SOLID GEOMETRY

Monday, June 15, 1914—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 solid geometry. The minimum time requirement is two recitations a week for a school year or four recitations a week for half a school year.

Name the author of the textbook you have used in your study of solid geometry.

Answer seven questions, selecting three from group I and two from each of the other two groups.

Assign 13 credits to each question in group I and 16 credits to each question in groups II and III.

Group I

1 Prove that if a straight line is perpendicular to each of two lines at their point of intersection, it is perpendicular to the plane of those lines.

2 Prove that a section of a circular cone made by a plane parallel to the base is a circle.

3 Prove that in two polar triangles each angle of the one is the supplement of the opposite side in the other.

4 Prove that the volume of a triangular pyramid is equal to one third the product of its base by its altitude.

Group II

5 Prove that if a plane and a line not lying in it are both perpendicular to the same plane, they are parallel.

6 Different cylinders are generated by the rotation of a rectangle about its side, according as it rotates about the longer or the shorter side. Prove that the curved surfaces generated in the two cases are equal.

7 Answer the following without figures or proof:

What is the locus of points (*a*) equidistant from two parallel planes, (*b*) equidistant from two intersecting planes, (*c*) equidistant from three points not in the same straight line, (*d*) equidistant from three planes meeting in a point, (*e*) equidistant from three nonparallel planes which are perpendicular to the same plane, (*f*) at a given distance from a given spheric surface, (*g*) at a given distance from a given line segment, (*h*) at a given distance from a given unlimited straight line?

Group III

8 Assuming that the earth is a sphere, prove that one half the earth's surface is included between the parallels 30° N. and 30° S. latitude.

9 *a* At 1½ cents per sq. ft, what will it cost to paint the inside of an open cistern having the form of a frustum of a cone of revolution whose depth is 7 ft, whose top diameter is 8 ft and bottom diameter 6 ft?

b How many gallons of water will the cistern hold if a cubic foot of water contains 7½ gallons?

10 If the slant hight of a cone of revolution is 18′, find the parts into which the slant hight is divided by a plane which is parallel to the base and which divides the convex surface in the ratio of 3 : 5.