The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

GEOMETRY

Thursday, January 28, 2010—9:15 a.m. to 12:15 p.m., only

Student Name: Mr. Sibol

School Name: JMAP

Print your name and the name of your school on the lines above. Then turn to the last page of this booklet, which is the answer sheet for Part I. Fold the last page along the perforations and, slowly and carefully, tear off the answer sheet. Then fill in the heading of your answer sheet.

This examination has four parts, with a total of 38 questions. You must answer all questions in this examination. Write your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in Parts II, III, and IV directly in this booklet. All work should be written in pen, except graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc.

The formulas that you may need to answer some questions in this examination are found at the end of the examination. This sheet is perforated so you may remove it from this booklet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A perforated sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will *not* be scored.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice...

A graphing calculator, a straightedge (ruler), and a compass must be available for you to use while taking this examination.

The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

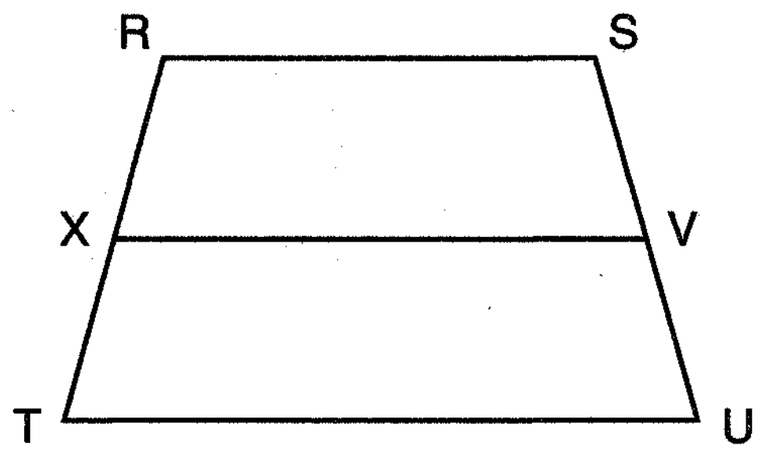
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer all 28 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. For each question, write on the separate answer sheet the numeral preceding the word or expression that best completes the statement or answers the question. [56]

Use this space for computations.

1 In the diagram below of trapezoid $RSUT$, $\overline{RS} \parallel \overline{TU}$, X is the midpoint of $\overline{RT}$, and V is the midpoint of $\overline{SU}$.



If $RS = 30$ and $XV = 44$, what is the length of $\overline{TU}$?

(1) 37
(2) 58
(3) 74
(4) 118

Because X and V are midpoints, $\overline{XV}$ is the midsegment of the trapezoid, and its length is equal to the average of $\overline{RS}$ and $\overline{TU}$.

$\frac{30+x}{2} = 44$

$30+x = 88$

$x = 58$

2 In $\triangle ABC$, $m\angle A = x$, $m\angle B = 2x + 2$, and $m\angle C = 3x + 4$. What is the value of x?

(1) 29
(2) 31
(3) 59
(4) 61

$x + 2x + 2 + 3x + 4 = 180$

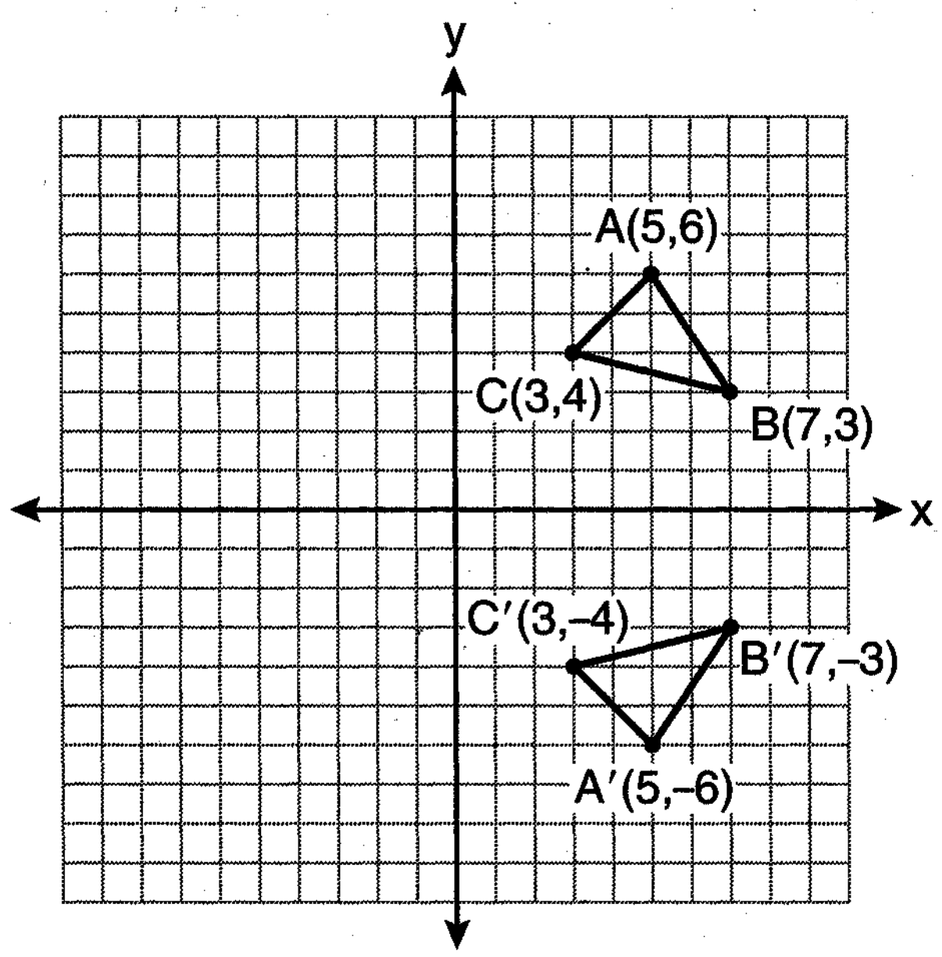
$6x + 6 = 180$

$6x = 174$

$x = 29$

Use this space for computations.

3 Which expression best describes the transformation shown in the diagram below?



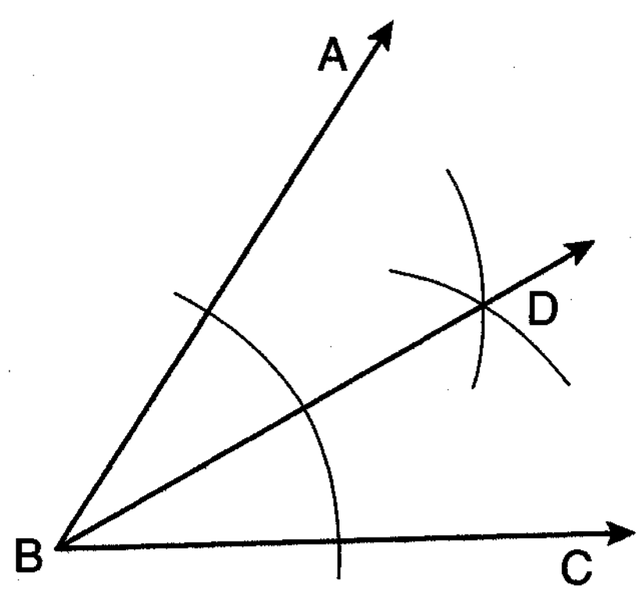
(1) same orientation; reflection

(2) opposite orientation; reflection

(3) same orientation; translation

(4) opposite orientation; translation

4 Based on the construction below, which statement must be true?



(1) $m\angle ABD = \frac{1}{2}m\angle CBD$

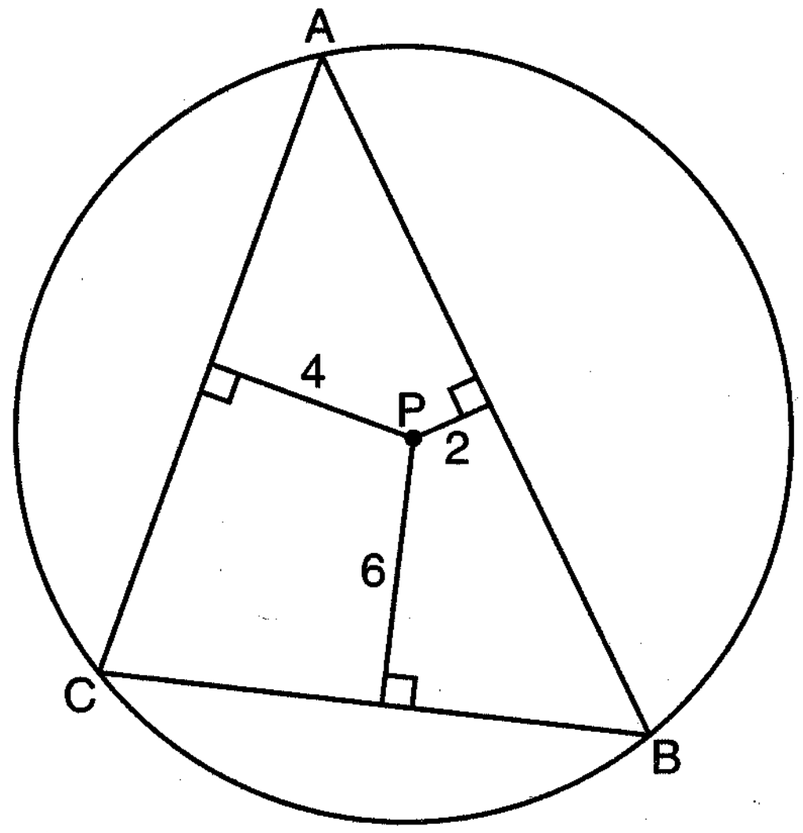
(2) $m\angle ABD = m\angle CBD$

(3) $m\angle ABD = m\angle ABC$

(4) $m\angle CBD = \frac{1}{2}m\angle ABD$

Use this space for computations.

5 In the diagram below, $\triangle ABC$ is inscribed in circle P. The distances from the center of circle P to each side of the triangle are shown.



The closer a chord is to the center of a circle, the longer the chord.

Which statement about the sides of the triangle is true?

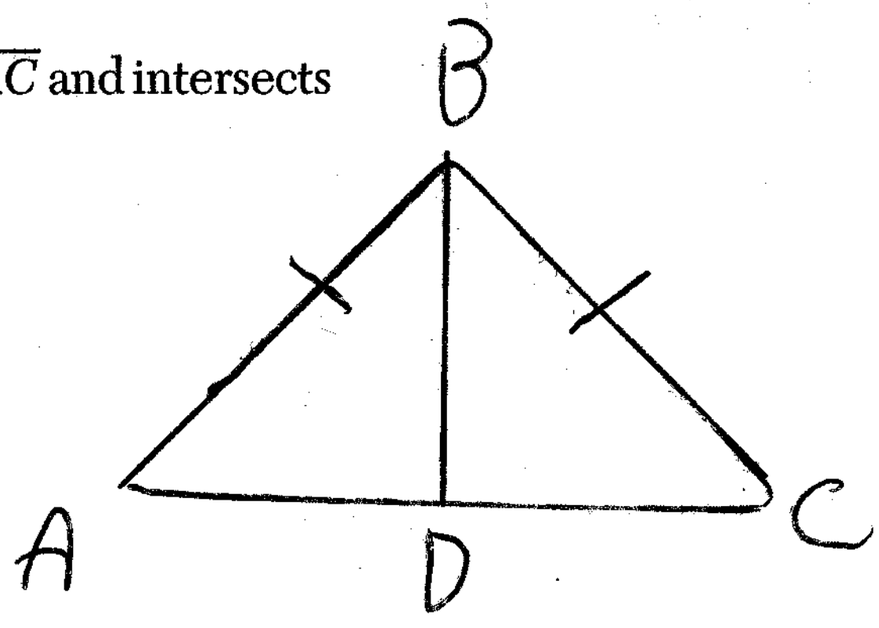
(1) $AB > AC > BC$
(2) $AB < AC$ and $AC > BC$
(3) $AC > AB > BC$
(4) $AC = AB$ and $AB > BC$

6 Which transformation is *not* always an isometry?

(1) rotation
(2) dilation
(3) reflection
(4) translation

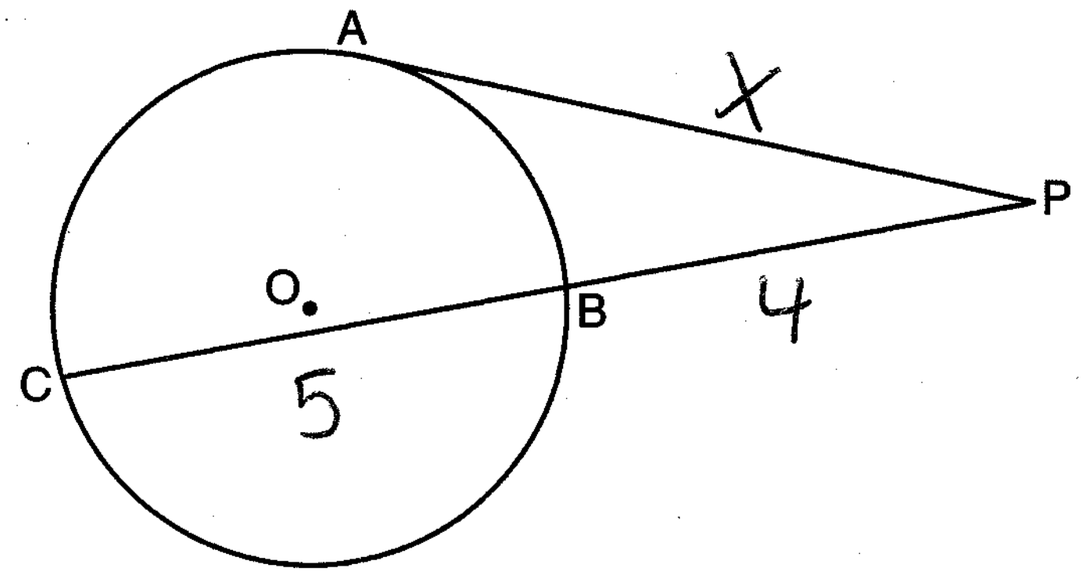
7 In $\triangle ABC$, $\overline{AB} \cong \overline{BC}$. An altitude is drawn from B to $\overline{AC}$ and intersects $\overline{AC}$ at D. Which statement is *not* always true?

(1) $\angle ABD \cong \angle CBD$
(2) $\angle BDA \cong \angle BDC$
(3) $\overline{AD} \cong \overline{BD}$
(4) $\overline{AD} \cong \overline{DC}$



Use this space for computations.

8 In the diagram below, tangent $\overline{PA}$ and secant $\overline{PBC}$ are drawn to circle O from external point P.



WE = WE

$x^2 = 9 \cdot 4$

$x^2 = 36$

$x = 6$

If $PB = 4$ and $BC = 5$, what is the length of $\overline{PA}$?

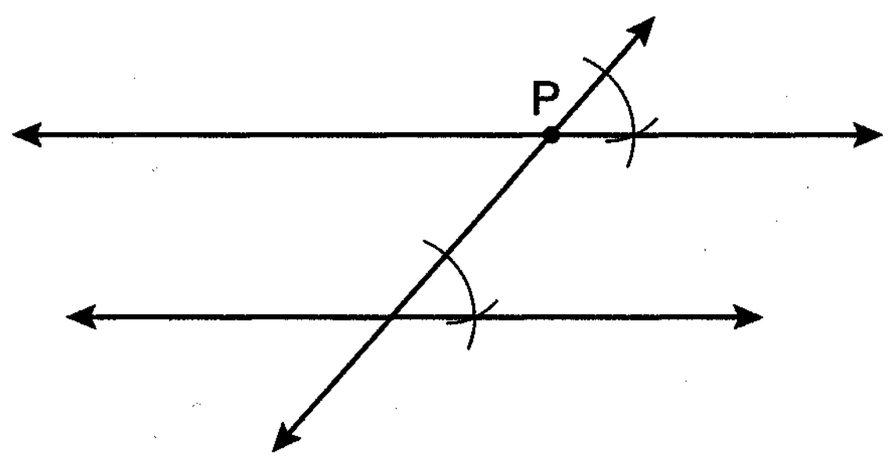
(1) 20

(2) 9

(3) 8

(4) 6

9 Which geometric principle is used to justify the construction below?



(1) A line perpendicular to one of two parallel lines is perpendicular to the other.

(2) Two lines are perpendicular if they intersect to form congruent adjacent angles.

(3) When two lines are intersected by a transversal and alternate interior angles are congruent, the lines are parallel.

(4) When two lines are intersected by a transversal and the corresponding angles are congruent, the lines are parallel.

Use this space for computations.

10 Which equation represents the circle whose center is $(-2,3)$ and whose radius is 5?

(1) $(x-2)^2+(y+3)^2=5$

(2) $(x+2)^2+(y-3)^2=5$

(3) $(x+2)^2+(y-3)^2=25$

(4) $(x-2)^2+(y+3)^2=25$

11 Towns A and B are 16 miles apart. How many points are 10 miles from town A and 12 miles from town B?

(1) 1

(2) 2

(3) 3

(4) 0

$16 < 10+12$

12 Lines j and k intersect at point P. Line m is drawn so that it is perpendicular to lines j and k at point P. Which statement is correct?

(1) Lines j and k are in perpendicular planes.

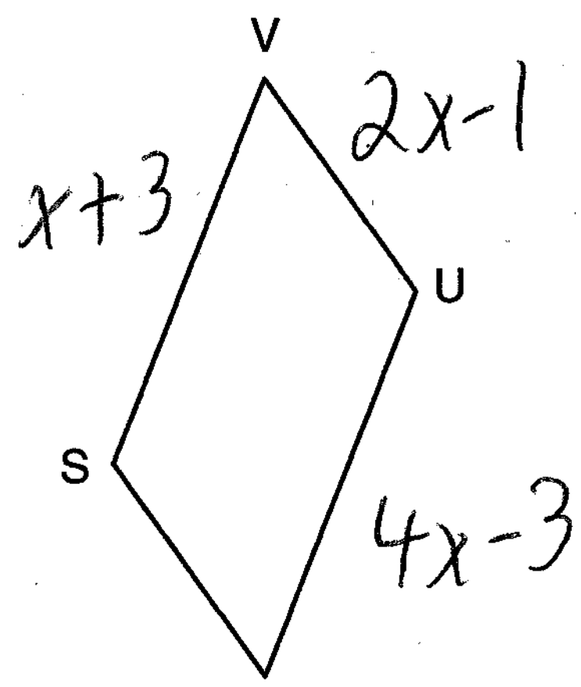
(2) Line m is in the same plane as lines j and k.

(3) Line m is parallel to the plane containing lines j and k.

(4) Line m is perpendicular to the plane containing lines j and k.

Use this space for computations.

13 In the diagram below of parallelogram $STUV$, $SV = x + 3$, $VU = 2x - 1$, and $TU = 4x - 3$.



$4x-3 = x+3$

$3x = 6$

$x = 2$

What is the length of $\overline{SV}$?

$\overline{SV} = x+3$

$= 2+3$

$= 5$

(1) 5

(2) 2

(3) 7

(4) 4

14 Which equation represents a line parallel to the line whose equation is $2y - 5x = 10$?

$m = \frac{-A}{B} = \frac{5}{2}$

(1) $5y - 2x = 25$

(2) $5y + 2x = 10$

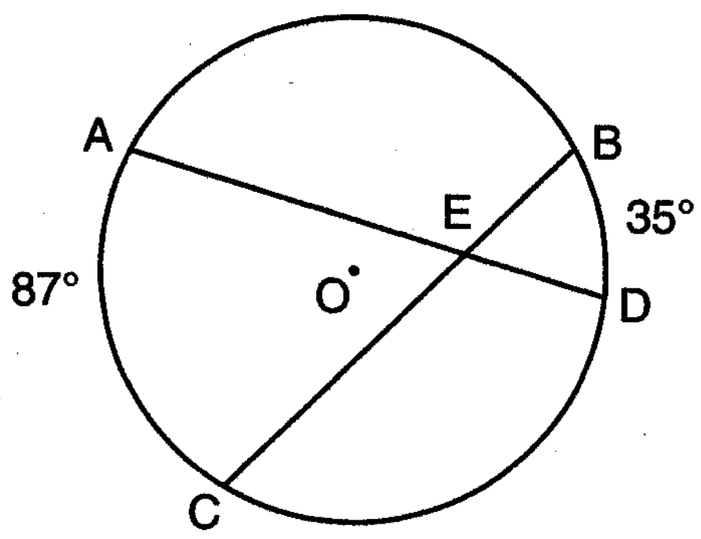
(3) $4y - 10x = 12$

(4) $2y + 10x = 8$

$-\frac{A}{B} = \frac{10}{4} = \frac{5}{2}$

Use this space for computations.

15 In the diagram below of circle O, chords $\overline{AD}$ and $\overline{BC}$ intersect at E, $m\overset{\frown}{AC} = 87$, and $m\overset{\frown}{BD} = 35$.

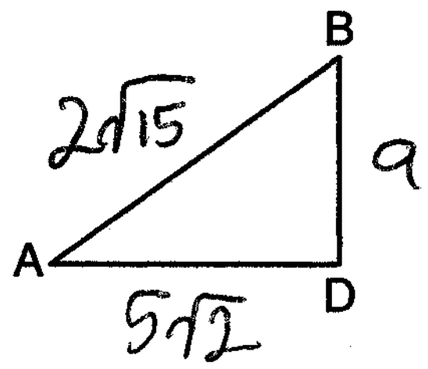


$\frac{87+35}{2} = \frac{122}{2} = 61$

What is the degree measure of $\angle CEA$?

(1) 87
(3) 43.5
(2) 61
(4) 26

16 In the diagram below of $\triangle ADB$, $m\angle BDA = 90$, $AD = 5\sqrt{2}$, and $AB = 2\sqrt{15}$.



$a^2 + (5\sqrt{2})^2 = (2\sqrt{15})^2$

$a^2 + (25 \cdot 2) = (4 \cdot 15)$

$a^2 + 50 = 60$

$a^2 = 10$

$a = \sqrt{10}$

What is the length of $\overline{BD}$?

(1) $\sqrt{10}$
(3) $\sqrt{50}$
(2) $\sqrt{20}$
(4) $\sqrt{110}$

Use this space for computations.

17 What is the distance between the points $(-3,2)$ and $(1,0)$?

(1) $2\sqrt{2}$

(2) $2\sqrt{3}$

(3) $5\sqrt{2}$

(4) $2\sqrt{5}$

$\sqrt{(-3-1)^2+(2-0)^2}$

$\sqrt{16+4}$

$\sqrt{20} = \sqrt{4}\sqrt{5} = 2\sqrt{5}$

18 What is an equation of the line that contains the point $(3,-1)$ and is perpendicular to the line whose equation is $y = -3x + 2$? $m = -3$ $m_\perp = \frac{1}{3}$

(1) $y = -3x + 8$

(2) $y = -3x$

(3) $y = \frac{1}{3}x$

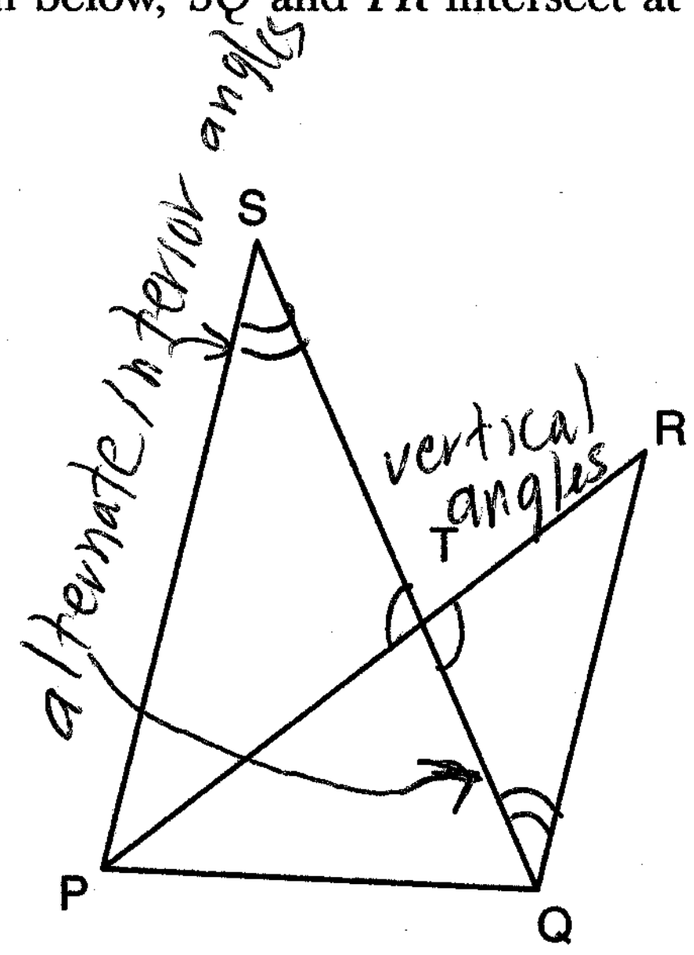
(4) $y = \frac{1}{3}x - 2$

$y = mx + b$

$-1 = \frac{1}{3}(3) + b$

$-1 = 1 + b$ $b = -2$

19 In the diagram below, $\overline{SQ}$ and $\overline{PR}$ intersect at T, $\overline{PQ}$ is drawn, and $\overline{PS} \parallel \overline{QR}$.



$y = mx + b$

$y = \frac{1}{3}x - 2$

Which technique can be used to prove $\triangle PST \sim \triangle RQT$?

(1) SAS

(2) SSS

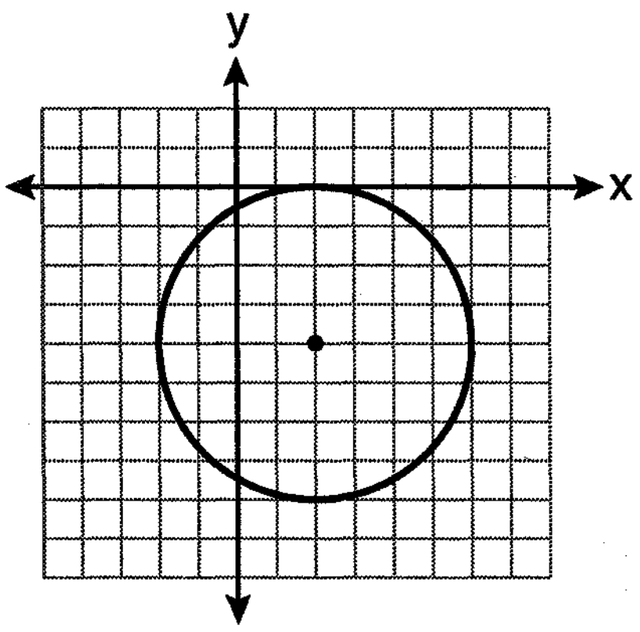
(3) ASA

(4) AA

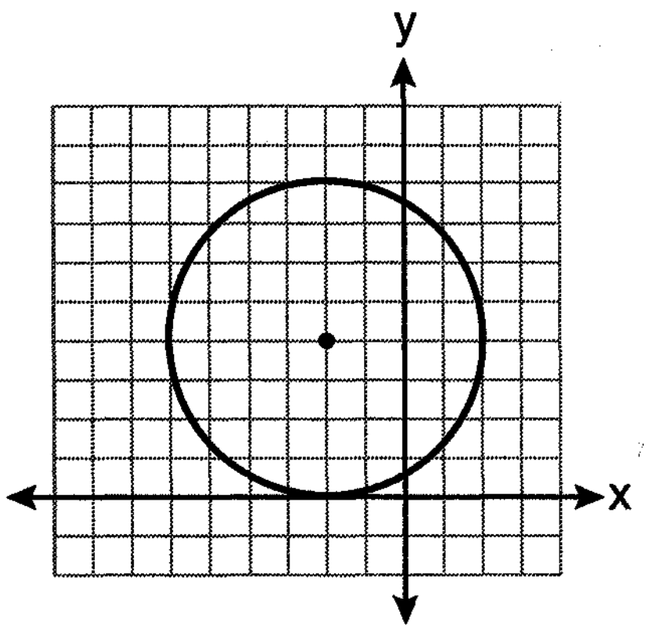
Use this space for computations.

20 The equation of a circle is $(x - 2)^2 + (y + 4)^2 = 4$. Which diagram is the graph of the circle?

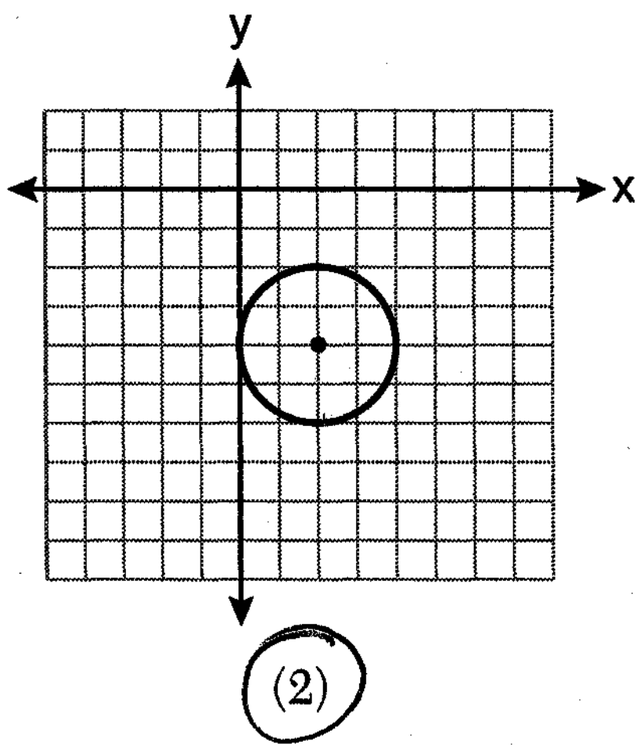
(1)



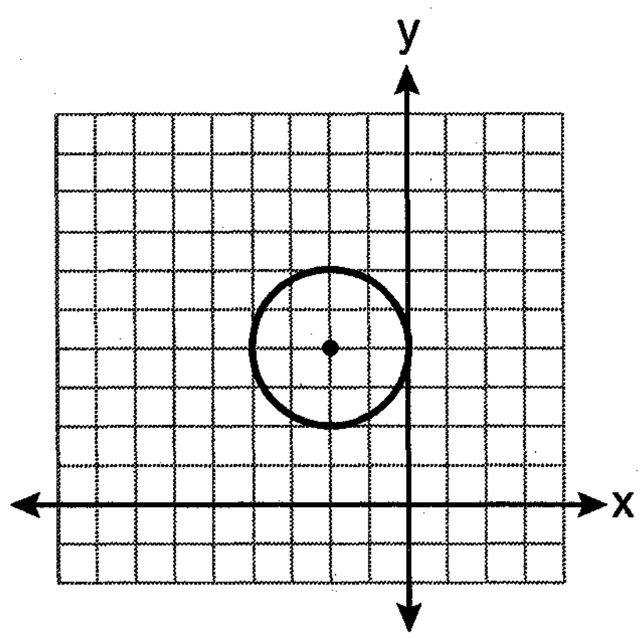
(3)



(2)

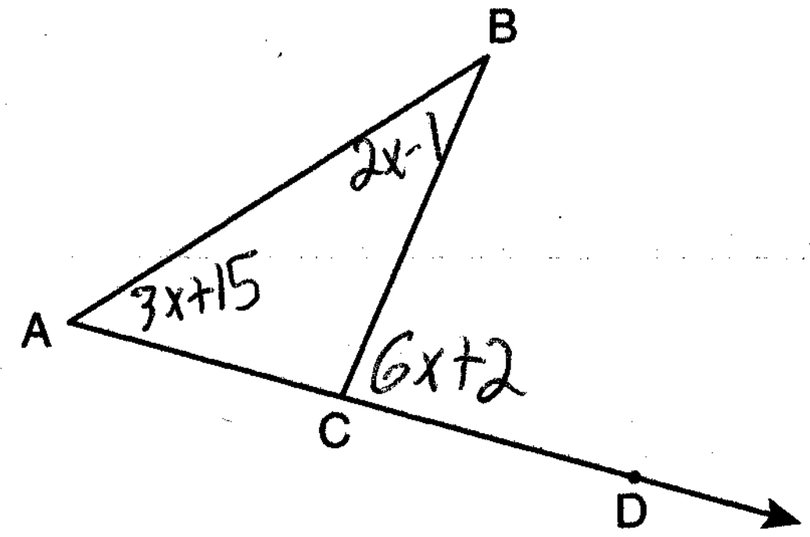


(4)



Use this space for computations.

21 In the diagram below, $\triangle ABC$ is shown with $\overline{AC}$ extended through point D.



$3x+15+2x-1=6x+2$

$5x+14=6x+2$

$12=x$

If $m\angle BCD = 6x + 2$, $m\angle BAC = 3x + 15$, and $m\angle ABC = 2x - 1$, what is the value of x?

(1) 12

(2) $14\frac{10}{11}$

(3) 16

(4) $18\frac{1}{9}$

22 Given $\triangle ABC \sim \triangle DEF$ such that $\frac{AB}{DE} = \frac{3}{2}$. Which statement is *not* true?

(1) $\frac{BC}{EF} = \frac{3}{2}$

(2) $\frac{m\angle A}{m\angle D} = \frac{3}{2}$

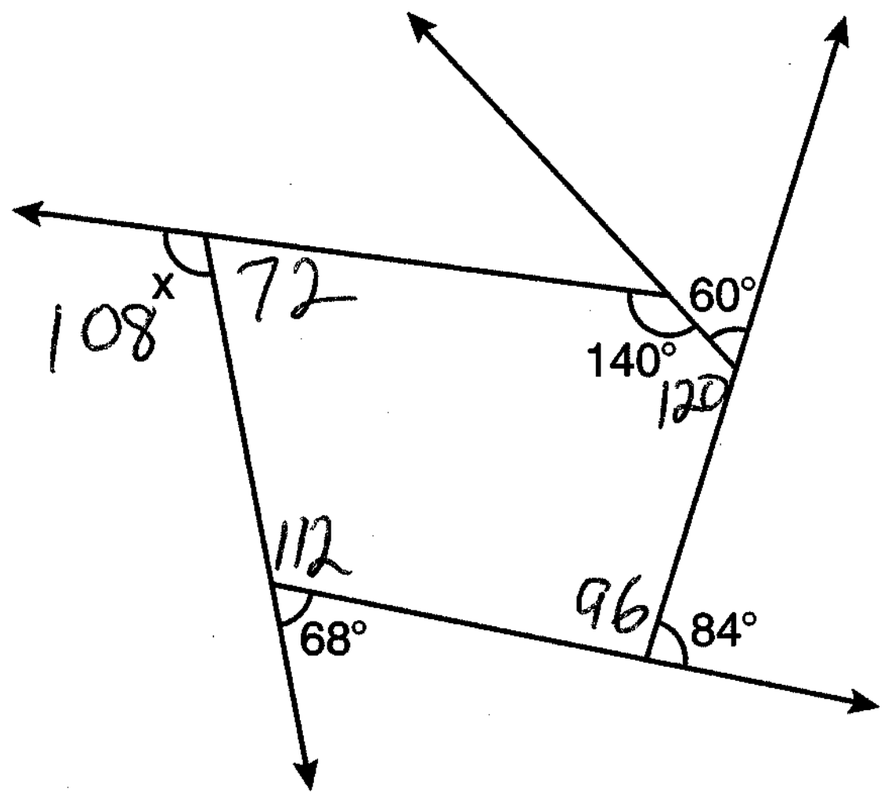
(3) $\frac{\text{area of } \triangle ABC}{\text{area of } \triangle DEF} = \frac{9}{4}$

(4) $\frac{\text{perimeter of } \triangle ABC}{\text{perimeter of } \triangle DEF} = \frac{3}{2}$

$\frac{m\angle A}{m\angle D} = 1$

23 The pentagon in the diagram below is formed by five rays.

Use this space for computations.



$(n-2)180$
$(5-2)(180)$
540
-468
72

140
120
96
112
468

What is the degree measure of angle x?

(1) 72
(2) 96
(3) 108
(4) 112

24 Through a given point, P, on a plane, how many lines can be drawn that are perpendicular to that plane?

(1) 1
(2) 2
(3) more than 2
(4) none

25 What is the slope of a line that is perpendicular to the line whose equation is $3x + 4y = 12$?

(1) $\frac{3}{4}$
(2) $-\frac{3}{4}$
(3) $\frac{4}{3}$
(4) $-\frac{4}{3}$

$m = \frac{-A}{B} = \frac{-3}{4}$

$m_{\perp} = \frac{4}{3}$

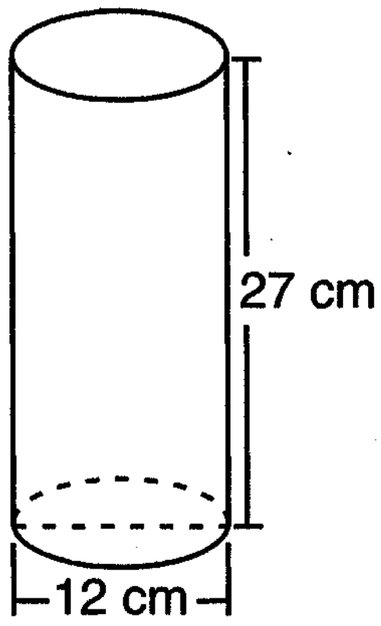
Use this space for computations.

26 What is the image of point $A(4,2)$ after the composition of transformations defined by $R_{90°} \circ r_{y=x}$?

(1) $(-4,2)$
(2) $(4,-2)$
(3) $(-4,-2)$
(4) $(2,-4)$

A(4,2)
A'(2,4) after reflection
A"(-4,2) after rotation

27 Which expression represents the volume, in cubic centimeters, of the cylinder represented in the diagram below?



$V = \pi r^2 h$
$= \pi \cdot 6^2 \cdot 27$
$= 972\pi$

(1) 162π
(2) 324π
(3) 972π
(4) $3{,}888\pi$

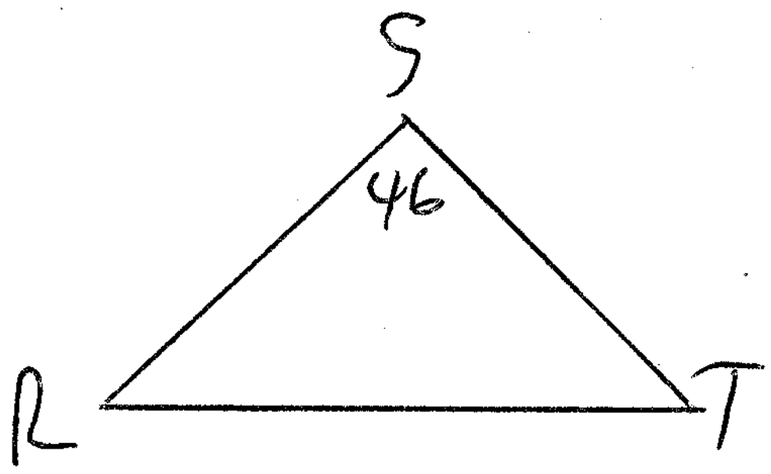
28 What is the inverse of the statement "If two triangles are not similar, their corresponding angles are not congruent"?

(1) If two triangles are similar, their corresponding angles are not congruent.
(2) If corresponding angles of two triangles are not congruent, the triangles are not similar.
(3) If two triangles are similar, their corresponding angles are congruent.
(4) If corresponding angles of two triangles are congruent, the triangles are similar.

Part II

Answer all 6 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

29 In $\triangle RST$, $m\angle RST = 46$ and $\overline{RS} \cong \overline{ST}$. Find $m\angle STR$.



$180 = 134 + 46$

$\frac{134}{2} = 67$

30 Tim has a rectangular prism with a length of 10 centimeters, a width of 2 centimeters, and an unknown height. He needs to build another rectangular prism with a length of 5 centimeters and the same height as the original prism. The volume of the two prisms will be the same. Find the width, in centimeters, of the new prism.

$$V_1 = V_2$$

$$l_1 w_1 h_1 = l_2 w_2 h_2$$

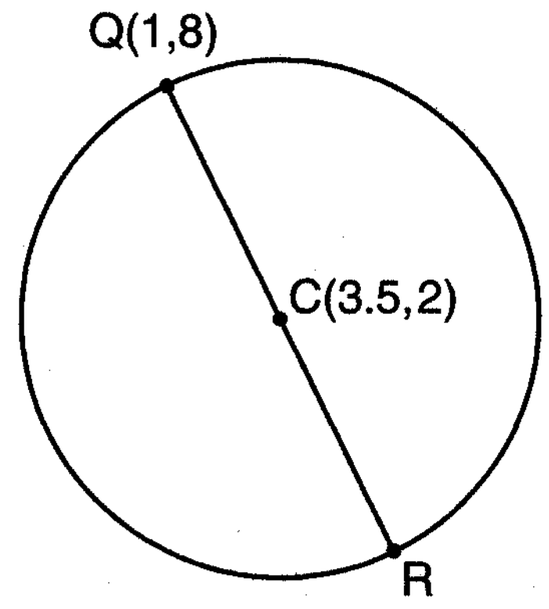
$$(10)(2)(h) = (5)(w_2)(h)$$

$$\frac{20}{5} = \frac{5 w_2}{5}$$

$$4 = w_2$$

31 In the diagram below of circle C, $\overline{QR}$ is a diameter, and $Q(1,8)$ and $C(3.5, 2)$ are points on a coordinate plane.

Find and state the coordinates of point R.



$3.5 = \frac{1+x}{2}$

$7 = 1+x$

$6 = x$

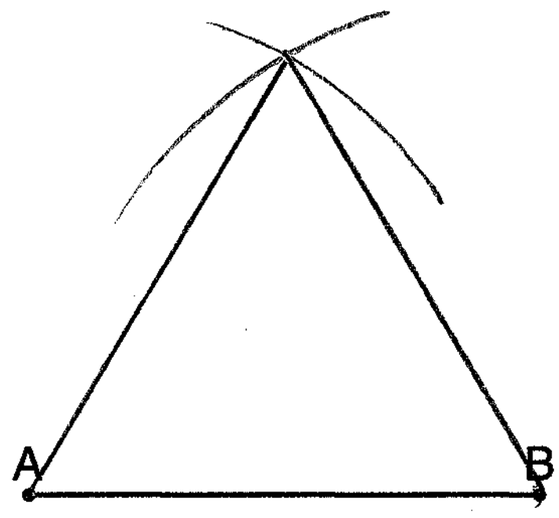
$2 = \frac{8+y}{2}$

$4 = 8+y$

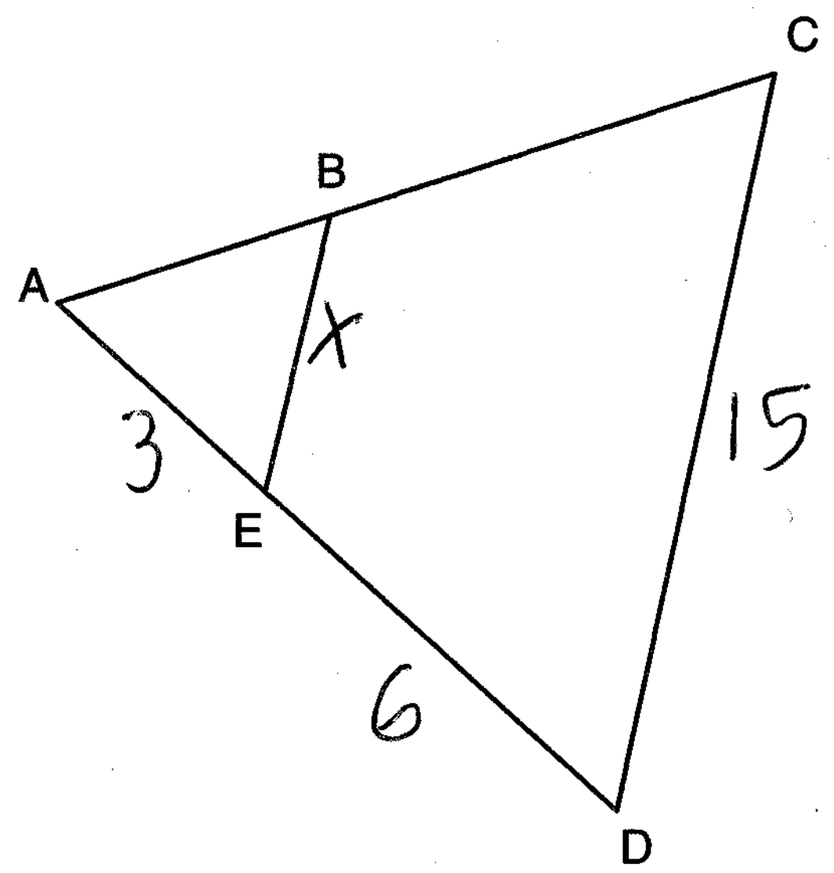
$-4 = y$

$(6, -4)$

32 Using a compass and straightedge, and $\overline{AB}$ below, construct an equilateral triangle with all sides congruent to $\overline{AB}$. [Leave all construction marks.]



33 In the diagram below of $\triangle ACD$, E is a point on $\overline{AD}$ and B is a point on $\overline{AC}$, such that $\overline{EB} \parallel \overline{DC}$. If $AE = 3$, $ED = 6$, and $DC = 15$, find the length of $\overline{EB}$.

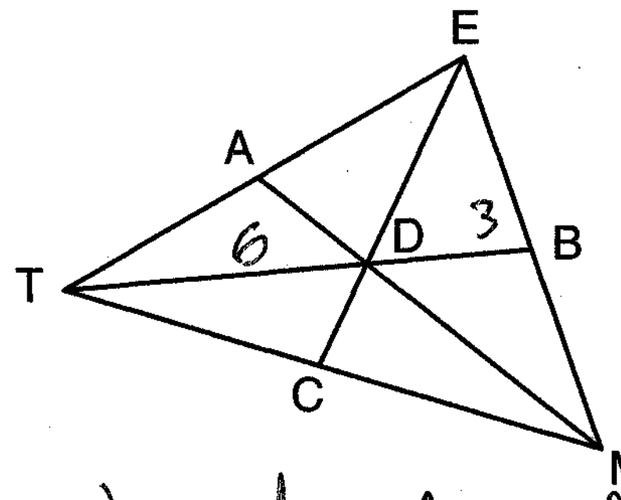


$$\frac{3}{x} = \frac{9}{15}$$

$$9x = 45$$

$$x = 5$$

34 In the diagram below of $\triangle TEM$, medians $\overline{TB}$, $\overline{EC}$, and $\overline{MA}$ intersect at D, and $TB = 9$. Find the length of $\overline{TD}$.



The centroid divides the medians into segments with a 2:1 ratio.

$\overline{TD} = 6$

Part III

Answer all 3 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

35 In $\triangle KLM$, $m\angle K = 36$ and $KM = 5$. The transformation D_2 is performed on $\triangle KLM$ to form $\triangle K'L'M'$.

Find $m\angle K'$. Justify your answer. 36. A dilation does not affect angle measure

Find the length of $\overline{K'M'}$. Justify your answer.

5X2=10

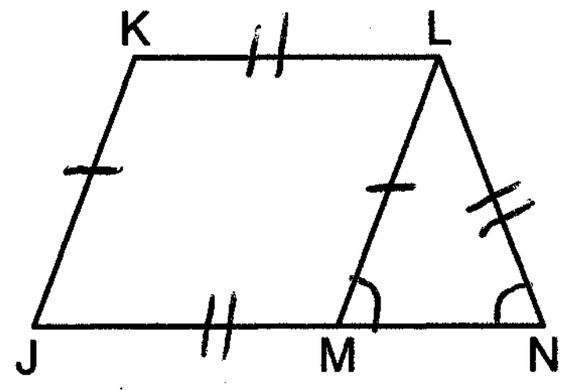
A dilation affects distance

36 Given: $JKLM$ is a parallelogram.

$\overline{JM} \cong \overline{LN}$

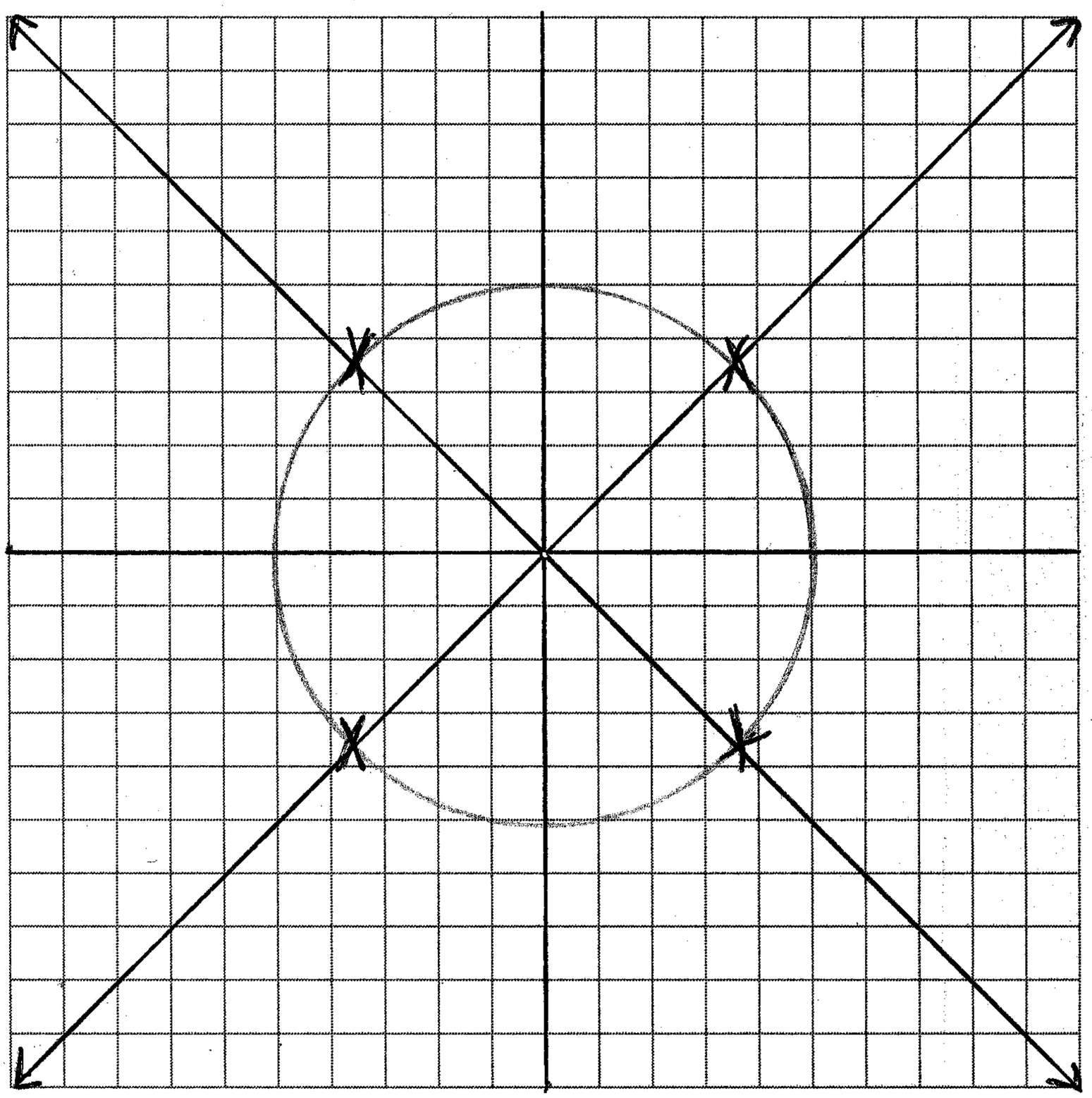
$\angle LMN \cong \angle LNM$

Prove: $JKLM$ is a rhombus.



STATEMENT	REASON
① JKLM is a parallelogram, $\overline{JM} \cong \overline{LN}$, $\angle LMN \cong \angle LNM$	① Given
② $\overline{JK} \cong \overline{LM}$, $\overline{JM} \cong \overline{LK}$	② Opposite sides of a parallelogram are congruent
③ $\overline{LM} \cong \overline{LN}$	③ Isosceles Triangle Theorem
④ $\overline{LM} \cong \overline{JM}$	④ Transitive Property
⑤ JKLM is a rhombus	⑤ All sides are congruent

37 On the grid below, graph the points that are equidistant from both the x and y axes and the points that are 5 units from the origin. Label with an **X** all points that satisfy both conditions.



Part IV

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. A correct numerical answer with no work shown will receive only 1 credit. The answer should be written in pen. [6]

38 On the set of axes below, solve the following system of equations graphically for all values of x and y.

$y = (x - 2)^2 + 4$ vertex (2, 4)

$4x + 2y = 14$

$y = -2x + 7$