AN ROINN OIDEACHAIS

(Department of Education)

LEAVING CERTIFICATE EXAMINATION, 1959.

MATHEMATICS—GEOMETRY—PASS.

THURSDAY, 4th JUNE.—Morning, 10 to 12.30.

Six questions to be answered.

Mathematical Tables may be obtained from the Superintendent.

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1. If a straight line is drawn parallel to one side of a triangle, prove that it cuts the other sides proportionally.
   D, E, F are points on the concurrent straight lines OA, OB, OC, respectively, such that DE is parallel to AB and EF is parallel to BC. Prove that DF is parallel to AC.

[30 marks.]

2. Describe, with proof, how to draw a circle to touch the side BC of a triangle ABC and to touch the sides AB, AC produced.
   If O is the centre of the circle and I is the incentre of the triangle ABC, show that the angle OBI is a right angle.

[30 marks.]

3. What is meant by saying that a given straight line is divided in medial section ?
   Explain how to construct an isosceles triangle having each of the base angles double the vertical angle, and give proof.

[30 marks.]

4. In a right-angled triangle if a perpendicular be drawn to the hypotenuse from the opposite vertex, prove that the triangles on each side of the perpendicular are similar to the whole triangle and to each other.
   AC is a chord of a circle of which AB is a diameter. The tangent at B meets AC produced at D. Prove that AB is a mean proportional to AC and AD.

[35 marks.]

5. Prove that similar polygons can be divided into the same number of similar triangles.

[35 marks.]

6. (i) Prove that $\cos 60° = \frac{1}{2}$, and find the values of $\cos 120°$, $\cos 240°$, $\cos 300°$.

(ii) Given that $180° = \pi$ radians, show that one radian equals $57° 18'$ approximately.

(iii) Write down the expansions of $\sin(A+B)$ and $\cos(A+B)$, and hence show that
$$\sin 40° + \cos 70° = \cos 10°.$$

[35 marks.]

7. Three warships are positioned at A, B, C, respectively, and a target-ship is situated at P. The points A, B, C are in one straight line in that order and $\angle BAP = 55°$, $\angle ABP = 100°$. If $AB = 2$ miles and $BC = 3$ miles, find in miles, correct to two decimal places, the distance each of the warships is from the target-ship.

[35 marks.