8. What sum of money at 3½% per annum, simple interest, will amount to £13,083 1s. 6¾d. in 3 years and 146 days?

9. Find to two places of decimals the diagonal of a face of a cube which contains 95443·993 cubic inches.

10. Find the value of $7 + \cfrac{1}{7 + \cfrac{1}{7 + \cfrac{1}{7 + \frac{1}{7}}}}$ × 1 ton, 2 cwts., 3 qrs., 11lb, in tons.

11. Multiply 31·027 by 0·0057, and divide the result by 27·64899.

12. Find the value of—

$$\frac{\frac{1}{12} + \frac{1}{17}}{\frac{1}{19} + \frac{1}{21}} \times \frac{\frac{1}{5} + \frac{1}{7}}{\frac{1}{3} + \frac{1}{4}} \times £56\ 8s.\ 0\tfrac{1}{4}d.$$

13. Find the compound interest on £104,166 13s. 4d. for four years at 3% per annum.

14. If £10,425 in 3½ per cents. be sold out at 102⅜, and the proceeds invested in 2½ per cents. at 69⅜, what will be the change of income, brokerage of ⅛ per cent. being charged on each transaction?

SOLUTIONS.

1. Tank holds 8575 quarts; 4 quarts weigh 10lbs, ∴ 1 quart weighs $\frac{10}{4}$lbs.
Weight of water = (85750÷4)lbs.
∴ No. cubic feet in tank = $85750 \div 4 \times \frac{4}{10} = 8585 \div 25 = 343 = 7^3$
∴ length of edge = 7 feet.

2. He went 17 quarter miles in 17 minutes, ∴ average rate = ¼ mile per minute. The middle minute must have been travelled at the average rate, *i.e.*, during the ninth minute he went ¼ mile = 440 yards. If D = decrease per minute in yards we have $440 - 8D = \frac{8}{9}(440 + 8D)$ ∴ $D = 13\frac{3}{4}$ yards.

3. Interest = $\frac{1}{9}$ loan; amount in 3 months = $\frac{10}{9}$ loan; amount in 1 year = $(\frac{10}{9})^4$ loan. Amount of 6561 in a year
$= (\frac{10}{9})^4 \times 6561 = 65{,}610{,}000 \div 9^4 = 10{,}000$
∴ Income = 10,000 − 6561 = £3439.

4.
$$\left.\begin{array}{rcl} 42\text{ in.} & : & 27\text{ in.} \\ 6\frac{1}{8}\text{ oz.} & : & \text{Ans.} \\ 45\text{ d.} & : & 77\text{ d.} \end{array}\right\} :: 98\text{d.} : 66\text{d.}$$
$$\text{Answer} = \frac{42 \times 6\frac{1}{8} \times 45 \times 66}{27 \times 77 \times 98} = 3\tfrac{3}{4}\text{ oz.}$$

5. Income = $2\frac{7}{8}\% = \frac{23}{800}$ capital; tax = $\frac{1}{20}$ income,
∴ tax = $\frac{1}{240} \times \frac{23}{800}$ capital = $\frac{23}{24} \times \frac{1}{8000}$ capital,
∴ capital = $\frac{23}{23} \times 8000$ tax = 8000 (tax + $\frac{1}{23}$ tax)
= 8000 × 4,024,921 " 12 " 6 = £32,199,373,000.

6. Observe that 4815 = 15 × 321; 3531 = 11 × 321; 6099 = 19 × 321,
∴ capitals are as 15, 11, and 19 shares of £321 each.
Then (15 × 17) + (11 × 25) + (19 × 10)
= 255 + 275 + 190 = 720 shares for 1 month.
∴ gains are $\frac{255}{720}$, $\frac{275}{720}$, $\frac{190}{720}$ of 1926.
i.e., A's = $\frac{51}{144}$, B's = $\frac{55}{144}$, C's = $\frac{38}{144}$ of £1926
= £682 " 2 " 6; £735 " 12 " 6; and £508 " 5, respectively.
Also 1926 ÷ 321 = 6 shares = profit,
i.e., 720 shares for 1 month, or 60 shares for a year, give 6 shares profit.
∴ rate of profit = $\frac{1}{10}$ or 10% on capital for a year.

7. £3511 " 10 " 6¾ − £3497 " 3 " 1½ = £14 " 7 " 5¼ = 13797 far.
2½% = $\frac{1}{40}$; and £3497 " 3 " 1½ = 3357270 far.
$\frac{13797}{335727} = \frac{3}{73}$, which must = $\frac{1}{10}$ × time in years.
∴ $\frac{3}{730} \times 365 = \frac{1}{40} \times$ time in days = $\frac{3}{2}$,
∴ time = 60 days.

8. $3\frac{1}{4}\% = \frac{13}{400}$; 146 days = $\frac{2}{5}$ year $3\frac{2}{3}$; = $\frac{11}{3}$.
Amount of £1 for given time $1 + \frac{13}{400} \times \frac{11}{3} = \frac{1243}{1200}$ principal
∴ principal = 2000 amount ÷ 2221
= 2000 / 13,083 " 1 " 6¾ ÷ 2221 = £11781 " 5 " 0 Answer.

9. Side³ = 95443·993, ∴ side = 45·7
(Diagonal of face)² = side² + side² (I. 47.)
= 2 side²
∴ diagonal of face = $\sqrt{2}$ × side = 1·41 × side.
= 1·41 × 45·7 = 64·437 nearly.

10. 1 ton, 2 cwts., 3 qrs., 11lb (long ton) = 2547lbs.
Fraction reduced = 18200 ÷ 2549.
Answer = 2547 × 18200 ÷ 2549lbs = 162½ cwt = 8⅛ tons.

11. 31·027 × ·0057 ÷ 27·64899 = ·00639.

12. Expression = $(\frac{3}{4} \times \frac{320}{321}) \times (\frac{1}{24}\frac{4}{3}) \times 54154$ farthings
= 43092 far. = £44 " 17 " 9.

13. Amount of £1 = $(1 + \frac{3}{100})^4$
= $1 + 4(\frac{3}{100}) + 6(\frac{3}{100})^2 + 4(\frac{3}{100})^3 + (\frac{3}{100})^4 = 1{\cdot}12550881$.
∴ Interest of £1 = ·12550881.
£104,166 " 13 " 4 = 100,000,000 farthings.
∴ Interest = 12550881 farthings = £13073 " 16 " 8½ Answer.

14. £10425 = 104¼ hundreds.
∴ First dividend = 104¼ × 3½ = 364⅞.
102⅜ − ⅛ = 102¼ = rate realized by sale of old stock.
69⅜ + ⅛ = 63½ = rate paid for new stock.
∴ Second dividend = $(104\frac{1}{4} \times 102\frac{1}{2}) \div (69\frac{1}{2} \times 2\frac{1}{2})$
= $\frac{3}{2} \times 102\frac{1}{4} \times 2\frac{1}{2} = \frac{7}{10}$.
Difference = $383\frac{7}{10} - 364\frac{7}{8} = 18\frac{9}{10}$ = £18 " 11 " 3 Answer.

SELECTED PROBLEMS,

SUITABLE FOR MATRICULATION AND TEACHERS' EXAMINATIONS.

I.—ARITHMETIC.

1. Investigate the rule for finding the square of a number exemplified in the following:—To find the square of 297.

297

49
126
28
81
36
4

Square = 88209

NOTE.—This is an easy application to arithmetic of the algebraical process $(a+b+c+\&c.)^2 = a^2 + 2ab + \&c. + b^2 + 2bc + \&c.$ the position of the figures being made to account for their local values.

2. The old standard bushel was defined by statute to contain 2,150 cubic inches but on examination it was found to contain only 2,124. By the Act of 1824, the bushel was declared to contain 2,218 cubic inches. Examine the real loss on the rental (1,075£) of a farm (which was calculated on a certain per centage of the selling price of the corn grown), supposing the price per bushel to remain the same.

NOTE.—First rental : second rental = 2,218 : 2,124,
i.e., £1,075 : " = " " &c.

3. Having three separate parcels of powders weighing respectively 84lbs, 3oz., 15dwt., Troy; 45lbs, 10oz., 4dr., 12grs., Apothecaries; and, 32lbs, 7oz., 3·712drs., Avoirdupois; how can I subdivide them into parcels weighing each the same integral number of grains?

NOTE.—1lb Troy = 1lb Apoth. = 5760grs.; 1lb Avoir. = 7000 grs. Reduce each weight to grains and take the G. C. M.

4. The link of Gunter's chain being $7\frac{23}{25}$ inches, prove that ten square chains make an acre.
The Scotch ell being 37·069 inches, and 24 ells making the Scotch chain, what difference (in square feet) is there between 55 English and 42 Scotch acres?

NOTE.—1 link = 7·92 inches, ∴ 1 chain = 792 inches = 66 feet = 22 yards.
10 square chains = 220 × 220 square yards = 4840 square yards.
Scotch chain = 37·069 × 24 inches = 37·069 × 2 feet = 74·138 feet.
42 Scotch acres = 42 × 741·38 × 741·38 square feet; 55 English acres = 55 × 4840 × 9, &c.

5. A grocer buys a stock of tea, and sells ⅝ of its nominal amount at 82 cents per lb, thus clearing $190; he now calculates that if he sells the remainder at 85 cents per lb he will, on the whole, make 30% on his outlay; but he has forgotten to take into account a loss