The University of the State of New York

247TH HIGH SCHOOL EXAMINATION

SOLID GEOMETRY

Friday, January 24, 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.

SOLID GEOMETRY

Friday, January 24, 1930

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 (questions 1–15) — 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 Every octahedron has . . . edges. Ans.............

2 A dihedral angle is measured by its . . . angle. Ans.............

3 A diagonal of a rectangular solid is 23 inches; if the base is 14 inches by 18 inches, then the altitude is . . . inches. Ans.............

4 The plane of a small circle is 4 inches from the center of its sphere. If the diameter of the sphere is 10 inches, the length of the circle is . . . inches. Ans.............

5 A prism and a pyramid have equal bases and the volume of the prism is 12 times the volume of the pyramid; the altitude of the prism is exactly . . . times the altitude of the pyramid. Ans.............

6 Angle A in spheric triangle ABC equals $70°$; the side $B'C'$ opposite A in the polar triangle has . . . degrees. Ans.............

7 The planes of any three great circles of a sphere intersect at the . . . of the sphere. Ans.............

8 The formula for the area of a zone of height H on a sphere of radius R is $S =$ . . . . Ans.............

9 The figure generated by revolving a right triangle about one of its legs is a right circular . . . . Ans.............

10 The diagonals of a rectangular parallelepiped intersect in a point that is equidistant from the . . . of the parallelepiped. Ans.............

11 Any section of a cone made by a plane through the vertex and cutting the base is a . . . . Ans.............

12 Two tanks in the form of cylinders of revolution are similar. The first holds 128 gallons and the second holds 250 gallons. If the first tank is 20 inches deep, the depth of the second tank is . . . inches. Ans.............

13 If each dimension of a cube is increased 20 per cent, then its total surface is increased . . . per cent. Ans.............

14 A line segment makes an angle of $60°$ with a plane. If its projection on the plane is $11\frac{1}{2}$ inches, then the line segment is . . . inches long. Ans.............

15 If a pyramid is cut by a plane parallel to its base, the edges and altitude are divided . . . . Ans.............

Directions (questions 16–20) — State whether *each* of the following statements is true or false.

16 Two lines parallel to the same plane are parallel. Ans............

17 The surface of a sphere of radius 5 inches equals the sum of the surfaces of two spheres having radii of 2 inches and 3 inches. Ans............

18 If a right section of a prism is a rectangle, the adjacent lateral faces are perpendicular to each other. Ans............

19 A regular prism can be inscribed in any *circular* cylinder. Ans............

20 The slant height of a regular pyramid inscribed in a cone is equal to an element of the cone. Ans............

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Friday, January 24, 1930

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 each of two intersecting planes is perpendicular to a third plane, their intersection is perpendicular to the third plane. [12]

22 Prove that the sum of the angles of a spheric triangle is greater than 180° and less than 540°. [12]

23 Prove that every section of a prism made by a plane parallel to a lateral edge is a parallelogram. [12]

24 What is the locus of points

a equidistant from two points? [3]

b equidistant from two intersecting planes? [3]

c equidistant from two parallel lines? [3]

d equidistant from three points not in one straight line? [3]

[Neither proofs nor drawings required]

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 A regular pyramid with a square base has each of its 8 edges equal to 4 inches. Find (*a*) its total surface, (*b*) its volume. [4, 8]

26 The sides of a spheric triangle on a sphere whose radius is 14 inches are 107°, 76° and 87°; find in square inches the area of the polar triangle. [Use $\pi = \frac{22}{7}$] [12]

27 Find the altitude of a cone of revolution if the radius of its base is 30 and if its volume equals the volume of a cylinder of revolution with diameter 36 and altitude 48. [12]

28 A light is 18 feet from the center of a sphere whose diameter is 12 feet; find the area of the illuminated surface. [Leave answer in terms of π.] [12]