7. Find the sum of ten numbers in Arithmetical Progression, the third being 10 and the seventh 30.

How many terms of the Geometrical Progression $1+3+9+27+$, etc., amount to 364?

8. From the following find x, y, z:

$$\left.\begin{aligned} x-y+z&=5\\ 3x+4y-5z&=13\\ x+\tfrac{1}{2}y+\tfrac{1}{3}z&=14 \end{aligned}\right\}.$$

9. Find the Greatest Common Measure of

$$\left.\begin{aligned} &x^4-10x^2+9\\ &x^4+7x^3+11x^2-7x-12\\ \text{and }&x^4+2x^3-16x^2-2x+15 \end{aligned}\right\}. \quad x-1.$$

10. A railway carries 1st, 2nd, and 3rd class passengers between A and B. The fares were one year in the ratio 7 : 5 : 4; the total number of passengers carried was 100,000, and the receipts £49,000. The next year the third class fare was reduced 25 per cent., and it was found that whilst the number of third class passengers increased 50 per cent., the second class diminished 10 per cent., and the first 5 per cent.; the number of passengers increased to 121,000, and the receipts to £49,300. Find the first, second, and third class fares and the numbers of passengers during the first year.

GEOMETRY.

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

1. Prove that the diagonals of a parallelogram bisect each other.

2. By aid of the preceding, or otherwise, draw through a given point a right line so that the part intercepted on it by two given intersecting right lines shall be bisected at the given point.

3. Prove that the angle included between the internal bisector of one base angle of a triangle and the external bisector of the other base angle is equal to half the vertical angle of the triangle.

4. Prove that the sum of the squares described on any two right lines is equal to double the square on half the sum of the lines together with double the square on half their difference.

5. Being given the base of a triangle and the sum of the squares described on its sides, find the locus of its vertex, and state when the locus becomes impossible.

6. Prove that the angle at the centre of a circle is double the angle at the circumference, on the same arc.

7. AB is any chord of a circle, and AC is the tangent at the point A; prove that the right line which bisects the angle BAC bisects also the corresponding arc of the circle.

8. Prove that the sum of a pair of opposite angles of a quadrilateral inscribed in a circle is equal to two right angles.

9. Construct an isosceles triangle having each of its base angles double the vertical angle.

10. Construct a triangle, being given its base, its area, and its vertical angle.

NATURAL PHILOSOPHY.

Examiners—Prof. W. G. Adams, M.A., F.R.S., and Professor William Garnett, M.A.

A.

1. Define acceleration, force, energy. A train which is uniformly accelerated starts from rest, and at the end of three seconds has a velocity with which it would travel through one mile in the next five minutes; find the acceleration.

2. Describe Attwood's Machine.

Two scale-pans, each weighing 2 oz., are suspended by a weightless string over a smooth pulley. A mass of 10 oz. is placed in one, and 4 oz. in the other. Find the tension of the string and the pressure on each scale-pan.

3. Distinguish between *mass* and *weight*.

A certain force acting on a mass of 10 lbs. for five seconds, produces in it a velocity of 100 feet per second. Compare the force with the weight of 1 lb., and find the acceleration it would produce if it acted on a ton.

4. The horizontal and vertical components of a certain force are equal to the weights of 5 lbs. and 12 lbs. respectively; what is the magnitude of the force?