The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

GEOMETRY

Wednesday, June 19, 2013 — 9:15 a.m. to 12:15 p.m., only

SAMPLE RESPONSE SET

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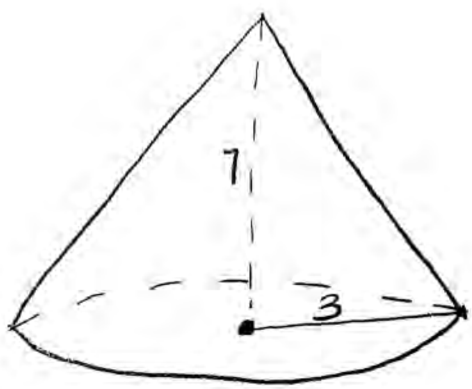
29 A right circular cylinder has a height of 7 inches and the base has a diameter of 6 inches. Determine the lateral area, in square inches, of the cylinder in terms of π.

$2\pi rh$ $LA = 42\pi$

Score 2: The student used the correct formula and found the correct lateral area.

29 A right circular cylinder has a height of 7 inches and the base has a diameter of 6 inches. Determine the lateral area, in square inches, of the cylinder in terms of π.



$l = \sqrt{7^2+3^2}$

$l = \sqrt{58}$

$SA = \pi r l$

$= \pi(3)(7.6)$

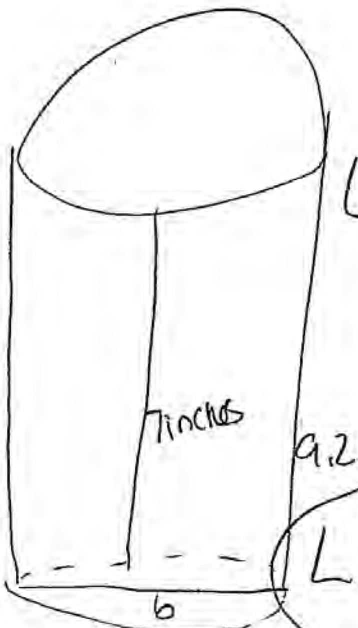
$= 22.8\pi$

Score 1: The student draws a cone and finds the appropriate lateral surface area. (The number of decimal places in front of π is irrelevant.)

29 A right circular cylinder has a height of 7 inches and the base has a diameter of 6 inches. Determine the lateral area, in square inches, of the cylinder in terms of π.

$L = \pi r l$

$l = 9.2$



$L = \pi 3(9.2)$

27.6π

$LA = 27.6\pi \text{ in}^2$

$7^2 + 6^2 = x^2$

$49 + 36 = x^2$

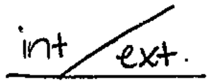
$\sqrt{85} = x^2$

9.219544457

≈ 9.2

Score 0: The student used the formula for the lateral area of a right circular cone. When attempting to find the slant height, the student used the diameter. These are two conceptual errors.

30 Determine, in degrees, the measure of each interior angle of a regular octagon.



int $\angle = \boxed{135°}$

$\frac{360}{8} = 45$

$$\begin{array}{r} 180 \\ -45 \\ \hline 135 \end{array}$$

Score 2: The student divided the sum of the exterior angles by the number of sides to find an exterior angle. Then the student found the supplement of this angle to find the interior angle.

30 Determine, in degrees, the measure of each interior angle of a regular octagon.

Octagon . = 8 sides

$\frac{360}{n} \rightarrow \frac{360}{8} = 45$

Measure of each interior angle is 45°

Score 1: The student made a conceptual error by using 360° as the sum of the interior angles of an octagon.

30 Determine, in degrees, the measure of each interior angle of a regular octagon.

$180(n-2)$

$180(8-2)$

1080°

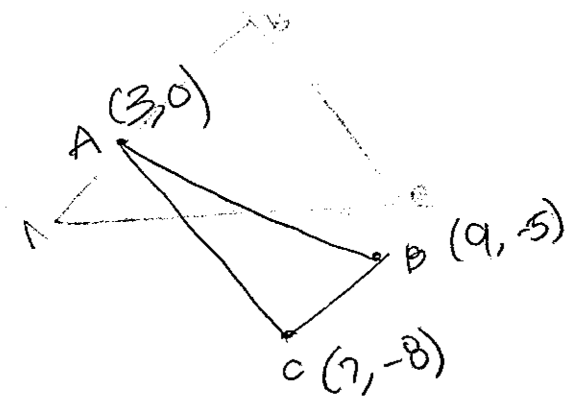
Score 1: The student showed work to find the sum of the interior angles of an octagon, but did not find the measure of each interior angle.

30 Determine, in degrees, the measure of each interior angle of a regular octagon.

$\frac{(n-2)180}{n}$ $\frac{(5-2)(180)}{2}$ $\frac{3(180)}{2} = 270^{0}$

Score 0: The student wrote the correct formula for finding an interior angle of a regular polygon, but made a conceptual error by using 5 as the number of sides in an octagon. A second conceptual error was made by dividing by 2 instead of the number of sides.

31 Triangle *ABC* has vertices at $A(3,0)$, $B(9,-5)$, and $C(7,-8)$. Find the length of $\overline{AC}$ in simplest radical form.



$d = \sqrt{(x^2 - x^1)^2 + (y^2 - y^1)^2}$

$\sqrt{(-8-0)^2 + (7-3)^2}$

$-8^2 + 4^2$

$\sqrt{64 + 16}$

$\sqrt{80}$

$\sqrt{20}\ \sqrt{4}$

$\sqrt{4}\ \sqrt{5}\quad 2$

$2\sqrt{5}$

$2 \times 2\sqrt{5}$

$\boxed{4\sqrt{5}}$

Score 2: The student showed appropriate work and simplified the radical completely.

31 Triangle *ABC* has vertices at *A*(3,0), *B*(9,−5), and *C*(7,−8). Find the length of $\overline{AC}$ in simplest radical form.

distance: $\sqrt{(y_2-y_1)^2+(x_2-x_1)^2}$

$\overline{AC}$: $\sqrt{(-8-0)^2+(7-3)^2}$

(3,0)(7,−8) $\quad -8^2+4^2$

$64+16$

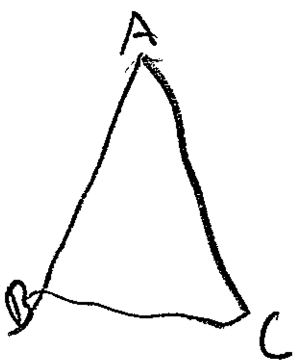
$\sqrt{80}$

$\sqrt{4}\times\sqrt{20}$

$2\sqrt{20}$

Score 1: The student showed appropriate work, but did not simplify the radical completely.

31 Triangle ABC has vertices at $A(3,0)$, $B(9,-5)$, and $C(7,-8)$. Find the length of $\overline{AC}$ in simplest radical form.

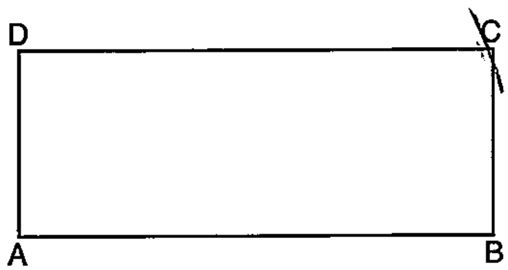


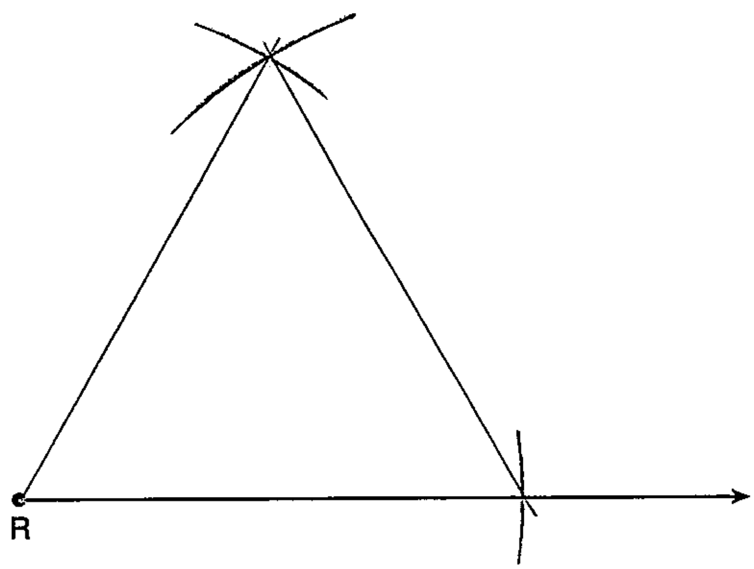
$$AC = \frac{-8-0}{7-3} = \frac{-8}{4} = \boxed{-2}$$

$$\boxed{AC = -2}$$

Score 0: The student found the correct slope of $\overline{AC}$, which is irrelevant to this problem.

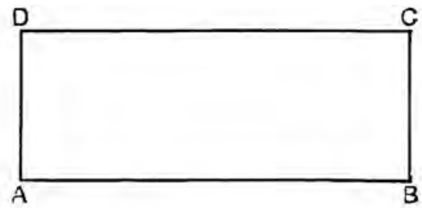
32 On the ray drawn below, using a compass and straightedge, construct an equilateral triangle with a vertex at *R*. The length of a side of the triangle must be equal to a length of the diagonal of rectangle *ABCD*.

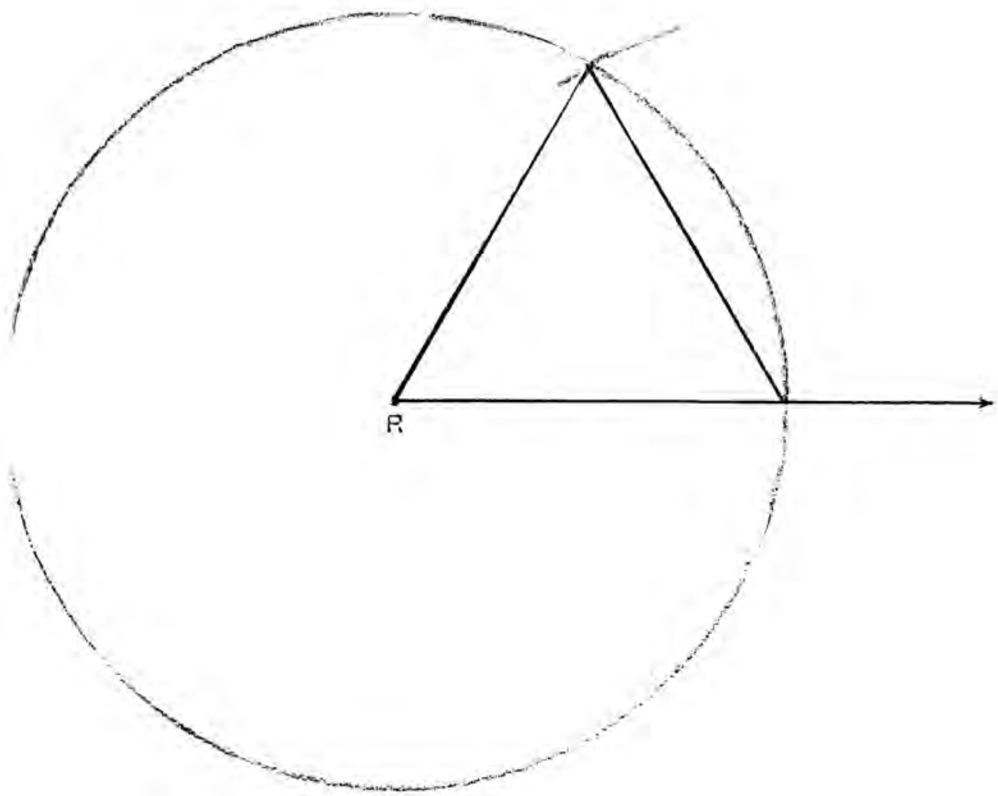




Score 2: The student did a correct construction using the length of a diagonal as each side of the triangle.

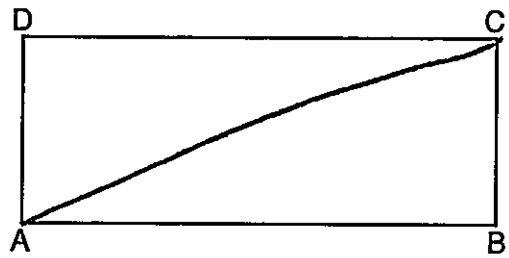
32 On the ray drawn below, using a compass and straightedge, construct an equilateral triangle with a vertex at *R*. The length of a side of the triangle must be equal to a length of the diagonal of rectangle *ABCD*.

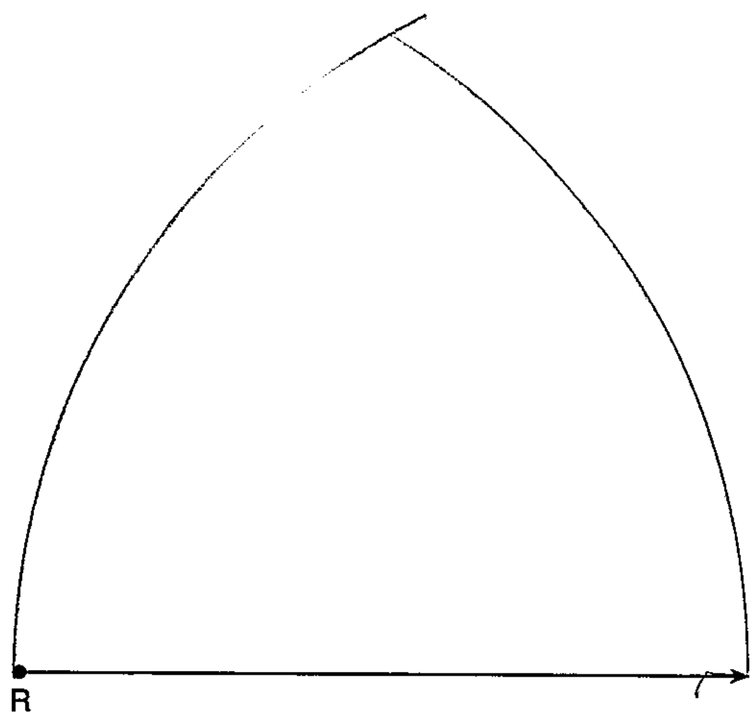




Score 1: The student showed a correct construction of an equilateral triangle, but used the length of $\overline{AB}$ as the side of the triangle.

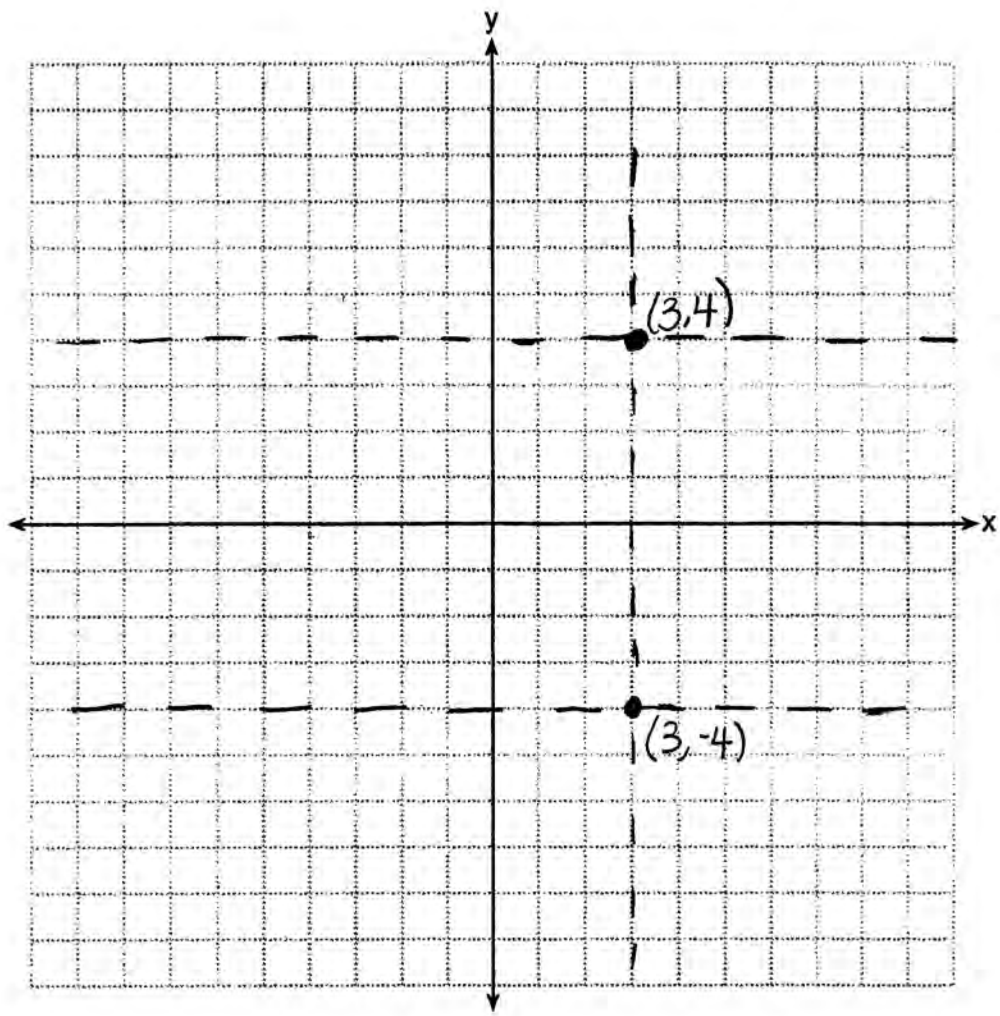
32 On the ray drawn below, using a compass and straightedge, construct an equilateral triangle with a vertex at *R*. The length of a side of the triangle must be equal to a length of the diagonal of rectangle *ABCD*.





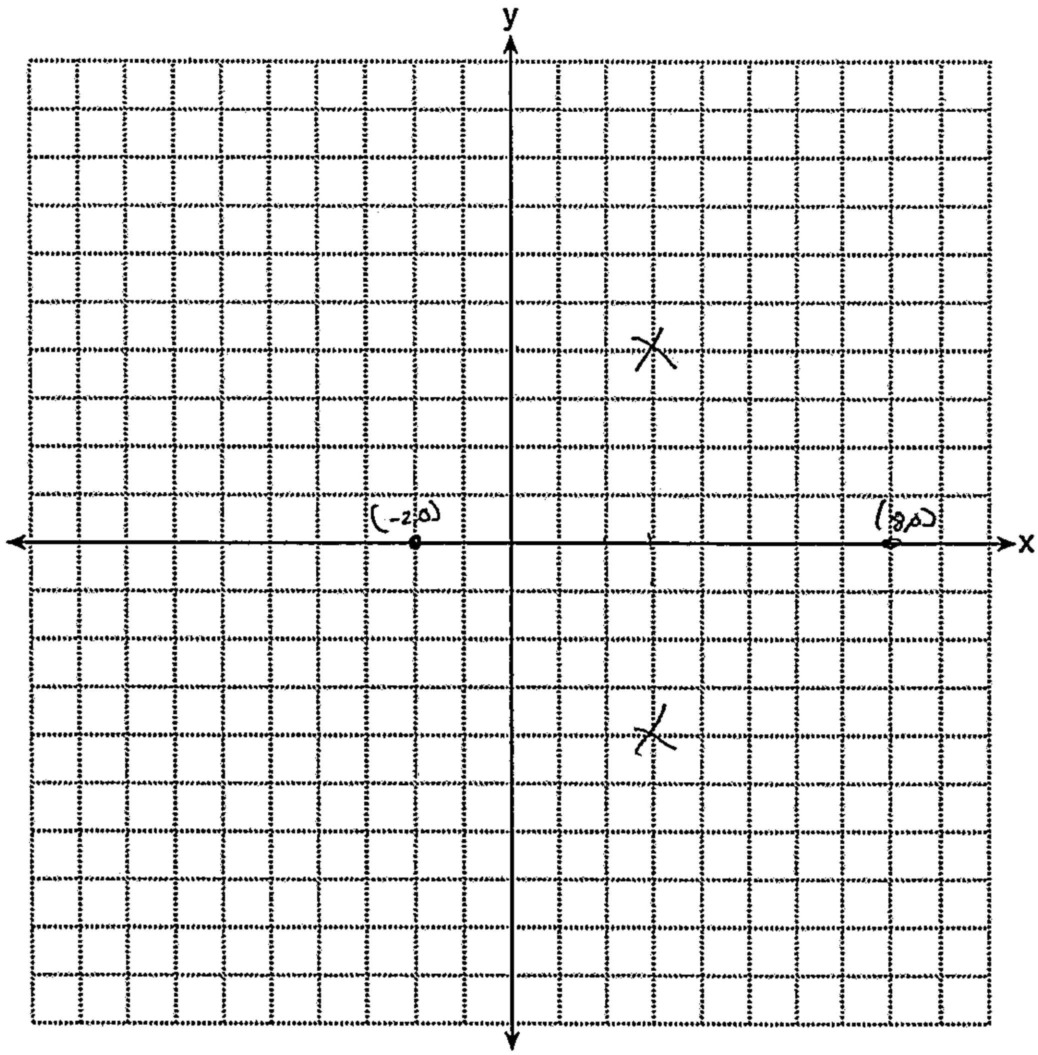
Score 0: The student used the ray as one side of an equilateral triangle and made appropriate arcs. However, the student did not draw a triangle.

33 On the set of axes below, graph the locus of points 4 units from the x-axis and equidistant from the points whose coordinates are $(-2,0)$ and $(8,0)$.
Mark with an **X** all points that satisfy *both* conditions.



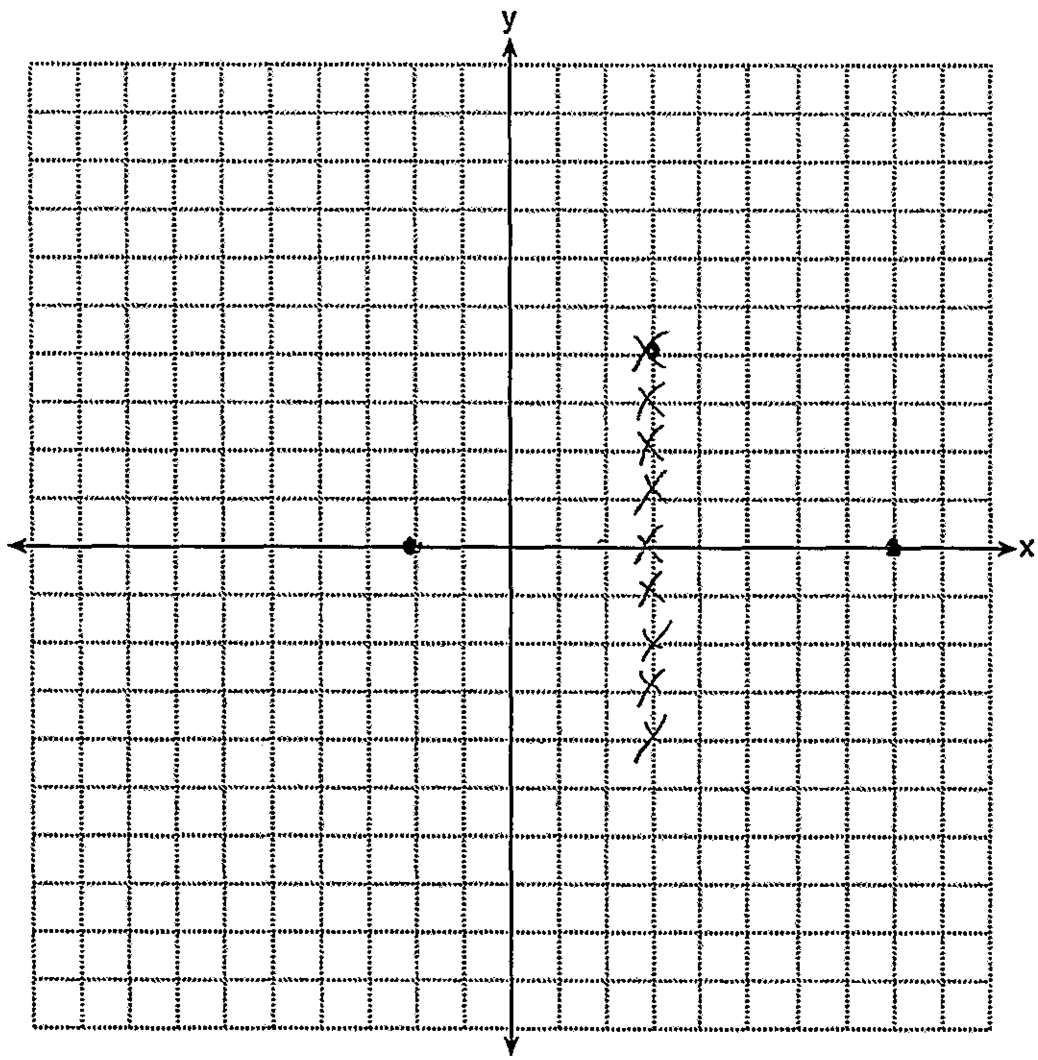
Score 2: The student graphed both loci correctly and labeled the points that satisfy both conditions with coordinates instead of an **X**.

33 On the set of axes below, graph the locus of points 4 units from the x-axis and equidistant from the points whose coordinates are $(-2,0)$ and $(8,0)$.
Mark with an **X** all points that satisfy *both* conditions.



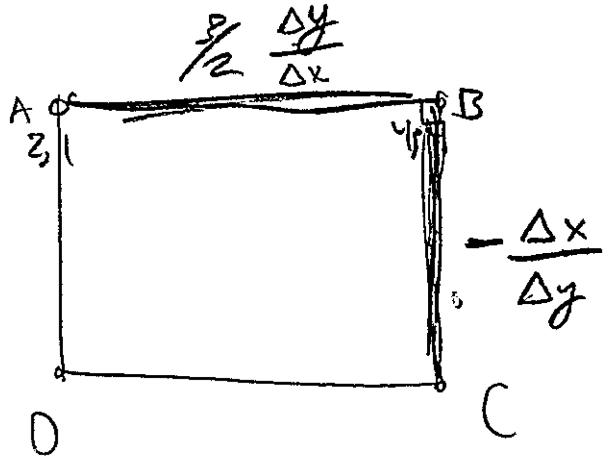
Score 1: The student located the two points that satisfy both conditions and marked them with an **X**, but did not graph either locus.

33 On the set of axes below, graph the locus of points 4 units from the x-axis and equidistant from the points whose coordinates are $(-2,0)$ and $(8,0)$.
Mark with an **X** all points that satisfy *both* conditions.



Score 0: The student did not graph either locus correctly and marked multiple points with an **X**.

34 The coordinates of two vertices of square $ABCD$ are $A(2,1)$ and $B(4,4)$. Determine the slope of side $\overline{BC}$.



$$\frac{4-1}{4-2} = \frac{3}{2}$$

$$\frac{3}{2} = \frac{\Delta y}{\Delta x}$$

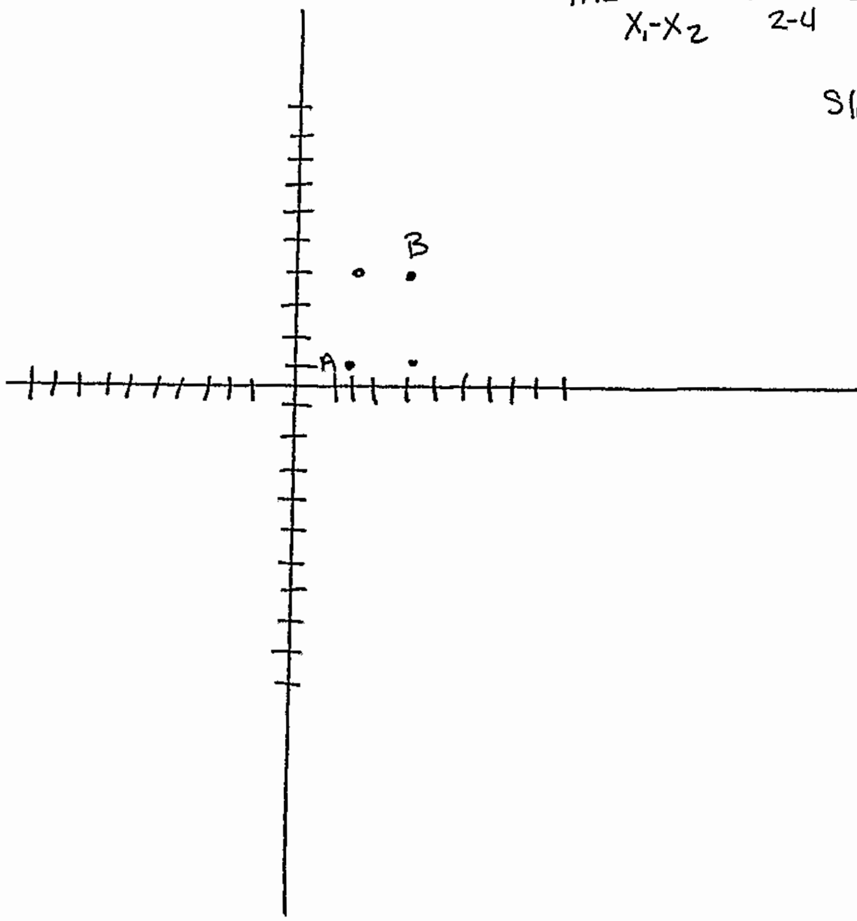
$$\frac{3}{2} \qquad -\frac{2}{3} \qquad -\frac{2}{3} = -\frac{\Delta x}{\Delta y}$$

Score 2: The student found the slope of $\overline{AB}$ correctly and used the negative reciprocal to find the slope of $\overline{BC}$.

34 The coordinates of two vertices of square $ABCD$ are $A(2,1)$ and $B(4,4)$.
Determine the slope of side $\overline{BC}$.

$$m = \frac{y_1 - y_2}{x_1 - x_2} = \frac{1-4}{2-4} = \frac{-3}{-2}$$

Slope of $\overline{BC} = \frac{-3}{-2}$



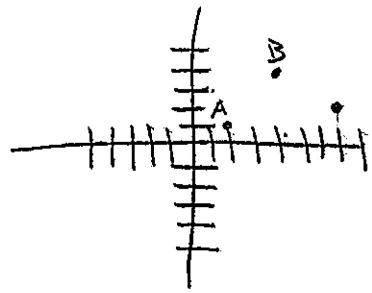
Score 1: The student found the slope of $\overline{AB}$ correctly, but made a conceptual error in stating that the slope of $\overline{BC}$ was the same.

34 The coordinates of two vertices of square *ABCD* are *A*(2,1) and *B*(4,4).
Determine the slope of side $\overline{BC}$.

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

$\perp 3/2 = \frac{-2}{3}$

$m\overline{BC} = \frac{2}{-3}x$



Score 1: The student included x when writing the slope as $\frac{2}{-3}$ in the circled solution, which is a conceptual error.

34 The coordinates of two vertices of square *ABCD* are $A(2,1)$ and $B(4,4)$. Determine the slope of side $\overline{BC}$.

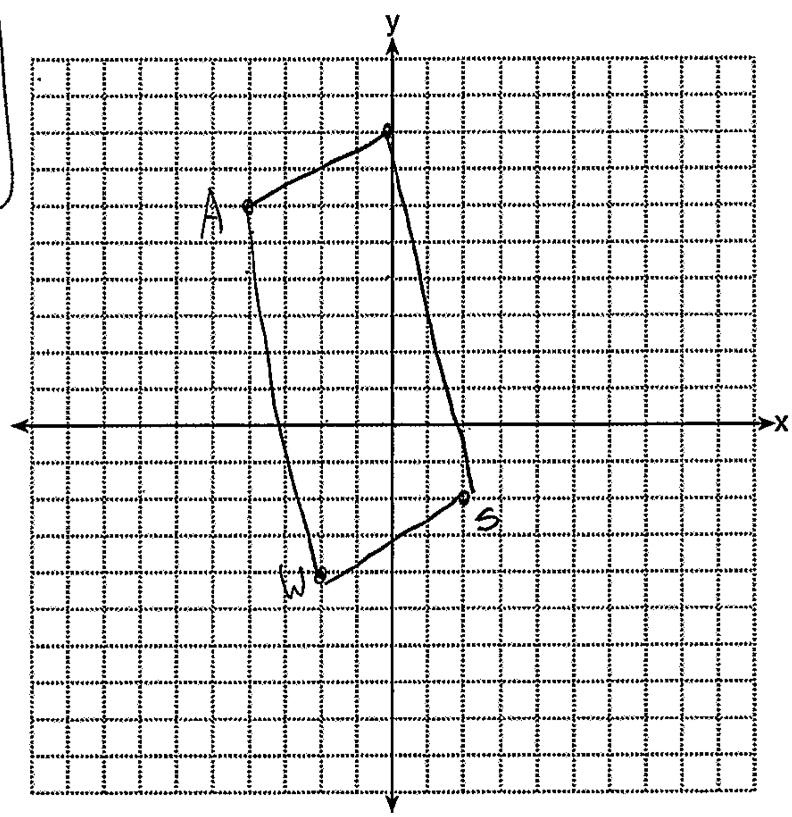
$$BC = \frac{4-2}{4-1} = \boxed{\frac{2}{3}}$$

Score 0: The student does not show appropriate work and the solution is incorrect.

35 The coordinates of the vertices of parallelogram *SWAN* are $S(2,-2)$, $W(-2,-4)$, $A(-4,6)$, and $N(0,8)$. State and label the coordinates of parallelogram $S''W''A''N''$, the image of *SWAN* after the transformation $T_{4,-2} \circ D_{\frac{1}{2}}$. [The use of the set of axes below is optional.]

$S(2,-2) \rightarrow (1,-1) \rightarrow (5,-3)$
$W(-2,-4) \rightarrow (-1,-2) \rightarrow (3,-4)$
$A(-4,6) \rightarrow (-2,3) \rightarrow (2,1)$
$N(0,8) \rightarrow (0,4) \rightarrow (4,2)$

$S''(5,-3)$
$W''(3,-4)$
$A''(2,1)$
$N''(4,2)$



Score 4: The student applied the correct transformation rules to find the coordinates of $S''W''A''N''$.

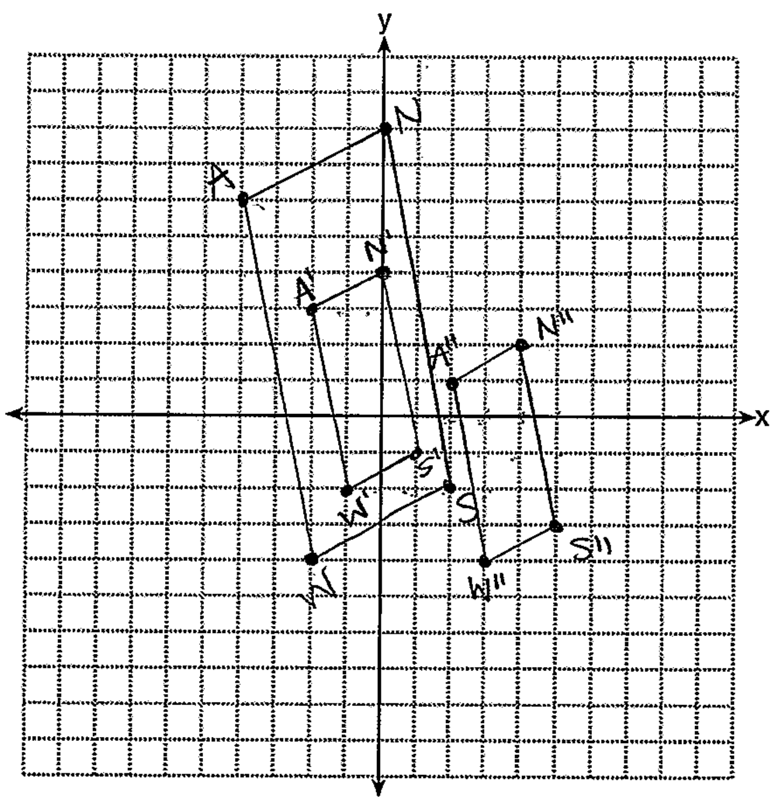
35 The coordinates of the vertices of parallelogram *SWAN* are $S(2,-2)$, $W(-2,-4)$, $A(-4,6)$, and $N(0,8)$. State and label the coordinates of parallelogram $S''W''A''N''$, the image of *SWAN* after the transformation $T_{4,-2} \circ D_{\frac{1}{2}}$. [The use of the set of axes below is optional.]

S" (5,-3)

W" (3,-4)

A" (2,1)

N" (4,2)



Score 4: The student used a graphic solution to find the coordinates of $S''W''A''N''$.

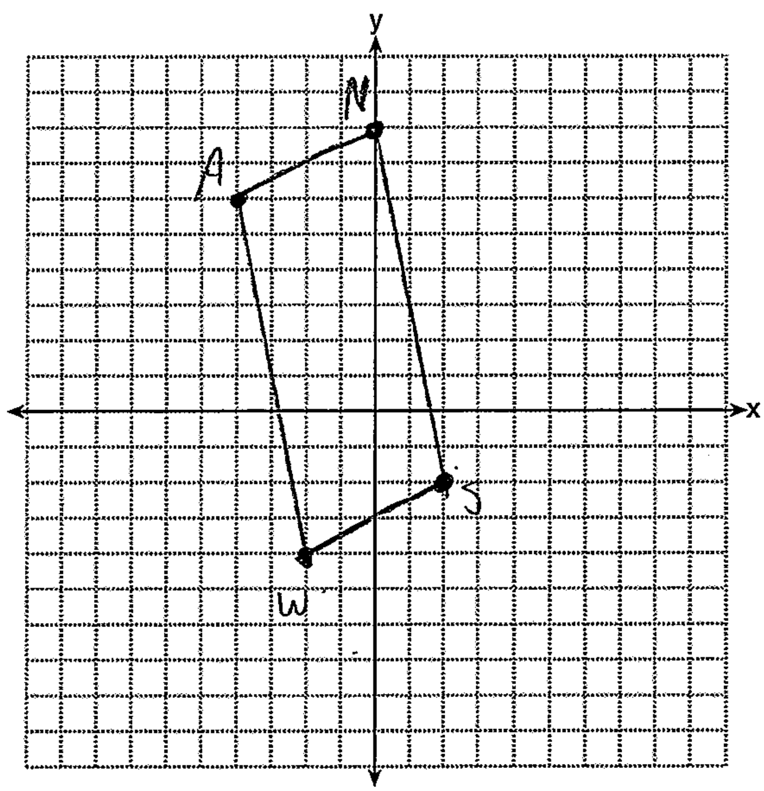
35 The coordinates of the vertices of parallelogram *SWAN* are $S(2,-2)$, $W(-2,-4)$, $A(-4,6)$, and $N(0,8)$. State and label the coordinates of parallelogram $S''W''A''N''$, the image of *SWAN* after the transformation $T_{4,-2} \circ D_{\frac{1}{2}}$. [The use of the set of axes below is optional.]

$S(2,-2): D_{1/2} \longrightarrow S'(1,-1): T_{4,-2} \longrightarrow S''(5,-3)$

$W(-2,-4): D_{1/2} \longrightarrow W'(-1,-2): T_{4,-2} \longrightarrow W''(3,-4)$

$A(-4,6): D_{1/2} \longrightarrow A'(-2,3): T_{4,-2} \longrightarrow A''(2,1)$

$N(0,8): D_{1/2} \longrightarrow N'(0,4): T_{4,-2} \longrightarrow N''(4,-2)$

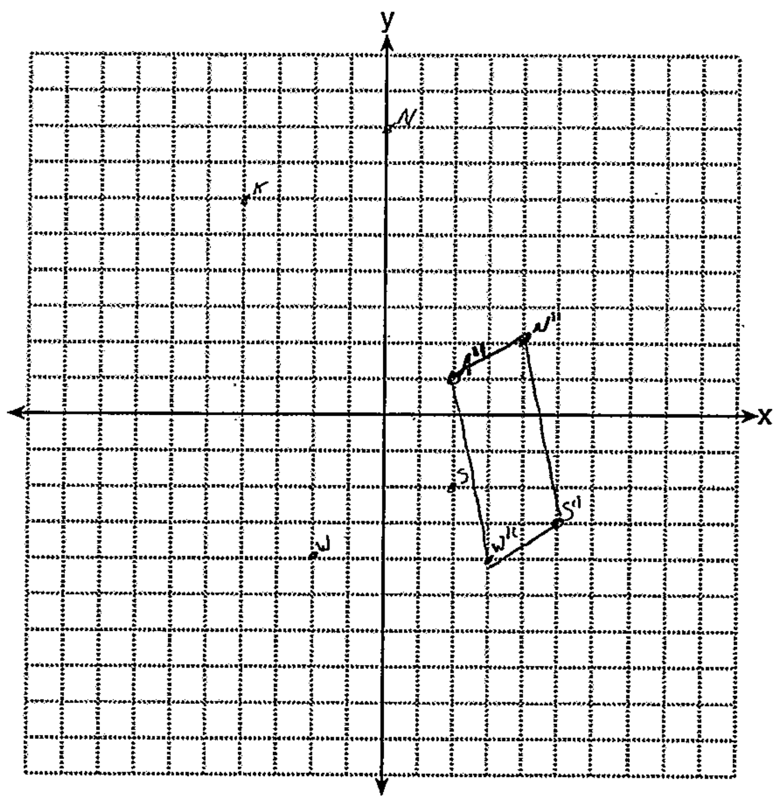


Score 3: The student made one computational error in finding N''.

35 The coordinates of the vertices of parallelogram *SWAN* are $S(2,-2)$, $W(-2,-4)$, $A(-4,6)$, and $N(0,8)$. State and label the coordinates of parallelogram $S''W''A''N''$, the image of *SWAN* after the transformation $T_{4,-2} \circ D_{\frac{1}{2}}$. [The use of the set of axes below is optional.]

S' 1,-1
V' -1,-2
A' -2,3
N' 0,4

S'' 5,-3
V'' 3,-4
A* 2,1
N' 4,2

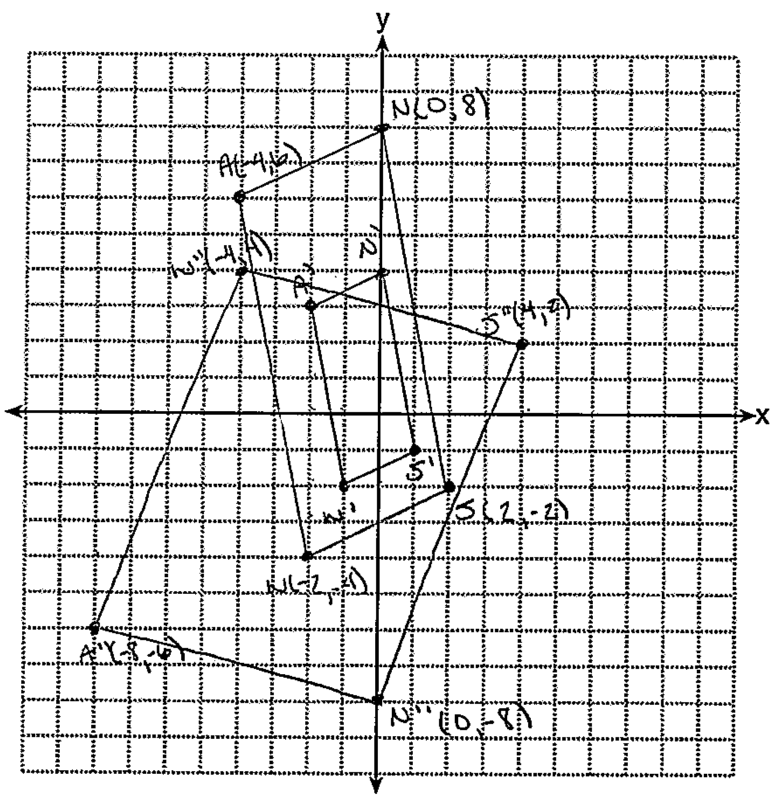


Score 3: The student applied the rules for composite transformations correctly, but did not put parentheses around the coordinates.

35 The coordinates of the vertices of parallelogram *SWAN* are $S(2,-2)$, $W(-2,-4)$, $A(-4,6)$, and $N(0,8)$. State and label the coordinates of parallelogram $S''W''A''N''$, the image of *SWAN* after the transformation $T_{4,-2} \circ D_{\frac{1}{2}}$. [The use of the set of axes below is optional.]

$D_{1/2}$
S(2,-2) → S'(1,-1)
W(-2,-4) → W'(-1,-2)
A(-4,6) → A'(-2,3)
N(0,8) → N'(0,4)

$T_{4,-2}$
S'(1,-1) → S"(4,2)
W'(-1,-2) → W'(-4,4)
A'(-2,3) → A"(-8,-6)
N'(0,4) → N"(0,-8)



Score 2: The student made a conceptual error in doing the translation (multiplied by 4 and –2 instead of adding 4 and –2).

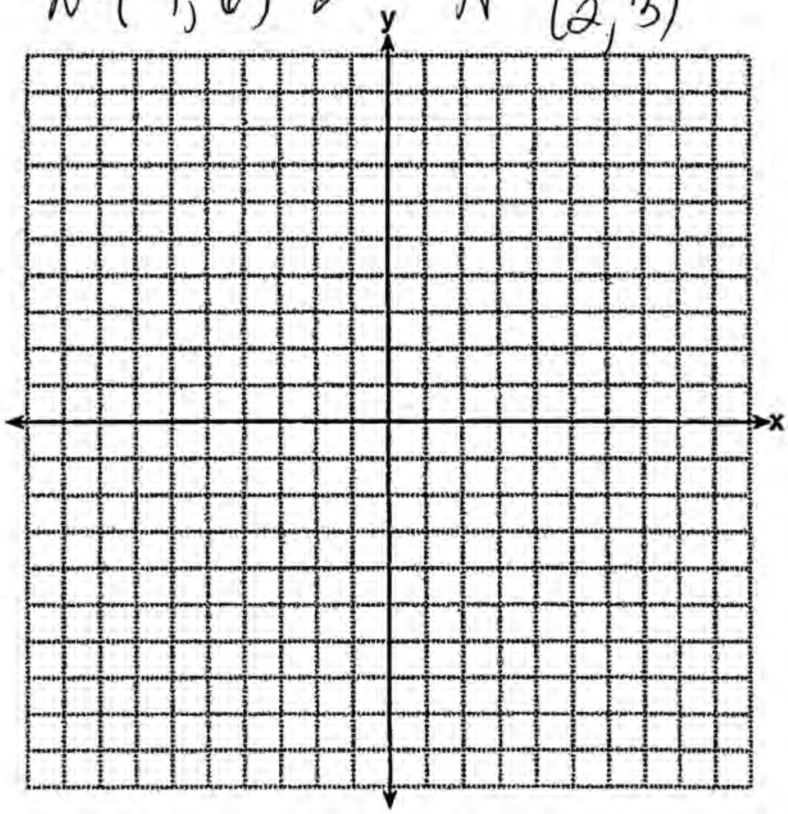
35 The coordinates of the vertices of parallelogram *SWAN* are $S(2,-2)$, $W(-2,-4)$, $A(-4,6)$, and $N(0,8)$. State and label the coordinates of parallelogram $S''W''A''N''$, the image of *SWAN* after the transformation $T_{4,-2} \circ D_{\frac{1}{2}}$. [The use of the set of axes below is optional.]

$S'(6,-4) \rightarrow S''(3,-4)$

$W'(2,-6) \rightarrow W''(1,-3)$

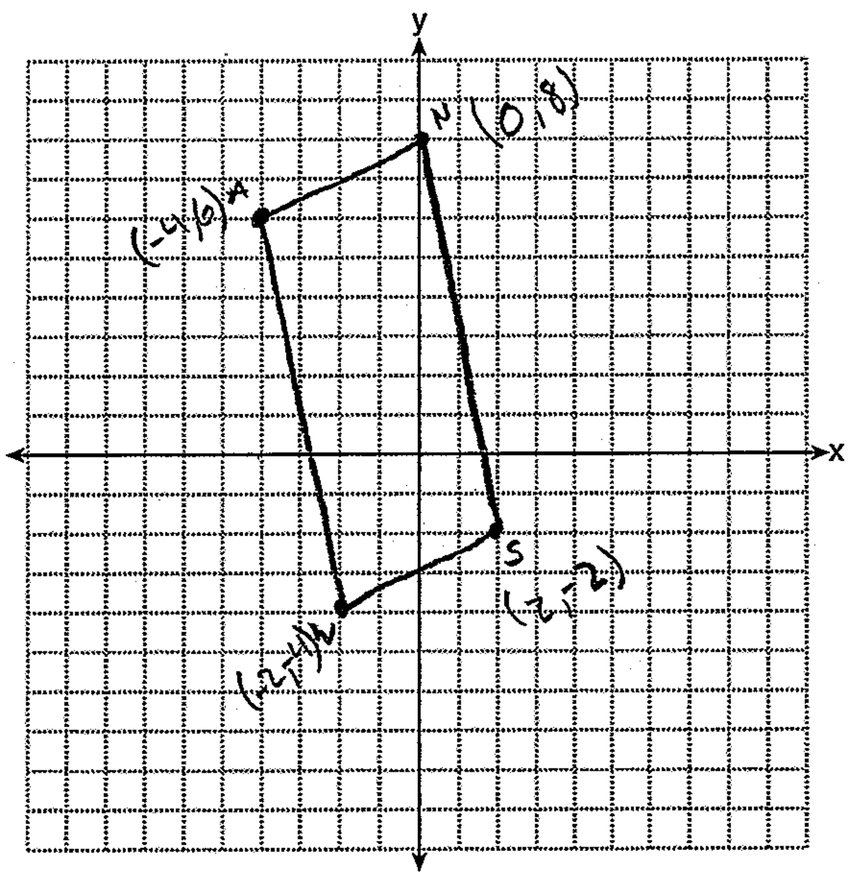
$A'(0,4) \rightarrow A''(0,2)$

$N'(4,6) \rightarrow N''(2,3)$



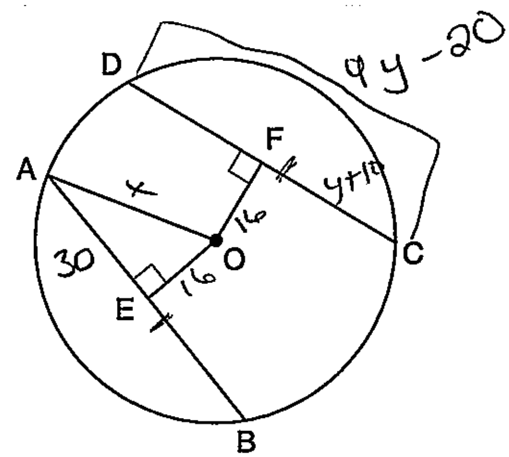
Score 1: The student did the transformation first, which is a conceptual error, and then made an error in calculating the *y*-coordinate for S''.

35 The coordinates of the vertices of parallelogram *SWAN* are $S(2,-2)$, $W(-2,-4)$, $A(-4,6)$, and $N(0,8)$. State and label the coordinates of parallelogram $S''W''A''N''$, the image of *SWAN* after the transformation $T_{4,-2} \circ D_{\frac{1}{2}}$. [The use of the set of axes below is optional.]



Score 0: The student graphed the parallelogram *SWAN* correctly, but did no other work.

36 In circle O shown below, chords $\overline{AB}$ and $\overline{CD}$ and radius $\overline{OA}$ are drawn, such that $\overline{AB} \cong \overline{CD}$, $\overline{OE} \perp \overline{AB}$, $\overline{OF} \perp \overline{CD}$, $OF = 16$, $CF = y + 10$, and $CD = 4y - 20$.



Determine the length of $\overline{DF}$.

$y+10+y+10=4y-20$
$2y+20=4y-20$
$40=2y$
$20=y$

$y+10$
$20+10$
30

$DF=30$

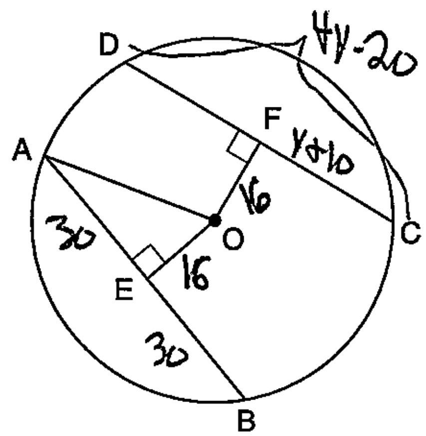
Determine the length of $\overline{OA}$.

$a^2+b^2=c^2$
$30^2+16^2=c^2$
$900+256=c^2$
$\sqrt{1156}=\sqrt{c^2}$
$c=34$

$OA=34$

Score 4: The student showed appropriate work to find both lengths.

36 In circle O shown below, chords $\overline{AB}$ and $\overline{CD}$ and radius $\overline{OA}$ are drawn, such that $\overline{AB} \cong \overline{CD}$, $\overline{OE} \perp \overline{AB}$, $\overline{OF} \perp \overline{CD}$, $OF = 16$, $CF = y + 10$, and $CD = 4y - 20$.



Determine the length of $\overline{DF}$.

$4y - 20 = 2y + 20$

$\underline{-2y + 20} \quad \underline{-2y + 20}$

$\frac{2y}{2} = \frac{40}{2} \quad y = 20$

$DF = 60$

Determine the length of $\overline{OA}$.

$16^2 + 30^2 = c^2$

$256 + 900 = c^2$

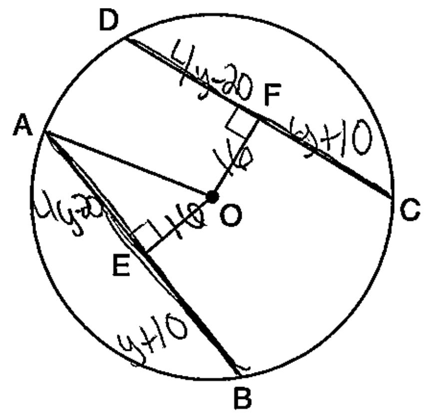
$\sqrt{1156} = \sqrt{c^2}$

$34 = c$

$AO = 34$

Score 3: The student showed appropriate work to find y, but the length of $\overline{DF}$ is incorrect. The student showed appropriate work to find the length of $\overline{OA}$.

36 In circle O shown below, chords $\overline{AB}$ and $\overline{CD}$ and radius $\overline{OA}$ are drawn, such that $\overline{AB} \cong \overline{CD}$, $\overline{OE} \perp \overline{AB}$, $\overline{OF} \perp \overline{CD}$, $OF = 16$, $CF = y + 10$, and $CD = 4y - 20$.



Determine the length of $\overline{DF}$.

$4y-20=y+10$
$-y \qquad -y$
$3y-20=10$
$+20 \quad +20$
$3y=30$
$\frac{3y}{3}=\frac{30}{3}$
$y=10$

$4y-20$
$4(10)-20$
$40-20$
$\boxed{DF=20}$

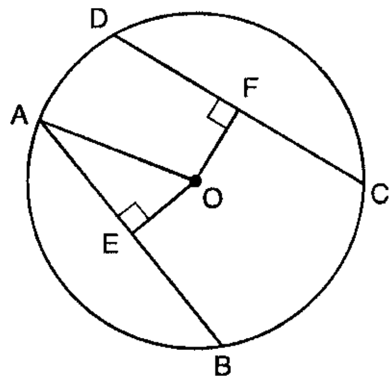
Determine the length of $\overline{OA}$.

$a^2+b^2=c^2$
$16^2+20^2=c^2$
$256+400=c^2$
$\sqrt{656}=\sqrt{c^2}$
$\sqrt{16 \cdot 41}=c$
$\boxed{4\sqrt{41}=OA}$

4
9
16
25
36
49
64
81
100
121
144
169
196
225
256
289

Score 2: The student made a conceptual error in writing the equation to find y, but used this answer to do the rest of the problem correctly and found appropriate lengths.

36 In circle O shown below, chords $\overline{AB}$ and $\overline{CD}$ and radius $\overline{OA}$ are drawn, such that $\overline{AB} \cong \overline{CD}$, $\overline{OE} \perp \overline{AB}$, $\overline{OF} \perp \overline{CD}$, $OF = 16$, $CF = y + 10$, and $CD = 4y - 20$.



Determine the length of $\overline{DF}$.

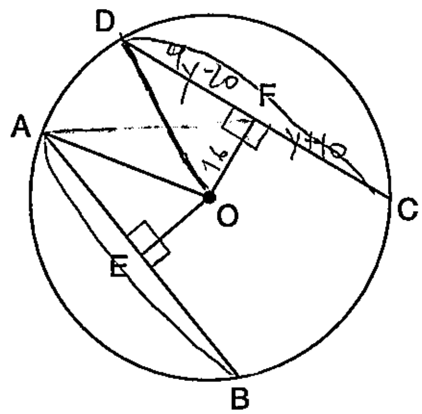
$$4y - 20 = 2(y + 10)$$
$$4y - 20 = 2y + 20$$
$$2y = 40$$
$$y = 20$$

$$4y - 20 =$$
$$4(20) - 20$$
$$80 - 20$$
$$60$$

Determine the length of $\overline{OA}$.

Score 1: The student wrote the correct equation and found $y = 20$, but no further correct work was shown.

36 In circle O shown below, chords $\overline{AB}$ and $\overline{CD}$ and radius $\overline{OA}$ are drawn, such that $\overline{AB} \cong \overline{CD}$, $\overline{OE} \perp \overline{AB}$, $\overline{OF} \perp \overline{CD}$, $OF = 16$, $CF = y + 10$, and $CD = 4y - 20$.



Determine the length of $\overline{DF}$.

$4y - 20 \stackrel{?}{=} y + 10$

$-y + 20 \quad -y + 20$

$3y - 30$

$y = 30$

$4y = 20 = DF$

$4(30) - 20 = DF$

$|DF| \; 120 - 20 = DF$

$\boxed{100 = DF}$

Determine the length of $\overline{OA}$.

$30^2 + 16^2 \stackrel{?}{=} c^2$

$900 + 256 = c$

$1156 = c^2$

$34 = c$

c= radius

34 = radius

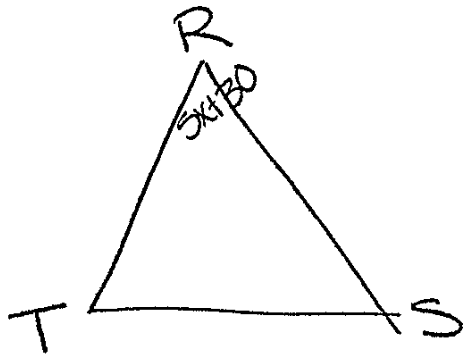
$\overline{OD}$ and $\overline{OA}$ are radii, so they are of equal lengths

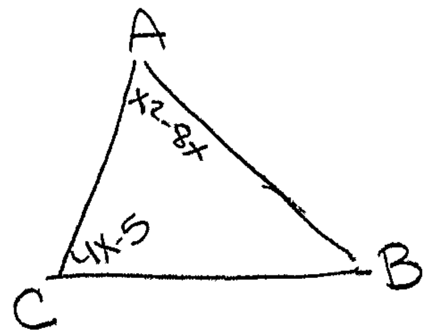
$\boxed{OA = 34}$

Score 0: The student made a conceptual error in writing the equation to solve for y, and then made a computational error when solving this equation. When solving for the length of $\overline{OA}$, the student made a second conceptual error by using their value for y instead of the length of $\overline{DF}$ in the Pythagorean Theorem. The student got a correct answer for the second part by an incorrect method.

37 If $\triangle RST \sim \triangle ABC$, $m\angle A = x^2 - 8x$, $m\angle C = 4x - 5$, and $m\angle R = 5x + 30$, find $m\angle C$.

[Only an algebraic solution can receive full credit.]





$1 \cdot 30$
$2 \cdot 15$

$x^2 - 8x = 5x + 30$
$-5x \quad -5x$

$x^2 - 13x - 30 = 0$

-30, -15, 2, -13

$\angle C = 4x - 5$
$\angle C = 4(15) - 5$
$\angle C = 60 - 5$
$\boxed{m\angle C = 55°}$

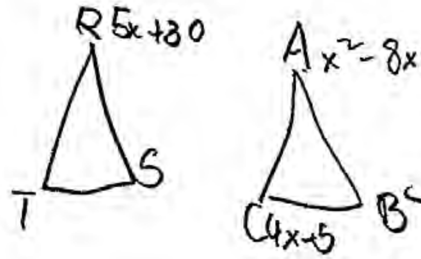
$(x-15)(x+2) = 0$

$+15 \qquad -2$

$\boxed{x = 15} \qquad x = -2$ reject

Score 4: The student wrote a correct equation and showed appropriate work to find $m\angle C$.

37 If $\triangle RST \sim \triangle ABC$, $m\angle A = x^2 - 8x$, $m\angle C = 4x - 5$, and $m\angle R = 5x + 30$, find $m\angle C$.
[Only an algebraic solution can receive full credit.]



$\boxed{m\angle C = 106^\circ}$

$5(15) + 30$

$75 + 30$

105

$5x + 30 = x^2 - 8x$

$-5x \qquad -5x$

$30 = x^2 - 13x - 30$

-30

$x^2 - 13x - 30$

$(x - 15)(x + 2)$

$x - 15 = 0 \qquad x + 2 = 0$

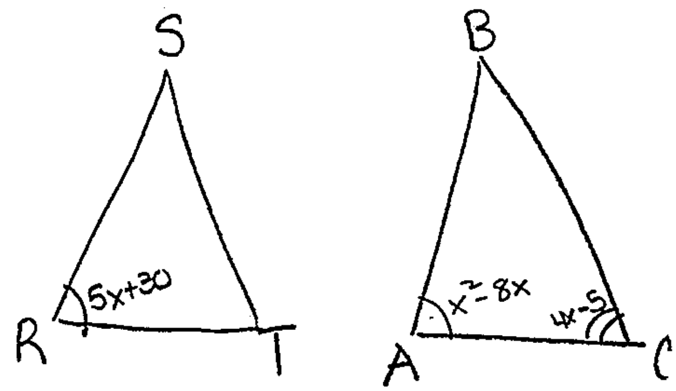
$x + 15 = +15 \qquad -2 \quad -2$

$\boxed{x = 15} \qquad \boxed{x = -2 \text{ Reject}}$

Score 3: The student showed appropriate work to find $x = 15$, but no further correct work is shown.

37 If $\triangle RST \sim \triangle ABC$, $m\angle A = x^2 - 8x$, $m\angle C = 4x - 5$, and $m\angle R = 5x + 30$, find $m\angle C$.

[Only an algebraic solution can receive full credit.]



$$5x + 30 = x^2 - 8x$$
$$-5x \qquad\qquad -5x$$
$$30 = x^2 - 13x$$
$$-30 \qquad\qquad -30$$
$$0 = x^2 - 13x - 30$$
$$0 = (x - 10)(x - 3)$$
$$x - 10 = 0 \qquad x - 3 = 0$$
$$+10 \;\; +10 \qquad +3 \;\; +3$$
$$x = 10 \qquad x = 3$$

$1 \cdot 30$
$2 \cdot 15$
$3 \cdot 10$
$5 \cdot 6$

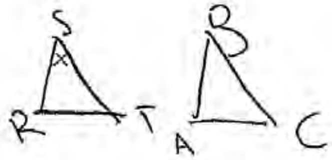
$4x - 5$	$4x - 5$
$4(10) - 5$	$4(3) - 5$
$40 - 5$	$12 - 5$
35	7

$m\angle C = \{35, 7\}$

Score 3: The student made a factoring error, but found appropriate measures for $\angle C$.

37 If $\triangle RST \sim \triangle ABC$, $m\angle A = x^2 - 8x$, $m\angle C = 4x - 5$, and $m\angle R = 5x + 30$, find $m\angle C$.

[Only an algebraic solution can receive full credit.]



$m\angle A = x^2 - 8x$

$m\angle C = 4x - 5$

$x^2 - 8x + 4x - 5 + 5x + 30 = 180$

$x^2 + -4x + 25 = 180$

$-25 \quad -25$

$x^2 + -4x = 155$

$\frac{}{-4} = \frac{}{-4}$

$5(15.5) + 30$

$\boxed{107.5}$

$m\angle C = 4x - 5$

$m\angle R = 5x + 30$

$5x + 30 + 4x - 5 + x = 180$

$10x + 25 = 180$

$-25 \quad -25$

$\frac{10x}{10} \quad x = 15.5 \quad \frac{155}{10}$

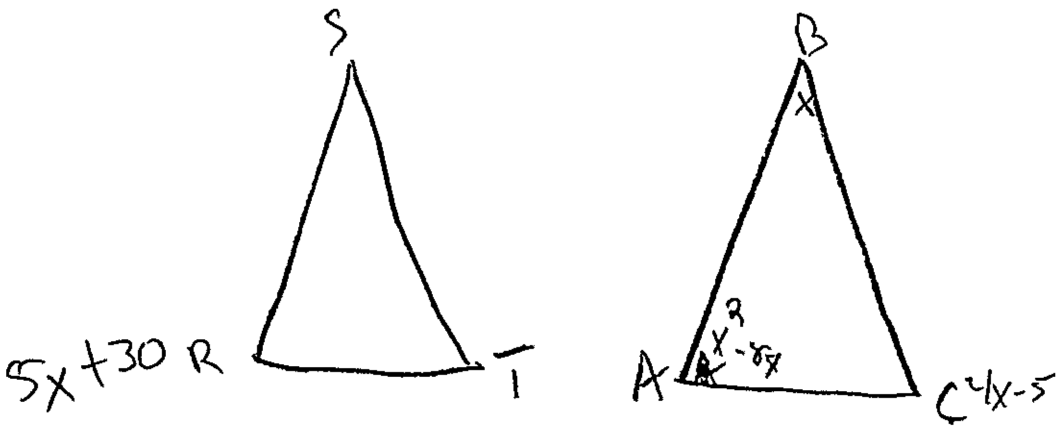
$4(15.5) - 5$

$\boxed{m\angle C \; 57}$

Score 2: The student crossed out the first attempt. Then the student made a conceptual error in assuming that the measure of $\angle S$ is x. The student used this value for x to find an appropriate measure for $\angle C$.

37 If $\triangle RST \sim \triangle ABC$, $m\angle A = x^2 - 8x$, $m\angle C = 4x - 5$, and $m\angle R = 5x + 30$, find $m\angle C$.

[Only an algebraic solution can receive full credit.]

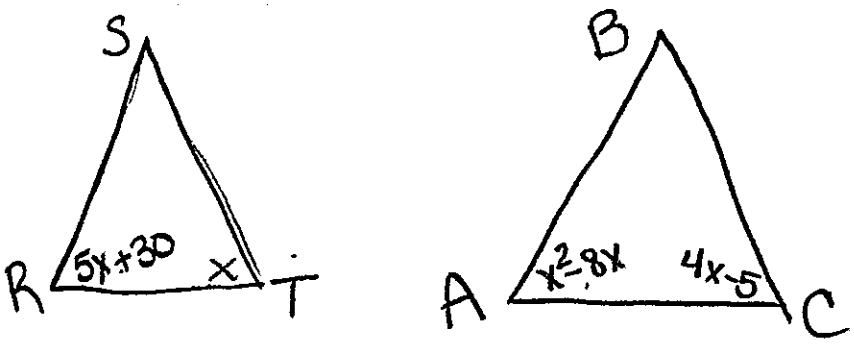


$$5x+30 = x^2 - 8x$$
$$-5x \qquad\qquad -5x$$
$$30 = x^2 - 13x$$

$$x^2 - 8x + x + 4x - 5 = 180$$
$$x^2 - 3x - 5 = 180$$
$$+5 \qquad +5$$
$$\frac{x^2 - 3x}{3x} = \frac{185}{3x}$$
$$x^2 + = x$$

Score 1: The student wrote a correct equation, but no further correct work was shown.

37 If $\triangle RST \sim \triangle ABC$, $m\angle A = x^2 - 8x$, $m\angle C = 4x - 5$, and $m\angle R = 5x + 30$, find $m\angle C$.
[Only an algebraic solution can receive full credit.]



$$\frac{x^2-8x}{4x-5} = \frac{5x+30}{x}$$

$$20x+25=2x^2-8x$$

$$28x+25=2x^2$$

$$\frac{2x^2}{2}-\frac{28x}{2}-\frac{25}{2}=0$$

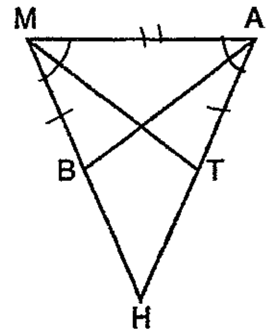
$$x^2-14x-12.5=0$$

$$(x+4)(x-3.5)=0$$

Score 0: The student's work is completely incorrect, irrelevant, and incoherent.

38 In the diagram of $\triangle MAH$ below, $\overline{MH} \cong \overline{AH}$ and medians $\overline{AB}$ and $\overline{MT}$ are drawn.

Prove: $\angle MBA \cong \angle ATM$

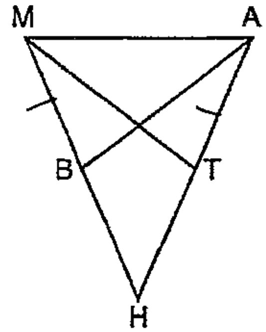


S	R
1. ΔMAH, $\overline{MH} \cong \overline{AH}$ medians $\overline{AB}$ and $\overline{MT}$	1. given
2. B is midpt of $\overline{MH}$ T is midpt of $\overline{AH}$	2. def of median
3. $\overline{MB} = \frac{1}{2}\overline{MH}$ $\overline{AT} = \frac{1}{2}\overline{AH}$	3. def of midpt
4. $\overline{MB} \cong \overline{AT}$	4. Halves of $=$s are $=$
5. $\angle AMH \cong \angle MAH$	5. If 2 sides of a Δ are $\cong$, the $\angle$'s opposite these sides are $\cong$
6. $\overline{MA} \cong \overline{AM}$	6. Reflexive Property
7. $\Delta AMB \cong \Delta MAT$	7. SAS
8. $\angle MBA \cong \angle ATM$	8. CPCTC

Score 6: The student showed a complete and correct proof.

38 In the diagram of $\triangle MAH$ below, $\overline{MH} \cong \overline{AH}$ and medians $\overline{AB}$ and $\overline{MT}$ are drawn.

Prove: $\angle MBA \cong \angle ATM$

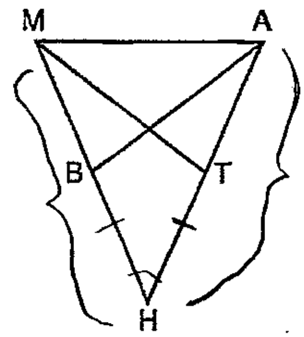


STATEMENTS	REASONS
1) $\triangle MAH$, $\overline{MH} = \overline{AH}$ $\overline{AB}$ AND $\overline{MT}$ ARE MEDIANS	1) GIVEN
2) B IS MIDPOINT $\overline{MH}$ T IS MIDPOINT $\overline{AH}$	2) DEFINITION OF MEDIAN
3) $\overline{MB} = \frac{1}{2}\overline{MH}$ $\overline{AT} = \frac{1}{2}\overline{AH}$	3) DEFINITION OF MIDPOINT
4) $\overline{MB} \cong \overline{AT}$	4) $\frac{1}{2}$'S OF ='S ARE =
5) $\overline{MA} \cong \overline{MA}$	5) REFLEXIVE
6) $\overline{BA} = \overline{TM}$	6) IF 2 SIDES OF $\triangle$ $\cong$ MEDIANS DRAWN TO THESE SIDES $\cong$
7) $\triangle MBA \cong \triangle ATM$	7) SSS

Score 5: The student proved $\triangle MBA \cong \triangle ATM$, but did not do the last step to prove $\angle MBA \cong \angle ATM$.

38 In the diagram of $\triangle MAH$ below, $\overline{MH} \cong \overline{AH}$ and medians $\overline{AB}$ and $\overline{MT}$ are drawn.

Prove: $\angle MBA \cong \angle ATM$

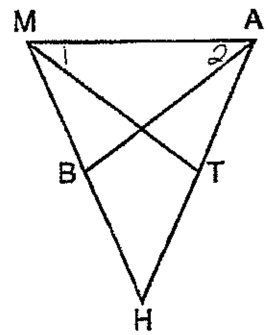


1 $\triangle MAH$, $\overline{MH} \cong \overline{AH}$, medians $\overline{AB}$ + $\overline{MT}$	1 given
2 B is midpoint of $\overline{MH}$, T is midpoint of $\overline{AH}$	2 medians connects vertex to midpoint of opposite side
3 $\overline{BH} = \frac{1}{2}MH$, $TH = \frac{1}{2}AH$	3 midpoint divides line segment in half
4 $\overline{BH} \cong \overline{TH}$	4 halves of equals are equal
5 $\angle H \cong \angle H$	5 reflexive property
6 $\triangle MHT \cong \triangle AHB$	6. SAS
7 $\angle HBA \cong \angle HTM$	7. CPCTC

Score 4: The student proved $\triangle MHT \cong \triangle AHB$, but is missing two steps to prove $\angle MBA \cong \angle ATM$.

38 In the diagram of $\triangle MAH$ below, $\overline{MH} \cong \overline{AH}$ and medians $\overline{AB}$ and $\overline{MT}$ are drawn.

Prove: $\angle MBA \cong \angle ATM$

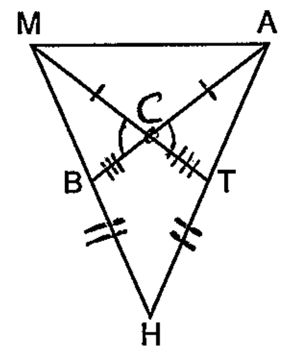


Statement	Reason
① $\overline{MH} \cong \overline{AH}$ median $\overline{AB}$ + $\overline{MT}$ ΔMAH	① given
② $\angle 1 \cong \angle 2$	② angle bisector divides $\angle$ in ½
③ $\angle MAT \cong \angle AMB$	③ 2 sides $\Delta \cong$ opposite $\angle$s $\cong$
④ $\overline{MA} \cong \overline{MA}$	④ reflexive property
⑤ $\Delta MAB \cong \Delta AMT$	⑤ ASA
⑥ $\angle MBA \cong \angle ATM$	⑥ CPCTC

Score 3: The student made a conceptual error in line 2, but from there the student proved $\angle MBA \cong \angle ATM$.

38 In the diagram of $\triangle MAH$ below, $\overline{MH} \cong \overline{AH}$ and medians $\overline{AB}$ and $\overline{MT}$ are drawn.

Prove: $\angle MBA \cong \angle ATM$

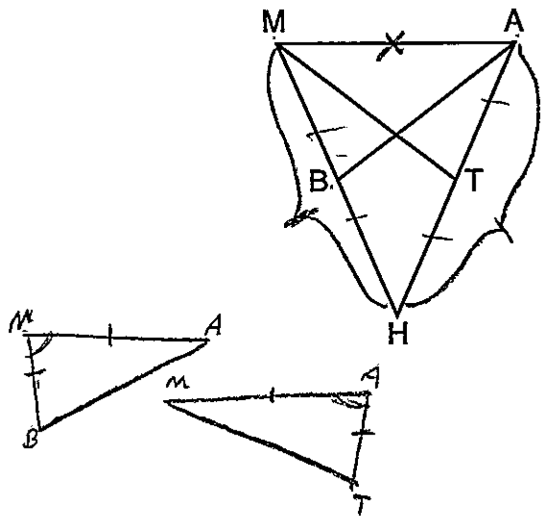


Statements	Reasons
① $\overline{MH} \cong \overline{AH}$, $\overline{AB}$ is a median to $\overline{MH}$. $\overline{MT}$ is a median to $\overline{AH}$.	① Given
② $\overline{AB} \cong \overline{MT}$ $\overline{BC} \cong \overline{TC}$ $\overline{MC} \cong \overline{AC}$	② When medians bisect two congruent sides then they must be congruent too. when the 2 medians intersect they form congruent lines.
③ $\angle MCB \cong \angle ACT$	③ Vertical Angles theorem
④ $\triangle MBC \cong \triangle ATC$	④ SAS
⑤ $\angle B \cong \angle T$	⑤ CPCTC

Score 2: The student made some relevant statements, but four statements or reasons are missing or are incorrect.

38 In the diagram of $\triangle MAH$ below, $\overline{MH} \cong \overline{AH}$ and medians $\overline{AB}$ and $\overline{MT}$ are drawn.

Prove: $\angle MBA \cong \angle ATM$

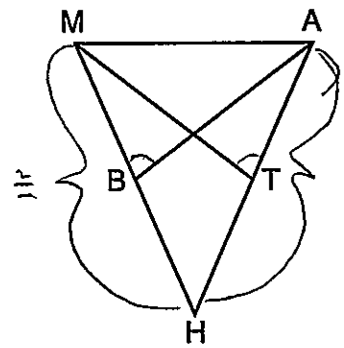


state ment	reason
1) $\overline{MH} \cong AH$, medians $\overline{AB}$ & $\overline{MT}$	give
2) $\overline{MA} \cong \overline{MA}$	2) refexive pos.
3) $\angle M \cong \angle A$	3) + in a $\triangle$ if 2 sides are $\cong$ the $\angle$'s opp those sides are $\cong$
4)	4)

Score 1: The student has only one or two correct statements and reasons, but no further correct work is shown.

38 In the diagram of $\triangle MAH$ below, $\overline{MH} \cong \overline{AH}$ and medians $\overline{AB}$ and $\overline{MT}$ are drawn.

Prove: $\angle MBA \cong \angle ATM$



statement	Reason
$\overline{MH} \cong \overline{AH}$	given
$\overline{MB} \cong \overline{AT}$	medians are congruent
$\overline{BH} \cong \overline{AT}$	medians are congruent
$\measuredangle MBA$ & $\measuredangle HBA = 180$	supplementary angles
$\measuredangle ATM + \measuredangle HTm =$ [illegible]	supplementary angles
$\measuredangle MBA \cong \measuredangle MTA$	Medians are congruent

Score 0: The student wrote no relevant statements.