29 The coordinates of the endpoints of $\overline{BC}$ are $B(5,1)$ and $C(-3,-2)$. Under the transformation $R_{90}$, the image of $\overline{BC}$ is $\overline{B'C'}$. State the coordinates of points $B'$ and $C'$.

Score 2: The student has a complete and correct response.
The coordinates of the endpoints of $\overline{BC}$ are $B(5,1)$ and $C(-3,-2)$. Under the transformation $R_{90}$, the image of $\overline{BC}$ is $B'C'$. State the coordinates of points $B'$ and $C'$.

**Score 1:** The student did not express the coordinates as an ordered pair.
The coordinates of the endpoints of $\overline{BC}$ are $B(5,1)$ and $C(-3,-2)$. Under the transformation $R_{90}$, the image of $\overline{BC}$ is $\overline{B'C'}$. State the coordinates of points $B'$ and $C'$.

\begin{align*}
B' & : (1, -5) \\
C' & : (2, -3)
\end{align*}

Score 1: The student only stated $(2, -3)$ correctly.
The coordinates of the endpoints of $\overline{BC}$ are $B(5,1)$ and $C(-3,-2)$. Under the transformation $R_{90}$, the image of $\overline{BC}$ is $\overline{B'C'}$. State the coordinates of points $B'$ and $C'$.

Score 0: The student's work is completely incorrect.
30 As shown in the diagram below, $AS$ is a diagonal of trapezoid $STAR$, $RA \parallel ST$, $m\angle ATS = 48$, $m\angle RSA = 47$, and $m\angle ARS = 68$.

Determine and state the longest side of $\triangle SAT$.

\[ \begin{array}{c}
\text{R} \quad 68^\circ \\
A \quad 65^\circ \\
S \quad 47^\circ \\
T \quad 48^\circ \\
\end{array} \]

\[ \begin{array}{c}
\frac{47 + 68}{115^\circ} + \frac{65 + 118}{113^\circ} = \frac{1150 + 1130}{1130} \\
\end{array} \]

\[ \overline{ST} \text{ is the longest side.} \]

**Score 2:** The student has a complete and correct response.
30 As shown in the diagram below, $\overline{AS}$ is a diagonal of trapezoid $STAR$, $\overline{RA} \parallel \overline{ST}$, $\angle ATS = 48$, $\angle RSA = 47$, and $\angle ARS = 68$.

Determine and state the longest side of $\triangle SAT$.

Score 2: The student has a complete and correct response.
30 As shown in the diagram below, \( \overline{AS} \) is a diagonal of trapezoid \( \text{STAR} \), \( \overline{RA} \parallel \overline{ST} \), \( m\angle ATS = 48 \), \( m\angle RSA = 47 \), and \( m\angle ARS = 68 \).

Determine and state the longest side of \( \triangle SAT \).

---

**Score 1:** The student made one conceptual error in finding \( m\angle SAT = 47 \), but found an appropriate \( m\angle AST \) and determined \( \overline{AT} \) as the longest side.
30 As shown in the diagram below, \( \overline{AS} \) is a diagonal of trapezoid \( \text{STAR} \), \( \overline{RA} \parallel \overline{ST} \), \( m\angle ATS = 48 \), \( m\angle RSA = 47 \), and \( m\angle ARS = 68 \).

Determine and state the longest side of \( \triangle SAT \).

Score 0: The student made one conceptual error in finding \( m\angle SAT \). A longest side was not stated.
31 In right triangle $ABC$ shown below, altitude $BD$ is drawn to hypotenuse $AC$.

If $AD = 8$ and $DC = 10$, determine and state the length of $AB$.

\[
\begin{align*}
\frac{\text{leg}}{\text{hyp}} & = \frac{8}{x} = \frac{x}{18} \\
x^2 & = 144 \\
x & = 12
\end{align*}
\]

Length of $AB = 12$

**Score 2:** The student has a complete and correct response.
31 In right triangle $ABC$ shown below, altitude $BD$ is drawn to hypotenuse $AC$.

If $AD = 8$ and $DC = 10$, determine and state the length of $AB$.

\[
\frac{8}{x} = \frac{x}{10} \\
x^2 = 80 \\
\sqrt{80} = 4\sqrt{5} \\
\]

**Score 1:** The student made a conceptual error when writing the proportion, but wrote an appropriate solution.
In right triangle $ABC$ shown below, altitude $BD$ is drawn to hypotenuse $AC$.

If $AD = 8$ and $DC = 10$, determine and state the length of $AB$.

\[ \frac{8}{x} = \frac{x}{10} \]

\[ 80 = x^2 \]

\[ x = 8.99 \]

\[ 8.99^2 + 8^2 = y^2 \]

\[ 79.21 + 64 = 143.21 \]

\[ y = 11.96 \]

**Score 1:** The student found an approximate length of $BD$, and used it to find the length of $AB$. 
31. In right triangle $ABC$ shown below, altitude $BD$ is drawn to hypotenuse $AC$.

If $AD = 8$ and $DC = 10$, determine and state the length of $AB$.

Score 0: The student’s work is completely incorrect.
32 Two prisms with equal altitudes have equal volumes. The base of one prism is a square with a side length of 5 inches. The base of the second prism is a rectangle with a side length of 10 inches. Determine and state, in inches, the measure of the width of the rectangle.

\[ A = bh \]
\[ A = 25 \]
\[ 25 = 10x \]
\[ 2.5 = x \]

**Score 2:** The student has a complete and correct response.
Two prisms with equal altitudes have equal volumes. The base of one prism is a square with a side length of 5 inches. The base of the second prism is a rectangle with a side length of 10 inches. Determine and state, in inches, the measure of the width of the rectangle.

\[ V = lwh \]

\[ V = V \]

\[ 5^2 = 10w \]

\[ 10 = 10w \]

\[ \frac{10}{10} = \frac{w}{w} \]

\[ 1 = w \]

**Score 1:** The student made a conceptual error in squaring 5.
32 Two prisms with equal altitudes have equal volumes. The base of one prism is a square with a side length of 5 inches. The base of the second prism is a rectangle with a side length of 10 inches. Determine and state, in inches, the measure of the width of the rectangle.

Score 0: The student did not write an equation or state an answer.
As shown in the diagram below, $BO$ and tangents $BA$ and $BC$ are drawn from external point $B$ to circle $O$. Radii $OA$ and $OC$ are drawn.

If $OA = 7$ and $DB = 18$, determine and state the length of $AB$.

$$18 \cdot 32 = AB^2$$

$$\sqrt{576} = AB$$

$$24 = AB$$

**Score 2:** The student has a complete and correct response using the theorem of a tangent and secant drawn to a circle. $AB = 24$ is stated.
33 As shown in the diagram below, \( BO \) and tangents \( BA \) and \( BC \) are drawn from external point \( B \) to circle \( O \). Radii \( OA \) and \( OC \) are drawn.

If \( OA = 7 \) and \( DB = 18 \), determine and state the length of \( AB \).

\[
25^2 - 7^2 = 576
\]

\[
\sqrt{576} = 24
\]

\( AB = 24 \)

**Score 2:** The student has a correct response. The student used the Pythagorean Theorem to find \( AB = 24 \).
As shown in the diagram below, $BO$ and tangents $BA$ and $BC$ are drawn from external point $B$ to circle $O$. Radii $OA$ and $OC$ are drawn.

If $OA = 7$ and $DB = 18$, determine and state the length of $AB$.

Score 1: The student made a computational error in calculating $25^2$. 

\[ a^2 + b^2 = 25^2 \]
\[ 4a + 25 = 225 \]
\[ 4a = 200 \]
\[ a = 50 \]
\[ b = \sqrt{126} \]
\[ b \approx 13.3 \]
33 As shown in the diagram below, $BO$ and tangents $BA$ and $BC$ are drawn from external point $B$ to circle $O$. Radii $OA$ and $OC$ are drawn.

If $OA = 7$ and $DB = 18$, determine and state the length of $AB$.

\[
a^2 + b^2 = c^2 \\
7^2 + b^2 = 18^2 \\
49 + b^2 = 324 \\
-49 \\
\sqrt{b^2} = \sqrt{275} \\
\]

\[
b = \sqrt{25 \cdot 11} \\
b = 5\sqrt{11}.
\]

**Score 1:** The student made a conceptual error by using 18 as the length of the hypotenuse.
33 As shown in the diagram below, $BO$ and tangents $BA$ and $BC$ are drawn from external point $B$ to circle $O$. Radii $OA$ and $OC$ are drawn.

If $OA = 7$ and $DB = 18$, determine and state the length of $AB$.

\[ a^2 + b^2 = c^2 \]
\[ 7^2 + 18^2 = c^2 \]
\[ \sqrt{37} \cdot 3 = c^2 \]
\[ 19.3 = c \]

**Score 0:** The student made two conceptual errors.
34 Triangle $RST$ is similar to $\triangle XYZ$ with $RS = 3$ inches and $XY = 2$ inches. If the area of $\triangle RST$ is 27 square inches, determine and state the area of $\triangle XYZ$, in square inches.

Score 2:  The student has a complete and correct response.
34 Triangle $RST$ is similar to $\triangle XYZ$ with $RS = 3$ inches and $XY = 2$ inches. If the area of $\triangle RST$ is 27 square inches, determine and state the area of $\triangle XYZ$, in square inches.

\[
\frac{27}{A} = \frac{3^2}{2^2} \quad \Rightarrow \quad \frac{27}{A} = \frac{9}{4}
\]

\[
9A = 108 \quad \Rightarrow \quad A = 12
\]

**Score 2:** The student has a complete and correct response.
Triangle $RST$ is similar to $\triangle XYZ$ with $RS = 3$ inches and $XY = 2$ inches. If the area of $\triangle RST$ is 27 square inches, determine and state the area of $\triangle XYZ$, in square inches.

\[
\frac{3}{27} = \frac{2}{x}
\]

\[3x = 2(27)\]

\[\frac{3x}{3} = \frac{54}{3}\]

\[x = 18\]

The area of $\triangle XYZ$ is $18\text{in}^2$

**Score 1:** The student made one conceptual error by not squaring the sides in the ratio.
34 Triangle $RST$ is similar to $\triangle XYZ$ with $RS = 3$ inches and $XY = 2$ inches. If the area of $\triangle RST$ is 27 square inches, determine and state the area of $\triangle XYZ$, in square inches.

**Score 1:** The student correctly calculated the height of $\triangle XYZ$, but made an error in calculating the area of the triangle.
34 Triangle $RST$ is similar to $\triangle XYZ$ with $RS = 3$ inches and $XY = 2$ inches. If the area of $\triangle RST$ is 27 square inches, determine and state the area of $\triangle XYZ$, in square inches.

\[
\frac{x^2}{3^2} = \frac{4}{9}
\]

\[
\left(\frac{9}{4}\right) \frac{4}{9} x = 27 \left(\frac{9}{14}\right)
\]

\[
x = 60
\]

**Score 0:** The student made an error by labeling the area of $\triangle XYZ$ as 27. The student made a rounding error in finding $x = 60$. 
35 The graph below shows $\triangle A'B'C'$, the image of $\triangle ABC$ after it was reflected over the $y$-axis.

Graph and label $\triangle ABC$, the pre-image of $\triangle A'B'C'$.

Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected through the origin.

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

Score 4: The student has a complete and correct response.
Question 35

35 The graph below shows ΔA′B′C′, the image of ΔABC after it was reflected over the y-axis.

Graph and label ΔABC, the pre-image of ΔA′B′C′.

Graph and label ΔA"B"C", the image of ΔA′B′C′ after it is reflected through the origin.

State a single transformation that will map ΔABC onto ΔA"B"C".

Score 3: The student graphed and labeled ΔABC and ΔA"B"C" correctly, but stated an incorrect transformation.
Question 35

35 The graph below shows $\triangle A'B'C'$, the image of $\triangle ABC$ after it was reflected over the $y$-axis.

Graph and label $\triangle ABC$, the pre-image of $\triangle A'B'C'$.

Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected through the origin.

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

Score 2: The student graphed and labeled $\triangle ABC$ correctly, but made one conceptual error in graphing $\triangle A''B''C''$. An appropriate transformation was stated.
35 The graph below shows $\triangle A'B'C'$, the image of $\triangle ABC$ after it was reflected over the $y$-axis.

Graph and label $\triangle ABC$, the pre-image of $\triangle A'B'C'$.

Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected through the origin.

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

Score 1: The student graphed and labeled $\triangle ABC$ correctly. No further correct work is shown.
35 The graph below shows $\triangle A'B'C'$, the image of $\triangle ABC$ after it was reflected over the $y$-axis.

Graph and label $\triangle ABC$, the pre-image of $\triangle A'B'C'$.

Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected through the origin.

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

**Score 0:** The student has no correct work.
36 On the set of axes below, sketch the locus of points 2 units from the $x$-axis and sketch the locus of points 6 units from the point $(0,4)$.

Label with an $X$ all points that satisfy both conditions.

**Score 4:** The student has a complete and correct response.
36 On the set of axes below, sketch the locus of points 2 units from the x-axis and sketch the locus of points 6 units from the point (0,4).

Label with an X all points that satisfy both conditions.

Score 3: The student sketched both loci correctly, but labeled only one point of intersection with an X.
36 On the set of axes below, sketch the locus of points 2 units from the $x$-axis and sketch the locus of points 6 units from the point $(0,4)$.

Label with an $X$ all points that satisfy both conditions.

Score 2: The student made a conceptual error by sketching the locus of points 2 units from the $y$-axis. Appropriate points are labeled with an $X$. 
36 On the set of axes below, sketch the locus of points 2 units from the $x$-axis and sketch the locus of points 6 units from the point $(0,4)$.

Label with an $X$ all points that satisfy both conditions.

Score 2: The student made a conceptual error by not graphing $y = -2$. Appropriate points are labeled with an $X$. 
Question 36

36 On the set of axes below, sketch the locus of points 2 units from the $x$-axis and sketch the locus of points 6 units from the point $(0,4)$.

Label with an $X$ all points that satisfy both conditions.

Score 1: The student sketched one locus correctly.
Question 36

36 On the set of axes below, sketch the locus of points 2 units from the x-axis and sketch the locus of points 6 units from the point (0,4).

Label with an X all points that satisfy both conditions.

Score 0: The student did not graph \(y = -2\) and sketched the locus of points 6 units from (4,0) instead of (0,4). Points of intersection are not labeled.
Using a compass and straightedge, construct an equilateral triangle with $AB$ as a side.

Using this triangle, construct a $30^\circ$ angle with its vertex at $A$.
[Leave all construction marks.]

**Score 4:** The student has a complete and correct construction.
37 Using a compass and straightedge, construct an equilateral triangle with $\overline{AB}$ as a side.

Using this triangle, construct a $30^\circ$ angle with its vertex at $A$.
[Leave all construction marks.]

Score 4: The student has a complete and correct construction.
37 Using a compass and straightedge, construct an equilateral triangle with $\overline{AB}$ as a side.

Using this triangle, construct a $30^\circ$ angle with its vertex at $A$.
[Leave all construction marks.]

Score 3 The student has a correct construction of an equilateral triangle, but constructed a $30^\circ$ angle at a vertex other than $A$. 
37 Using a compass and straightedge, construct an equilateral triangle with $AB$ as a side. Using this triangle, construct a $30^\circ$ angle with its vertex at $A$. [Leave all construction marks.]

Score 3: The student showed all appropriate arcs for constructing an equilateral triangle, but did not draw both sides. The student made a correct construction of a $30^\circ$ angle at vertex $A$. 
37 Using a compass and straightedge, construct an equilateral triangle with $AB$ as a side.

Using this triangle, construct a $30^\circ$ angle with its vertex at $A$.

[Leave all construction marks.]

Score 2: The student showed a correct construction of an equilateral triangle. No further correct work is shown.
Question 37

37 Using a compass and straightedge, construct an equilateral triangle with $\overline{AB}$ as a side.

Using this triangle, construct a $30^\circ$ angle with its vertex at $A$.
[Leave all construction marks.]

Score 1: The student showed all appropriate arcs for constructing an equilateral triangle, but did not draw the sides. No further correct work is shown.
37 Using a compass and straightedge, construct an equilateral triangle with $AB$ as a side.

Using this triangle, construct a $30^\circ$ angle with its vertex at $A$.
[Leave all construction marks.]

**Score 1:** The student showed an appropriate construction of an equilateral triangle, but used a length other than $AB$. 
37 Using a compass and straightedge, construct an equilateral triangle with $AB$ as a side.

Using this triangle, construct a $30^\circ$ angle with its vertex at $A$.

[Leave all construction marks.]

Score 0: The student made a drawing that is not an appropriate construction.
38 The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1)$, $K(1,-5)$, $L(7,-2)$, and $M(3,4)$.

Prove that $JKLM$ is a parallelogram.

Prove that $JKLM$ is not a rhombus.

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

\[ m_{JM} = \frac{4-1}{3+3} = \frac{3}{6} = \frac{1}{2} \]
\[ m_{KL} = \frac{-2-5}{7-1} = \frac{-7}{6} = \frac{1}{-2} \]
\[ \overrightarrow{JM} \parallel \overrightarrow{KL} \text{ are } \parallel \]

\[ m_{JK} = \frac{-5-1}{1+3} = \frac{-6}{4} = \frac{3}{2} \]
\[ m_{ML} = \frac{4+2}{3-7} = \frac{6}{-4} = \frac{-3}{2} \]
\[ \overrightarrow{JK} \parallel \overrightarrow{ML} \text{ are } \parallel \]

\[ \text{J}KLM \text{ is a } \square \]
\[ \text{b/c the } 2 \text{ pairs of opposite sides are } \parallel \text{ and equal.} \]

**Score 6:** The student has a complete and correct response.
38 The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1)$, $K(1,-5)$, $L(7,-2)$, and $M(3,4)$.

Prove that $JKLM$ is a parallelogram.

Prove that $JKLM$ is not a rhombus.

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

---

Score 5: The student did not write the radical symbol when finding the length of $KL$. 

---

Geometry – June ’14
38 The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1)$, $K(1,-5)$, $L(7,-2)$, and $M(3,4)$.

Prove that $JKLM$ is a parallelogram.

Prove that $JKLM$ is not a rhombus.

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

\[ JM = \frac{1-4}{-3-3} = \frac{-3}{-6} = \frac{3}{6} \]
\[ KL = \frac{-5+2}{1-7} = \frac{-3}{-6} = \frac{3}{6} \]
\[ ML = \frac{4+2}{7-7} = \frac{6}{0} = \text{undefined} \]
\[ JK = \frac{-5-1}{-3-1} = \frac{-6}{-4} = \frac{3}{2} \]

$JKLM$ is a parallelogram.

A parallelogram contains 2 sets of parallel sides.

Parallel sides are created when 2 segments share the same slope.

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
\[ KM = \frac{-5}{1-3} = \frac{-9}{-2} \]
\[ JL = \frac{4+2}{3-7} = \frac{3}{-10} \]

The diagonals in a rhombus form a right angle. Since the slopes of the diagonals are not negative reciprocals, it is not a rhombus because the diagonals are not perpendicular and do not form a right angle.

Score 4: The student made a computational error in finding the slope of $ML$. The student made a second error in finding the slope of $JK$. 

Geometry – June ’14
The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1)$, $K(1,-5)$, $L(7,-2)$, and $M(3,4)$.

Prove that $JKLM$ is a parallelogram.

Prove that $JKLM$ is not a rhombus.

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

Score 3: The student showed work to prove $JKLM$ is not a rhombus.
38 The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1)$, $K(1,-5)$, $L(7,-2)$, and $M(3,4)$.

Prove that $JKLM$ is a parallelogram.

Prove that $JKLM$ is not a rhombus.

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

Score 2: The student did work to show that one pair of sides is congruent and parallel.
38 The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1)$, $K(1,-5)$, $L(7,-2)$, and $M(3,4)$.

Prove that $JKLM$ is a parallelogram.

Prove that $JKLM$ is not a rhombus.

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

Score 1: The student found the slopes of all four sides. The concluding statement is not complete.
38 The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1), K(1,-5), L(7,-2)$, and $M(3,4)$.

Prove that $JKLM$ is a parallelogram.

Prove that $JKLM$ is not a rhombus.

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

Score 1: The student found the slopes of both diagonals.
The vertices of quadrilateral $JKLM$ have coordinates $J(-3,1)$, $K(1,-5)$, $L(7,-2)$, and $M(3,4)$.

Prove that $JKLM$ is a parallelogram.

Prove that $JKLM$ is not a rhombus.

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

Score 0: The student has no relevant work.