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(Secondary Education Branch).

INTERMEDIATE CERTIFICATE EXAMINATION, 1931.

MATHEMATICS (II).

MONDAY, 15*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 15 marks.)

(*a*) Prove that the line joining the mid-points of two sides of a triangle is parallel to the third side and equal to half it in length.

(*b*) PQRS is a cyclic quadrilateral : prove that the sum of the angles PQR and RSP is equal to two right angles.

(*c*) Use a geometrical method to construct a square equal in area to a rectangle 3″ long and 2″ wide. Measure the side of the square.

(*d*) Define a " parallelogram." Construct accurately a parallelogram having an area of 12 square inches, one side 3″ long and a diagonal 6″.

(*e*) Describe a triangle whose sides are 3″, 2·5″ and 2″ respectively in length, and draw a circle passing through the angular points of the triangle. Give proof.

(*f*) Using only ruler and compass make an angle whose tangent is 1·6, and use your diagram to find the sine and the cosine of that angle.

Section II.

1. Prove that if two circles touch one another externally the line joining the centres shall pass through the point of contact.

P is a point 1·8″ from the centre of a circle X of radius 1″. Through P draw a circle of radius 1·2″ touching the circle X. Explain clearly each step in the construction.

[33 marks.]

2. Draw a geometrical diagram illustrating the identity

$$x^2 - y^2 = (x+y)(x-y).$$

Mark on your diagram the parts corresponding to each of the algebraical quantities.

[33 marks.]

3. Through a point on the circumference of a circle a radius and a line perpendicular to the radius are drawn : show that that line is a tangent, *i.e.* that it does not intersect the circle.

The difference between the radii of two concentric circles is $3\frac{1}{2}″$ and a chord of the one 11″ in length is a tangent to the other. Find the length of the radius of the larger circle.

[33 marks.]

4. Prove that the angle which an arc of a circle subtends at the centre is double the angle which it subtends at the circumference.

A quadrilateral is inscribed in a circle : prove that the sum of the angles in the four segments outside the quadrilateral is equal to six right angles.

[33 marks.]

5. Prove that the area of a triangle is half that of a rectangle whose sides are the base and the height of the triangle.

From any point on the perimeter of a rectangle perpendiculars are drawn to the diagonals : show that the sum of those perpendiculars is constant.

[33 marks.]

6. A and B are points on the same side of a line XY. Show how to find a point P on XY such that AP+PB may be as small as possible. Give proof.

Show that that value of AP+PB is equal to $\sqrt{c^2+4ab}$, where A and B are c inches apart and a, b inches respectively from XY.

[33 marks.]

7. Describe a square such that two of its vertices lie on the circumference of a circle and the other two on a diameter. (Begin by constructing an angle whose tangent is 2).

[33 marks.]

8. In a triangle ABC, tan $B = \frac{19}{13}$, tan $C = \frac{11}{5}$ and AD, the perpendicular from A on BC, is 4″. Using ruler and compass only, construct the triangle accurately and measure AB, AC. Test your results by Trigonometrical calculation.

[34 marks.]

9. Express the length of the side of a triangle in terms of the other sides and their contained angle.

In the triangle ABC, AB$=4$, AC$=3\frac{1}{2}$, angle A$=120°$: find by calculation the length of the side BC and the number of degrees in the angle ABC.

[34 marks.]