S 32

OXFORD LOCAL EXAMINATIONS

SCHOOL CERTIFICATE

FRIDAY, JULY 8, 1949

TIME ALLOWED—$2\frac{1}{4}$ HOURS

Geometry

[Write GEOMETRY at the head of each sheet of your answers.

No credit will be given for any attempt at a question in Practical Geometry if any of the construction lines are erased. When parallels or perpendiculars are drawn the method used must be stated.

The use of a straight edge or compasses must in all cases be indicated by a drawn straight line or arc, that is, any constructed point must be shown as the intersection of two lines, not as a dot on one line. It is unnecessary to draw very exact figures except in Questions 3, 4, and 7.]

Mathematical tables may **not** *be used.*

1. Draw a circle of radius 2 in. with centre O and inscribe in it a regular hexagon $ABCDEF$. State briefly your method of construction.

Prove that

(i) the triangles ABC, AOC are congruent;

(ii) the area of the hexagon is twice the area of the triangle ACE;

(iii) the length of AC is $2\sqrt{3}$ in.

2. Prove that, if one pair of opposite sides of a quadrilateral are equal and parallel, then the other pair of sides are parallel.

The two parallelograms $ABCD$, $ABLM$ have a common side AB. Prove that the quadrilateral $CDML$ is a parallelogram and that the triangles ADM, BCL are congruent.

3. $ABCD$ is a parallelogram in which $AB = 3{\cdot}5$ in., $AD = 2{\cdot}5$ in., and the perpendicular distance between the sides AB and CD is 2 in. Construct the parallelogram, and give a brief description of your construction. Calculate, to the nearest tenth of an inch, the lengths of the diagonals AC and BD.

4. Draw a line AB of length 4 in. and construct a semicircle of which AB is a diameter. What is the locus of the centre of the circle of radius 0·75 in. which touches the semicircle internally? Construct the two circles of radius 0·75 in. which touch the semicircle and its diameter AB and lie between them. Give a brief description of your construction and measure the distance between the centres of the two circles.

[Only TWO of Questions 5, 6, 7 are to be attempted.]

5. Prove that, if a straight line touches a circle and from the point of contact a chord is drawn, the angles which this chord makes with the tangent are equal to the angles in the alternate segments.

ABC is a triangle. The tangent at A to the circumcircle of the triangle meets BC produced at O. The circle with centre O and radius OA cuts BC at L and BC produced at M. Prove that AL and AM are the internal and external bisectors of the angle BAC.

6. Prove that, if two triangles are equiangular, the corresponding sides are proportional.

AB and XY are two parallel lines. C is the mid-point of AB; Z is the mid-point of XY. The lines AZ, XC intersect at P; the lines BZ, YC intersect at Q. Prove that (i) $AP:PC:CA = ZP:PX:XZ$ and (ii) PQ is parallel to AB.

7. AA', BB', CC', DD' are four parallel edges of a cube and they are each of length 2 in. $ABCD$ is a face of the cube. E, F are the mid-points of the edges CC', DD'. M is the centre of the rectangle $A'FEB'$. Find, by drawing and measurement or by calculation, the distance of M from (i) the corner A', (ii) the face $ABCD$, (iii) the edge AB.