Scoring Guide for the Geometry Test Sampler

Answers to multiple-choice questions 1 through 28, and the specific rubrics for open-ended questions 29 through 38, are provided on the following pages. A complete and correct student response is provided for each open-ended question. The response shows one example of how to solve the problem. In most cases there are other acceptable solutions. Other student responses are shown for each score level.

The maximum raw score for the Regents Examination in Geometry is allocated as follows:

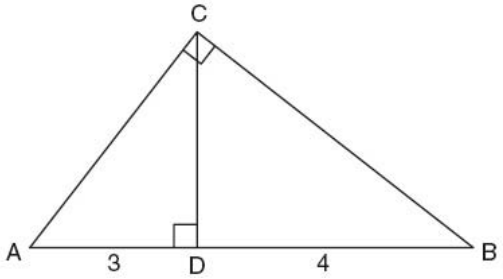
Part I	28 two-credit multiple-choice questions	56 credits
Part II	6 two-credit open-ended questions	12 credits
Part III	3 four-credit open-ended questions	12 credits
Part IV	1 six-credit open-ended question	6 credits

Part I

(1)	3	(8)	3	(15)	1	(22)	4
(2)	4	(9)	1	(16)	3	(23)	1
(3)	1	(10)	4	(17)	2	(24)	4
(4)	3	(11)	3	(18)	4	(25)	3
(5)	3	(12)	2	(19)	2	(26)	4
(6)	2	(13)	2	(20)	1	(27)	4
(7)	1	(14)	3	(21)	1	(28)	2

Part II

(29) In the diagram below of right triangle ACB, altitude $\overline{CD}$ intersects $\overline{AB}$ at D. If $AD = 3$ and $DB = 4$, find the length of $\overline{CD}$ in simplest radical form.



Rubric

[2] $2\sqrt{3}$, and appropriate work is shown.

[1] Appropriate work is shown, but the answer is not written in simplest radical form.

or

[1] Appropriate work is shown, but one computational error is made.

or

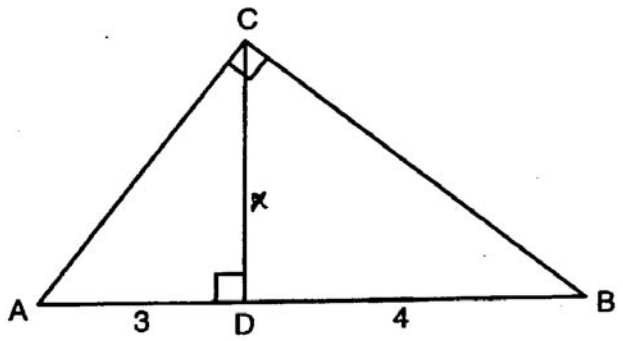
[1] Appropriate work is shown, but one conceptual error is made.

or

[1] $2\sqrt{3}$, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Student work for Item 29 – Score 2



$$\frac{3}{x} = \frac{x}{4}$$

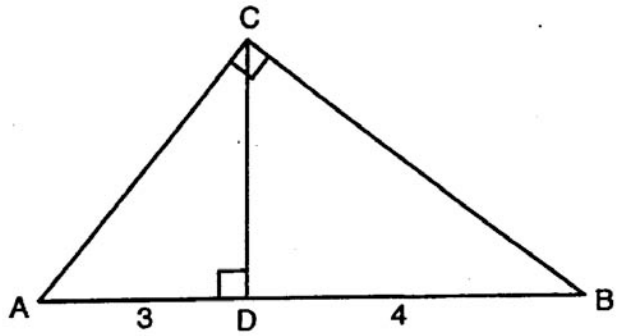
$$12 = x^2$$

$$x = \sqrt{12}$$

$$\sqrt{4}\sqrt{3}$$

$$\boxed{x = 2\sqrt{3}}$$

Student work for Item 29 – Score 1

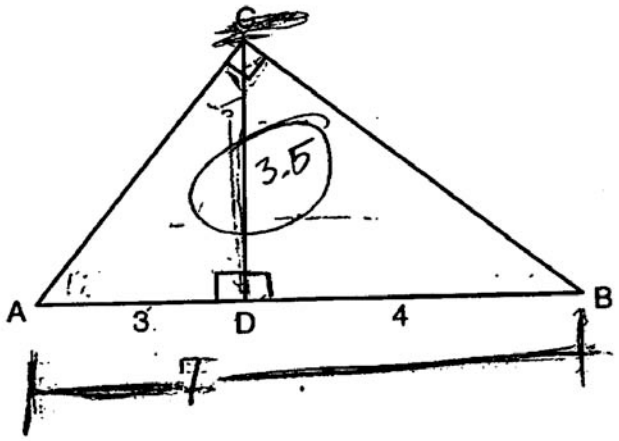


$3 \cdot 4 = x \cdot x$

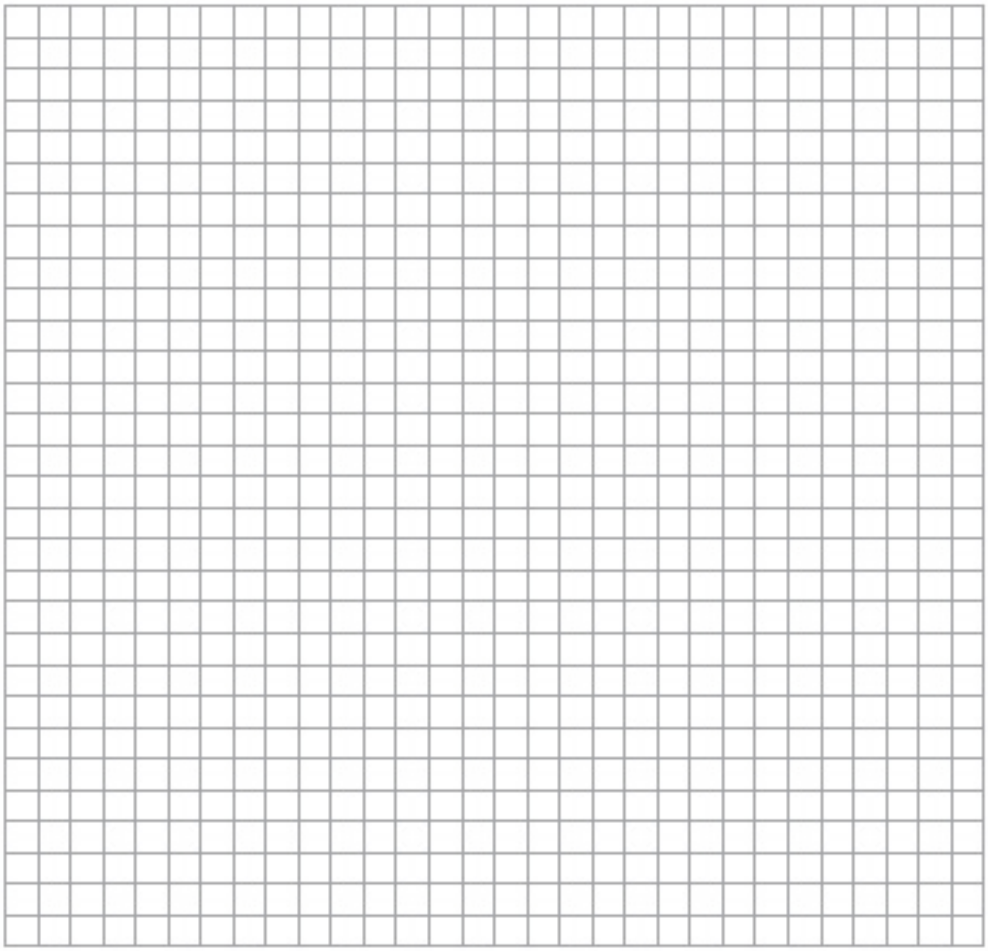
$12 = x^2$

$\boxed{3 = x}$

Student work for Item 29 – Score 0



(30) The vertices of $\triangle ABC$ are $A(3,2)$, $B(6,1)$, and $C(4,6)$. Identify and graph a transformation of $\triangle ABC$ such that its image, $\triangle A'B'C'$, results in $\overline{AB} \parallel \overline{A'B'}$.



Rubric

[2] A correct transformation is stated and drawn, such as a translation, a dilation, a reflection through the origin, a rotation of 180° around the origin, or any description of a transformation.

[1] A correct transformation is stated, but the graph is missing or incorrect.

or

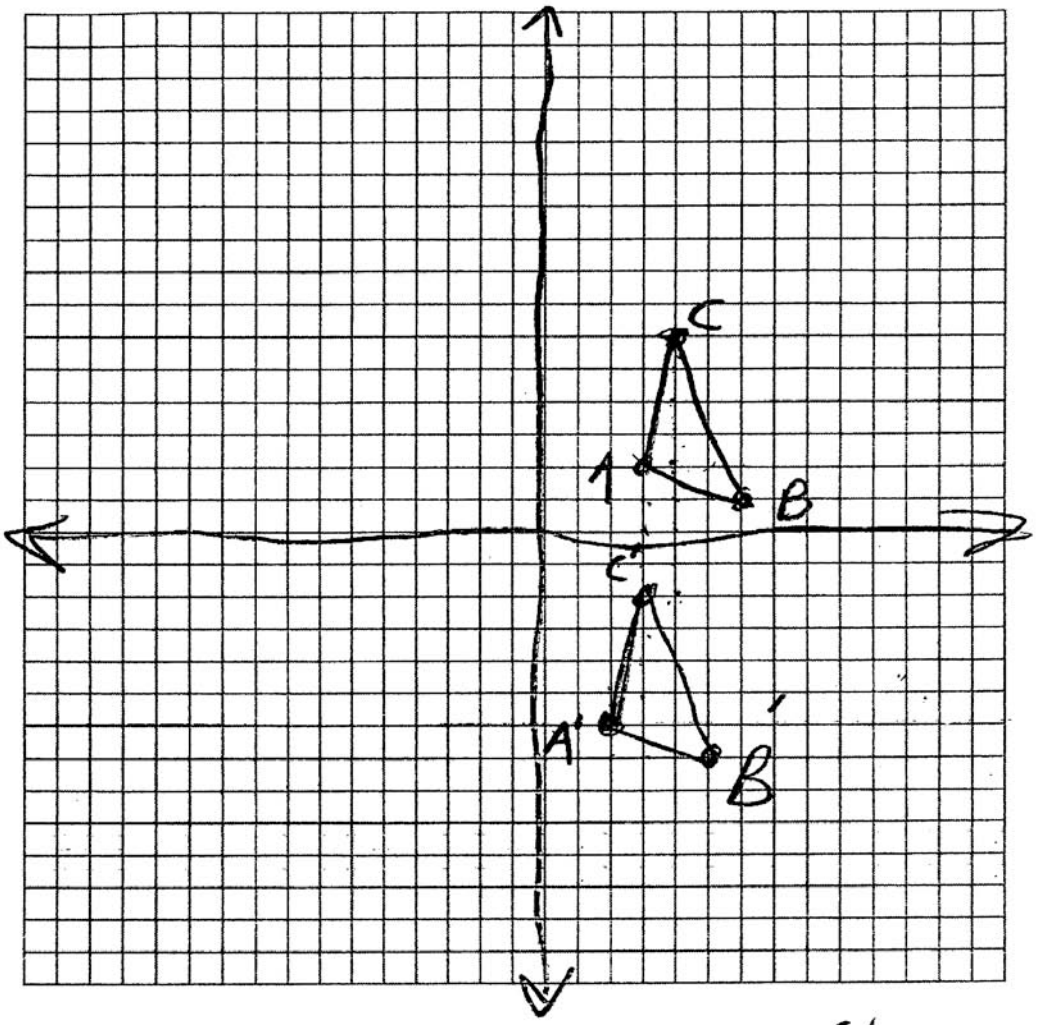
[1] A correct graph is drawn, but a transformation is not stated or is stated incorrectly.

or

[1] Appropriate work is shown, but one conceptual error is made.

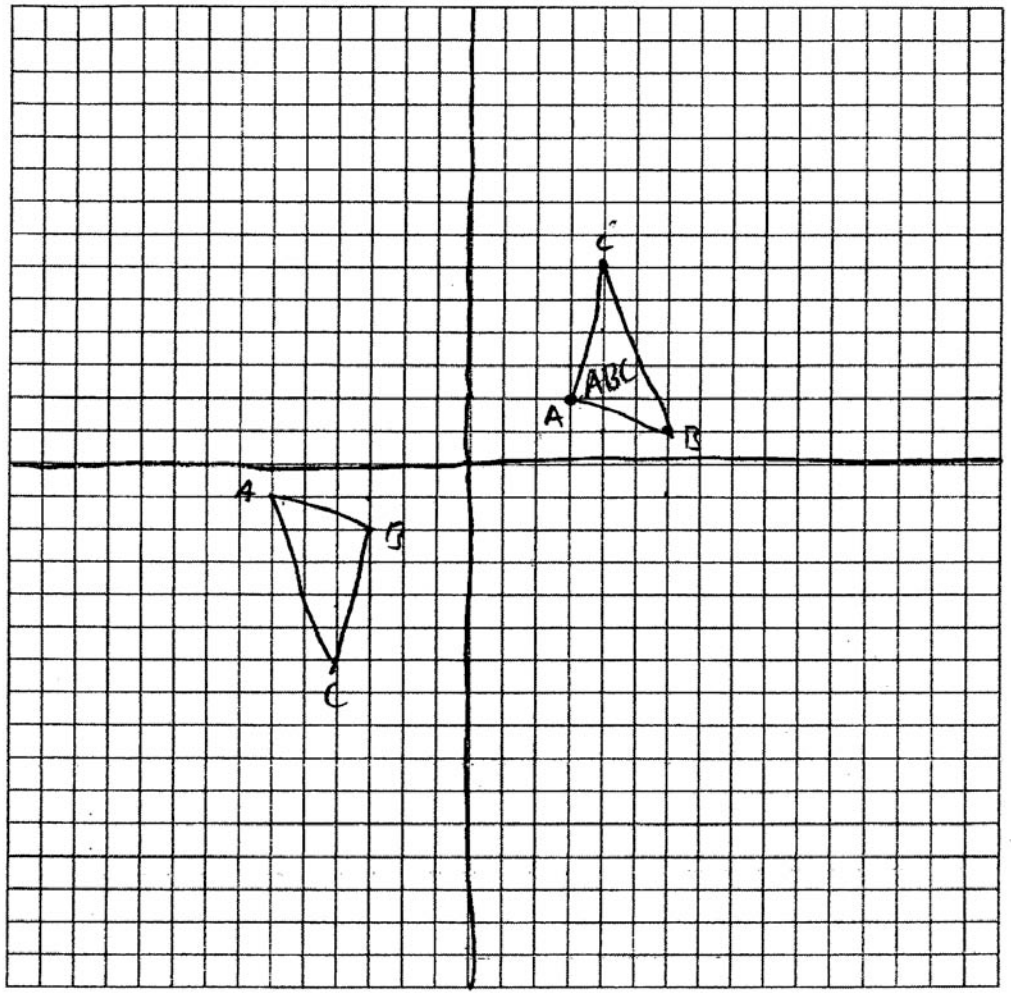
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Student work for Item 30 – Score 2



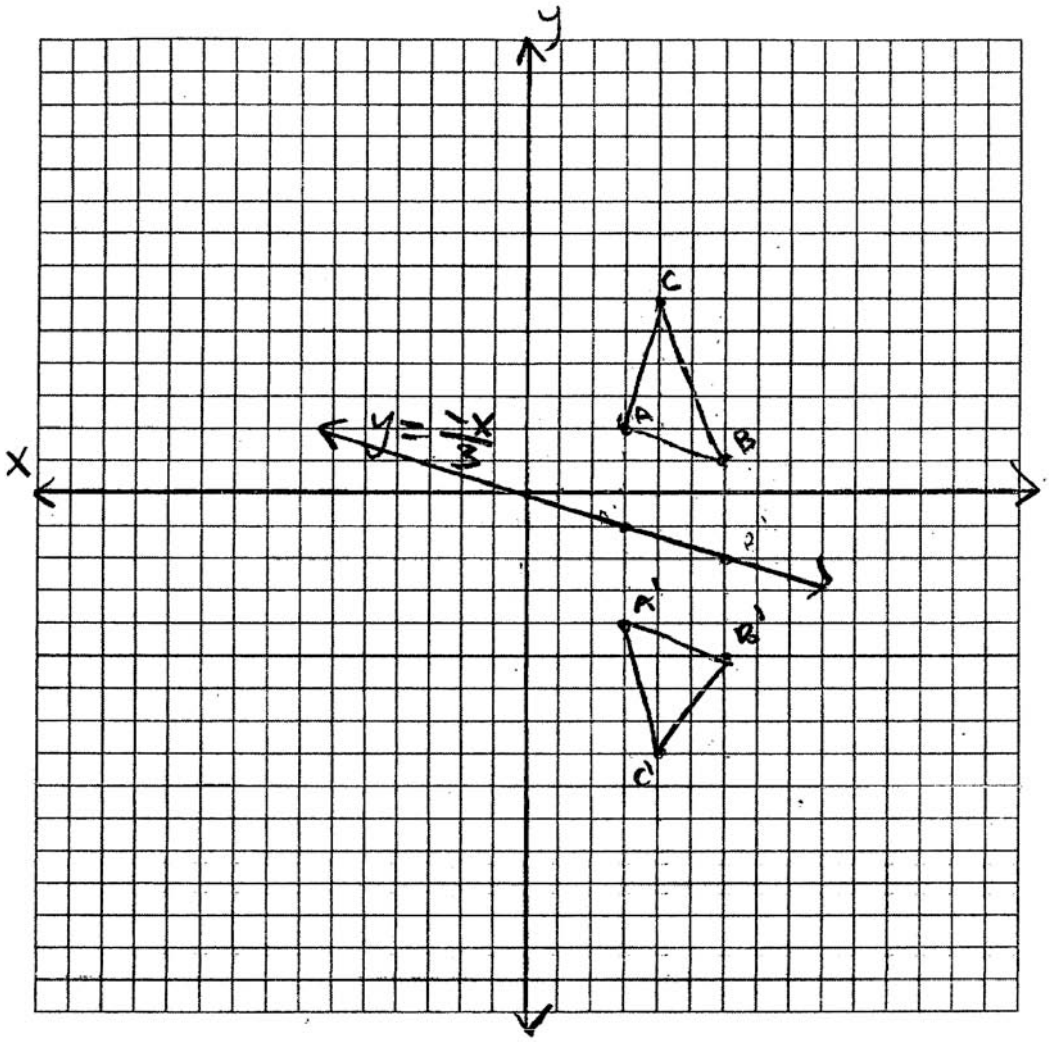
Down 8
left 1

Student work for Item 30 – Score 1



reflection through origin

Student work for Item 30 – Score 0



$m_{AB} = \frac{y_2 - y_1}{x_2 - x_1}$

$= \frac{1-2}{6-3}$

$= \frac{-1}{3}$

$y = \frac{-x}{3}$ → tranformation over line

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

(31) The endpoints of $\overline{PQ}$ are $P(-3,1)$ and $Q(4,25)$. Find the length of $\overline{PQ}$.

Rubric

[2] 25, and appropriate work is shown.

[1] Appropriate work is shown, but one computational or simplification error is made.

or

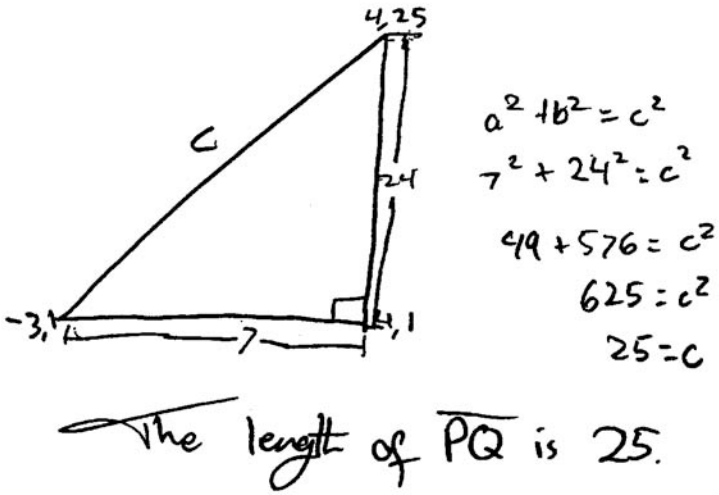
[1] Appropriate work is shown, but one conceptual error is made.

or

[1] 25, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Student work for Item 31 – Score 2



Student work for Item 31 – Score 2

$$d = \sqrt{(-3-4)^2 + (1-25)^2}$$

$$d = \sqrt{(-7)^2 + (24)^2}$$

$$d = \sqrt{49 + 576}$$

$$d = \sqrt{625}$$

$$d = 25$$

Student work for Item 31 – Score 1

Distance formula $= \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

$$D = \sqrt{(4--3)^2 + (25-1)^2}$$

$$D = \sqrt{49 + 576}$$

$$D = \sqrt{627}$$

$$\begin{array}{r} 24 \\ 24 \\ \hline 96 \\ 480 \\ \hline 576 \\ 49 \\ \hline 627 \end{array}$$

Student work for Item 31 – Score 1

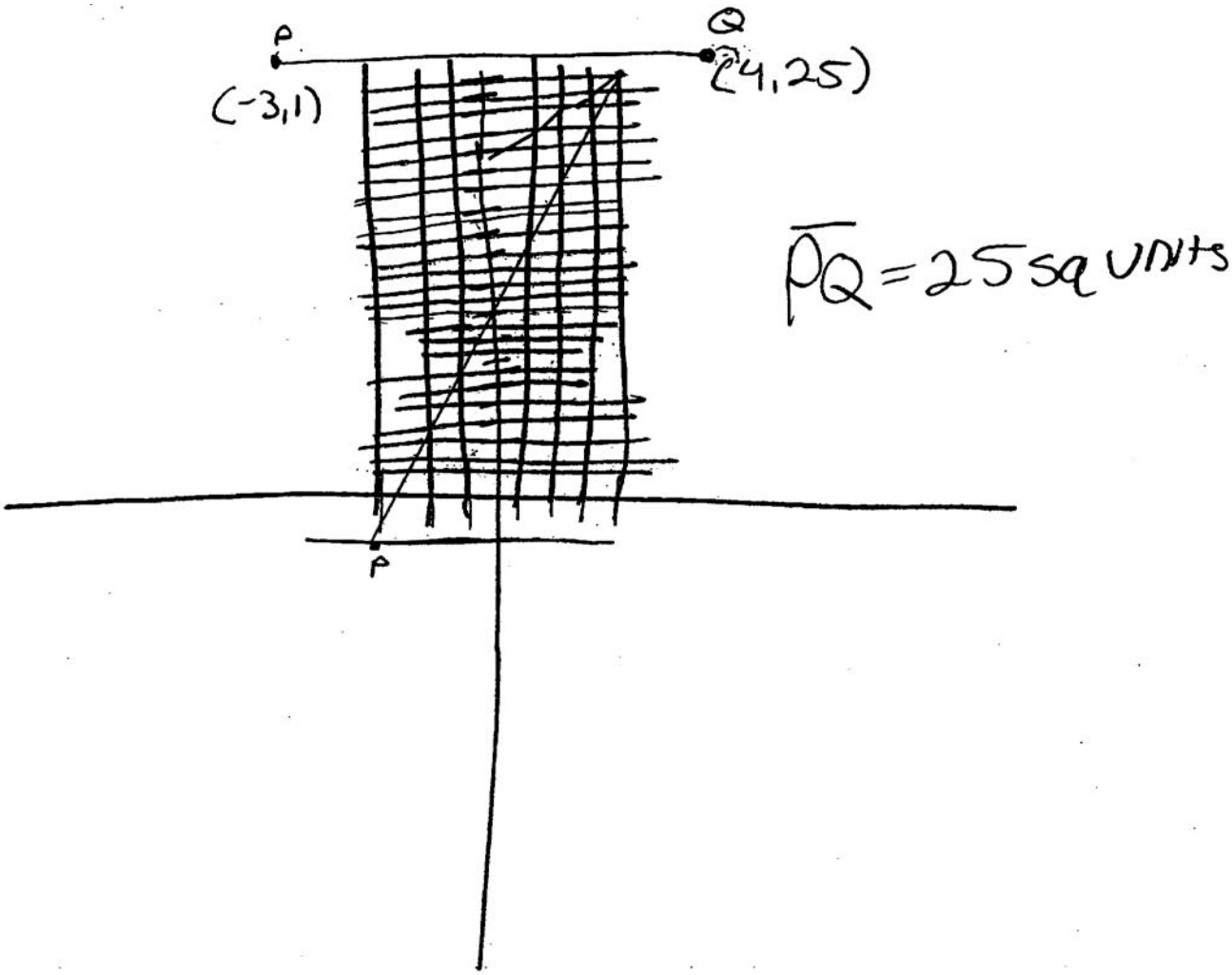
$$D = \sqrt{(x^2 - x_1)^2 - (y^2 - y^1)^2}$$

$$D = \sqrt{(4 - -3)^2 - (25 - 1)^2}$$

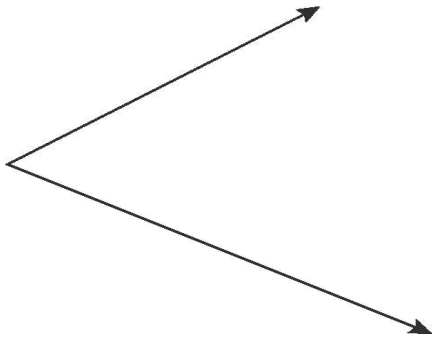
$$D = \sqrt{49 - 576}$$

$$D = \sqrt{-527}$$

Student work for Item 31 – Score 0



(32) Using a compass and straightedge, construct the bisector of the angle shown below. [*Leave all construction marks.*]



Rubric

[2] A correct construction is drawn showing all appropriate arcs, and the angle bisector is drawn.

[1] All construction arcs are drawn, but the angle bisector is not drawn.

or

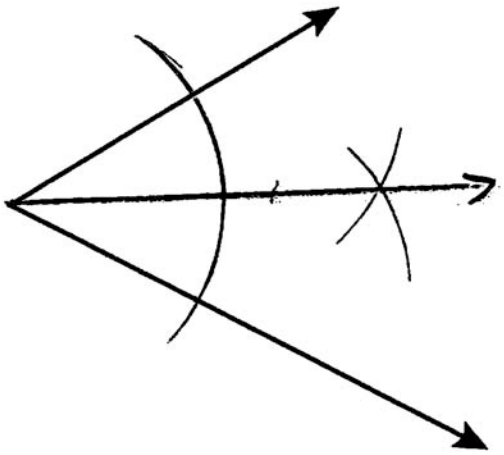
[1] The appropriate method is demonstrated, but one construction error is made, such as not extending the sides to show points of intersection by the arc.

[0] A drawing that is not an appropriate construction is shown.

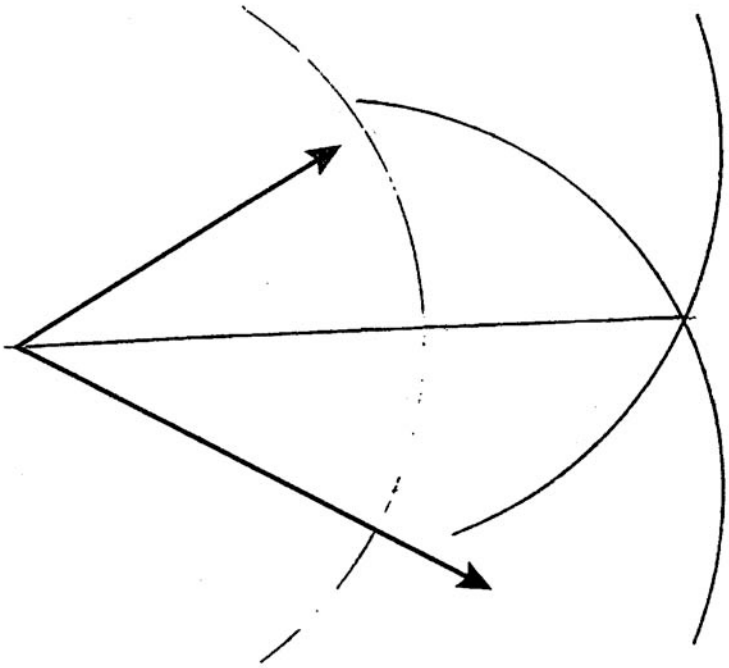
or

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

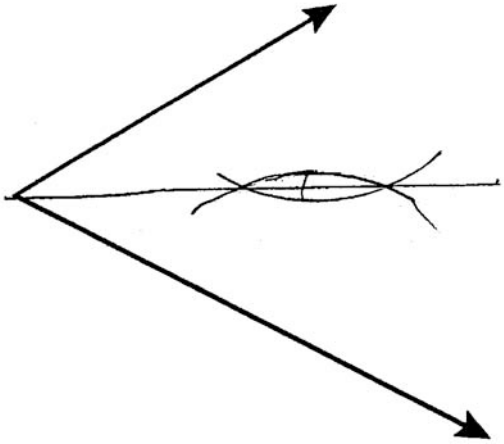
Student work for Item 32 – Score 2



Student work for Item 32 – Score 1



Student work for Item 32 – Score 0



(33) The volume of a cylinder is 12,566.4 cm^3. The height of the cylinder is 8 cm. Find the radius of the cylinder to the *nearest tenth of a centimeter*.

Rubric

[2] 22.4, and appropriate work is shown.

[1] Appropriate work is shown, but one computational or rounding error is made.

or

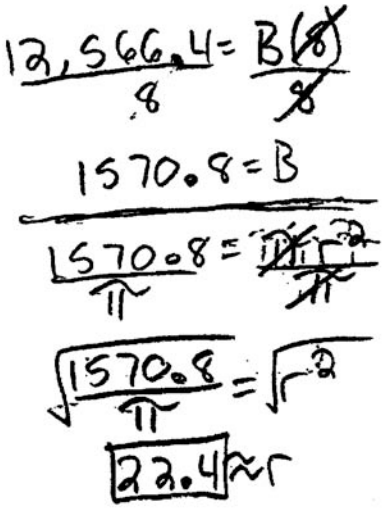
[1] Appropriate work is shown, but one conceptual error is made.

or

[1] 22.4, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

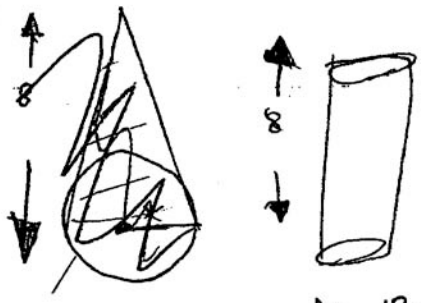
Student work for Item 33 – Score 2



Student work for Item 33 – Score 1

$12{,}566.4\,cm^3 = B \cdot 8$

$A = \pi \cdot r^2$



$V = 12{,}566$

$12{,}566.4 = \pi \cdot r^2 \cdot 8$

$\div 8 \qquad \div 8$

$\frac{12558.4}{\pi} = \frac{\pi \cdot r^2}{\pi}$

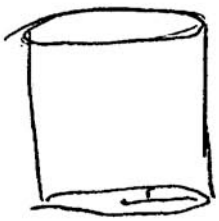
$\sqrt{3999.49} = \sqrt{r^2}$

63.24

$\boxed{r = 63.2}$

Student work for item 33 – Score 0

$V = Bh.$



$h = 8.$

$V = 12{,}566.4\,cm^3$

$\frac{12{,}566.4}{8} = 1570.8 = B$

$\frac{1570.8}{3.14} = 500.254 = r^2.$

$r = 22.366.. \approx \boxed{r = 22.}$

(34) Write a statement that is logically equivalent to the statement "If two sides of a triangle are congruent, the angles opposite those sides are congruent."

Identify the new statement as the converse, inverse, or contrapositive of the original statement.

Rubric

[2] A correct logically equivalent statement is written and identified as the contrapositive.

[1] An incorrect statement is written, but it is identified appropriately.

or

[1] Contrapositive is identified, but the statement is missing or incorrect.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Student work for Item 34 – Score 2

If the angles opposite 2 sides of a triangle are not congruent, then the two sides are not congruent.

This statement is the contrapositive of the original statement

Student work for Item 34 – Score 1

If the angles opposite of two side of a triangle are congruent, then those two sides of a triangle are congruent

The statement above is the converse of the original statement.

Student work for Item 34 – Score 1

If two sides of a triangle are not congruent, the angles opposite those sides are not congruent.

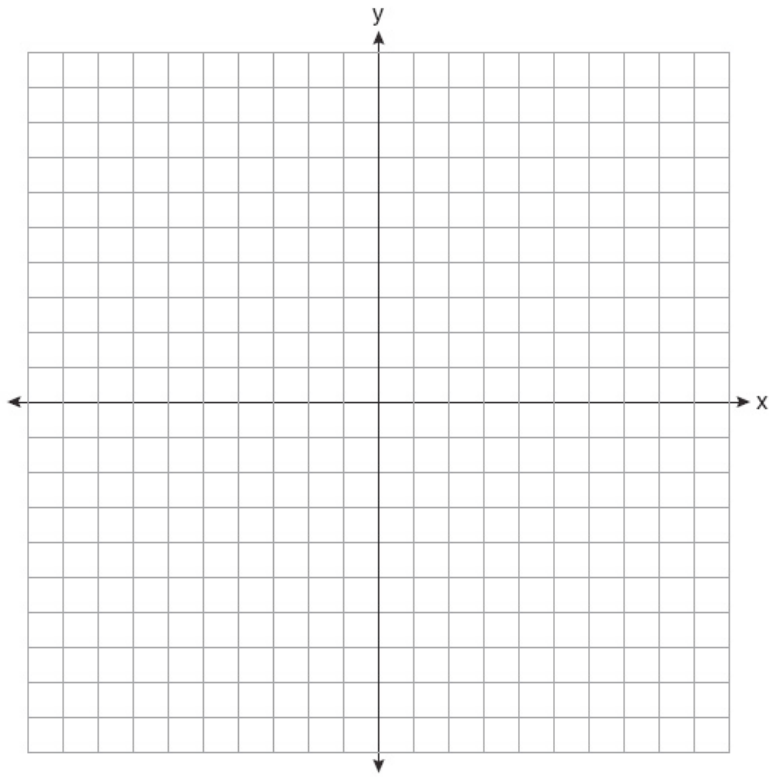
contrapositive

Part III

(35) On the set of axes below, graph and label $\triangle DEF$ with vertices at $D(-4,-4)$, $E(-2,2)$, and $F(8,-2)$.

If G is the midpoint of $\overline{EF}$ and H is the midpoint of $\overline{DF}$, state the coordinates of G and H and label each point on your graph.

Explain why $\overline{GH} \parallel \overline{DE}$.



Rubric for Item 35

[4] $\triangle DEF$ is graphed and labeled correctly, $G(3,0)$ and $H(2,-3)$ are stated and labeled correctly, and an appropriate explanation is written, such as the slopes are congruent or the midsegment theorem.

[3] Appropriate work is shown, but one computational, graphing, or labeling error is made.

or

[3] Appropriate work is shown, and an appropriate explanation is written, but the coordinates of G and H are missing or incorrect.

or

[3] $\triangle DEF$ is graphed and labeled correctly, $G(3,0)$ and $H(2,-3)$ are stated and labeled correctly, appropriate work is shown to find the slopes of $\overline{GH}$ and $\overline{ED}$, but the explanation is missing or incorrect.

[2] Appropriate work is shown, but two or more computational, graphing, or labeling errors are made.

or

[2] Appropriate work is shown, but one conceptual error is made.

or

[2] $\triangle DEF$ is graphed and labeled correctly, $G(3,0)$ and $H(2,-3)$ are stated and labeled correctly, but no further correct work is shown.

[1] Appropriate work is shown, but one conceptual error and one computational, graphing, or labeling error are made.

or

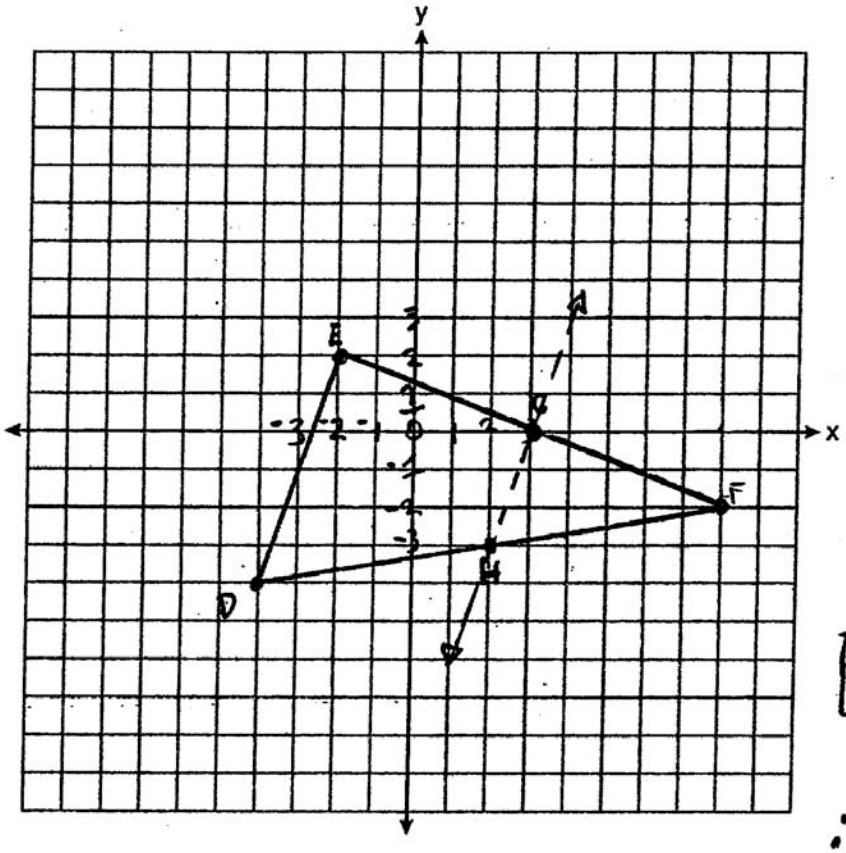
[1] The midsegment theorem is written, but no work is shown.

or

[1] $G(3,0)$ and $H(2,-3)$, but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Student work for Item 35 – Score 4



midpt $\overline{EF} = \left(\frac{-2+8}{2}, \frac{2-2}{2}\right)$

$= \left(\frac{6}{2}, \frac{0}{2}\right)$

$G = (3, 0)$

midpt $\overline{DF} = \left(\frac{-4+8}{2}, \frac{-2-4}{2}\right)$

$= \left(\frac{4}{2}, \frac{-6}{2}\right)$

$H = (2, -3)$

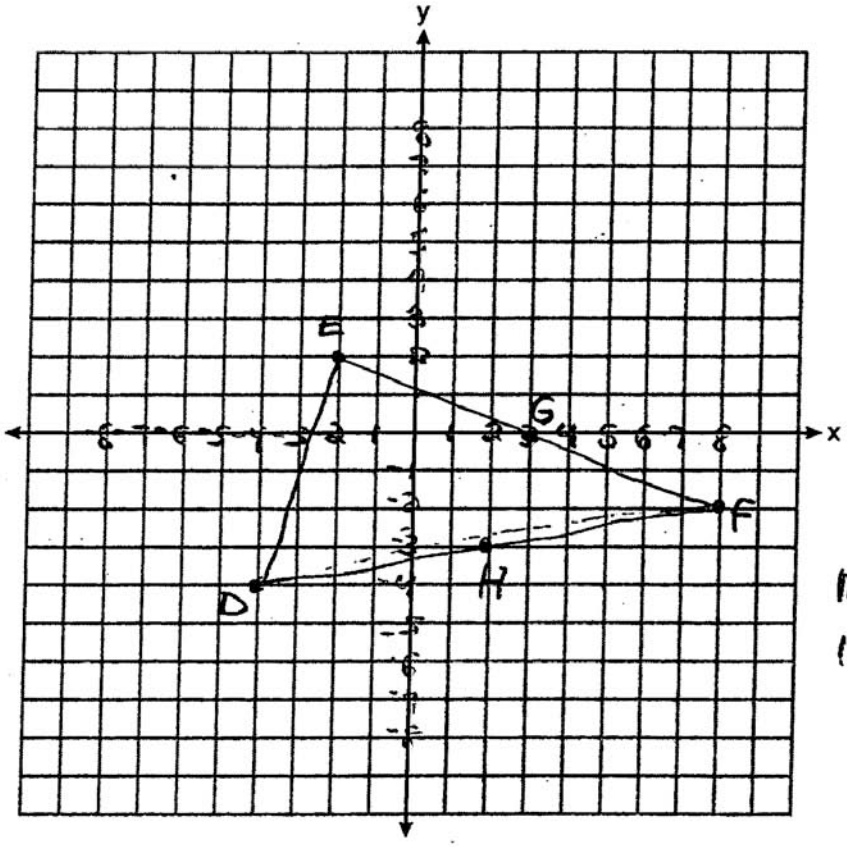
$m = \frac{y_2 - y_1}{x_2 - x_1}$

$m^{\overline{GH}} = \frac{0+3}{3-2} = \frac{3}{1}$ $\boxed{m^{\overline{GH}} = 3}$

$m^{\overline{DE}} = \frac{2+4}{-2+4} = \frac{6}{2}$ $\boxed{m^{\overline{DE}} = 3}$

$\therefore \overline{GH} \parallel \overline{DE}$ because their slopes are both equal to 3, they have the same slopes

Student work for Item 35 – Score 3



$\overline{GH} \parallel \overline{DE}$ because mid points of 2 lines on a $\triangle$ are $\parallel$ to its base

midpoint G = $\frac{-2+8}{2}, \frac{2+(-2)}{2}$

(3,0) is the midpoint of $\overline{EF}$

midpoint H = $\frac{-4+8}{2}, \frac{-4-2}{2}$

(2,-3) is the midpoint of $\overline{DF}$

Student work for Item 35 – Score 2

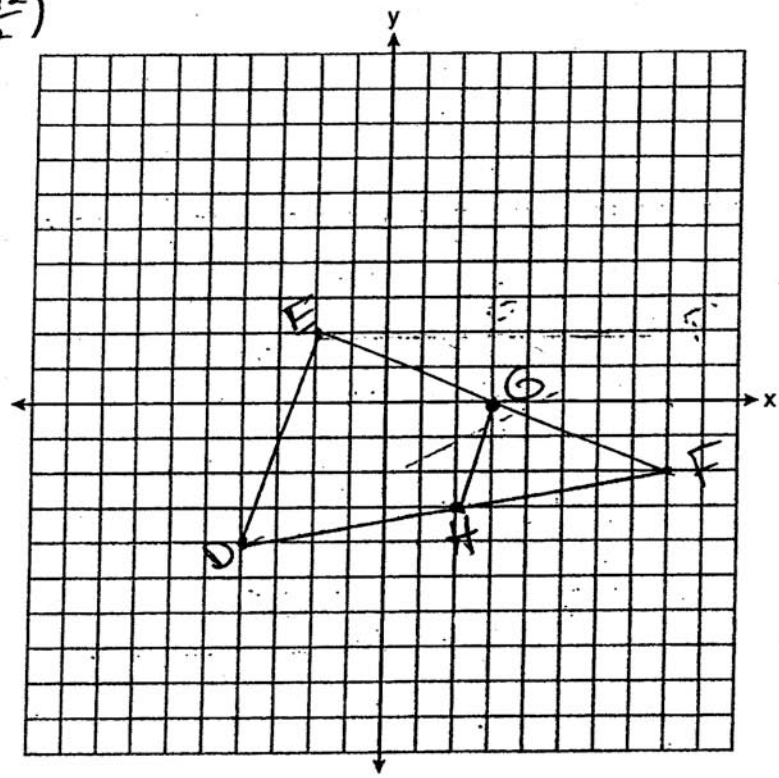
midpt = $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$H\left(\frac{-4+8}{2}, \frac{-4-2}{2}\right)$

$H(2,-3)$

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

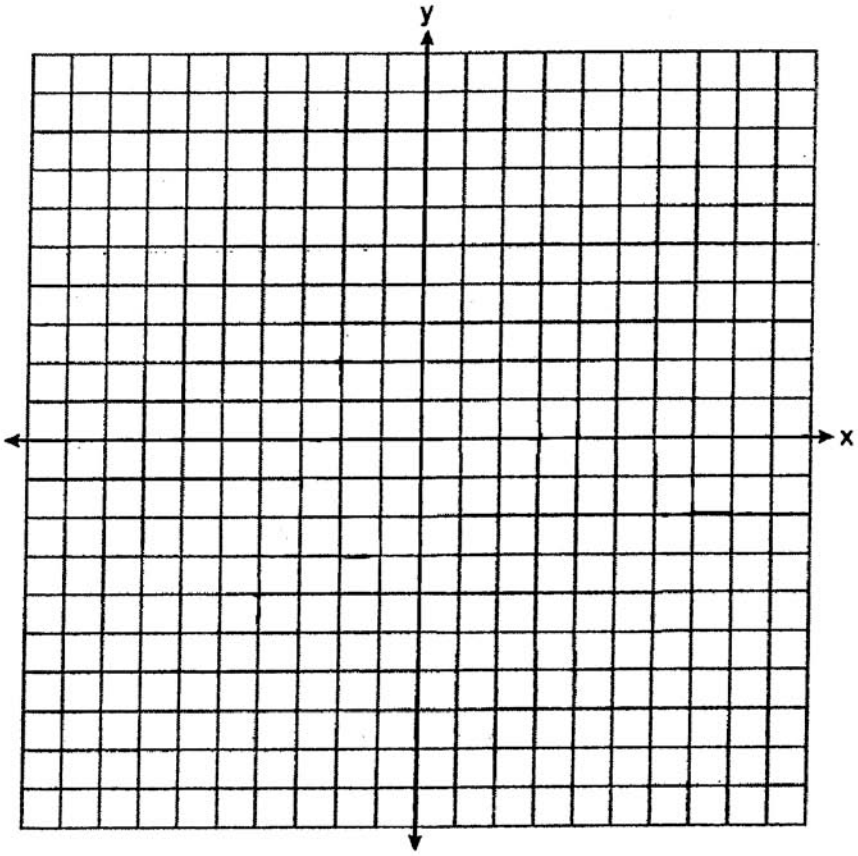
$G(3,0)$



$G(3,2)$

$\overline{GH} \parallel \overline{DE}$ because $\triangle HGF$ is similar to $\triangle DEF$.

Student work for Item 35 – Score 1



Slope formula: $\frac{x_2 - x_1}{y_2 - y_1}$

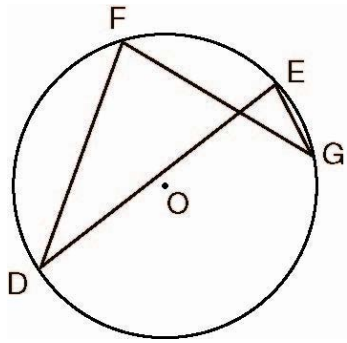
$\overline{GH} \parallel \overline{DE}$

$\overline{GH} = \frac{3-2}{0--3} = \frac{1}{3}$

G(3,0)
H(-2,-3)
D(-4,-4)
E(-2,2)

$\overline{DE} = \frac{-4--2}{-4-2} = \frac{-2}{-6} = \frac{1}{3}$

(36) In the diagram below of circle O, chords $\overline{DF}$, $\overline{DE}$, $\overline{FG}$, and $\overline{EG}$ are drawn such that $m\overset{\frown}{DF} : m\overset{\frown}{FE} : m\overset{\frown}{EG} : m\overset{\frown}{GD} = 5 : 2 : 1 : 7$. Identify one pair of inscribed angles that are congruent to each other and give their measure.



Rubric for Item 36

[4] $\angle D$ and $\angle G$ and 24, or $\angle E$ and $\angle F$ and 84, and appropriate work is shown.

[3] Appropriate work is shown, but one computational error is made.

or

[3] The measure of at least one inscribed angle is found correctly, and appropriate work is shown, but a pair of angles is not identified or is identified incorrectly.

[2] Appropriate work is shown, but two or more computational errors are made.

or

[2] Appropriate work is shown, but one conceptual error is made.

or

[2] Appropriate work is shown to find the measures of all four arcs, but no further correct work is shown.

[1] Appropriate work is shown, but one conceptual error and one computational error are made.

or

[1] One pair of inscribed angles is correctly identified, but no further correct work is shown.

or

[1] Appropriate work is shown to find $x = 24$, the measure of $\overset{\frown}{EG}$, but no further correct work is shown.

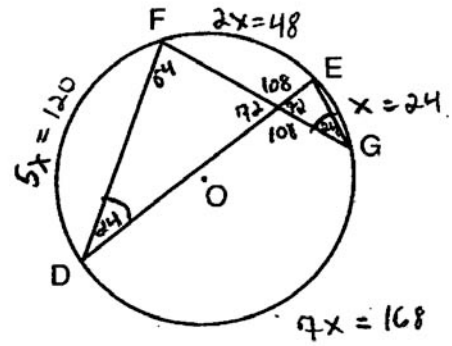
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Student work for Item 36 – Score 4

$5x + 2x + x + 7x = 360$

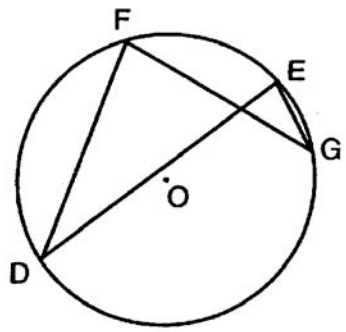
$\frac{15x}{15} = \frac{360}{15}$

$x = 24$



$\boxed{\begin{array}{l} m\angle FGE = 24 \\ m\angle FDE = 24 \end{array}}$

Student work for Item 36 – Score 3



$5x + 2x + x + 7x = 360$

$\frac{15x}{15} = \frac{360}{15}$

$x = 24$

$5x = 120 = \overset{\frown}{DF}$
$2x = 48 = \overset{\frown}{FE}$
$x = 24 = \overset{\frown}{EG}$
$7x = 188 = \overset{\frown}{GD}$

Inscribed angles are equal to one-half the measure of their intercepted arcs

$\angle F$ and $\angle E$ both intercept $\overset{\frown}{GD}$

$188 \div 2 = 94$

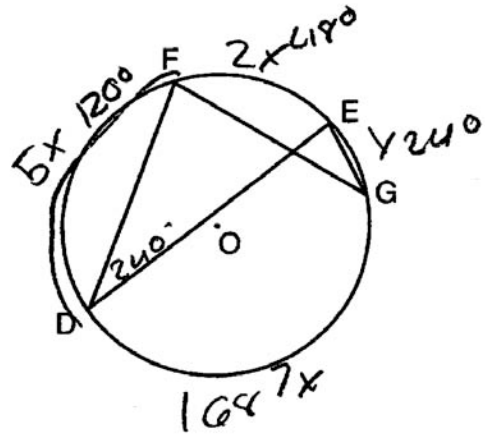
$\boxed{\angle F \text{ and } \angle E = 94°}$

Student work for Item 36 – Score 3

$5x + 2x + 1x + 7x =$

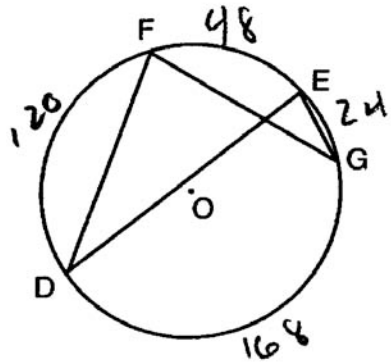
$\frac{15x}{15} = \frac{360}{15}$

$x = 24$



$m\angle FDE = 240°$

Student work for Item 36 – Score 2



$5x + 2x + x + 7x = 360$

$15x = 360$

$x = 24$

$2x = 48$

$5x = 120$

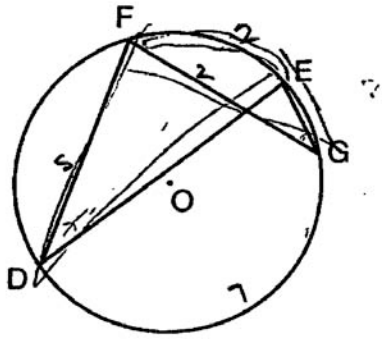
$7x = 168$

$\angle DEG \cong \angle DFG$

$\angle DEG = 168°$

$\angle DFG = 168°$

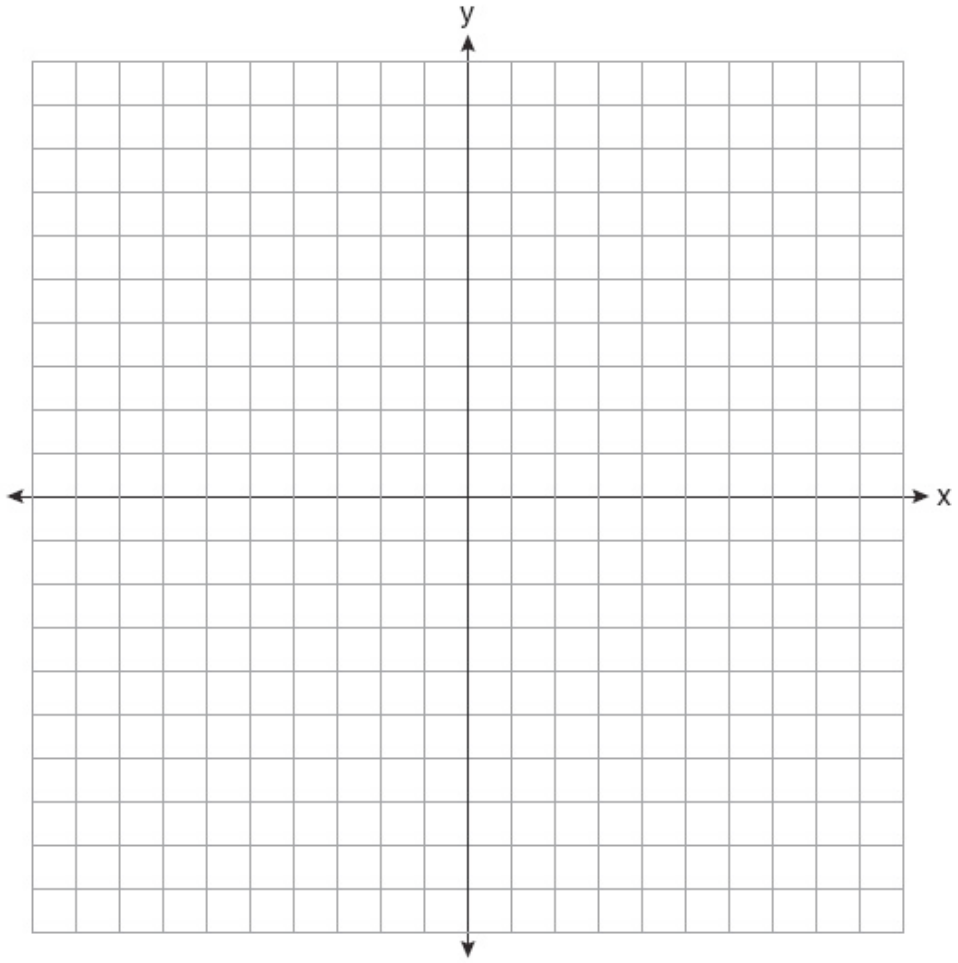
Student work for Item 36 – Score 1



$\angle FDE \approx \angle FGE$

(37) A city is planning to build a new park. The park must be equidistant from school *A* at (3,3) and school *B* at (3,– 5). The park also must be exactly 5 miles from the center of town, which is located at the origin on the coordinate graph. Each unit on the graph represents 1 mile.

On the set of axes below, sketch the compound loci and label with an **X** all possible locations for the new park.



Rubric for Item 37

[4] Both loci are drawn correctly and the two points of intersection are labeled with an **X**.

[3] Both loci are drawn correctly, but only one correct point of intersection is labeled.

or

[3] Both loci are drawn, but one graphing error is made, but appropriate points of intersection are labeled.

[2] Both loci are drawn correctly, but the points of intersection are not labeled or are labeled incorrectly.

or

[2] Both loci are drawn, but two or more graphing errors are made, but appropriate points of intersection are labeled.

or

[2] One conceptual error is made, such as drawing two parallel lines instead of a circle, but appropriate points of intersection are labeled.

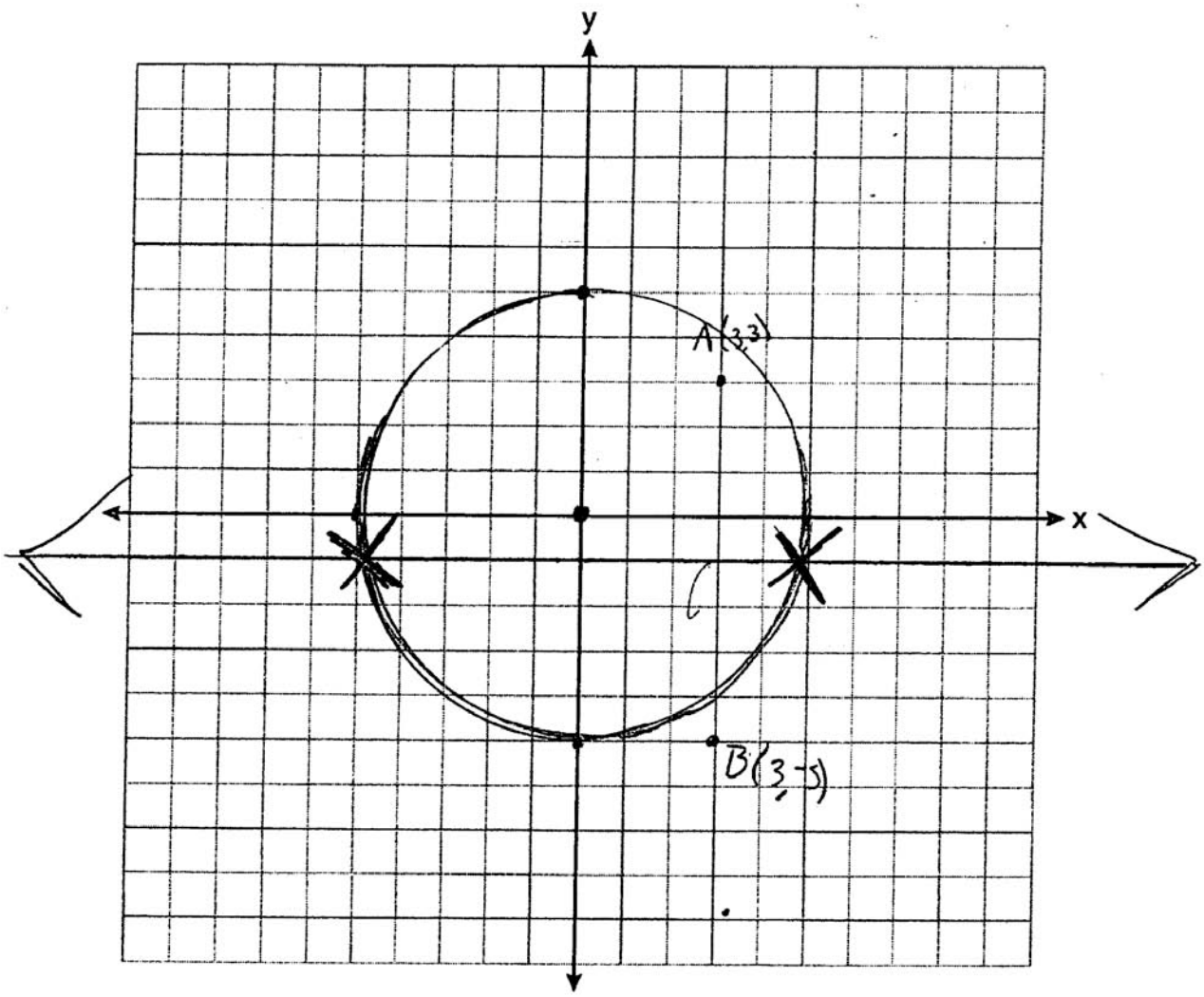
[1] One locus is drawn correctly, but no further correct work is shown.

or

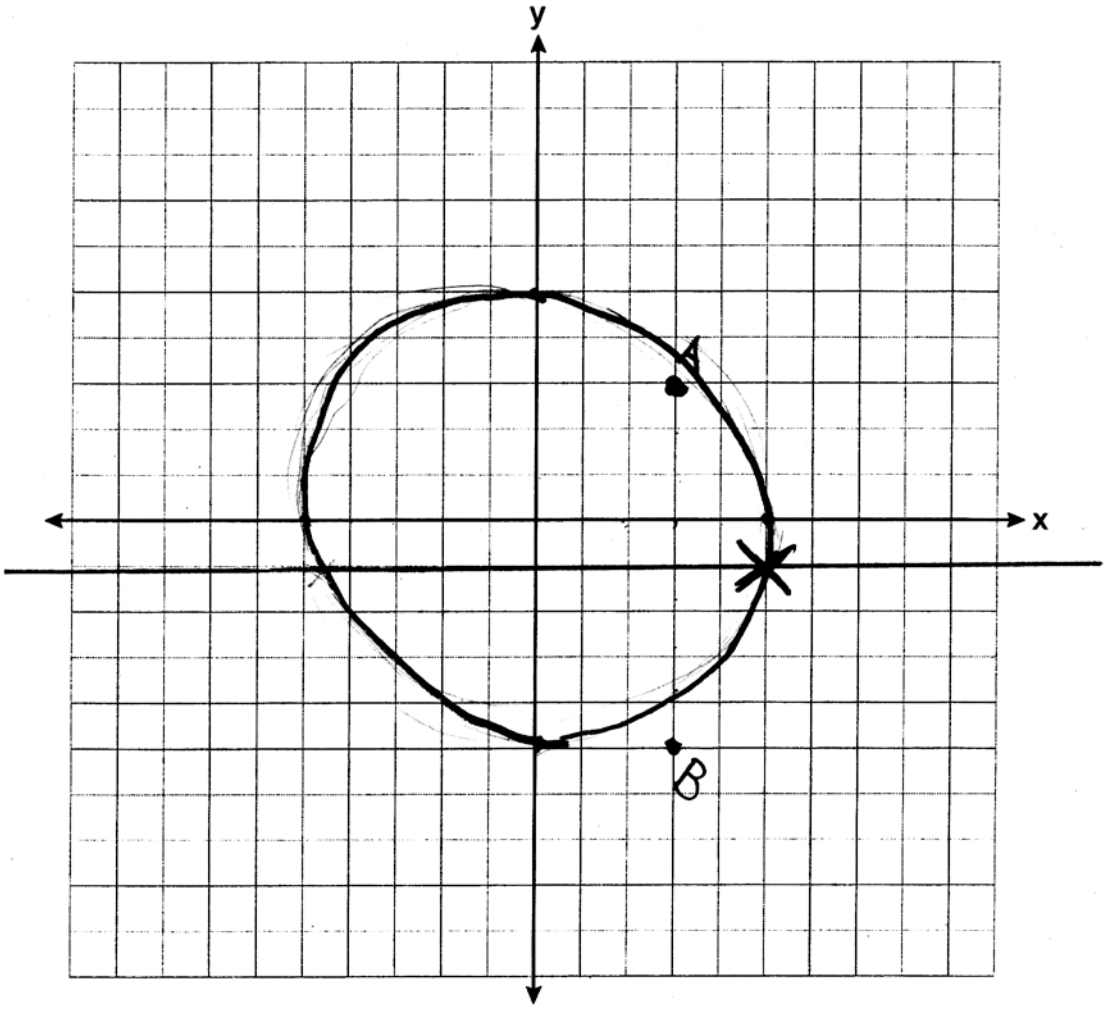
[1] **X**s are placed appropriately, but no loci are drawn.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

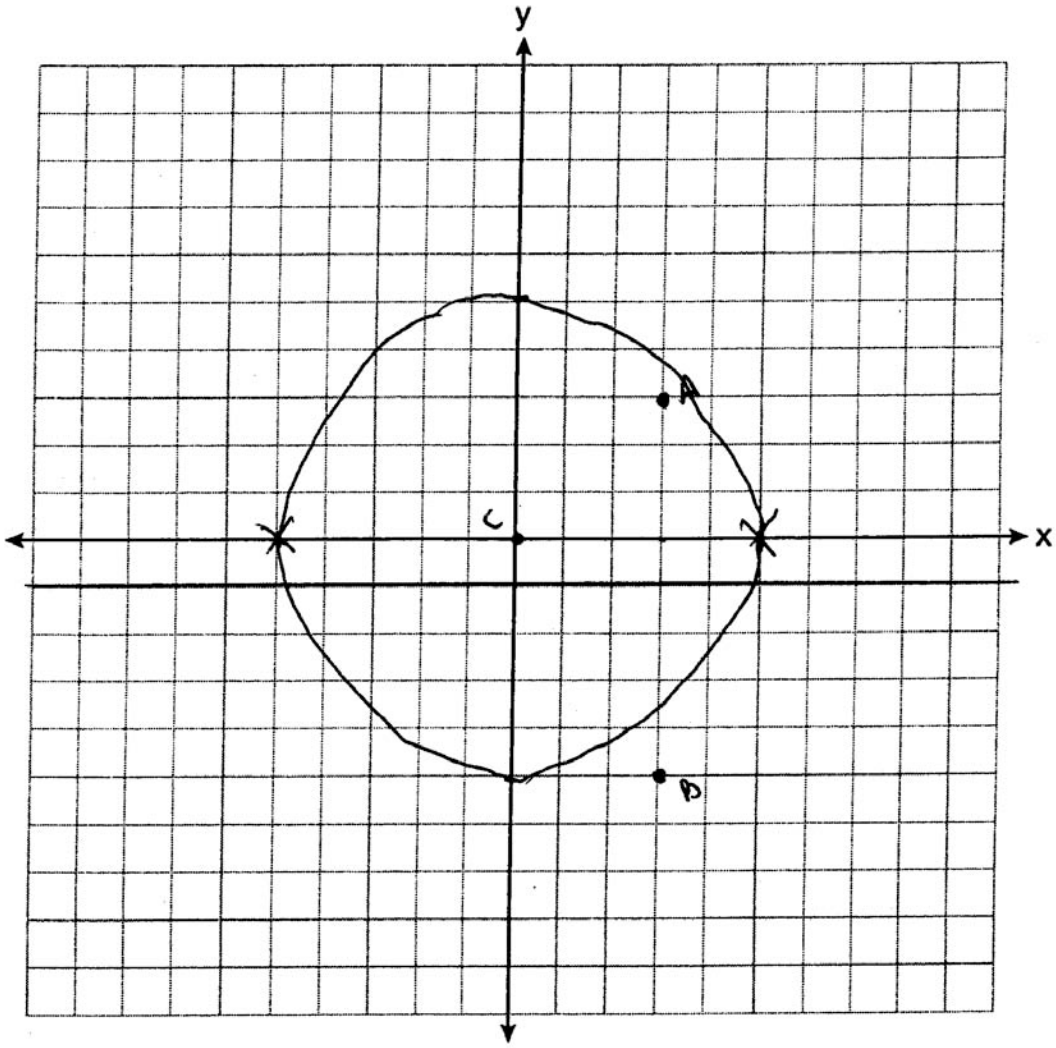
Student work for Item 37 – Score 4



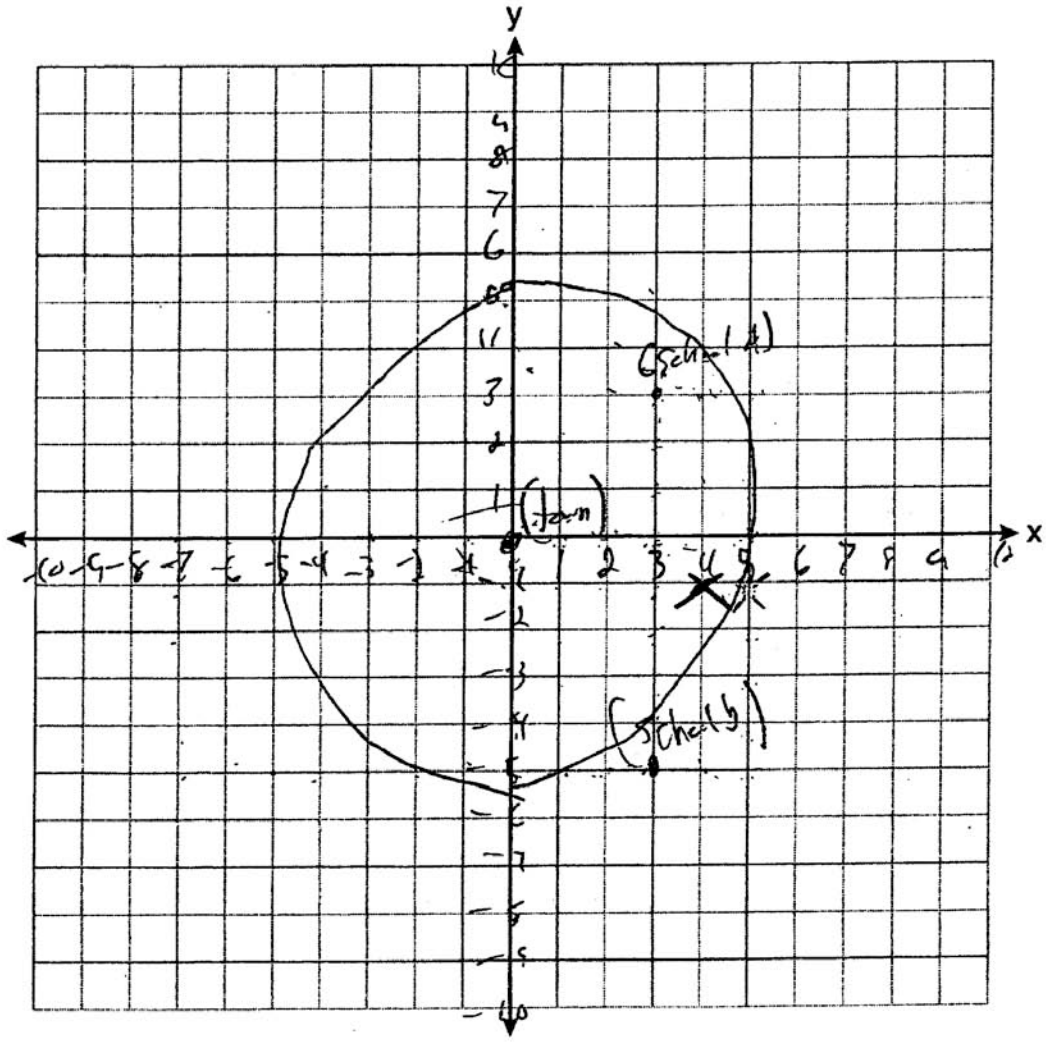
Student work for Item 37 – Score 3



Student work for Item 37 – Score 2

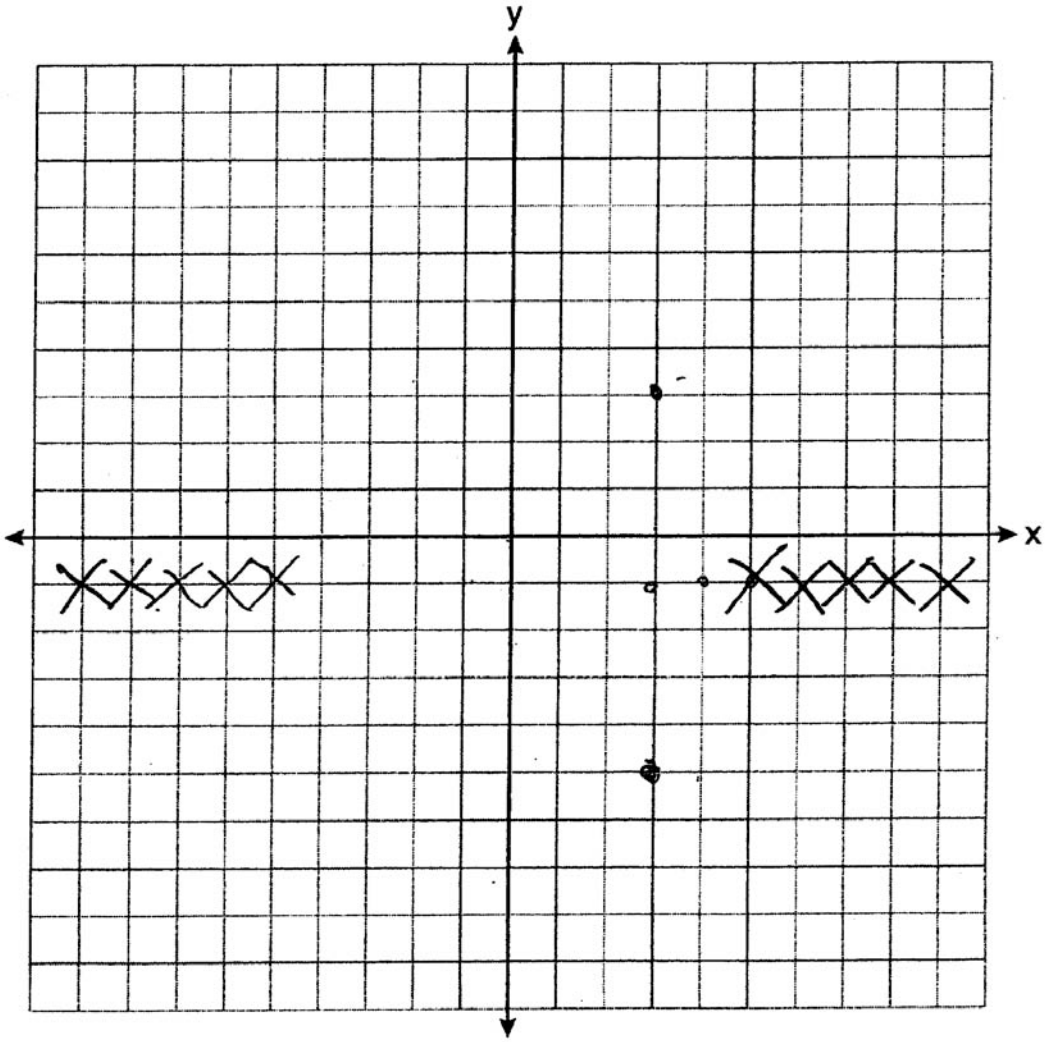


Student work for Item 37 – Score 1



(9, 1)

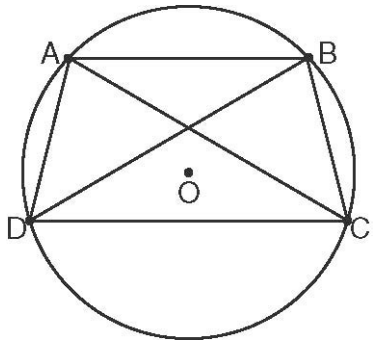
Student work for Item 37 – Score 0



Part IV

(38) In the diagram below, quadrilateral $ABCD$ is inscribed in circle O, $\overline{AB} \parallel \overline{DC}$, and diagonals $\overline{AC}$ and $\overline{BD}$ are drawn.

Prove that $\triangle ACD \cong \triangle BDC$.



Rubric for Item 38

[6] A complete and correct proof that includes a concluding statement is written.

[5] A proof is written that demonstrates a thorough understanding of the method of proof and contains no conceptual errors, but one statement or reason is missing or incorrect.

[4] A proof is written that demonstrates a good understanding of the method of proof and contains no conceptual errors, but two statements or reasons are missing or incorrect.

[3] A proof is written that demonstrates a good understanding of the method of proof, but one conceptual error is made.

[2] A proof is written that demonstrates an understanding of the method of proof, but one conceptual error is made and one statement or reason is missing or incorrect.

or

[2] Some correct relevant statements about the proof are made, but three or four statements or reasons are missing or incorrect.

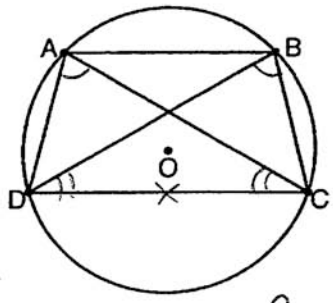
[1] Only one correct relevant statement and reason are written.

[0] The "given" and/or the "prove" statements are rewritten in the style of a formal proof, but no further correct relevant statements are written.

or

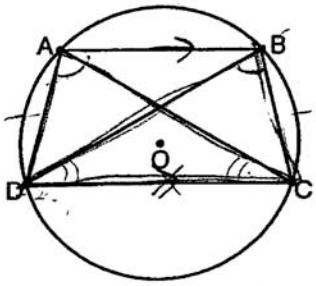
[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.

Student work for Item 38 – Score 6



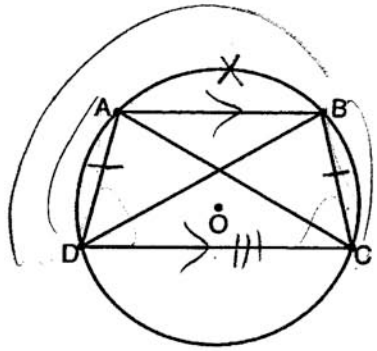
Statement	Reason
1. $\overline{AB} \parallel \overline{DC}$	1. Given
2. $\angle DAC \cong \angle DBC$	2. Inscribed angles intercepting the same arc are congruent
3. $\overline{DC} \cong \overline{DC}$	3. Reflexive Property
4. $\widehat{AD} \cong \widehat{BC}$	4. Parallel Lines intercept congruent arcs
5. $\angle BDC \cong \angle ACD$	5. Inscribed angles intercepting congruent arcs are congruent
6. $\triangle ACD \cong \triangle BDC$	6. AAS

Student work for Item 38 – Score 5



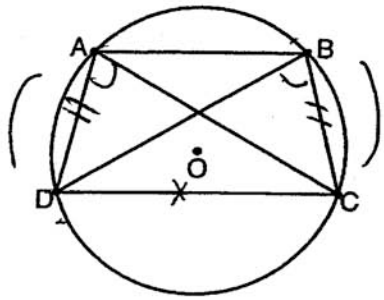
Statements	Reasons
① _____	① Given
② $\overline{DC} \cong \overline{DC}$	② Reflexive Prop. of $\cong$
③ $\angle ACD \cong \angle BDC$	③ inscribed angles that intercept $\cong$ arcs are $\cong$
④ $\angle DAC \cong \angle CBD$	④ inscribed angles that intercept the same arc are $\cong$
⑤ $\triangle ACD \cong \triangle BDC$	⑤ aas $\cong$ aas.

Student work for Item 38 – Score 4



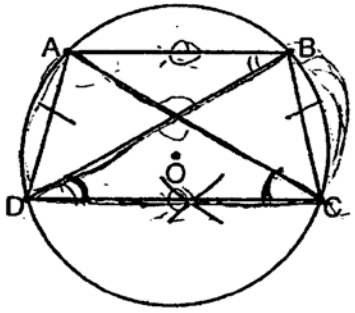
Statements	
1.	1. given
2. $\overset{\frown}{AD} \cong \overset{\frown}{BC}$	2. // lines intercept ≅ arcs
3. $\overline{AD} \cong \overline{BC}$	3. ≅ arcs have ≅ chords
4. $\overline{DC} \cong \overline{DC}$	4. Reflexive
5. $\overset{\frown}{AD} \cong \overset{\frown}{BC}$	5. // lines intercept ≅ arcs
$\overset{\frown}{AB} = \overset{\frown}{AD}$ $\overset{\frown}{AD} + \overset{\frown}{AB} = \overset{\frown}{BC} + \overset{\frown}{AB}$ 6. $\overset{\frown}{DAB} \cong \overset{\frown}{CBA}$	6. Addition
7. $\overline{DB} \cong \overline{AC}$	7. ≅ arcs have ≅ chords
8. $\triangle ACD \cong \triangle BDC$	8. SSS ≅ SSS

Student work for Item 38 – Score 3



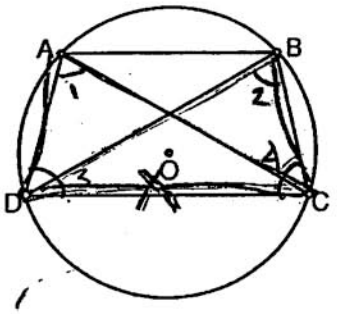
1. Given	1.
2. $\overset{\frown}{AD} \cong \overset{\frown}{BC}$	2. // lines intercept $\cong$ arcs
3. $\overline{AD} \cong \overline{BC}$	3. $\cong$ arcs intercept $\cong$ chords
4. $\angle DAC \cong \angle CBD$	4. Inscribed Angles that intercept ~~the~~ The same chord are $\cong$
5. $\overline{DC} \cong \overline{DC}$	5. Reflexive Prop
6. ~~$\triangle ADC$~~ $\triangle ACD \cong \triangle BDC$	6. SSA

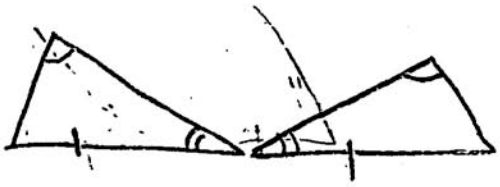
Student work for Item 38 – Score 2



① Quad $\overline{ABCD}$	① Given
② $\overline{AB} \parallel \overline{DC}$	② Given
③ Quad $\overline{ABCD}$ is a trap	③ only One pair of opposite sides are ∥
~~④ $\overline{AD} \cong \overline{BC}$~~	~~④~~
④ $DC = DC$	④ Reflexive
⑤ $\overset{\frown}{AD} \cong \overset{\frown}{BC}$	⑤ Two Arcs are ≅ if they connect ∥ lines
⑥ $\angle C \cong \angle D$	⑥ Same Arcs have same inscribed ∠
⑦ $AD = BC$	⑦ Lines of ≅ Arc are ≅
⑧ $\triangle ACD \cong \triangle BDC$	⑧ SAS

Student work for Item 38 – Score 1





Statement	Reason
1. ABCD is inscribed in circle O, $\overline{AB} \parallel \overline{DC}$, and $\overline{AC}$ & $\overline{BD}$ are diagonals	1. given
2. $\overline{DC} \cong \overline{DC}$	2. Reflexive Property
3. $\angle 1$ & $\angle 2 \cong$ $\angle 3$ & $\angle 4 \cong$	3. alt interior $\angle$s are $\cong$
4. $\triangle ACD \cong \triangle BDC$	4. AAS $\cong$ AAS

Appendix A

The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Albany, New York 12234

Specifications for the Regents Examination in Geometry
(First Administration – June 2009)

The questions on the Regents Examination in Geometry will assess both the content and the process strands of New York State Mathematics Standard 3. Each question will be aligned to one content performance indicator but will also be aligned to one or more process performance indicators, as appropriate for the concepts embodied in the task. As a result of the alignment to both content and process strands, the examination will assess students' conceptual understanding, procedural fluency, and problem-solving abilities rather than assessing knowledge of isolated skills and facts.

There will be 38 questions on the Regents Examination in Geometry. The table below shows the percentage of total credits that will be aligned with each content band.

Content Band	% of Total Credits
Geometric Relationships	8–12%
Constructions	3–7%
Locus	4–8%
Informal and Formal Proofs	41–47%
Transformational Geometry	8–13%
Coordinate Geometry	23–28%

Question Types

The Regents Examination in Geometry will include the following types and numbers of questions.

Question Type	Number of Questions
Multiple Choice	28
2-credit open ended	6
4-credit open ended	3
6-credit open ended	1
Total Credits	86

Calculators

Schools must make a graphing calculator available for the exclusive use of each student while that student takes the Regents Examination in Geometry.

Appendix B

Map to Learning Standards

The table below shows which content band each item is aligned to. The numbers in the table represent the question numbers on the test.

Content Band	Multiple-Choice Item Number	2-Credit Item Number	4-Credit Item Number	6-Credit Item Number
Geometric Relationships	6, 8, 15, 16	33		
Constructions	4, 7	32		
Locus	25		37	
Informal and Formal Proofs	1, 2, 9, 10, 11, 17, 19, 21, 24, 26, 27	29, 34	36	38
Transformational Geometry	3, 18, 23	30		
Coordinate Geometry	5, 12, 13, 14, 20, 22, 28	31	35	