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INTERMEDIATE CERTIFICATE EXAMINATION, 1927.

MATHEMATICS (II).

TUESDAY, 21*st* *JUNE*.—Afternoon, 3.30 to 6 p.m.

Seven questions may be answered. Somewhat higher marks will be awarded to the questions at the end of the paper.

Proofs need be given only when asked for.

Trigonometrical Tables may be obtained from the Superintendent.

1. Using ruler and compass only draw a perpendicular to a given straight line from a given point P outside of the line and prove your construction.

Show that no other line through P can be perpendicular to the line and that the point of the line nearest to P is the foot of the perpendicular from P.

2. Show that the area of a triangle is half that of any parallelogram of equal base and altitude.

ABC and DBC are two unequal triangles and E, F, G, H the mid-points of AB, AC, DB, DC respectively: prove that EFGH is a parallelogram and suggest what relation may exist between its area and the areas of the triangles ABC and DBC.

3. Two sides of a triangle b and c and the angle A between them are known: write down expressions for a (i) when A is acute; (ii) when A is obtuse.

In a triangle ABC, BC=10″, CA=13″, AB=15″, and BD is drawn perpendicular to CA: calculate the lengths of AD and CD and hence find from the tables the number of degrees in each angle of triangle ABC.

4. Show geometrically the truth of the theorem

$$(x + y)^2 + y^2 \equiv 2\,(x + y)\,y + x^2$$

where x and y are positive.

5. Prove, for all cases, that the angle at the centre of a circle is double that at the circumference on the same arc.

ABC is a triangle having AC greater than AB. With A as centre and AB as radius a circle is described cutting CA in D and CA produced in D′ and BC in E. Find in terms of A, B and C, the angles of triangle ABC, the following angles :—

DBD′, DD′B, ADB, DBC, EAB, EAC.

6. Prove that, if the sum of two opposite angles of a quadrilateral is two right angles, the quadrilateral is cyclic.

ABCD is a parallelogram and AD is a chord of a circle which cuts AB in M and (i) DC in N, (ii) DC produced in N. Prove that in each case MBCN is concyclic. What does the theorem become when N coincides with D ?

7. Prove that the rectangles contained by the segments of two intersecting chords of a circle are equal.

O is the mid-point of AB, the side of a square ABCD inscribed in a circle : DO meets the circle again in R : show that OD = 5OR.

8. State and prove the relation between the sides of a triangle, the sines of the angles and the radius of the circumscribed circle.

ABCD is a square of side s units, M is the mid-point of AB : a circle is described passing through M, B, D : find its radius.

9. What is the area of the greatest triangle that can be made with two sides 43 ft. and 56 ft. ?

What is the perimeter of a triangle having the same two sides and half of the above area ?