High School Department

163D EXAMINATION

PLANE GEOMETRY

Wednesday, March 28, 1900—9.15 a. m. to 12.15 p. m., only

Answer eight questions but **no more**, *including at least one from each of the three divisions. If more than eight are answered only the first eight answers will be considered. Draw carefully and neatly each figure in construction or proof, using letters instead of numerals. Arrange work logically. Each complete answer will receive 12½ credits. Papers entitled to 75 or more credits will be accepted.*

First division

1 Prove that if two parallel lines are cut by a third line the alternate interior angles are equal.

2 Prove that two triangles are equal if the three sides of one are equal to the three sides of the other, each to each.

3 Prove that through three points not in a straight line one circumference and only one can be drawn.

4 Prove that two triangles are similar if an angle of one is equal to an angle of the other and the sides including these angles are proportional.

5 Prove that the areas of two similar triangles are to each other as the squares of any two homologous sides.

Second division

6 The ratio of the sum of the interior angles of a polygon to the sum of the exterior angles made by producing each of the sides in succession is as 5 to 1; how many sides has the polygon?

7 B and C are the extremities of an arc of 120° on a circle whose radius is 2 inches; tangents at B and C meet at A. Find the perimeter of triangle ABC.

8 From A, a point without a circle and 9 inches from the circumference, a secant is drawn through the center O; AB, tangent to the circle at B, is 21 inches long. Find the area of triangle AOB.

9 Find one side of an equilateral triangle equivalent to a regular hexagon whose perimeter is 36 inches.

10 Find the area of a circle inscribed in a rhombus whose perimeter is 100 inches and longer diagonal 40 inches.

Third division

11 Show how to construct a line making an angle of 45° with a given line and tangent to a given circle.

12 Show how to construct a square, its diagonal being given.

13 Find the locus of the center of a circle with a given radius and tangent to a given circle *a*) internally, *b*) externally.

14 Prove that if the sides of any quadrilateral are bisected the figure formed by joining the adjacent points of bisection is a parallelogram.

15 A circle whose center is A is tangent internally at O to a larger circle whose center is B; the line OCD cuts the smaller circle at C and the larger at D. Prove AC parallel to BD.