The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

GEOMETRY

Wednesday, January 29, 2014 — 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.

Part I

Answer all 28 questions in this part. Each correct answer will receive 2 credits. 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 The midpoint of $\overline{AB}$ is $M(4,2)$. If the coordinates of A are $(6,-4)$, what are the coordinates of B?

(1) $(1,-3)$
(2) $(2,8)$
(3) $(5,-1)$
(4) $(14,0)$

$\frac{6+x}{2} = 4$

$6+x = 8$

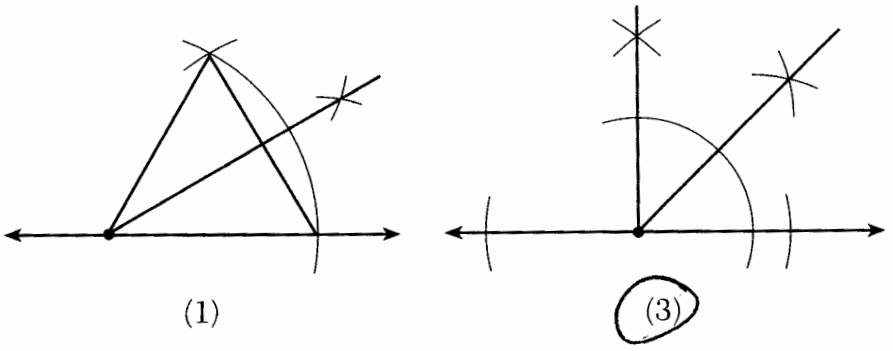
$x = 2$

$\frac{-4+y}{2} = 2$

$-4+y = 4$

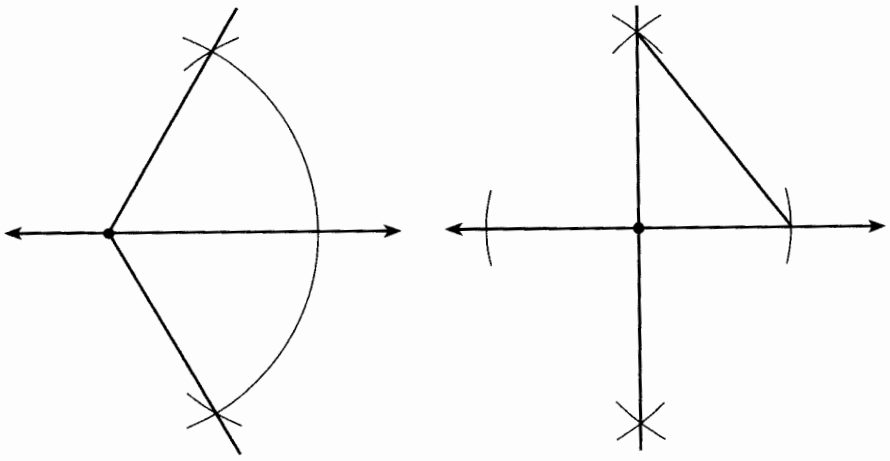
$y = 8$

2 Which diagram shows the construction of a 45° angle?



(1)

(3)



(2)

(4)

Use this space for computations.

3 What are the coordinates of the center and the length of the radius of the circle whose equation is $(x + 1)^2 + (y - 5)^2 = 16$?

(1) (1,−5) and 16
(2) (−1,5) and 16
(3) (1,−5) and 4
(4) (−1,5) and 4

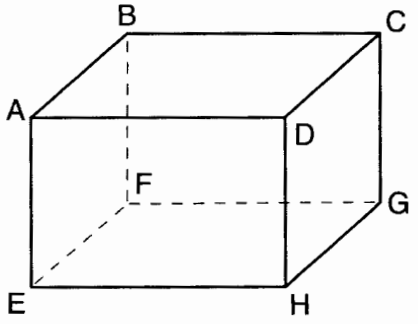
4 If distinct planes $\mathcal{R}$ and S are both perpendicular to line ℓ, which statement must always be true?

(1) Plane $\mathcal{R}$ is parallel to plane S.
(2) Plane $\mathcal{R}$ is perpendicular to plane S.
(3) Planes $\mathcal{R}$ and S and line ℓ are all parallel.
(4) The intersection of planes $\mathcal{R}$ and S is perpendicular to line ℓ.

5 If $\triangle ABC$ and its image, $\triangle A'B'C'$, are graphed on a set of axes, $\triangle ABC \cong \triangle A'B'C'$ under each transformation *except*

(1) D_2
(2) $R_{90°}$
(3) $r_{y=x}$
(4) $T_{\langle -2,3 \rangle}$

6 A right rectangular prism is shown in the diagram below.



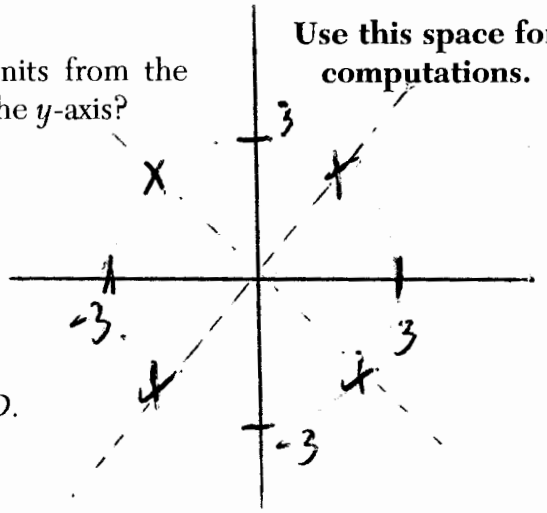
Which pair of edges are *not* coplanar?

(1) $\overline{BF}$ and $\overline{CG}$
(2) $\overline{BF}$ and $\overline{DH}$
(3) $\overline{EF}$ and $\overline{CD}$
(4) $\overline{EF}$ and $\overline{BC}$

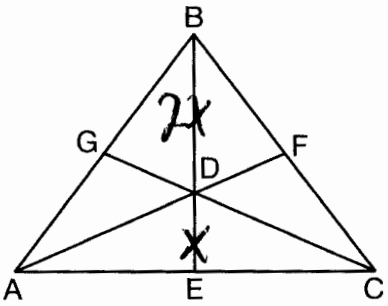
Use this space for computations.

7 How many points in the coordinate plane are 3 units from the origin and also equidistant from both the x-axis and the y-axis?

(1) 1
(3) 8
(2) 2
(4) 4



8 As shown below, the medians of $\triangle ABC$ intersect at D.



If the length of $\overline{BE}$ is 12, what is the length of $\overline{BD}$?

(1) 8
(3) 3
(2) 9
(4) 4

$2x + x = 12$
$3x = 12$
$x = 4$
$\overline{BD} = 2(4) = 8$

9 The solution of the system of equations $y = x^2 - 2$ and $y = x$ is

(1) (1,1) and (−2,−2)
(3) (1,1) and (2,2)
(2) (2,2) and (−1,−1)
(4) (−2,−2) and (−1,−1)

$x^2 - 2 = x$
$x^2 - x - 2 = 0$
$(x-2)(x+1) = 0$
$x = 2, -1$
$(2,2)\ (-1,-1)$

10 Line ℓ passes through the point (5,3) and is parallel to line k whose equation is $5x + y = 6$. An equation of line ℓ is

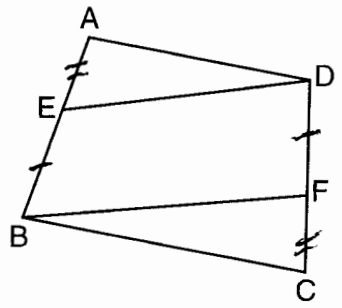
(1) $y = \frac{1}{5}x + 2$
(3) $y = \frac{1}{5}x - 2$
(2) $y = -5x + 28$
(4) $y = -5x - 28$

$y = -5x + 6$
m

$y = mx + b$
$3 = (-5)(5) + b$
$3 = -25 + b$
$28 = b$

Use this space for computations.

11 In the diagram below of quadrilateral $ABCD$, E and F are points on $\overline{AB}$ and $\overline{CD}$, respectively, $\overline{BE} \cong \overline{DF}$, and $\overline{AE} \cong \overline{CF}$.



Which conclusion can be proven?

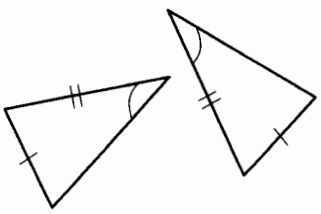
(1) $\overline{ED} \cong \overline{FB}$

(2) $\overline{AB} \cong \overline{CD}$

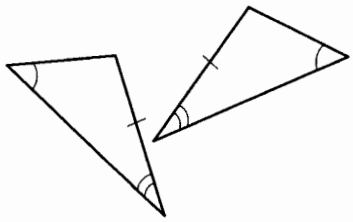
(3) $\angle A \cong \angle C$

(4) $\angle AED \cong \angle CFB$

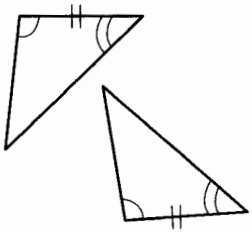
12 In the diagram below, four pairs of triangles are shown. Congruent corresponding parts are labeled in each pair.



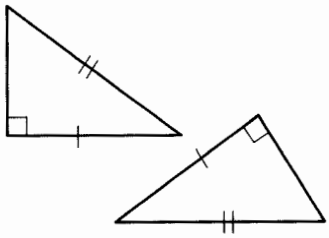
A SSA



C AAS



B ASA



D HL

Using only the information given in the diagrams, which pair of triangles can *not* be proven congruent?

(1) A

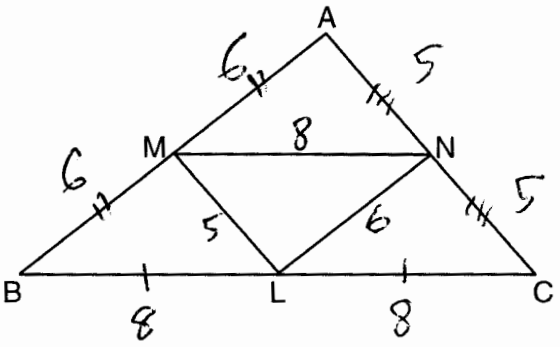
(2) B

(3) C

(4) D

Use this space for computations.

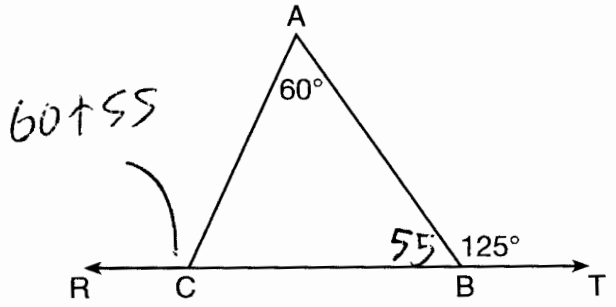
13 In $\triangle ABC$ shown below, L is the midpoint of $\overline{BC}$, M is the midpoint of $\overline{AB}$, and N is the midpoint of $\overline{AC}$.



If $MN = 8$, $ML = 5$, and $NL = 6$, the perimeter of trapezoid $BMNC$ is

(1) 35
(2) 31
(3) 28
(4) 26

14 In the diagram below, $\overleftrightarrow{RCBT}$ and $\triangle ABC$ are shown with $m\angle A = 60$ and $m\angle ABT = 125$.

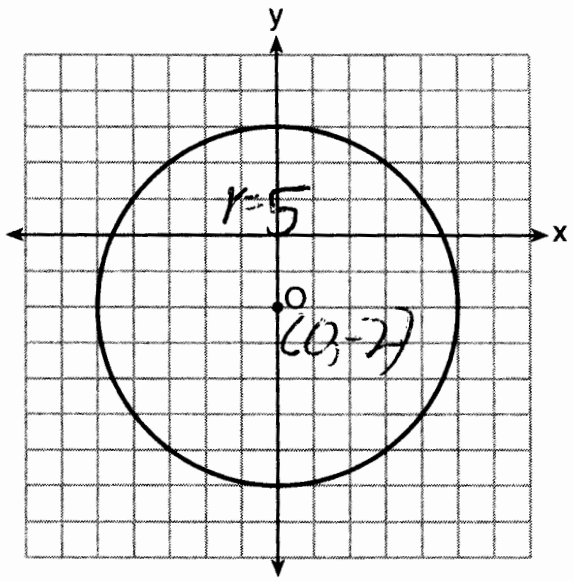


What is $m\angle ACR$?

(1) 125
(2) 115
(3) 65
(4) 55

15 Which equation represents circle O shown in the graph below?

Use this space for computations.



(1) $x^2 + (y - 2)^2 = 10$

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

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

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

16 For which measures of the sides of $\triangle ABC$ is angle B the largest angle of the triangle?

(1) $AB = 2, BC = 6, AC = 7$

(2) $AB = 6, BC = 12, AC = 8$

(3) $AB = 16, BC = 9, AC = 10$

(4) $AB = 18, BC = 14, AC = 5$

17 What is the measure of the largest exterior angle that any regular polygon can have?

(1) 60°

(2) 90°

(3) 120°

(4) 360°

The regular polygon with the smallest interior angle is an equilateral triangle with 60°
180°-60°=120

Use this space for computations.

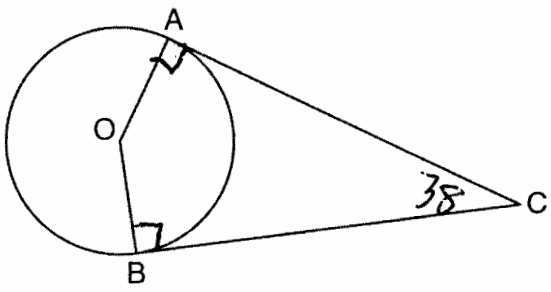
18 As shown in the diagram below, a landscaper uses a cylindrical lawn roller on a lawn. The roller has a radius of 9 inches and a width of 42 inches.

To the *nearest square inch*, the area the roller covers in one complete rotation is

(1) 2,374
(2) 2,375
(3) 10,682
(4) 10,688

$\pi d \cdot h$
$18\pi \cdot 42 \approx 2375$

19 In the diagram below, $\overline{AC}$ and $\overline{BC}$ are tangent to circle O at A and B, respectively, from external point C.



$180 - 38 = 142$

If $m\angle ACB = 38$, what is $m\angle AOB$?

(1) 71
(2) 104
(3) 142
(4) 161

Use this space for computations.

20 What is the perimeter of a square whose diagonal is $3\sqrt{2}$?

(1) 18
(2) 12
(3) 9
(4) 6

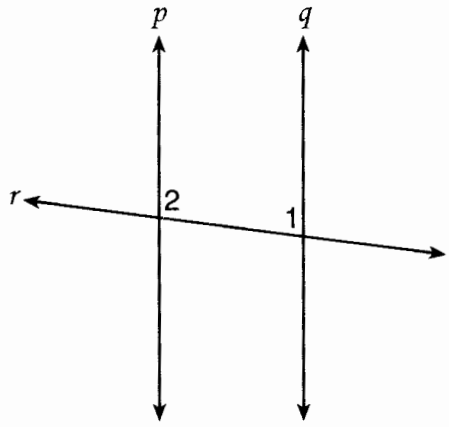
$5^2+5^2=(3\sqrt{2})^2$
$25=9\cdot 2$
$5=3$
$3\cdot 4=12$

21 The coordinates of point P are (7,1). What are the coordinates of the image of P after $R_{90°}$ about the origin?

(1) (1,7)
(2) (−7,−1)
(3) (1,−7)
(4) (−1,7)

$(x,y)\rightarrow(-y,x)$
$(7,1)\rightarrow(-1,7)$

22 Lines p and q are intersected by line r, as shown below.



If $m\angle 1 = 7x - 36$ and $m\angle 2 = 5x + 12$, for which value of x would $p \parallel q$?

(1) 17
(2) 24
(3) 83
(4) 97

$7x-36+5x+12=180$
$12x-24=180$
$12x=204$
$x=17$

Use this space for computations.

23 What is the equation of the circle with its center at $(-1,2)$ and that passes through the point $(1,2)$?

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

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

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

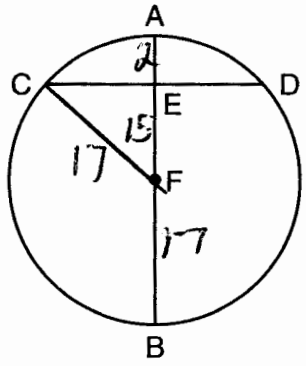
(4) $(x - 1)^2 + (y + 2)^2 = 2$

(1,2)

r = 2

$r^2 = 4$

24 In the diagram below, diameter $\overline{AB}$ bisects chord $\overline{CD}$ at point E in circle F.



$\sqrt{17^2 - 15^2}$

$\sqrt{289 - 225}$

$\sqrt{64}$

8

If $AE = 2$ and $FB = 17$, then the length of $\overline{CE}$ is

(1) 7

(2) 8

(3) 15

(4) 16

25 Which quadrilateral does *not* always have congruent diagonals?

(1) isosceles trapezoid

(2) rectangle

(3) rhombus

(4) square

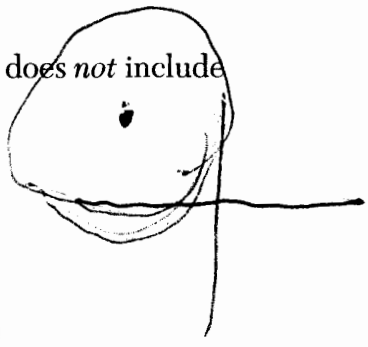
26 A circle with the equation $(x + 6)^2 + (y - 7)^2 = 64$ does *not* include points in Quadrant

(1) I

(2) II

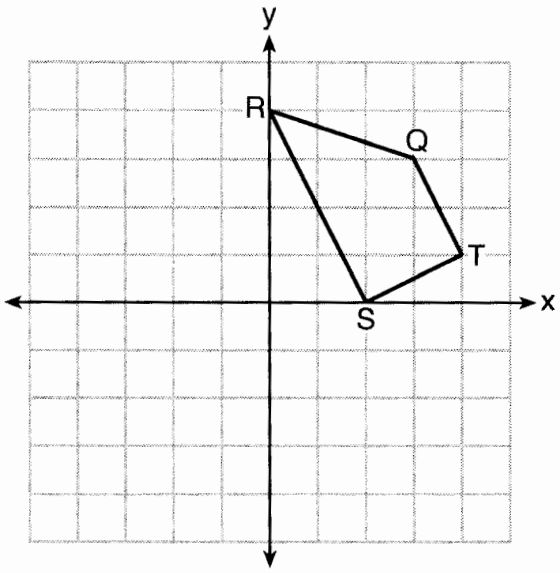
(3) III

(4) IV



Use this space for computations.

27 Trapezoid $QRST$ is graphed on the set of axes below.



Under which transformation will there be *no* invariant points?

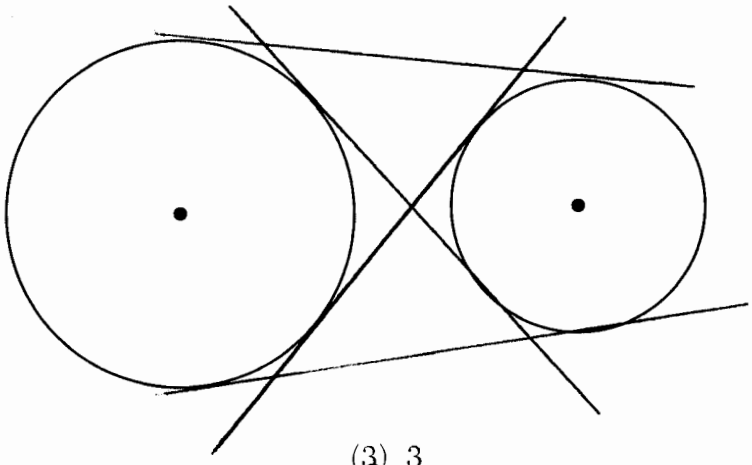
(1) $r_{y=0}$

(2) $r_{x=0}$

(3) $r_{(0,0)}$

(4) $r_{y=x}$

28 How many common tangent lines can be drawn to the circles shown below?



(1) 1

(2) 2

(3) 3

(4) 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]

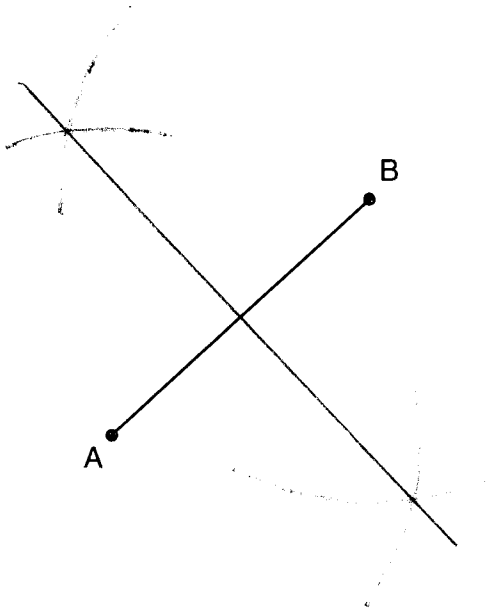
29 The diameter of a sphere is 5 inches. Determine and state the surface area of the sphere, to the *nearest hundredth of a square inch.*

$SA = 4\pi r^2$

$= 4\pi \cdot \left(\frac{5}{2}\right)^2$

≈ 78.54

30 Using a compass and straightedge, construct the perpendicular bisector of $\overline{AB}$.
[Leave all construction marks.]



31 The endpoints of $\overline{AB}$ are $A(3,-4)$ and $B(7,2)$. Determine and state the length of $\overline{AB}$ in simplest radical form.

$\sqrt{(3-7)^2+(-4-2)^2}$

$\sqrt{16+36}$

$\sqrt{52}$

$\sqrt{4}\sqrt{13}$

$2\sqrt{13}$

32 A right prism has a square base with an area of 12 square meters. The volume of the prism is 84 cubic meters. Determine and state the height of the prism, in meters.

$V = lwh$

$84 = 12h$

$7 = h$

33 State whether the lines represented by the equations $y = \frac{1}{2}x - 1$ and $y + 4 = -\frac{1}{2}(x - 2)$ are parallel, perpendicular, or neither. Explain your answer.

$m = \frac{1}{2}$

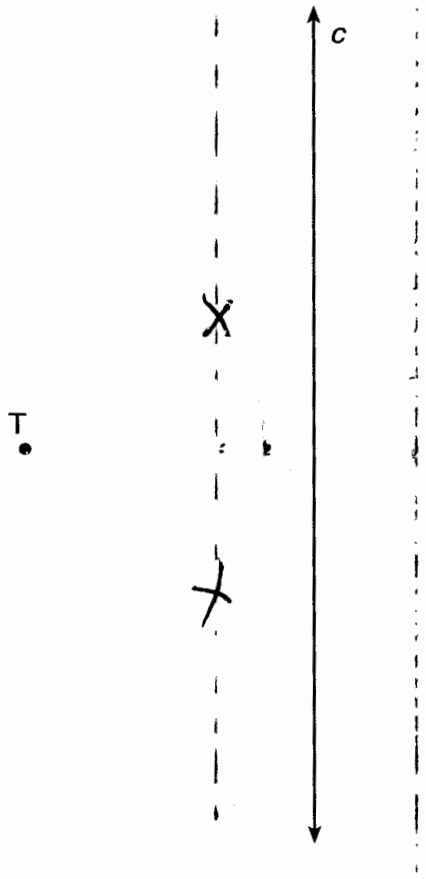
$m = -\frac{1}{2}$

Neither. The slopes are neither equal nor opposite reciprocals

34 A tree, T, is 6 meters from a row of corn, c, as represented in the diagram below. A farmer wants to place a scarecrow 2 meters from the row of corn and also 5 meters from the tree.

Sketch both loci.

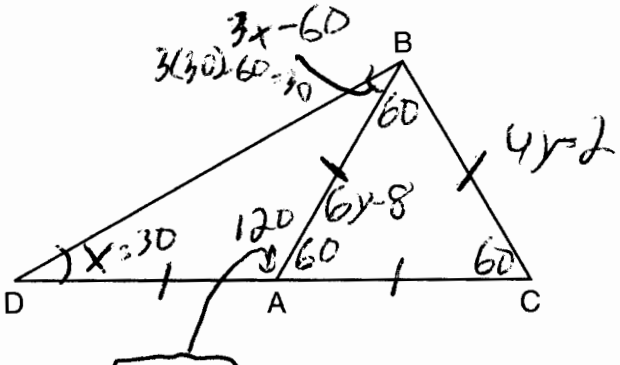
Indicate, with an **X**, all possible locations for the scarecrow.



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 the diagram of $\triangle BCD$ shown below, $\overline{BA}$ is drawn from vertex B to point A on $\overline{DC}$, such that $\overline{BC} \cong \overline{BA}$.



In $\triangle DAB$, $m\angle D = x$, $m\angle DAB = 5x - 30$, and $m\angle DBA = 3x - 60$. In $\triangle ABC$, $AB = 6y - 8$ and $BC = 4y - 2$. [Only algebraic solutions can receive full credit.]

Find $m\angle D$. $x + 3x - 60 + 5x - 30 = 180$
$9x - 90 = 180$
$9x = 270$
$x = 30 = m\angle D$

Find $m\angle BAC$. $5(30) - 30$
$150 - 30 = 120$ $180 - 120 = 60$

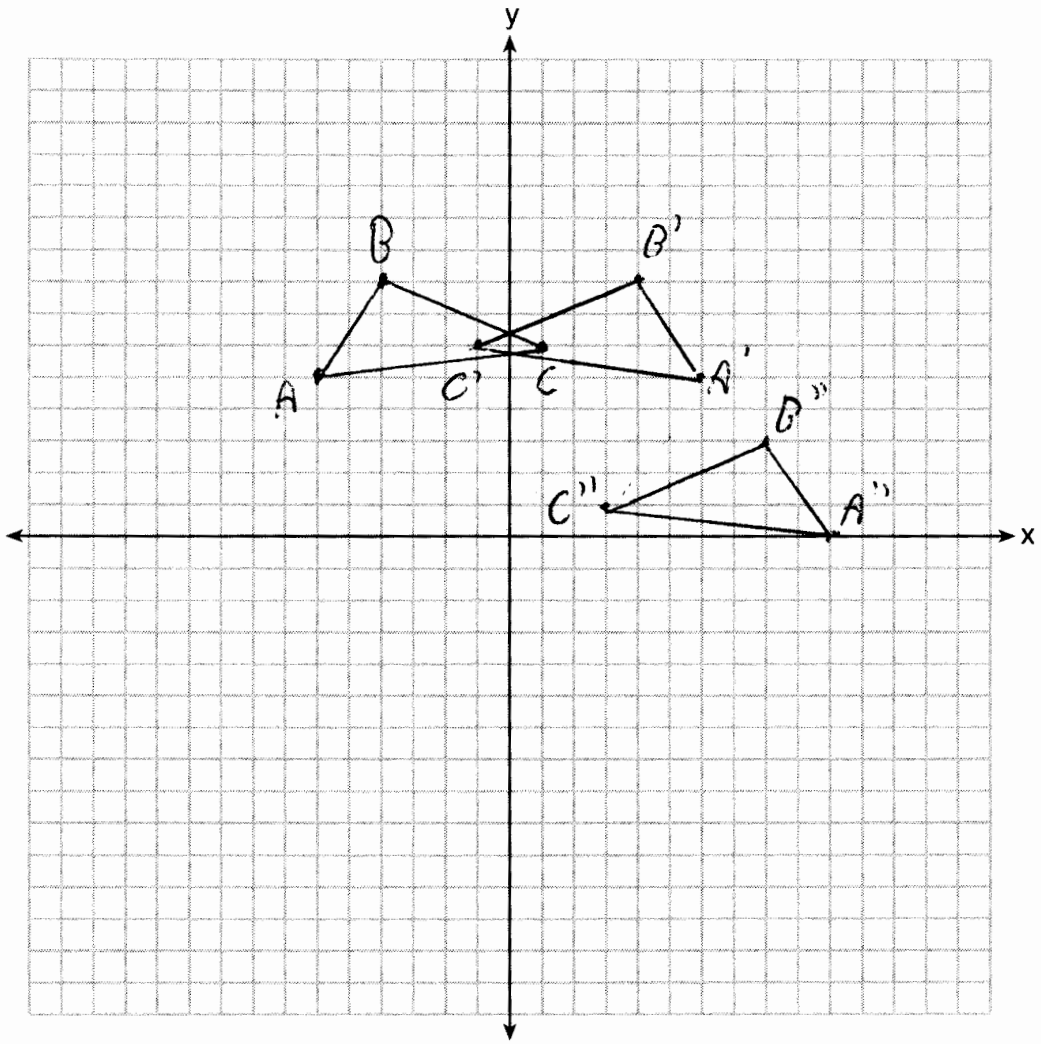
Find the length of $\overline{BC}$. $6y - 8 = 4y - 2$ $4(3) - 2 = 10$
$2y = 6$
$y = 3$

Find the length of $\overline{DC}$.
$10 + 10 = 20$

36 The coordinates of the vertices of $\triangle ABC$ are $A(-6,5)$, $B(-4,8)$, and $C(1,6)$. State and label the coordinates of the vertices of $\triangle A''B''C''$, the image of $\triangle ABC$ after the composition of transformations $T_{4,-5} \circ r_{y\text{-axis}}$.

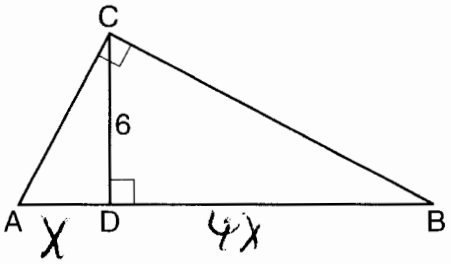
[The use of the set of axes below is optional.]

A'(6,5) B'(4,8) C'(-1,6)
A''(10,0) B''(8,3) C''(3,1)



37 In right triangle ABC below, $\overline{CD}$ is the altitude to hypotenuse $\overline{AB}$. If $CD = 6$ and the ratio of AD to AB is 1:5, determine and state the length of $\overline{BD}$.

[Only an algebraic solution can receive full credit.]



x $4x$

$4x \cdot x = 6^2$

$4x^2 = 36$

$x^2 = 9$

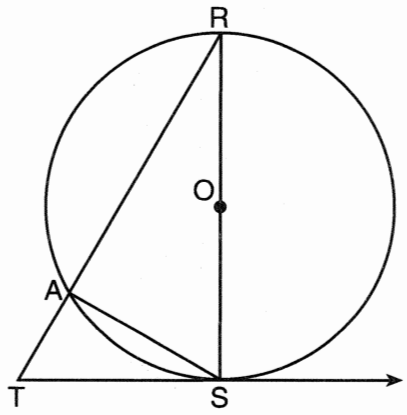
$x = 3$

$\overline{BD} = 4(3) = 12$

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

38 In the diagram of circle O below, diameter $\overline{RS}$, chord $\overline{AS}$, tangent $\overrightarrow{TS}$, and secant $\overline{TAR}$ are drawn.



Complete the following proof to show $(RS)^2 = RA \bullet RT$

Statements	Reasons
1. circle O, diameter $\overline{RS}$, chord $\overline{AS}$, tangent $\overrightarrow{TS}$, and secant $\overline{TAR}$	1. Given
2. $\overline{RS} \perp \overrightarrow{TS}$	2. The diameter of a circle is ⊥ to a tangent at the point of tangency
3. $\angle RST$ is a right angle	3. ⊥ lines form right angles
4. $\angle RAS$ is a right angle	4. An angle inscribed in a semi-circle is a right angle
5. $\angle RST \cong \angle RAS$	5. All right angles are congruent
6. $\angle R \cong \angle R$	6. Reflexive property
7. $\triangle RST \sim \triangle RAS$	7. AA
8. $\frac{RS}{RA} = \frac{RT}{RS}$	8. Corresponding sides of similar triangles are in proportion
9. $(RS)^2 = RA \bullet RT$	9. The product of the means equals the product of the extremes