*University of the State of New York*

## High School Department

175TH EXAMINATION

# PLANE GEOMETRY

**Wednesday,** September 24, 1902—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 Define *five* of the following: converse, angle, perpendicular, obtuse triangle, median, pentagon, sector.

2 Prove that the perpendicular is the shortest line that can be drawn to a straight line from an external point.

3 Prove that if two sides of a triangle are equal respectively to two sides of another, but the third side of the first triangle is greater than the third side of the second, the angle opposite the third side of the first triangle is greater than the angle opposite the third side of the second.

4 Prove that two triangles which have their sides respectively perpendicular are similar.

5 Prove that if from a point without a circle a secant and a tangent are drawn, the tangent is a mean proportional between the whole secant and its external segment.

**Second division**

6 It requires $41\frac{1}{7}$ rods of fencing to inclose a semicircular field; find the area of the field.

7 Two sides of a triangle are respectively 15 inches and 13 inches; the diameter of the circumscribed circle is $16\frac{1}{4}$ inches. Find the altitude on the third side of the triangle.

8 The center of a chord 10 inches in length is $1\frac{1}{2}$ inches from the circumference; find the diameter of the circle.

9 The area of a regular hexagon equals $24\sqrt{3}$; find the apothem of the hexagon.

10 Find the area of a circle circumscribed about an equilateral triangle whose side is $a$.

**Third division**

11 Show how to construct a square equivalent to $2\frac{1}{4}$ times a given square.

12 Show how to inscribe in a given circle a triangle similar to a given triangle.

13 Prove that if one leg of an isosceles triangle is the diameter of a circle the circumference bisects the base.

14 Prove that the perpendiculars drawn from two vertices of an acute triangle to the opposite sides divide each other into segments which are reciprocally proportional.

15 Prove that the star-shaped polygon formed by producing the sides of a regular hexagon is equivalent to twice the given hexagon.