The University of the State of New York

262D HIGH SCHOOL EXAMINATION

PLANE GEOMETRY

Wednesday, January 23, 1935 — 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.

Group I

This group is to be done first and the maximum time allowed for it is one and one half hours.

If you finish group I before the signal to stop is given you may begin group II. However, it is advisable to look your work over carefully before proceeding, since *no credit will be given any answer in group 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 group 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.

Groups II and III

Write at top of first page of answer paper to groups II and III (*a*) name of school where you have studied, (*b*) number of weeks and recitations a week in plane geometry, (*c*) author of textbook used.

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

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.

Group I

Answer all questions in this group. Each correct answer will receive 2½ credits. No partial credit will be allowed. Each answer must be reduced to its simplest form.

Directions (questions 1–17) — 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. No work need be shown.

1 An angle formed by two chords intersecting within a circle is measured by one half the ... of the intercepted arcs. *Ans*.....

2 The area of a regular polygon is equal to one half the product of its ... and its apothem. *Ans*.....

3 If one acute angle of a right triangle is double the other, then the ratio of the shorter leg to the hypotenuse is .... *Ans*.....

4 If the diagonals of a rhombus are 8 and 12, then the area of the rhombus is .... *Ans*.....

5 The locus of the centers of all circles that are tangent to each of two given parallel lines is a .... *Ans*.....

6 If one angle of a parallelogram is a right angle, then the figure must be a .... *Ans*.....

7 Doubling the radius of a circle multiplies the circumference by .... *Ans*.....

8 In a circle whose radius is 12, the area of a sector whose angle is 30° is .... [Answer may be left in terms of π.] *Ans*.....

9 The area of an equilateral triangle is $64\sqrt{3}$; the length of a side is .... *Ans*.....

10 The length of a tangent drawn from a point 3 inches from a circle whose radius is 12 inches is ... inches. *Ans*.....

11 In the right triangle ABC, CD is the altitude upon the hypotenuse AB; then AC is the mean proportional between AD and .... *Ans*.....

12 Two isosceles triangles having a base angle of one equal to a base angle of the other are .... *Ans*.....

13 If in parallelogram $ABCD$ any point E is taken on side DC and if AE and BE are drawn, then the area of parallelogram $ABCD$ is exactly ... the area of triangle ABE. *Ans*.....

14 Two sides of a triangle are a and b. The third side must be less than .... *Ans*.....

15 If the number of sides of a polygon increases, then the sum of the exterior angles of the polygon .... [Answer *increases, decreases* or *remains the same.*] *Ans*.....

16 A photograph 2 inches by 3 inches is to be enlarged to 9 times its present area. The length of the shorter side will then be ... inches. *Ans*.....

17 If two adjacent sides of a parallelogram are 12 inches and 16 inches and the angle included between these sides is 31°, then the altitude on the longer side, correct to the *nearest inch*, is .... *Ans*.....

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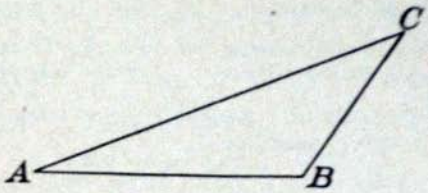
Directions (questions 18–20) — Leave all construction lines on the paper.

18 Circumscribe a circle about triangle ABC.

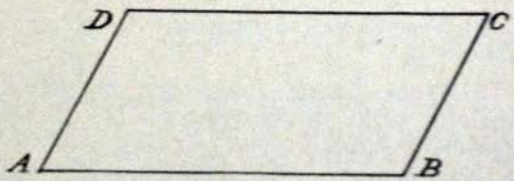


19 Divide line segment AB into parts that shall be proportional to the two given segments m and n.

m

n

20 Given parallelogram $ABCD$; by construction find in the side CD the point P which is equidistant from sides AB and AD.



See instructions for groups II and III on page 1.

Group II

Answer three questions from this group.

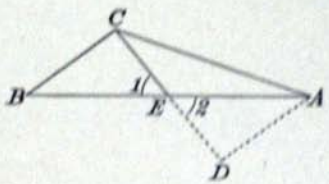
21 Prove that if two chords intersect within a circle, the product of the segments of one is equal to the product of the segments of the other. [10]

22 Prove that the diameter perpendicular to a chord of a circle bisects the chord and the arcs determined by the chord. [10]

23 Prove that two triangles are congruent if a side, an adjacent angle and the bisector of this angle in one triangle are equal respectively to the corresponding parts in the other triangle. [10]

24 Prove that the perimeters of two similar polygons have the same ratio as any two corresponding sides. [10]

25 The sum of any two sides of a triangle is greater than twice the median drawn to the third side.



Given: $\triangle ABC$ and median CE

To prove: $AC + CB > 2\,CE$

Construction: Produce CE its own length to D. Draw AD.

Below are given the statements for a proof of the above theorem but they are not arranged in logical order. *Do not copy the above material.* Rearrange the statements in logical order on your answer paper and assign a reason for *each* statement. [10]

$\angle 1 = \angle 2$
$AD = CB$
$AE = EB$
$\triangle ADE \cong \triangle CEB$

$AC + CB > CD$ or $2\,CE$
$AC + AD > CD$
$CE = ED$

Group III

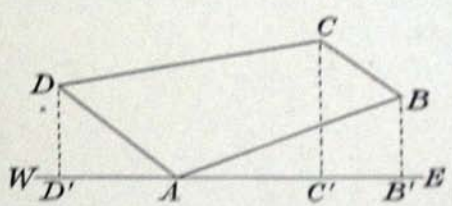
Answer two questions from this group.

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 inscribed in a circle subtend arcs of 48° and 136° and are on opposite sides of the center of the circle. Find (*a*) the number of degrees in each angle of the trapezoid, (*b*) the number of degrees in the angle formed by the two nonparallel sides produced to meet. [7, 3]

27 A surveyor wishes to determine the area of the quadrangular field $ABCD$. He draws a line EW passing through point A, and upon this line drops the perpendiculars DD', CC' and BB'. He then makes the following measurements:

$DD' = 8$ rods
$AD' = 10$ rods
$CC' = 12$ rods
$AC' = 12$ rods
$BB' = 7$ rods
$B'C' = 7$ rods



Find in square rods the area of the field $ABCD$ by means of trapezoids and triangles. [10]

28 Two sides of a triangle are 6 and 16 and the included angle is 60°.
a Find the altitude on side 16. [Answer may be left in radical form.] [3]
b Find the length of the third side of the triangle. [7]

29 A chord of a circle is 20.6 inches long and subtends a central angle of 62°.
a Find the radius of the circle. [Suggestion: Use numerical trigonometry.] [7]
b Using the value of the radius found in answer to *a*, find the length of the minor arc subtended by the chord. [Answer may be left in terms of π.] [3]