PLANE GEOMETRY

Wednesday, June 17, 1925 — 9.15 a. m. to 12.15 p. m., only

Write at top of first page of answer paper (a) name of school where you have studied, (b) number of weeks and recitations a week in plane geometry.

The minimum time requirement is five recitations a week for a school year.

Name the author of the textbook you have used in plane geometry.

Answer eight questions, including not more than three from group I and at least one from group II.

Group I

Do not answer more than three questions from this group.

1 Prove that if two opposite sides of a quadrilateral are equal and parallel, the figure is a parallelogram. [$12\frac{1}{2}$]

2 Prove that an angle inscribed in a circle is measured by one half its intercepted arc. Consider the three cases. [7, 3, $2\frac{1}{2}$]

3 Prove that if through a point outside a circle a tangent and a secant are drawn, the tangent is the mean proportional between the whole secant and its external segment. [$12\frac{1}{2}$]

4 Prove that the area of a triangle is equal to one half the product of its base and its altitude. [$12\frac{1}{2}$]

Group II

Answer at least one question from this group.

Problems in this group should be constructed accurately with ruler and compasses. Leave all construction lines on the paper.

5 Construct a square equal to a given oblique triangle. [$12\frac{1}{2}$]

6 a Given an angle, a point K on one of its sides and a line segment d. Find all points equally distant from the sides of the angle and at the distance d from point K. [$9\frac{1}{2}$]

b When will there be two points? one point? no point? [1, 1, 1]

Group III

Irrational results may be left in the form of π and radicals unless otherwise stated.

7 Given the triangle ABC with AC equal to BC. AC is extended any distance through C to D and D is joined to B. Prove that BD is less than AD. [$12\frac{1}{2}$]

8 ABCD is an inscribed quadrilateral. Arc $AB = 105°$, arc $BC = 60°$, and arc $CD = 50°$. Find (a) angle ABC, (b) the angles formed by chords AC and BD, (c) the angle formed by sides BC and AD extended to meet, (d) the angle formed by the tangent at B and side DC extended to meet. [3, 3, 3, $3\frac{1}{2}$]

9 A circular flower bed 30 feet in diameter is surrounded by a walk 10 feet wide. How many square feet are there in the surface of the walk? [$12\frac{1}{2}$]

10 ABCD is a square. Points K, L, M and N are taken on the sides AB, BC, CD and DA respectively so that $KB = LC = MD = NA$. Prove that the figure KLMN has all of its sides equal and all of its angles right angles. [6, $6\frac{1}{2}$]

11 One angle of a parallelogram is 60°. If the shorter side is 8 and the shorter diagonal 13, find the area of the parallelogram. [$12\frac{1}{2}$]

12 In the right triangle ABC, altitude CD is drawn to hypotenuse AB, $AC = 15$ and DB exceeds AD by 7. Find AD, BD and CD. [$6\frac{1}{2}$, 2, 4]