10. A man invests £3,500, part in 3-per-cent. stock at 97, and the remainder in 4-per-cent. stock at 104: find how much he must invest in each in order that he may have equal returns from the two sources.

Arithmetic.—For Civil Service Senior. (Old Regulations). Time allowed: 3 hours.

[NOTE.—The full working of the questions, and not merely the results, must in all cases be given.]

1. A man sells a bale of goods at 7 per cent. profit, and another like it at 3 guineas profit, making a mean profit of 11 per cent.: what was the prime cost of one bale?

2. A business is started by three men with equal capitals: one of them, being manager, is to receive 16 per cent. on the total profits before the division is made: if his share altogether comes to £451, what were the total profits?

3. Simplify—

$$3\tfrac{4}{5} + \cfrac{5\tfrac{5}{6}}{7\tfrac{7}{8} + \cfrac{8\tfrac{9}{10}}{10\tfrac{1}{12} + \cfrac{13}{9\tfrac{3}{4}}}}$$

4. State and prove the rule for reducing a mixed repeating decimal to a vulgar fraction, and reduce to a vulgar fraction in its lowest terms $3{\cdot}8643\dot{0}1\dot{8}$.

5. A piece of land, 220 yards long by 176 yards wide, is rented for £26 19s.: how much is that an acre?

6. If when A makes a profit of £2, B makes £3; and when B makes £4, C makes £5; and when C makes £6, D makes £7: compare the profits of A, B, C, and D.

7. Find, by practice, the area of an estate which can be divided into $347\frac{3}{8}$ fields, each containing 6a. 3r. 15p.

8. The sea occupies $\frac{11}{14}$ of the surface of the globe; the surface of Asia is $\frac{121}{277}$ that of Europe; of Africa, $\frac{22}{7}$ that of Europe; of America, $\frac{111}{209}$ that of Europe; of Oceania, $\frac{31}{17}$ that of Europe; and the surface of Africa is 12,006,522 square miles: find the area of the surface of the globe.

9. Explain the meaning of the term, "arbitrated rate of exchange." The rate of exchange between London and Petersburg is $31\frac{7}{8}$d. for one rouble; between Vienna and Petersburg, $95\frac{5}{8}$ florins for 60 roubles; and between Paris and Vienna, $93\frac{1}{4}$ florins for 200 francs: find the arbitrated rate between London and Paris in francs for £1.

10. Find the difference between the amount of £494 10s. for two years at $3\frac{3}{4}$ per cent., and the present worth of the same sum at the same rate due at the end of two years.

11. The ceiling of a room is whitewashed, at $2\frac{1}{4}$d. the square yard; the walls are papered with paper $\frac{3}{2}$ yard wide, at $6\frac{3}{4}$d. the yard; and the floor carpeted with carpet $\frac{3}{4}$ yard wide, at 6s. 9d. the yard: find the total cost, if the room is 17 ft. 3 in. long, 10 ft. wide, and 16 ft. high, allowing for three windows (each 8 ft. by 4 ft.), two doors (each 6 ft. by 3 ft.), and a space (7 ft. high, 3 ft. long, and 1 ft. 4 in. deep) for a stove against the wall.

12. Silk is bought at 14s. $5\frac{1}{4}$d. the yard: at what price must it be sold to gain a clear profit of $17\frac{1}{2}$ per cent., after allowing a discount to the purchaser of $3\frac{3}{4}$ per cent.

Arithmetic and Algebra.—For Civil Service Senior (New Regulations). Time allowed: 3 hours.

1. A train 88 yards long takes 24 seconds to pass a second train 88 yards long, travelling in the same direction, and afterwards passes a third train 44 yards long, travelling in the opposite direction, in 6 seconds: how long will the second train take to pass the third train?

2. Find to the nearest penny the amount of £100 for 8 years, at 5 per cent. compound interest. Employ the shortest method, but show all your work. Use your result to find the present value of an annuity of £100 for 8 years, 5 per cent. being the current rate of interest.

3. A man has £3,000, which he invests in 3 per cent. stock at 96, and 6 per cent. stock at 108: what sums must he invest in the respective stocks to make $3\frac{1}{2}$ per cent. on the whole?

4. The Bastille was stormed on the 14th July, 1789: what day of the week was that?

5. Simplify $(a+b+c)^2 - 2(b+c)(a+b+c) + 2(b+c)^2$, and find the value of $(x-y)^2 + (x+y)^2 + 4(x+y)(x-y)$ when $x = \sqrt{2}$ and $y = \sqrt{3}$.

6. Define the lowest common multiple of a number of expressions.

Find the L.C.M. of $8x^3 + 38x^2 + 59x + 30$ and $6x^3 - 13x^2 - 13x + 30$

7. Multiply $a^{\frac{2}{3}} + b^{\frac{4}{3}} + c^2 - b^{\frac{2}{3}}c - ca^{\frac{1}{3}} - a^{\frac{1}{3}}b^{\frac{2}{3}}$ by $a^{\frac{1}{3}} + b^{\frac{2}{3}} + c$

8. Extract the square root of—

$$x^4 + \frac{1}{x^4} + 2x^3 - \frac{2}{x^3} + x^2 + \frac{1}{x^2} + 2x - \frac{2}{x}$$

9. Find the factors of—

$p^2 - pq - 2q^2$, $5xy - x^2 - 6y^2$, $16x^4 + 36x^2y^2 + 81y^4$, and $x^3 + 27y^3 - z^3 + 9xyz$

10. When is $a^n - b^n$ divisible by $a + b$? Prove that your answer is true universally.

11. Solve the equations—

(i) $\dfrac{(x-1)^2}{4} + \dfrac{(x-2)^2}{2} = x - \dfrac{(x-9)(x-8)}{4}$

(ii) $13x^2 - 90x - 7 = 0$

(iii) $5x^2 + 11x - 12\sqrt{(x+4)(5x-9)} = 36$

(iv) $\left.\begin{aligned} x^2 + 4xy &= 35 \\ 2xy - 16y^2 &= 1 \end{aligned}\right\}$