{2}{3}$ cts. : \$4560 :: \$1 : amount of debts;

therefore amount required $= \frac{456000}{56\frac{2}{3}} = \$3047\frac{1}{17}$.

(19)

400 ac., 2 ro., 20 po. : 1 ac. :: \$1201.87$\frac{1}{2}$: rent per acre;

therefore rent per acre $= \frac{160 \times 240375}{64100 \times 2}$ cts. = \$3.

(24)

Loss on £1 debt = 4 fl., 2 c., 5 m.;

therefore £1 : £11793 5 fl. :: 425 m. : loss required;

therefore loss $= \frac{117935 \times 425}{10}$ m. = £5012 2 fl., 3 c., 7$\frac{1}{2}$ m.

(25)

2$\frac{1}{2}$ lbs. : 2 tons, 16 cwt., 17 lbs. :: 10*d.* : price required;

therefore price required $= \frac{6289 \times 10 \times 2}{5} d.$ = £104 16*s.* 4*d.*

(29)

356 ac., 3 ro., 39$\frac{1}{2}$ po. : 2 ac. :: £951 19*s.* 10*d.* : rent required;

therefore rent required $= \frac{2 \times 320 \times 228478}{114239} d.$

$= 1280d.$ = £5 6*s.* 8*d.*

(30)

27 bus., 2 pks. : 16½ bus. :: £10 7*s.* 2¼*d.* : price required;

therefore price required $= \frac{2 \times 33 \times 9945}{55 \times 2} q. = £6\ 4s.\ 3\frac{3}{4}d.$

(33)

Area of field = (121 × 86) sq. yds ;

therefore 4840 yds. : (121 × 86) yds. :: $80 : price required;

therefore price required $= \$\frac{121 \times 86 \times 80}{4840} = \$172.$

(36)

£12 7*s.* 11⅝*d.* : £3 19*s.* 0¾*d.* :: 34½ yds. : number of yds required;

therefore number of yards required $= \frac{3795 \times 69}{23805 \times 4 \times 2} = 11.$

(37)

Area of field = (50·4 × 56·25) sq. chains = 2835 sq. ch. = 283·5 ac.;

therefore 1 ac. : 283·5 ac. :: $7.20 : rent required,

rent required = (283.5 × $7.20) = $2041.20.

(39)

$\dot{3}$ of 4·5 cwt. = ⅓ of 4·5 cwt. = 1·5 cwt. = 150 lbs.;

therefore 150 lbs. : 1 lb. :: $11.55 : price required;

therefore price required $= \frac{1155}{150}$ cts. = 7·7 cts.

(40)

£3 17*s.* 10½*d.* : £150 :: 1 oz. : number of oz. in the piece of gold;

therefore weight of the piece of gold $= \frac{36000}{934\frac{1}{2}}$ oz.

Again, 12 oz. : $\frac{36000}{934\frac{1}{2}}$ oz. :: 54*s.* 6*d.* : value of silver;

therefore value required $= \frac{36000 \times 654 \times 2}{12 \times 1869} d.$

$= £8\ 14s.\ 11\frac{1}{2}d.\ \frac{46}{623} q.$

(41)

$375\frac{1}{2} \times 75\frac{1}{2} : 278\frac{3}{4} \times 151 :: \$566.40 :$ value required;

therefore price required $= \frac{278\frac{3}{4} \times 151 \times 113401}{375\frac{1}{2} \times 75\frac{1}{2}} q.$

$= \frac{1115 \times 151 \times \$566.40}{751 \times 151} = \$840.92\frac{568}{751}.$

(42)

Number of days from Jan. 1 to May 27 = 146;

therefore $365 : 146 :: \$224 :$ wages required;

therefore wages required $= \frac{146 \times 35}{365}$ guineas $= \$89.60.$

(43)

$\frac{3}{11}$ of $\frac{2}{9}$ of $\frac{4}{17} : \frac{1\frac{2}{8}}{4\frac{1}{4}}$ of $\frac{2}{5} :: \$1600 :$ value required;

therefore value required $= \$\frac{11 \times 9 \times 17 \times 5 \times 4 \times 2 \times 1600}{3 \times 2 \times 3 \times 4 \times 17 \times 5}$

$= \$13200.$

(44)

48 yds. : 60 yds. :: 7*s.* 3*d.* : price required;

therefore price required $= \frac{60 \times 87}{48} d. = 9s.\ 0\frac{5}{4}d.$

(45)

97 cts. : \$1 :: \$7838.12 : income required;

therefore income $= \$\frac{783812}{97} = \$80805\frac{53}{97}.$

(46)

From noon on Monday to 10 hrs., 15 min. A. M. on Saturday there are $118\frac{1}{4}$ hrs.; therefore $24 : 118\frac{1}{4} :: 3'\ 10'' :$ gain required;

therefore gain $= \frac{473 \times 190}{24 \times 4}$ sec. $= 15'\ 36\frac{7}{48}''$;

therefore time indicated by the watch will be

10 hrs., $15' + 15'\ 36\frac{7}{48}'' + 10'$, or 10 hrs., $40'\ 36\frac{7}{48}''$.

(47)

1 : 3·1416 :: $22\frac{1}{2}$ ft. : circumference required;

therefore circumference required $= \left(3{\cdot}1416 \times \frac{45}{2}\right)$ ft

$=70$ ft., 8.232 in.

(48)

$25\frac{3}{4}$: 40 :: 3 cwt. : weight required;

therefore weight required $= \frac{4 \times 40 \times 3}{103}$ cwt. $= 4\frac{68}{103}$ cwt.

(49)

14 : 365 :: \$20 : annual expenditure;

therefore annual expenditure $= \$\frac{365 \times 20}{14} = \$521\frac{3}{7}$;

therefore income must be $\$721\frac{3}{7}$.

(50)

175 guineas : £120 :: £6 17*s.* $9\frac{1}{4}$*d.* : tax required;

therefore tax $= \frac{2400 \times 6615}{3675}$ *q.* $=$ £4 10*s.*

(51)

1 lb., 10 oz., 10 dwts. : 1 oz. :: \$29.70 : price required;

therefore price per oz. $= \$\frac{20 \times 29.70}{450} = \$1.32$.

(52)

$4\frac{1}{2}$ days : 9 days :: $7\frac{1}{2}$ hours : number of hours required;

therefore number of hours $= \frac{9 \times 15 \times 2}{9 \times 2} = 15$.

(53)

Cost of silver when manufactured will be

(\$15.84 + 36 cts. + 44 cts.), or \$16.64 per lb.;

therefore 1 lb. : 7 lbs., 7oz., 10 dwts. :: \$16.64 : price req'd;

therefore price required $= \$\frac{1830 \times 16{\cdot}64}{240} = \$126.88$

(54)

365 : 63 :: \$3925 + \$90 : sum required;

therefore sum required $= \$\frac{63 \times 4015}{365} = \$693.$

(55)

Since 1 man = 3 boys and 1 woman = 2 boys, the question is the same as the following: if (45 + 24 + 9) boys do the work in 50 days, in what time will (27 + 30 + 18) boys do 4 times as much?

therefore 75 : 78 :: 50 days : days required for same work;

therefore days required for same work $= \frac{78 \times 50}{75} = 52$;

therefore days required to do 4 times as much = 208.

(56)

Tax = \$40; therefore he has \$711.75 to spend annually;

therefore 365 : 1 :: \$711.75 : daily expenditure;

therefore sum required $= \$\frac{711.75}{365} = \$1.95.$

(57)

Since 3 cows eat as much as 7 horses,

7 cows eat as much as $\frac{49}{3}$ horses;

therefore $3 + \frac{49}{3} : 7 :: 29$: days required;

therefore days $= \frac{3 \times 7 \times 29}{58} = 10\frac{1}{2}.$

(58)

Area of room $= \frac{440}{9}$ sq. yds.;

therefore $\frac{3}{4}$ sq. yd. : $\frac{440}{9}$ sq. yds. :: 1 yd. : number of yds. required;

therefore number of yds. required $= \frac{4 \times 440}{3 \times 9} = 65\frac{5}{27}.$

(59)

Cost of eggs $=(50+33\frac{1}{3})d.=83\frac{1}{3}d.$,

also $5 : 200 :: 2d.$: selling price;

therefore eggs are sold for $\frac{200\times 2}{5}d.=80d.$;

therefore loss is $3\frac{1}{3}d.$

(60)

From 12 P. M. on Saturday till 12 A. M. on Tuesday are 60 hours, and till 4 P. M. Thursday the clock will indicate 112 hours;

therefore 60 hrs., 3 min. : 112 hrs. :: 3 min. : gain on true time;

therefore gain on true time $=\frac{60\times 112\times 3}{3603}$ min. $=5\frac{715}{1201}$ min.

therefore true time will be $5\frac{715}{1201}$ min. before 4.

(61)

96 cts. : 100 cts. :: \$7200 : sum required;

therefore sum required $=\$\frac{7200\times 100}{96}=\$7500.$

(62)

In 12 days $\frac{12}{50}$ of the work is done, and the remaining 19 men have $\frac{38}{50}$ of the work to finish.

Also 19 men do $\frac{19}{50\times 35}$ of the work daily;

therefore $\frac{19}{50\times 35} : \frac{38}{50} :: 1$ day : days required;

therefore days required $=\frac{50\times 35\times 38}{19\times 50}=70.$

(63)

Number of square yards in 1000 coats $=1000\times 2\frac{1}{2}\times 1\frac{1}{4}$;

therefore $\frac{3}{4}$ sq. yds. : $\left(1000\times\frac{5}{2}\times\frac{5}{4}\right)$ sq. yds. :: 1 yd. : number of yds. required;

therefore number yds. required $=\frac{4\times 1000\times 5\times 5}{3\times 2\times 4}=4166\frac{2}{3}.$

(64)

$2\frac{1}{2}$ fur. : 240000 miles :: 5 oz. : weight required;

therefore weight required $= \frac{240000 \times 5 \times 2 \times 8}{5}$ oz.

$= (240000 \times 16)$ oz. $= 240000$ lbs.

(65)

$(3 \times 3{\cdot}1416)$ ft. : 4 miles :: 1 : number of revolutions;

therefore number revolutions $= \frac{4 \times 1760 \times 3}{3 \times 3{\cdot}1416} = 2240\frac{15}{3927}$.

(66)

8 oz. : ·75 ton :: ·5635*s*. : price required;

therefore price required $= \$\frac{15 \times 100 \times 16 \times {\cdot}0525}{8}$

$= \$(3000 \times {\cdot}0525) = \$157.50$.

(67)

·4583*s*. : £61 12*s*. :: ·0625 lbs. : weight required;

therefore weight required $= \frac{1232 \times {\cdot}0625}{{\cdot}4583}$ lbs. $= 168\frac{56}{83}$ lb.

(68)

4′ 10″ : 60′ :: 1 day : number of days required;

therefore number of days $= \frac{3600}{250} = 14$ days., 9 hrs., 36 min.;

therefore the time will be on Monday fortnight at 6 hrs., 36 min. P. M.

(69)

$(2{\cdot}5 \times 3)$ sq. ft. : (20×27) sq. ft. :: 1 yd. : number yds. required;

therefore number of yards $= \frac{20 \times 27}{7{\cdot}5} = 72$.

(70)

960 galls. : 1 gall. :: \$3072 : price required;

therefore price required $= \$\frac{640}{960} = \$3.20$.

(71)

A soldier's daily allowance $=\frac{12}{8}$ lbs. $=1\frac{1}{2}$ lbs.;

therefore 1 : 366 :: $\left(850\times\frac{3}{2}\right)$ lbs. : weight required;

therefore weight required $=\frac{366\times2550}{2}$ lbs. $=466650$ lbs.

(72)

1600 men will have provision enough for 2000 men for 80 days;

therefore 1600 : 2000 :: 80 days : number of days required;

therefore number of days $=\frac{2000\times80}{1600}=100$.

(73)

20 sq. poles : (10000 × 160) sq. poles :: (3 × 52) cts. : yearly income;

therefore yearly income $=\frac{10000\times160\times3\times52}{20}$ cts.

$=\$124800$.

(74)

1 oz. : ·36822916 lbs. :: £4·189583 : value required;

therefore value required =

$=£\frac{12\times\cdot36822916\times3770625}{900000}=£18\ 10s.\ 3\frac{17}{3125}d.$

(75)

850 men will have enough provisions to last 1000 men for 68 days;

therefore 850 : 1000 :: 68 days : time required;

therefore time required $=\frac{1000\times68}{850}$ days $=80$ days.

(76)

1 ac. : 182·3 ac. :: $£\frac{4\cdot65}{4}$: rent required;

therefore rent required $=£\frac{547\times4\cdot65}{3\times4}=£211\ 19s.\ 3d.$

(77)

$\$(576+12+294)=\$882$;

therefore 2 tons, 3 cwt., 3 qrs. : 1 cwt. :: \$882 : price required;

therefore price per cwt. $=\$\frac{4\times3675}{175}=\$30\frac{4}{27}$.

(78)

Area of piece $=(2 \times 14\frac{5}{8} \times 13\frac{2}{13})$ sq. yds.;

therefore $40\frac{1}{2}$ sq. yds. : $\left(2 \times \frac{117}{8} \times \frac{171}{13}\right)$ sq. yds. :: 1 yd.

: number of yds. required;

therefore number of yds. $= \frac{2 \times 117 \times 171 \times 2}{81 \times 8 \times 13} = 9\frac{1}{2}$.

(79)

3·75 yds. = 60 nails, and 38 yds., 2 qrs., 3 nails = 619 nails;

therefore 60 : 619 :: \$3.825 : price required;

therefore price $= \$\frac{619 \times 3{\cdot}825}{60} = \$39.46125$.

(80)

1 cow eats as much as $\frac{9}{7}$ horses, 9 cows eat as much as $\frac{81}{7}$ horses;

therefore $4+\frac{54}{7} : 18+\frac{81}{7} :: 1$: relative size of second field;

therefore size of second field $= \frac{7 \times 207}{82 \times 7} = \frac{207}{82}$ size first field.

(81)

A reaps $\frac{1}{55}$, and B $\frac{1}{66}$ in 1 hour;

therefore together they reap $\frac{1}{55}+\frac{1}{66}$, or $\frac{1}{30}$ in 1 hour;

therefore $\frac{10}{30} : 1 :: 1$ day : days required;

therefore days required $= \frac{30}{10} = 3$.

DOUBLE RULE OF THREE.

Ex. L. (p. 188.)

(1)

6 ac. : 15 ac.
14 hrs. : 12 hrs. } :: 7 men : number of men required;

therefore number of men $= \frac{7 \times 15 \times 13}{6 \times 14} = 15$.

(2)

$$\left.\begin{array}{l}\$75 : \$78.75 \\ 9 \text{ days} : 20 \text{ days}\end{array}\right\} :: 3 \text{ men} : \text{number of men required};$$

$$\text{therefore number of men} = \frac{20 \times 315 \times 3}{9 \times 300} = 7.$$

(3)

$$\left.\begin{array}{l}7 \text{ horses} : 16 \text{ horses} \\ 96 \text{ bus.} : 66 \text{ bus.}\end{array}\right\} :: 42 \text{ days} : \text{number of days required};$$

$$\text{therefore number of days} = \frac{66 \times 16 \times 42}{7 \times 96} = 66.$$

(4)

$$\left.\begin{array}{l}5 \text{ sacks} : 15 \text{ sacks} \\ 2 \text{ days} : 6 \text{ days}\end{array}\right\} :: 800 \text{ soldiers} : \text{number of soldiers required};$$

$$\text{therefore number required} = \frac{15 \times 6 \times 800}{2 \times 5} = 7200.$$

(5)

$$\left.\begin{array}{l}6 \text{ horses} : 8 \text{ horses} \\ 13 \text{ days} : 11 \text{ days}\end{array}\right\} :: 17 \text{ bus.} : \text{number of bushels required};$$

$$\text{therefore number of bushels} = \frac{11 \times 8 \times 17}{6 \times 13} = 19\tfrac{7}{39}.$$

(6)

$$\left.\begin{array}{l}16 \text{ horses} : 12 \text{ horses} \\ 8 \text{ days} : 5 \text{ days}\end{array}\right\} :: 1280 \text{ ac.} : \text{number of acres required};$$

$$\text{therefore number of acres} = \frac{5 \times 12 \times 1280}{16 \times 8} = 600.$$

(7)

$$\left.\begin{array}{l}36 \text{ cwt., } 23 \text{ lbs.} : 11 \text{ cwt.} \\ £1\ 5 \text{ c.} : £5\ 2\text{f.}\ 5 \text{ c.}\end{array}\right\} :: 12 \text{ miles} : \text{miles required};$$

$$\text{therefore number of miles} = \frac{1100 \times 5{\cdot}25 \times 12}{1{\cdot}50 \times 3623} = 12\tfrac{7}{36}\tfrac{7}{23}\tfrac{4}{3}.$$

(8)

$$\left.\begin{array}{l}53 \text{ miles} : 124 \text{ miles} \\ \$30.24 : \$15.12\end{array}\right\} :: 8 \text{ cwt} : \text{number of cwt. required};$$

$$\text{therefore number of cwt.} = \frac{15{\cdot}62 \times 124 \times 8}{53 \times 30{\cdot}24} = 9\tfrac{1}{3}.$$

(9)

5 men : 7 men
11 mo : 4 mo. } :: \$1540 : sum required;

therefore sum required $= \$\frac{7 \times 4 \times 1540}{5 \times 11} = \$784.$

(10)

\$225 : \$1000
\$100 : \$ 49½ } :: 5 months : number of months required;

therefore months required $= \frac{1000 \times 495 \times 5}{225 \times 1000} = 11.$

(11)

3 horses : 2 horses
7 mo. : 11 mo. } :: \$84 : sum required;

therefore sum required $= \$\frac{2 \times 11 \times 84}{3 \times 7} = \$88.$

(12)

100 miles : 160 miles
\$3.85 : \$30 } :: 4¾ cwt. : weight required;

therefore weight required $= \frac{160 \times 30 \times 19}{100 \times 3{\cdot}85}$ qrs.

$= 59$ cwt., $22\frac{5}{77}$ lbs.

(13)

7 men : 1 man
345⅝ sq. yds. : 6 ac. } :: 1 hr. : hours required;

therefore number of hours required $= \frac{6 \times 4840}{7 \times \frac{2420}{7}} = 12.$

(14)

12 men : 20 men
\$900 : \$1500 } :: 3 weeks : number of weeks required;

therefore number of weeks $= \frac{20 \times 1500 \times 3}{12 \times 900} = 8\frac{1}{3}.$

(15)

1 cwt., 3 qrs., 21 lbs. : 2½ tons
52¼ miles : 46½ miles } :: 17*s.* 5*d.* : cost required;

therefore cost required $= \frac{5 \times 2240 \times 93 \times 209 \times 4}{2 \times 2 \times 217 \times 209} d. = £20.$

(16)

8 men : 10 men
$7\frac{1}{2}$ ac. : 9 ac. } : 36 hours : numbers required;

therefore number of hours $= \frac{10 \times 9 \times 36 \times 2}{8 \times 15} = 54$;

therefore number of days $= \frac{54}{16}$ days 6 hours.

(17)

30 men : 25 men
16 days : 24 days } :: 8 hrs. : number of hours required;

therefore number of hours $= \frac{8 \times 25 \times 24}{30 \times 16} = 10.$

(18)

17 ac., 3 ro., 2 po. : 26 ac., 2 ro., 23 po.
7 ac. : 6 ac. } :: £39 4*s.* 7*d.* : rent req'd;

therefore rent required $= \frac{4263 \times 6 \times 9415}{7 \times 2842}$ *d.* $=$ £50 8*s.* 9 *d.*

(19)

1500 copies : 5000 copies
11 sheets : 25 sheets } :: 66 reams : number reams required;

therefore number of reams $= \frac{5000 \times 25 \times 66}{11 \times 1500} = 500.$

(20)

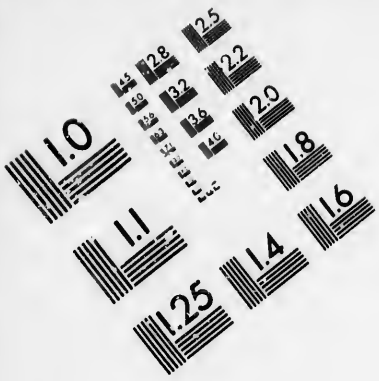
7 men : 5 men
12 hrs. : 14 hrs.
800 ft. : 1800 ft.
700 ft. : 960 ft. } :: $3\frac{1}{2}$ days : number of days required;

therefore number of days $= \frac{5 \times 14 \times 1800 \times 960 \times 7}{7 \times 12 \times 800 \times 700 \times 2} = 9.$

(21)

1500 men : 1000 men
$6\frac{2}{3}$ oz. : 16 oz. } :: 5 weeks : number of weeks required;

therefore number of weeks $= \frac{1000 \times 16 \times 5 \times 3}{1500 \times 20} =$ [illegible].



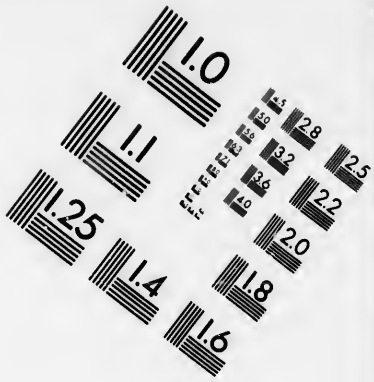
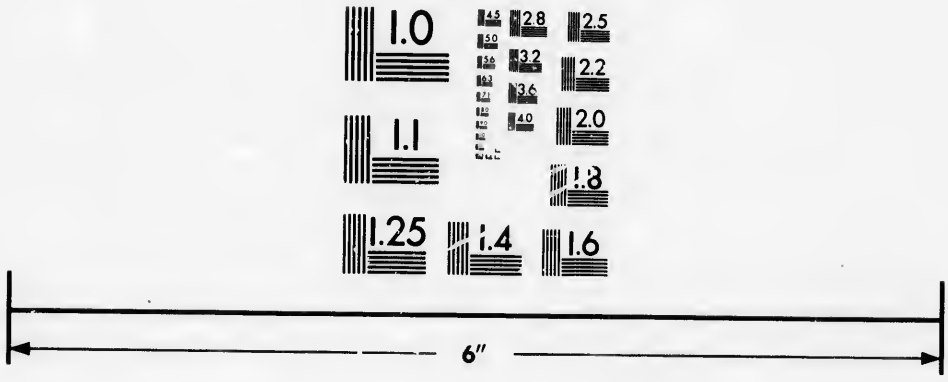
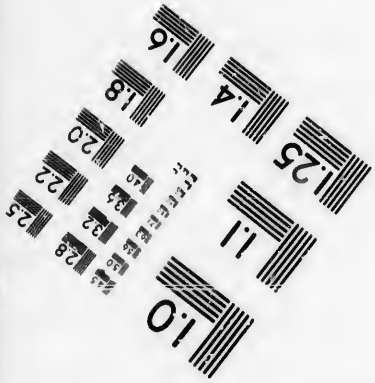
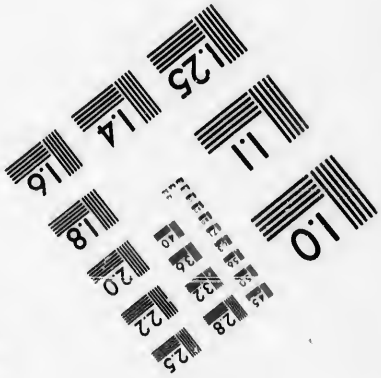


IMAGE EVALUATION TEST TARGET (MT-3)







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WEBSTER, N.Y. 14580
(716) 872-4503

(22)

60 masons : 20 masons
10 hrs. : 7 hrs.
50 ft. : 500 ft.
2 ft. : 4 ft.
14 ft. : 16 ft.
} :: 12 days : number of days required;

therefore number of days $= \frac{20 \times 7 \times 500 \times 4 \times 16 \times 12}{60 \times 10 \times 50 \times 2 \times 14} = 64.$

(23)

$\frac{24}{5}$ days : 24 days
1 day : 7 days
} :: 10 men : number of men required;

therefore number of men $= \frac{24 \times 7 \times 10 \times 5}{24} = 350.$

(24)

100 yds. : 1000 yds.
20 ft. : 16 ft.
4 ft. : 6 ft.
30 hrs. : 48 hrs.
} :: 125 men : number of men required;

therefore number of men $= \frac{1000 \times 16 \times 6 \times 48 \times 125}{100 \times 20 \times 4 \times 30} = 2400.$

(25)

5 ft. : $12\frac{1}{2}$ ft.
$3\frac{3}{4}$ ft. : $6\frac{1}{2}$ ft.
$2\frac{1}{2}$ ft. : $8\frac{1}{4}$ ft.
} :: 7500 lbs. : weight required;

therefore weight required $= \frac{25 \times 13 \times 33 \times 2 \times 4 \times 7500}{2 \times 2 \times 4 \times 5 \times 15 \times 5}$ lbs.

47 tons, 17 cwt., 66 lbs.

(26)

\$96 : \$345.60
\$ 1.20 : \$ 1.08
} :: 100 men : number of men required;

therefore number of men $= \frac{345{\cdot}60 \times 1{\cdot}08}{120 \times 96} = 324.$

(27)

Here 25 horses eat as much as 40 ponies. Also for \$205.15 we can buy, at 55 cts. a bushel, 373 bushels;

therefore 40 ponies : 12 ponies
15 qrs. : $\frac{3\frac{7}{8}}{8}$ qrs.
} :: 64 days : number days req'd;

therefore number of days $= \frac{12 \times 373 \times 64}{40 \times 15 \times 8} = 59\frac{17}{20}.$

(28)

$$\left.\begin{matrix} 42\tfrac{1}{2} \text{ yds.} : 118\tfrac{1}{4} \text{ yds.} \\ 18 \text{ in.} : 36 \text{ in.} \end{matrix}\right\} :: £59\ 14s.\ 2d. : \text{cost required};$$

$$\text{therefore cost} = \frac{473 \times 36 \times 2 \times 14330}{4 \times 85 \times 18} d. = £332\ 5s.\ 2\tfrac{4}{17} d.$$

(29)

$$\left.\begin{matrix} 124 \text{ men} : 62 \text{ men} \\ 55 \text{ hrs.} : 63 \text{ hrs.} \end{matrix}\right\} :: (110 \times 3 \times 3 \times 4) \text{ cub. ft.} : \text{number of cub. ft. required};$$

$$\text{therefore number cub. ft.} = \frac{110 \times 3 \times 3 \times 4 \times 62 \times 63}{55 \times 124} = 2268.$$

(30)

$$\left.\begin{matrix} 3{\cdot}35 \text{ lbs.} : 47{\cdot}5 \text{ lbs.} \\ \$1.14 : \$1.60 \end{matrix}\right\} :: 8 \text{ cts.} : \text{price required};$$

$$\text{therefore price required} = \frac{47{\cdot}5 \times 1{\cdot}60 \times 8}{3{\cdot}35 \times 1{\cdot}14} \text{cts.} = \$1.59\tfrac{779}{3819}.$$

(31)

$$\left.\begin{matrix} 63 \text{ ft.} : 14 \text{ ft.} \\ \$14.40 : \$21.60 \end{matrix}\right\} :: 24 \text{ ft.} : \text{number of ft. required};$$

$$\text{therefore number of ft.} = \frac{14 \times 21{\cdot}60 \times 24}{63 \times 14{\cdot}40} = 8.$$

(32)

$$\left.\begin{matrix} 24 \text{ in.} : 27 \text{ in.} \\ 9 \text{ cts.} : 8 \text{ cts.} \end{matrix}\right\} :: \$10.35 : \text{cost required};$$

$$\text{therefore cost} = \frac{10{\cdot}35 \times 27 \times 8}{24 \times 9} = \$10.35.$$

(33)

$$\left.\begin{matrix} 7 \text{ men} : 4 \text{ men} \\ 16 \text{ days} : 42 \text{ days} \end{matrix}\right\} :: 880 \text{ yds.} : \text{number of yds. required};$$

$$\text{therefore number of yds.} = \frac{880 \times 4 \times 42}{7 \times 16} = 1320.$$

(34)

$$\left.\begin{matrix} 3\tfrac{1}{4} \text{ ft.} : 2\tfrac{1}{2} \text{ ft.} \\ 7\tfrac{1}{2} \text{ in.} : 8 \text{ in.} \\ 1280 \text{ lbs.} : 2028 \text{ lbs.} \end{matrix}\right\} :: 16 \text{ ft.} : \text{number of feet required};$$

$$\text{therefore number of ft.} = \frac{9 \times 8 \times 2028 \times 16 \times 2 \times 4}{13 \times 15 \times 1280 \times 4} = 18\tfrac{18}{25}.$$

(35)

Here 12 oxen eat as much as 28 sheep,

9 " " " 21 sheep;

therefore $\left.\begin{matrix}(28+36)\text{ sheep} : (21+12)\text{ sheep}\\ 8\text{ days} : 28\text{ days}\end{matrix}\right\}$ :: \$20.16 : cost req'd;

therefore cost $= \$\frac{33\times 28\times 20{\cdot}16}{63\times 8} = \$465.69\frac{3}{5}$.

(36)

Here 1 man does $\frac{3}{2}$ of a woman's work;

therefore $\left.\begin{matrix}(3+1)\text{ women} : (\frac{3}{2}+2)\text{ women}\\ 1\text{ woman} : 4\text{ women}\end{matrix}\right\}$ :: 10 days : number of days required;

therefore number of days $= \frac{7\times 4\times 10}{4\times 2} = 35$.

(37)

$\left.\begin{matrix}142{\cdot}2\text{ miles} : 508{\cdot}6\text{ miles}\\ 8{\cdot}4\text{ hrs.} : 10{\cdot}164\text{ hrs.}\end{matrix}\right\}$ :: $4\frac{1}{2}$ days : number of days required;

therefore number of days $= \frac{505{\cdot}6\times 10{\cdot}164\times 9}{8{\cdot}4\times 142{\cdot}2} = 19{\cdot}36$.

(38)

$\left.\begin{matrix}\frac{1}{2}s. : 18\frac{2}{5}s.\\ 18\frac{2}{5}s. : 5\frac{3}{4}s.\end{matrix}\right\}$ :: $4\frac{7}{20}$ lbs. : number of lbs. required;

therefore number of lbs. $= \frac{272\times 23\times 87\times 5\times 2}{20\times 92\times 15\times 4}$

$= \frac{29\times 17}{10} = 49{\cdot}3$.

(39)

$\left.\begin{matrix}9\text{ people} : 8\text{ people}\\ 12\text{ mo.} : 7\text{ mo.}\\ 5 : 3\end{matrix}\right\}$ :: \$7862.40 : cost in shillings;

therefore cost $= \$\frac{8\times 7\times 3\times 17862{\cdot}4}{9\times 12\times 5} = \$2446.08$.

SIMPLE INTEREST.

Ex. LI. (p. 194.)

(9)

£	s.	d.
236	6	8
		3
7·09	0	0
20		
1·80s.		

1·80s.
12
9·60d.
4
2·40q.

£	s.	d.	q.
and 7	1	9½	⅔
			2½
14	3	7	⅘
3	10	10¾	⅕
£17	14	6	

(10)

£	s.	d.
98	15	10
		2½
197	11	8
49	7	11½
2·46	19	7
20		
9·29s.		
12		
4·75d.		
4		
3·00q.		

£	s.	d.	q.
and 2	9	4¾	
		¼	
£1	4	8½	½

(13)

m.
1050625
8
8405 000 interest for 1 year.
6
504·30 interest for 6 years.
1050·625 principal.
1554·925 amount.

(16)

£	s.	d.
1554	6	3
		8
122·74	10	0
20		
14·80		
12		
10·80		

£	s.	d.
122	14	10⅘
		1⅝
122	14	10⅘
61	7	5⅖
15	6	10 7/20
199	9	2 11/20
1554	6	3
1753	15	5 11/20

(21)

$10
8
3.20

Now from March 16, 1850, to January 23, 1851, there were 313 days;
therefore interest required $=\frac{313}{365}$ of \$3.20
$=\$2.74\frac{39}{73}$
and amount $=\$42.74\frac{39}{73}$.

(22)

\$320.75
7
22.4525
2
44.9050

Now interest for 35 days $=\frac{35}{365}$ of \$22.4525
$=\$2.15\ldots$.
therefore \$44.905
2.15
47.055 interest.
320.75
367.80 amount.

(23)

£ s.
34 10
6
2·07 0
20
1·40
12
4·80

Now from Aug. 10 to October 21 there are 72 days;
therefore interest required
$=\frac{72}{365}$ of £2 0*s.* 4·8*d.*
$=8s.\ 2d.$ nearly;
therefore amount $=$ £34 18*s.* 2*d.* nearly.

Ex. LII. (p. 195.)

(1)

\$132 : \$150 :: \$100 : sum required;
therefore sum required $=\$\frac{150\times 100}{132}=\$113.\dot{6}\dot{3}$.

(2)

\$540 : \$100 :: $\frac{1}{9}$ of \$928.80 : rate required;
therefore rate required $=\$\frac{100\times 928.80}{540\times 9}=\$8$.

(3)

Interest on \$350 for 1 year $=\$24.50$;
therefore \$24.50 : \$98 :: 1 year : time required;
therefore time required $=\frac{98}{24.5}$ years $=4$ years.

(4)

Interest for 1 year $= \frac{2}{7}$ of \$68.3025 $=$ \$19.52$\frac{1}{7}$;

therefore \$325.50 : \$100 :: \$19.52$\frac{1}{7}$: rate required;

therefore rate required $= \$\frac{100 \times 68.3025}{325.5 \times 7} = \$6.$

(5)

Interest on \$142.50 for 1 year $=$ \$9.97$\frac{1}{2}$;

therefore \$9.97$\frac{1}{2}$: \$99.75 :: 1 year : time required;

therefore time required $= \frac{9975}{997\frac{1}{2}}$ years $= 10$ years.

(6)

\$157 : \$100 :: $\frac{1}{25}$ of \$235.50 : rate required;

therefore rate required $= \$\frac{100 \times 235.50}{157 \times 25} = \$6.$

(7)

\$6$\frac{1}{2}$: \$87.75 :: \$100 : sum required;

therefore sum required $= \$\frac{87.75 \times 100 \times 2}{13} = \$600.$

(8)

\$100 amounts in 3$\frac{1}{2}$ years to \$124$\frac{1}{2}$;

therefore \$124$\frac{1}{2}$: \$1014.67$\frac{1}{2}$ :: \$100 : sum required;

therefore sum required $= \$\frac{2029.35 \times 100}{249} = \$815.$

(9)

£112 : £387 7*s*. 7$\frac{1}{2}$*d*. :: £100 : sum required;

therefore sum required $= £\frac{464856 \times 100}{26880 \times 5} =$ £345 17*s*. 6*d*.

(10)

Interest on £1275 for 1 year $=$ £48 9*s* ;

therefore £48 9*s*. : £274 11*s*. :: 1 year : time required;

therefore time required $= \frac{5491}{969}$ years $= 5\frac{2}{3}$ years.

(11)

£936 13*s.* 4*d.* : £100 :: $\frac{8}{39}$ of £220 14*s.* 0$\frac{1}{4}$*d.* : rate required;

therefore rate required = £$\frac{100 \times 211874 \times 8}{224800 \times 39}$ = £4$\frac{5}{6}$.

(12)

Interest on \$125 for 1 year = \$6.25;

therefore \$6.25 : \$125 :: 1 year : time required;

therefore time required = $\frac{125 \times 20}{125}$ years = 20 years.

(13)

£100 in 10 years amounts to £135;

therefore £135 : £100 :: £425 19*s.* 4$\frac{4}{5}$*d* : sum required;

therefore sum required = $\frac{100 \times 349773}{135}$ *q.* = £315 10*s.* 8*d.*

Again, interest on £315 10*s.* 8*d.* for 1 year, at 3$\frac{1}{2}$ per cent., will be £11 0*s.* 10·48*d.*,

and £453 11*s.* 7*d.* − £425 19*s.* 4$\frac{4}{5}$*d.* = £27 12*s.* 2$\frac{1}{5}$*d.* the interest to be acquired;

therefore £11 0*s.* 10·48*d.* : £27 12*s.* 2·2*d.*

:: 1 year : time required;

therefore time required = $\frac{6626 \cdot 2}{2650 \cdot 48}$ years = 2$\frac{1}{2}$ years.

(14)

Interest on \$250 for 1 year = \$15;

therefore interest on \$250 will amount in 6 years to \$90.

Again, \$100 in 4 years, at 10 per cent., will acquire \$40 interest;

therefore \$40 : \$90 :: \$100 : sum required;

therefore sum required = \$$\frac{90 \times 100}{40}$ = \$225.

COMPOUND INTEREST.

Ex. LIII. (p. 198.)

(1)

\$2000	\$2120	\$120	interest for 1st year
6	6	127.20	interest for 2d year
120.00	127.20	\$247.20	interest required.

(2)

$800 = 1st principal; $\frac{7}{56.00}$ $856 = 2d prin.; $\frac{7}{59.92}$ $915.92 = 3d prin.; $\frac{7}{\$64.1144}$

therefore amount = \$(800 + 56 + 59.92 + 64.1144)
= \$980.0344.

(3)

$270 = 1st. principal; $\frac{8}{21.60}$ $291.60 2d prin.; $\frac{8}{23.3280}$ ∴ $21.60 + 23.328 = \$44.928 interest.

(4)

$690 = 1st principal; $\frac{7}{48.30}$ $738.30 = 2d prin.; $\frac{7}{51.6810}$ $789.981 = 3d prin.; $\frac{7}{55.29867}$

therefore amount = \$(690 + 48.30 + 51.681 + 55.29867)
= \$845.27967.

(5)

$230.75 = 1st principal; $\frac{6}{13.8450}$ $244.595 = 2d prin.; $\frac{6}{14.67570}$ $259.2407 = 3d prin.; $\frac{6}{15.554442}$

therefore amount = \$(230.75 + 13.845 + 14.6757 + 15.554442)
= \$274.826942.

(6)

$415.50 = 1st principal; $\frac{7}{29.0850}$ $444.585 = 2d principal; $\frac{7}{31.12095}$

$475.70595 = 3d prin.; $\frac{7}{33.2994165}$ $509.0053665 = 4th prin.; $\frac{7}{35.630375655}$

therefore total interest
= \$(29.08.... + 31.12.... + 33.30 + 35.63....) = \$129.13,
simple interest = \$29.085 × 4 = \$116.34;
therefore difference = \$129.13 − \$116.34 = \$12.79.

(7)

1st payment = \$130 $\times \frac{4}{100}$ = \$5 20
2d " = 135.20 $\times \frac{4}{100}$ = 5.408
3d " = 140.608 $\times \frac{4}{100}$ = 5.62432
4th " = 146.23232 $\times \frac{4}{100}$ = 5.8492928
5th " = 152.0826128 $\times \frac{1}{100}$ = 6.083304512
6th " = 158.165917312 $\times \frac{4}{100}$ = 6.32663669248

therefore compound interest = \$34.49153400448

(8)

\$1760.50 = 1st prin. \$1901.34 = 2d prin. \$2053.4472 = 3d prin.
8 8 8

140.840 152.1072 164.275776

therefore interest for $\frac{1}{2}$ year = \$82.137888;
therefore amount = \$(1760.50 + 140.84 + 152.1072 + 82.137888)
= \$2135.58+

(9)

\$230 = 1st principal \$246.10 \$476.10
7 230 33.327
230
16.10 476.10 = 2d principal *Ans.* \$739.427
7
33.3270

(10)

\$416 = 1st prin. \$440.96 = 2d prin. Comp. int. = \$24.96
6 6 26.4576
51.4176
24.96 26.4576 simple int. = 49.92
Ans. \$1.4976

(11)

$\frac{1}{20}$ of \$13333 = \$666.65,
$\frac{1}{20}$ of 13999.65 = 699.9825,
$\frac{1}{20}$ of 14699.6325 = 734.981625,
$\frac{1}{20}$ of 15434.614125 = 771 73070625,
$\frac{1}{20}$ of 16206.34483175 = 810.31724. . . .;
therefore compound interest = \$3683.662
simple interest = 3333.25
Ans. \$350.412

(13)

$100, at compound interest, will amount in 2 years to $114.49;
therefore $114.49 : $100 :: $100 : sum required;
therefore sum required $= \$\frac{100 \times 100}{114.49} = \$87.34\ldots$

(14)

$100, at compound interest, will amount in 2 years to $116.64;
therefore $110\frac{1}{4}$: $100 :: $264 : sum required;
therefore sum required $= \$\frac{100 \times 264}{116.64} = 226.33\ldots$

(15)

£
256
$4\frac{1}{2}$

1024
128

11·52
20

10·40*s.*
12

4·80*d.*

£ *s.* *d.*
279 11 2·016=3d principal
$4\frac{1}{2}$

1118 4 8·064
139 15 7·008

12·58 0 3·072
20

11·60*s.*
12

7·23072*d.*

£ *s.* *d.*
11 10 4·8
3

£34 11 2·4 simple interest.

£ *s.* *d.*
267 10 4·8=2d principal
$4\frac{1}{2}$

1070 1 7·2
133 15 2·4

12·03 16 9·6
20

0·76*s.*
12

9·216*d.*

£ *s.* *d.*
∴ 36 2 9·24672 compound interest
34 11 2·4 simple interest

£1 11 6·84672

and 12 | 6·84672

2,0 | 11·57056

Ans. £1 578

DISCOUNT.

Ex. LIV. (p. 202.)

(1)

\$107 : \$321 :: \$100 : present worth;

therefore present worth $= \$\frac{321 \times 100}{107} = \$300.$

(2)

\$106 : \$251.56 :: \$100 : present worth;

therefore present worth $= \$\frac{251.56 \times 56}{106} = \$237.32....$

(3)

\$104 : \$683.28 :: \$100 : present worth;

therefore present worth $= \$\frac{683.28 \times 100}{104} = \$657.$

(4)

\$103.50 : 944.92 :: \$100 : present worth;

therefore present worth $= \$\frac{944.50 \times 100}{103.50} = \$912.965....$

(5)

\$103 : \$463.50 :: \$100 : present worth;

therefore present worth $= \$\frac{463.50 \times 100}{103} = \$450.$

(6)

£103$\frac{12}{24}$: £390 :: £100 : present worth;

therefore present worth $= £\frac{390 \times 100 \times 24}{2491} = £375\ 15s.\ 0\frac{1}{2}d.$

(7)

\$104.50 : \$856.96 :: \$100 : present worth;

therefore present worth $= \$\frac{856.96 \times 100}{104.5} = \$824.$

(8)

\$101 : \$1252.40 :: \$100 : present worth;

therefore present worth $= \$\frac{1252.4 \times 100}{101} = \$1240.$

(9)

\$101.75 : 1250 :: \$100 : present worth;

therefore present worth $= \$\frac{1250 \times 100}{101.75} = \$1228.50.$

(10)

£105½ : £2110 :: £100 : present worth;

therefore present worth $= £\frac{2110 \times 100 \times 2}{211} = £2000.$

(11)

£105 : £275⅓ :: £100 : present worth;

therefore present worth $= £\frac{826 \times 100}{105 \times 3} = £262\ 4s.\ 5\frac{1}{7}d.\ \frac{1}{7}q.$

(12)

£120 : £918 :: £100 : present worth;

therefore present worth $= £\frac{918 \times 100}{120} = £765.$

(13)

$108⅓ : $500 :: $100 : present worth;

therefore present worth $= \$\frac{500 \times 100 \times 96}{16379} = \$462.47\ldots.$

(14)

£112 9*s.* 8·736*d.* : £2197 :: £100 : present worth;

therefore present worth $= £\frac{527280 \times 100}{26996 \cdot 736}$

$= £\frac{527280 \times 100 \times 1000}{26999736} = £\frac{15625}{8} = £1953\ 2s.\ 6d.$

(15)

$102 : $64 :: $2 : discount;

therefore discount $= \$\frac{64 \times 2}{102} = \$1.25\frac{25}{51}.$

(16)

$106 : $1380 :: $6 : discount;

therefore discount $= \$\frac{1380 \times 6}{106} = \$78.11\frac{17}{53}.$

(17)

$102½ : $107½ :: $2½ : discount;

therefore discount $= \$\frac{429 \times 5 \times 2}{205 \times 4 \times 2} = \$2.61\frac{24}{41}.$

(18)

$102 : $125.46 :: $2 : discount;

therefore discount $= \$\frac{125.46 \times 2}{102} = \$2.46.$

(19)

$\$102\frac{1}{2} : \$487 :: \$2\frac{1}{2} :$ discount;

therefore discount $= \$\frac{487 \times 35}{1235} = \$13.80\frac{40}{247}$.

(20)

$\$102.50 : \$340 :: \$2.50 :$ discount;

therefore discount $= \$\frac{340 \times 2.5}{102.5} = \$8.29\frac{11}{41}$.

(21)

$£104 : £3640 :: £4 :$ discount;

therefore discount $= £\frac{3640 \times 4}{104} = £140$.

(22)

$£106\frac{2}{3} : £813\frac{8}{20} :: £6\frac{1}{3} :$ discount;

therefore discount $= £\frac{16269 \times 19 \times 3}{20 \times 3 \times 319} = £\frac{969}{20} = £48\ 9s.$

(23)

$\$111\frac{1}{3} : \$250\frac{3}{4} :: \$11\frac{1}{3} :$ discount;

therefore discount $= \$\frac{1003 \times 34}{4 \times 334} = \$25.52\frac{91}{167}$.

(24)

$\$102 : \$102 :: \$2 :$ discount;

therefore discount $= \$\frac{102 \times 2}{102} = \$2$.

(25)

$£100 : £649 :: £1\frac{763}{1460} :$ interest on £649;

therefore interest $= £\frac{649 \times 2223}{100 \times 1460} = £9\ 17s.\ 7\frac{1106}{1825}d.$

Again, $£101\frac{763}{1460} : £649 :: £1\frac{763}{1460} :$ discount;

therefore discount $= £\frac{649 \times 2223 \times 1460}{1460 \times 148223} = £9\ 14s.\ 8\frac{5552}{148223}d.$

therefore banker's gain $= 2s.\ 11d.$, nearly.

(26)

$\$100\frac{392}{365} : \$100 :: \frac{392}{365} :$ discount;

therefore discount $= \$\frac{39200}{36892} = \$1.06\frac{368}{923}$.

(27)

\$100 : \$545 :: \$14 : interest;

therefore interest $= \$\frac{545 \times 14}{100} = \$76.30.$

Again, \$114 : \$621.30 :: \$14 : discount;

therefore discount $= \$\frac{621.3 \times 14}{114} = \$76.30.$

(28)

$\frac{1}{5}$ of the sum is the price of one volume at the end of a year, and $\frac{1}{6}$ of the sum is the present price;

therefore $\frac{1}{5} - \frac{1}{6} = \frac{1}{30}$ of given sum is the allowance made per volume;

therefore allowance on 5 volumes $= \frac{5}{30} = \frac{1}{6}$ of the sum;

therefore 1 : 100 :: $\frac{1}{6}$: rate of discount;

therefore rate of discount $= \frac{100}{6} = 16\frac{2}{3}$ per cent.

(29)

£105 : £100 :: £$2\frac{9}{20}$: cash price;

therefore cash price $= £\frac{100 \times 49}{105 \times 20} = £\frac{7}{3} = £2\ 6s.\ 8d.$

STOCKS.

Ex. LV. (p. 207.)

(8)

\$$90\frac{1}{2}$: \$2353 :: \$100 : stock required;

therefore stock required $= \$\frac{2353 \times 100 \times 2}{181} = \$2600.$

(9)

£106 : £3277 :: £100 : stock required;

therefore stock required $= £\frac{3277 \times 100}{106} = £3091\ 10s.\ 2\frac{1}{3}d.$

(14)

£109 : \$1000 :: £$97\frac{1}{4}$: value required;

therefore value required $= £\frac{1000 \times 389}{100 \times 4} = \$972\ 10s.$

(15)

£100 : £$2153\frac{1}{2}$ :: £188 : value required;

therefore value required $= £\frac{4307 \times 188}{2 \times 100} = £4048\ 11s.\ 7\frac{1}{5}d.$

(22)

£94¼ : £3500 :: £3 : income required;

therefore income $= £\frac{3500 \times 3 \times 4}{377} = £111\ 8s.\ 1\frac{15}{377}d.$

(26)

£3 : £87 :: £74⅝ : sum required;

therefore sum required $= £\frac{87 \times 597}{3 \times 8} = £2164\ 2s.\ 6d.$

(27)

£4 : £37½ :: £93⅜ : sum required;

therefore sum required $= £\frac{75 \times 747}{4 \times 2 \times 8} = £875\ 7s.\ 9\frac{3}{4}d.$

(30)

$96⅝ : $100 :: $8 : interest required;

therefore interest $= \$\frac{100 \times 8 \times 8}{773} = \$8.27\frac{29}{773}.$

(31)

$103 : $100 :: $7 : interest required;

therefore interest $= \$\frac{100 \times 7}{103} = \$6.79\frac{63}{103}.$

(32)

$105 : $7927½ :: $7.88 : net income;

therefore net income $= \$\frac{7927{\cdot}5 \times 7{\cdot}88}{105} = \$594.94.$

(33)

$90 : $100 :: $7 : rate per cent.; therefore rate per cent. $= \$7.77\frac{7}{9}$;

$80 : $100 :: $7 : rate per cent.; therefore rate per cent. $= \$8.75$;

therefore advantage $= \$8.75 - \$7.77\frac{7}{9} = .97\frac{2}{9}$.

(34)

$8 : $7 :: $100 : price of stock;

therefore price of stock $= \$\frac{100 \times 7}{8} = \$87\frac{1}{2}.$

$87½ : $1200 :: $100 : quantity of stock;

therefore quantity of stock $= \$\frac{1200 \times 100 \times 2}{175} = \$1371\frac{3}{7}.$

(35)

$163 : $157 :: $5500 : amount required;

therefore amount $= \$\frac{157 \times 5500}{163} = \$5297.54\frac{98}{163}.$

(36)

\$100 : \$4000 :: \$8 : whole gain;

therefore whole gain $= \$\frac{4000 \times 8}{100} = \$320.$

(37)

\$163 : \$9000 :: \$6 : loss required;

therefore loss $= \$\frac{9000 \times 6}{163} = \$331.28\frac{136}{163}.$

(38)

£3 : £$3\frac{1}{2}$ :: £$89\frac{1}{2}$: price required;

therefore price $= £\frac{7 \times 170}{3 \times 2 \times 2} =$ £104 8*s.* 4*d.*

(39)

\$92 : \$400 :: \$$3\frac{1}{2}$: half-yearly income;

therefore income $= \$\frac{400 \times 7}{2 \times 92} = \$15.21\frac{17}{23}.$

(40)

\$100 : \$5000 :: \$6 : 1st income; therefore 1st income = \$300;

\$100 : \$5000 :: \$160 : value of stock;

therefore value of stock $= \$\frac{5000 \times 160}{100} = \$8000,$

and \$107 : \$8000 :: \$4 : income;

therefore 2d income $= \$\frac{8000 \times 4}{107} = \$299\frac{7}{107};$

therefore difference in his income $= \$300 - \$299\frac{7}{107} = \$\frac{100}{107}.$

(41)

\$100 : \$5000 :: \$4 : income from \$5000 stock;

therefore 1st income $= \$\frac{5000 \times 4}{100} = \$200.$

\$106 : \$5000 :: \$3 : income from investment;

therefore 2d income $= \$\frac{5000 \times 3}{106} = \$141.50\frac{50}{53}.$

(42)

\$100 : \$7000 :: \$4 : income; therefore income = \$280;

\$100 : \$7000 :: \$105 : value of stock; therefore value = \$7350.

(43)

£$98\frac{1}{4}$: £$98\frac{3}{8}$ :: £3000 : quantity of $3\frac{1}{2}$ per cent. stock;

therefore quantity of stock $= £\frac{715 \times 3000 \times 4}{393 \times 8} = £2729\frac{1}{11};$

(Continued on next page.)

(43 continued.)

£100 : £2729$\frac{1}{131}$ :: $3\frac{1}{2}$: income from $3\frac{1}{2}$ per cents.;

therefore 2d income $= £\frac{357500 \times 7}{131 \times 2 \times 100} = £95\ 10s.\ 3\frac{87}{131}d.$

and 1st income $= £\frac{3000 \times 3}{100} = £90\ 0\ 0$

therefore alteration in his income $= £\ 5\ 10\ 3\frac{87}{131}$

(44)

In the C. B. of C. stock at 101, \$1 gives \$$\frac{4}{101}$ interest,

In the Q. B. stock at 106, \$1 gives \$$\frac{3\frac{1}{2}}{106}$, or \$$\frac{7}{212}$;

and since $\frac{4}{101}$ is greater than $\frac{7}{212}$, the former is the better investment.

(45)

(6 × 2) cts. = 12 cts. = income tax on \$100 stock;

therefore net income on \$100 stock = \$6.00 − .12 = \$5.88;

therefore \$5.88 : \$600 :: \$104 : sum required;

therefore sum required $= \$\frac{600 \times 104}{5.88} = \$10612.24\frac{4}{49}$.

(46)

£83 : £1037$\frac{1}{2}$ :: £100 : quantity of 3 per cent. stock;

therefore quantity of 3 per cent. stock $= £\frac{2075 \times 100}{83 \times 2} = £1250$;

£96 : £84 :: £1250 : quantity of 4 per cent. stock;

therefore quantity of 4 per cent. stock $= £\frac{1250 \times 84}{96} = £1093\frac{3}{4}$;

therefore £100 : £1250 :: £3 : 1st income, or 1st income = £37 10*s.*,

£100 : £1093$\frac{3}{4}$ :: £4 : 2d income, or 2d income = £43 15*s.*;

therefore difference of income = £43 15*s.* − £37 10*s.* = £6 5*s.*

(47)

£103$\frac{3}{8}$: £100 :: £1654 : present worth;

therefore present worth $= £\frac{100 \times 1654 \times 8}{827} = £1600$;

therefore £96 : £1600 :: £100 : quantity of stock required;

therefore quantity of stock $= £\frac{1600 \times 100}{96} = £1666\ 13s.\ 4d.$

(48)

In 13 years the dividend on £100 stock, at 3 per cent., was £(3 × 13) = £39;

∴ £39 : £3081 :: £100 : amount of stock; ∴ stock = £7900,

and £100 : £7900 :: £79⅞ : value of stock; ∴ value = £6310 2*s.* 6*d.*

(49)

£79⅝ : £1911 :: 100 : stock bought;

therefore stock bought = £2400, and stock must be sold for £1911 + £150 = £2061;

therefore £2400 : £100 :: £2061 : price of stock;

therefore price = £85⅞;

therefore to pay the brokerage the price must be £(85⅞ + ⅛), or £86.

(50)

Income from South-Sea annuities = £300,

£100 : £110 :: £10000 : amount of 2½ stock;

therefore amount of 2½ stock = £11000;

therefore income from 2½ stock = £(110 × 2½) = £275;

therefore loss of income from accepting this stock = £25.

Again, £93 : £10000 :: £3 : income from investment in consols;

therefore income from consols = £322 11*s.* 7⅓*d.*;

therefore gain by investing in consols = £22 11*s.* 7⅓*d.*

(51)

£100 : £4000000 :: £½ : saving; therefore saving = £20000,

£100 : £4000000 :: £5⅝ : loss of fundholders;

therefore loss = $£\frac{4000000 \times 45}{100 \times 8} = £225000.$

APPLICATIONS OF THE TERM PER CENT.

Ex. LVI. (p. 216.)

(1)

100 : ⅛ :: 56394 : percentage required;

$\therefore$ percentage required $= \frac{56394 \times \frac{1}{8}}{100} = \frac{18798}{100} = 187{\cdot}98.$

100 : ⅝ :: 56394 : percentage required;

$\therefore$ percentage required $= \frac{56394 \times \frac{5}{8}}{100} = \frac{28197}{80} = 352{\cdot}4625.$

(2)

96 : 100 :: 15 : number required;

$\therefore$ number required $= \frac{100 \times 15}{96} = \frac{125}{8} = 15{\cdot}625.$

81 : 100 :: 19 : number required;

$\therefore$ number required $= \frac{100 \times 19}{81} = \frac{1900}{81} = 23\frac{37}{81} = 23{\cdot}456\ldots.$

(7)

If 27 per cent. leaked away, 73 per cent. remained in the cask;

$\therefore$ 100 : 2005 :: 73 : number of gallons remaining;

$\therefore$ gallons remaining $= \frac{2005 \times 73}{100} = \frac{146365}{100} = 1463{\cdot}65.$

(8)

100 : 7500 :: $112\frac{1}{2}$: bushels required;

$\therefore$ bushels required $= \frac{7500 \times 225}{100 \times 2} = \frac{16875}{2} = 8437{\cdot}5.$

(9)

By selling 15·75 oz. he gains ·25 oz.;

$\therefore$ 15·75 : ·25 :: 100 : gain per cent.;

$\therefore$ gain per cent. $= \frac{100 \times {\cdot}25}{15{\cdot}75} = \frac{2500}{1575} = \frac{100}{63} = 1\frac{37}{63}.$

(14)

14804 : 100 :: 1588 : rate per cent. of mortality in Small-pox;

$\therefore$ rate required $= \frac{100 \times 1588}{14804} = \frac{39700}{3701} = 10{\cdot}72\ldots.$

2422 : 100 :: 211 : rate per cent. of mortality in Scarlet Fever;

$\therefore$ rate required $= \frac{100 \times 211}{2422} = \frac{10550}{1211} = 8{\cdot}71\ldots.$

17226 : 100 :: 1799 : rate per cent. of mortality in both sicknesses;

$\therefore$ rate required $= \frac{100 \times 1799}{17226} = \frac{89950}{8613} = 10{\cdot}44\ldots.$

(15)

Since 8175124 − 7767401 = 407723,

and 8175124 − 6515794 = 1659330,

and 7767401 − 6515794 = 1251607,

7767401 : 407723 :: 100 : increase per cent. in the 1st ten years;

$\therefore$ increase per cent. $= \frac{407723 \times 100}{7767401} = 5{\cdot}24\ldots.$

(Continued on next page.)

(15 continued.)

8175124 : 1659330 :: 100 : decrease per cent. in the last ten years;

$$\therefore \text{decrease per cent.} = \frac{1659330 \times 100}{8175124} = 20{\cdot}29\ldots.$$

7767401 : 1251607 :: 100 : decrease per cent. in the twenty years;

$$\therefore \text{decrease per cent.} = \frac{1251607 \times 100}{7767401} = 16{\cdot}11\ldots.$$

(16)

$$\text{Population at end of first year} = \frac{1000000 \times 101\frac{1}{2}}{100} = 1015000,$$

$$\text{Population at end of second year} = \frac{1015000 \times 101\frac{1}{2}}{100} = 1030225,$$

$$\text{Population at end of third year} = \frac{1030225 \times 101\frac{1}{2}}{100} = 1045678{\cdot}375.$$

(17)

Of the age of 18 there are 3 scholars.

Between 15 and 18 there are $\frac{5 \times 380}{100} = 19$,

" 12 " 15 " $\frac{10 \times 380}{100} = 38$,

" 10 " 12 " $\frac{35 \times 380}{100} = 133$,

and under 10 there will be $383 - (3 + 19 + 38 + 133)$
$= 383 - 193 = 190.$

(21)

Since 1 ton $= (20 \times 100)$ lbs. $= 2000$ lbs.

100 : 49·856 :: 2240 : number of lbs. of oxygen;

$$\therefore \text{number of lbs. oxygen} = \frac{49{\cdot}856 \times 2000}{100} = 997{\cdot}12.$$

100 : 43·265 :: 2240 : number of pounds of carbon;

$$\therefore \text{number lbs. carbon} = \frac{43{\cdot}265 \times 2000}{100} = 865{\cdot}3,$$

and number of lbs. hydrogen
$= 2000 - (997{\cdot}12 + 865{\cdot}3) = 137{\cdot}58.$

(23)

Cost of wheat $= \$(13600 \times 1.05) = \$14280.$

number of bushels wasted $= \frac{13600 \times 2\frac{1}{2}}{100} = 340;$

(Continued on next page.)

(23 continued.)

number of bushels left to sell $=13600-340=13260$;

of which he sells part for $\$\frac{56\times 13260}{100}=\$7425.60.$

of which he sells part for $\$\frac{20\times 13260\times 1.05}{100}=\$2784.60.$

of which he sells the rest for $\$\frac{24\times 13260\times 1.25}{100}=\$3978.$

$\therefore$ he sells his wheat for $\$(7425.60+2784.60+3978)$
$=\$14188.20$;

$\therefore$ he loses $\$(14280-14188.20)=\$91.80.$

(24)

If M and F represent the number of males and females respectively,

$\frac{101{\cdot}8\times(M+F)}{100}$ = increased number of males and females,

$\frac{95{\cdot}4\times M}{100}$ = decreased number of males,

$\frac{109{\cdot}8\times F}{100}$ = increased number of females,

Then $\frac{95{\cdot}4\times M}{100}+\frac{109{\cdot}8\times F}{100}=\frac{101{\cdot}8\times(M+F)}{100}$;

$\therefore 95{\cdot}4\times M+109{\cdot}8\times F=101{\cdot}8\times M+101{\cdot}8\times F$;

$\therefore (109{\cdot}8-101{\cdot}8)\times F=(101{\cdot}8-95{\cdot}4)\times M$;

$\therefore 8\ F=6{\cdot}4\times M$, or $80\ F=64\ M$, or $5\ F=4\ M$,

and $\therefore M : F :: 5 : 4.$

(25)

£95 : £100 :: 5*s.* : cost price;

$\therefore$ cost price $=\frac{100\times 5}{95}s.=5s.\ 3\frac{3}{19}d.$

Again, $100 : 104\frac{1}{2} :: 5s.\ 3\frac{3}{19}d.$: required price;

$\therefore$ price required $=\frac{209\times 1200}{100\times 2\times 19}d.=66d.=5s.\ 6d.$

(26)

Expense of sale $=\frac{1}{20}$ of $\$1.60=.08$;

$\therefore$ whole outlay $=\$1.60+.08=\$1.68$,

and $\$100 : \$125 :: \$1.68$: selling price;

$\therefore$ selling price $=\$\frac{125\times 1.68}{100}=\$2.10.$

(27)

£92 : £100 :: £25½ : cost price;

$\therefore$ cost price $= £\frac{100 \times 51}{92 \times 2} = £27\frac{33}{46}$.

Hence gain if sold for £38 $= £10\frac{13}{46}$;

$\therefore$ $£27\frac{33}{46} : £10\frac{13}{46} :: £100$: gain per cent.,

or gain per cent. $= £\frac{473 \times 100 \times 46}{46 \times 1275} = £\frac{1892}{51} = £37\ 1s.\ 11\frac{1}{2}d.\ \frac{2}{17}q.$

(30)

The wine costs $\$(36 \times 2.40) = \$86.40$;

$\therefore$ \$100 : \$120 :: \$86.40 : selling price;

$\therefore$ selling price $= \$\frac{120 \times 86.40}{100} = \$103.68.$

Hence price per gallon $= \$\frac{103.68}{30} = \$3.456.$

(33)

Profit on 1000 quills $= \frac{3}{8}$ of $11s. + 2s.\ 6d. = 4s.\ 1\frac{1}{2}d. + 2s.\ 6d. = 6s.\ 7\frac{1}{2}d.$;

$\therefore$ cost of 1000 quills $= 13s.\ 6d. - 6s.\ 7\frac{1}{2}d. = 6s.\ 10\frac{1}{2}d.$

Hence $6s.\ 10\frac{1}{2}d. : 6s.\ 7\frac{1}{2}d. :: £100$: gain per cent.

$\therefore$ gain per cent. $= £\frac{318 \times 100}{330} = £96\ 7s.\ 3\frac{3}{11}d.$

(34)

Cost of tobacco $= (15 \times 6 \times 100)d. = £37\ 10s.$

Hence, (1) 4 cwt. : 1 lb. :: £37 10*s.* : price in first case;

$\therefore$ price for neither gain or loss $= £\frac{75}{800} = 1s.\ 10\frac{1}{2}d.$

(2) 4 cwt. : 1 lb. :: $£42\frac{3}{4}$: price in second case;

$\therefore$ price to gain 5 guineas $= £\frac{171}{1600} = 2s.\ 1\frac{1}{4}d.\ \frac{1}{4}q.$

(3) 4 cwt. : 1 lb. :: £75 : price in third case;

$\therefore$ price to gain cent. per cent. $= £\frac{75}{400} = 3s.\ 9d.$

(35)

Rent on 1st supposition $= £96 + (\text{no. of qrs.} \times 56)s.$,

Rent on 2d supposition $= £96 + (\text{no. of qrs.} \times 38)s.$,

Hence £100 : £85 :: $£96 + (\text{no. of qrs.} \times 56)s.$

: $£96 + (\text{no. of qrs.} \times 38)s.$;

(Continued on next page.)

(35 continued.)

$$\therefore £96+(\text{no. of qrs.}\times 38)s.=\frac{[£96+(\text{no. of qrs.}\times 56)]s\times 85}{100};$$

$$\therefore £96+(\text{no. of qrs.}\times 38)s.$$
$$=\frac{17}{20}\text{ of }£96+\frac{17}{20}\text{ of (no. of qrs.}\times 56)s.;$$

$$\therefore \frac{3}{20}\text{ of }£96=\left(\frac{17}{20}\times 56-38\right)s.\times\text{no. of qrs.};$$

$$\therefore £288=(952-760)s.\times\text{no. of qrs.},$$
or $(288\times 20)s.=192s.\times$ no. of qrs.;

$$\therefore \text{no. of qrs.}=\frac{288\times 20}{192}=30.$$

(36)

By the sale the person receives $\frac{95}{100}$ of cost of watch.

If he had received \$3 more he would had $\frac{101}{100}$ of cost of watch;

$$\therefore \frac{101}{100}\text{ cost of watch}=\frac{95}{100}\text{ cost of watch}+\$3,$$
$$\text{or }\frac{6}{100}\text{ cost of watch}=\$3;\ \therefore\text{ watch costs }\$50.$$

Again, since the duty was 25 per cent.,

125 : 100 :: \$50 : price received by French maker;

$$\therefore \text{maker receives }\$\frac{100\times 50}{125}\text{ or }\$40.$$

EQUATIONS OF PAYMENTS.

Ex. LVII. (p. 220.)

(7)

$\$\frac{1812}{3}=\$604$, the amount to be paid in money,

$\$\frac{1812}{4}=\$453$, the amount to be paid in wheat,

\$1812−\$1057=\$755 to be paid in barley.

Now \$1.51 : \$1.75 :: \$604 : amount to be paid in wheat;

$$\therefore \text{value of wheat}=\$\frac{453\times 175}{151}=\$525.$$

Also, 75½ cts. : 85 cts. :: \$453 : amount to be paid in barley;

$$\therefore \text{value of barley}=\$\frac{755\times 85}{755}=\$850.$$

$$\therefore \text{whole rent}=\$604+\$525+\$850=\$1979.$$

(8)

Since $\frac{310 \cdot 20}{3}s.$ is paid in each kind of corn,

$\frac{310 \times 20}{3 \times 56}$ = number of quarters of wheat,

$\frac{310 \times 20}{3 \times 32}$ = number of quarters of barley,

$\frac{310 \times 20}{3 \times 22}$ = number of quarters of oats,

$\therefore$ rent in second case =

$$= \left(\frac{310 \times 20 \times 64}{3 \times 56} + \frac{310 \times 20 \times 44}{3 \times 32} + \frac{310 \times 20 \times 24}{3 \times 22}\right)s.$$

$$= \frac{310 \times 20}{3}\left(\frac{64}{56} + \frac{44}{32} + \frac{24}{22}\right)s.$$

$$= \frac{310 \times 20}{3}\left(\frac{8}{7} + \frac{11}{8} + \frac{12}{11}\right)s.$$

$$= \frac{6200}{3} \times \frac{2223}{7 \times 8 \times 11}s.$$

$$= 7458\tfrac{6}{77}s.$$

$$= £372\ 18s.\ 1\tfrac{1}{4}d.\ \tfrac{47}{77}q.$$

Ex. LVIII. (p. 266.)

(5)

Sum of parts = 3 + 4 + 15 = 22;

therefore

22 : 15 :: 18 cwt. : weight of gold;	$\therefore$ weight of gold =	12 cwt. 30$\frac{6}{11}$ lbs.,
22 : 4 :: 18 : weight of silver;	$\therefore$ weight of silver =	3 30$\frac{6}{11}$,
22 : 3 :: 18 : weight of copper;	$\therefore$ weight of copper =	2 50$\frac{10}{11}$,

(8)

Number of shares = 3 + 6 + 3 = 12;

$\therefore$ 12 : 3 :: £13000 : eldest son's share;

$\therefore$ eldest son's share = £3250 0*s.* 0*d.*

12 : 2 :: £13000 : a younger son's share;

$\therefore$ a younger son's share = £2166 13*s.* 4*d.*

12 : 1 :: £13000 : a daughter's share;

$\therefore$ a daughter's share = £1083 6*s.* 8*d.*

(15)

Remainder of debt $=\frac{13}{60}$;

therefore

$\frac{13}{60} \times$ no. of months required $= 7\frac{1}{30} - \frac{1}{3} \times 4 - \frac{1}{4} \times 6 - \frac{1}{5} \times 8 = \frac{13}{5}$;

$\therefore$ no. of months required $= \frac{13}{5} \times \frac{60}{13} = 12$.

(17)

Profits to be shared by B and $C = \frac{3}{4}$ of \$4500 = \$3375;

$\therefore$ \$5000 + \$3000 : \$3000 :: \$3375 : C's share;

$\therefore$ C's share $= \$\frac{300 \times 3375}{8000} = \$1265.62\frac{1}{2}$.

(18)

$(25 \times 4 + 25 \times 12) = (15 \times 6 + 30 \times 12) + (70 \times 6) = 1270$;

£ £

$\therefore$ 1270 : 400 :: 254 : A's share; $\therefore$ A's share = 80,

1270 : 450 :: 254 : B's share; $\therefore$ B's share = 90,

1270 : 420 :: 254 : C's share; $\therefore$ C's share = 84.

EXCHANGE.

Ex. LIX. (p. 235.)

(1)

Value of thaler = \$·727;

$\therefore$ sum required $= \$\frac{612}{1} \times \frac{727}{1000} \times \frac{201}{200} =$ \$447·14862.

(2)

1 mil. : 4750·280 mil. :: $64\frac{1}{4}d.$: sum required;

$\therefore$ sum required $= \frac{4750{\cdot}280 \times 257}{4} d. =$ £1271 13s. $9\frac{42}{100}d.$

by enactment £9 st. = \$40: £1271 13s. $9\frac{42}{100}d. = \frac{3052054{\cdot}2}{100}d.$;

$\therefore$ sum $= \frac{30520549}{100} \times \frac{40}{9} \times \frac{108}{100} \times \frac{1}{240} =$ \$6104.11.

(3)

$47\frac{1}{2}d.$: £246 15s. 6d. :: 1 pias. : number of piastres required;

$\therefore$ number of pias. $= \frac{1181532 \times 2}{95} =$ 1246 pias., $6\frac{6}{95}$ rials.

(4)

$\frac{899{\cdot}2 \times 258}{1000} = 231{\cdot}9936$ = no. grs. pure gold in \$10 (eagle.)

$\frac{1}{10} \times 231{\cdot}9936 = 23{\cdot}19936$ = grs. pure gold in \$1.

1869 sovs. are coined from 40 lbs. Troy, standard gold which is $\frac{11}{12}$ fine;

$\therefore$ weight of sov. = 123·27447, and weight of pure gold in sov. = 113·00159;

$\therefore$ 23·19936 : 113·00159 :: \$1 : par of exchange;

par of exchange = \$4.87.

(5)

$412{\cdot}5 \times \frac{9}{10} = 371{\cdot}25$ = number grs. pure silver in \$1.

480 = number grs. in 1 oz. Troy.

$\frac{37 \times 480}{40} = 444$ = no. grs. pure silver in 1 oz. Troy of standard.

371·25 : 444 :: \$1 : $\$1.19\frac{4}{9}$ = value of 5*s.* $1\frac{3}{8}d.$;

$\therefore$ 5*s.* $1\frac{3}{8}d.$: 20*s.* :: $\$1{\cdot}19\frac{4}{9}$: par of exchange;

$\therefore$ par of exchange = $\$4{\cdot}67\frac{12}{16}\frac{4}{20}\frac{3}{3}$.

(6)

$192 \times \frac{9}{10} = 172{\cdot}8$ = number grs. pure silver in $\$\frac{1}{2}$, and (as above) 444 grs. are worth pure silver in 5*s.* $1\frac{3}{8}d.$

172·8 : 444 :: $\$\frac{1}{2}$: \$1.28 = value of 5*s.* $1\frac{3}{8}d.$

5*s.* $1\frac{3}{8}d.$: 20*s.* :: \$1.28 : par of exchange;

$\therefore$ par of exchange = \$5.02. *Ans.*

(7)

36*s.* 3*d.* : 91*d.* :: £1 : value of ruble via Amsterdam;

$\therefore$ value of ruble = $\frac{91 \times 240}{435}d. = 50\frac{6}{29}d.$

And in the direct way the ruble costs 50*d.*;

$\therefore$ the direct way is the cheaper.

(8)

25·6 fr. : 500 fr. :: £1 : value required;

$\therefore$ value required = $£\frac{500}{22{\cdot}6}$ = £19 10*s.* $7\frac{1}{2}d.$

Again, 1 ree = $\frac{1}{160}$ francs; $\therefore$ 400 rees = $\frac{5}{2}$ francs;

$\therefore$ $3\frac{1}{2}$*s.* Flemish = $\frac{5}{2}$ francs; $\therefore$ 1*s.* Flemish = $\frac{5}{7}$ francs;

$\therefore$ £1 = 35*s.* Flemish = $\frac{35 \times 5}{7}$ francs = 25 francs.

(9)

On 1st supposition 1 franc=£$\frac{1}{23}$; ∴ 1 ruble=£$\frac{2}{23}$.

On 2d supposition 1 franc=£$\frac{1}{24}$; ∴ 1 ruble=£$\frac{1}{16}$;

∴ broker gains £$\left(\frac{2}{23}-\frac{1}{16}\right)$ on each ruble.

∴ he gains £11 5*s*.

(10)

Income in England £90=$438 at par.

£3000 stock @ 97=£2910 sterling.

£2910=$\$\frac{4\,0}{9}\times\frac{1\,0\,8}{1\,0\,0}\times 2910=\$13968$.

Income in Canada=$\$\frac{2\,0\,0}{2\,1\,3}\times 13968\times\frac{7}{1\,0\,0}=\$918.08\frac{3\,2}{7\,1}$.

∴ difference=$\$918.08\frac{3\,2}{7\,1}-\$438=\$480.08\frac{3\,2}{7\,1}$.

SQUARE ROOT.

Ex. LX. (p. 241.)

(5)

	29506624	(5432
	25	
104	450	
	416	
1083	3466	
	3249	
10862	21724	
	21724	

	5345344	(2312
	4	
43	134	
	129	
461	553	
	461	
4622	9244	
	9244	

	14356521	(3789
	9	
67	535	
	469	
748	6665	
	5984	
7569	68121	
	68121	

(6)

	236144689	(15367
	1	
25	136	
	125	
303	1114	
	909	
3066	20546	
	18396	
30727	215089	
	215089	

$\dot{2}8\dot{2}42\dot{9}53\dot{6}48\dot{1}$ (531441

	25	
103	324	
	309	
1061	1529	
	1061	
10624	46853	
	42496	
106284	435764	
	425136	
1062881	1062881	
	1062881	

$\dot{4}1\dot{6}0\dot{5}8\dot{0}0\dot{6}2\dot{5}0\dot{0}$ (2039750

	4	
403	1605	
	1209	
4069	39680	
	36621	
40787	305906	
	285509	
407945	2039725	
	2039725	
	00	

$\dot{2}8\dot{2}475\dot{2}4\dot{9}$ (16807

	1	
26	182	
	156	
328	2647	
	2624	
33607	235249	
	235249	

(8) $\dot{1}6\dot{7}\cdot9\dot{6}1\dot{6}$ (12·96

	1	
22	67	
	44	
249	2396	
	2241	
2586	15516	
	15516	

(7) $29\dot{5}0\dot{6}6\dot{2}40\dot{0}0\dot{0}$ (543200

	25	
104	450	
	416	
1083	3466	
	3249	
10862	21724	
	21724	
	0000	

$2\dot{8}\cdot8\dot{3}6\dot{9}$ (5·37

	25	
103	383	
	309	
1067	7469	
	7469	

$\dot{5}7\dot{6}4\dot{8}\cdot0\dot{1}$ (240·1

	4	
44	176	
	176	
4801	4801	
	4801	

(9) ·34̇86̇78̇44̇01̇ (·59049
25

109	986
	981
11804	57844
	47216
118089	1062801
	1062801

39̇·15̇38̇03̇29̇ (6·2573
36

122	315
	244
1245	7138
	6225
12507	91303
	87549
125143	375429
	375429

(10) ·04̇28̇49̇ (·207
4

407	2849
	2849

·06̇13̇98̇76̇ (·0374
9

67	498
	469
744	2976
	2976

·00̇20̇34̇01̇ (·0451
16

85	434
	425
901	901
	901

(11) 57̇74̇40̇9 (2403
4

44	177
	176
4803	14409
	14409

5̇·77̇44̇09 (2·403
4

44	177
	176
4803	14409
	14409

(12) 12̇08̇88̇·68̇37̇90̇25̇ (347·6905
9

64	308
	256
687	5288
	4809
6946	47968
	41676
69529	629237
	625761
6953805	34769025
	34769025

240398·012416 (490·304
16
—
89 | 803
801
—
9803 | 29801
29409
—
98064 | 3922416
3922416
—

(13) 16 (4
16
—

1·60000000 (1·2649..
1
—
22 | 60
44
—
246 | 1600
1476
—
2524 | 12400
10096
—
25289 | 230400
227601
—
2799

·16 (·4
16
—

·01600000 (·1264...
1
—
22 | 60
44
—
246 | 1600
1476
—
2524 | 12400
10096
—
2344

(14) 235·60000000 (15·3492...
1
—
25 | 135
125
—
303 | 1060
909
—
3064 | 15100
12256
—
30689 | 284400
276001
—
306982 | 839900
613964
—
225936

·10000000 (·3162...
9
—
61 | 100
61
—
626 | 3900
3756
—
6322 | 14400
12644
—
1756

·01 (.1
1
—

·50000000 (·7071...
49
—
1407 | 10000
9849
—
14141 | 15100
14141
—
959

$\dot{5}\cdot\dot{0}0\dot{0}0\dot{0}0\dot{0}0\dot{0}$ (2·2360...

	4
42	100
	84
443	1600
	1329
4466	27100
	26796
4472	31400

$\dot{3}\dot{7}\dot{9}\cdot\dot{8}\dot{6}\dot{4}\dot{0}\dot{0}\dot{0}\dot{0}\dot{0}$ (19·4901...

	1
29	279
	261
384	1886
	1536
3889	35040
	55001
389801	390000
	389801
	199

(15) $\cdot\dot{0}0\dot{0}\dot{4}$ (·02

	4

$\cdot\dot{0}0\dot{0}\dot{8}1\dot{0}0\dot{0}$ (·0284...

	4
48	410
	384
564	2600
	2256
	344

(16) $\sqrt{20\frac{1}{4}}=\sqrt{\frac{81}{4}}=\frac{9}{2}=4\frac{1}{2}.$

$\sqrt{153\frac{7}{9}}=\sqrt{\frac{1384}{9}}=\frac{37\cdot2021...}{3}$

$=12\cdot4007....$

$\sqrt{\frac{1}{8}}=\sqrt{\cdot\dot{3}3\dot{3}}=\cdot5773....$

$\dot{2}\dot{2}0\dot{9}$ (47

	16
87	609
	609

$9\dot{8}0\dot{1}$ (99

	81
189	1701
	1701

$\therefore \sqrt{\frac{2209}{9801}}=\frac{47}{99}.$

(17) $\sqrt{\frac{3}{5}}=\sqrt{\left(\frac{3\times5}{5\times5}\right)}=\frac{\sqrt{15}}{5}=\frac{3\cdot8729...}{5}=\cdot7745...$

$\sqrt{\frac{1}{17}}=\sqrt{\left(\frac{1\times17}{17\times17}\right)}=\frac{\sqrt{17}}{17}=\frac{4\cdot12310...}{17}=\cdot2425...$

$\sqrt{2\frac{1}{2}}=\sqrt{2\cdot5}=1\cdot5811$

$\sqrt{\frac{3\frac{1}{2}}{4\frac{1}{2}}}=\sqrt{\frac{7}{9}}=\frac{\sqrt{7}}{3}=\frac{2\cdot6457...}{3}=\cdot8819...$

(18) $\sqrt{\frac{5{\cdot}04}{{\cdot}021}}=\sqrt{\frac{5040}{21}}=\sqrt{240}=15{\cdot}4919\ldots$

$\sqrt{1\frac{56}{169}}=\sqrt{\frac{225}{169}}=\frac{25}{13}=1\frac{12}{13}$.

$23{\cdot}10\dot{0}0\dot{0}0\dot{0}0\dot{0}$ ($4{\cdot}8062\ldots$

16

88 | 710
704

9606 | 60000
57636

96122 | 236400
192244

44156

$42{\cdot}0\dot{0}0\dot{0}0\dot{0}0\dot{0}0$ ($6{\cdot}4807\ldots$

36

124 | 600
496

1288 | 10400
10304

129607 | 960000
907249

52751

CUBE ROOT.

Ex. LXI. (p. 248.)

(5) $25\dot{1}23\dot{9}59\dot{1}$ (631

216

$3\times6^2=108$ | 35239

$3\times(60)^2=10800$

$3\times60\times3=540$

$3^2=9$

11349

3

34047 | 34047

$3\times(63)^2=11907$ | 1192591

$3\times(630)^2=1190700$

$3\times630\times1=1890$

$1^2=1$

1192591 | 1192591

$$
\begin{array}{l|l}
 & 48\dot{2}2\dot{8}5\dot{4}\dot{4} \ (\ 364 \\
 & 27 \\
 & \hline
3\times(8)^2=27 & 21228 \\
3\times(30)^2=2700 & \\
3\times30\times6=\ 540 & \\
6^2=\ 36 & \\
\hline
28\dot{3}7\dot{2}6\dot{2}5 \ (\ 305 & 3276 \\
27 & 6 \\
\hline
 & 19656 \quad 19656 \\
\hline
3\times3^2=\ 27 & 1372625 \\
3\times(30)^2=2700 & 3\times(36)^2=3888 \quad 1572544 \\
3\times(300)^2=270000 & 3\times(360)^2=388800 \\
3\times300\times5=\ 4500 & 3\times360\times4=\ 4320 \\
5^2=\ 25 & 4^2=\ 16 \\
\hline
274525 & 393136 \\
5 & 4 \\
\hline
1372625 & 1372625 \quad 1572544 \quad 1572544
\end{array}
$$

$$
\begin{array}{l|l}
(6) & 1\dot{7}1\dot{7}3\dot{5}1\dot{2} \ (\ 258 \\
 & 8 \\
 & \hline
3\times2^2=12 & 9173 \\
3\times(20)^2=1200 & 3\times(25)^2=1875 \quad 1548512 \\
3\times20\times5=\ 300 & 3\times(250)^2=187500 \\
5^2=\ 25 & 3\times250\times8=\ 6000 \\
 & 8^2=\ 64 \\
\hline
1525 & 193564 \\
5 & 8 \\
\hline
7625 & 7625 \quad 1548512 \quad 1548512 \\
\hline
 & 1548512
\end{array}
$$

$$
\begin{array}{l|l}
 & 2\dot{5}9\dot{6}9\dot{4}0\dot{7}\dot{2} \ (\ 638 \\
 & 216 \\
 & \hline
3\times6^2=108 & 43694 \\
3\times(60)^2=10800 & 3\times(63)^2=11907 \quad 9647072 \\
3\times60\times3=\ 540 & 3\times(630)^2=1190700 \\
3^2=\ 9 & 3\times630\times8=\ 15120 \\
 & 8^2=\ 64 \\
\hline
11349 & 1205884 \\
3 & 8 \\
\hline
34047 & 34047 \quad 9647072 \quad 9647072 \\
\hline
 & 9647072
\end{array}
$$

$926\dot{8}59\dot{3}75\dot{}$ (975
729

$3\times 9^2=243$	197859
$3\times(90)^2=24300$	
$3\times 90\times 7=1890$	
$7^2=49$	
26239	
7	
183673	183673
	14186375

$3\times(97)^2=28227$	14186375
$3\times(970)^2=2822700$	
$3\times 970\times 5=14550$	
$5^2=25$	
2837275	
5	
14186375	14186375

(7)

$2\dot{7}0\dot{5}4\dot{0}3\dot{6}00\dot{8}$ (3002
27

$3\times 3^2=27$	54036008
$3\times(30)^2=2700$	
$3\times(300)^2=270000$	
$3\times(3000)^2=27000000$	
$3\times(3000)\times 2=18000$	
$2^2=4$	
27018004	
2	
54036008	54036008

$21\dot{9}36\dot{5}32\dot{7}79\dot{1}$ (6031
216

$3\times 6^2=108$	3365327
$3\times(60)^2=10800$	
$3\times(600)^2=1080000$	
$3\times 600\times 3=5400$	
$3^2=9$	
1085409	
3	
3256227	3256227
$3\times(603)^2=1090827$	109100791
$3\times(6030)^2=109082700$	
$3\times 6030\times 1=18090$	
$1^2=1$	
109100791	109100791

(8)

$$
\begin{array}{r|l}
 & \dot{3}89\dot{0}1\dot{7}\ (\ \cdot 73 \\
 & 343 \\
\hline
3\times 7^2=147 & 46017 \\
4\times(70)^2=14700 & \\
3\times 70\times 3=\ \ 630 & \\
3^2=\ \ \ 9 & \\
\hline
15339 & \\
3 & \\
\hline
46017 & \\
\end{array}
$$

$$
\begin{array}{r|l}
 & 46017 \\
\hline
 & \\
\end{array}
$$

$$
\begin{array}{r|l}
 & 3\dot{2}\cdot 46\dot{1}75\dot{9}\ (\ 3\cdot 19 \\
 & 27 \\
\hline
3\times 3^2=27 & 5461 \\
3\times(30)^2=2700 & \\
3\times 30\times 1=\ \ 90 & \\
1^2=\ \ \ 1 & \\
\hline
2791 & 2791 \\
\hline
3\times(31)^2=2883 & 2670759 \\
3\times(310)^2=288300 & \\
3\times 310\times 9=\ \ 8370 & \\
9^2=\ \ \ 81 & \\
\hline
296751 & \\
9 & \\
\hline
2670759 & 2670759 \\
\end{array}
$$

$$
\begin{array}{r|l}
 & 9\dot{5}44\dot{3}\cdot 99\dot{3}\ (\ 45\cdot 7 \\
 & 64 \\
\hline
3\times 4^2=48 & 31443 \\
3\times(40)^2=4800 & \\
3\times 40\times 5=\ \ 600 & \\
5^2=\ \ \ 25 & \\
\hline
5425 & \\
5 & \\
\hline
27125 & 27125 \\
\hline
3\times(45)^2=6075 & 4318993 \\
3\times(450)^2=607500 & \\
3\times 450\times 7=\ \ 9450 & \\
7^2=\ \ \ 49 & \\
\hline
616999 & \\
7 & \\
\hline
4318993 & 4318993 \\
\end{array}
$$

$\dot{0}0\dot{1}90\dot{6}62\dot{4}$ (·124

1

$3\times1^2=3$	906	$3\times(12)^2=432$	178624
$3\times(10)^2=300$		$3\times(120)^2=43200$	
$3\times10\times2=60$		$3\times120\times4=1440$	
$2^2=4$		$4^2=16$	
364		44656	
2		4	
728	728	178624	178624
	178624		

$\dot{0}0\dot{0}9\dot{1}26\dot{7}3\dot{3}$ (·097

729

$3\times9^2=243$	183673		
$3\times(90)^2=24300$			
$3\times90\times7=1890$			
$7^2=49$			
26239			
7			
183673	183673		

$\dot{0}0\dot{0}0\dot{2}43\dot{8}\dot{9}$ (·029

8

		$3\times2^2=12$	16389
		$3\times(20)^2=1200$	
		$3\times20\times9=540$	
		$9^2=81$	
		1821	
		9	
		16389	16389

(9) $\dot{3}\cdot\dot{0}0\dot{0}0\dot{0}0\dot{0}0\dot{0}$ (1·442...

1

$3\times1^2=3$	2000		
$3\times(10)^2=300$			
$3\times10\times4=120$			
$4^2=16$			
436			
4			
1744	1744		
$3\times(14)^2=588$	256000	$3\times(144)^2=62208$	14016000
$3\times(140)^2=58800$		$3\times(1440)^2=6220800$	
$3\times140\times4=1680$		$3\times1440\times2=8640$	
$4^2=16$		$2^2=4$	
60496		6229444	
4		2	
241984	241984	12458888	12458888
	14016000		1557112

$\dot{3}00000000\dot{0}$ (·669...
216

$3\times6^2=108$	84000	
$3\times(60)^2=10800$	$3\times(66)^2=13068$	12504000
$3\times60\times6=1080$	$3\times(660)^2=1306800$	
$6^2=36$	$3\times660\times9=17820$	
11916	$9^2=81$	
6	1324701	
71496	9	
71496	11922309	11922309
12504000		581691

$\dot{0}30000000\dot{0}$ (·310...
27

$3\times3^2=27$	3000	
$3\times(30)^2=2700$		
$3\times30\times1=90$		
$1^2=1$		
2791	2791	
$3\times(31)^2=2883$	209000	

$(10)\ \sqrt[3]{\left(\frac{8}{27}\right)}=\frac{2}{3}$;

$\sqrt[3]{\left(\frac{250}{686}\right)}=\sqrt[3]{\left(\frac{125}{343}\right)}=\frac{5}{7}$;

$44\dot{6}00000000\dot{0}$ (3·546...
27

$3\times3^2=27$	17600	
$3\times(30)^2=2700$	$3\times(35)^2=3675$	1725000
$3\times30\times5=450$	$3\times(350)^2=367500$	
$5^2=25$	$3\times350\times4=4200$	
3175	$4^2=16$	
5	371716	
15875	4	
15875	1486864	1486864
1725000		23813600
	$3\times(354)^2=376948$	
	$3\times(3540)^2=37694800$	
	$3\times3540\times6=63720$	
	$6^2=36$	
	37758556	
	6	
	226551336	226551336
		11584664

(11) $\sqrt[3]{(405\frac{2}{1}\frac{8}{2}\frac{8}{5})} = \sqrt[3]{\left(\frac{50653}{125}\right)} = \frac{37}{5} = 7\frac{2}{5}$;

Since $\dot{5}0\dot{6}5\dot{3}$ (37
27

$3 \times 3^2 = 27$	23653
$3 \times (30)^2 = 2700$	
$3 \times 30 \times 7 = 630$	
$7^2 = 49$	
3379	
7	
23653	23653

$\sqrt[3]{(7\frac{1}{3})} = \sqrt[3]{(7{\cdot}2)}$;

and $\dot{7}{\cdot}2\dot{0}0\dot{0}0\dot{0}0\dot{0}0\dot{0}$ (1·930....
1

$3 \times 1^2 = 3$	6200		
$3 \times (10)^2 = 300$		$3 \times (19)^2 = 1083$	341000
$3 \times 10 \times 9 = 270$		$3 \times (190)^2 = 108300$	
$9^2 = 81$		$3 \times 190 \times 3 = 1710$	
651		$3^2 = 9$	
9		110019	
5859	5859	3	
	341000	330057	330057
		$3 \times (193)^2 = 11747$	10943000

$\dot{3}{\cdot}00\dot{4}1\dot{5}0000$ (1·442....
1

$3 \times 1^2 = 3$	2004		
$3 \times (10)^2 = 300$			
$3 \times 10 \times 4 = 120$			
$4^2 = 16$			
436			
4			
1744	1744		
$3 \times (14)^2 = 588$	260150	$3 \times (144)^2 = 62208$	18166000
$3 \times (140)^2 = 58800$		$3 \times (1440)^2 = 6220800$	
$3 \times 140 \times 4 = 1680$		$3 \times 1440 \times 2 = 8640$	
$4^2 = 16$		$2^2 = 4$	
60496		6229444	
4		2	
241984	241984	12458888	12458888
	18166000		5707112

(12) $\dot{0}0\dot{0}1\dot{0}0\dot{0}0\dot{0}0$ (·046....

64

$3\times4^2=48$	36000
$3\times(40)^2=4800$	
$3\times40\times6=720$	
$6^2=36$	
5556	
6	
33336	33336
	2664

Since $\frac{1257\cdot728}{16384}=\frac{157\cdot216}{2048}=\frac{19\cdot652}{256}=\frac{4\cdot913}{64}$;

$$\sqrt[3]{\left(\frac{1257\cdot728}{16384}\right)}=\sqrt[3]{\left(\frac{4\cdot913}{64}\right)}=\frac{1\cdot7}{4}=\cdot425.$$

(13) $2\dot{3}3\cdot7\dot{4}4\dot{8}9\dot{6}$ (6·16

216

$3\times6^2=108$	17744
$3\times(60)^2=10800$	
$3\times60\times1=180$	
$1^2=1$	
10981	10981
	6763896
$3\times(61)^2=11163$	
$3\times(610)^2=1116300$	
$3\times610\times6=10980$	
$6^2=36$	
1127316	
6	
6763896	6763896

$\sqrt[3]{(233\cdot744896\times\cdot008)}=6\cdot16\times\cdot2=1\cdot232.$

(14) Number of cubic inches in mass $=\frac{£10481\ 1s.\ 4d.}{10s.\ 5d.}$

$=\frac{2515456}{125}=20123\cdot648.$

(Continued on next page.)

(14 continued.)

$\dot{2}0\dot{1}2\dot{3}\cdot6\dot{4}\dot{8}$ (27·2 inches = edge of cube

8

$3\times2^2=12$	12123
$3\times(20)^2=1200$	
$3\times20\times7=420$	
$7^2=49$	
1669	
7	
11683	11683
	440648
$3\times(27)^2=2187$	
$3\times(270)^2=218700$	
$3\times270\times2=1620$	
$2^2=4$	
220324	
2	
440648	440648

(15) $5\dot{0}6\dot{5}\dot{3}$ (37

27

$3\times3^2=27$	23653
$3\times(30)^2=2700$	
$3\times30\times7=630$	
$7^2=49$	
3379	
7	
23653	23653

∴ area = (37×37) sq. ft. = 1369 sq. ft.

(16) 56 cub. ft., 568 cub. in. = 97336 cub. in.

$9\dot{7}\dot{3}\dot{3}\dot{6}$ (46 inches = 3 ft., 10 in.

64

$3\times4^2=48$	33336
$3\times(40)^2=4800$	
$3\times40\times6=720$	
$6^2=36$	
5556	
6	
33336	33336

SCALES OF NOTATION.

Ex. LXII. (p. 251.)

(3)

2064	57264;	468	85τ;
312	675	701	734
4150	354604	468	3117
2064	513354	2τ310	2368
6234	434070	2τ3568	5484
650410	51117344		574097

9294	6τ12	ε7τ8;
344	814	2ττ9
30ε14	23448	88ε00
30ε14	6τ12	986τ8
23340	46894	986τ8
2704054	475τ968	1ε394
		29τ96580

(4)

6541) 1433221 (1456
6541
44612
36124
54551
45665
55536
55536

2ττ9) 29τ96580 (ε7τ8
27ετ3
1 τε35
18433
27028
250ε6
20320
20320

13) 201002 (10232
13
110
32
120
111
32
32

4331) 24510502 (3402
21433
30335
30204
13102
13102

(5) $1\dot{2}0\dot{4}4\dot{2}\dot{4}$ (2504

	4	
45	404	
	401	
5404	34424	
	34424	

$3\dot{2}\dot{\varepsilon}\dot{7}5\dot{7}\dot{2}\dot{1}$ ($62\tau\varepsilon$

	30	
102	$2\varepsilon 7$	
	204	
104τ	$\varepsilon 357$	
	$\tau 404$	
1058ε	$\varepsilon 5321$	
	$\varepsilon 5321$	

$4\dot{7}6\dot{1}0\dot{3}\dot{7}\dot{0}$ (6543

	40	
135	761	
	687	
1114	6303	
	5757	
11183	43570	
	43570	

(6)

7	1828	
7	261	—1
7	37	—2
	5	—2

$\therefore 1828=(5221)_7$,

12	80198	
12	6683	—2
12	556	—11
12	46	—4
	3	—τ

$\therefore 80198=(3\tau 4\varepsilon 2)_{12}$,

11	1000	
11	90	—τ
	8	—2

$\therefore 1000=(82\tau)_{11}$

(7)

	$62\tau\varepsilon$
	12
	74
	12
	898
	12
	10787

12	34523	
12	1524	—3
12	54	—4
	2τ	

$\therefore (34523)_6=(2\tau 43)_{12}$

7 | 654321
7 | ε0738—5
7 | 16ε3ε—3
7 | 2858—3
7 | 478—0
7 | 7ε—3
7 | 11—4
1—6

∴ $(654321)_{12}=(16430335)_7$

(8) 12 | 23784
12 | 1736—4
12 | 132—9
12 | 10—2
0—9

∴ $(23784)_9=(9294)_{12}$

7 | 4321
7 | 313—5
7 | 21—6
1—4

∴ $(4321)_6=(1465)_7$

11 | 2304
11 | 104—τ
2—7

∴ $(2304)_5=(27\tau)_{11}$

(9) 12 | 8978
12 | 816—2
12 | 75—1
6—τ

∴ $(8978)_{11}=(6\tau12)_{12}$

12 | 3256
12 | 166—4
12 | 11—1
0—8

∴ $(3256)_7=(814)_{12}$

6τ12
814
23448
6τ12
46894
475τ968

Ex. XXIII. (p. 255.)

(1) $(7)_{10}=(11)_6$, $\left(\frac{25}{36}\right)_{10}=\frac{25\times6}{36}=4\frac{1}{6}=4+\frac{1\times6}{6}=41$;

∴ $(7\frac{25}{36})_{10}=(11{\cdot}41)_6$:

$(7)_{10}=(7)_{12}$, $\left(\frac{25}{36}\right)_{10}=\frac{25\times12}{36}=8\frac{1}{3}=8+\frac{1\times12}{3}=8+4$;

∴ $(7\frac{25}{36})_{10}=(7{\cdot}84)_{12}$:

$(37)_{10}=(101)_6$, $\left(\frac{16}{27}\right)_{10}=\frac{16\times6}{27}=3\frac{5}{9}=3+\frac{5\times6}{9}=3+3+\frac{1}{3}$ &c.

$(37\frac{16}{27})_{10}=(101{\cdot}332)_6$:

$(37)_{10}=(31)_{12}$, $\left(\frac{16}{27}\right)_{10}=\frac{16\times12}{27}=3\frac{1}{9}=3+\frac{1\times12}{9}$

$=3+1\times\frac{1}{8}$ &c.;

$\therefore (37\frac{16}{27})_{10}=(31\cdot314)_{12}$:

$(940)_{10}=(4204)_{6}$, $\left(\frac{11}{17}\right)_{10}=\frac{11\times6}{17}=3\frac{5}{17}=3+\frac{15\times6}{17}$

$=3+5\frac{6}{7}$ &c.;

$\therefore (940\frac{11}{17})_{10}=(4204\cdot314\ \ldots)_{6}$:

$(940)_{10}=(664)_{12}$, $\left(\frac{11}{17}\right)_{10}=\frac{11\times12}{17}=7\frac{13}{17}=7+\frac{13\times12}{17}$

$=7+9\frac{3}{17}$ &c.;

$\therefore (940\frac{11}{17})_{10}=(664\cdot792\ldots)_{12}$:

$\left(\frac{125}{1728}\right)_{10}=\frac{125\times6}{1728}=0+\frac{125}{288}=0+\frac{125\times6}{288}=0+2\frac{34}{48}$

$=02+\frac{29}{48}=023\frac{5}{8}$ &c.;

$\therefore \left(\frac{125}{1728}\right)_{10}=(\cdot02334\ldots)_{6}$:

$\left(\frac{125}{1728}\right)_{10}=\frac{125\times12}{1728}=0\frac{125}{144}=0+\frac{125\times12}{144}=0\tau\frac{5}{12}=0\tau5$;

$\therefore \left(\frac{125}{1728}\right)_{10}=(\cdot0\tau5)_{12}$:

$(42)_{10}=(132)_{5}$, $\left(\frac{9}{25}\right)_{10}=\frac{9\times5}{25}=1\frac{4}{5}=1+\frac{4\times5}{5}=14$;

$\therefore (42\frac{9}{25})_{10}=(132\cdot14)_{5}$.

(2) $(123)_{10}=(102)_{11}$

$\therefore (123\cdot456)_{10}=(102\cdot501\tau\ldots)_{11}$.

·456	
11	
5·016	
11	
0·176	
11	
1·936	
11	
10·296	

$(123)_{10}=(146)_{9}$,

$\therefore (123\cdot456)_{10}=(149\cdot4083\ldots)_{9}$

·456	
9	
4·104	
9	
0·936	
9	
8·424	
9	
3·816	

$(123)_{10}=(173)_8$

·456
8
3·648
8
5·184
8
1·472
8
3·776

$\therefore (123{\cdot}456)_{10}$
$=(173{\cdot}3513\ldots.)_8$;

$(23)_{10}=(21)_{11}$

·125;
11
1·375
11
4·125

$\therefore (23{\cdot}125)_{10}$
$=(21{\cdot}\dot{1}\dot{4})_{11}$

$(23)_{10}=(25)_9$

·125
9
1·125
9
1·125

$\therefore (23{\cdot}125)_{10}$
$=(25{\cdot}\dot{1})_9$

$(23)_{10}=(27)_8$

·125;
8
1·000

$\therefore (23{\cdot}125)_{10}=(27{\cdot}1)_8$

$(1637)_{10}=(1259)_{11}$

·52
11
·572
11
7·92
11
τ·12

$\therefore 1637{\cdot}52 \ldots$
$=(1259{\cdot}57\tau13)_{11}$

$1637=(2218)_9$

·52
9
4·68
9
6·12
9
1·08

$\therefore 1637{\cdot}52$
$=(2218{\cdot}461\ldots.)_9$

$1637=(3145)_8$

·52
8
4·16
8
1·28
8
2·24

$1637=(3145{\cdot}412\ldots.)_8$

$376=(312)_{11}$

·54
11
5·94
11
τ·34
11
3·74

$\therefore 576{\cdot}54$
$=(312{\cdot}5\tau3\ldots.)_{11}$

$376=(457)_9$

$$\begin{array}{r} \cdot 54 \\ 9 \\ \hline 4\cdot 86 \\ 9 \\ \hline 7\cdot 74 \\ 9 \\ \hline 6\cdot 66 \end{array}$$

$376\cdot 54=(457\cdot 476\ldots.)_9$

$376=(570)_8$

$$\begin{array}{r} \cdot 54 \\ 8 \\ \hline 4\cdot 32 \\ 8 \\ \hline 2\cdot 56 \\ 8 \\ \hline 4\cdot 48 \end{array}$$

$\therefore 576\cdot 54=(570\cdot 424\ldots.)_8$

(3)

$(345)_8=(22111)_3$

$$\begin{array}{r} \cdot 6273 \\ 3 \\ \hline 2\cdot 3061 \\ 3 \\ \hline 1\cdot 1223 \\ 3 \\ \hline 0\cdot 3671 \end{array}$$

$\therefore (345\cdot 6273)_8=(22111\cdot 210\ldots.)_3$

$(345)_8=(3211)_4$

$$\begin{array}{r} \cdot 6273\,; \\ 4 \\ \hline 3\cdot 1354 \\ 4 \\ \hline 0\cdot 5660 \\ 4 \\ \hline 2\cdot 7300 \end{array}$$

$\therefore (345\cdot 6273)_8=(3211\cdot 302\ldots.)_4$

$(7304)_8=(12012000)_3$,

$$\begin{array}{r} \cdot 513 \\ 3 \\ \hline 1\cdot 741 \\ 3 \\ \hline 2\cdot 643 \\ 3 \\ \hline 2\cdot 351 \end{array}$$

$\therefore (7304\cdot 513)_8=(12012000\cdot 122\ldots.)_3$

$(7304)_8=(323010)_4$

$$\begin{array}{r} \cdot 513\,; \\ 4 \\ \hline 2\cdot 454 \\ 4 \\ \hline 2\cdot 260 \\ 4 \\ \hline 1\cdot 300 \end{array}$$

$\therefore (7304\cdot 513)_8=(323010\cdot 221\ldots.)_4$

$(13)_8=(103)_3$

$$\begin{array}{r} \cdot 454 \\ 3 \\ \hline 1\cdot 604 \\ 3 \\ \hline 2\cdot 214 \\ 3 \\ \hline 0\cdot 644 \end{array}$$

$\therefore (13\cdot 454)_8=(102\cdot 120\ldots.)_3$

$(13)_8=(23)_4$

$$\begin{array}{r} \cdot 454\,; \\ 4 \\ \hline 2\cdot 260 \\ 4 \\ \hline 1\cdot 300 \\ 4 \\ \hline 1\cdot 400 \end{array}$$

$\therefore (13\cdot 454)_8=(23\cdot 211\ldots.)_4$

(4) 675) 511173440 (572640,
4261
6307
6053
2343
1572
5514
5156
3364
3364

$(28)_8=(26)_{10}$

$\cdot 0725=\frac{725-7}{8800}=\left(\frac{717}{8800}\right)_8$

$=\left(\frac{585}{640}\right)_{10}$;

$\therefore (28\cdot 0725)_9=26\frac{585}{640}$.

(5) $\frac{29 \text{ ft., } 4 \text{ in.}}{2 \text{ ft., } 3 \text{ in., } 6 \text{ pts.}}=12$ ft., 9 in.

(6) Cost$=2(30\frac{5}{12}+17\frac{7}{12})\times 9\frac{5}{6}\times\frac{1}{9}\times\frac{9}{4}$ shillings$=$£11 16*s*.

SQUARE AND CUBIC MEASURE.

Ex. LXIV. (p. 264.)

(1) Circ.$=4\frac{2}{3}$ ft.$\times\frac{22}{7}=4$ yds., 2 ft., 8 in.:
number of rev.$=10\frac{1}{4}$ mls.$\div 4$ yds., 2 ft., 8 in.$=3690$.

(2) Area$=\left(\frac{15}{2}\right)^2\times\frac{22}{7}=176\frac{1}{14}$ sq. ft.$=19$ sq. yds., 5 ft., $113\frac{1}{7}$ in.

(3) $15\frac{3}{4}$ mls.$=997920$ in.; $\therefore$ diameter$=\frac{997920}{4290}\div\frac{22}{7}$
$=2$ yds., $2_1\frac{2}{43}$ in.

diameter$=\sqrt{2\frac{1}{2}\times 4\times\frac{7}{22}}=124\cdot 096\ldots$. yds.

(4)

(1) Circumference of circle made by horse$=\frac{22}{7}\times\frac{77}{6}$ ft.$=\frac{121}{3}$ ft.,

distance passed over in an hour$=\frac{121}{3}\times\frac{35}{1}\times\frac{120}{7}$ ft.
$=24200$ ft.$=8066\frac{2}{3}$ yds.,
5 miles$=8800$ yds.; $\therefore$ difference$=8800$ yds.$-8066\frac{2}{3}$ yds
$=733$ yds., 1 ft.

(2) No. of sq. yds.$=(12^2-8^2)\times\frac{22}{7}$ ft.$=27$ sq. yds., 8 ft., $61\frac{5}{7}$ in.

(5) Circumference $=2(52 \text{ ft., } 6 \text{ in.}) \times \frac{22}{7} = 330 \text{ ft.} = 110 \text{ yds.}$;
$\therefore$ cost $= 110 \times 84 \text{ cts.} = \$92.40$:
greater space $= (14^2 - 7^2) \times \frac{22}{7} \text{ yds.} = 462 \text{ sq. yds.}$

(6) Hypothenuse $= \sqrt{(24^2 + \frac{5.5^2}{2})} = 36 \text{ ft., } 6 \text{ in.}$:
hypothenuse $= \sqrt{(4{\cdot}25^2 - 2{\cdot}55^2)} = 3 \text{ ch., } 40 \text{ lks.}$

(7) Side of sq. $= \sqrt{1386} = 37{\cdot}229 \text{ yds.}$,
radius $= \sqrt{1386} \div \frac{22}{7} = 21 \text{ yds.}$;
$\therefore$ difference $= 37{\cdot}229\ldots\text{yds.} - 21 \text{ yds.} = 16{\cdot}229\ldots\text{yds.}$

(18) (2) $7\frac{1}{2} \text{in.} = \frac{7\frac{1}{2}}{12} \text{ft.} = \frac{5}{8} \text{ ft.}$;
$\therefore$ length $= \frac{3}{1} \times \frac{8}{5} \text{ ft.} = 4 \text{ ft., } 9\frac{3}{5} \text{ in.}$

(19) (1) Area of a sq. = diag. squared $\div 2$
$= 735 \text{ links} \times 735 \div 2$
$= 540225 \div 2 = 270112\frac{1}{2} \text{ links}$
$= 2 \text{ ac., } 2{\cdot}8045 \text{ roods.}$

(3) $1\frac{1}{4}$ acres $= 175000$ links;
required length in links $= 175000 \div 500 = 3 \text{ ch., } 50 \text{ lks.}$

(25) (1) Wt. in oz. $= 6 \times 3 \times \frac{7}{4} \times 1000 =$ &c.

(2) Depth in inches $= 277{\cdot}25 \times 1216 \div 2432 = 11 \text{ ft., } 6\frac{25}{32} \text{ in.}$

(26) (1) No. of times $= \frac{462}{5} \times \frac{462}{5} \times \frac{462}{5} \div 2156 = 365\frac{113}{125}$.

(2) Solid contents on floor $= \frac{22}{7} \times \frac{225}{2} \times \frac{225}{2} \times 14 \text{ in.}$
$= 556875 \text{ inches}$;
$\therefore$ no. of bushels $= 556875 \div 2218{\cdot}192 = 251{\cdot}049.$

(3) Height $= 2218{\cdot}192 \div \frac{94}{10} \times \frac{94}{10} \times \frac{22}{7} \text{ in.} = 7{\cdot}987 \text{ in.}$

(27) (1) Area of a flag-stone $= 23{\cdot}804$ sq. ft:
perimeter of court $= 2 \times (137{\cdot}21 + 24{\cdot}9 + 125{\cdot}79) = 576$ ft.,
area of cloister $= 576 \times 12{\cdot}45$ sq. ft., $= 7171{\cdot}2$ sq. ft.,
number of flag-stones $= 7171{\cdot}2$ sq. ft. $\div 23{\cdot}804 = 300.$

(2) Side of square=81·24 ft.;
∴ perimeter of moat=2×(81·24+90+81·24) ft.=504·96.
cubic contents=504·96×7½ ft.=3787·2;
∴ number of gallons=$\frac{3787\cdot2\times1728}{277\cdot274}$=3155002.

(29) (1) Area of the court=50×80 sq. yds.=4000,
yards under grass=(50−6)×(80−6)=3256,
yards in walks=4000 sq. yds.−3256 sq. yds.
=744 sq. yds.
3256 @ 3*s.*=£488 8*s.*, 744 sq. yds.=6696 sq. ft.,
6696 @ 20*d.*=£558; ∴ total cost=£1046 8*s.*

(2) $4\frac{1}{2}\times2\frac{2}{3}\times2$=24 c. feet,
$4\times2\frac{1}{2}\times1\frac{1}{2}$=15 c. ft.: 24÷15=$1\frac{2}{5}$,
$1\frac{2}{5}\times50$=80, no. of books in larger box,
total number of books=50+80=130,
number left is 150−130=20.

(31) (2) $9^2\times3\frac{1}{7}=\frac{81\times22}{7}$ inches=$\frac{81\times22}{7\times144}$ feet.

$\frac{81\times22}{7\times144}=\frac{252}{81}=3\frac{1}{9}$ ft.=3 ft., $1\frac{1}{3}$ in.

(32) 113×108=12204, $\frac{2}{3}\times12204$=8136
$\frac{8136}{27}$=301⅓ cb. yds.:
8136 : 1 :: 600 tons
(600 tons=1344000 lbs.)
lbs. in c. ft=$\frac{1344000}{8136}=165\frac{1660}{1356}=165\frac{665}{339}$.

(33) (1) 2 ft., 7 in.=$2\frac{7}{12}$ ft.=$\frac{31}{12}$ ft.=radius
c. yds.=$\frac{31}{12}\times\frac{31}{12}\times\frac{22}{7}\times\frac{55}{2}\times\frac{1}{27}=\frac{581405}{27216}=21\frac{9869}{27216}$.

(2) 2 ft., 8 in.=$2\frac{2}{3}$ ft.=$\frac{8}{3}$ ft.
no. of gals.=$\frac{8}{3}\times\frac{8}{3}\times\frac{22}{7}\times\frac{7}{2}\times\frac{1728}{277\cdot274}=\frac{135168000}{277274}$
=487½ nearly.

(3) Number of cubic feet obtained by the surface sinking
one foot=$\frac{8}{3}\times\frac{8}{3}\times\frac{22}{7}=\frac{1408}{63}$,
number of gallons=$\frac{1408}{63}\times62\frac{1}{2}$=139·28....

EXAMINATION PAPERS.

I. (p. 268.)

(1 $\$5\frac{1}{4}=\$5.25$, £1·35=\$5.40, £$\frac{3}{7}$ st.=£$\frac{7\,3}{0\,0}$ c'y=\$2·08$\frac{4}{7}$.
sum=\$(5·25+5·40−2·08$\frac{4}{7}$)=\$8·56$\frac{3}{7}$.

(2) Let 1 represent C's capacity for work per hour;
then $1\frac{1}{2}$ and 2 will represent B's and A's respectively.
The comparative work of each will be as follows:

$9\times6\times8\times1 = 432$=C's

$2\times6\times7\times1\frac{1}{2}=126$	$7\times4\times2\times2=112$
$2\times6\times5\times1\frac{1}{2}=90$	$2\times6\times10\times2=240$
$4\times6\times3\times1\frac{1}{2}=108$	$2\times6\times4\times2=48$
$1\times6\times11\times1\frac{1}{2}=99$	A's=$\overline{400}$:
B's=$\overline{423}$:	

total number=400+423+432=1255;
∴ A's share will be $\frac{400}{1255}$ of \$125.25=\$40,
B's=\$42.30,
C's=\$43.20.

(3) Insurance by steamer on \$780 @ $1\frac{1}{2}\%$=\$11.70,
insurance by sailing vessel on \$780 @ $4\frac{3}{4}\%$=\$37.05:
freight by steamer=$\frac{11}{2}\times\frac{13}{3}\times\frac{13}{4}\times\frac{1}{40}\times\$19.20=\$37.56\frac{3}{4}\frac{5}{8}$,
freight by sailing vessel=$\frac{11}{2}\times\frac{13}{3}\times\frac{13}{4}\times\frac{1}{40}\times\$6=\$11.61\frac{7}{8}$;
therefore total cost by steamer is \$49.26$\frac{3}{4}\frac{5}{8}$,
by sailing vessel \$48.66$\frac{7}{8}$,
difference=$59\frac{1}{4}\frac{1}{8}$ cts. in favor of sailing vessel.

(4) £1 4*s*. $4\frac{1}{2}$*d*. currency=\$4.87$\frac{1}{2}$; ∴ shilling st.=$24\frac{3}{8}$ cts.

(5) $\frac{4}{7}+\frac{2}{5}=\frac{34}{35}$=part of filled portion of tank made by the two pipes;
∴ time required=$1\div\frac{34}{35}$ hrs.=$1\frac{1}{34}$ hrs.

(6) $30\times120=3600$ sq. ft.; no. of sq. ft. in an acre=43560;
∴ price=$\$\frac{43560}{3600}\times100=\$36300$.

(8) 15 guineas weigh 1920 grs.; ∴ there are 1760 & 160 grains pure gold and alloy respectively in 15 guineas, and 1760 grains pure gold $=\frac{1760\times 239}{11}$ grs.$=38240$ grains alloy; hence 15 guineas, or 315s.$=(38240+160)$ grains alloy $=38400=\frac{38400}{7000}$ lbs. avoir.$=\frac{192}{35}$ lbs.;

∴ 1 lb. avoir.$=\frac{315\times 35}{192}s.=$£2 17$s$. $5\frac{1}{16}d$.

(9) Quantity of pulp in trough$=10\frac{7}{12}\times 3\times\frac{11}{12}=\frac{1397}{48}$ c. ft., of which only $\frac{1397}{48}\times\frac{2}{5}=\frac{1397}{120}$ c. ft. available for making paper.

Area of one sheet$=\frac{1}{12\times 48}\times\frac{11}{12}$ sq. ft.$=\frac{11}{576\times 12}$ sq. ft.;

∴ length of paper$=\frac{1397}{48}\div\frac{11}{576\times 12}$

$=7315\frac{1}{3}$ inches$=$1 mile, 3 fur., 3 per., 1 yd., 2 ft., $8\frac{2}{3}$ in.

(10) 150 lbs. @ 14 cts.$=$\$21.00
39 lbs. @ 6 cts.$=$ 2.34
total cost$=$23.34

$12\frac{1}{2}$ % on \$23.34$=$2.9175; ∴ whole cost is \$26·2575.

189 lbs. were bought; the grocer gains 1 lb. in every 63 lbs.;
∴ 189 lbs. are sold for 192 lbs.:
192 lbs. @ 25 cts.$=$\$48.00;
∴ gain is \$(48−26·2575)$=$\$21·7425 on \$26·2575,
or 83 per cent., nearly.

(11) By ten figures; by $10\times 10=100$.

(12) £4 4s. $11\frac{5}{11}d$.$=$£$\frac{1}{440}$$=$value of 480 grs., or $\frac{1}{12}$ lb. Troy;

∴ weight in pure gold of £1$=\frac{1}{12}\times\frac{440}{1869}$ lb.$=\frac{110}{3\times 1869}$ lbs. Troy;

∴ Avoirdupois weight of sovereign$=\frac{110}{3\times 1869}\times\frac{144}{175}$
$=\frac{352}{21805}$ lb. pure gold.

II. (p. 270.)

(2) $\frac{2}{3}\times\frac{3}{7}\times\frac{14}{3}+\left(\frac{4\frac{1}{3}}{4\frac{1}{4}}-\frac{\frac{2}{5}}{\frac{5}{7}}+\frac{17}{60}\right)\div\frac{3}{5}=\frac{8}{3}+\frac{3789}{5100}\times\frac{5}{3}$

$=\frac{8}{3}+\frac{1263}{1020}=\frac{3983}{1020}=3\frac{923}{1020}$.

(3) A few words are omitted from the question in the text; it should read as follows: the population is 1842265 souls, and the revenue from customs is \$3595754 by an average duty of $12\frac{1}{2}$ per cent. If the duty be raised to 20 per cent. and the consumption fall off one-tenth; how much is the average taxation per head altered?

$\$\frac{359575400}{12\frac{1}{2}}=\$28766032$ imports,

$\frac{9}{10}$ of \$28766032=\$25889428.80 imports;

revenue from \$25889428.80 @ 20%=\$5177885.76;

∴ difference is \$(5177885.76−3595754)=\$1582131.76;

∴ taxation has been altered $\$\frac{1582131.76}{1842265}$

=86 cts., nearly.

(4) ·034695÷·000241=143·962....

·084 of a mile=147 yds., 2 ft.,6·24 inches.

(5) From January 1st, 1862, to 15th April, 1863, is 469 days;

∴ interest=$£\frac{400}{3}\times\frac{469\times7}{36500}$=£11 19*s*. $10\frac{8}{73}d$.

(6) (*a*) 8642. *Ans.* (*b*) ·1809....

(7) $\cdot075\dot{3}8\dot{6}=\frac{74633}{990000}$.

The expression=$\frac{4100}{4601}$=·891110628....

(8) The interest and protesting charges amount to \$55; besides this there are \$24 at interest for 6 mos. at 2 per cent. per month, and \$31 for 3 mos. at $2\frac{1}{2}$ per cent. per month; interest on these two items=\$5.205;

∴ total interest for 6 mos.=\$60.205; and ∴ for year =\$120.41; ∴ rate per cent. per annum=\$30.10.

(9) The price of the metal at first was \$66.40; ∴ profit on the spoons was \$23.60: in the second place the metal cost \$74·972, hence to make the same profit he must sell the spoons for \$(74·972+23·60)=\$98·572, or each spoon for \$2·4643.

(10) $0{\cdot}000279 \div 300000 = {\cdot}00000000093$;

$23{\cdot}4\dot{1}5\dot{9} \times 0{\cdot}0839\dot{0} = 1{\cdot}96693$.

(11) Fraction $= \frac{\frac{7000}{16}}{5760} = \frac{175}{2304}$

(12) Fraction $= \frac{191}{309}$.

III. (p. 271.)

(1) $\frac{33}{1056} = {\cdot}03125$, $\frac{3}{17} = {\cdot}\dot{1}76470588235294\dot{1}$;

$3{\cdot}0561 = 3\frac{561}{10000}$, $15{\cdot}601\dot{3}789\dot{0} = 15\frac{167033}{277750}$.

(2) (*a*) \$5958.75. (*b*) \$22.75, nearly.

(3) If d=discount, m=amount, n=time and r=rate per cent.;

then $d = \frac{mnr}{1+nr}$, or $5 = (5-\frac{1}{4})n$; ∴ $n = \frac{20}{19}$ years.

(4) $\frac{17}{2} \times \frac{23}{4} = \frac{391}{8}$ sq. ft. 23 c. yds.,=621 c. ft.;

∴ $621 \div \frac{391}{8} = 12\frac{12}{17}$ ft. long; *Ans.*$= 20\frac{5}{16} - 12\frac{12}{17} = 7\frac{168}{272}$.

(5) A mile=1760 yards, acre=4840 sq. yds.

50 miles=88000 yards; amount received

$= £\frac{88000 \times 22}{4840} \times 55 = £22000$;

∴ value of field=£22000+£3600=£25600:

number of roods in field=25600÷10=2560=640 acres;

∴ side of field is one mile long.

(6) £126 discount on £1726 for 21 months is at the rate of £4$\frac{1}{4}$ per cent. per annum.

amount of bill=£356 $3\frac{17}{821}$*s.* + (£356 $3\frac{17}{821}$) $\times \frac{7}{12} \times \frac{9}{200}$

$= £356\frac{1}{8}\frac{3}{2}\frac{4}{1}\left(1+\frac{21}{800}\right) = £365\ 10s.$

(7) In a crown, half-crown, shilling, sixpence and penny there are 109 pence;

therefore number of each = £11 7*s*. 1*d*. ÷ 109 = 25.

(8) $100 gold buys $205 treasury notes, which is in ratio of 20 : 41; ∴ discount = $\frac{21}{41}$ of $100 = 51\frac{9}{41}$ per cent.

(9) Amount of American silver bought with $100 = $\$\frac{25}{24} \times 100$ = 104\frac{1}{6}$,

in New York $100 = $180 in greenbacks;

∴ 104\frac{1}{6}$ = $\$\frac{625}{6} \times \frac{9}{5}$ = $187.50 greenbacks. Gold falls to 150;

∴ $150 = $100, and $187.50 = $187.50 × $\frac{2}{3}$ gold = $125;

hence gain on $100 is $25, and therefore we have

$25 : $120 :: $100 : $480.

(10) Income from £1500 at given rate = £45 = $219.15:

£1500 stock = £1470 = $7158.90, which being invested in stock at 105 gives $6818, income from which at 6 per cent. is $409.08; gain in income = $409.08 − $219.15 = $189.93.

(12) Gold at 250, 40 cts. only will be got for a $1 greenback;

∴ 39 cts. : 40 cts. :: 250 : 256$\frac{16}{39}$; raise = 6$\frac{16}{39}$.

IV. (p. 272.)

(1) Eagle weighs 258 grs.; ∴ pure gold in an eagle = 232·2 grs.

1869 sovereigns weigh 40 lbs.; ∴ pure gold in sovereign = 113·00159 grs.

value of a sovereign = $\$\frac{113 \cdot 00159 \times 10}{232 \cdot 2}$

= $4·866.... = 4.86\frac{2}{3}$.

From the question 40 Spanish dollars = £9;

$\frac{40}{9}$: 4.86$\frac{2}{3}$ :: 100 : rate of exchange;

∴ rate of exchange = 4·86$\frac{2}{3}$ × 100 ÷ $\frac{40}{9}$ = 109$\frac{1}{2}$.

(2) $\frac{3}{5}$ of 4*s*. 7*d*. + $\frac{7}{20}$ of 1*s*. 5$\frac{1}{2}$*d*. − $\frac{13}{48}$ of 5*s*. = 1*s*. 11$\frac{1}{4}$*d*.

(3) If the denominator be composed of p cyphers and q nines, and the numerator consist of p+q figures; then the fraction will be such as required.

$\frac{1}{13}$ = ·076923; $\frac{1}{13} \times 1 \cdot 4 \times \frac{65}{7}$ = 1.

(4) Loss on each bushel=2218−2124=94, or in fraction of a bushel=$\frac{94}{2124}=\frac{47}{1062}$; ∴ that proportion of the whole rent;

therefore loss on rent=£1075 × $\frac{47}{1062}$=£47 11s. $6\frac{47}{531}d.$

(5) The number of grains in each parcel, taken order, is 485640, 264252, 227164; the G. C. M. of which is 76, and by dividing 76 into each of the above numbers the number of parcels is obtained.

(6) 37·069 × 24=889·656 inches in a chain,
(889·656)² × 10=7914877·98336 sq. in. in an acre;
∴ sq. in. in 42 acres=332424875330112
=2308506·07848 sq. ft.:
number of sq. ft. in 55 acres=2395800;
∴ difference=87293·92152 sq. ft.

(7) Let A represent number of lbs. of tea bought,
price of $\frac{5}{6}$A @ 82 cts.=\$$\frac{41}{60}$A;
∴ price of a lb.=$\frac{\$\frac{41}{60}A-\$190}{\frac{5}{6}A}=\$\frac{41A-11400}{50A}$:
price of $\frac{A}{6}$ @ 85 cts.=\$$\frac{17}{120}$A;
∴ \$$\frac{41A}{60}+\$\frac{17A}{120}=\$\frac{33A}{40}=\$\frac{41A-11400}{50}$.
$+\$\frac{3}{10}\left(\frac{41A-11400}{50}\right)=\$\frac{533A-148200}{500}$;
∴ A=1230 nearly.

By using this value for A, we get cost price of a lb., $63\frac{19}{41}$ cts.
1230 @ $63\frac{19}{41}$ cts.=\$780·60;
∴ the grocer expected to receive \$780·60+$\frac{3}{10}$ of \$780.60
=\$1014.78.
1230 lbs. − $\frac{2}{100}$ of 1230 lbs.=$\frac{6027}{5}$
=what was actually sold,
$\frac{6027}{5}\times\frac{5}{6}\times 82$ cts.=\$823.69, $\frac{6027}{5}\times\frac{1}{6}\times 85$ cts.=\$170.76½;
∴ total amount received=\$994.45½;
difference=\$(1014.78−994.45½)=\$20·32½.

(8) (1) \$7.52....per cent. per annum,
(2) \$7.38... " "

(10) \$10.52....per cent. per annum.

(11) $23{\cdot}58 \times {\cdot}0005 \div {\cdot}36 = {\cdot}03275$.

(12) Value of stock $= \$\frac{200}{13} \times \frac{100}{1} \times \frac{397}{2} \times 4{\cdot}86$;

$\therefore$ income $= \$\frac{200}{13} \times \frac{100}{1} \times \frac{397}{200} \times \frac{4{\cdot}86}{1} \times \frac{200}{225} \times \frac{5}{100}$

$= \$659.63....$

V. (p. 274.)

(1) In the Nonary scale $3954 = 5373$,
" " $6872 = 10375$,
$5373 \times 10375 = 56113736 = 446646222$ in Sept.

(2) £37 10*s.* = \$182·625, by the question,
\$182.625 $\times \frac{4\frac{1}{2}}{100} = \$8.218125$,
\$182.625 + \$8·218125 = \$190.843125, £65 = \$240,
\$240 − \$190.843125 = \$69.156875,
\$190.843125 : \$100 :: \$69.156875 : required gain;
$\therefore$ gain per cent. = \$36.2....

(3) 120 gals. − 20 gals. = 100 gals.:
$\therefore$ after filling vessel, wine in each gal. $= \frac{5}{6}$,
15 gals. mixture $\times \frac{5}{6} = 12\frac{1}{2}$ gals. wine,
100 gals. $- 12\frac{1}{2}$ gals. $= 87\frac{1}{2}$ gals. of wine left;
$\therefore \frac{87\frac{1}{2}}{120} = \frac{35}{48}$ in each gal. of wine,
continuing this operation for the number of times specified, we have finally $46\frac{23}{40}\frac{8}{78}$ wine left.

(4) $\frac{4259}{19980}, \frac{30937}{99000}, \frac{2978}{3333}$.

(5) A has £ 50 in for 4 years, equivalent to £200 for 1 year
A " 100 " 2 " " 200 " "
B " 150 " 3 " " 450 " "
B " 50 " 4 " " 200 " "
C " 250 " 4 " " 1000 " "

£600 was the original capital, £250 were withdrawn, leaving £350; hence £(1000−350) = £650 profit;

$\therefore$ A's share of profit $= £\frac{400 \times 650}{2050} = £126\frac{3}{41}$.

(7) $\frac{10}{9{\cdot}009}=1{\cdot}110\frac{10}{9009}$; $\frac{10}{1{\cdot}11}=9{\cdot}009\frac{1}{11}$;

$\therefore$ the former is the more correct of the two statements.

(8) $(99{\cdot}9899995)^2=(10^2-{\cdot}0100005)^2$

$=10^4-200{\cdot}0100005+\left(\frac{100005}{10^7}\right)$

$=9998-{\cdot}0001+{\cdot}00010001000025$

$=9998+{\cdot}00000001000025$,

which proves the statement.

(9) $59{\cdot}9643\times3962{\cdot}8=237626{\cdot}52804$=the moon's distance from the earth in miles.

(10) 70000 grains are equal to 10 lbs.;

$\therefore$ 277·2 : 1728 :: 70000 : number of grs. in a c. ft.;

$\therefore$ number of grs. in a c. ft.=436363·63....

number of grs. in a 1000 ounces is 437500;

$\therefore$ error=437500 grs.−436363·63 grs.=1136·34....grs.

(11) A centimetre cubed=·061028....;

$\therefore$ ·06102 : 1728 :: 15·434 grs. : number of grs. required;

$\therefore$ number of grs.=437017·32,

which is less than 437500 grs. by 482·68 grs.

VI. (p. 275.)

(1) In 40 lbs. standard gold there are $36\frac{2}{3}$ lbs. pure gold,

In 22 oz., 18 carats fine, there are $16\frac{1}{2}$ oz. pure gold;

$\therefore$ 440 lbs. : $16\frac{1}{2}$ oz. :: £1869 : £70 1*s.* 9*d.*,

£70 1*s.* 9*d.*+$\frac{2}{3}$(£70 1*s.* 9*d.*)=£116 16*s.* 3*d.*:

$£1\frac{409}{660}\times16\frac{1}{2}=£\frac{1069}{660}\times\frac{33}{2}=$£26 14*s.* 6*d.*

£70 1*s.* 9*d.*+£26 14*s.* 6*d.*=£96 16*s.* 3*d.*;

charge for workmanship=£116 16*s.* 3*d.*−£96 16*s.* 3*d.*=£20.

(2) Their interest in the \$55 will be in accordance with ratio of their payments, and they contributed in the ratio of 2 to 1; hence A's share is \$36⅔, and B's \$18⅓. Hereafter the ratio of payment will be as 4 to 3.

(4) G. C. M. is 169.

(5) 7, 3, 3, 2, 2, 5, 5.

(6) $\frac{5}{12}$.
(7) 2 ft., $2\frac{3}{5}$ in.
(8) 7.
(9) 14·61287...., ·707...
(10) 36·....
(11) 23·25.

VII. (p. 276.)

(1) $\frac{7}{11}$, $\dot{6}\dot{3}$.
(2) $333\frac{1}{3}$.
(3) 8 min., $14\frac{9}{4}$ sec.
(4) 19·3248.
(6) $\frac{10}{9}$.
(7) $\frac{5821}{16500}$.
(8) £2 7*s.* $6\frac{54}{115}d.$
(9) ·002828.
(10) 101001000.
(11) £5 7*s.* $8\frac{1}{4}d.$, nearly.
(12) £3 7*s.* per cent;
£2·678 per cent.

VIII. (p. 277.)

(1) $18\frac{1}{704}$ sheets.
(2) £4068 7*s.* $5\frac{23}{113}$.
(3) 282·1259....
(4) ·37823....
(5) $1\frac{313}{360}$.
(6) $\frac{188}{333}$.
(7) $\$884.79\frac{57}{217}$.
(8) $518·96295.
(9) ·2738.
(10) 23 cwt., $18\frac{3}{5}$ lbs.; ·23184.
(11) $\frac{2519}{3920}$.
(12) $9.12; £1 17*s.* $6\frac{10}{27}d.$

IX. (p. 278.)

(1) $1\frac{667}{840}$.
(2) $11.07+, per cent.
(3) $3056·01804; £764, nearly.
(4) 1·4142.
(5) ·17375, $\frac{11009}{63360}$.
(6) Ratio=63360 : 39371.
(7) ·20625, $82\frac{1}{2}$ cts.
(8) £88 12*s.* $11\frac{75}{79}d.$
(9) $143.
(10) $3\frac{127}{240}$.
(11) 277·274.

X. (p. 279.)

(2) $\$239·59\frac{109}{149}$.
(3) $\$604.16\frac{2}{3}$.

(4) 5·7061. (5) $\frac{187}{464}$. (6) 9. (7) $\frac{400}{9999}$.

(8) 11*s.* $4\frac{3}{20}$*d.* (9) 112 men. (10) £3258 4*s.* $3\frac{8}{9}\frac{8}{8}\frac{1}{9}$*d.*

(11) \$2715·654$1\frac{1}{4}\frac{1}{8}$,
£678 18*s.* 3·25....*d.* (12) $\frac{7493}{9000}$.

XI. (p. 279.)

(1) \$3423.$07\frac{9}{11}\frac{9}{3}$.

(2) Solid content of gold bar is ·827328 c. in.,
solid content of silver bar is 9·861020 c. in.;

$$\therefore \text{ratio} = 827328 \times \frac{19\cdot35}{1728} : 9861020 \times \frac{10\cdot51}{1728},$$

or gold bar : silver bar = 1 : 6·47....

(3) 10·325, 7·74375. (4) 6·519. (5) \$82.89....

(6) 122·64.... (7) 427. (8) $19\frac{3}{40}$. (9) 16.

(10) ·037399..lbs. (11) 1·60352.

(12) £28·$12\frac{9}{11}\frac{6}{11}\frac{8}{11}$*s.*

XII. (p. 280.)

(1) $101\frac{3}{4}$ lbs. (2) $5\frac{5}{11}\frac{7}{11}\frac{0}{11}$ in. (3) £433 11*s.* $2\frac{2}{3}\frac{2}{7}$*d.*

(4) 92°, 14′, $4\frac{7}{2}\frac{2}{3}\frac{1}{6}\frac{9}{0}\frac{9}{5}\frac{6}{9}\frac{1}{1}$″. (5) $1558\frac{5}{7}\frac{7}{7}$ miles.

(6) 23·855....per cent. (7) \$2694·$38\frac{2}{7}\frac{6}{3}$.

(8) 16·8 geographical miles = 19·46 statute miles,
365·25 days = 31557600 seconds,
31557600 × 19·46 miles = 614110896 miles
= circumference of circle made by the earth:
614110896 miles ÷ 3·14159 = 195477734·52....miles;
∴ radius of circle described by the earth
= 195477734·52...miles ÷ 2 = 97738867·26...miles,
∴ distance required = 37140769·56.

(9) $2\frac{2}{3}$ inches. (10) 4·1484375.

(11) £15 5*s.* $11\frac{3}{6}\frac{7}{0}$*d.* (12) \$99·$627\frac{3}{3}$.

XIII. (p. 281.)

(3) $1\frac{3}{5}$; $10\frac{5}{7}$. (4) ·$20\dot{8}\dot{3}$; $12644\frac{2}{4}\frac{2}{7}$.

(5) ·02983....; 5·19....; 3 ro., 20 per.

(6) £2 14*s.* $8\frac{1}{4}$*d.* (7) £6; £1 13*s.* (8) 30 men.

(9) 25 (10) £30·1. (11) £7 10*s.*; £18.
(12) \$2.81¼.

XIV. (p. 282.)

(1) $\frac{109}{333}$. (2) ·668. (3) 1·1401; ·89. (4) 30.
(5) $30\frac{5}{14}$. (6) 1½ days. (7) $33\frac{5}{27}$. (8) $\$0{\cdot}98\frac{2}{81}$.
(9) 69 per cent., nearly. (10) $\$5.43\frac{3}{4}$.
(11) $82\frac{3}{8}$ cents. One solution is 1 lb. at \$1, 1 lb. at 90 cents and 4 lbs. at 80 cents. A large number of solutions can be obtained.

XV. (p. 282.)

(1) 1 hr., 41′, $46\frac{1}{4}''$; £1 6*s.* ¼*d.*; £2970 11*s.* 5*d.*
(2) 442 feet.; no. of times is greatest integer in $\frac{10\times8\times40\times5\frac{1}{2}\times3}{442}=119$.
(3) ·001; ·12; 13·04. (5) £21 7*s.* $\frac{2}{13}d.$
(6) 8642; ·1809. (7) 12*s.* $10\frac{1}{7}\frac{9}{14}d.$; 12 yds., 2 nls., $1\frac{55}{198}$ in.
(8) 36 men. (9) $\frac{7}{8}$; $\frac{9}{13}$
(10) 2 ro., 20 per.; 1*s.* $11\frac{1}{5}d.$; 3 per., 2 ft., 11·98848 in.; 7½*d.*
(11) $\frac{32}{1}$; $\frac{32}{1}$; $\cdot00108\dot{3}$; ·00035.
(12) £110 8*s.* $8\frac{13}{40}d.$; £600. (13) 69·5684....yds.

XVI. (p. 284.)

(1) $16\frac{3}{70}$; $\frac{19}{30}$. (2) ·16875; ·07.
(3) 23·12; $\frac{3\sqrt{8}-2\sqrt{7}}{\sqrt{8}-\sqrt{7}}=\frac{10+2\sqrt{14}}{1}=10+2\times3{\cdot}741\ldots$
$=17{\cdot}482\ldots$
(4) £25 + 10 per cent. of £25 = £27 10*s.* = entire selling price,
38 − 8 = 30 = no. of gallons sold,
$\frac{£27\ 10s.}{30}$ = 18*s.* 4*d.* = selling price per gallon.

(5) Gold bg. at $\frac{1}{2}$ per cent. disc., £100 is bought for £99$\frac{1}{2}$;

$\therefore$ £99$\frac{1}{2}$=\$484.565,

add 3.634 for freight,

\$488.20 cost of £100 in gold,

\$497.77=cost of a bill of exch. for £100,

\$9.57=difference on \$488.20;

$\therefore$ difference per cent. $=\frac{100}{488{\cdot}20}\times 9{\cdot}57=1{\cdot}9$, or 2, **nearly.**

(6) $$\frac{\sqrt{5}+\sqrt{3}}{2\sqrt{2}}-\frac{\sqrt{3}}{\sqrt{5}+\sqrt{3}+\sqrt{2}}=\frac{5-3+\sqrt{2}(\sqrt{5}+\sqrt{3})-2\sqrt{2}\sqrt{3}}{2\sqrt{2}(\sqrt{5}-\sqrt{3}+\sqrt{2})}$$

$$=\frac{\sqrt{2}\sqrt{5}-\sqrt{2}\sqrt{3}+2}{2\sqrt{2}(\sqrt{5}-\sqrt{3}+\sqrt{2})}=\frac{\sqrt{2}(\sqrt{5}-\sqrt{3}+\sqrt{2})}{2\sqrt{2}(\sqrt{5}-\sqrt{3}+\sqrt{2})}=\frac{1}{2}.$$

$$\left(\sqrt{2+\sqrt{2+\sqrt{2}}}\right)^3-3\sqrt{2+\sqrt{2+\sqrt{2}}}$$

$$=\sqrt{2+\sqrt{2+\sqrt{2}}}\left\{2+\sqrt{2+\sqrt{2}}-3\right\}$$

$$=\sqrt{2+\sqrt{2+\sqrt{2}}}\sqrt{3+\sqrt{2}-2\sqrt{2+\sqrt{2}}}$$

$$=\sqrt{6+2\sqrt{2}-4\sqrt{2+\sqrt{2}}+3\sqrt{2+\sqrt{2}}+\sqrt{2}}$$

$$\left[\sqrt{2+\sqrt{2}}-2\left(2+\sqrt{2}\right)\right.$$

$$=\sqrt{2-\sqrt{2+\sqrt{2}}+\sqrt{2}\sqrt{2+\sqrt{2}}}$$

$$=\sqrt{2+\sqrt{2+\sqrt{2}}(\sqrt{2}-1)}$$

$$=\sqrt{2+\sqrt{2+\sqrt{2}}\sqrt{3-2\sqrt{2}}}$$

$$=\sqrt{2+\sqrt{2-\sqrt{2}}}.$$

(8) Discount on £567 for one year at given rate is £$\frac{5103}{209}$.

$\therefore$ time required $=\frac{34\frac{5}{7}}{\frac{5103}{209}}$ years $=1\frac{2}{7}$ years.

(9) £1$=\frac{40}{9}\times\frac{112\frac{1}{2}}{100}=\frac{40}{9}\times\frac{225}{100}$

$\therefore$ £18 19s.$=\frac{40}{9}\times\frac{225}{200}\times 18\frac{19}{20}=\frac{40}{9}\times\frac{225}{200}\times\frac{379}{20}=\frac{379}{4}=\$94.75.$

(10) $\dot{6}\dot{7}=\frac{67}{99}$, $\dot{1}\dot{4}=\frac{13}{90}$.

(1) $\cdot\dot{9}285714 = \cdot92857142$

$\cdot82\dot{1}42857 = \cdot82\dot{1}42857$

$\cdot\dot{4}8 = \cdot48484848$

$2\cdot\dot{8}\dot{7} = 2\cdot\overline{87878787}$

$5\cdot11363636$

(3) $\cdot1\dot{6}\dot{3} \times \cdot0\dot{6} = \cdot0099173553\ldots.$

(4) $1\cdot015873\dot{}\div1\cdot636904761\dot{} = 1\frac{15873}{999999}\div1\frac{636904698}{999999900}$

$= \frac{\frac{169312}{1015872}}{\frac{999999}{111111}} \times \frac{\frac{111111100}{999999999}}{\frac{1636904598}{272817433}} =$

(11) $\cdot00776$ days = error made each year;

$\therefore$ in $\frac{1}{\cdot00776}$ years this error will amount to a day

$= 128\frac{8}{97}$ years.

(12) $\sqrt[3]{\frac{2}{3}} = \sqrt[6]{\frac{4}{9}}$, $\sqrt{\frac{1}{3}} = \sqrt[6]{\frac{1}{27}}$; $\therefore \sqrt[3]{\frac{2}{3}}$ is the greater.

XVII. (p. 285.)

(1) 10 men.

(2) $\frac{21164}{26312}, \frac{18975}{26312}, \frac{21160}{26312}$

difference of 1st two $= \frac{2189}{26312}$,

difference of 2d two $= \frac{2185}{26312}$

fraction required $= \frac{2189}{2185}$.

(3) 1600 ounces, 4840 s. yds. (4) 3·04; 30·4.

(5) £9 5*s.* $2\frac{3}{10}$*d.* (6) \$254.60.

(7) 4 women = 3 men; $\therefore$ 2 women = $1\frac{1}{2}$ men

5 boys = 3 men; $\therefore$ 3 boys = $1\frac{4}{5}$ men

6 girls = 3 men; $\therefore$ 4 girls = 2 men

1 man + 2 women + 3 boys + 4 girls = $6\frac{3}{10}$ men

3 men do it in 60 days

1 " " 180 "

$6\frac{3}{10}$ " " $\frac{180}{6\frac{3}{10}} = 28\frac{4}{7}$ days.

(8) Difference = £2 9*s.* $3\frac{3}{8}d.$

(9) £315 10*s.* 8*d.* (10) £12 5*s.*

XVIII. (p. 286.)

(1) (1) $\frac{23760}{26136}=\frac{10}{11}.$

(2) $\left(\frac{2}{7}\text{ of }5\frac{2}{11}\right)+\frac{1}{3}\text{ of }\left(2\frac{1}{2}+6\frac{1}{4}\right)=\frac{2}{7}\text{ of }\frac{57}{11}+\frac{1}{3}\text{ of }\frac{35}{4}$
$=1\frac{37}{77}+2\frac{11}{12}=4\frac{367}{924}.$

(3) $\cfrac{1}{2+\cfrac{1}{3+\cfrac{1}{4+\frac{1}{5}}}}=\cfrac{1}{2+\cfrac{1}{3+\frac{5}{21}}}=\frac{1}{2+\frac{21}{68}}=\frac{68}{157}.$

(4) $\left(\frac{7}{6}\text{ of }\frac{1}{2}\text{ of }\frac{3}{10}\right)\div\left(\frac{6}{11}\text{ of }\frac{7}{8}\text{ of }\frac{9}{2}\right)=\frac{11}{135}.$

(5) $\cfrac{\frac{13}{21}\times\frac{1}{2}-\frac{11}{14}\times\frac{1}{3}}{\frac{16}{21}\times\frac{1}{2}-\frac{13}{14}\times\frac{1}{3}}=\frac{13-11}{16-13}=\frac{2}{3}.$

(2) (1) £$4\frac{1}{6}$ = £4 3*s.* 4*d.*, $11\frac{1}{3}s.=11s.\ 4d.$, $7\frac{9}{12}d.=7\frac{3}{4}d.$;
$\therefore$ £$4\frac{1}{6}+11\frac{1}{3}s.+7\frac{9}{12}d.$ = £4 15*s.* $3\frac{3}{4}d.$

(2) $\cfrac{1416\text{ ac., }2\text{ ro., }16\text{ p.}}{\frac{1}{8}\text{ of }(4\text{ ac., }3\text{ ro., }27\text{ p.})}=\cfrac{226656\text{ po.}\times 8}{787\text{ po.}}$
$=\cfrac{1813248\text{ po.}}{787\text{ po.}}=2304.$

(3) $\cfrac{\frac{5}{8}\text{ of }1s.\ 9d.}{3s.\ 4d.}=\cfrac{\frac{5}{8}\text{ of }21}{40}=\frac{21}{64}.$

(4) (1) $2\cdot\dot{7}=2\cdot777\ldots$
$\dot{9}1\dot{8}$
$1\cdot86\dot{4}$

(2)
$91\cdot78$
$\cdot381$
9178
73424
27534
$34\cdot96818$

(3) $\cfrac{\cdot00044406}{\cdot0112}=\cfrac{4\cdot4406}{112}=\cdot039648\dot{2}142857.$

(4) $2\dot{2}\dot{7}=2\frac{27}{99}=2\frac{3}{11}$, $1\cdot1\dot{3}\dot{6}=1\frac{135}{990}=1\frac{15}{110}$,

$$2\dot{2}\dot{7}\div1\cdot1\dot{3}\dot{6}=2\tfrac{3}{11}\div1\tfrac{15}{110}=\frac{25}{11}\times\frac{110}{125}=2.$$

(5)

$$\begin{array}{rl}
\frac{1}{1} & =1\cdot\\
\frac{1}{1,2} & =\cdot5\\
\frac{1}{1,2,3} & =\cdot16666666\\
\frac{1}{1,2,3,4} & =\cdot04166666\\
\frac{1}{1,2,3,4,5} & =\cdot00833333\\
\frac{1}{1,2,3,\ldots.6} & =\cdot00138888\\
\frac{1}{1,2,3,\ldots.7} & =\cdot00019841\\
\frac{1}{1,2,3,\ldots.8} & =\cdot00002480\\
\frac{1}{1,2,3,\ldots.9} & =\cdot00000275\\
\frac{1}{1,2,3,\ldots.10} & =\cdot00000027\\
\frac{1}{1,2,3,\ldots.11} & =\cdot00000002\\
\hline & 1\cdot71828178
\end{array}$$

The decimals being successively obtained by dividing previous result by 3, 4, 5, 6, &c.

(5) 5 yds., 2 ft., 9 in.=17 ft., 9 in.

		5*s.*	$3\frac{1}{2}d.$
			17
		4 9	$11\frac{1}{2}$
6	$\frac{1}{2}$	2	$7\frac{3}{4}$
3	$\frac{1}{2}$	1	$3\frac{7}{8}$
		4 13	$11\frac{1}{8}$

(6) Mohur of Bengal has $\frac{993}{1000}$ of 191 grs., and £46 14*s.* 6*d.* is price of $\frac{11}{12}$ of 5760 grs.

required value is $\frac{\text{£46 14}s.\ 6d.}{\frac{11}{12}\text{ of }5760} \times \frac{993}{1000}$ of 191

$$= \text{£46 14}s.\ 6d. \times \frac{993 \times 191}{1000 \times 11 \times 480} = \text{£1 13}s.\ 6\tfrac{7}{8}\tfrac{2}{0}\tfrac{0}{0}\tfrac{1}{0}\tfrac{4}{0}\tfrac{7}{0}d.$$

(7) 120 : 111 :: 100 : £92 10*s.*

(8) £1000 ·03 = £30·00 = 1st income.

100 × 8 = 800 = amt. of stock held in 2d case.

800 ·04 = £32·00 = 2d income.

£2 = difference of incomes.

s. 6*d.* is

d.

n 2d case.