The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

GEOMETRY

Friday, June 20, 2014 — 1:15 to 4:15 p.m., only

Student Name: *Mr. Sibol*

School Name: *JMAP*

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

Print your name and the name of your school on the lines above.

A separate answer sheet for Part I has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 38 questions. You must answer all questions in this examination. Record 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 for 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.

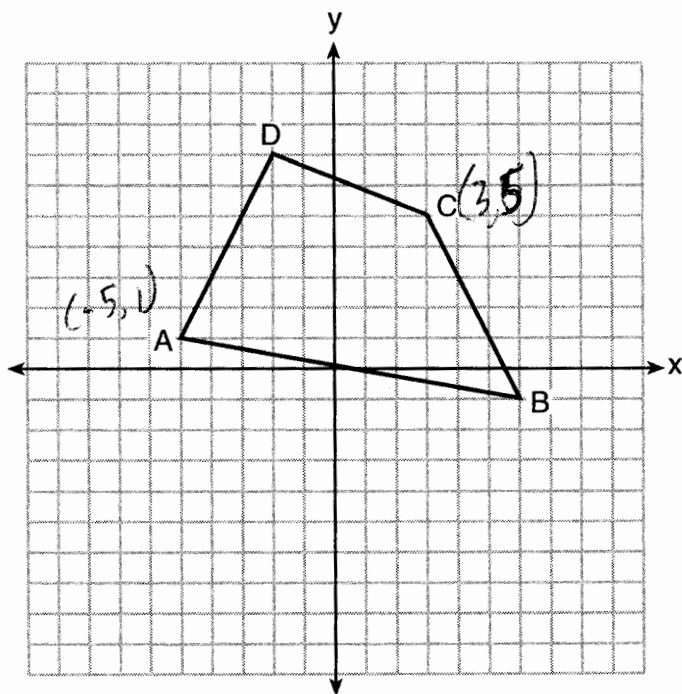**DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.**

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

Use this space for computations.

1 Plane $\mathcal{P}$ is parallel to plane Q. If plane $\mathcal{P}$ is perpendicular to line ℓ, then plane Q

  (1) contains line ℓ

  (2) is parallel to line ℓ

  (3) is perpendicular to line ℓ

  (4) intersects, but is not perpendicular to line ℓ

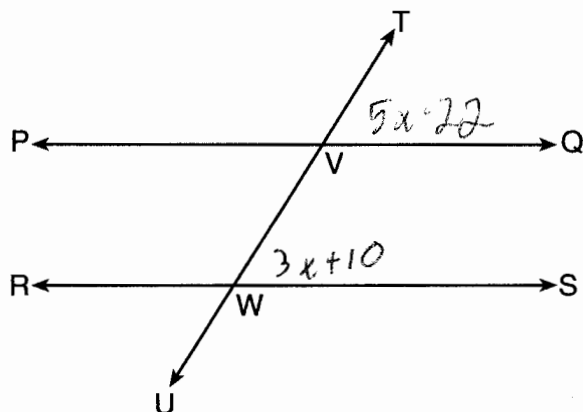2 In the diagram below, quadrilateral $ABCD$ has vertices $A(-5,1)$, $B(6,-1)$, $C(3,5)$, and $D(-2,7)$.

$$\left(-\frac{5+3}{2}, \frac{1+5}{2}\right)$$

$$(-1, 3)$$

What are the coordinates of the midpoint of diagonal $\overline{AC}$?

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

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

3 In the diagram below, transversal $\overleftrightarrow{TU}$ intersects $\overrightarrow{PQ}$ and $\overleftrightarrow{RS}$ at V and W, respectively.

If $m\angle TVQ = 5x - 22$ and $m\angle VWS = 3x + 10$, for which value of x is $\overleftrightarrow{PQ} \parallel \overleftrightarrow{RS}$?

(1) 6   (3) 24

(2) 16   (4) 28

Handwritten computation:
$$5x - 22 = 3x + 10$$
$$2x = 32$$
$$x = 16$$

4 The measures of the angles of a triangle are in the ratio 2:3:4. In degrees, the measure of the *largest* angle of the triangle is

(1) 20   (3) 80

(2) 40   (4) 100

Handwritten computation:
$$\frac{4}{2+3+4} \times 180$$
$$\frac{4}{9} \times 180$$
$$80$$

5 The diameter of the base of a right circular cylinder is 6 cm and its height is 15 cm. In square centimeters, the lateral area of the cylinder is

(1) 180π

(3) 90π

(2) 135π

(4) 45π

$L = 2\pi rh = 2\pi\left(\frac{6}{2}\right) 15 = 90\pi$

6 When the system of equations $y + 2x = x^2$ and $y = x$ is graphed on a set of axes, what is the total number of points of intersection?

(1) 1

(3) 3

(2) 2

(4) 0

$x + 2x = x^2$

$0 = x^2 - x$

$0 = x(x-1)$ $(0,0)$

$x = 0, 1$ $(1,1)$

7 The vertex angle of an isosceles triangle measures 15 degrees more than one of its base angles. How many degrees are there in a base angle of the triangle?

(1) 50

(3) 65
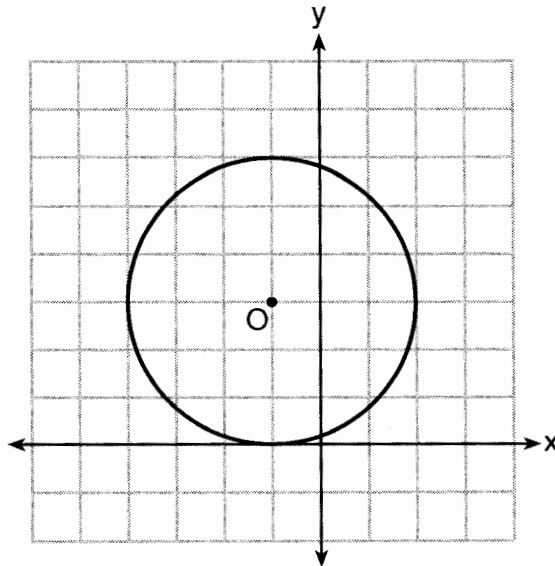
(2) 55

(4) 70

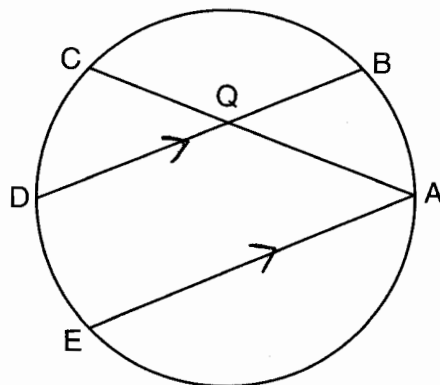$x + x + x + 15 = 180$

$3x + 15 = 180$

$3x = 165$

$x = 55$

8 Circle O is graphed on the set of axes below. Which equation represents circle O?

$\bigcirc$(1) $(x + 1)^2 + (y - 3)^2 = 9$

(2) $(x - 1)^2 + (y + 3)^2 = 9$

(3) $(x + 1)^2 + (y - 3)^2 = 6$

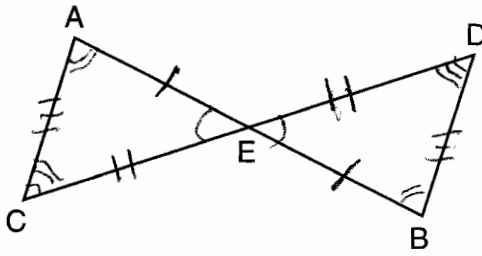(4) $(x - 1)^2 + (y + 3)^2 = 6$

9 In the diagram of the circle shown below, chords $\overline{AC}$ and $\overline{BD}$ intersect at Q, and chords $\overline{AE}$ and $\overline{BD}$ are parallel.

Which statement must always be true?

(1) $\overset{\frown}{AB} \cong \overset{\frown}{CD}$ $\bigcirc$(3) $\overset{\frown}{AB} \cong \overset{\frown}{DE}$

(2) $\overset{\frown}{DE} \cong \overset{\frown}{CD}$ (4) $\overset{\frown}{BD} \cong \overset{\frown}{AE}$

10 In the diagram below, $\triangle AEC \cong \triangle BED$.

Which statement is *not* always true?

(1) $\overline{AC} \cong \overline{BD}$

(3) $\angle EAC \cong \angle EBD$

(2) $\overline{CE} \cong \overline{DE}$

(4) $\angle ACE \cong \angle DBE$

11 What is the length of $\overline{RS}$ with $R(-2,3)$ and $S(4,5)$?

(1) $2\sqrt{2}$

(3) $2\sqrt{10}$

(2) 40

(4) $2\sqrt{17}$

(handwritten) $\sqrt{(-2-4)^2 + (3-5)^2}$

$\sqrt{36+4}$

$\sqrt{40}$

$\sqrt{4\cdot\sqrt{10}}$

12 What are the truth values of the statement "Two is prime" and its negation?

(1) The statement is false and its negation is true.

(2) The statement is false and its negation is false.

(3) The statement is true and its negation is true.
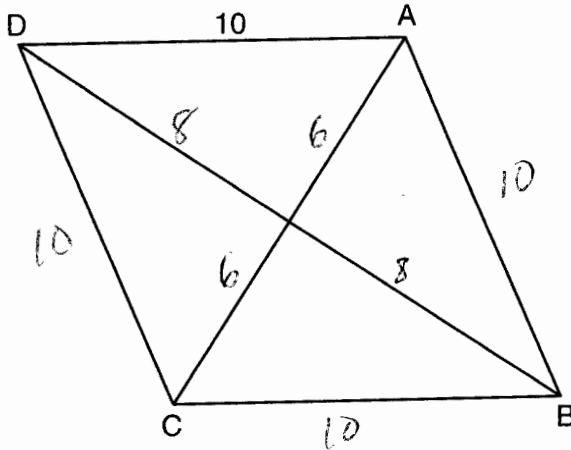
(4) The statement is true and its negation is false.

13 A regular polygon has an exterior angle that measures 45°. How many sides does the polygon have?

(1) 10

(3) 6

(2) 8

(4) 4

(handwritten) $180 - \dfrac{180(n-2)}{n} = 45$

$\dfrac{180n - 180n + 360}{45} = \dfrac{45n}{45}$

$8 = n$

Geometry – June '14   [6]

14 In rhombus $ABCD$, with diagonals $\overline{AC}$ and $\overline{DB}$, $AD = 10$.

If the length of diagonal $\overline{AC}$ is 12, what is the length of $\overline{DB}$?

(1) 8   (3) $\sqrt{44}$

(2) 16   (4) $\sqrt{136}$

15 If the surface area of a sphere is 144π square centimeters, what is the length of the diameter of the sphere, in centimeters?

$4\pi r^2 = 144\pi$

$r^2 = 36$

$r = 6$

(1) 36   (3) 12

(2) 18   (4) 6

16 Which numbers could represent the lengths of the sides of a triangle?

(1) 5, 9, 14   (3) 1, 2, 4

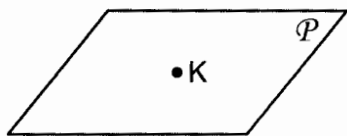(2) 7, 7, 15   (4) 3, 6, 8 $3+6>8$

17 The equation of a line is $3y + 2x = 12$. What is the slope of the line perpendicular to the given line?

$M = \dfrac{-A}{B} = \dfrac{-2}{3}$

(1) $\dfrac{2}{3}$ (3) $-\dfrac{2}{3}$

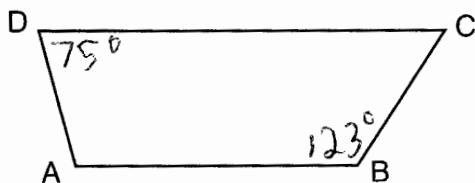(2) $\dfrac{3}{2}$ (4) $-\dfrac{3}{2}$

18 In the diagram below, point K is in plane P.

How many lines can be drawn through K, perpendicular to plane P?

(1) 1   (3) 0

(2) 2   (4) an infinite number

19 In the diagram below, $\overline{AB}$ and $\overline{CD}$ are bases of trapezoid $ABCD$.

$180 - 123 = 57$

(Not drawn to scale)

If $m\angle B = 123$ and $m\angle D = 75$, what is $m\angle C$?

(1) 57   (3) 105

(2) 75   (4) 123

20 What is the equation of a line passing through the point $(4,-1)$ and parallel to the line whose equation is $2y - x = 8$?

$M = -\dfrac{A}{B} = \dfrac{1}{2}$

(1) $y = \frac{1}{2}x - 3$ (3) $y = -2x + 7$

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

$y = mx + b$
$-1 = \frac{1}{2}(4) + b$
$-1 = 2 + b$
$-3 = b$

** The image of rhombus *VWXY* preserves which properties under the transformation T$_{2,-3}$?

(1) parallelism, only

(2) orientation, only

(3) both parallelism and orientation

(4) neither parallelism nor orientation

** The equation of a circle is $(x - 3)^2 + y^2 = 8$. The coordinates of its center and the length of its radius are

(1) $(-3,0)$ and 4

(2) $(3,0)$ and 4

(3) $(-3,0)$ and $2\sqrt{2}$

(4) $(3,0)$ and $2\sqrt{2}$

$\sqrt{8} = \sqrt{4}\sqrt{2} = 2\sqrt{2}$

** Which statement has the same truth value as the statement "If a quadrilateral is a square, then it is a rectangle"? T
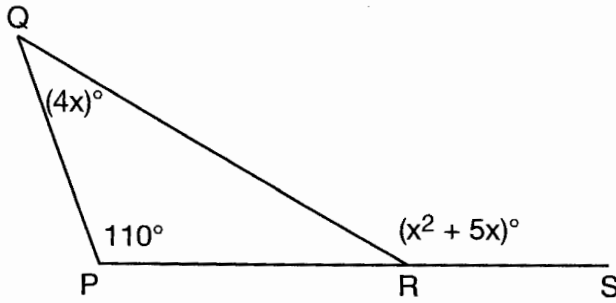
(1) If a quadrilateral is a rectangle, then it is a square.

(2) If a quadrilateral is a rectangle, then it is not a square.

(3) If a quadrilateral is not a square, then it is not a rectangle.

(4) If a quadrilateral is not a rectangle, then it is not a square. T

** The three medians of a triangle intersect at a point. Which measurements could represent the segments of one of the medians?

(1) 2 and 3

(2) 3 and 4.5

(3) 3 and 6 $1:2$

(4) 3 and 9

– June '14

[9]

[OVER]

25 In the diagram of $\triangle PQR$ shown below, $\overline{PR}$ is extended to S, $m\angle P = 110$, $m\angle Q = 4x$, and $m\angle QRS = x^2 + 5x$.

What is $m\angle Q$?

(1) 44

(2) 40

(3) 11

(4) 10

Handwritten computations:

$x^2 + 5x = 4x + 110$

$x^2 + x - 110 = 0$

$(x + 11)(x - 10) = 0$

$x = 10$

$4(10) = 40$

26 Triangle PQT with $\overline{RS} \parallel \overline{QT}$ is shown below.

If $PR = 12$, $RQ = 8$, and $PS = 21$, what is the length of $\overline{PT}$?

(1) 14

(2) 17

(3) 35

(4) 38

Handwritten computations:

$\dfrac{12}{8} = \dfrac{21}{x}$

$12x = 168$

$x = 14$

$21 + 14 = 35$

27 In the diagram of $\overline{WXYZ}$ below, $\overline{WY} \cong \overline{XZ}$.

W———————X———————Y———————Z

Which reasons can be used to prove $\overline{WX} \cong \overline{YZ}$?

(1) reflexive property and addition postulate

(2) reflexive property and subtraction postulate

(3) transitive property and addition postulate

(4) transitive property and subtraction postulate

28 The coordinates of the endpoints of the diameter of a circle are $(2,0)$ and $(2,-8)$. What is the equation of the circle?

(1) $(x - 2)^2 + (y + 4)^2 = 16$

(2) $(x + 2)^2 + (y - 4)^2 = 16$

(3) $(x - 2)^2 + (y + 4)^2 = 8$

(4) $(x + 2)^2 + (y - 4)^2 = 8$

$\left(\dfrac{2+2}{2}, \dfrac{0+-8}{2} \right)$

$(2, -4)$

$\sqrt{(2-2)^2 + (-8-0)^2}$

$\sqrt{64}$

$8 = d$

$4 = r$

$16 = r^2$
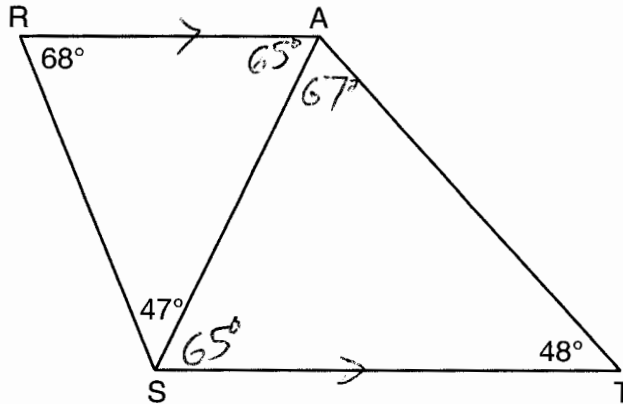
Answer all 6 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

29 The coordinates of the endpoints of $\overline{BC}$ are $B(5,1)$ and $C(-3,-2)$. Under the transformation R_{90}, the image of $\overline{BC}$ is $\overline{B'C'}$. State the coordinates of points B' and C'.

$$(x, y) \rightarrow (-y, x)$$
$$B(5,1) \rightarrow (-1, 5)$$
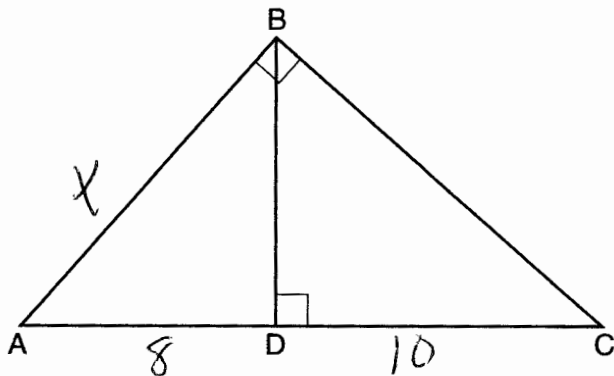$$C(-3,-2) \rightarrow (2,-3)$$

30 As shown in the diagram below, $\overline{AS}$ is a diagonal of trapezoid $STAR$, $\overline{RA} \parallel \overline{ST}$, m$\angle ATS = 48$, m$\angle RSA = 47$, and m$\angle ARS = 68$.

Determine and state the longest side of $\triangle SAT$.

$$\overline{ST}$$

31 In right triangle ABC shown below, altitude $\overline{BD}$ is drawn to hypotenuse $\overline{AC}$.

B

x

A   8   D   10   C

If $AD = 8$ and $DC = 10$, determine and state the length of $\overline{AB}$.
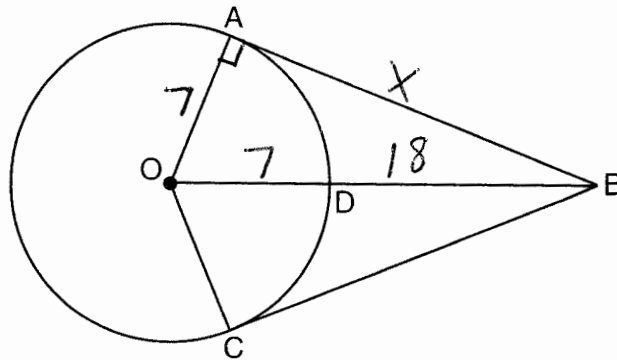
$$x^2 = 8 \cdot 18$$
$$x^2 = 144$$
$$x = 12$$

32 Two prisms with equal altitudes have equal volumes. The base of one prism is a square with a side length of 5 inches. The base of the second prism is a rectangle with a side length of 10 inches. Determine and state, in inches, the measure of the width of the rectangle.

$$lwh = lwh$$
$$5 \cdot 5 = 10w$$
$$25 = 10w$$
$$2.5 = w$$

33 As shown in the diagram below, $\overline{BO}$ and tangents $\overline{BA}$ and $\overline{BC}$ are drawn from external point B to circle O. Radii $\overline{OA}$ and $\overline{OC}$ are drawn.

If $OA = 7$ and $DB = 18$, determine and state the length of $\overline{AB}$.

$$x^2 + 7^2 = 25^2$$

$$x^2 + 49 = 625$$

$$x^2 = 576$$

$$x = 24$$

34 Triangle RST is similar to $\triangle XYZ$ with $RS = 3$ inches and $XY = 2$ inches. If the area of $\triangle RST$ is 27 square inches, determine and state the area of $\triangle XYZ$, in square inches.

$$\left(\frac{3}{2}\right)^2 = \frac{27}{A}$$

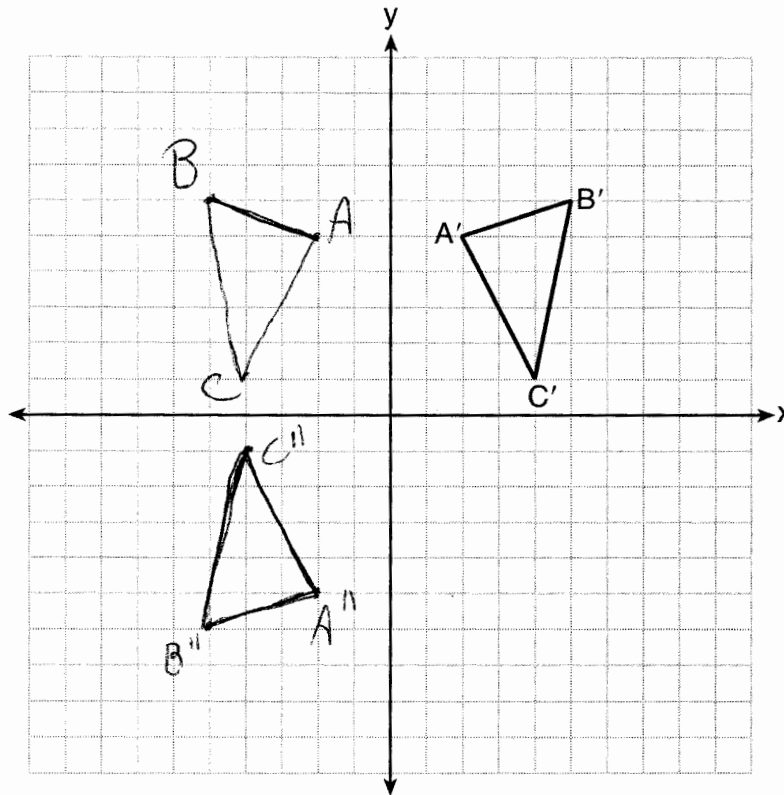$$\frac{9}{4} = \frac{27}{A}$$

$$9A = 108$$

$$A = 12$$

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]

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35 The graph below shows $\triangle A'B'C'$, the image of $\triangle ABC$ after it was reflected over the y-axis.

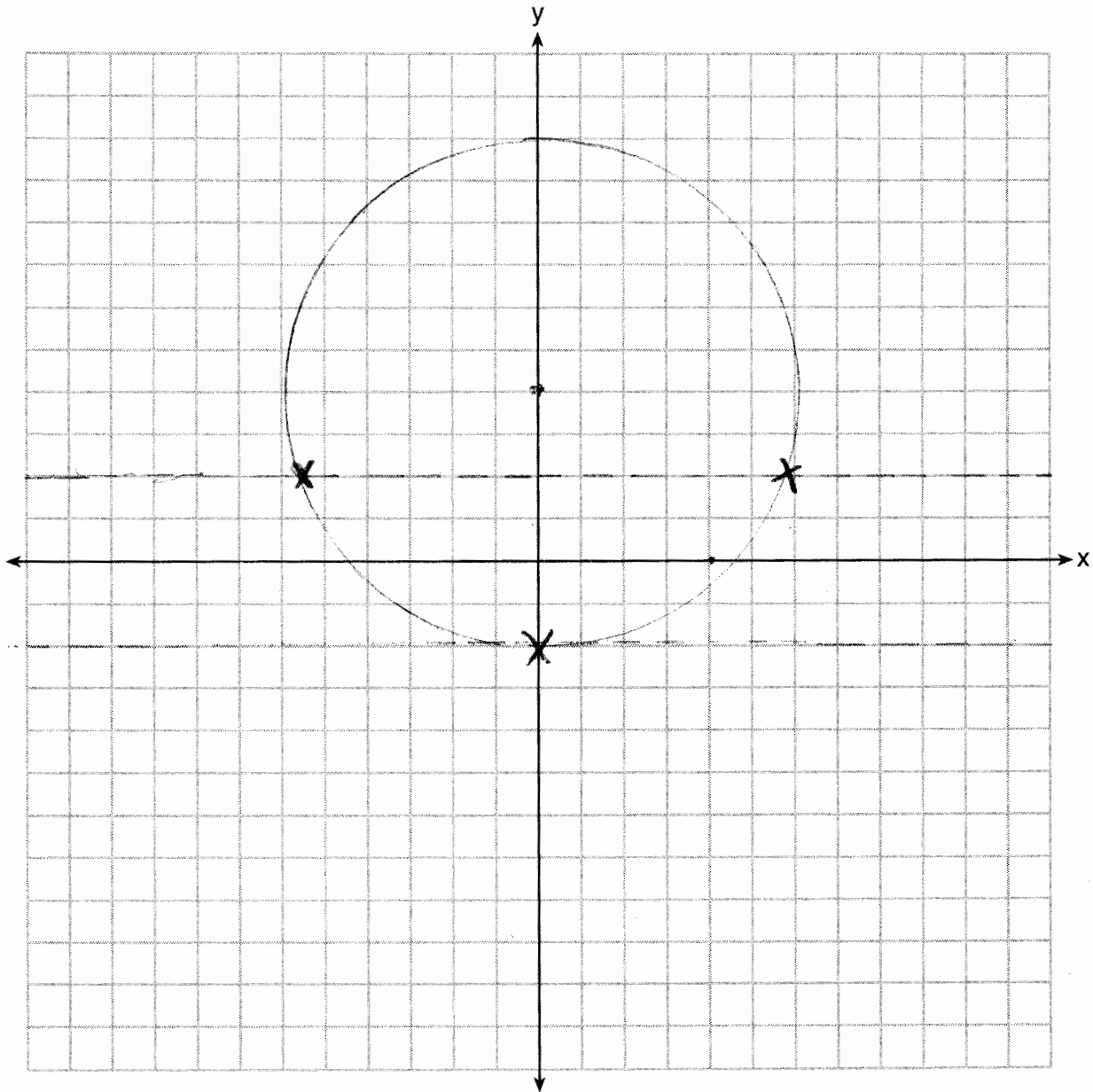Graph and label $\triangle ABC$, the pre-image of $\triangle A'B'C'$.

Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected through the origin.

State a single transformation that will map $\triangle ABC$ onto $\triangle A''B''C''$. $r_{x\text{-}axis}$

36 On the set of axes below, sketch the locus of points 2 units from the x-axis and sketch the locus of points 6 units from the point $(0,4)$.
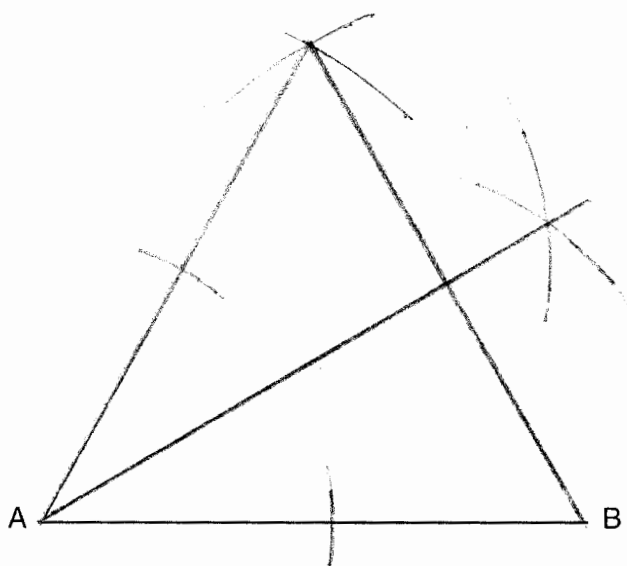
Label with an **X** all points that satisfy both conditions.

37 Using a compass and straightedge, construct an equilateral triangle with $\overline{AB}$ as a side.

Using this triangle, construct a 30° angle with its vertex at A.
[Leave all construction marks.]

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, except for graphs and drawings, which should be done in pencil. [6]

38 The vertices of quadrilateral *JKLM* have coordinates *J*(−3,1), *K*(1,−5), *L*(7,−2), and *M*(3,4).

Prove that *JKLM* is a parallelogram.

Opposites sides have equal slopes are parallel, so JKLM is a parallelogram

Prove that *JKLM* is *not* a rhombus.

$\overline{KL} = \sqrt{45}$ $\overline{LM} = \sqrt{52}$

[The use of the set of axes below is optional.]

Since not all sides are not equal JKLM is not a rhombus