1. TEACHER READS:
Read and complete the task that follows.

On a standardized exam for high school seniors in 2013, the mean scale score for the mathematics portion of the exam was 514 and the standard deviation was 118. If the scores for this exam are approximately normally distributed, what percent of students taking the exam received a scale score between 396 and 632? Express your answer as a whole percent.

A. 48%   B. 68%   C. 95%   D. 99%

2. TEACHER READS:
Read the question to yourself and select the best answer.

A population characteristic is normally distributed. Approximately what percentage of the population lies within two standard deviations of the mean?

A. 48%   B. 68%   C. 95%   D. 99%
TEACHER READS:
Read and complete the task that follows.

A construction company is hiring a person to frame new houses. During the interview the manager requires you to fill out the form below to make sure that you have the geometry knowledge to become a member of the team. The manager would like you to provide a definition for the given word and include a drawing to illustrate that word.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Circle</th>
<th>Line Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parallel Lines</th>
<th>Perpendicular Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The student showed a complete understanding of the definitions of common geometric terms. The student provided a correct illustration to all of the words.

### Angle
- Formed by two rays with the same vertex.

![Angle Diagram]

### Circle
- The set of all points in a plane that are a given distance, radius, from a given point, the center.

![Circle Diagram]

### Line Segment
- Part of a line consisting of two points, endpoints, and all points between them.

![Line Segment Diagram]

### Parallel Lines
- Two lines that lie in the same plane and do not intersect.

![Parallel Lines Diagram]

### Perpendicular Lines
- Two lines that intersect and form a right angle.

![Perpendicular Lines Diagram]

The student showed a good understanding of the definitions to common geometric terms and was able to illustrate the word. The student made some errors in the definitions or illustrations in at least two of the terms.

The student showed partial understanding of the definitions of geometric terms. The student correctly provided illustrations to all of the terms, however, the student did not provide any definitions.

The student did not understand the definitions to common terms. The student did not correctly understand any portion of the item.

Standards:
- G-CO.1
The diagram below shows two triangles.

\[
\begin{array}{c}
\triangle ABC \quad \triangle DEF
\end{array}
\]

Based on the diagram, which statements are true? Select three that apply.

A. The two triangles are congruent since all isosceles right triangles are congruent.
B. The two triangles are congruent since the corresponding sides and angles are congruent.
C. The two triangles are congruent since a rotation can carry one triangle onto the other triangle.
D. The two triangles are congruent since a reflection can carry one triangle onto the other triangle.

Master ID: 551594 Revision: 1
Correct: BCD
Rationale:
A. Student(s) may have confused the concept of isosceles right triangles with that of SAS.
B. Correct answer
C. Correct answer
D. Correct answer
Standards: G-CO.7
In the figure below, \( \angle HFG \cong \angle HKJ \) and \( HF \cong HK \).

Select the triangle congruence criterion that can be used to prove that \( \triangle HFG \cong \triangle HKJ \).

A. angle–angle–side (AAS)  
B. angle–side–angle (ASA)  
C. side–angle–side (SAS)  
D. side–side–angle (SSA)

Master ID: 2034613 Revision: 1
Correct: B
Rationale:
A. Student(s) may have realized that \( \angle FHG \cong \angle KHJ \), resulted in two pairs of congruent angles and one pair of congruent sides but may not have been able to distinguish between AAS and ASA.
B. Correct answer
C. Student(s) may have thought that \( FG \cong KJ \).
D. Student(s) may have thought that \( HG \cong HJ \) and may not have realized that SSA is not a triangle congruence criterion.

Standards: G-CO.8
Emma knows that $\angle R \cong \angle X$ and $\angle T \cong \angle Z$. She claims that triangles $RST$ and $XYZ$ are congruent. As part of her reasoning, which criterion could she use? Select two that apply.

A. Angle–Angle (AA)  
B. Hypotenuse–Leg (HL)  
C. Side–Angle–Side (SAS)  
D. Angle–Side–Angle (ASA)

Master ID: 551276  
Revision: 1  
Correct: CD  
Rationale: 
A. Student(s) may not have realized that AA is a similarity criterion, not a congruence criterion.  
B. Student(s) may not have realized that HL requires a right triangle.  
C. Correct answer  
D. Correct answer  
Standards: G-CO.8
Read the question to yourself and select the best answer.

The diagram below shows a transversal line crossing through \( \overline{AB} \) and \( \overline{CD} \). \( \overline{AB} \) is parallel to \( \overline{CD} \).

Given the information above, a student makes the claim \( \angle 1 \cong \angle 5 \). Her work to prove this claim is shown in the table below.

<table>
<thead>
<tr>
<th>Step</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>It is given that ( \overline{AB} \parallel \overline{CD} ).</td>
</tr>
<tr>
<td>2</td>
<td>( \angle 1 \cong \angle 3 ) therefore ( m\angle 1 = m\angle 3 )</td>
</tr>
<tr>
<td>3</td>
<td>( \angle 3 \cong \angle 5 ) therefore ( m\angle 3 = m\angle 5 )</td>
</tr>
<tr>
<td>4</td>
<td>If ( m\angle 1 = m\angle 3 ) and ( m\angle 3 = m\angle 5 ), then ( m\angle 1 = m\angle 5 )</td>
</tr>
<tr>
<td>5</td>
<td>Therefore ( \angle 1 \cong \angle 5 )</td>
</tr>
</tbody>
</table>

Which reason best supports the statement she made in step 3 of her work?

A. Vertical angles are congruent.  
B. Supplementary angles are congruent.  
C. Corresponding angles formed by two parallel lines are congruent.  
D. Alternate interior angles formed by two parallel lines are congruent.

Master ID: 463218  
Revision: 1  
Correct: D  
Rationale:  
A. Student(s) may have thought \( \angle 3 \) and \( \angle 5 \) are vertical angles.  
B. Student(s) may have thought \( \angle 3 \) and \( \angle 5 \) are supplementary angles and that supplementary angles are congruent.  
C. Student(s) may have thought \( \angle 3 \) and \( \angle 5 \) are corresponding angles.  
D. Correct answer  
Standards: G-CO.9
Given $P \parallel Q$ and $T$ is a transversal, which of the following justifies $\angle 3 \cong \angle 6$?

A. Corresponding Angles Postulate  
B. Alternate Interior Angles Theorem  
C. Consecutive Interior Angles Theorem  
D. Alternate Exterior Angles Theorem

Rationale:
A. Student(s) may not have understood the properties of parallel lines, thus confusing corresponding angles with alternate interior angles.
B. Correct answer
C. Student(s) may not have understood the properties of parallel lines, thus confusing consecutive interior angles with alternate interior angles.
D. Student(s) may not have understood the properties of parallel lines, thus confusing alternate exterior angles with alternate interior angles.

Standards:
G-CO.9
In the figure below, line $a \parallel$ line $b$.

If $m\angle 2 = 78^\circ$, which of the following angles also measure $78^\circ$? Select three that apply.

A. $\angle 3$  
B. $\angle 4$  
C. $\angle 5$  
D. $\angle 6$  
E. $\angle 7$  
F. $\angle 8$

Master ID: 550633  
Revision: 1  
Correct: BDF

Rationale:

A. Student(s) may have incorrectly thought that angles forming a linear pair are congruent instead of supplementary.
B. Correct answer
C. Student(s) may have correctly determined that $m\angle 4 = 78^\circ$, but then incorrectly thought that $\angle 4$ and $\angle 5$ are congruent instead of supplementary.
D. Correct answer
E. Student(s) may have incorrectly thought that same-side exterior angles are congruent instead of supplementary.
F. Correct answer

Standards:

G-CO.9
Given: $ABCD$ is a parallelogram

Prove: $\triangle ABC \cong \triangle CDA$

Based on the information shown above, Brandon started to write the proof below.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) $ABCD$ is a parallelogram</td>
<td>1) Given</td>
</tr>
<tr>
<td>2)</td>
<td>2) Opposite sides of a parallelogram are congruent.</td>
</tr>
<tr>
<td>3)</td>
<td>3) When a transversal crosses parallel lines, alternate interior angles are congruent.</td>
</tr>
<tr>
<td>4)</td>
<td>4) Reflexive Property</td>
</tr>
<tr>
<td>5) $\triangle ABC \cong \triangle CDA$</td>
<td>5) SAS Postulate</td>
</tr>
</tbody>
</table>

In order to show that $\triangle ABC \cong \triangle CDA$ according to the reasons provided, which three statements listed below will Brandon need to use to complete his proof?

A. $\angle BCD \cong \angle DAB$
B. $BC \cong AD$
C. $\angle BAC \cong \angle DCA$
D. $AB \cong CD$
E. $\angle ABC \cong \angle CDA$
F. $\overline{AC} \cong \overline{AC}$
Directions: Answer the following question(s).

Master ID:                     184163 Revision:                     1
Correct:                     CDF
Rationale:
A. Student(s) may have incorrectly thought that these angles were written as \( \angle BCA \cong \angle DAC \), which would make them alternate interior angles.
B. Student(s) may have incorrectly thought that they needed to select any pair of opposite sides in the parallelogram instead of determining which pair of opposite sides was needed to complete the proof using the SAS postulate.
C. Correct answer
D. Correct answer
E. Student(s) may have incorrectly thought that the first letter of the angle name represents the vertex. Student(s) may have then incorrectly thought that these angles were alternate interior angles instead of opposite angles in the parallelogram.
F. Correct answer
Standards:
G-CO.9

TEACHER READS:
Read the question to yourself and select the best answer(s).

In which of the following triangles does \( m\angle A=62^\circ \)? Select three that apply.

A. \( \triangle ABC \)
B. \( \triangle BCD \)
C. \( \triangle ACD \)
D. \( \triangle ADC \)

Master ID:                     550783 Revision:                     1
Correct:                     ABD
Rationale:
A. Correct answer
B. Correct answer
C. Student(s) may have incorrectly thought that since \( \angle A \) and the 62° angle are corresponding angles that they must be congruent.
D. Correct answer
Standards:
G-CO.10
TEACHER READS:
Read the question to yourself and select the best answer.

![Diagram](image)

**Given:**
- Line segment $WZ$ bisects line segment $XY$
- Line segment $XY$ bisects line segment $WZ$

**To prove:**
- Triangles $WAX$ and $ZAY$ are congruent

<table>
<thead>
<tr>
<th>Statements:</th>
<th>Reasons:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Segment $WZ$ bisects $XY$</td>
<td>1. given</td>
</tr>
<tr>
<td>2. Segments $XA$ and $AY$ are congruent</td>
<td>2. When a segment is bisected the resulting segments are congruent</td>
</tr>
<tr>
<td>3. Segment $XY$ bisects $WZ$</td>
<td>3. given</td>
</tr>
<tr>
<td>4. ___________________________</td>
<td>4. When a segment is bisected the resulting segments are congruent</td>
</tr>
<tr>
<td>5. Angles $WAX$ and $YAZ$ are congruent</td>
<td>5. Vertical angles of intersecting lines are equal</td>
</tr>
<tr>
<td>6. Triangles $WAX$ and $ZYA$ are congruent</td>
<td>6. Triangles with two sides and an included angle equal are congruent</td>
</tr>
</tbody>
</table>

**What should be in statement 4 to complete the proof?**

A. Statement 4 is not needed the proof works without it.
B. Segments $WA$ and $AZ$ are congruent.
C. Segments $WX$ and $YZ$ are congruent.
D. Angles $WXA$ and $ZYA$ are congruent.
TEACHER READS:

Read the question to yourself and select the best answer.

Which of the following belongs in the blank in the geometric proof shown below?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>∆ABC is a right triangle with ∠C as the right angle.</td>
<td>Given</td>
</tr>
<tr>
<td>m∠C = 90°</td>
<td>Definition of right angle</td>
</tr>
<tr>
<td>_________</td>
<td>Triangle Sum Theorem</td>
</tr>
<tr>
<td>m∠A + m∠B = 90°</td>
<td>Subtracting Property of Equality</td>
</tr>
<tr>
<td>∠A and ∠B are complementary angles.</td>
<td>Definition of complementary</td>
</tr>
</tbody>
</table>

A. ∠B = 45° B. 0° < m∠A ≤ 90° C. 90° < m∠A + m∠C < 180° D. m∠A + m∠B + m∠C = 180°
TEACHER READS:
Read the question to yourself and select the best answer(s).

Examine the figure below.

Determine which of the following angle measures are correct. Select two that apply.

A. \( \angle ABC = 68^\circ \)  
B. \( \angle BAC = 72^\circ \)  
C. \( \angle BCD = 108^\circ \)  
D. \( \angle ACB = 112^\circ \)

Master ID: 550948 Revision: 1
Correct: BC
Rationale:
A. Student(s) may have incorrectly solved for \( x \) as \( x = 21 \) by setting up the equation as \( 5x + 7 + 4x - 16 = 180 \) instead of \( 5x + 7 + 5x + 7 + 4x - 16 = 180 \).
B. Correct answer
C. Correct answer
D. Student(s) may have incorrectly solved for \( x \) as \( x = 21 \) by setting up the equation as \( 5x + 7 + 4x - 16 = 180 \) instead of \( 5x + 7 + 5x + 7 + 4x - 16 = 180 \).

Standards:
G-CO.10
Patricia writes a proof to show that opposite angles of a parallelogram are congruent.

Given: \( LMNO \) is a parallelogram
Prove: \( \angle LON \cong \angle NML \) and \( \angle OLM \cong \angle MNO \)

<table>
<thead>
<tr>
<th>STATEMENTS</th>
<th>REASONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( LMNO ) is a parallelogram</td>
<td>Given</td>
</tr>
<tr>
<td>2. ( LM \cong ON )</td>
<td>Definition of a parallelogram</td>
</tr>
<tr>
<td>3. ( \angle LOM \cong \angle NMO ) ( \angle LNO \cong \angle LNM )</td>
<td>Alternate Interior Angles Theorem</td>
</tr>
<tr>
<td>4. ( LN \cong LN ) ( MO \cong MO )</td>
<td>Reflexive Property</td>
</tr>
<tr>
<td>5. ( \Delta LNO \cong \Delta NLM )</td>
<td>Angle – Side – Angle Congruence Postulate</td>
</tr>
<tr>
<td>6. ( \angle LON \cong \angle LML ) ( \angle OLM \cong \angle MNO )</td>
<td>Corresponding parts of a congruent triangle are congruent.</td>
</tr>
</tbody>
</table>

Part A:
In statement 3, two other sets of angles must be proved congruent to each other to complete the proof. What are these other two sets of angles?

Part B:
In statement 5, two other triangles must be proved congruent to each other to complete the proof. What are these two triangles?
The student shows thorough understanding of proving that opposite angles of a parallelogram are congruent. The student found the correct answer in Part A and Part B.

Part A:
\[ \angle MLN \cong \angle ONL \]
\[ \angle MON \cong \angle OML \]

Part B:
\[ \triangle LMO \cong \triangle NOM \]

The student shows partial understanding of proving that opposite angles of a parallelogram are congruent. The student found the correct answer in either Part A or Part B.

The student shows limited or no understanding of proving that opposite angles of a parallelogram are congruent. The student was unable to find the correct answer in Part A or Part B.

Standards:
G-CO.11
TEACHER READS:
Read the question to yourself and select the best answer(s).

A parallelogram is shown below.

Which angles and sides must be congruent to each other? Select three that apply.

A. \( MN \cong NP \)   
B. \( MN \cong OP \)   
C. \( MO \cong NP \)   
D. \( \angle M \cong \angle O \)   
E. \( \angle N \cong \angle P \)   
F. \( \angle M \cong \angle P \)

Master ID: 551607 Revision: 1
Correct: BCF
Rationale:
A. Student(s) may have thought that the parallelogram is a square and determined that all of the sides are congruent to each other.
B. Correct answer
C. Correct answer
D. Student(s) may have thought that the parallelogram is a square and determined that all of the angles are congruent to each other.
E. Student(s) may have thought that the parallelogram is a square and determined that all of the angles are congruent to each other.
F. Correct answer
Standards: G-CO.11
Read the question to yourself and select the best answer(s).

Examine parallelogram $ABCD$ below.

In order to determine the length of each side of the parallelogram, which of the following equations would need to be used? Select two that apply.

A. $5x + 12 + 8x - 6 = \frac{180}{2}$  
B. $9y - 2 + 7y + 4 = 180$  
C. $5x + 12 = 8x - 6$  
D. $9y - 2 = 7y + 4$

**Rationale:**
- A. Student(s) may have confused the equation for congruent sides with the equation for supplementary angles.
- B. Student(s) may have confused the equation for congruent sides with the equation for supplementary angles.
- C. Correct answer
- D. Correct answer

**Standards:**
- G-CO.11
TEACHER READS:

Read the question to yourself and select the best answer(s).

Examine parallelogram \( RSTU \) below.

Determine which of the following values are correct. Select three that apply.

A. \( x = 15 \)  
B. \( y = 23 \)  
C. \( m\angle R = 27^\circ \)  
D. \( m\angle S = 135^\circ \)  
E. \( m\angle T = 45^\circ \)  
F. \( m\angle U = 99^\circ \)

Master ID: 550953  Revision: 1  
Correct: BDE  
Rationale:  
A. Student(s) may have incorrectly thought that \( \angle S \) and \( \angle U \) were supplementary instead of congruent.  
B. Correct answer  
C. Student(s) may have incorrectly solved for \( x \) as \( x = 15 \), which resulted in \( 3y - 15 = 2y - 1 \) instead of \( 3y - 24 = 2y - 1 \).  
D. Correct answer  
E. Correct answer  
F. Student(s) may have incorrectly thought that \( \angle S \) and \( \angle U \) were supplementary instead of congruent, which resulted in solving for \( x \) as \( x = 15 \) instead of \( x = 24 \).  

Standards: G-CO.11
What must be the length of $PQ$ in order for $\triangle JKL$ to be similar to $\triangle PQR$?

A. 8  
B. 15  
C. 18  
D. 19

Master ID: 179568  Revision: 1  
Correct: C  
Rationale:
A. Student(s) may have incorrectly set up the proportion as $6/9 = PQ/12$ instead of $9/6 = PQ/12$.  
B. Student(s) may have incorrectly thought that the corresponding sides of similar triangles have a common difference instead of a common ratio. Student(s) may have then thought that the common difference was $9 - 6 = 3$, which means that $15 - 12 = 3$.  
C. Correct answer  
D. Student(s) may have incorrectly thought that the corresponding sides of similar triangles have a common difference instead of a common ratio. Student(s) may have then thought that the common difference was $21 - 14 = 7$, which means that $19 - 12 = 7$.  

Standards:  
G-SRT.2
Based on the triangles shown below, Theodore claims that $\triangle TUV$ is transformed to $\triangle WXY$ with a scale factor of $\frac{3}{2}$. Is Theodore correct?

A. Yes, the triangles are similar with a scale factor of $\frac{3}{2}$.
B. No, the triangles are similar with a scale factor of $\frac{2}{3}$.
C. No, the triangles are similar with a scale factor of $\frac{2}{3}$.
D. No, the triangles are similar with a scale factor of $\frac{4}{3}$.

Master ID: 2576427 Revision: 1
Correct: C
Rationale:
A. Student(s) may have incorrectly compared the sides 12/8 and 18/12 within each triangle instead of comparing the corresponding pairs of sides of the triangles.
B. Student(s) may have incorrectly compared the sides 24/12 and 16/8 within each triangle instead of comparing the corresponding pairs of sides of the triangles.
C. Correct answer
D. Student(s) may have incorrectly compared the sides 24/18 and 16/12 within each triangle instead of comparing the corresponding pairs of sides of the triangles.

Standards:
G-SRT.2
A lamppost is 6 feet high and casts an 8 foot shadow. At the same time of day, a flagpole near the lamppost casts a 20 foot shadow. Using the properties of similar triangles, find the height, \( H \), of the flagpole.

\[
\frac{H}{6} = \frac{20}{8}
\]

A. 2.4 ft  
B. 15 ft  
C. 20 ft  
D. 26.67 ft

**Rationale:**
A. Student(s) likely used either \( H/6 = 8/20 \) or \( H/8 = 6/20 \), both incorrect ratios.
B. Correct answer
C. Student(s) may have guessed, assuming that the height was the same as the length of the shadow. Student likely did not understand how to proceed with the question.
D. Student(s) likely used \( 20/H = 6/8 \), an incorrect ratio for this problem.

**Standards:**
G-SRT.5
23 TEACHER READS:
Read the question to yourself and select the best answer.

**Determine the ratio needed to calculate the tangent trigonometric function.**

A. \( \frac{\text{opposite leg}}{\text{adjacent leg}} \)
B. \( \frac{\text{opposite leg}}{\text{hypotenuse}} \)
C. \( \frac{\text{adjacent leg}}{\text{opposite leg}} \)
D. \( \frac{\text{adjacent leg}}{\text{hypotenuse}} \)

Master ID: 182531 Revision: 1
Correct: A
Rationale:
A. Correct answer
B. Student(s) may have confused the ratios for tangent and sine.
C. Student(s) may have confused the order for the ratio of the sides.
D. Student(s) may have confused the ratios for tangent and cosine.

Standards:
G-SRT.6

24 TEACHER READS:
Read the question to yourself and select the best answer.

**In \( \triangle RST \), which trigonometric function is represented by the ratio \( \frac{ST}{RS} \)?**

A. \( \cos(R) \)
B. \( \csc(S) \)
C. \( \sin(R) \)
D. \( \tan(S) \)

Master ID: 182529 Revision: 1
Correct: C
Rationale:
A. Student(s) may have incorrectly thought that cosine is the ratio of the opposite leg to the hypotenuse instead of the adjacent leg to the hypotenuse.
B. Student(s) may have confused the terms cosine and cosecant.
C. Correct answer
D. Student(s) may have incorrectly thought that tangent is the ratio of the adjacent leg to the hypotenuse instead of the opposite leg to the adjacent leg.

Standards:
G-SRT.6
TEACHER READS:
Read and complete the task that follows.

Consider this right triangle.

![Right Triangle Diagram]

Enter the ratio equivalent to \( \tan(R) \).

A. Input #1 Answers  
B. \( \frac{35}{12} \)

Master ID: 462692  
Revision: 1  
Correct:  
Standards:  
G-SRT.6
TEACHER READS:

Read and complete the task that follows.

The front door of a new school is located 4 ft above the ground and the school has decided to build a ramp up to the door. The school is not sure how long the ramp needs to be, but they would like the ramp to form an angle of 7° between the ground and the ramp.

Part A:
If \( d \) is the distance of the ramp, draw a picture to represent the situation. Assume that the school is at a right angle to the ground.

Part B:
Write an equation that will be used to find the distance of the ramp.

Part C:
Solve for \( d \). Round your answer to the nearest tenth.
The student has a solid understanding of how to make productive use of knowledge and problem–solving strategies to solve a problem arising in everyday life. The student draws a picture and writes an equation to model a real–life situation and uses the equation to find an answer to a question within a context. The student correctly draws a picture to represent the situation in part A, uses the drawing from part A to write a correct equation in part B, and then correctly solves the equation in part C.

**Part A:**

![Diagram of a 4 ft line and a 7° angle]

**Part B:**

\[
\sin 7^\circ = \frac{4}{d}
\]

**Part C:**

\[
d \cdot \sin 7^\circ = 4
\]

\[
d = \frac{4}{\sin 7^\circ}
\]

\[
d = 32.8 \text{ ft}
\]
TEACHER READS:

Read the question to yourself and select the best answer.

Jared is constructing a rectangular door for a shed. If the door, shown below, has a width of 42 in. and a diagonal support of 94 in., what is the approximate height of the door?

A. 52 in.  
B. 84 in.  
C. 103 in.  
D. 136 in.

Master ID: 182660 Revision: 1  
Correct: B  
Rationale:
A. Student(s) may have incorrectly subtracted 94 in. and 42 in. instead of setting up the Pythagorean Theorem as $42^2 + h^2 = 94^2$ to calculate the door height.  
B. Correct answer  
C. Student(s) may have incorrectly set up the Pythagorean Theorem as $42^2 + 94^2 = h^2$ instead of $42^2 + h^2 = 94^2$.  
D. Student(s) may have incorrectly added 94 in. and 42 in. instead of setting up the Pythagorean Theorem as $42^2 + h^2 = 94^2$ to calculate the door height.  
Standards: G-SRT.8
Read and complete the task that follows.

On the diagram below, a boat, represented by point $A$, is 450 feet away from a buoy, represented by point $B$. Another buoy is located at point $C$. The three points form a right triangle with the measure of $\angle A$ equal to 21.3°.

Enter the distance between the two buoys, rounded to the nearest foot.

[Diagram showing a right triangle with $A$ at the bottom left, $B$ at the bottom right, and $C$ at the top right, with $\angle A = 21.3°$ and $AB = 450$ ft.]

A. Input #1 Answers  
B. 175
Find the value of x that will ensure that segment CD and segment CB are tangent to circle A.

A. 4.3  
B. 58.3  
C. 5  
D. 13

Master ID: 2197236 Revision: 1
Correct: D
Rationale:
A. Algebra mistake made
B. The segments don't add to 180 degrees
C. Algebra mistake made
D. Correct answer
Standards: G-C.2
If $m\overset{\frown}{AB} = 30^\circ$ and $m\overset{\frown}{CD} = 110^\circ$, find $m\angle E$.

A. 15°  B. 30°  C. 40°  D. 70°
TEACHER READS:
Read and complete the task that follows.

In the circle $M$ shown below, $\overline{MV}$ is a radius and $\overline{VT}$ is a tangent to the circle.

Determine the values of $\angle MVT$ (in degrees), $\overline{MS}$, and $\overline{ST}$, then complete the table below.

<table>
<thead>
<tr>
<th>Angle or Side</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\angle MVT$</td>
<td>°</td>
</tr>
<tr>
<td>$\overline{MS}$</td>
<td></td>
</tr>
<tr>
<td>$\overline{ST}$</td>
<td></td>
</tr>
</tbody>
</table>

A. Input #1 Answers  B. 90  C. Input #2 Answers  D. 9
E. Input #3 Answers  F. 6

Master ID: 3098162 Revision: 1
Correct:
Standards: G-C.2
TEACHER READS:

Read the question to yourself and select the best answer.

If arc $WX = 40^\circ$ and arc $YZ = 92^\circ$, find $m\angle 3$.

![Diagram showing a circle with points W, X, Y, and Z, and an angle labeled $\angle 3$.]

A. $21^\circ$  B. $46^\circ$  C. $66^\circ$  D. $92^\circ$

Master ID: 13240 Revision: 1
Correct: C
Rationale:
A. Student(s) may have subtracted the arcs and then took half the difference.
B. Student(s) may have calculated 1/2 of arc $YZ$.
C. Correct answer
D. Student(s) may have thought the angle should be the same measurement as the arc $YZ$.
Standards:
G-C.2
Quadrilateral $ABCD$ is inscribed in a circle. The measure of $\angle A$ is $68^\circ$ and the measure of $\angle D$ is $99^\circ$.

Complete the table below with measures of $\angle B$ and $\angle C$.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\angle B$</td>
<td>$_81_^\circ$</td>
</tr>
<tr>
<td>$\angle C$</td>
<td>$_112_^\circ$</td>
</tr>
</tbody>
</table>

A. Input #1 Answers  B. $81$  C. Input #2 Answers  D. $112$
A circle is drawn on the coordinate plane below.

Write the equation of this circle.
TEACHER READS:
Read the question to yourself and select the best answer.

A diameter of a circle has endpoints of (–5 , 6) and (–5 , –2). What is the equation of this circle?

A. \((x + 5)^2 + (y - 2)^2 = \frac{16}{16}\)  
B. \((x - 5)^2 + (y + 2)^2 = 4\)  
C. \((x + 5)^2 + (y - 2)^2 = 4\)  
D. \((x + 5)^2 + (y - 2)^2 = \frac{64}{64}\)

Master ID: 8571 Revision: 1
Correct: A
Rationale:
A. Correct answer
B. Student(s) may have confused the signs and may have forgotten to square the radius.
C. Student(s) may not have remembered to square the radius.
D. Student(s) may have confused cubing and squaring.
Standards:
G-GPE.1

TEACHER READS:
Read the question to yourself and select the best answer(s).

A circle drawn on a coordinate plane has the equation \(x^2 + y^2 + 8x - 8y + 24 = 0\). Select each true statement regarding this circle.

A. The circle has a radius of 4 units.
B. The circle has a radius of \(2\sqrt{2}\) units.
C. The center of the circle is located at the point (4, –4).
D. The center of the circle is located at the point (–4, 4).
E. The equation of the circle can be written as \((x + 4)^2 + (y - 4)^2 = 8\).

Master ID: 541550 Revision: 1
Correct: BDE
Rationale:
A. Student(s) may have taken half of 8 rather than the square root of 8.
B. Correct answer
C. Student(s) may have thought that a circle \((x + h)^2 + (y + k)^2 = r^2\) has center \((h, k)\).
D. Correct answer
E. Correct answer
Standards:
G-GPE.1
37 TEACHER READS:
Read and complete the task that follows.

A bird feeder has a diameter of 3 inches and is composed of a cylinder and a cone. A diagram of the bird feeder is shown below.

![Diagram of a bird feeder with a cylinder and a cone, labeled with dimensions: 2 in. on the diameter of the cylinder and 6 in. for the height of the cylinder and cone combined.]

What is the volume of this bird feeder, to the nearest tenth of a cubic inch?

\[ \text{cubic inches} \]

A.  Input #1 Answers  B. \( \ast \) 47.1

Master ID: 541545 Revision: 1
Correct:
Standards:
G-GMD.3

38 TEACHER READS:
Read the question to yourself and select the best answer.

A cylinder has a height of 5 and a radius of 2.3. Calculate its volume.

A. 3.32  B. 16.62  C. 83.10  D. 180.64

Master ID: 18497 Revision: 1
Correct: C
Rationale:
A. Student(s) may have calculated the area of the base and divided rather than multiplied by the height.
B. Student(s) may have calculated the area of the base and failed to multiply by the height.
C. Correct answer
D. Student(s) may have interchanged the height and radius when calculating the volume.
Standards:
G-GMD.3
TEACHER READS:
Read the question to yourself and select the best answer.

Find the volume of a sphere with a diameter of 22m. Round to the nearest tenth. Use 3.14 for $\pi$.

![Diagram of a sphere with diameter 22m]

A. $44,579.6 \text{ m}^3$  
B. $5572.5 \text{ m}^3$  
C. $1393.1 \text{ m}^3$  
D. $506.6 \text{ m}^3$

Master ID: 84140 Revision: 1
Correct: B
Rationale:
A. Student(s) likely used a radius of 22.
B. Correct answer
C. Student(s) likely did not multiply by 4/3, but only divided by 3.
D. Student(s) may have confused the units and squared rather than cubing.

Standards:
G-GMD.3
Which graph represents the equation $y = 2x + 4$? Note: The scale for both axes on all of the graphs is 1.

A.

B.

C.

D.
Directions: Answer the following question(s).

Master ID: 346016 Revision: 1
Correct: A
Rationale:
A. Correct answer
B. Student(s) may have believed that the x–intercept, not the y–intercept, was at 4.
C. Student(s) may have graphed the equation \( y = -2x + 4 \), rather than \( y = 2x + 4 \).
D. Student(s) may have graphed a line with a slope of \( \frac{1}{2} \), rather than 2.
Standards:
F-IF.7.a

41  TEACHER READS:

Read the question to yourself and select the best answer.

What is the x-intercept of the graph shown below?

![Graph Image]

A. \((0, -6)\)  B. \((-6, 0)\)  C. \((0, 3)\)  D. \((3, 0)\)

Master ID: 9967 Revision: 1
Correct: D
Rationale:
A. Student(s) may not have understood how to correctly differentiate between the y–intercept and the x–intercept and found the wrong one.
B. Student(s) may have found the y–intercept rather than the x–intercept and switched the order of the coordinates.
C. Student(s) may have understood how to find the x–intercept, but switched the order of the coordinates.
D. Correct answer
Standards:
F-IF.7.a
Which best represents the graph of $y = -\frac{1}{2}x^2 + 4$?

A. 

![Graph A]

B. 

![Graph B]

C. 

![Graph C]

D. 

![Graph D]
Master ID: 43246 Revision: 1
Correct: B

Rationale:
A. Student(s) may have calculated the coordinates of the vertex incorrectly by simplifying the expression \(-4/2(-.5) = 4\) when finding the \(x\)-coordinate, leading to a \(y\)-coordinate of \(-4\).
B. Correct answer
C. Student(s) may not have known how to graph a quadratic function and used the numbers given by the \(a\) and \(c\) values as the coordinates of the vertex.
D. Student(s) may have incorrectly assumed that the constant term, 4, represents the \(x\)-intercept of the parabola.

Standards:
F-IF.7.a
TEACHER READS:

Read the question to yourself and select the best answer.

Look at the function that is graphed below.

What is the minimum value of this function?

A. –4  
B. –2  
C. –1  
D. 0

Master ID: 33778  Revision: 1
Correct: C
Rationale:
A. Student(s) may have chosen this option because it is the least of the four choices or because appears to be the left most value of the graph.
B. Student(s) may have chosen this option because it is the lesser of the two x–intercepts.
C. Correct answer
D. Student(s) may have assumed that 0 must be the least value, not recognizing that the graph goes below the x axis.

Standards:
F-IF.7.a
**TEACHER READS:**

Read the question to yourself and select the best answer.

*What are the x–intercepts of the graph of \( y = 6x^2 + 7x - 5 \)?*

A. \( \frac{1}{2} \) and \( -\frac{5}{3} \)  
B. \( -\frac{1}{2} \) and \( \frac{5}{3} \)  
C. \( \frac{1}{6} \) and \(-5\)  
D. \( -\frac{1}{6} \) and \( 5 \)

Master ID: 36984 Revision: 1  
Correct: A  
Rationale:  
A. Correct answer  
B. Student(s) may have made a sign error when factoring or when extracting the roots from the factors.  
C. Student(s) may have incorrectly factored \( 6x^2 + 7x - 5 \) as \( (6x - 1)(x + 5) \).  
D. Student(s) may have incorrectly factored \( 6x^2 + 7x - 5 \) as \( (6x + 1)(x - 5) \).  
Standards: F-IF.7.a

**TEACHER READS:**

Read the question to yourself and select the best answer(s).

*Which of the following functions has a zero at \( x = -2 \)? Select two that apply.*

A. \( f(x) = x^2 - x - 6 \)  
B. \( f(x) = (x + 2)^2 - 5 \)  
C. \( f(x) = x^2 - 6x + 8 \)  
D. \( f(x) = (x - 2)^2 + 1 \)  
E. \( f(x) = x(x + 2) \)  
F. \( f(x) = (x - 2)(x - 5) \)

Master ID: 551408 Revision: 1  
Correct: AE  
Rationale:  
A. Correct answer  
B. Student(s) may have recognized the \( (x + 2) \) but may have forgotten that in this form, it refers to a minimum at \( x = -2 \).  
C. Student(s) may have forgotten that the factor \( (x - 2) \) corresponds to a zero at \( x = 2 \).  
D. Student(s) may have forgotten that in this form, the \( (x - 2) \) corresponds to a minimum at \( x = 2 \).  
E. Correct answer  
F. Student(s) may have forgotten that the factor \( (x - 2) \) corresponds to a zero at \( x = +2 \).  
Standards: F-IF.8.a
46  **TEACHER READS:**
Read the question to yourself and select the best answer.

How many times does the graph of the following equation intersect the x-axis?

\[ y = 15x^2 + 11x + 2 \]

A. 0  B. 1  C. 2  D. 3

Master ID: 13226 Revision: 1
Correct: C
Rationale:
A. Student(s) may have calculated the discriminant incorrectly. \[ b^2 - 4ac = 112 - (4)(15)(2) = +1 \] (not negative).
B. Student(s) may have calculated the discriminant incorrectly. \[ b^2 - 4ac = 112 - (4)(15)(2) = +1 \] (not zero).
C. Correct answer
D. Student(s) may have failed to understand that the graph of a quadratic equation cannot intersect the x-axis three times.

Standards:
F-IF.8.a

---

47  **TEACHER READS:**
Read the question to yourself and select the best answer.

Solve for \( x \).

\[ (4x + 3)(3x + 7) = 0 \]

A. \( x = \frac{-3}{4} \) and \( x = \frac{-7}{3} \)  B. \( x = \frac{-4}{3} \) and \( x = \frac{-3}{7} \)  C. \( x = \frac{-3}{4} \) and \( x = \frac{-7}{3} \)  D. \( x = \frac{-4}{3} \) and \( x = \frac{-3}{7} \)

Master ID: 30827 Revision: 1
Correct: C
Rationale:
A. Student(s) may have believed signs of the zeros would be the same as the signs inside the parentheses.
B. Student(s) may have believed signs of the zeros would be the same as the signs inside the parentheses and inverted the fractions when dividing.
C. Correct answer
D. Student(s) may have inverted the fractions when solving for the zeros of this equation.

Standards:
F-IF.8.a
The graph of the equation \( y = x^2 - 2x - 3 \) is shown above. What are the roots of the equation?

A. \( x = 0 \) only  
B. \( y = 3 \) only  
C. \( x = -1 \) and \( x = 3 \)  
D. \( x = 1 \) and \( x = -3 \)

Master ID: 17839  
Revision: 1  
Correct: C

Rationale:
A. Student(s) may have misunderstood the meaning of "roots" of an equation.
B. Student(s) may have misunderstood the meaning of "roots" or mistaken the \( y \)-intercept of the parabola for the value of \( x \) that makes the equation equal to 0.
C. Correct answer
D. Student(s) may have incorrectly factored the quadratic equation or factored correctly but forgotten they needed the value that made zero of each factor.

Standards:
F-IF.8.a
A student creates the following flowchart to find the inverse function of \( f(x) = 4x^3 - 1 \).

**Part A:**
Complete the "Process" box by writing a statement that describes the process that can be used to find the inverse function of \( f(x) = 4x^3 - 1 \).

**Part B:**
Complete the "Output" box with the inverse function of \( f(x) = 4x^3 - 1 \).
TEACHER READS:
Read and complete the task that follows.

Anna claims that the inverse of $g(x) = \frac{x+1}{x+5}$ is $g^{-1}(x) = \frac{5+x}{1+x}$. Decide if Anna’s claim is correct. If she is correct, enter $\frac{5+x}{1+x}$ below. If she is incorrect, enter a correct expression that represents $g^{-1}(x)$.

$g^{-1}(x) = \boxed{}$

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>E</td>
<td>F</td>
<td>G</td>
<td>H</td>
</tr>
<tr>
<td>I</td>
<td>J</td>
<td>K</td>
<td>L</td>
</tr>
<tr>
<td>M</td>
<td>N</td>
<td>O</td>
<td>P</td>
</tr>
<tr>
<td>Q</td>
<td>R</td>
<td>S</td>
<td>T</td>
</tr>
<tr>
<td>U</td>
<td>V</td>
<td>W</td>
<td></td>
</tr>
</tbody>
</table>

A. Input #1 Answers  
B. $\frac{1-5x}{x-1}$  
C. $\frac{1-5x}{-1+x}$  
D. $\frac{1-5x}{x+1}$  
E. $\frac{-5x+1}{x-1}$  
F. $\frac{-5x+1}{-1+x}$  
G. $\frac{-5x+1}{x+1}$  
H. $\frac{1+5x}{-1+x}$  
I. $\frac{1+5x}{x-1}$  
J. $\frac{1+5x}{x+1}$  
K. $\frac{5x-1}{1-x}$  
L. $\frac{-1+5x}{-x+1}$  
M. $\frac{-1(5x-1)}{-1(1-x)}$  
N. $\frac{(1-5x)}{(x-1)}$  
O. $\frac{(1-5x)}{(-1+x)}$  
P. $\frac{-(1-5x)}{(x-1)}$  
Q. $\frac{-(5x+1)}{(x-1)}$  
R. $\frac{-(5x+1)}{-(1+1)}$  
S. $\frac{-(5x+1)}{(x-1)}$  
T. $\frac{(1-5x)}{(-1+1)}$  
U. $\frac{(1+5x)}{(x-1)}$  
V. $\frac{5x-1}{-x+1}$  
W. $\frac{-1+5x}{1-x}$  

Master ID: 2034612  
Revision: 1  
Correct:  
Standards: F-BF.4.a
Let \( f(x) = 3x^2 \).

Part A:
Write an expression that represents the inverse of the function \( f(x) \).

\[ f^{-1}(x) = \]

Part B:
Explain how you determined your answer.

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

Master ID: 529168 Revision: 1
Rubric: 2 Point(s)

2 The student demonstrates thorough understanding of solving for the inverse of a function, mapping relationships in an equation.
The student provides an appropriate expression for the inverse and provides an appropriate reasoning for this response.

Part A:
\[ f^{-1}(x) = \frac{\sqrt{x}}{3} \]

Part B:
Since \( y = 3x^2 \), switching \( x \) and \( y \) yields \( x = 3y^2 \). Division by 3 on both sides of the equation yields \( x/3 = y^2 \) and isolation of \( y \) yields \( y = f^{-1}(x) = \frac{\sqrt{x}}{3} \).

1 The student demonstrates partial understanding of solving for the inverse of a function, mapping relationships in an equation. The student provides an appropriate expression for the inverse or provides an appropriate reasoning that would have led to a correct response.

0 The student demonstrates little or no understanding of solving for the inverse of a function, mapping relationships in an equation. The student does not provide an appropriate expression for the inverse and does not provide an appropriate reasoning that would have led to a correct response.

Standards:
F-BF.4.a
52 TEACHER READS:

Which of the following is equivalent to \((x + 1)^2\) ?

A. \(x^2 + 1\)  
B. \(x^2 + 2x\)  
C. \(x^2 + 1x + 1\)  
D. \(x^2 + 2x + 1\)

Master ID: 18141 Revision: 1
Correct: D
Rationale:
A. Student(s) may not have recognized this factoring identity and/or believed they could distribute the exponent to create this option.
B. Student(s) may not have recognized this factoring identity and/or made computational errors when expanding the expression.
C. Student(s) may not have recognized this factoring identity and/or believed the expression was equivalent to the first term squared plus the second term squared, plus the product of the terms.
D. Correct answer
Standards: A-SSE.2

53 TEACHER READS:

Factor completely:

\(4x^2 – 144\)

A. \(4(x^2 – 36)\)  
B. \(4(x + 6)(x – 6)\)  
C. \((2x – 12)(2x + 12)\)  
D. \((x + 12)(4x – 12)\)

Master ID: 2671 Revision: 1
Correct: B
Rationale:
A. Student(s) factored out a common factor, but did not recognize the difference of two squares (DOTS).
B. Correct answer
C. Student(s) factored using DOTS, but did not factor out the common factor.
D. Student(s) missed the concept of DOTS, and just tried to factor the problem as if it were a trinomial.
Standards: A-SSE.2
Read the question to yourself and select the best answer.

**Factor the polynomial:**

\[ x^2 + 7x + 12 \]

A. \((x + 3)(x + 4)\)  
B. \((x + 2)(x + 6)\)  
C. \((x + 1)(x + 12)\)  
D. \((x + 7)(x + 12)\)

Master ID: 1045  
Correct: A

Rationale:

A. Correct answer  
B. Student(s) may have only focused on the binomials producing the first and last terms of the stem trinomial.  
C. Student(s) may have misunderstood how to find binomial factors and used the coefficients of the first and last terms as values in the factors.  
D. Student(s) may have misunderstood how to find the binomial factors and used the coefficients of the trinomial as values in the factors.

Standards:

A-SSE.2

---

**What are the zeros of the function** \( s(t) = 3t^2 - 14t - 24? \)

A. \( t = -6 \) and \( t = -\frac{4}{3} \)  
B. \( t = -6 \) and \( t = \frac{4}{3} \)  
C. \( t = -\frac{4}{3} \) and \( t = 6 \)  
D. \( t = \frac{4}{3} \) and \( t = 6 \)

Master ID: 84568  
Correct: C

Rationale:

A. Student(s) may have mistakenly determined the factored form of the function to be \( s(t) = (3t + 4)(t + 6) \), set both of the factors equal to 0, and solved for \( t \).  
B. Student(s) may have mistakenly determined the factored form of the function to be \( s(t) = (3t - 4)(t + 6) \), set both of the factors equal to 0, and solved for \( t \).  
C. Correct answer  
D. Student(s) may have mistakenly determined the factored form of the function to be \( s(t) = (3t - 4)(t - 6) \), set both of the factors equal to 0, and solved for \( t \).

Standards:

A-SSE.3.a
56. **TEACHER READS:**

   Read the question to yourself and select the best answer.

   If Laura uses factoring to find the zeros of the quadratic function \( f(x) = 3x^2 + 10x - 8 \), which of the following is the factored form of the function?

   A. \( f(x) = (3x - 2)(x + 4) \)  
   B. \( f(x) = (3x + 2)(x - 4) \)  
   C. \( f(x) = (3x - 4)(x + 2) \)  
   D. \( f(x) = (3x + 4)(x - 2) \)

57. **TEACHER READS:**

   Read the question to yourself and select the best answer.

   Solve for \( x \).

   \( x^2 = -8x - 7 \)

   A. \(-7 \) and \(-1 \)  
   B. \( \frac{-7}{8} \) and \( \frac{7}{8} \)  
   C. \( 1 \) and \(-7 \)  
   D. \( \frac{-7 - \sqrt{17}}{2} \) and \( \frac{-7 + \sqrt{17}}{2} \)
TEACHER READS:
Read and complete the task that follows.

A quadratic equation is shown below.

\[ f(x) = x^2 + 14x + 16 \]

Part A:
Complete the square of the quadratic equation to write it in \( f(x) = (x - h)^2 + k \) form.

Part B:
What is the minimum value of the quadratic equation?

Part C:
Could this quadratic equation be used to model the path a golf ball takes when hit if the ground is represented by the \( x \)-axis? Why or why not?
Directions: Answer the following question(s).

TEACHER READS:
Adam graphed a polynomial with zeros at $x = -1$, $x = 2$ and $x = 5$. Which of the following graphs did he draw?

A. 

B. 

C. 

D.
Teacher Reads:

Read the question to yourself and select the best answer.

Which of these polynomial functions is graphed below?

- A. \( y = x^2 - 3x + 2 \)
- B. \( y = x^2 - x - 2 \)
- C. \( y = x^2 + x - 2 \)
- D. \( y = x^2 + 3x + 2 \)
TEACHER READS:
Read the question to yourself and select the best answer.

Which of these polynomial functions is graphed below?

A. \( y = x^2 - 4 \)  
B. \( y = x^2 - 4x \)  
C. \( y = x^3 - 4 \)  
D. \( y = x^3 - 4x \)

Correct: D

Rationale:
A. Student(s) may have correctly factored \( x^2 - 4 \) as \( (x - 2)(x + 2) \), set each factor equal to 0, and solved for \( x \) to find the zeros of the function before graphing, mistakenly having the graph pass through the origin.
B. Student(s) may have incorrectly factored \( x^2 - 4x \) as \( x(x - 2)(x + 2) \), set each factor equal to 0, and solved for \( x \) to find the zeros of the function before graphing.
C. Student(s) may have incorrectly factored \( x^3 - 4 \) as \( x(x - 2)(x + 2) \), set each factor equal to 0, and solved for \( x \) to find the zeros of the function before graphing.
D. Correct answer

Standards:
A-APR.3
An expression is shown.

\[(3x^2 + 2x + 6)(x^2 – 12x + 2) – (4x^2 + 5x – 6)\]

Which polynomial is equal to the expression?

A. \(x^2 – 2x – 59\)
B. \(x^2 + 2x – 59\)
C. \(2x^2 – 2x – 59\)
D. \(2x^2 + 2x – 59\)

What is \((x – 8)(x + 4) + (x – 3)(x + 9)\)?

A. \(x^2 – 2x – 59\)  
B. \(x^2 + 2x – 59\)  
C. \(2x^2 – 2x – 59\)  
D. \(2x^2 + 2x – 59\)
64 TEACHER READS:
Read the question to yourself and select the best answer.

Select an expression equivalent to
$(29r^4 – 11r^3s + 5r^2s^2 + 19rs^3 + 4) – (20r^4 – 10r^3s + 13r^2s^2 + 14rs^3 – 33)$.

A. $9r^4 – 21r^3s – 8r^2s^2 + 5rs^3 – 29$
B. $9r^4 – 21r^3s – 8r^2s^2 + 5rs^3 + 37$
C. $9r^4 – r^3s – 8r^2s^2 + 5rs^3 – 29$
D. $9r^4 – r^3s – 8r^2s^2 + 5rs^3 + 37$

Master ID: 88594 Revision: 1
Correct: D
Rationale:
A. Student(s) may have subtracted 10 from –11 instead of subtracting –10 from –11 when finding the coefficient of the second term of the difference between the two polynomials. Student(s) may have also subtracted 33 from 4 instead of subtracting –33 from 4 when finding the last term.
B. Student(s) may have subtracted 10 from –11 instead of subtracting –10 from –11 when finding the coefficient of the second term of the difference between the two polynomials.
C. Student(s) may have subtracted 33 from 4 instead of subtracting –33 from 4 when finding the last term of the difference between the two polynomials.
D. Correct answer
Standards:
A-APR.1

65 TEACHER READS:
Read the question to yourself and select the best answer.

Solve:
$5x^2 + 3x – 1 = 0$

A. $\frac{-3 \pm \sqrt{29}}{10}$
B. $\frac{3 \pm \sqrt{29}}{10}$
C. $\frac{-3}{10} \pm \sqrt{29}$
D. no real solutions

Master ID: 2476 Revision: 2
Correct: A
Rationale:
A. Correct answer
B. Student(s) may have forgotten that the quadratic formula starts with negative $b$, not positive $b$.
C. Student(s) may have interpreted the quadratic formula by dividing $–b$ by $2a$ instead of dividing the entire numerator by $2a$.
D. Student(s) may have calculated the radical to be $9 – 4(5)(1)$, resulting in $–11$, which results in an imaginary result.
Standards:
A-REI.4.b
**TEACHER READS:**

Read the question to yourself and select the best answer.

What are the solutions to the equation $x^2 - 4x = -1$?

A. $x = 0; x = 4i$  
B. $x = -1; x = 3$  
C. $x = 2 + i; x = 2 - i$  
D. $x = 2 + \sqrt{3}; x = 2 - \sqrt{3}$

---

**TEACHER READS:**

Read the question to yourself and select the best answer.

Which of the equations below has a solution of $x = \frac{-1 \pm i\sqrt{17}}{3}$?

- $3x^2 + 2x + 6 = 0$
- $9x^2 + 6x - 16 = 0$

A. only $3x^2 + 2x + 6 = 0$  
B. only $9x^2 + 6x - 16 = 0$  
C. both $3x^2 + 2x + 6 = 0$ and $9x^2 + 6x - 16 = 0$  
D. neither $3x^2 + 2x + 6 = 0$ nor $9x^2 + 6x - 16 = 0$

---

**Rationale:**

A. Student(s) may have mistakenly believed the $-1$ on the right side simply attached an "$i$" to the solutions of $x^2 - 4x = 0$.

B. Student(s) may have mistakenly believed they could solve by factoring the left side and setting each factor equal to $-1$: $x = -1$ and $(x - 4) = -1$.

C. Student(s) may have forgotten to add 4 to the right side when solving by completing the square.

D. Correct answer

**Standards:**  
A-REI.4.b
What is the solution to the equation $4x^2 + 5x = 2x + 2$?

A. $x = \frac{-7 \pm \sqrt{17}}{8}$  
B. $x = \frac{-3 \pm \sqrt{38}}{8}$  
C. $x = \frac{-3 \pm \sqrt{41}}{8}$  
D. no real solution

Rationale:
A. Student(s) may have incorrectly combined like terms and re-written the equation as $4x^2 + 7x + 2 = 0$.
B. Student(s) may have incorrectly squared 3 to equal 6 instead of 9 inside the radical.
C. Correct answer
D. Student(s) may have substituted 2 instead of –2 for $c$, resulting in the discriminant being negative rather than positive.

Standards:
A-REI.4.b

What are the solutions to the equation $3x^2 + 8x + 10 = 1$?

A. $x = -\frac{4}{3} + \frac{i\sqrt{11}}{3}; x = -\frac{4}{3} - \frac{i\sqrt{11}}{3}$  
B. $x = -\frac{4}{3} + \frac{i\sqrt{11}}{3}; x = -\frac{4}{3} - \frac{i\sqrt{11}}{3}$  
C. $x = -\frac{7}{3} + \frac{i\sqrt{44}}{3}; x = -\frac{7}{3} - \frac{i\sqrt{44}}{3}$  
D. $x = -\frac{4}{3} + \frac{2i\sqrt{11}}{3}; x = -\frac{4}{3} - \frac{2i\sqrt{11}}{3}$

Rationale:
A. Correct answer
B. Student(s) may have added 1 to the left side instead of subtracting when setting the quadratic equal to 0.
C. Student(s) may have used $c = 10$ in the quadratic formula and then subtracted 1 from those solutions instead of setting the equation equal to 1 first.
D. Student(s) may have simplified the square root of –44 incorrectly.

Standards:
A-REI.4.b
The equation $y = x^2 - 6x + 5$ is graphed below. Which of the statements is correct?

A. The equation has no real solutions.
B. The equation has 1 real solution.
C. The equation has 2 real solutions.
D. The equation has an infinite number of real solutions.

Master ID: 3121162 Revision: 1
Correct: C
Standards: A-REI.10
Given the graph of the functions \( f(x) = 2x - 1 \) and \( g(x) = x^2 \), determine the solution of the graphs. Enter the coordinates of the solution in the response boxes below.

\[
\begin{array}{c}
\text{A. Input #1 Answers} \\
\text{B. } 1 \\
\text{C. Input #2 Answers} \\
\text{D. } 1
\end{array}
\]
The graph shows the equations \( f(x) \) and \( g(x) \), where \( f(x) = -2x^2 + 3 \), and \( g(x) = 1 \).

Two students, Anne and James, are asked to determine the values for \( x \) that are solutions to equation \( f(x) = g(x) \).

Each student’s claim is shown.

Anne makes the claim that the solutions to the equation are \( x = -1 \) and \( x = 1 \).

James makes the claim that the solutions to the equation are \( x = -1.2, x = 1.2, \) and \( x = 3 \).

Which statement provides a correct analysis of the student’s claims?

A. Anne’s claim is correct because those are the two points at which the graph lines intersect.

B. Anne’s claim is partially correct, because \( x = -1, x = 1 \) are solutions but \( x = 3 \) is also a solution.

C. James’s claim is correct because those are the points at which \( f(x) \) crosses the \( x \)-axis on the graph.

D. James’s claim is partially correct \( x = -1.2, x = 1.2 \) are solutions but \( x = 3 \) is not a solution.
TEACHER READS:
Read and complete the task that follows.

Given the graph of the systems of equations \( f(x) = x + 2 \) and \( g(x) = 3x - 2 \), determine the solution.

Enter the coordinates of the solution in the response boxes.

\((__,__)\)

Input #1 Answers
- 2

Input #2 Answers
- 4
Read the question to yourself and select the best answer.

Which expression equals $9x^2$?

A. $\frac{9}{x^2}$  
B. $\frac{18}{x^2}$  
C. $-3x$  
D. $-18x$

Master ID: 14579 Revision: 1
Correct: A
Rationale:
A. Correct answer 
B. Student(s) may have multiplied the 9 and 2, and then created a denominator from $x$ to the $-2$.
C. Student(s) may have taken the square root of $9x$ and used the negative sign from the exponent.
D. Student(s) may have multiplied 9 by $-2$ and retained the $x$.
Standards:
N-RN.2

Read the question to yourself and select the best answer.

Which of the following is equivalent to $\frac{1}{8^{\frac{1}{2}}}$?

A. $\frac{1}{64}$  
B. 4  
C. $\sqrt[6]{8}$  
D. $1 \log_2 8$

Master ID: 15963 Revision: 1
Correct: C
Rationale:
A. Student(s) may have mistakenly treated the problem as $\frac{1}{8^2}$.
B. Student(s) may have mistakenly treated the problem as $8(\frac{1}{2})$.
C. Correct answer
D. Student(s) may have mistakenly believed this problem translated into a logarithmic expression.
Standards:
N-RN.2
If $i = \sqrt{-1}$, which graph below shows $-4 + 2i$ correctly on the plane at Point $Z$?

A. 

B. 

C. 

D.
Directions: Answer the following question(s).

Master ID:                     20775 Revision:                     1
Correct:                      D
Rationale:                    
A.  Student(s) may have added –4 and 2 and plotted the point on the real axis at –2.
B.  Student(s) may have added –4 and 2 and plotted the point on the imaginary axis at –2i.
C.  Student(s) may have confused the real axis with the imaginary axis and plotted the point at 2 – 4i.
D.  Correct answer
Standards:                    N-CN.1

TEACHER READS:
Read the question to yourself and select the best answer.

Use the table below to evaluate \( i^49 \):

<table>
<thead>
<tr>
<th>( i )</th>
<th>(-1)</th>
<th>(-i)</th>
<th>1</th>
<th>(i)</th>
<th>(-1)</th>
</tr>
</thead>
</table>

A.  –1       B.  1       C.  -i       D.  \( i \)

Master ID:                     20774 Revision:                     1
Correct:                      D
Rationale:                    
A.  Student(s) may have divided 49 and 4 to get 12.25 and treated this as having a remainder of 2. Student(s) then may have misinterpreted this to mean that \( i^{49} \) is equivalent to \( i^2 \).
B.  Student(s) may have truncated the remainder of the quotient of 49 and 4 to get 12, which is divisible by 4, misinterpreting this to mean \( i^{49} \) is equivalent to \( i^4 \).
C.  Student(s) may have divided 49 by 4 to get 12.25 and rounded this up to 12.3. Student(s) may then have misinterpreted this to mean \( i^{49} \) is equivalent to \( i^3 \).
D.  Correct answer
Standards:                    N-CN.1

TEACHER READS:
Read and complete the task that follows.

What is the value of \( 4i^4 - 2i^2 \), where \( i \) is the imaginary number?

\[ 4i^4 - 2i^2 = \]

A.  Input #1 Answers       B.  6

Master ID:                     3097804 Revision:                     1
Correct:                      
Standards:                    N-CN.1
79 TEACHER READS:
Read the question to yourself and select the best answer.

What is the simplified form of $-3\sqrt{-8}$?

A. $6i$  
B. $12i$  
C. $-6i\sqrt{2}$  
D. $-12i\sqrt{2}$

Master ID: 498982 Revision: 1
Correct: C
Rationale:
A. Student(s) may have multiplied two negative numbers together to get a positive 6 and may have forgotten about $\sqrt{2}$.
B. Student(s) may have thought that $\sqrt{8} = 4$ and may have multiplied two negative numbers together to get a positive.
C. Correct answer
D. Student(s) may not have taken the square root of 4.

Standards:
N-CN.1

80 TEACHER READS:
Read the question to yourself and select the best answer.

Simplify.

$$\frac{(4 + 4i)(1 - 2i)}{3 - i}$$

A. 4  
B. $-2 - 2i$  
C. $\frac{16 - 12i}{5}$  
D. 5

Master ID: 16959 Revision: 1
Correct: A
Rationale:
A. Correct answer
B. Student(s) may have thought $i^2 = 1$ instead of $-1$.
C. Student(s) may have multiplied the numerator by $3 - i$ instead of $3 + i$.
D. Student(s) may have forgotten to change the sign when converting $i^2$ into $-1$ in the denominator, making the denominator equal 8 instead of 10.

Standards:
N-CN.2
TEACHER READS:
Read the question to yourself and select the best answer.

**What is the simplified form of \((-7 + 8i) - (-5i + 4i^2)\)?**

A. \(-11 + 3i\)  
B. \(-11 + 13i\)  
C. \(-3 + 3i\)  
D. \(-3 + 13i\)

Master ID: 498985 Revision: 1
Correct: D
Rationale:
A. Student(s) may not have distributed the negative to \(4i^2\) and to \(5i\).
B. Student(s) may not have distributed the negative to \(4i^2\).
C. Student(s) may not have distributed the negative to \(5i\).
D. Correct answer
Standards:
N-CN.2

TEACHER READS:
Read the question to yourself and select the best answer.

**Simplify this expression.**

\((2 - 3i) - (2 + 3i)\)

A. \(6\)  
B. \(0\)  
C. \(-6i\)  
D. \(-13 - 12i\)

Master ID: 18785 Revision: 1
Correct: C
Rationale:
A. Student(s) may have mistakenly treated \(i\) as \(-1\) instead of \(\sqrt{-1}\).
B. Student(s) may have believed \((2 - 3i)\) and \((2 + 3i)\) were equivalent.
C. Correct answer
D. Student(s) may have correctly distributed the negative sign but then mistakenly evaluated the expression as if \((2 - 3i)\) and \((2 + 3i)\) were being multiplied together.
Standards:
N-CN.2
TEACHER READS:

Read and complete the task that follows.

Complex numbers can be subtracted either algebraically or graphically.

Part A:
What is \((-5 - 4i) - (-2 + i)\)?

Part B:
What is the graph of \((-5 - 4i) - (-2 + i)\) on a complex plane?
The student shows thorough understanding of subtracting complex numbers both algebraically and graphically. The student subtracts the numbers algebraically in Part A and graphically in Part B.

Part A:
\(-3 - 5i\)
\((-5 - 4i) - (-2 + i) =
-3 - 5i\)

Part B:

Standards:
N-CN.2