

SOLID GEOMETRY

Monday, January 21, 1918—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 and four from group II.

Group I

Answer four questions from this group.

1 Prove that all the perpendiculars that can be drawn to a straight line at a given point lie in the plane perpendicular to the line at that point.

2 Prove that if two straight lines are cut by three parallel planes, the corresponding segments are proportional.

3 Prove that the lateral area of a cylinder of revolution is equal to the product of the circumference of its base and its altitude.

4 Prove that the volume of a circular cone is equal to one third the product of its base and its altitude.

5 The angle formed by two arcs of great circles is equal to the angle between the planes of the circles, and is measured by the arc of a great circle described from its vertex as a pole and included between its sides (produced if necessary).

6 Prove that the area of a sphere is equal to that of four great circles of the sphere.

Group II

Answer four questions from this group.

7 Prove that if a plane is cut by two concentric spheres, the sections are two concentric circles.

8 Prove that the area inclosed between the concentric circles referred to in question 7 is constant for all positions of the plane.

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9 $ABCD$ is a square whose area is 36 square inches. It is folded about AC until the plane of the triangle ABC is perpendicular to that of the triangle ADC .

a Prove that the tetrahedron $BADC$ has two of its faces equilateral triangles.

b Calculate the volume of this tetrahedron.

10 An irregular piece of stone placed in a cylinder partly filled with water causes the water to rise 7 inches; if the diameter of the cylinder is 10 inches, what is the volume of the stone?

11 How many bricks are necessary to build a chimney 80 feet high, in the shape of a frustum of a cone, if the outer diameters are 3 feet and 7 feet and the inner diameters are 2 feet and 4 feet? [Allow 12 bricks to a cubic foot.]

12 The gasoline tank of an automobile is a cylinder 35" long and 15" in diameter; how many gallons will it hold?