The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

GEOMETRY

Wednesday, January 28, 2015 — 9:15 a.m. to 12:15 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 What is the solution of the system of equations graphed below?

$$y = 2x + 1$$
$$y = x^2 + 2x - 3$$

(1) $(0,-3)$

(2) $(-1,-4)$
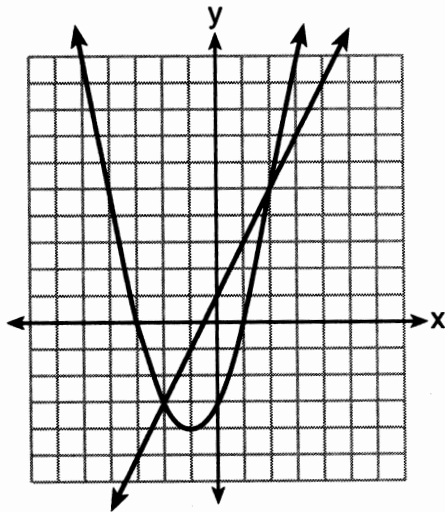
(3) $(-3,0)$ and $(1,0)$

(4) $(-2,-3)$ and $(2,5)$

2 What are the coordinates of the midpoint of the line segment with endpoints $(2,-5)$ and $(8,3)$?

(1) $(3,-4)$

(2) $(3,-1)$

(3) $(5,-4)$

(4) $(5,-1)$

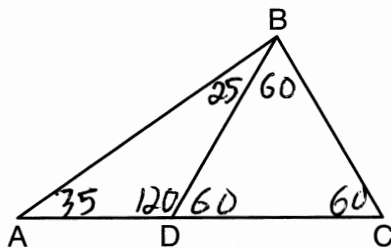$$\left(\frac{2+8}{2}, \frac{-5+3}{2} \right)$$

$$(5, -1)$$

3 As shown in the diagram below, when hexagon *ABCDEF* is reflected over line *m*, the image is hexagon *A'B'C'D'E'F'*.
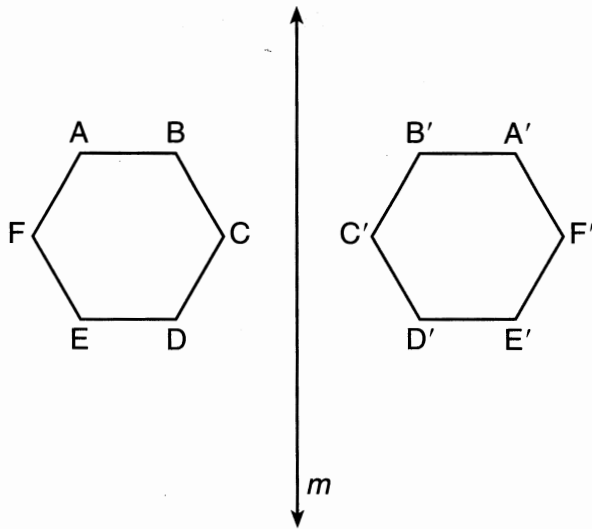
Under this transformation, which property is *not* preserved?

(1) area

(3) orientation

(2) distance

(4) angle measure

4 In the diagram of △*ABC* below, $\overline{BD}$ is drawn to side $\overline{AC}$.

If m∠*A* = 35, m∠*ABD* = 25, and m∠*C* = 60, which type of triangle is △*BCD*?

(1) equilateral

(3) obtuse

(2) scalene

(4) right

5 In the diagram below of rhombus $ABCD$, the diagonals $\overline{AC}$ and $\overline{BD}$ intersect at E.

A diagram of rhombus $ABCD$ with vertices A (top left), B (top right), C (bottom right), D (bottom left), diagonals intersecting at E. Segments labeled 9 and 12.

$\sqrt{9^2+12^2}$; $\sqrt{81+144}$

$= \sqrt{225}$

$=) 5$
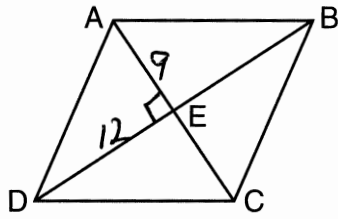
If $AC = 18$ and $BD = 24$, what is the length of one side of rhombus $ABCD$?

(1) 15   (3) 24

(2) 18   (4) 30

6 What are the truth values of the statement "Opposite angles of a trapezoid are always congruent" and its negation?

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

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

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

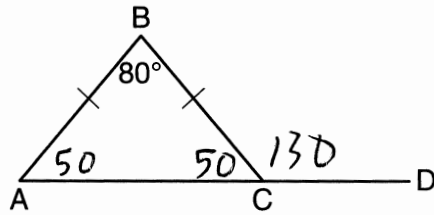(4) The statement is false and its negation is false.

7 What is the length of a line segment whose endpoints have coordinates $(5,3)$ and $(1,6)$?

(1) 5   (3) $\sqrt{17}$

(2) 25   (4) $\sqrt{29}$

$\sqrt{(5-1)^2+(3-6)^2}$

$\sqrt{16+9}$

$\sqrt{25}$

5

8 In the diagram below of isosceles $\triangle ABC$, the measure of vertex angle B is 80°. If $\overline{AC}$ extends to point D, what is m$\angle BCD$?

B 80° A 50 50 130 C D

(1) 50   (3) 100
(2) 80   (④) 130

9 A student used a compass and a straightedge to construct $\overline{CE}$ in $\triangle ABC$ as shown below.
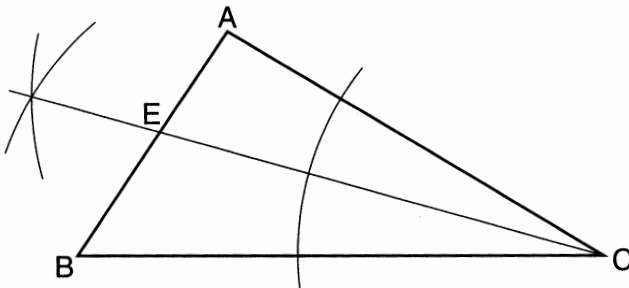
Which statement must always be true for this construction?

(1) $\angle CEA \cong \angle CEB$ (3) $\overline{AE} \cong \overline{BE}$
(②) $\angle ACE \cong \angle BCE$ (4) $\overline{EC} \cong \overline{AC}$

10 In $\triangle ABC$, $AB = 4$, $BC = 7$, and $AC = 10$. Which statement is true?

(1) m$\angle B >$ m$\angle C >$ m$\angle A$ (3) m$\angle C >$ m$\angle B >$ m$\angle A$
(②) m$\angle B >$ m$\angle A >$ m$\angle C$ (4) m$\angle C >$ m$\angle A >$ m$\angle B$

Use this space for computations.

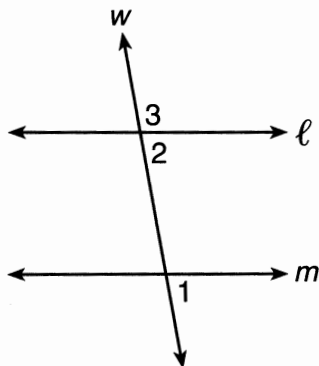Geometry – Jan. '15   [5]   [OVER]

11 A circle whose center has coordinates $(-3,4)$ passes through the origin. What is the equation of the circle?

(1) $(x + 3)^2 + (y - 4)^2 = 5$

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

(3) $(x - 3)^2 + (y + 4)^2 = 5$

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

12 Point W is located in plane $\mathcal{R}$. How many distinct lines passing through point W are perpendicular to plane $\mathcal{R}$?

(1) one   (3) zero

(2) two   (4) infinite

13 In the diagram below, line ℓ is parallel to line m, and line w is a transversal.

(Not drawn to scale)

If $m\angle 2 = 3x + 17$ and $m\angle 3 = 5x - 21$, what is $m\angle 1$?

(1) 19   (3) 74

(2) 23   (4) 86

$3x + 17 + 5x - 21 = 180$

$8x - 4 = 180$

$8x = 184$

$x = 23$

$m\angle 1 = m\angle 2 = 3(23) + 17$

$= 86$

14 The diagram below is a graph of circle O.
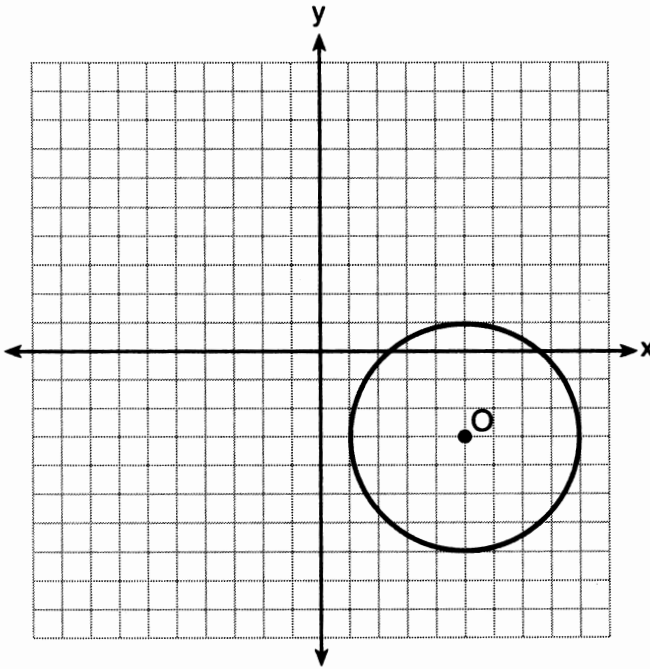
Which equation represents circle O?

(1) $(x - 5)^2 + (y + 3)^2 = 4$

(2) $(x + 5)^2 + (y - 3)^2 = 4$

(3) $(x - 5)^2 + (y + 3)^2 = 16$

(4) $(x + 5)^2 + (y - 3)^2 = 16$

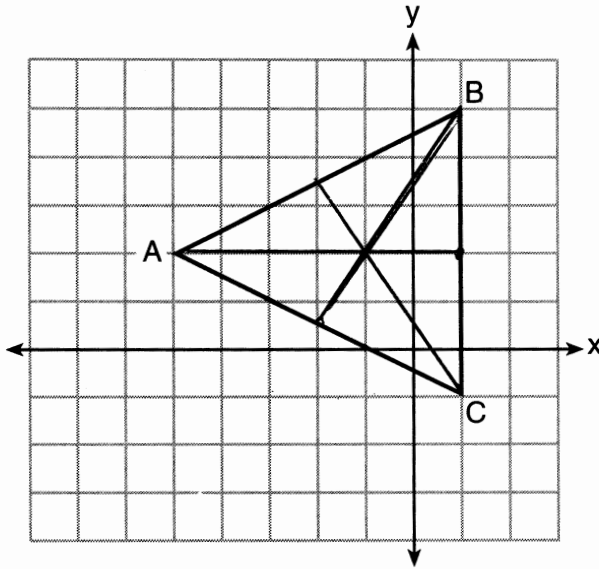**15** In isosceles trapezoid $QRST$ shown below, $\overline{QR}$ and $\overline{TS}$ are bases.
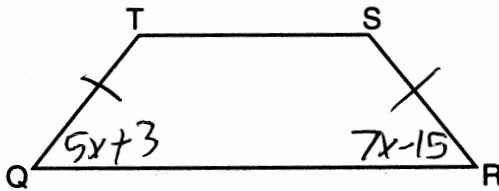
If m∠Q = $5x + 3$ and m∠R = $7x - 15$, what is m∠Q?

(1) 83   (3) 16

(2) 48   (4) 9

$5x + 3 = 7x - 15$

$18 = 2x$

$9 = x$

$m\angle Q = 5(9) + 3$

$45 + 3$

48

16 Triangle *ABC* is graphed on the set of axes below.

What are the coordinates of the point of intersection of the medians
of △*ABC*?

(1) $(-1,2)$ (3) $(0,2)$

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

17 Given the statement, "If a number has exactly two factors, it is a
prime number," what is the contrapositive of this statement?

(1) If a number does not have exactly two factors, then it is not a
prime number.

(2) If a number is not a prime number, then it does not have exactly
two factors.

(3) If a number is a prime number, then it has exactly two factors.

(4) A number is a prime number if it has exactly two factors.

18 Which graph represents a circle whose equation is
$(x - 2)^2 + (y + 4)^2 = 4$?

(1)

(3)

(2)

(4)
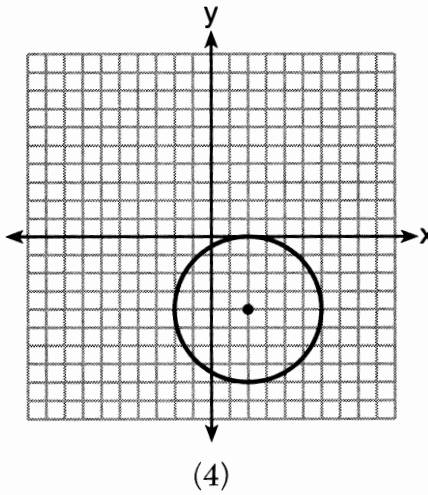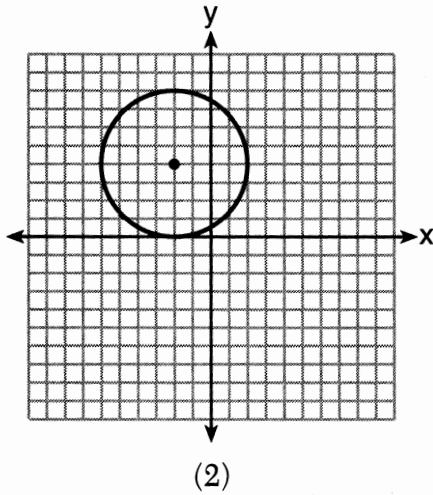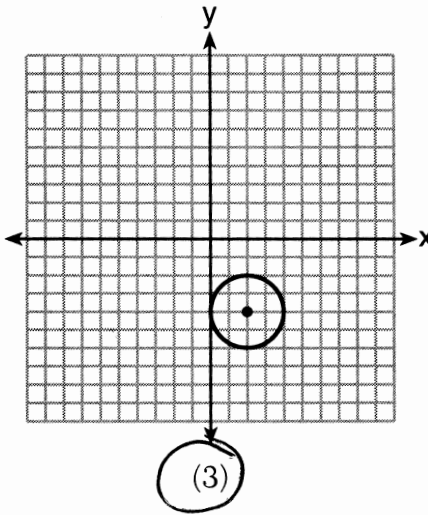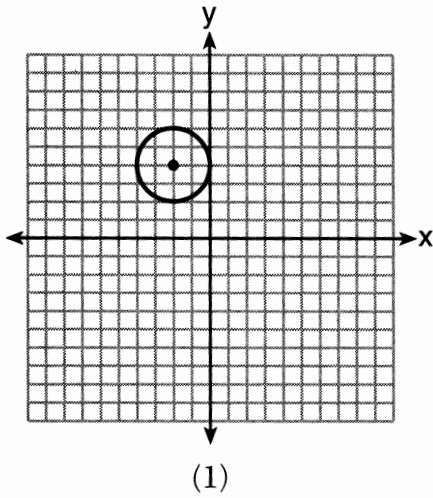
19 If two sides of a triangle have lengths of 4 and 10, the third side could be

(1) 8

(2) 2

(3) 16
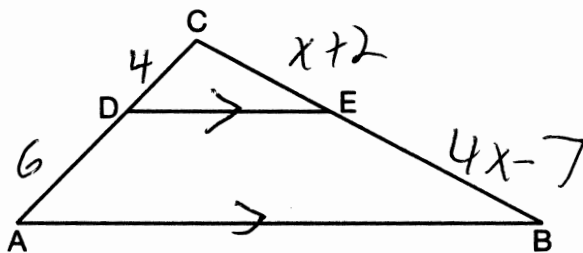
(4) 4

$10 - 4 = 6$

$10 + 4 = 14$

$6 < s < 14$

20 The lines represented by the equations $4x + 6y = 6$ and

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

$M = \frac{-A}{B} = \frac{-4}{6} = \frac{-2}{3}$

(1) parallel

(2) the same line

(3) perpendicular

(4) intersecting, but *not* perpendicular

21 In the diagram below of $\triangle ABC$, $\overline{DE} \parallel \overline{AB}$.

If $CD = 4$, $CA = 10$, $CE = x + 2$, and $EB = 4x - 7$, what is the
length of $\overline{CE}$?

(1) 10   (3) 6

(2) 8   (4) 4
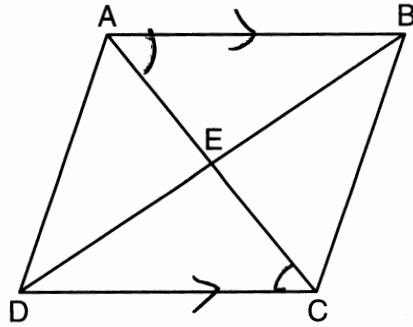
$$\frac{4}{6} = \frac{x+2}{4x-7}$$

$$16x - 28 = 6x + 12$$

$$10x = 40$$

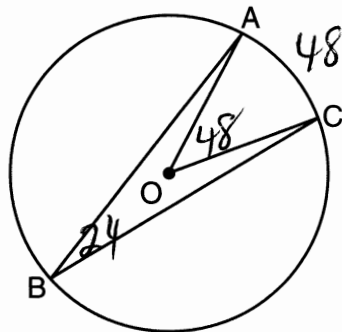$$x = 4$$

$$CE = 4 + 2 = 6$$

22 Parallelogram $ABCD$ with diagonals $\overline{AC}$ and $\overline{BD}$ intersecting at E is
shown below.

Which statement must be true?

(1) $\overline{BE} \cong \overline{CE}$ (3) $\overline{AB} \cong \overline{BC}$

(2) $\angle BAE \cong \angle DCE$ (4) $\angle DAE \cong \angle CBE$

23 In the diagram below of circle O, $m\angle ABC = 24$.

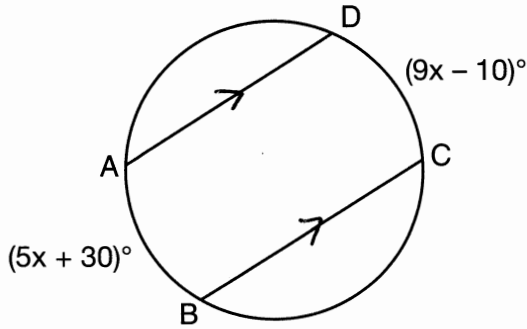What is $m\angle AOC$?

(1) 12   (3) 48

(2) 24   (4) 60

24 Triangle $A'B'C'$ is the image of $\triangle ABC$ after a dilation of 2.
Which statement is true?

(1) $AB = A'B'$ (3) $m\angle B = m\angle B'$

(2) $BC = 2(B'C')$ (4) $m\angle A = \frac{1}{2}(m\angle A')$

25 In the diagram of the circle below, $\overline{AD} \parallel \overline{BC}$, $\overparen{AB} = (5x + 30)°$, and $\overparen{CD} = (9x - 10)°$.
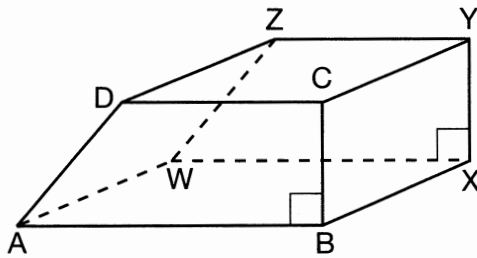

What is $m\overparen{AB}$?

(1) 5

(2) 10

(3) 55

(4) 80

(handwritten computations:)
$9x - 10 = 5x + 30$
$4x = 40$
$x = 10$
$5(10) + 30$
80

26 The bases of a prism are right trapezoids, as shown in the diagram below.
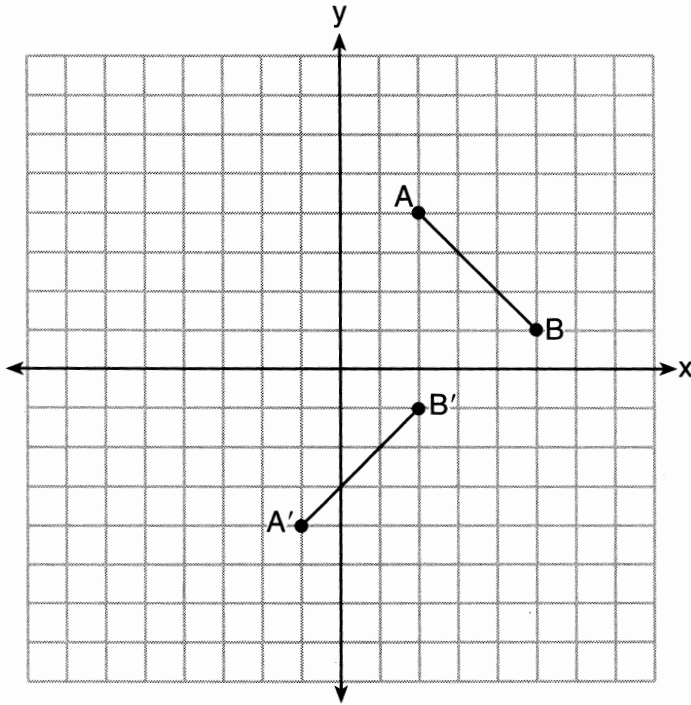

Which two edges do *not* lie in the same plane?

(1) $\overline{BC}$ and $\overline{WZ}$

(2) $\overline{AW}$ and $\overline{CY}$

(3) $\overline{DC}$ and $\overline{WX}$

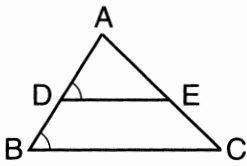(4) $\overline{BX}$ and $\overline{AB}$

27 In the diagram below, $\overline{A'B'}$ is the image of $\overline{AB}$ under which single transformation?
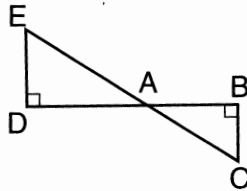

(1) dilation   (3) translation

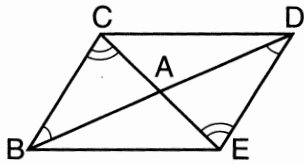(2) rotation   (4) glide reflection

28 For which diagram is the statement $\triangle ABC \sim \triangle ADE$ *not* always true?
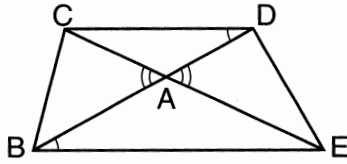

(1)

(3)

(2)

(4)

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]
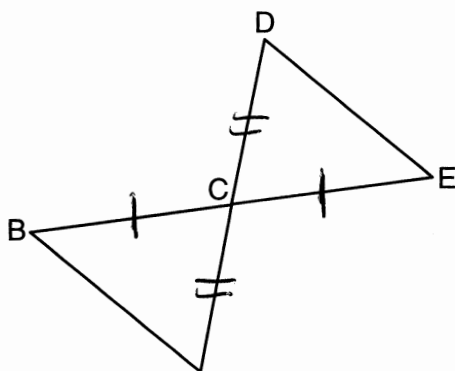
29 Given: $\overline{BE}$ and $\overline{AD}$ intersect at point C

$\overline{BC} \cong \overline{EC}$
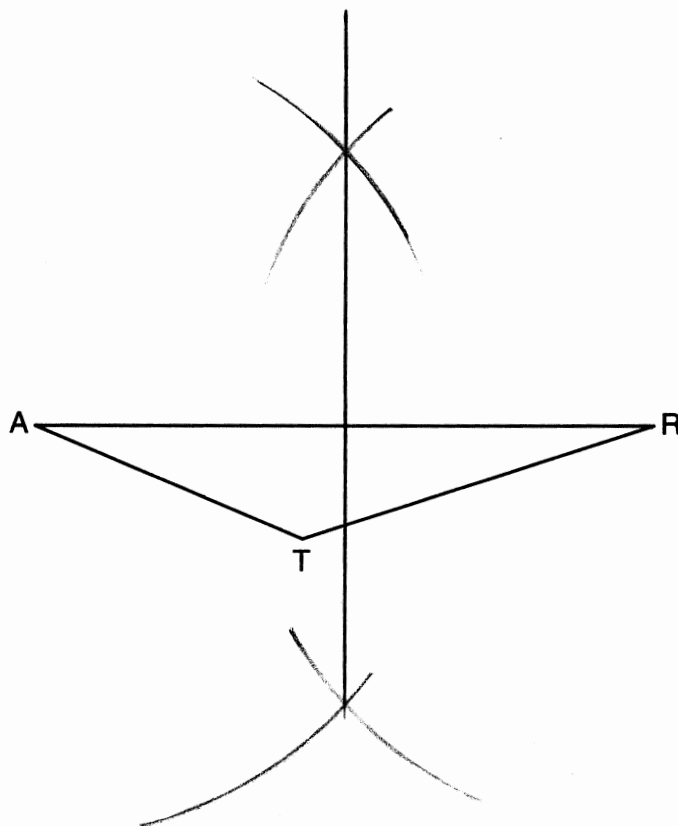
$\overline{AC} \cong \overline{DC}$

$\overline{AB}$ and $\overline{DE}$ are drawn

Prove: $\triangle ABC \cong \triangle DEC$

Statement	Reason
① $\overline{BE}$ & $\overline{AD}$ intersect at point C, $\overline{BC} \cong \overline{EC}$, $\overline{AC} \cong \overline{DC}$, $\overline{AB}$ & $\overline{DE}$ are drawn	① Given
② $\angle BCA \cong \angle ECD$	② Vertical Angles
③ $\triangle ABC \cong \triangle DEC$	③ SAS

30 Using a compass and straightedge, construct the perpendicular bisector of side $\overline{AR}$ in $\triangle ART$ shown below. [Leave all construction marks.]

31 Determine and state the measure, in degrees, of an interior angle of a regular decagon.

$$\frac{(10-2)180}{10} = 144$$

32 Write an equation of a line that is parallel to the line whose equation is $\dfrac{3y}{3} = \dfrac{x}{3} + \dfrac{6}{3}$ and that passes through the point $(-3,4)$.
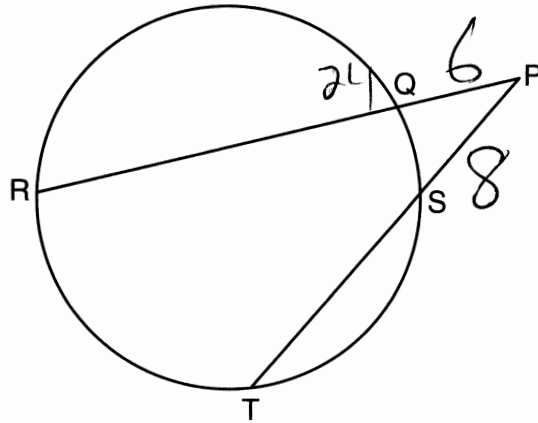
$$M = \dfrac{1}{3}$$

$$y = Mx + b$$

$$4 = \dfrac{1}{3}(-3) + b$$

$$4 = -1 + b$$

$$5 = b$$

$$y = \dfrac{1}{3}x + 5$$

33 In the diagram below, secants $\overline{PQR}$ and $\overline{PST}$ are drawn to a circle from point P.

If $PR = 24$, $PQ = 6$, and $PS = 8$, determine and state the length of $\overline{PT}$.

$WE \subset WE$

$24 \cdot 6 = W \cdot 8$

$144 = 8W$

$18 \subset W$

34 The slope of $\overline{QR}$ is $\dfrac{x-1}{4}$ and the slope of $\overline{ST}$ is $\dfrac{8}{3}$. If $\overline{QR} \perp \overline{ST}$, determine and state the value of x.

$$\frac{x-1}{4} = \frac{-3}{8}$$

$$8x - 8 = -12$$

$$8x = -4$$

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

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 Quadrilateral *HYPE* has vertices $H(2,3)$, $Y(1,7)$, $P(-2,7)$, and $E(-2,4)$. State and label the coordinates of the vertices of $H''Y''P''E''$ after the composition of transformations $r_{x\text{-axis}} \circ T_{5,-3}$. [The use of the set of axes below is optional.]

$H'(7,0)$, $Y'(6,4)$, $P'(3,4)$, $E'(3,1)$

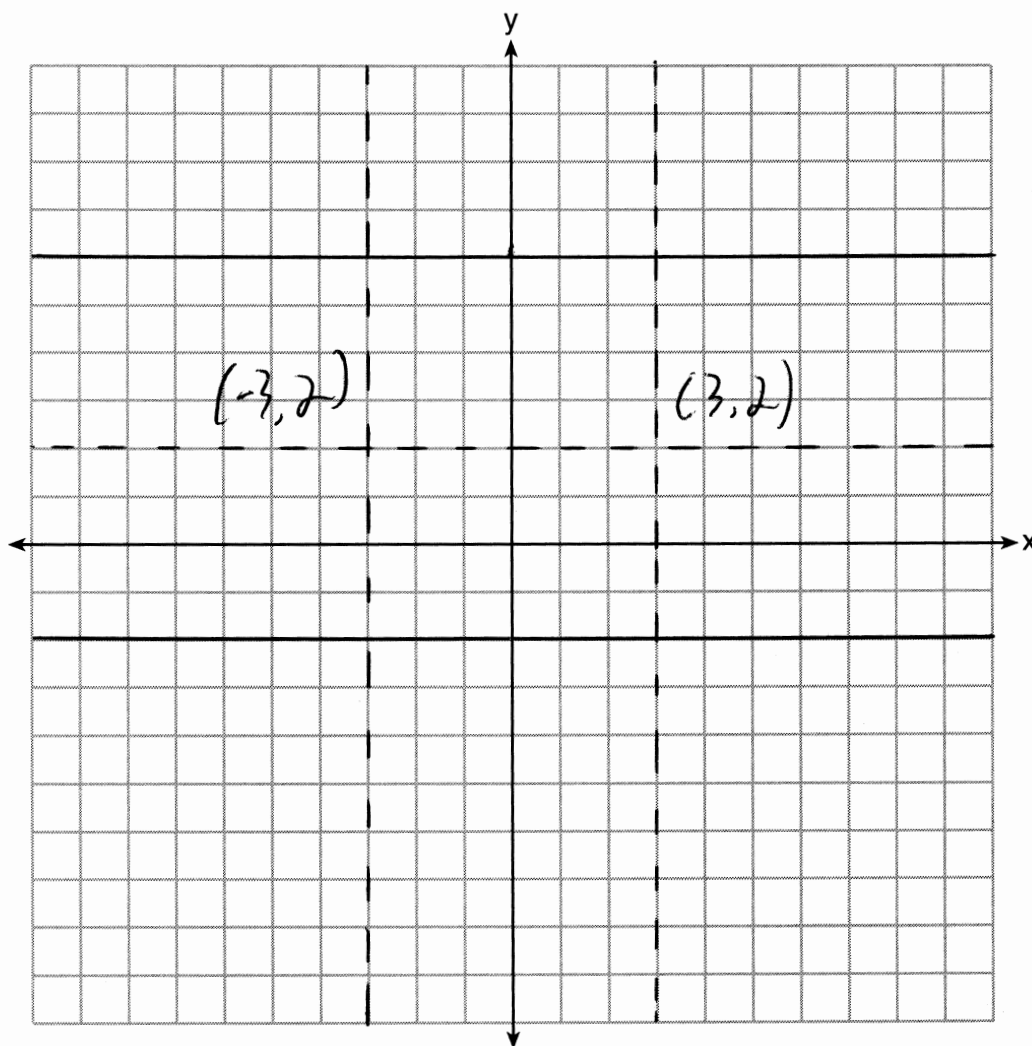$H''(7,0)$, $Y''(6,-4)$, $P''(3,-4)$, $E''(3,-1)$
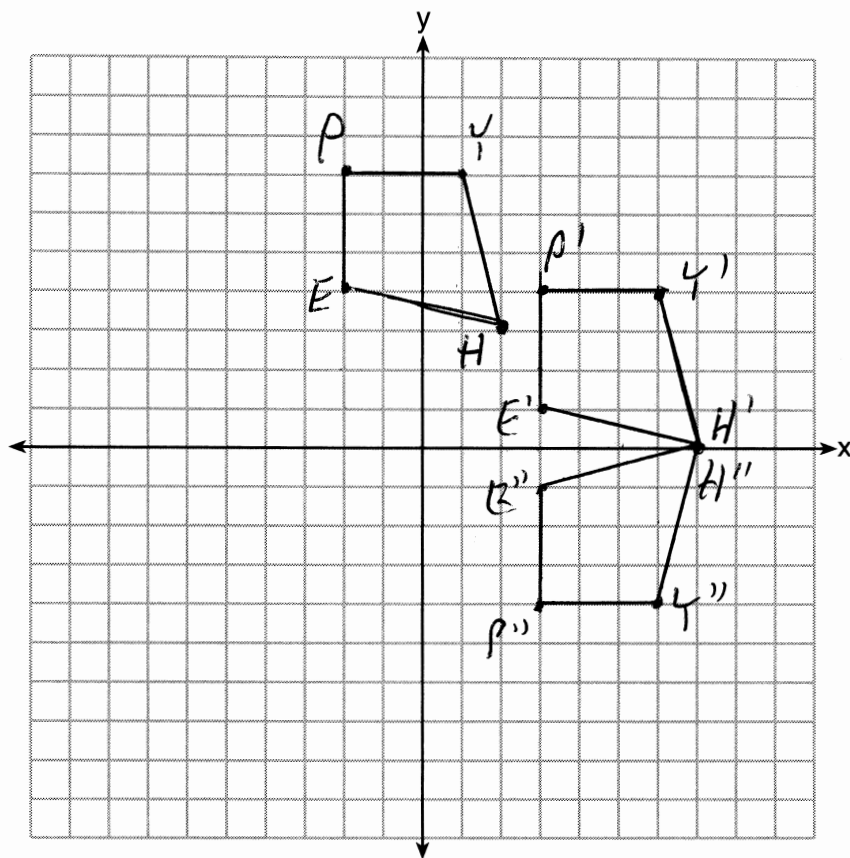
36 On the set of axes below, graph two horizontal lines whose y-intercepts are $(0,-2)$ and $(0,6)$, respectively.

Graph the locus of points equidistant from these horizontal lines.

Graph the locus of points 3 units from the y-axis.

State the coordinates of the points that satisfy both loci.
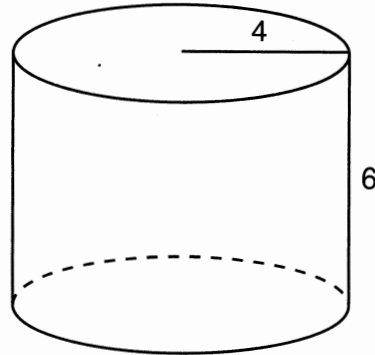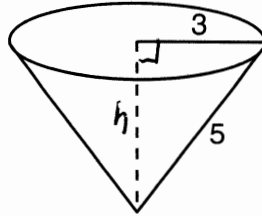

$(-3,2)$ $(3,2)$

37 In the diagram below, a right circular cone with a radius of 3 inches has a slant height of 5 inches, and a right cylinder with a radius of 4 inches has a height of 6 inches.

$h = \sqrt{5^2 - 3^2}$

$h = \sqrt{16}$

$h = 4$

Determine and state the number of full cones of water needed to completely fill the cylinder with water.

$V = \frac{1}{3}\pi r^2 h \qquad V = \pi r^2 h$

$V = \frac{1}{3} \cdot \pi \cdot 3^2 \cdot 4 \qquad V = \pi \cdot 4^2 \cdot 6$

$V = 12\pi \qquad\qquad V = 96\pi$

$\dfrac{96\pi}{12\pi} = 8$

   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]

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38 In the diagram below, right triangle RSU is inscribed in circle O, and $\overline{UT}$ is the altitude drawn to hypotenuse $\overline{RS}$. The length of $\overline{RT}$ is 16 more than the length of $\overline{TS}$ and $TU = 15$.

Find the length of $\overline{TS}$.

Find, in simplest radical form, the length of $\overline{RU}$.
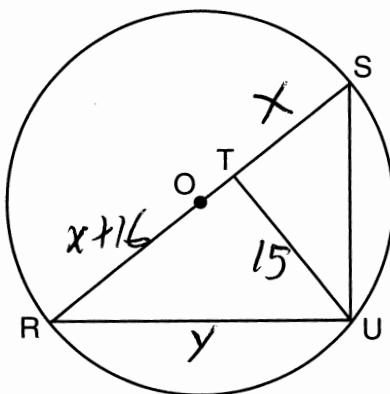
$$X(x+16) = 15^2$$
$$x^2 + 16x - 225 = 0$$
$$(x+25)(x-9) = 0$$
$$x = 9$$

$$25 \cdot 34 = y^2$$
$$5\sqrt{34} = y$$