The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA I

Wednesday, August 16, 2023 — 8:30 to 11:30 a.m., only

MODEL RESPONSE SET

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25 Classify the expression \( \frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3} \) as rational or irrational. Explain your reasoning.

\[
\frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3} = \frac{2}{12} + \frac{13}{3} = \frac{9}{3} = 4.5
\]

\( \frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3} \) is rational because its solution is 4.5 which is a terminating decimal.

**Score 2:** The student gave a complete and correct response.
25 Classify the expression \( \frac{8}{\sqrt{144}} + \frac{\sqrt{169}}{3} \) as rational or irrational. Explain your reasoning.

Rational because \( \frac{8}{\sqrt{144}} + \frac{\sqrt{169}}{3} = 4.5 \) and it can be changed into a fraction of \( \frac{9}{2} \).

Score 2: The student gave a complete and correct response.
25 Classify the expression \( \frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3} \) as rational or irrational. Explain your reasoning.

\[
\text{Rational} + \text{rational} = \text{rational}
\]

Score 2: The student gave a complete and correct response.
25 Classify the expression $\frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3}$ as rational or irrational. Explain your reasoning.

\[
\frac{2}{12} + \frac{13}{3} = 4.5 \quad 4 \frac{1}{2}
\]

Rational.

Score 1: The student gave a justification, not an explanation.
Question 25

25 Classify the expression \( \frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3} \) as rational or irrational. Explain your reasoning.

Irrational, the resulting answer is a fraction/decimal that terminates.

Score 1: The student made a conceptual error.
25 Classify the expression $\frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3}$ as rational or irrational. Explain your reasoning.

\[
\frac{2}{12} = \frac{13}{3}
\]

This expression is irrational because the numbers have repeating digits and they are \textit{NEVER ENDING}.

\textbf{Score 0:} The student did not show enough correct work to receive any credit.
Classify the expression \( \frac{2}{\sqrt{144}} + \frac{\sqrt{169}}{3} \) as rational or irrational. Explain your reasoning.

\[
\frac{2}{\sqrt{144}} = \frac{2}{12} = \frac{1}{6}
\]

\[
\frac{\sqrt{169}}{3} = \frac{13}{3}
\]

\[
\frac{1}{6} \rightarrow \frac{1}{6}
\]

\[
+ \frac{13}{3} \rightarrow \frac{26}{6}
\]

\[
\frac{249}{6} \quad \text{IRRATIONAL}
\]

\[
\frac{9}{2}
\]

**Score 0:** The student did not state rational and did not write an explanation.
Julia surveyed 150 of her classmates at City Middle School to determine their favorite animals. Of the 150 students, 46% were male.

Forty-two students said their favorite animal was a horse, and \( \frac{1}{3} \) of those students were female.

Of the 60 students who said dolphins were their favorite animal, 30% were male.

Using this information, complete the two-way frequency table below.

<table>
<thead>
<tr>
<th></th>
<th>Horse</th>
<th>Dolphin</th>
<th>Penguin</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>28</td>
<td>16</td>
<td>23</td>
<td>69</td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
<td>42</td>
<td>25</td>
<td>81</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>60</td>
<td>48</td>
<td>150</td>
</tr>
</tbody>
</table>

**Score 2:** The student gave a complete and correct response.
Julia surveyed 150 of her classmates at City Middle School to determine their favorite animals. Of the 150 students, 46% were male.

Forty-two students said their favorite animal was a horse, and \( \frac{2}{3} \) of those students were female.

Of the 60 students who said dolphins were their favorite animal, 30% were male.

Using this information, complete the two-way frequency table below.

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<td>28</td>
<td>18</td>
<td>23</td>
<td>69</td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
<td>47</td>
<td>20</td>
<td>81</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>65</td>
<td>43</td>
<td>150</td>
</tr>
</tbody>
</table>

Score 1: The student placed 14, 18, and 69 correctly in the table.
Julia surveyed 150 of her classmates at City Middle School to determine their favorite animals. Of the 150 students, 46% were male.

Forty-two students said their favorite animal was a horse, and \( \frac{1}{3} \) of those students were female.

Of the 60 students who said dolphins were their favorite animal, 30% were male.

Using this information, complete the two-way frequency table below.

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<tbody>
<tr>
<td>Male</td>
<td>24</td>
<td>35</td>
<td>6</td>
<td>65</td>
</tr>
<tr>
<td>Female</td>
<td>18</td>
<td>25</td>
<td>33</td>
<td>85</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>60</td>
<td>148</td>
<td>150</td>
</tr>
</tbody>
</table>

Score 0: The student did not show enough correct work to receive any credit.
27 Bryan said that the piecewise function graphed below has a domain of all real numbers.

State two reasons why Bryan is incorrect.

1) The function is not defined at $x=3$.
2) The function is not defined after $x=4$.

Score 2: The student gave a complete and correct response.
27 Bryan said that the piecewise function graphed below has a domain of all real numbers.

State two reasons why Bryan is incorrect.

There is no value for 3 because both dots are open and he forgot to put an arrow on the function at (4,3).

Score 2: The student gave a complete and correct response.
27 Bryan said that the piecewise function graphed below has a domain of all real numbers.

State two reasons why Bryan is incorrect.

Bryan is incorrect because the domain is not continuous.

Score 1: The student wrote only one correct reason.
27 Bryan said that the piecewise function graphed below has a domain of all real numbers.

State two reasons why Bryan is incorrect.

Bryan is incorrect because the dots at $x=3$ are both open, it has to be one open, one closed. Another reason is the line need to be straight.

Score 1: The student wrote only one correct reason.
27 Bryan said that the piecewise function graphed below has a domain of all real numbers.

State two reasons why Bryan is incorrect.

- One reason Bryan is wrong because all real numbers should not include negatives.
- Another reason he is incorrect would be because the functions are both different and don't show real numbers.

Score 0: The student wrote two incorrect reasons.
The formula \( d = t \left( \frac{v_i + v_f}{2} \right) \) is used to calculate the distance, \( d \), covered by an object in a given period of time, \( t \).

Solve the formula for \( v_f \), the final velocity, in terms of \( d \), \( t \), and \( v_i \), the initial velocity.

\[
\frac{d}{t} = \frac{v_i + v_f}{2} \\
2\left(\frac{d}{t}\right) = v_i + v_f \\
2\left(\frac{d}{t}\right) - v_i = v_f
\]

**Score 2:** The student gave a complete and correct response.
The formula \( d = t \left( \frac{v_i + v_f}{2} \right) \) is used to calculate the distance, \( d \), covered by an object in a given period of time, \( t \).

Solve the formula for \( v_f \), the final velocity, in terms of \( d \), \( t \), and \( v_i \), the initial velocity.

\[
2d = t \left( \frac{v_i + v_f}{2} \right)
\]

\[
2d = \frac{t}{2} (v_i + v_f)
\]

\[
2d - v_i = \frac{t}{2} v_f
\]

\[
v_f = \frac{2d - v_i}{t}
\]

**Score 1:** The student made one error by subtracting \( v_i \) before dividing it by \( t \).
The formula \( d = t \left( \frac{v_i + v_f}{2} \right) \) is used to calculate the distance, \( d \), covered by an object in a given period of time, \( t \).

Solve the formula for \( v_f \), the final velocity, in terms of \( d \), \( t \), and \( v_i \), the initial velocity.

\[
\begin{align*}
    d &= t \left( \frac{v_i + v_f}{2} \right) \\
    d &= \frac{1}{2} \left( v_i + v_f \right) \\
    \frac{d}{t} &= \frac{1}{2} \left( v_i + v_f \right) \\
    \frac{d}{t} &= v_i + v_f \\
    v_f &= v_i + \frac{d}{t}
\end{align*}
\]

**Score 1:** The student made one error by not multiplying both sides by 2.
The formula \( d = t \left( \frac{v_i + v_f}{2} \right) \) is used to calculate the distance, \( d \), covered by an object in a given period of time, \( t \).

Solve the formula for \( v_f \), the final velocity, in terms of \( d \), \( t \), and \( v_i \), the initial velocity.

\[
(2) \quad d = t \left( \frac{v_i + v_f}{2} \right)
\]

\[
\frac{2d}{t} = \frac{v_i + v_f}{2}
\]

\[
\frac{2d}{t} - v_f = \frac{v_i + v_f}{2}
\]

\[
\frac{2d}{t} - v_f = v_i
\]

**Score 1:** The student solved for \( v_i \).
28 The formula \( d = t \left( \frac{v_i + v_f}{2} \right) \) is used to calculate the distance, \( d \), covered by an object in a given period of time, \( t \).

Solve the formula for \( v_f \), the final velocity, in terms of \( d \), \( t \), and \( v_i \), the initial velocity.

\[
d = t \left( \frac{v_i + v_f}{2} \right)
\]

\[
d = \frac{t v_i + t v_f}{2}.
\]

\[
d = \frac{v_i + v_f}{2} \cdot t.
\]

\[
2d = \frac{v_i + v_f}{v_i} \cdot 2.
\]

\[
2d = \frac{v_i + v_f}{v_i}.
\]

\[
\frac{2d}{v_i} = v_f.
\]
29 Solve \( x^2 - 9x = 36 \) algebraically for all values of \( x \).

\[
x^2 - 9x - 36 = 0
\]

\[
(x - 12)(x + 3) = 0
\]

\[
x - 12 = 0 \quad x + 3 = 0
\]

\[
x = 12 \quad x = -3
\]

\( x = 12, -3 \)

**Score 2:** The student gave a complete and correct response.
Question 29

29 Solve \( x^2 - 9x = 36 \) algebraically for all values of \( x \).

\[
\begin{align*}
  x^2 - 9x - 36 &= 0 \\
  a &= 1 \\
  b &= 9 \\
  c &= -36 \\
  D &= (9)^2 - 4(1)(-36) = 225 \\
  x &= \frac{-b \pm \sqrt{D}}{2a} \\
  x &= \frac{-9 \pm \sqrt{225}}{2} \\
  x &= \frac{9 \pm 15}{2} \\
  x &= 12, -3
\end{align*}
\]

**Score 2:** The student gave a complete and correct response.
29 Solve \( x^2 - 9x = 36 \) algebraically for all values of \( x \).

\[
\begin{align*}
-36 & \quad -36 \\
\hline
-9x & \quad 3x \\
\hline
x^2 - 9x - 36 &= 0 \\
(x - 12)(x + 3) &= 0 \\
\end{align*}
\]

**Score 1:** The student factored \( x^2 - 9x - 36 = 0 \) correctly, but did not solve for the values of \( x \).
29 Solve $x^2 - 9x = 36$ algebraically for all values of $x$.

\[ x^2 - 9x - 36 = 0 \]

\[ (x - 3) (x + 12) = 0 \]

\[ x = 3 \quad \text{or} \quad x = -12 \]

**Score 1:** The student made a factoring error.
29 Solve \( x^2 - 9x = 36 \) algebraically for all values of \( x \).

\[
x^2 - 9x = 36
\]

\[
x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(1)(0)}}{2(1)}
\]

\[
x = \frac{9 \pm \sqrt{81}}{2}
\]

No Real Solutions.
(value in radical is negative)

**Score 0:** The student used \( c = 0 \) and did not square \(-9\) correctly.
29 Solve \( x^2 - 9x = 36 \) algebraically for all values of \( x \).

\[
\sqrt{x^2 - 9x} = \sqrt{36} \\
x - 3x = 6 \\
-2 \frac{x}{-2} = \frac{6}{-2} \\
\boxed{x = -3}
\]

Score 0: The student did not show enough correct work to receive any credit.
30 Determine the common difference of the arithmetic sequence in which $a_1 = 5$ and $a_5 = 17$.

$$\frac{17-5}{4} = 3 \quad d = 3$$

$$\frac{12}{4} = 3 \quad \frac{5, 8, 11, 14, 17}{1, 2, 3, 4, 5}$$

Determine the $21^{st}$ term of this sequence.

$$5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 47, 50, 53, 56, 59$$

Score 2: The student gave a complete and correct response.
30 Determine the common difference of the arithmetic sequence in which $a_1 = 5$ and $a_5 = 17$. 

\[
\begin{align*}
14 + 3 &= 17 \\
14 &= 14 \\
8 + 3 &= 11 \\
5 + 3 &= 8 \\
5 &= 5
\end{align*}
\]

Determine the 21st term of this sequence.

\[
\begin{align*}
q_{21} &= q_1 + (n-1)d \\
q_{21} &= 5 + (21-1)d \\
q_{21} &= 5 + 20d \\
q_{21} &= 5 + 60 \\
q_{21} &= 65
\end{align*}
\]

Score 2: The student gave a complete and correct response.
30 Determine the common difference of the arithmetic sequence in which $a_1 = 5$ and $a_5 = 17$.

Determine the 21st term of this sequence.

$5, 8, 11, 14, 17, 20, 23, 26$
$29, 32, 35, 38, 41, 44, 47,$
$50, 53, 56, 59, 62, 65$

$a_{21} = 65$

Score 1: The student showed correct work to find 65.
30 Determine the common difference of the arithmetic sequence in which $a_1 = 5$ and $a_5 = 17$.

Determine the 21st term of this sequence.

$\begin{align*}
8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 47, 50, 53, 56, 59, 62, 65, 68, 71
\end{align*}$

$\underline{a_{21} = 69}$

Score 0: The student made multiple errors.
31 Factor $18x^2 - 2$ completely.

\[2(3x-1)(3x+1)\]

**Score 2:** The student gave a complete and correct response.
31 Factor $18x^2 - 2$ completely.

\[
\frac{18x^2 - 2}{2(9x^2 - 1)}/ \underline{(3x - 1)(3x + 1)}
\]

**Score 1:** The student did not include the common factor in their final answer.
31 Factor $18x^2 - 2$ completely.

\[
x = \frac{-0 \pm \sqrt{0^2 - 4(18)(-2)}}{2(18)}
\]

\[
x = \frac{0 \pm \sqrt{144}}{36}
\]

\[
x = \frac{0 \pm 12}{36}
\]

\[
x = \frac{0 + 12}{36} \quad \frac{0 - 12}{36}
\]

\[
x = \frac{1}{3} \quad \frac{1}{3}
\]

**Score 0:** The student solved the expression as an equation.
31 Factor $18x^2 - 2$ completely.

$$2(9x - 1)(9x + 1)$$

**Score 0:** The student did not show enough correct work to receive any credit.
31 Factor $18x^2 - 2$ completely.

$$2(9x^2 - 1)$$

**Score 0:** The student did not show enough grade-level work to receive any credit.
32 Solve $x^2 + 3x - 9 = 0$ algebraically for all values of $x$. Round your answer to the nearest hundredth.

\[ x^2 + 3x - 9 = 0 \]
\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]
\[ a = 1, \quad b = 3, \quad c = -9 \]
\[ x = \frac{-3 \pm \sqrt{3^2 - 4(1)(-9)}}{2(1)} \]
\[ x = \frac{-3 \pm \sqrt{45}}{2} \]
\[ x = \frac{-3 \pm 3\sqrt{5}}{2} \]
\[ x = \frac{3 + 3\sqrt{5}}{2}, \quad x = \frac{3 - 3\sqrt{5}}{2} \]

\[ x = 1.85, \quad x = -4.85 \]

**Score 2:** The student gave a complete and correct response.
32 Solve $x^2 + 3x - 9 = 0$ algebraically for all values of $x$. Round your answer to the nearest hundredth.

\[
x = \frac{-3 \pm \sqrt{9 + 36}}{2}
\]

\[
x = \frac{-3 \pm \sqrt{45}}{2}
\]

\[
x = \frac{-3 \pm 6.7082039325}{2}
\]

\[
x = 1.85410196625, -4.85410196625
\]

**Score 2:** The student gave a complete and correct response.
32 Solve \( x^2 + 3x - 9 = 0 \) algebraically for all values of \( x \). Round your answer to the nearest hundredth.

\[
\begin{align*}
x^2 + 3x - 9 &= 0 \\
x^2 + 3x + \frac{9}{4} &= 9 + \frac{9}{4} \\
(x + \frac{3}{2})^2 &= \frac{45}{4} \\
x + \frac{3}{2} &= \pm \sqrt{\frac{45}{4}} \\
x + 1.5 &= \pm 3.354 \\
x &= -1.5 \pm 3.354 \\
x &\in \{ 1.85, -4.85 \}
\end{align*}
\]

**Score 2:** The student gave a complete and correct response.
32 Solve \( x^2 + 3x - 9 = 0 \) algebraically for all values of \( x \). Round your answer to the nearest hundredth.

\[
\begin{align*}
x^2 + 3x - 9 &= 0 \\
\text{a} &= 1, \text{b} = 3, \text{c} = -9 \\
x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
&= \frac{-3 \pm \sqrt{3^2 - 4(1)(-9)}}{2(1)} \\
&= \frac{-3 \pm \sqrt{9 + 36}}{2} \\
&= \frac{-3 \pm \sqrt{45}}{2} \\
&= \frac{-3 \pm 6.71}{2} \\
&= \frac{-3 + 6.71}{2} \quad \text{or} \quad \frac{-3 - 6.71}{2} \\
&= 1.86 \quad \text{or} \quad -4.86
\end{align*}
\]

**Score 1:** The student made one rounding error.
32 Solve $x^2 + 3x - 9 = 0$ algebraically for all values of $x$. Round your answer to the nearest hundredth.

\[
\begin{align*}
    & \quad \frac{x^2 + 3x - 9}{x + q} = 0 \\
    & \quad x^2 + 3x = 9 \\
    & \quad (\frac{3}{2})^2 = (1.5)^2 = 2.25 \\
    & \quad x^2 + 3x + 2.25 = 9 + 2.25 \\
    & \quad \sqrt{(x+1.5)^2} = \pm 1.25 \\
    & \quad x + 1.5 = 3.35 \quad \quad x + 1.5 = -3.35 \\
    & \quad -1.25 \quad -1.25 \\
    & \quad x = 2.10 \quad x = -4.60
\end{align*}
\]

\[\{2.10, -4.60\}\]

**Score 1:** The student made a mistake when factoring $x^2 + 3x + 2.25$. 
32 Solve \( x^2 + 3x - 9 = 0 \) algebraically for all values of \( x \). Round your answer to the nearest hundredth.

\[
x^2 + 3x - 9 = 0
\]

\[
a = 1 \\
b = 3 \\
c = -9
\]

\[
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]

\[
x = \frac{-3 \pm \sqrt{9 - 36}}{2}
\]

\[
x = \frac{-3 \pm \sqrt{-27}}{2}
\]

\[
x = \frac{-3 + \sqrt{-27}}{2} \quad \text{and} \quad x = \frac{-3 - \sqrt{-27}}{2}
\]

\[
x = 1.10 \quad \text{and} \quad x = -4.10
\]

**Score 0:** The student did not show enough correct work to receive any credit.
Question 33

The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs $15.79, and a case of bottled water costs $5.69. The senior class has $125 to spend on the drinks.

If \( x \) represents the number of cases of sports drinks and \( y \) represents the number of cases of bottled water purchased, write an inequality that models this situation.

\[
15.79x + 5.69y \leq 125
\]

Nine cases of bottled water are purchased for this year’s field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased.

Explain your answer.

\[
15.79x + 5.69(9) \leq 125
\]

\[
15.79x + 51.21 \leq 125
\]

\[
-51.21 -51.21
\]

\[
15.79x \leq 73.79
\]

\[
\frac{15.79}{15.79} \quad \frac{73.79}{15.79}
\]

\[
x \leq 4.7
\]

4 cases of sports drinks do not have enough money to purchase. Can't buy a part of a case.

Score 4: The student gave a complete and correct response.
33 The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs $15.79, and a case of bottled water costs $5.69. The senior class has $125 to spend on the drinks.

If $x$ represents the number of cases of sports drinks and $y$ represents the number of cases of bottled water purchased, write an inequality that models this situation.

$$15.79x + 5.69y \leq 125$$

Nine cases of bottled water are purchased for this year’s field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased.

$$15.79x + 5.69(9) \leq 125$$

$$15.79x + 51.21 \leq 125$$

$$-51.21$$

$$15.79x \leq 73.79$$

$$x \leq 4.673$$

Only 4 cases of sports drinks can be bought because 9 waters cost $51.21 and with the rest of the money only four cases of sports drinks can be bought.

Score 4: The student gave a complete and correct response.
33 The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs $15.79, and a case of bottled water costs $5.69. The senior class has $125 to spend on the drinks.

If $x$ represents the number of cases of sports drinks and $y$ represents the number of cases of bottled water purchased, write an inequality that models this situation.

\[
15.79x + 5.69y \leq 125
\]

Nine cases of bottled water are purchased for this year’s field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased.

Explain your answer.

\[
\begin{align*}
15.79x + 5.69(9) &\leq 125 \\
15.79x + 51.21 &\leq 125 \\
15.79x &\leq 125 - 51.21 \\
x &\leq \frac{73.79}{15.79} \\
x &\leq 4.67
\end{align*}
\]

41 cases of sports drinks were purchased.

Score 3: The student did not explain why only 4 cases can be purchased.
33 The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs $15.79, and a case of bottled water costs $5.69. The senior class has $125 to spend on the drinks.

If \( x \) represents the number of cases of sports drinks and \( y \) represents the number of cases of bottled water purchased, write an inequality that models this situation.

\[
15.79x + 5.69y \leq 125
\]

Nine cases of bottled water are purchased for this year’s field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased.

Explain your answer.

\[
5.69 \times 9 = 51.21
\]

\[
4 \times 15.79 = 63.16
\]

4 cases of sports drinks can be purchased. If you purchase 5 it will end up being more than 125.

**Score 3:** The student used a method other than algebraic to find 4.
33 The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs $15.79, and a case of bottled water costs $5.69. The senior class has $125 to spend on the drinks.

If \( x \) represents the number of cases of sports drinks and \( y \) represents the number of cases of bottled water purchased, write an inequality that models this situation.

\[
15.79x + 5.69y \geq 125
\]

Nine cases of bottled water are purchased for this year's field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased.

Explain your answer.

\[
\begin{align*}
15.79x + 5.69(9) & \geq 125 \\
15.79x + 51.21 & \geq 125 \\
15.79x & \geq 73.79 \\
x & \geq \frac{73.79}{15.79} \\
x & \geq 4.67
\end{align*}
\]

\[
\text{5 or they will go over their price limit.}
\]

Score 2: The student wrote an incorrect inequality but solved it appropriately, and no further correct work is shown.
The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs $15.79, and a case of bottled water costs $5.69. The senior class has $125 to spend on the drinks.

If $x$ represents the number of cases of sports drinks and $y$ represents the number of cases of bottled water purchased, write an inequality that models this situation.

\[
5.69x + 15.79y \leq 125
\]

Nine cases of bottled water are purchased for this year’s field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased.

Explain your answer.

Only 4 cases of sports drinks can be purchased because $73.79 \div 15.79 = 4.67$ and $15.79 \times 5 = 78.95$ - which is over the budget.

Score 2: The student wrote an incorrect inequality, found 4 using a method other than algebraic, and wrote a correct explanation.
33 The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs $15.79, and a case of bottled water costs $5.69. The senior class has $125 to spend on the drinks.

If \( x \) represents the number of cases of sports drinks and \( y \) represents the number of cases of bottled water purchased, write an inequality that models this situation.

\[ 15.79x \leq 5.69y \]

Nine cases of bottled water are purchased for this year’s field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased.

Explain your answer.

\[ 5.69(9) = 51.21 \]

\[ \frac{125.00}{51.21} = 2.40 \]

\[ 125.00 - 51.21 = 73.79 \]

\[ 73.79 \div 15.79 = 4.7 \]

4 cases of sport drinks can be bought

---

**Score 1:** The student used a method other than algebraic to find 4.
The senior class at Hills High School is purchasing sports drinks and bottled water to sell at the school field day. At the local discount store, a case of sports drinks costs $15.79, and a case of bottled water costs $5.69. The senior class has $125 to spend on the drinks.

If \( x \) represents the number of cases of sports drinks and \( y \) represents the number of cases of bottled water purchased, write an inequality that models this situation.

\[
15.79x + 5.69y \leq 125
\]

Nine cases of bottled water are purchased for this year’s field day. Use your inequality to determine algebraically the maximum number of full cases of sports drinks that can be purchased.

Explain your answer.

Score 0: The student did not show enough correct work to receive any credit.
The path of a rocket is modeled by the function \( h(t) = -4.9t^2 + 49t \), where \( h \) is the height, in meters, above the ground and \( t \) is the time, in seconds, after the rocket is launched.

Sketch the graph on the set of axes below.

State the vertex of this function.

\((5, 122.5)\)

Explain what the vertex means in the context of this situation.

It took 5 seconds for the rocket to reach the highest height of 122.5 meters.

Score 4: The student gave a complete and correct response.
The path of a rocket is modeled by the function \( h(t) = -4.9t^2 + 49t \), where \( h \) is the height, in meters, above the ground and \( t \) is the time, in seconds, after the rocket is launched.

Sketch the graph on the set of axes below.

State the vertex of this function.

\((5, 122.5)\)

Explain what the vertex means in the context of this situation.

At 5 seconds, the rocket was 122.5 ft in the air.

**Score 3:** The student wrote incorrect units in the explanation.
34 The path of a rocket is modeled by the function \( h(t) = -4.9t^2 + 49t \), where \( h \) is the height, in meters, above the ground and \( t \) is the time, in seconds, after the rocket is launched.

Sketch the graph on the set of axes below.

State the vertex of this function.

Explain what the vertex means in the context of this situation.

The vertex is at \( t = 5 \) seconds. The highest distance the rocket will reach before falling down is 122.5 meters.

Score 2: The student made one graphing error and did not state the vertex.
34 The path of a rocket is modeled by the function $h(t) = -4.9t^2 + 49t$, where $h$ is the height, in meters, above the ground and $t$ is the time, in seconds, after the rocket is launched.

Sketch the graph on the set of axes below.

State the vertex of this function.

$\left(5, 122.5\right)$

Explain what the vertex means in the context of this situation.

it is the highest the rocket got

Score 1: The student stated the vertex correctly.
The path of a rocket is modeled by the function \( h(t) = -4.9t^2 + 49t \), where \( h \) is the height, in meters, above the ground and \( t \) is the time, in seconds, after the rocket is launched.

Sketch the graph on the set of axes below.

State the vertex of this function.

Explain what the vertex means in the context of this situation.

\( (6.16, 116.99) \)

it is the middle point of the graph

Score 0: The student did not show enough correct work to receive any credit.
35 A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

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<thead>
<tr>
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<tbody>
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<td>7.9</td>
</tr>
<tr>
<td>28</td>
<td>9.3</td>
</tr>
</tbody>
</table>

Write the linear regression equation for this set of data.

\[ y = 0.41x - 2.31 \]

State, to the nearest hundredth, the correlation coefficient of these linear data.

0.99 is the correlation coefficient

State what this correlation coefficient indicates about the linear fit of the data.

It indicates that the linear fit of the data is a good fit and a strong positive correlation.

Score 4: The student gave a complete and correct response.
35 A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

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</table>

Write the linear regression equation for this set of data.

\[ y = 0.41x - 2.31 \]

State, to the nearest hundredth, the correlation coefficient of these linear data.

\[ r = 0.99 \]

State what this correlation coefficient indicates about the linear fit of the data.

The correlation coefficient indicates the data has a nearly perfect linear fit.

Score 4: The student gave a complete and correct response.
35 A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

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</table>

Write the linear regression equation for this set of data.

\[
y = 0.38x + (-1.94)\]

State, to the nearest hundredth, the correlation coefficient of these linear data.

\[r = 0.98\]

State what this correlation coefficient indicates about the linear fit of the data.

\[\text{strong}\]

Score 3: The student wrote the full display of their calculator showing incorrect values for \(a\), \(b\), and \(r\).
Question 35

A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

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Write the linear regression equation for this set of data.

\[
y = 0.41x + 2.31\]

State, to the nearest hundredth, the correlation coefficient of these linear data.

\[
r = 0.99\]

State what this correlation coefficient indicates about the linear fit of the data.

Score 3: The student wrote a correct regression equation and correlation coefficient.
A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

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Write the linear regression equation for this set of data.

\[
y = 0.41x - 2.31
\]

State, to the nearest hundredth, the correlation coefficient of these linear data.

State what this correlation coefficient indicates about the linear fit of the data.

Score 2: The student wrote a correct linear regression equation.
35 A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

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Write the linear regression equation for this set of data.

\[ y = 0.41x + 2.31 \]

State, to the nearest hundredth, the correlation coefficient of these linear data.

\[ 0.8 \]

State what this correlation coefficient indicates about the linear fit of the data.

Strong positive

Score 2: The student wrote an incorrect sign in the linear regression equation and wrote an incorrect correlation coefficient.
35 A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

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</table>

Write the linear regression equation for this set of data.

\[ 41x + 2.3 \]

State, to the nearest hundredth, the correlation coefficient of these linear data.

\[ 0.97 \]

State what this correlation coefficient indicates about the linear fit of the data.

its increase of profit

Score 1: The student wrote a correct expression.
A software company kept a record of their annual budget for advertising and their profit for each of the last eight years. These data are shown in the table below.

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</table>

Write the linear regression equation for this set of data.

\[ y = \text{linear equation} \]

State, to the nearest hundredth, the correlation coefficient of these linear data.

\[ r = 0.9 \]

State what this correlation coefficient indicates about the linear fit of the data.

\[ r = 0.9 \]

Score 0: The student showed no correct work.
36 Graph the following system of inequalities on the set of axes below:

\[-2y \leq 3x + 12 \quad \rightarrow \quad -2y < 3x + 12 \quad \quad \frac{x \geq -3}{-3} \]

\[y > -1.5x - 6\]

Label the solution set \(S\).

Allison thinks that \((2, -9)\) is a solution to this system. Determine if Allison is correct. Justify your answer.

Allison is not correct because \((2, -9)\) falls on a dotted line, which is not part of the solution set.

Score 4: The student gave a complete and correct response.
36 Graph the following system of inequalities on the set of axes below:

\[ \begin{align*}
-2y &< 3x + 12 \\
x &\geq -3 \\
\frac{-2y}{-2} &< \frac{3x + 12}{-2} \\
y &> -\frac{3}{2}x - 6
\end{align*} \]

Label the solution set \( S \).

Allison thinks that \((2, -9)\) is a solution to this system. Determine if Allison is correct.

Justify your answer.

\((2, -9)\) is not a solution to the system because it falls on an inequality that cannot contain any solutions since it is not equal to.

**Score 3:** The student did not label either inequality.
Graph the following system of inequalities on the set of axes below:

\[ \begin{align*}
-2y & \leq 3x + 12 \\
x & \geq -3 \\
y & \geq -\frac{2}{3}x - 6
\end{align*} \]

Label the solution set \( S \).

Allison thinks that \((2, -9)\) is a solution to this system. Determine if Allison is correct. Justify your answer.

\[ \text{No because it is on the dashed line which doesn't include the points on the line.} \]

**Score 2:** The student labeled \( S \) correctly based on their graph and wrote an appropriate justification.
Graph the following system of inequalities on the set of axes below:

\[
\begin{align*}
2y & \leq 3x + 12 \\
x & \geq -3
\end{align*}
\]

Label the solution set \( S \).

Allison thinks that \((2, -9)\) is a solution to this system. Determine if Allison is correct. Justify your answer.

**Score 1:** The student labeled \( S \) correctly, based on their graph.
36 Graph the following system of inequalities on the set of axes below:

\[-2y < 3x + 12\]
\[x \geq -3\]

Label the solution set \(S\).

Allison thinks that \((2, -9)\) is a solution to this system. Determine if Allison is correct. Justify your answer.

\[
2(-4) < 3(2) + 12 \quad 18 \geq -3 \checkmark \\
18 < 14 \times \\
\text{No} \quad (2, 4) \text{ does not satisfy both inequalities}
\]

Score 0: The student did not show enough correct work to receive any credit.
Question 36

Graph the following system of inequalities on the set of axes below:

\[-2y < 3x + 12\]
\[x \geq -3\]

Label the solution set \(S\).

Allison thinks that \((2, -9)\) is a solution to this system. Determine if Allison is correct. Justify your answer.

Score 0: The student only graphed one equation correctly.
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take \( x \) hours of classes.

Write an equation that models this situation, where \( A \) represents the total cost of Center A.

\[
y = 25x + 25
\]

Write an equation that models this situation, where \( B \) represents the total cost of Center B.

\[
y = 15x + 75
\]

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

\[
\text{Center A: } 25 \times 10 + 25 = 275 \\
\text{Center B: } 15 \times 10 + 75 = 225
\]

Center B is the better choice as it costs $225 dollars which is less than center A's $275 dollars for 10 hours of classes.

**Score 6:** The student gave a complete and correct response.
Graph your equations for Center \(A\) and Center \(B\) on the set of axes below.

\[
y = 15x + 75 \quad \text{and} \quad y = 25x + 25
\]

State the number of hours of classes when the centers will cost the same.

\[
25x + 25 = 15x + 75
\]
\[
10x = 50
\]
\[
x = 5
\]

\(5\) hours
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take \( x \) hours of classes.

Write an equation that models this situation, where \( A \) represents the total cost of Center A.

\[
a = 25x + 25
\]

Write an equation that models this situation, where \( B \) represents the total cost of Center B.

\[
b = 15x + 75
\]

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

The graph shows that Center B is the better option since it will cost less at 10 hours since Center B is below Center A.

Score 6: The student gave a complete and correct response.
Graph your equations for Center A and Center B on the set of axes below.

State the number of hours of classes when the centers will cost the same.

5 hours
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take $x$ hours of classes.

Write an equation that models this situation, where $A$ represents the total cost of Center A.

$$A = 25x + 25$$

Write an equation that models this situation, where $B$ represents the total cost of Center B.

$$B = 15x + 75$$

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

For Center A:

$$25(10) + 25 = 275$$

For Center B:

$$15(10) + 75 = 225$$

Center B will cost less.

**Question 37 is continued on the next page.**

**Score 5:** The student wrote expressions for Center A and Center B.
State the number of hours of classes when the centers will cost the same.

5 hours
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take $x$ hours of classes.

Write an equation that models this situation, where $A$ represents the total cost of Center A.

$$A = 25x + 25$$

Write an equation that models this situation, where $B$ represents the total cost of Center B.

$$B = 15x + 75$$

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

$$A = 25(10) + 25 = 275$$

$$B = 15(10) + 75 = 225$$

Center B is a better choice.

Score 5: The student made one graphing error by extending the lines with arrows on the left.
Question 37 continued

Graph your equations for Center A and Center B on the set of axes below.

State the number of hours of classes when the centers will cost the same.

at 5 hrs.
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take $x$ hours of classes.

Write an equation that models this situation, where $A$ represents the total cost of Center A.

Write an equation that models this situation, where $B$ represents the total cost of Center B.

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

Option A - 10 hours = $275

Option B - 10 hours = $225

Option B is the cheaper choice.

Score 4: The student did not write a system of equations.
Question 37 continued

Graph your equations for Center A and Center B on the set of axes below.

State the number of hours of classes when the centers will cost the same.

5 hours
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take $x$ hours of classes.

Write an equation that models this situation, where $A$ represents the total cost of Center A.

\[ y = 25x + 25 \]

Write an equation that models this situation, where $B$ represents the total cost of Center B.

\[ y = 15x + 75 \]

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

\[ 15(10) + 75 = y \quad 25(10) + 25 = y \]
\[ 150 + 75 = y \quad 250 + 25 = y \]
\[ 225 = y \quad 275 = y \]

She should use Center B because it will cost less.

Question 37 is continued on the next page.

**Score 4:** The student wrote both equations in terms of $y$ and did not label either graph.
State the number of hours of classes when the centers will cost the same.

5 hours
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take $x$ hours of classes.

Write an equation that models this situation, where $A$ represents the total cost of Center A.

Write an equation that models this situation, where $B$ represents the total cost of Center B.

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

My graphs show that Center B is the better choice because the amount of money paid increases slower. By 10 hours, at Center A you would have spent more money than you would've at Center B.

Question 37 is continued on the next page.

Score 3: The student did not write a system of equations and did not label either equation on their graph.
Question 37 continued

Graph your equations for Center A and Center B on the set of axes below.

State the number of hours of classes when the centers will cost the same.

5 hours
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take $x$ hours of classes.

Write an equation that models this situation, where $A$ represents the total cost of Center A.

Write an equation that models this situation, where $B$ represents the total cost of Center B.

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

Score 2: The student stated 5 and determined that Center B was less expensive.
Graph your equations for Center A and Center B on the set of axes below.

State the number of hours of classes when the centers will cost the same.
Lydia wants to take art classes. She compares the cost at two art centers. Center A charges $25 per hour and a registration fee of $25. Center B charges $15 per hour and a registration fee of $75. Lydia plans to take $x$ hours of classes.

Write an equation that models this situation, where $A$ represents the total cost of Center A.

$$C_A = 25x + 25$$

Write an equation that models this situation, where $B$ represents the total cost of Center B.

$$C_B = 15x + 75$$

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less.

Score 1: The student wrote $C_1$ and $C_2$ in the system of equations.
Question 37 continued

Graph your equations for Center A and Center B on the set of axes below.

State the number of hours of classes when the centers will cost the same.
37 Lydia wants to take art classes. She compares the cost at two art centers. Center A charges \$25 per hour and a registration fee of \$25. Center B charges \$15 per hour and a registration fee of \$75. Lydia plans to take \(x\) hours of classes.

Write an equation that models this situation, where \(A\) represents the total cost of Center A.

Write an equation that models this situation, where \(B\) represents the total cost of Center B.

If Lydia wants to take 10 hours of classes, use your equations to determine which center will cost less. (I0c)

\[
25(x) + 25 = \]$75 \[
25 - 15 + 75 = \]$100

Score 0: The student did not show enough work to receive any credit.
Graph your equations for Center A and Center B on the set of axes below.

State the number of hours of classes when the centers will cost the same.

3 hours