AN ROINN OIDEACHAIS
(Department of Education).

BRAINSE AN MHEÁN-OIDEACHAIS
(Secondary Education Branch).

INTERMEDIATE CERTIFICATE EXAMINATION, 1930.

MATHEMATICS (II).

TUESDAY, 17th 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 15 marks.)

(*a*) What are parallel straight lines ? Prove that if a straight line cuts two parallel straight lines the alternate angles are equal.

(*b*) AC and BD are two equal straight lines which bisect each other : prove that the figure ABCD is a rectangle.

(*c*) Prove that the internal bisectors of the angles of a triangle meet in a point.

(*d*) Show how to construct a triangle equal in area to any given quadrilateral.

(*e*) Give a geometrical construction for drawing a triangle ABC, right-angled at C, in which AC=3 inches and sin A=0·85.

(*f*) ABCD is a quadrilateral in which AB=CD. The straight lines bisecting AD, BC at right-angles meet at O. Prove that the angles AOB and COD are equal.

Section II.

1. Prove that in a circle the greater of two chords is that which is nearer to the centre.

Show how to draw the shortest chord through a given point in a circle. [33 marks.]

2. Through O, a fixed point, any straight line is drawn to meet a given circle at A and B: prove that the rectangle OA.OB is constant. [33 marks.]

3. Given two sheets of paper of the same size and shape, one of which is blank and on the other of which a triangle is drawn, what is the least number and the nature of measurements required to construct on the blank sheet a triangle having (i) the same *shape*, (ii) the same *shape* and *size*, (iii) the same *shape*, *size* and *position* relative to the paper, as the given triangle? Give reasons in each case with explanatory illustrations. [33 marks.]

4. ABC is a triangle in which AB, BC are equal sides. A point P moves in the plane of ABC so that the angle APB is equal to the angle BPC. Show that P may lie on part of the circumference of the circumcircle of the triangle ABC. What is the complete locus of P? [33 marks.]

5. Prove that a circle can be inscribed in any rhombus.

Show also that it is *not* possible to inscribe a circle in an equilateral figure of more than four sides unless in exceptional circumstances. What are these circumstances? [33 marks.]

6. Prove that in any triangle the square on the side opposite an acute angle is equal to the sum of the squares on the sides containing it diminished by twice the rectangle contained by one of these sides and the projection of the other upon it.

ABC is an acute-angled triangle. BD is perpendicular to and equal to BA and on the same side of it as C. BE is perpendicular to and equal to BC and on the same side of it as A. Prove that $ED^2+AC^2=2AB^2+2BC^2$. [33 marks.]

7. Draw to scale a quadrilateral ABCD having AB, BC 22 and 11 inches long respectively and the angles ABC, BCD and CAD 90, 100 and 90 degrees respectively. Measure CD and DA and verify by trigonometrical calculation. [33 marks.]

8. From the top of a tower 100 feet high a man observes that the angles of depression of the bottom and of the top of a vertical pole standing on the ground are 20 and 10 degrees respectively. Calculate the horizontal distance of the pole from the tower and the height of the pole. [34 marks.]

9. ABCD is a parallelogram in which AB, BC are x, y inches long respectively and the angle ABC equals θ. Two rectangles are formed, one by the internal bisectors and the other by the external bisectors of the angles of the parallelogram. Express the areas of these two rectangles in terms of x, y and θ and hence show that the ratio of these areas is the same for all values of θ. [34 marks.]