The University of the State of New York

248TH HIGH SCHOOL EXAMINATION

SOLID GEOMETRY

Friday, June 20, 1930 — 9.15 a. m. to 12.15 p. m., only

Instructions

Do not open this sheet until the signal is given.

Answer all questions in part I; in part II, answer three questions from group I and two questions from group II.

Part I is to be done first and the maximum time to be allowed for this part is one hour.

If you finish part I before the signal to stop is given you may begin part II. However, it is advisable to look your work over carefully before proceeding to part II, since *no credit will be given any answer in part I which is not correct and in its simplest form.*

When the signal to stop is given at the close of the one hour period, work on part I must cease and this sheet of the question paper must be detached. The sheets will then be collected and you should continue with the remainder of the examination.

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Fill in the following lines:

Name of school.....Name of pupil.....

Detach this sheet and hand it in at the close of the one hour period.

Part I

Answer all questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Each answer must be reduced to its simplest form.

Directions — Write on the dotted line at the right of each question the expression which when inserted in the corresponding blank will make the statement true.

1 Through a given point on a given line there can be but one . . . perpendicular to the line. *Ans*.....

2 Through a given point not on a given line there can be not more than one . . . parallel to the given line. *Ans*.....

3 If two planes intersect, it is possible to construct a . . . perpendicular to both planes. *Ans*.....

4 Through a given point there may be drawn . . . planes, each perpendicular to all the others. *Ans*.....

5 The locus of points equidistant from the three vertices of a triangle is a . . . . *Ans*.....

6 Two face angles of a trihedral angle are 60° and 20°. The third face angle must be between . . . degrees and . . . degrees and may have any value between these limits. *Ans*.....

7 Two vertical trihedral angles are always . . . . *Ans*.....

8 The area of the base of any regular pyramid is . . . than its lateral area. *Ans*.....

9 The base of a pyramid is one of the faces of a rectangular parallelepiped and its vertex is in the opposite face. The volume of the rectangular parallelepiped is exactly . . . times the volume of the pyramid. *Ans*.....

10 The dimensions of a rectangular parallelepiped are as 2:3:6. If its diagonal is 35, its longest dimension is . . . . *Ans*.....

11 If the radii of the bases of the frustum of a right circular cone are 3 inches and 6 inches and the altitude is 4 inches, then the lateral area is . . . square inches. [Leave answer in terms of π.] *Ans*.....

12 Any section of a circular cylinder made by a plane containing an element is a . . . . *Ans*.....

13 If a pyramid has for its base an equilateral triangle 4 inches on a side and its altitude is 6 inches, then its volume is . . . cubic inches. [Leave answer in radical form.] *Ans*.....

14 The area on the earth's surface included between the meridians of longitude 20° W. and 60° W. is . . . square miles. [Assume the radius of the earth to be 4000 miles and leave answer in terms of π.] *Ans*.....

15 If one side of a spheric triangle is 70°, then the angle opposite this side in the polar triangle contains . . . degrees. *Ans*.....

16 All parallel circles of a sphere have the same . . . . *Ans*.....

17 When the capacity of a spheric balloon is multiplied by 8, the surface is increased by . . . per cent. *Ans*.....

18 If the angles of a triangle on a sphere are 115°, 100° and 85°, its surface is . . . the surface of the sphere. *Ans*.....

19 Zones on the same sphere are equal only when their . . . are equal. *Ans*.....

20 A light is 6 feet from a wall. A piece of cardboard containing 18 square inches of surface is held between the light and the wall, 4 feet from the wall and parallel to it. The area of the shadow is . . . square inches. *Ans*.....

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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 five recitations a week for half a school year.

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

Part II

Answer five questions from part II, including three questions from group I and two questions from group II.

Group I

Answer three questions from this group.

21 Prove that if a line is perpendicular to a given plane, every plane that contains this line is perpendicular to the given plane. [12]

22 What is the locus of points

a at a given distance from a given point? [3]

b at a given distance from a given line? [3]

c equidistant from the sides of a plane angle? [3]

d equidistant from all points on a circle? [3]

23 Prove that any straight line drawn through the mid-point of a diagonal of a parallelepiped and terminated by two opposite faces is bisected by this point. [12]

24 If a right circular cylinder and a right circular cone, each of whose diameters is equal to an element, are inscribed in a sphere, prove that the total area of the cylinder is a mean proportional between the total area of the cone and the area of the sphere. [12]

Group II

Answer two questions from this group.

Leave all work on the paper; merely writing the answers is not sufficient. Irrational results should be left in the form of π and radicals unless otherwise stated.

25 The lateral edges of an oblique parallelepiped are 6 inches long and make an angle of 60° with the base. The base is a parallelogram 8 inches by 12 inches with an included angle of 45°. Find the volume of the parallelepiped. [12]

26 A right circular cylinder has a radius of 10 inches and is filled with water to a certain point. When a sphere is completely immersed in the water, the surface rises 5 inches. What is the radius of the sphere? [A solid when immersed in water displaces a volume of water equal to the volume of the solid.] [12]

27 Two concentric spheres have radii of 13 inches and 15 inches. A plane intersects the two spheres 12 inches from their common center. Find the area of the ring formed by this intersection. [12]