PLANE GEOMETRY

Wednesday, January 21, 1931 — 9.15 a. m. to 12.15 p. m., only

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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 (questions 1–18) — 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 To construct the perpendicular bisector of a given line segment, it is necessary to find ... points through which this perpendicular must pass. *Ans............*

2 If two parallel lines are cut by a transversal, the bisectors of a pair of corresponding angles are ... to each other. *Ans............*

3 An angle that is one third of its supplement contains ... degrees. *Ans............*

4 If the bisectors of angles A and B of the equilateral triangle ABC meet at point D, then angle ADB contains ... degrees. *Ans............*

5 In a circle whose radius is 10 inches, a chord 16 inches long is ... inches from the center. *Ans............*

6 If the diagonals of a parallelogram are equal, the figure must be a .... *Ans............*

7 Tangents to a circle at the ends of a diameter are ... to each other. *Ans............*

8 The sides of a triangle inscribed in a circle cut off arcs that have the ratio $3:4:5$. The number of degrees in the largest angle of the triangle is .... *Ans............*

9 The geometric figure that is the locus of points at a given distance from a given point is a .... *Ans............*

10 In a right triangle one leg is 8 inches and the hypotenuse is 10 inches; the shorter segment of the hypotenuse made by the altitude on it is ... inches. *Ans............*

11 A diameter cuts another chord into two segments whose lengths are 2 inches and 6 inches. One segment of the diameter is 1 inch. The length of the diameter of the circle is ... inches. *Ans............*

12 A line parallel to one side of a triangle cuts a second side into segments 4 inches and 5 inches long. The length of the third side is 12 inches. The shorter segment of the third side is ... inches. *Ans............*

13 The base of a triangle is 8 and the altitude on it is 6. If the altitude on another side is 4, the length of that side is .... *Ans............*

14 The base of a triangle is 12. A line segment parallel to the base and ending in the other two sides cuts off a triangle whose area is one fourth the area of the given triangle. The length of the line segment is .... *Ans............*

[3] [OVER]

15 In the right triangle *ABC*, if angle *B* equals 30° and *AC* equals 2 inches, then the hypotenuse *AB* equals ... inches.

Ans............

16 The circumference of a circle is 18π; the area of the circle in terms of π is ....

Ans............

17 A sector whose angle is 40° is drawn in a circle whose radius is 10; the area of the sector in terms of π is ....
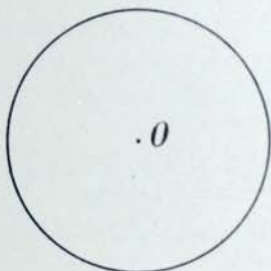
Ans............

18 Sides *AB* and *AC* of angle *A* are 14 and 10 respectively. As angle *A* increases from 0° to 180°, the distance from *B* to *C* increases from 4 to ....
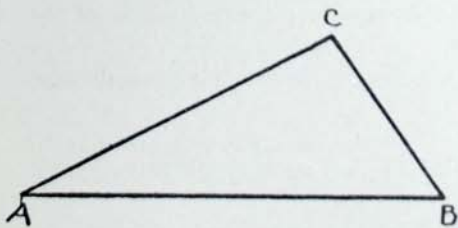
Ans............

Directions (questions 19–20) — Leave all construction lines on the paper.

19 Construct an inscribed square in the circle below.

.*0*

20 Through *C* construct the locus of the vertices of all triangles lying above *AB* that have *AB* for their base and have the same area as triangle *ABC*.

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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 plane geometry.

The minimum time requirement is five recitations a week for a school year.

<u>Name the author of the textbook you have used in plane geometry.</u>

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 triangles have an angle of one equal to an angle of the other and the sides including these angles proportional, the triangles are similar. [12]

22 Prove that the area of a regular polygon is equal to one half the product of its perimeter and its apothem. [12]

23 In rhombus $ABCD$, prove that the bisector of the exterior angle at vertex A is parallel to diagonal BD. [12]

24 Prove that if the tangents through the vertices of an inscribed isosceles triangle are extended to intersect, they form another isosceles triangle. [12]

25 In the isosceles triangle ABC, the base BC is produced through C to D, and AD is drawn; prove that AD is longer than AB. [12]

Group II

Answer two questions from this group.

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

26 The bases of a trapezoid are 6 and 16 and its altitude is 14; find the radius of a circle whose area equals the area of the trapezoid. [Use $\pi = \frac{2}{7}2$] [12]

27 Find the area of a rhombus if its shorter diagonal equals one of its sides and its longer diagonal is 12. [12]

28 With a given radius construct a circle tangent to a given line and passing through a given point whose distance from the given line is less than the given radius. [12]

29 Some Boy Scouts, wishing to determine the width of a river, select two points, A and B, directly opposite each other, one on each bank. Along the bank a line AC is run perpendicular to the line BA and a line CF sighted at right angles to line CB. Point D is located where CF crosses BA extended through A. AC is measured and found to be 30 yards and AD is 20 yards. Find BA, the width of the river. [12]

[2]