In the *first* series, the first term and com. diff. are 1 and $\frac{1}{3}$; in the *second*, 1 and $\frac{1}{2}$; then by the question,

$$\frac{n}{2}\left\{2+(n-1)\tfrac{1}{2}\right\}=4\frac{n}{2}\left\{2+(n-1)\tfrac{1}{3}\right\};$$

$\therefore\ n=37;\ \frac{3}{2}$.

8. The attraction of a planet upon a body at its surface varies directly as the planet's mass and inversely as the square of its radius. The length of a pendulum varies directly as the attraction and inversely as the square of the number of beats which it makes in a given time. The mass of the earth being 75 and of the moon 1, the radius of the earth 4,000 miles and of the moon 1,100, and the length of a pendulum which beats 5 times in 2 seconds at the earth's surface being 6.26 in., find the length of a second's pendulum at the moon's surface.

8. For earth we have $A=p\frac{M}{r^2}$, $l=p\frac{A}{n^2}$, by the question, where A = attractive force, M = mass, r radius, n number of beats, and l length of pendulum: from these $=ns$,

$A=\frac{\sqrt{939}}{1600\sqrt{2}}$, and p (constant factor)

$$=400\sqrt{\frac{313}{6}}.$$

For moon, we have

$$l=p^2\frac{M}{r^2n^2}$$

$$=160000\times\frac{313}{6}\times\frac{1}{1210000}$$

$$=6\cdot89 \text{ in.}$$

9. From a company of 15 men, 6 are selected each night as a guard. How often, respectively, will A and B be together (1) with C? (2) without C? (3) with C or D? (4) with C and D?

9. (1) $\frac{12,\ 11,\ 10}{\lfloor 3}$, (2) $\frac{14,\ 13,\ 12,\ 11}{\lfloor 4}$,

(3) $2\frac{12,\ 11,\ 10}{\lfloor 3}$, (4) $\frac{11,\ 10}{\lfloor 2}$.

10. Given $x^2+\frac{a-b}{ab}x+\frac{ab}{a-b}=0$.

(1) Express b in terms of a when the two values of x are (a) equal in magnitude and opposite in signs; (β) equal in magnitude and of like signs.

(2) If x_1, x_2 be the roots, express the value of $\frac{1}{x_1}+\frac{1}{x_2}$ in terms of a and b.

10. (1) (a) $\frac{b-a}{2ab}$ = either root;

$\therefore\ \frac{(b-a)^2}{4a^2b^2}=\frac{ab}{b-a}$ or $b=\frac{a}{1-a\frac{1}{4}}$,

(β) $b=\frac{a}{1+a\frac{1}{4}}$.

(2) $\frac{1}{x_1}+\frac{1}{x_2}=\frac{x_1+x_2}{x_1-x_2}=-\left(\frac{a-b}{ab}\right)^2$.

UNIVERSITY OF LONDON.

MATRICULATION EXAMINATIONS' JUNE, 1883.

ARITHMETIC AND ALGEBRA.

Examiners—Dr. John Hopkinson, M.A., F.R.S., and Benjamin Williamson, Esq., M.A., F.R.S.

1. From the sum of $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ of a pound subtract the sum of $\frac{1}{6}$, $\frac{1}{7}$, and $\frac{1}{8}$ of a guinea, and express the result as a fraction of five pounds reduced to its simplest form.

2. Express $\sqrt{\frac{0.678\times 9\cdot01}{0\cdot0234}}$ correctly to the nearest integer.

3. Reduce $\frac{0.01747}{0.002477}$ to a vulgar fraction in its simplest form.

4. A reduction of 10 per cent. in the price of coal would enable a purchaser to obtain for the sum of £13 10*s.* two tons more than at the higher price. What may be the price of coal before reduction?

5. Divide £11 4*s.* 0*d.* between three men, four women, five boys, and six girls, in such wise that each woman has one-fourth less than a man, each boy two-sevenths as much as a man and woman together, and each girl one-fifth as much as a man, woman, and boy together.

6. Simplify

$$\frac{\frac{x^2+y^2}{y}-x}{\frac{1}{y}-\frac{1}{x}}\times\frac{x^2-y^2}{x^2+y^2};\ \text{and}\ a\times\frac{1}{1+\frac{a+1}{3-a}}.$$