Question 28

28 In a certain school, the heights of the population of girls are normally distributed, with a mean of 63 inches and a standard deviation of 2 inches. If there are 450 girls in the school, determine how many of the girls are shorter than 60 inches. Round the answer to the nearest integer.

Score 2: The student has a complete and correct response.
In a certain school, the heights of the population of girls are normally distributed, with a mean of 63 inches and a standard deviation of 2 inches. If there are 450 girls in the school, determine how many of the girls are shorter than 60 inches. Round the answer to the nearest integer.

\[
\text{normalcdf}\left(9E-99, 60, 63, 2\right) = 0.0668
\]

\[
(0.0668)(450) = 30.06 \approx 30
\]

**Score 2:** The student has a complete and correct response.
In a certain school, the heights of the population of girls are normally distributed, with a mean of 63 inches and a standard deviation of 2 inches. If there are 450 girls in the school, determine how many of the girls are shorter than 60 inches. Round the answer to the nearest integer.

\[
\begin{align*}
\text{34.1}\% & \quad 57 < 59 < 61 \quad 63 \\
\text{53.8}\% & \quad 4.4\% \quad 1.7\% \quad 0.1\% \quad 1.5\%
\end{align*}
\]

\[\boxed{6.7\%}\]

**Score 1:** The student made one conceptual error by finding the percentage of girls shorter than 60 inches, but not how many girls.
Question 28

28 In a certain school, the heights of the population of girls are normally distributed, with a mean of 63 inches and a standard deviation of 2 inches. If there are 450 girls in the school, determine how many of the girls are shorter than 60 inches. Round the answer to the nearest integer.

Score 0: The student made one conceptual error and one computational error.
The table below shows the concentration of ozone in Earth’s atmosphere at different altitudes. Write the exponential regression equation that models these data, rounding all values to the nearest thousandth.

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\[ y = e^{0.488 \times 1.116^x} \]

Score 2: The student has a complete and correct response.
The table below shows the concentration of ozone in Earth’s atmosphere at different altitudes. Write the exponential regression equation that models these data, rounding all values to the nearest thousandth.

**Concentration of Ozone**

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\[ y = a \cdot b^x \]
\[ a = 0.488 \cdot 1560152 \]
\[ b = 1.116306161 \]
\[ r^2 = 0.8911842707 \]
\[ r = 0.9440255667 \]

\[ y = a \cdot b^x \]
\[ y = 0.488 \cdot 1.116^x \]

**Score 2:** The student has a complete and correct response.
The table below shows the concentration of ozone in Earth’s atmosphere at different altitudes. Write the exponential regression equation that models these data, rounding all values to the nearest thousandth.

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\[ a = 0.79, \quad b = 1.12, \quad r^2 = 0.89, \quad r = 0.94 \]

\[ y = (a)(b)^x \]

**Score 1:** The student made one rounding error.
29 The table below shows the concentration of ozone in Earth’s atmosphere at different altitudes. Write the exponential regression equation that models these data, rounding all values to the nearest thousandth.

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\[ a = 0.4881560152 \]

\[ b = 1.116300141 \]

\[ 0.488 \cdot 1.116^x \]

**Score 1:** The student wrote an exponential regression expression.
29 The table below shows the concentration of ozone in Earth's atmosphere at different altitudes. Write the exponential regression equation that models these data, rounding all values to the nearest thousandth.

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<td>4.9</td>
</tr>
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</table>

\[
a = 0.49 \\
b = 1.12 \\
r^2 = 0.89 \\
r = 0.94
\]

Score 0: The student made one rounding error and did not write an exponential regression equation.
30 Solve $|2x - 3| > 5$ algebraically.

\[
\begin{align*}
2x - 3 &> 5 \\
2x - 3 &< -5 \\
2x &> 8 \\
x &> 4 \\
\end{align*}
\]

\[
\begin{align*}
2x &< -2 \\
x &< -1 \\
\end{align*}
\]

Score 2: The student has a complete and correct response.
30 Solve \( |2x - 3| > 5 \) algebraically.

\[
\begin{align*}
2x - 3 &= 6 \\
2x &= 9 \\
x &= 4.5 \\
\end{align*}
\]

\[
\begin{align*}
-2x + 3 &= -3 \\
-2x &= -6 \\
x &= 3 \\
\end{align*}
\]

\[
\begin{align*}
\frac{2x}{2} &= \frac{9}{2} \\
x &= 4.5 \\
\end{align*}
\]

\[
\begin{align*}
\frac{-2x}{-2} &= \frac{-6}{-2} \\
x &= 3 \\
\end{align*}
\]

\[
\begin{align*}
1: &-2 \; T \\
2: &0 \; F \\
3: &5 \; T \\
\end{align*}
\]

Score 2: The student has a complete and correct response.
30 Solve $|2x - 3| > 5$ algebraically.

\[
\begin{align*}
2x - 3 &> 5 \\
2x &> 8 \\
x &> 4
\end{align*}
\quad
\begin{align*}
2x - 3 &\leq -5 \\
2x &\leq -2 \\
x &\leq -1
\end{align*}
\]

Score 2: The student has a complete and correct response.
30 Solve \(|2x - 3| > 5\) algebraically.

\[
\begin{align*}
2x - 3 & > 5 \\
2x & > 8 \\
x & > 4 \\

2x - 3 & \leq -5 \\
2x & \leq -2 \\
x & \leq -1
\end{align*}
\]

**Score 1:** The student did not express the answer as a disjunction.
30 Solve $|2x - 3| > 5$ algebraically.

\[
\begin{align*}
2x - 3 & > 5 \\
2x - 3 & < -5 \\
2x & > 8 \\
2x & < -2 \\
x & > 4 \\
x & < -4
\end{align*}
\]

**Score 1:** The student made one computational (copy) error.
30 Solve $|2x - 3| > 5$ algebraically.

\[
\begin{align*}
\frac{-2x + 3}{1} & > 5 \\
-2x & > 2 \\
x & < -1
\end{align*}
\]

**Score 1:** The student showed appropriate work to find $x < -1$, only.
Question 30

30 Solve $|2x - 3| > 5$ algebraically.

- $2x - 3 > 5$
  - $2x > 8$
  - $x > 4$

- $2x - 3 < -5$
  - $2x < -2$
  - $x < -1$

$x > 4$

Score 0: The student made one conceptual error and one computational error.
30 Solve $|2x - 3| > 5$ algebraically.

Score 0: The student made multiple conceptual errors.
31 Convert 2.5 radians to degrees, and express the answer to the nearest minute.

\[
\frac{2.5 \cdot 180}{\pi} = \frac{450}{\pi}
\]

\[143^\circ14', \text{ or } 143.23^\circ\]

**Score 2:** The student has a complete and correct response.
Question 31

31 Convert 2.5 radians to degrees, and express the answer to the nearest minute.

\[
2.5 \left( \frac{180}{\pi} \right) = 143.2394488 = 143^\circ
\]

Score 1: The student made one conceptual error by not expressing the answer to the nearest minute.
Question 31

31 Convert 2.5 radians to degrees, and express the answer to the nearest minute.

\[
\frac{2.5 \pi \cdot 180}{\pi} = 270
\]

Score 0: The student made one conceptual error and one computational error.
32 Multiply $x + yi$ by its conjugate, and express the product in simplest form.

\[
(x + yi)(x - yi) = x^2 - y^2i^2 = x^2 + y^2
\]

Score 2: The student has a complete and correct response.
32 Multiply $x + yi$ by its conjugate, and express the product in simplest form.

\[
(x + yi)(x - yi) = x^2 - (yi)^2 = x^2 - y^2i^2
\]

**Score 1:** The student made one conceptual error by not substituting for $i^2$. 

32 Multiply $x + yi$ by its conjugate, and express the product in simplest form.

\[
(x + yi)(-x - yi) = -x^2 + xyi - xyi - yi^2
\]

\[
= -x^2 + xyi - xyi - y^2
\]

\[
= -x^2 - y^2
\]

\[
= -x^2 + 2
\]

Conjugates.

**Score 0:** The student made one conceptual error in writing the conjugate and multiple computational errors.
33 Solve algebraically for $x$:

$$\log_{5x-1} 4 = \frac{1}{3}$$

$$(5x-1)^{\frac{1}{3}} = 4$$

$$5x-1 = 4^3$$

$$5x-1 = 64$$

$$5x = 65$$

$$x = 13$$

**Score 2:** The student has a complete and correct response.
33 Solve algebraically for $x$:

$$\log_{5x-1} 4 = \frac{1}{3}$$

$$\frac{\log 4}{\log (5x-1)} = \frac{1}{3}$$

$$3 \log 4 = \log (5x-1)$$

$$\log 64 = \log (5x-1)$$

$$64 = 5x - 1$$

$$65 = 5x$$

$$x = 13$$

**Score 2:** The student has a complete and correct response.
33 Solve algebraically for $x$:

$$\log_{5x-1} 4 = \frac{1}{3}$$

$$\left( \frac{1}{5x-1} \right)^3 = 4$$

$$5x^{\frac{1}{3}} - 1^{\frac{1}{3}} = 4$$

$$\downarrow$$

$$5x^{\frac{1}{3}} = 4 + 1^{\frac{1}{3}} \left( \begin{array}{c} \text{31} \\ \text{9} \end{array} \right)$$

$$5x^{\frac{1}{3}} = 5^{\frac{1}{3}} + 1$$

$$5x = \left( \frac{5}{3} \right)^3 + 1$$

$$5x = \frac{64}{27} + 1$$

$$\frac{5x}{5} = \frac{64}{27}$$

$$x = \frac{13}{3}$$

**Score 1:** The equation $(5x - 1)^{\frac{1}{3}} = 4$ is written, but no further correct work is shown.
33 Solve algebraically for $x$:

$$\log_{5x-1} 4 = \frac{1}{3}$$

$$5x-1^{\frac{1}{3}} = 4$$

$$\frac{5x}{4} = 4 + 1$$

$$\frac{5x}{5} = \frac{5}{5}$$

$$x = 1$$

**Score 1:** The student made one conceptual error.
33 Solve algebraically for $x$:

$$\log_{5x-1} 4 = \frac{1}{3}$$

$$(5x-1)^3 = 4$$

$$5x - 1 = 4^{\frac{1}{3}}$$

$$5x - 1 = 1.58$$

$$x = 1.516$$

**Score 0:** The student made one conceptual error and one rounding error.
34 Solve $\sec x - \sqrt{2} = 0$ algebraically for all values of $x$ in $0^\circ \leq x < 360^\circ$.

\[
\sec x - \sqrt{2} = 0 \\
\sec x = \sqrt{2} \\
\begin{align*}
\square 1, 11 \, \text{V} \\
R & \, 45^\circ \\
S & \, 45^\circ \\
360 - 45 & = 315
\end{align*}
\]

Score 2: The student has a complete and correct response.
34 Solve \( \sec x - \sqrt{2} = 0 \) algebraically for all values of \( x \) in \( 0^\circ \leq x < 360^\circ \).

\[
\sec(x) = \sqrt{2} \\
x = 45^\circ
\]

\[
45^\circ, 135^\circ, 225^\circ, 315^\circ
\]

\[
45^\circ + 90^\circ = 135^\circ \\
45^\circ + 180^\circ = 225^\circ \\
45^\circ + 270^\circ = 315^\circ
\]

**Score 1:** The student found one solution, but no further correct work is shown.
34 Solve $\sec x - \sqrt{2} = 0$ algebraically for all values of $x$ in $0^\circ \leq x < 360^\circ$.

\[
\frac{1}{\cos x} - \sqrt{2} = 0
\]

\[
\frac{1}{\cos x} = \sqrt{2}
\]

\[
\cos x = \frac{1}{\sqrt{2}}
\]

Score 0: The student did not find any solutions.
34 Solve $\sec x - \sqrt{2} = 0$ algebraically for all values of $x$ in $0^\circ \leq x < 360^\circ$.

Score 0: The student made one conceptual error and then found only one solution.
35 The function $f(x)$ is graphed on the set of axes below.

On the same set of axes, graph $f(x + 1) + 2$.

**Score 2:** The student has a complete and correct response.
35 The function \( f(x) \) is graphed on the set of axes below.

On the same set of axes, graph \( f(x + 1) + 2 \).

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

Score 1: The student made one conceptual error by applying the transformation to \( y = x^2 \).
35 The function \( f(x) \) is graphed on the set of axes below.

On the same set of axes, graph \( f(x + 1) + 2 \).

Score 0: The student made multiple graphing errors.
Question 36

36 Express in simplest terms:

\[
\frac{\frac{x^2 + 3}{x} \frac{\sqrt{100}}{\sqrt{2}}}{\frac{x^2 - 5x - 24}{x^2}}
\]

\[
\frac{x^2 + 3x}{x^2 - 5x - 24} = \frac{x(x+3)}{(x+3)(x-8)}
\]

\[
\frac{x}{x-8}
\]

Score 4: The student has a complete and correct response.
36 Express in simplest terms:

\[
\frac{1 + \frac{3}{x}}{\frac{1 - \frac{5}{x}}{\frac{24}{x^2}}}
\]

\[
\frac{x^3}{x^2} - \frac{3x^2}{x^2}
\]

\[
\frac{x^3 - 5x^2 - 3x}{x^2 - 8x + 3}
\]

\[
\frac{x^2}{x - 8}
\]

Score 3: The student made one factoring error.
Question 36

Express in simplest terms:

\[
\frac{\left(1 + \frac{3}{x}\right) x}{\left(1 - \frac{5}{x} - \frac{24}{x^2}\right) x^2} \rightarrow \frac{x + 3 - 1}{x^2 - 5x - 24} \frac{1}{(x-8)(x+3)}
\]

Score 2: The student made one conceptual error.
36 Express in simplest terms:

\[
\frac{\frac{1}{x} + \frac{3}{x}}{1 - \frac{5}{x} - \frac{24}{x^2}}
\]

\[
\frac{(x^3 + 3x)}{x} + \frac{x + 3}{x}
\]

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

Score 1: The student made one conceptual error and one simplification error.
Question 36

36 Express in simplest terms:

\[
\frac{(x^2 + \frac{3}{x})}{(x^2 - \frac{5}{x^2} - \frac{24}{x^2})} = \frac{x + 3}{x} \cdot \frac{x^2 - 5x - 24}{x^3} \cdot \frac{x + 3}{x - 8} \cdot \frac{x - 8}{x}
\]

**Score 0:** The student made two conceptual errors.
37 Solve \( x^3 + 5x^2 = 4x + 20 \) algebraically.

\[
\begin{align*}
-4x - 20 \\
& \quad \quad \quad \quad x^3 + 5x^2 = 4x - 20 \\
& \quad \quad \quad \quad x^2(x+5) - 4(x+5) \\
& \quad \quad \quad \quad (x^2 - 4) \quad \quad (x+5) = 0 \\
& \quad \quad \quad \quad x^2 - 4 = 0 \\
& \quad \quad \quad \quad x = 2 \\
& \quad \quad \quad \quad x = -2 \\
& \quad \quad \quad \quad x + 5 = 0 \\
& \quad \quad \quad \quad x = -5
\end{align*}
\]

**Score 4:** The student has a complete and correct response.
37 Solve $x^3 + 5x^2 = 4x + 20$ algebraically.

\[
\begin{align*}
\frac{x^3 + 5x^2 - 4x - 20}{x^2 (x + 5) - 4 (x + 5)} &= 0 \\
(x^2 - 4) (x + 5) &= 0 \\
(x - 4)(x + 4)(x + 5) &= 0
\end{align*}
\]

\[
\begin{array}{c|c|c|c}
\hline
x - 4 & x + 4 & x + 5 \\
\hline
0 & 0 & 0 \\
-4 & -4 & -5 \\
-4 & -5 & -5 \\
\hline
\end{array}
\]

\[
\begin{align*}
x &= 4 \\
\frac{1}{4} + \frac{1}{4} \\
x &= -4 \\
\frac{1}{4} & -5 \\
1 & 1 \\
x &= -5 \\
\end{align*}
\]

\[\{ -4, 1, -5 \} \]

Score 3:  The student made one factoring error.
37 Solve \( x^3 + 5x^2 = 4x + 20 \) algebraically.

\[
\begin{align*}
&x^3 + 5x^2 - 4x - 20 = 0 \\
&(x^2(x + 5) - 4(x + 5) = 0 \\
&(x^2 - 4)(x + 5) = 0 \\
&(-2)(x - 2)(x + 5) = 0
\end{align*}
\]

**Score 2:** The student wrote \((x^2 - 4)(x + 5) = 0\), but did not complete the solution.
37 Solve $x^3 + 5x^2 = 4x + 20$ algebraically.

Score 2: The student used a method other than algebraic to solve the equation.
37 Solve \( x^3 + 5x^2 = 4x + 20 \) algebraically.

\[
\begin{align*}
    x^3 + 5x^2 & = 4x + 20 \\
    x^3 + 5x^2 - 4x - 20 & = 0 \\
    x \left( x^2 + 5x - 4 - 20 \right) & = 0 \\
    x=0 & \quad \left( x^2 + 5x - 24 \right) = 0 \\
    (x-3)(x+8) & = 0 \\
    x=3 & \quad x=-8
\end{align*}
\]

Score 1: The student made one conceptual error by misidentifying the GCF as \( x \) and then rejected \( x = 0 \) as part of the solution.
37 Solve $x^3 + 5x^2 = 4x + 20$ algebraically.

\[
x^2(x+5) = 4(x+5)
\]

\[
\sqrt{x^2} = \sqrt{4}
\]

\[
x = 2
\]

**Score 0:** The student made two conceptual errors.
Question 38

38 Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

\[ P \cdot 0.57 \]
\[ Q \cdot 0.43 \]
\[ n \cdot 5 \]
\[ r \cdot 2, 1, 0 \]

\[ \binom{5}{2} \cdot (0.57)^2 \cdot (0.43)^3 = 0.258318243 \]
\[ \binom{5}{1} \cdot (0.57)^1 \cdot (0.43)^4 = 0.0974352285 \]
\[ \binom{5}{0} \cdot (0.57)^0 \cdot (0.43)^5 = 0.014708443 \]

\[ 0.37 \]

Score 4: The student has a complete and correct response.
38 Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

\[
\text{binomial pdf (5, 0.57, 0) + binomial pdf (5, 0.57, 1) + binomial pdf (5, 0.57, 2)} = 0.3704549158
\]

Score 4: The student has a complete and correct response.
Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

\[
\begin{align*}
\sum_{i=0}^{5} \binom{5}{i} (0.57)^i (0.43)^{5-i} &= 0.0147008443 \\
\sum_{i=1}^{5} \binom{5}{i} (0.57)^{i-1} (0.43)^{6-i} &= 0.0974358285 \\
\sum_{i=2}^{5} \binom{5}{i} (0.57)^{i-2} (0.43)^{7-i} &= 0.558318243
\end{align*}
\]

**Score 3:** The student did not find the sum.
38 Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

\[ P = 0.57 \quad Q = 0.43 \]

\[ n = 5, \quad r = 1, 2 \]

\[ \binom{5}{1} \times 0.57 \times 0.43^4 + \binom{5}{2} \times 0.57^2 \times 0.43^3 \]

\[ = 0.9743583 \quad 2.58318 = 0.36 \]

\[ = 36\% \]

**Score 2:** The student made one conceptual error by not finding the probability of \( \binom{5}{0} \).
Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

\[
\begin{align*}
\binom{5}{0} \left(\frac{57}{100}\right)^0 \left(\frac{43}{100}\right)^5 \\
\binom{5}{1} \left(\frac{57}{100}\right)^1 \left(\frac{43}{100}\right)^4 \\
\binom{5}{2} \left(\frac{57}{100}\right)^2 \left(\frac{43}{100}\right)^3 \\
\binom{5}{3} \left(\frac{57}{100}\right)^3 \left(\frac{43}{100}\right)^2 \\
\binom{5}{4} \left(\frac{57}{100}\right)^4 \left(\frac{43}{100}\right)^1 \\
\binom{5}{5} \left(\frac{57}{100}\right)^5 \left(\frac{43}{100}\right)^0
\end{align*}
\]

\[0.029345007\]

\[0.03418801\]

\[0.079507\]

\[0.25042215\]

\[0.1146725636\]

\[0.0944330285\]

\[0.268182493\]

\[0.47\] chance of horror movies

Score 2: The student made two computational errors when evaluating \(\binom{5}{0} \left(\frac{57}{100}\right)^0 \left(\frac{43}{100}\right)^5\).
Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

\[ \binom{5}{2} (0.57)^2 (0.43)^3 = 0.26 \]

**Score 1:** The student found the probability of exactly two movies.
38 Whenever Sara rents a movie, the probability that it is a horror movie is 0.57. Of the next five movies she rents, determine the probability, to the nearest hundredth, that no more than two of these rentals are horror movies.

\[
\binom{5}{2} \left( \frac{57}{100} \right)^2 \left( \frac{43}{100} \right)^3 = 0.92
\]

**Score 0:** The student did not correctly evaluate the probability of exactly two movies.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.
Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

\[ a^2 = 28^2 + 40^2 - 2(28)(40)\cos 115° \]
\[ a^2 = 3330.4649 \]
\[ a = 57.7119 \]

\[ \frac{40}{\sin x} = \frac{58}{\sin 115°} \]
\[ 40\sin 115° = 58 \sin x \]
\[ 0.6250 = \sin x \]
\[ 38.6851 = x \]

Score 6: The student has a complete and correct response.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.

Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

\[ a^2 = b^2 + c^2 - 2bc \cos A \]
\[ a^2 = 28^2 + 40^2 - 2(28)(40) \cos 115 \]
\[ a^2 = 3330.664906 \]
\[ a = 57.7119 \]

\[ 40^2 = 28^2 + 58^2 - 2(28)(58) \cos x \]
\[ 1600 = 784 + 3364 - 3248 \cos x \]
\[ 1600 = 4148 - 3248 \cos x \]
\[ -2548 = -3248 \cos x \]
\[ 0.784482759 = \cos x \]
\[ x = 38.327 \]
\[ x = 38° \]

**Score 6:** The student has a complete and correct response.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.

Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

\[
c^2 = a^2 + b^2 - 2ab\cos C
\]

\[
c^2 = 28^2 + 40^2 - 28(40)\cos 115°
\]

\[c \approx 53 \text{ lbs}
\]

Score 5: The student made one computational error by dropping the 2 in the equation

\[c^2 = 28^2 + 40^2 - 28(40)\cos 115°.
\]
39 Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.
Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

\[ r^2 = 40^2 + 28^2 - 2(40)(28) \cos 115^\circ \]
\[ r \approx 5.8 \approx 56 \text{ pounds} \]

\[ 28^2 = 56^2 + 40^2 - 2(56)(40) \cos A \]
\[ 784 = 4736 - 4480 \cos A \]
\[ -3952 = -4480 \cos A \]
\[ \cos A \approx 0.88214 \]
\[ A \approx 28^\circ \]

**Score 5:** The student found the magnitude of the resultant incorrectly by using radians instead of degrees, but then correctly found the angle, in degrees, based on their magnitude.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.

Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

**Law of Cosines**

\[ a^2 = b^2 + c^2 - 2bc \cos A \]

\[ a^2 = (40)^2 + (28)^2 - 2(40)(28) \cos 65° \]

\[ a^2 = 2384 - 964.6649063 \]

\[ a = \sqrt{1437.335094} \]

\[ a = 37.91220244 \]

Magnitude of resultant = 38 lb

**Law of Sines**

\[ \frac{a}{\sin A} = \frac{b}{\sin B} \]

\[ \frac{38}{\sin 65°} = \frac{40}{\sin B} \]

\[ 38\sin B = \frac{40 \sin 65°}{38} \]

\[ \sin B = \frac{40 \sin 65°}{38} \]

\[ \sin B = 0.9540081969 \]

\[ B = 72.55557886° \]

\[ \angle = 73° \]

**Score 4:** The student made one conceptual error.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound. Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

\[ x^2 = 28^2 + 40^2 - 2(28)(40) \cos 15° \]
\[ x^2 = 3330.164 \]
\[ x = 58 \]

\[ \frac{x}{\sin 15°} = \frac{58}{\sin 40°} \]

\[ \frac{58 \sin 40°}{\sin 15°} = x \frac{\sin 15°}{\sin 15°} \]

\[ x = 41° \]

**Score 4:** The student made one conceptual error in using the Law of Sines.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.

Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

\[
\begin{align*}
C &= a^2 + b^2 - 2ab \cos C \\
&= 28^2 + 40^2 - 2(28)(40) \cos 65° \\
&= 784 + 1600 - 2240 \cos 65° \\
&= 2384 - 2240 \cos 65° \\
&= 1437 \\
C &= 38
\end{align*}
\]

\[
\frac{\sin 65°}{38} = \frac{\sin x}{40}
\]

\[36 = 38 \sin x\]

\[x = 72°\]

Score 3:  The student made one conceptual error and one rounding error.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.

Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

Score 2: The student made two conceptual errors.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.
Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

Score 2: The student made one conceptual error in finding the resultant, followed by one rounding error and one computational error in using the Law of Sines.
Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is $65^\circ$. Find the magnitude of the resultant force, to the nearest pound.

Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

\[
a^2 = 28^2 + 40^2 - 2(28)(40)\cos 50^\circ
\]
\[
a = \sqrt{2161.5} \approx 46.5 \text{ lbs}
\]

Score 1: The student correctly drew and labeled the diagram, but no further correct work is shown.
Question 39

39 Two forces of 40 pounds and 28 pounds act on an object. The angle between the two forces is 65°. Find the magnitude of the resultant force, to the nearest pound.

Using this answer, find the measure of the angle formed between the resultant and the smaller force, to the nearest degree.

\[ a^2 + b^2 = c^2 \]
\[ 28^2 + 40^2 = c^2 \]
\[ 784 + 1600 = c^2 \]
\[ \sqrt{2384} = c \]
\[ 48.8 = c \]

\[ c^2 = a^2 + b^2 - 2ab \cos C \]
\[ 48.8^2 = 40^2 + 28^2 - 2(40)(28) \cos C \]
\[ 2304 = 1600 + 784 - 2(1120) \cos C \]
\[ 2304 = 1600 + 784 - 2240 \cos C \]
\[ 2304 = 2384 - 2240 \cos C \]
\[ \frac{2304}{144} = \frac{144 \cos C}{144} \]
\[ 16 = \cos C \]

Score 0: The student did not label the diagram, made two conceptual errors and one rounding error, and did not state the angle.