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(Department of Education).

BRAINSE AN MHEÁN-OIDEACHAIS
(Secondary Education Branch).

INTERMEDIATE CERTIFICATE EXAMINATION, 1929.

MATHEMATICS (II).

TUESDAY, 18*th JUNE*.—AFTERNOON, 3.30 TO 6 P.M.

Each item (*a*), (*b*), (*c*), (*d*), (*e*), (*f*) in Section I. will be counted as a *half-question*. The total number of questions answered should not exceed *six*, every pair of items from Section I. being counted as a whole question.

(Candidates should see that answers to questions in excess of *six* are cancelled).

Mathematical Tables may be obtained from the Superintendent.

Candidates should state the text-book used in order to indicate the sequence followed.

SECTION I.

(Each item (*a*), (*b*), (*c*), (*d*), (*e*), (*f*) in this section carries 16 marks).

(*a*) Define a rectangle. Prove that the diagonals of a rectangle are equal.

(*b*) Show how to divide a given finite straight line into any number of equal parts. Give proof.

(*c*) Prove that the opposite angles of a cyclic quadrilateral are supplementary.

(*d*) In a triangle ABC, right-angled at C, AB is double BC. Prove that the angle ABC is double the angle CAB.

(*e*) Show that the sum of the angles of a polygon of n sides is 2 (n—2) right angles. Hence calculate the size of the angle of a regular pentagon.

(*f*) In a triangle ABC show how to find a point which is equidistant from the sides AB and AC and which is also equidistant from the points A and B.

Section II.

1. The sides of a triangle are 2, 3 and x inches long. Between what limits must x lie so that the triangle may be possible? Prove the theorem on which you base your answer. [33 marks].

2. On a straight line $2\frac{1}{2}$ inches long construct an *isosceles* triangle equal in area to a triangle whose sides are 2, 3 and 4 inches long respectively. (No proof is required, but the construction lines should be clearly shown). [33 marks].

3. AOB, COE are two straight lines which cut at O such that the angle AOC = 40 degrees, AO = 2·9 inches, OB = 1·4 inches, CO = 2·3 inches. Construct a circle to pass through A, B, C and to cut OE in D. Measure OD and verify by calculation. [33 marks].

4. Prove any geometrical theorem that will establish the identity $(x+y)^2 + (x-y)^2 \equiv 2x^2 + 2y^2$.

Or

Illustrate the identity geometrically. [33 marks].

5. Show how to construct a square equal to a given rectangle.

O is a point in a straight line AB. Find a point P in AB such that $OP^2 = AP.PB$. [33 marks].

6. The sides AB, BC, CA of a triangle ABC are 3, $3\frac{1}{2}$, 4 inches long respectively. Find (i) the locus of points which are equidistant from A and B and are at least 2 inches from C; (ii) the region containing all points that are not more than $2\frac{1}{2}$ inches from each of the vertices A, B, C. [33 marks].

7. Prove that the angles which a tangent to a circle makes with a chord drawn through the point of contact are equal to the angles in the alternate segments of the circle.

Two circles touch externally at O; through O are drawn straight lines POQ, ROS meeting one circle in P, R and the other in Q, S. Prove that the triangles ROQ, POS are equal in area. [33 marks].

8. If $\tan^2 A = 1 + 2 \tan^2 B$, show that $2 \cos^2 A = \cos^2 B$ and that $2(\cos^2 A - \sin^2 A) = \cos^2 B - \sin^2 B - 1$. [34 marks].

9. The angle of elevation of a tower viewed from a point A on the ground is 40 degrees and from a point B 100 feet nearer the tower is 80 degrees. Find by means of a scale drawing the height of the tower, and verify by calculation. [34 marks].