

# AN ROINN OIDEACHAIS

(Department of Education).

## BRAINNSE AN MHEADHON-OIDEACHAIS

(Secondary Education Branch).

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LEAVING CERTIFICATE EXAMINATION, 1936.

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PASS.

### MATHEMATICS

(GEOMETRY)

THURSDAY, 18th JUNE.—MORNING, 10 A.M. TO 12.30 P.M.

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Six questions may be answered.

Mathematical Tables may be obtained from the Superintendent.

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

1. Prove that a diameter of a circle subtends a right angle at any point on the circumference.

ABCD is a rectangle in which  $AB=a$  ins.,  $BC=b$  ins.; circles on AB, BC as diameters intersect again at P. Prove

(i) that P lies on AC,

(ii) that  $BP=ab/\sqrt{a^2+b^2}$  ins. [30 marks.]

2. Prove (i) that the medians of a triangle are concurrent and (ii) that they divide one another in the ratio 2 : 1.

Hence show that the sum of the medians of a triangle is greater than  $\frac{3}{4}$  of the perimeter. [30 marks.]

3. Define a "regular polygon."

Prove that the vertices of any regular polygon are concyclic. [30 marks.]

4. Show how to inscribe a regular ten-sided figure in a circle without using a protractor.

(Proof need not be given).

If the radius of the circle is 3 ins. calculate the length of the side of the regular decagon. [30 marks.]

5. Prove that a line drawn parallel to one side of a triangle divides the other sides proportionally.

ABC is a triangle in which  $AB=11$  ins.,  $BC=15$  ins.,  $\angle B=90^\circ$ . P and Q are points on BA, BC respectively such that  $BP=5$  ins.,  $BQ=12$  ins. PQ and AC, when produced, meet at R: find the length of QR.

[Hint: Through Q draw a line parallel to AB.] [30 marks.]

6. Prove that the areas of similar triangles are proportional to the areas of the squares on their corresponding sides.

Construct a triangle similar to and three times as large as a given triangle. [30 marks.]

7. Through a point P within a circle whose centre is Q and radius r any chord XPY is drawn: prove that  $XP \cdot PY = r^2 - QP^2$ .

Show how to draw a chord LPM so that  $LP=2PM$ .

[35 marks.]

8. Prove that  $\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$ , where  $90^\circ > A > B$ .

Hence find the value of  $\tan 15^\circ$  in its simplest surd form.

[35 marks.]

9. Prove that the area of a triangle ABC is  $\sqrt{s(s-a)(s-b)(s-c)}$ , where  $2s = a + b + c$ .

Calculate the length of the shortest altitude of the triangle whose sides are 8 ins., 6 ins., 3 ins. respectively. [35 marks.]

10. Show how to draw a *direct common tangent* to two circles.

An endless taut string, ABCDEFA, passes round two wheels, X, Y, as shown in the diagram. The radii of X and Y are 10 ins. and 6 ins. respectively and their centres are 24 ins. apart. Calculate the length of the string. [35 marks.]

