UNIVERSITY OF LONDON.

MATRICULATION EXAMINATION, JUNE, 1887.

ARITHMETIC AND ALGEBRA.

Examiners—Prof. A. G. Greenhill, M.A., Prof. M. J. M. Hill, M.A.

1. Find to six decimals the difference between the cube of 4.791288 and the square of 10.487655.

2. Calculate to five decimals the value of $\sqrt{\left(\frac{\sqrt{13}+3}{\sqrt{13}-3}\right)}$.

3. Determine the longest paying voyage, when freight is a penny a mile for 10 tons, of a steamer carrying 2,000 tons of coal and cargo; supposing the steamer to go 10 knots (miles) an hour, with a consumption of 60 tons of coal a day; the coal costing 12*s.* a ton, and the steamer £20 a day for wages, repairs, and interest on capital.

4. Prove that if $\frac{(a-b)(c-d)}{(a-c)(b-d)}=z$, then

(i.) $\frac{1}{x}$ is the resulting expression from an interchange of a, d, or b, c;

(ii.) $1-x$ from an interchange of b, d, or a, c;

(iii.) $\frac{x}{x-1}$ from an interchange of c, d, or a, b; but that no alteration takes place in the expression $\frac{(1-x+x^2)^3}{x^2(1-x)^2}$.

5. Prove that $(x^2+14x+1)^3 - (x^3-33x^2-33x+1)^2 = 108x(x-1)^4$.

6. Simplify:—

(i.) $\frac{x+8}{(x-15)(x-17)}+\frac{x+15}{(x-8)(x-17)}-\frac{x-15}{(x-8)(x+17)}$;

(ii.) $\frac{x^4-8x^2y^2+16y^4}{x^3-6x^2y+12xy^2-8y^3}$.

7. Find the sum of all the numbers from one to a thousand which are not divisible by 2 or 5.

8. Find the sum of a given number of terms of a geometrical progression, given the first term and the common ratio.

Reduce to a fraction in its simplest form the recurring decimal $.01234567\dot{9}$.

9. Solve the equations:—

(i.) $(3x-8)(3x+2)-(4x-11)(2x+1)=(x-3)(x+7)$;

(ii.) $2x+3y=5$, and $3x+5y=8$.

10. With 4¾ hours at his disposal, how far can a man go out by train at 20 miles an hour in order to walk back at 3¾ miles an hour?

GEOMETRY.

Examiners—Prof. A. G. Greenhill, M.A., Prof. M. J. M. Hill, M.A.

1. If one side of a triangle be produced, prove that the exterior angle is greater than either of the interior and opposite angles.

2. If two triangles have two angles of the one respectively equal to two angles of the other, and the sides adjacent to the equal angles in each equal, show that the triangles are equal in all respects.

3. Prove that equal triangles on the same base and on the same side of it are between the same parallels.

4. If a straight line be divided into two equal parts and also into two unequal parts, show that the rectangle contained by the unequal parts together with the square on the line between the points of section is equal to the square on half the line.

5. Prove that of all parallelograms with equal perimeter, the one which has the largest area is a square.

6. If from a certain point inside a circle more than two equal straight lines can be drawn to the circumference, prove that this point is the centre of the circle.

7. Prove that the opposite angles of any quadrilateral figure inscribed in a circle are together equal to two right angles.

8. A is the centre of a circle, B a point inside it. Through B a chord is drawn perpendicular to BA. Prove that if the tangents at its extremities intersect at C, then the rectangle contained by AB and AC is equal to the square on the radius of the circle.

Show further that if the tangents at the extremities of any other chord through B