

10. By selling tobacco at 1s. 3d. per pound a tobacconist gains 35 per cent.: what does his profit amount to on the sale of 4cwt. 11lb.?
11. A man invests £420 in the 3-per-cents at 90, sells out at 81, and reinvests in the 5-per-cents at 108. What is his last income?
12. Find the compound interest on £540 for 3 years at $2\frac{1}{2}$ per cent.
13. Four merchants, A, B, C, and D, join their capitals in the proportion of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$. At the end of twelve months they lose £120. What are their respective shares of the loss?
14. If 3 men and 11 boys working together can do 5 times as much work per hour as a man and a boy together, compare the work of a boy with that of a man.

Arithmetic.—For Senior Civil Service. Time allowed: 3 hours.

- Define *prime number, quotient, factor, decimal, ratio, power, cube root, discount*.
- A spirit lamp with a salted wick emits five hundred and ten billions of light-waves per second, the length of each wave being the forty-two thousand five hundredth part of an inch. Hence find the velocity of light in miles per second.
- How many sacks, each containing 1cwt. 1qr. 6lb., are required to make up 40 tons 3cwt. of coal?
- Find the value of $76\frac{2}{15}$ bales of wool at £17 16s. 8d. per bale.
- A sheet of ice is three-fourths of an acre in extent and one inch in thickness: find its weight, taking the weight of a cubic foot of ice to be 918oz.
- Divide the product of $1\frac{1}{4}$ of $(2\frac{1}{2}-1\frac{1}{3})$ and $(7\frac{1}{7}-6\frac{1}{4}) \div (4\frac{2}{3}-3\frac{2}{3})$ by their sum.
- A gentleman's pace is 2ft. 6in., a lady's pace $2\frac{3}{11}$ ft. How often will they step together in walking 1,000 yards?
- Reduce $\cdot 09$ of 1.83 of £1 6s. to the fraction of $\cdot 7027$ of $\cdot 336$ of £4 8s.
- A and B occupied a grass paddock, at a rent of 32 guineas for six months. For four months of the time B's stock was $\frac{5}{11}$ of A's; and for the remaining two months A's stock was $\frac{5}{11}$ of B's. Having given that the number of A's stock remained unaltered during the whole period, find the portion of the rent that each should pay.
- In a mile race "Sultan" can beat "Khedive" by 80 yards, and "Khedive" can beat "Mahdi" by 88 yards. By how much can "Sultan" beat "Mahdi" in a race of the same length?
- Find the amount, at compound interest, of £1,829 5s. for three years, at $3\frac{1}{2}$ per cent.
- A fruiterer, having bought a case of oranges at $4\frac{1}{2}$ d. per dozen, found, on opening the case, one-fifth of the whole to be unsaleable. He divided the rest into two equal portions, which he sold at the rates of eight for a shilling and twelve for a shilling respectively. Find his gain per cent.
- A person finds that he will have an income of £99 16s. 8d. a year more by investing his capital in New Zealand $3\frac{1}{2}$ -per-cents at $97\frac{1}{2}$ than in the Reduced $2\frac{1}{2}$ -per-cent. Consols at 98. How much capital has he to invest?
- An English merchant bought, at Bordeaux, 84 hectolitres of wine at 150fr. per hectolitre. He paid, for freight and charges, $22\frac{1}{2}$ per cent. on the cost price, and 2s. per gallon duty. At what price per dozen bottles must he sell the wine in order to make a profit of 32 per cent.? [1 hectolitre = 22 gallons; 1 gallon = 6 bottles; course of exchange, 25.16fr. for £1.]

Algebra.—Alternative with Arithmetic for Senior Civil Service. Time allowed: 3 hours.

- If $a - \frac{1}{2} = a + b = a - 2c = 0$, find the value of $(b^2 - c^2) \cdot [b^2 + c^2 - b(a - c)]$.
- Divide $\frac{1}{3}x^3 + \frac{1}{2}x^2y - \frac{2}{3}y^3$ by $\frac{1}{2}x + y$.
- If $s = \frac{1}{2}(a + b + c)$, show that $3a(s - b)(s - c) = [(s - b) + (s - c)]^3 - [(s - b)^3 + (s - c)^3]$.
- Resolve $x^5 + x^2$, $x^5 - x$, and $x^5 + x^3 + x$ into simple factors, and write down their lowest common multiple.

5. Simplify—

$$(a.) \quad \frac{a^2 - 3a + 2}{a^2 + 4a^2 - 5}$$

$$(b.) \quad \left\{ 1 - \frac{x^2 + y^2}{2xy} \right\} \div \left\{ 1 - \frac{2xy}{x^2 + y^2} \right\}$$

$$(c.) \quad \frac{1}{x+1 + \frac{1}{3x+1 + \frac{1}{8x}}}$$

6. Find the square root of $46 + 12\sqrt{14}$; also of $1 - x^2$ to four places.

7. Solve the following equations:—

$$(a.) \quad \frac{a}{x-a} - \frac{b}{x-b} = \frac{a-b}{x}$$

$$(b.) \quad 5x - \frac{21}{y-1} = 18; \quad x - (x-7)y = 13.$$

$$(c.) \quad \frac{4-x}{4+x} + \frac{3+x}{3-x} = \frac{2(6-x)}{7+x}$$

8. Divide M pounds among three persons, giving the first a pounds more than the second, and the second b pounds more than the third.

9. A passenger train and a goods train start from a station at the same hour for another station 180 miles distant, and the passenger train, by travelling 8 miles an hour faster than the other, reaches its destination $3\frac{1}{4}$ hours before it. Find the speed of each train.