The sides of a triangle measure 7, 4, and 9. If the longest side of a similar triangle measures 36, determine and state the length of the shortest side of this triangle.

\[
\frac{9}{36} = \frac{4}{x}
\]

\[9x = (36)(4)\]

\[9x = 144\]

\[x = 16\]

**Score 2:** The student has a complete and correct response.
The sides of a triangle measure 7, 4, and 9. If the longest side of a similar triangle measures 36, determine and state the length of the shortest side of this triangle.

\[
\frac{9}{4} = \frac{36}{x}
\]

\[x = 16\]

**Score 2:** The student has a complete and correct response.
29 The sides of a triangle measure 7, 4, and 9. If the longest side of a similar triangle measures 36, determine and state the length of the shortest side of this triangle.

Score 1: The student wrote shortest side next to $4 \times 4 = 16$ but circled “shortest side = 36” as the answer.
The sides of a triangle measure 7, 4, and 9. If the longest side of a similar triangle measures 36, determine and state the length of the shortest side of this triangle.

\[ \frac{9}{4} = \frac{39}{x} \]

\[ 9x = 156 \]

\[ x = 17.3 \]

**Score 1:** The student made a transcription error, but found an appropriate length for the shortest side.
The sides of a triangle measure 7, 4, and 9. If the longest side of a similar triangle measures 36, determine and state the length of the shortest side of this triangle.

\[ a^2 + b^2 = c^2 \]
\[ 7^2 + 4^2 = 9^2 \]
\[ 49 + 16 = 81 \]
\[ 65 \]
\[ x = \frac{2}{3} \]

Score 0: The student’s work was completely incorrect.
Question 30

Triangle $ABC$ has coordinates $A(6,-4)$, $B(0,2)$, and $C(6,2)$. On the set of axes below, graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a dilation of $\frac{1}{2}$.

Score 2: The student has a complete and correct response.
30 Triangle $ABC$ has coordinates $A(6,-4)$, $B(0,2)$, and $C(6,2)$. On the set of axes below, graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a dilation of $\frac{1}{2}$.

Score 2: The student has a complete and correct response.
Question 30

30 Triangle $ABC$ has coordinates $A(6, -4)$, $B(0, 2)$, and $C(6, 2)$. On the set of axes below, graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a dilation of $\frac{1}{2}$.

$A (6, -4) \rightarrow (3, -2)$
$B (0, 2) \rightarrow (0, 1)$
$C (6, 2) \rightarrow (3, 1)$

Score 1: The student stated the coordinates of each corresponding point of the image of $\triangle ABC$. 
30 Triangle $ABC$ has coordinates $A(6,-4)$, $B(0,2)$, and $C(6,2)$. On the set of axes below, graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a dilation of $\frac{1}{2}$.

$A\left(6, -4\right) \xrightarrow{\text{dilation}} A' \left(3, -2\right)$

$B\left(0, 2\right) \xrightarrow{\text{dilation}} B' \left(0, 1\right)$

$C\left(6, 2\right) \xrightarrow{\text{dilation}} C' \left(3, 1\right)$

Score 1: The student made an error graphing $B'$. 
**Question 30**

Triangle $ABC$ has coordinates $A(6,-4)$, $B(0,2)$, and $C(6,2)$. On the set of axes below, graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after a dilation of $\frac{1}{2}$.

**Score 0:** The student’s work was completely incorrect.
31 In parallelogram \( RSTU \), \( m \angle R = 5x - 2 \) and \( m \angle S = 3x + 10 \).
Determine and state the value of \( x \).

\[
\begin{align*}
360^\circ &= 5x - 2 + 5x - 2 + 3x + 10 + 3x + 10 \\
360^\circ &= 10x - 4 + 60 + 20 \\
360^\circ &= 10x + 16 \\
-16
\end{align*}
\]

\[
\begin{align*}
344 &= 10x \\
116 &= 10x \\
21.5 &= x
\end{align*}
\]

**Score 2:** The student has a complete and correct response.
31 In parallelogram $RSTU$, $m\angle R = 5x - 2$ and $m\angle S = 3x + 10$.
Determine and state the value of $x$.

\[
\begin{align*}
5x - 2 + 3x + 10 &= 180 \\
8x + 8 &= 180 \\
8x &= 172 \\
x &= 21.5
\end{align*}
\]

**Score 2:** The student has a complete and correct response.
31 In parallelogram $RSTU$, $m\angle R = 5x - 2$ and $m\angle S = 3x + 10$. Determine and state the value of $x$.

\[8x + 8 = 180\]
\[8x = 172\]
\[x = 22.5\]

\[16x + 16 = 360\]

**Score 1:** The student made an error in division.
Question 31

31 In parallelogram $RSTU$, $m\angle R = 5x - 2$ and $m\angle S = 3x + 10$.
Determine and state the value of $x$.

\[ \begin{align*}
5x - 2 &= 3x + 10 \\
-3x &= 12 \\
x &= 4
\end{align*} \]

Score 1: The student made an error by setting the consecutive angles of the parallelogram equal.
In parallelogram $RSTU$, $m\angle R = 5x - 2$ and $m\angle S = 3x + 10$.
Determine and state the value of $x$.

\[
5x - 2 + 3x + 10 = 360
\]

\[
8x - 2 + 10 = 360
\]

\[
8x - 8 = 360
\]

\[
+ 8 + 8
\]

\[
\frac{8x}{8} = \frac{386}{8}
\]

\[
x = 48
\]

**Score 0:** The student wrote an incorrect equation and made an error in solving it.
Question 32

32 Determine and state the length of a line segment whose endpoints are (6,4) and (-9,-4).

\[
\sqrt{(6+9)^2 + (4+4)^2} = \sqrt{(15)^2 + (8)^2} = \sqrt{225 + 64} = \sqrt{289} = 17
\]

\[\text{Score 2: The student has a complete and correct response.}\]
32 Determine and state the length of a line segment whose endpoints are (6,4) and (−9,−4).

\[ \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2} \]

\[ \sqrt{(0-9)^2 + (-4-4)^2} \]

\[ \sqrt{(-3)^2 + (-8)^2} \]

\[ \sqrt{9 + 64} \]

\[ = \sqrt{73} \]

Score 1: The student used an incorrect formula for the length of a line segment, but found an appropriate solution.
32 Determine and state the length of a line segment whose endpoints are (6,4) and (-9,-4).

\[ d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2} \]

\[ d = \sqrt{(-9-6)^2 + (-4-6)^2} \]

\[ d = \sqrt{-15^2 + -10^2} \]

\[ d = \sqrt{225 + 100} \]

\[ d = \sqrt{325} \]

\[ d = 18 \]

**Score 0:** The student made an incorrect substitution into the formula and did not show the entire display of the calculator.
The base of a right pentagonal prism has an area of 20 square inches. If the prism has an altitude of 8 inches, determine and state the volume of the prism, in cubic inches.

\[ V = 20 \times 8 \]

\[ V = 160 \]

**Score 2:** The student has a complete and correct response.
The base of a right pentagonal prism has an area of 20 square inches. If the prism has an altitude of 8 inches, determine and state the volume of the prism, in cubic inches.

Score 1: The student showed no work.
The base of a right pentagonal prism has an area of 20 square inches. If the prism has an altitude of 8 inches, determine and state the volume of the prism, in cubic inches.

\[
(20)(8) = 160 \text{ sq. in.}
\]

**Score 1:** The student wrote incorrect units in the answer.
Question 33

The base of a right pentagonal prism has an area of 20 square inches. If the prism has an altitude of 8 inches, determine and state the volume of the prism, in cubic inches.

\[
\frac{1}{2} \times 8 \times 20 = 80 \,
\]

\[
\text{Volume} = 100 \, \text{in}^3
\]

Score 0: The student used an incorrect formula and made an error in multiplication.
Question 34

34 Using a compass and a straightedge, construct the bisector of $\angle CDE$.

[Leave all construction marks.]

Score 2: The student has a complete and correct response.
Question 34

34 Using a compass and a straightedge, construct the bisector of $\angle CDE$.

[Leave all construction marks.]

Score 1: The student drew a correct construction on an angle other than $\angle CDE$. 
34 Using a compass and a straightedge, construct the bisector of $\angle CDE$.

[Leave all construction marks.]

Score 1: The student did not complete the construction.
34 Using a compass and a straightedge, construct the bisector of $\angle CDE$.

[Leave all construction marks.]

**Score 0:** The student did not demonstrate a proper method of construction.
34 Using a compass and a straightedge, construct the bisector of $\angle CDE$.

[Leave all construction marks.]

**Score 0**: The student drew a construction that was irrelevant to the problem.
Question 35

35 The coordinates of $\triangle ABC$, shown on the graph below, are $A(2,5)$, $B(5,7)$, and $C(4,1)$. Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after it is reflected over the $y$-axis. Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected over the $x$-axis. State a single transformation that will map $\triangle ABC$ onto $\triangle A''B''C''$.

Score 4: The student has a complete and correct response.
35 The coordinates of $\triangle ABC$, shown on the graph below, are $A(2,5)$, $B(5,7)$, and $C(4,1)$.

Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after it is reflected over the $y$-axis.

Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected over the $x$-axis.

State a single transformation that will map $\triangle ABC$ onto $\triangle A''B''C''$.

Score 4: The student has a complete and correct response.
35 The coordinates of $\triangle ABC$, shown on the graph below, are $A(2,5)$, $B(5,7)$, and $C(4,1)$. Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after it is reflected over the $y$-axis. Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected over the $x$-axis. State a single transformation that will map $\triangle ABC$ onto $\triangle A''B''C''$.

Score 3: The student did not state the single transformation completely.
Question 35

35 The coordinates of \( \triangle ABC \), shown on the graph below, are \( A(2,5) \), \( B(5,7) \), and \( C(4,1) \).

Graph and label \( \triangle A'B'C' \), the image of \( \triangle ABC \) after it is reflected over the \( y \)-axis.

Graph and label \( \triangle A''B''C'' \), the image of \( \triangle A'B'C' \) after it is reflected over the \( x \)-axis.

State a single transformation that will map \( \triangle ABC \) onto \( \triangle A''B''C'' \).

Score 2: The student graphed the two images correctly, but did not label them or state a single transformation.
Question 35

35 The coordinates of \( \triangle ABC \), shown on the graph below, are \( A(2,5) \), \( B(5,7) \), and \( C(4,1) \).

Graph and label \( \triangle A'B'C' \), the image of \( \triangle ABC \) after it is reflected over the \( y \)-axis.

Graph and label \( \triangle A''B''C'' \), the image of \( \triangle A'B'C' \) after it is reflected over the \( x \)-axis.

State a single transformation that will map \( \triangle ABC \) onto \( \triangle A''B''C'' \).

\[
\begin{align*}
A(2,5) & \rightarrow (5,-2) \rightarrow (5,3) \\
B(5,7) & \rightarrow (7,-5) \rightarrow (7,5) \\
C(4,1) & \rightarrow (1,-4) \rightarrow (1,4)
\end{align*}
\]

**Score 2:** The student graphed the first transformation incorrectly, but graphed and labeled the second correctly and stated an appropriate single transformation.
35 The coordinates of $\triangle ABC$, shown on the graph below, are $A(2,5)$, $B(5,7)$, and $C(4,1)$. Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after it is reflected over the $y$-axis. Graph and label $\triangle A"B"C"$, the image of $\triangle A'B'C'$ after it is reflected over the $x$-axis. State a single transformation that will map $\triangle ABC$ onto $\triangle A"B"C"$.

Score 1: The student graphed and labeled $\triangle A'B'C'$ correctly. When graphing $\triangle A"B"C"$ the student reflected $\triangle ABC$ over the $x$-axis, and stated an incorrect single transformation.
35 The coordinates of \( \triangle ABC \), shown on the graph below, are \( A(2,5) \), \( B(5,7) \), and \( C(4,1) \).

Graph and label \( \triangle A'B'C' \), the image of \( \triangle ABC \) after it is reflected over the \( y \)-axis.

Graph and label \( \triangle A''B''C'' \), the image of \( \triangle A'B'C' \) after it is reflected over the \( x \)-axis.

State a single transformation that will map \( \triangle ABC \) onto \( \triangle A''B''C'' \).

Score 0: The student did not show any work that was relevant to the problem.
36 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[ y = x^2 + 4x + 2 \]
\[ y = 2x + 5 \]

Score 4: The student has a complete and correct response.
36 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[
\begin{align*}
y &= x^2 + 4x + 2 \\
y - 2x &= 5 \\
y &= 2x + 5
\end{align*}
\]

Score 3: The student graphed both equations accurately, but only showed and stated one solution.
36 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[ y = x^2 + 4x + 2 \]
\[ y - 2x = 5 \]

\[ y = 2x + 5 \]

Score 2: The student confused the slope and \( y \)-intercept, but stated appropriate solutions.
36 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[
\begin{align*}
y &= x^2 + 4x + 2 \\
y - 2x &= 5 \\
y &= 2x + 5
\end{align*}
\]

\[
\begin{align*}
2x + 5 &= x^2 + y + 2 \\
2x + 3 &= x^2 + y + 2 \\
0 &= x^2 + 2x - 3 \\
0 &= (x - 1)(x + 3) \\
x - 1 = 0 & \quad x + 3 = 0 \\
x = 1 & \quad x = -3 \\
y &= 7 & \quad y = -7
\end{align*}
\]

Score 2: The student found both solutions by a method other than graphing.
36 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[ y = x^2 + 4x + 2 \]
\[ y - 2x = 5 \]

Score 2: The student graphed both equations correctly, but did not state the coordinates of the solution.
36 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[
\begin{align*}
y &= x^2 + 4x + 2 \\
y &= 2x + 5
\end{align*}
\]

Score 1: The student only graphed the quadratic equation correctly.
36 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[ y = x^2 + 4x + 2 \]

\[ y - 2x = 5 \]

Score 1: The student only graphed the linear equation correctly.
36 On the set of axes below, solve the following system of equations graphically and state the coordinates of all points in the solution.

\[ y = x^2 + 4x + 2 \]
\[ y - 2x = 5 \]

Score 0: The student did not show any work that was relevant to the problem.
37 Given: Triangle RST has coordinates $R(-1,7)$, $S(3,-1)$, and $T(9,2)$

Prove: $\triangle RST$ is a right triangle

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

$$\text{Slope } \overline{RS} = \frac{2}{-1} = -2$$

$$\text{Slope } \overline{ST} = \frac{-1}{6} = \frac{1}{2}$$

Lines $RS$ and $ST$ are perpendicular because they have negative reciprocal slopes of each other. Perpendicular lines contemplated form right angles; therefore, angle $RST$ is a right angle, a triangle needs exactly one right triangle and it has one.

Score 4: The student has a complete and correct response.
37 Given: Triangle $RST$ has coordinates $R(-1,7)$, $S(3,-1)$, and $T(9,2)$

Prove: $\triangle RST$ is a right triangle

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

1) Get side $RS$ by doing Pythag Thm: $8^2 + 4^2 = x^2 \Rightarrow x = \sqrt{80}$

2) Get side $RT$ by doing Pythag Thm: $10^2 + 6^2 = x^2 \Rightarrow x = \sqrt{136}$

3) Get side $ST$ by doing Pythag Thm: $6^2 + 8^2 = x^2 \Rightarrow x = \sqrt{100}$

4) $\sqrt{80} + \sqrt{136} \neq 128$

5) $\triangle RST$ is a right $\Delta$ because it's sides worked in: $Pythag$ Thm

Score 4: The student has a complete and correct response.
37 Given: Triangle $RST$ has coordinates $R(-1,7)$, $S(3,-1)$, and $T(9,2)$

Prove: $\triangle RST$ is a right triangle

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

$$\begin{align*}
\text{Slope of } \overline{ST} &= \frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - (-1)}{-1 - 3} = \frac{3}{-4} = \frac{-3}{4} \\
\text{Slope of } \overline{RS} &= \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - 7}{3 - (-1)} = \frac{-8}{4} = -2
\end{align*}$$

$m \overline{RS}$ is the negative reciprocal of $m \overline{ST}$ so $\overline{RS}$ is perpendicular to $\overline{ST}$ forming a $90^\circ$ or right angle.

Score 3: The student wrote an incomplete concluding statement.
37 Given: Triangle $RST$ has coordinates $R(-1,7)$, $S(3,-1)$, and $T(9,2)$

Prove: $\triangle RST$ is a right triangle

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

![Graph showing triangle RST with coordinates and calculations]

Distance formula:

$$D = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$

$$\overline{RT} (hyp.) = \sqrt{(-1-9)^2 + (7-2)^2}$$

$$\overline{RS} = \sqrt{(-1-3)^2 + (-1+1)^2}$$

$$\overline{ST} = \sqrt{(3-9)^2 + (2+1)^2}$$

Score 3: The student did not write a concluding statement.
37 Given: Triangle RST has coordinates R(−1,7), S(3,−1), and T(9,2)

Prove: ΔRST is a right triangle

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

\[
\begin{align*}
\text{slope of } & RS \quad \text{slope of } ST \\
\frac{-1 - 7}{3 + 1} & \frac{2 + 1}{9 - 3} \\
\frac{-8}{4} & = -2 \quad \frac{3}{6} = \frac{1}{2}
\end{align*}
\]

Lines RS is perpendicular to line ST because the slopes are neg reciprocals.

Score 2: The student proved RS \perp ST.
Question 37

37 Given: Triangle $RST$ has coordinates $R(-1,7)$, $S(3,-1)$, and $T(9,2)$
Prove: $\triangle RST$ is a right triangle
[The use of the set of axes below is optional.]

Score 2: The student did not show that the Pythagorean Theorem was satisfied, and did not write a concluding statement.
Question 37

Given: Triangle $RST$ has coordinates $R(-1,7)$, $S(3,-1)$, and $T(9,2)$.

Prove: $\triangle RST$ is a right triangle

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

$$d_{RS} = \sqrt{(3-(-1))^2 + (-1-7)^2}$$
$$= \sqrt{(4)^2 + (-8)^2}$$
$$= \sqrt{16 + 64}$$
$$= \sqrt{80}$$

$$d_{RT} = \sqrt{(9-(-1))^2 + (2-7)^2}$$
$$= \sqrt{(10)^2 + (-5)^2}$$
$$= \sqrt{100 + 25}$$
$$= \sqrt{125}$$

$$d_{ST} = \sqrt{(9-3)^2 + (2-(-1))^2}$$
$$= \sqrt{(6)^2 + (3)^2}$$
$$= \sqrt{36 + 9}$$
$$= \sqrt{45}$$

Score 1: The student only found the lengths of all three sides.
37 Given: Triangle RST has coordinates R(−1, 7), S(3, −1), and T(9, 2)
Prove: △RST is a right triangle

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

\[
\sqrt{(4-3)^2+(9-1)^2} = \sqrt{(-1)^2+(8)^2} = \sqrt{16+64} = \sqrt{80}
\]

\[
\sqrt{(3-9)^2+(-1-2)^2} = \sqrt{(-6)^2+(-3)^2} = \sqrt{36+9} = \sqrt{45}
\]

\[
\sqrt{(9-(-1))^2+(2-7)^2} = \sqrt{(10)^2+(-5)^2} = \sqrt{100+25} = \sqrt{125}
\]

Score 0: The student attempted to find the lengths of all three sides.
In right triangle $FGH$ shown below, $\angle GHF = 90$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{JG}$. [Only an algebraic solution can receive full credit.]

$$16x + x^2 = 225$$
$$x^2 + 16x = 225$$
$$x^2 + 16x - 225 = 0$$

$$x = \frac{-16 \pm \sqrt{(-16)^2 - 4(1)(-225)}}{2(1)}$$
$$x = \frac{-16 \pm \sqrt{256 + 900}}{2}$$
$$x = \frac{-16 \pm 34}{2}$$
$$x = 9, -15$$

Since $x$ represents a length, $x = 9$.

$$\overline{JG} = 9$$

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

$$16^2 = 9^2 + x^2$$
$$256 = 81 + x^2$$
$$x^2 = 175$$
$$x = \sqrt{175}$$

$$\overline{HJ} = 12$$

**Score 6:** The student has a complete and correct response.
In right triangle $FGH$ shown below, $m\angle GHF = 90$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{GJ}$. [Only an algebraic solution can receive full credit.]

$$\frac{x}{15} \times \frac{15}{16 + x} \quad 16x + x^2 = 225$$

$$x^2 + 16x - 225 = 0$$

$$(x + 25)(x - 9) = 0$$

$$x = 9$$

$$\frac{9}{15} = \frac{15}{10 + 9}$$

$$\frac{16 \times 5}{25} (9) = 225$$

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

$$\frac{16}{x} \times \frac{x}{q} \quad x^2 = 144$$

$$\sqrt{144} = 12 \quad x = 12$$

$$\overline{HJ} = 12$$

**Score 6:** The student has a complete and correct response.
Question 38

38 In right triangle $FGH$ shown below, $m\angle GHF = 90$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{JG}$. [Only an algebraic solution can receive full credit.]

$$x + 16 = 15$$

$$x^2 + 16x = 225$$

$$x^2 + 16x - 225 = 0$$

$$(x - 9)(x + 25) = 0$$

$$x = 9$$

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

$$16 \div y$$

$$y^2 = 15.4$$

$$y = \sqrt{15.4}$$

Score 5: The student made a multiplication error.
Question 38

38 In right triangle $FGH$ shown below, $m\angle GHF = 90^\circ$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{JG}$. [Only an algebraic solution can receive full credit.]

\[
\frac{x}{15} = \frac{15}{x + 16} \\
\frac{x(x + 16)}{15} = 15^2 \\
x^2 + 16x = 225 \\
x^2 + 16x - 225 = 0 \\
(x + 25)(x - 9) = 0 \\
x = -25 \quad x = 9
\]

\[
\overline{JG} = 9
\]

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

\[
\frac{9}{y} = \frac{y}{15} \\
\sqrt{y^2} = \sqrt{135} \\
y = 3 \sqrt{15} \\
\overline{HJ} = 3 \sqrt{15}
\]

Score 4: The student found the length of $\overline{JG}$, but no further correct work was shown.
In right triangle $FGH$ shown below, $m \angle GHF = 90, \text{ altitude } \overline{HJ}$ is drawn to $\overline{FG}, FJ = 16, \text{ and } HG = 15.$

Determine and state the length of $JG.$ [Only an algebraic solution can receive full credit.]

\[ \frac{x + 16}{15} = \frac{15}{x} \]

\[ x^2 + 16x = 225 \]

\[ x^2 + 16x - 225 = 0 \]

Determine and state the length of $HJ.$ [Only an algebraic solution can receive full credit.]

\[ 25^2 = 15^2 + y^2 \]

\[ 625 = 225 + y^2 \]

\[ 400 = y^2 \]

\[ y = 20 \]

**Score 3:** The student made one factoring error when finding $JG$, and substituted into the Pythagorean Theorem incorrectly.
Question 38

38 In right triangle $FGH$ shown below, $\angle GHF = 90$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{JG}$. [Only an algebraic solution can receive full credit.]

\[
\frac{16 + x}{15} = \frac{15}{x}
\]

\[225 = 16x + x^2
\]

\[-x^2 - 16x + 225 = 0\]

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

\[
\frac{x}{y} = \frac{y}{16}
\]

Score 3: The student wrote a correct quadratic equation for $JG$ and a correct proportion for $HJ$. 
38 In right triangle $FGH$ shown below, $m \angle GHF = 90$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{JG}$. [Only an algebraic solution can receive full credit.]

\[
\frac{x+16}{16} = \frac{15}{x}
\]

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

\[
\frac{x}{y} = \frac{y}{16}
\]

\[
y^2 = 16x
\]

**Score 2:** The student wrote correct proportions for both $JG$ and $HJ$. 
Question 38

38 In right triangle $FGH$ shown below, $m\angle GHF = 90$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{JG}$. [Only an algebraic solution can receive full credit.]

\[
\frac{x}{15} = \frac{15}{x+16}
\]

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

Score 1: The student wrote a correct proportion to find $JG$. 

Geometry – Jan. ’16

[59]
38 In right triangle $FGH$ shown below, $m\angle GHF = 90$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

$3 \times 5 = 15$

$3 \times 3 = 9$

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

$4 \times 3 = 12$

Score 1: The student did not show sufficient work for 9 and 12.
38 In right triangle $FGH$ shown below, $m\angle GHF = 90$, altitude $\overline{HJ}$ is drawn to $\overline{FG}$, $FJ = 16$, and $HG = 15$.

Determine and state the length of $\overline{JG}$. [Only an algebraic solution can receive full credit.]

\[
\frac{16}{x} = \frac{x}{15}
\]

\[
\sqrt{x^2} = \sqrt{240}
\]

\[
x = 4\sqrt{15}
\]

Determine and state the length of $\overline{HJ}$. [Only an algebraic solution can receive full credit.]

Score 0: The student’s work was completely incorrect.