

SOLID GEOMETRY

Monday, June 14, 1920—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 eight questions, including four from group I, two from group II and two from group III.

Group I

Answer four questions from this group.

- 1 Prove that a straight line perpendicular to one of two parallel planes is perpendicular to the other also.
- 2 Prove that the sum of any two face angles of a trihedral angle is greater than the third face angle.
- 3 Prove that every section of a circular cone made by a plane parallel to its base is a circle.
- 4 Prove that in two polar triangles each angle of one is measured by the supplement of the side lying opposite to it in the other.
- 5 a What is meant by the angle between a line and a plane?
b How would you locate the poles of a given great circle on a sphere?
c To what is the volume of any prism equal?
d To what is the lateral area of a frustum of a regular pyramid equal?
e To what is the volume of a circular cone equal?
f To what is the volume of a sphere equal?

Group II

Answer two questions from this group.

- 6 Prove that if a straight line is parallel to a plane, any plane perpendicular to the line is perpendicular to the plane.

7 Prove that any line drawn through the center of a parallelepiped, terminating in a pair of opposite faces, is bisected at that point.

8 The corner of a cube is cut off by a plane passed through the outer extremities of the three edges meeting at the given corner. What part of the volume of the cube is thus removed?

9 Prove that all tangents drawn to a sphere from any external point are equal.

Group III

Answer two questions from this group.

10 A sphere of diameter 30" is cut by a plane 12" from the center. Find the area of a square inscribed in the circle of intersection.

11 A water pail is in the shape of a frustum of a cone, the diameters of the bottom and top being 9" and 12" respectively, and the height of the pail 14". How many quarts does it hold? [One gallon contains 231 cubic inches.]

12 The sides of a spheric triangle on a sphere of radius 15" are 44° , 63° and 97° respectively. Find the number of square inches in the area of the polar triangle.

13 The cross section of a tunnel $2\frac{1}{2}$ miles in length is in the form of a rectangle 6 yards wide and 4 yards high, surmounted by a semicircle whose diameter is equal to the width of the rectangle. How many cubic yards of material were taken out in the construction of the tunnel? [1 mile = 1760 yards. Use $\pi = 3.1416$.]