The University of the State of New York

254TH HIGH SCHOOL EXAMINATION

SOLID GEOMETRY

Friday, June 24, 1932 — 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 and one half hours. Merely place the answer to each question in the space provided; no work need be shown.

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 and one half 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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Friday, June 24, 1932

Fill in the following lines:

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

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

Part I

Answer all questions in this part. Each correct answer will receive 2½ credits. No partial credit will be allowed. Each answer must be reduced to its simplest form. Irrational results may be left in the form of π and radicals unless otherwise stated.

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 If the projection of a line segment on a plane is equal in length to the line segment, then the line segment is . . . to the plane. *Ans*.....

2 Two lines meet at an angle of 71°. A plane perpendicular to one of them meets the other at an angle of . . . degrees. *Ans*.....

3 A line perpendicular to one of two perpendicular planes and not passing through their intersection is . . . to the other plane. *Ans*.....

4 Each of three lines is perpendicular to the other two; a plane parallel to two of them is . . . to the other. *Ans*.....

5 Of the following sets of angles (*a*) 120°, 130°, 140°; (*b*) 90°, 80°, 60°; (*c*) 60°, 130°, 70°; (*d*) 40°, 20°, 10°, only those given in . . . can be the three face angles of a trihedral angle. [Answer *a* or *b* or *c* or *d*.] *Ans*.....

6 The locus of the centers of all spheres tangent to two given parallel lines is a . . . . *Ans*.....

7 Two cubes have edges in the ratio 2:3 and the sum of their volumes is 280. An edge of the larger cube is . . . . *Ans*.....

8 The altitude of a prism is 8 and its base is an equilateral triangle each of whose sides is 10; the volume of the prism is . . . . *Ans*.....

9 A cylindric iron bar is 2 inches in diameter and 4 feet long. If a cubic inch of iron weighs ¼ of a pound, the weight of the bar is . . . pounds. *Ans*.....

10 The distances from the vertex of a circular cone to two sections parallel to the base which cut all elements are in the ratio 4:9; the areas of the sections are in the ratio . . . . *Ans*.....

11 The lateral area of a cone of revolution is 3 times the area of its base; if the radius of the base is 7, the slant height is . . . . *Ans*.....

12 The area of the base of a triangular prism is B and its altitude is h; its volume is . . . . *Ans*.....

13 The radius of the earth is approximately 4000 miles; the length of the parallel of latitude 60° North is approximately . . . miles. *Ans*.....

1951

14 From a sphere whose radius is 8 a circle is cut by a plane which is 5 from the center of the sphere. The area of this circle is . . . . *Ans*.....

15 The locus of points at a given distance from a given line is a . . . surface. *Ans*.....

16 The area of a spheric triangle is $\frac{1}{8}$ that of the sphere on which it lies; the sum of the angles of this triangle is . . . degrees. *Ans*.....

17 The area of a zone is $\frac{1}{5}$ that of the sphere on which it lies; if the radius of the sphere is $12\frac{1}{2}$, the altitude of the zone is . . . . *Ans*.....

18 An edge of a cube is 6; the volume of its circumscribed sphere is . . . . *Ans*.....

19 The base of a regular pyramid is a square 6 inches on a side. Its slant height is 5; the volume of the pyramid is . . . . *Ans*.....

20 An angle of a spheric triangle is 117°; in the opposite side of its polar triangle there are . . . degrees. *Ans*.....

Friday, June 24, 1932

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 two lines are parallel, every plane containing one of the lines, and only one, is parallel to the other. [10]

22 Prove that a spherical angle is measured by the arc of the great circle described from its vertex as a pole and included between its sides, produced if necessary. [10]

23 Line segment AB lies in plane MN. Prove that all lines perpendicular to AB at point B lie in a plane perpendicular to MN. [10]

24 Prove that the plane determined by one edge of a tetrahedron and the middle point of the opposite edge bisects the volume of the tetrahedron. [10]

Group II

Answer two questions from this group.

Leave all work on the paper; merely writing the answers is not sufficient. Use $\pi = \frac{22}{7}$ *unless otherwise stated.*

25 The radius of the base of a right circular cone is 7. A plane parallel to the base and 2 inches from it cuts off a frustum whose volume is $\frac{7}{8}$ that of the cone. What is the volume of the given cone? [10]

26 Find to the *nearest degree* the acute angle formed by two diagonals of a cube whose edge is 8. [10]

27 On a sphere whose diameter is 21 lies an equilateral spheric triangle. If this triangle should grow larger until each of its angles became double its former size, the area of the triangle would be multiplied by 5. Find its original area. [10]

194