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(Department of Education).

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INTERMEDIATE CERTIFICATE EXAMINATION, 1925

MATHEMATICS (II).

FRIDAY, 19*th JUNE*.—MORNING, 10 A.M. *to* 1 P.M.

EIGHT *questions may be answered, and the marks will be awarded on the first* EIGHT *answers left uncancelled.*
Mathematical Tables may be obtained from the Superintendent.

1. Solve, diagrammatically or otherwise:—A room facing south measures 18 feet from front to back, and the tops of the windows are $9\frac{1}{2}$ feet above the floor. At mid-winter, when the sun is directly in front, the sunlight reaches to a height of $5\frac{1}{2}$ feet on the opposite wall. At mid-summer, when the sun is again due south, its altitude has increased by $46\frac{1}{2}$ degrees: how far across the room will the sunlight reach?
Use the tables to find the noon angle of elevation of the sun at midwinter.

2. P is joined to two points A and B; a point Q is taken within the triangle PAB: prove that $QA + QB$ is less than $PA + PB$.
P is a point outside a quadrilateral $ABCD$. Find a point Q such that the sums of its distances from the vertices of $ABCD$ is less than the sum of the distances of P from the same points. For what position of Q will this sum be least?

3. Construct accurately triangles having dimensions:—
(i) $\Delta\ ABC$: $BC = 2$ ins., area of triangle 2 sq. ins., angle $B = 30°$.
(ii) $\Delta\ DEF$: angle $E = 30°$, $DE = 1{\cdot}7$ ins., $DF = 1{\cdot}3$ ins.

(iii) $\Delta\ PQR : PQ = 2$ ins., area $= 2$ sq. ins., angle $R = 30°$.

Is there an uncertainty about any one of the triangles, and, if so, why?

4. Prove that parallelograms on the same base and of equal altitude are equal in area.

Find a point equidistant from three sides of a parallelogram, and show that the lines bisecting, internally or externally, the angles of a parallelogram form a rectangle the diagonals of which are parallel to the sides of the parallelogram.

5. An external angle of a quadrilateral is equal to the opposite interior angle: show that the quadrilateral is cyclic.

AB and AC are two straight lines, and P is a point on the side of AC remote from AB: through P draw a line cutting AC in X and AB in Y such that the rectangle $PX \,.\, PY$ may be of given area.

6. Given that $a + b = c$, find the minimum value of $a^2 + b^2$.

Construct a square, being given the point of intersection of the diagonals and a point on each of two adjacent sides.

7. On a line 0·7 inch long describe accurately a regular pentagon. Show all steps in the construction, and give proof.

Two diagonals AC and BD of a regular pentagon $ABCDE$ intersect at X: show that the rectangle

$$AC \,.\, CX = AX^2.$$

8. Construct angles A, B, C, such that $\cos A = 0{\cdot}625$, $\tan B = 3{\cdot}74$, and $\operatorname{cosec} C = 2{\cdot}5$, and calculate the values of $\sin A$, $\cos B$, and $\tan C$.

A circle, centre O and radius OX, 5 feet, has OX produced to A and to B such that $OA = 12$ ft. and $OB = 18$ ft. From A and B tangents AP and BQ, both on the same side of OA, are drawn to the circle: find the length of the arc PQ.

9. A tunnel connecting two places M and N has to be bored through a mountain. To get from M to N over the mountain one has to walk 5·17 kilometres upwards at an angle of 23°, and then 2·89 kilometres downwards at an angle of 34° with the horizon, the paths being all in one vertical plane. Calculate the length of the tunnel, the difference of level of its two ends, and the inclination of the tunnel to the horizontal.