Determine the average rate of change, in mph, from 2 to 4 hours on the graph shown below.

\[ \frac{60 - 20}{4 - 2} = \frac{40}{2} = 20 \]

20 mph = average rate of change

Score 2: The student gave a complete and correct response.
25 Determine the average rate of change, in mph, from 2 to 4 hours on the graph shown below.

\[
\frac{40 \text{ miles}}{2 \text{ hours}} = 20 \text{ mph}
\]

Score 2: The student gave a complete and correct response.
25 Determine the average rate of change, in mph, from 2 to 4 hours on the graph shown below.

Average rate of change = 20 mph

Score 1: The student did not show any work.
25 Determine the average rate of change, in mph, from 2 to 4 hours on the graph shown below.

\[
\frac{20}{2} = 10 \text{ mph} \quad \frac{10 + 8.\overline{3} + 15}{3} = \frac{33.\overline{3}}{3} \quad \frac{25}{3} = 8.\overline{3} \text{ mph} \quad \underline{\text{= 11.1 mph}} \\
\frac{60}{4} = 15 \text{ mph}
\]
25 Determine the average rate of change, in mph, from 2 to 4 hours on the graph shown below.

He increased by 40 miles

Score 0: The student did not show enough correct work to receive any credit.
Factor the expression \( x^3 - 2x^2 - 9x + 18 \) completely.

\[
x^2(x-2) \quad \Downarrow \quad -9(x-2)
\]

\[
(x^2 - 9)(x-2)
\]

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

**Score 2:** The student gave a complete and correct response.
26 Factor the expression \( x^3 - 2x^2 - 9x + 18 \) completely.

\[
(x^3 - 2x^2 - 9x + 18) = (x^2 - 3)(x - 2) - 9(x - 2) = (x^2 - 9)(x - 2) = (x - 3)(x + 3)(x - 2)
\]

\[
x = \pm 3, 2, 3
\]

**Score 1:** The student found the roots after factoring completely.
Factor the expression \( x^3 - 2x^2 - 9x + 18 \) completely.

\[
x^3 - 2x^2 + 9x + 18
\]

\[
x(x - 2) - 9(x - 2)
\]

\[
(x - 9)(x - 2)
\]

Score 1: The student made a factoring error.
26 Factor the expression $x^3 - 2x^2 - 9x + 18$ completely.

\[ x^3 - 2x^2 - 9x + 18 = x(x^2 - 2x - 9 + 18) = x(x^2 - 2x + 9) = x(x - 3)(x + 3) \]

**Score 0:** The student made multiple factoring errors.
26 Factor the expression \((x^3 - 2x^2)(9x + 18)\) completely.

\[
\begin{align*}
&x^2(x-2) + 9(x-2) \\
&= (x^2+9)(x-2) = 0 \\
&x^2+9=0 \\
&x=\pm\sqrt{-9} \\
&x=\pm3i
\end{align*}
\]

**Score 0:** The student made a factoring error and found the roots.
27 Solve algebraically for all values of $x$:

\[
\sqrt{4x + 1} = 11 - x
\]

\[
(\sqrt{4x + 1})^2 = (11 - x)^2
\]

\[
4x + 1 = x^2 - 22x + 121
\]

\[
0 = x^2 - 26x + 120
\]

\[
(x-20)(x-6)
\]

\[
x = 20, 6
\]

\[
\sqrt{4\cdot20+1} = 11-20
\]

\[
\sqrt{81} = -9
\]

\[
9 \neq -9
\]

\[
\sqrt{4\cdot6+1} = 11-6
\]

\[
\sqrt{25} = 5
\]

\[
x = 6
\]

Score 2: The student gave a complete and correct response.
27 Solve algebraically for all values of $x$:

\[
\sqrt{\frac{x^2}{4x+1}} = \left(1 - \frac{x}{2}\right)^2
\]

\[
4x+1 = (1-x)(1-x)
\]

\[
4x+1 = 121-11x-11x+x^2
\]

\[
4x+1 = x^2-22x+121
\]

\[
x^2-26x+120=0
\]

\[
(x^2-10x)(20x-120)=0
\]

\[
x(x-10)+20(x-10)=0
\]

\[
(x-10)(x-20)=0
\]

\[
x=10 \quad x=20
\]
27 Solve algebraically for all values of $x$:

\[
\left(\sqrt{4x+1} - 11 + x\right)^2 = (1-x)(1-x)
\]

\[
4x+1 = 121 + 22x + x^2
\]

\[
-4x - 1 - 4x - 1
\]

\[
0 = x^2 - 26x + 120
\]

\[
0 = (x - 20)(x - 6)
\]

\[
x - 20 = 0 \quad x - 6 = 0
\]

\[
+20 +26 +6 +6
\]

\[
x = 20 \quad x = 6
\]

CHECKS

\[
\sqrt{4x+1} = 11 - x
\]

\[
\sqrt{4(0)+1} = 11 - 20
\]

\[
\sqrt{81} = 11 - 20
\]

\[
\pm 9 = 11 - 20
\]

\[
-9 \neq -9
\]

\[
\sqrt{4(16)+1} = 11 - 6
\]

\[
\sqrt{25} = 11 - 6
\]

\[
\pm 5 = 11 - 6
\]

Score 1: The student made a computational error in the check for extraneous roots.
27 Solve algebraically for all values of $x$:

\[
\sqrt{4x + 1} = 11 - x
\]

$x = 6$

Score 1: The student received credit for stating 6.
27 Solve algebraically for all values of $x$:

$$\sqrt{4x + 1} = 11 - x$$

\[
\left(\sqrt{4x + 1}\right)^2 = (11 - x)^2
\]

\[
4x + 1 = -x^2 - 22x + 121
\]

\[
x^2 + 26x - 120 = 0
\]

\[
(x + 30)(x - 4) = 0
\]

\[
x = -30, 4
\]

No Solutions

Score 1: The student made one computational error.
27 Solve algebraically for all values of $x$:

\[ \sqrt{4x + 1} = 11 - x \]

\[ 4x + 1 = -x^2 + 121 \]

\[ x^2 + 4x + 1 = 121 \]

\[ x^2 + 4x - 120 = 0 \]

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

\[ = \frac{-2 \pm \sqrt{49}}{-2} \]

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

**Score 0:** The student made multiple errors.
27 Solve algebraically for all values of $x$:

\[ \sqrt{4x + 1} = 11 - x \]

\[ 4x + 1 = (11 - x)^2 \]

\[ 4x + 1 = 121 - 22x - x^2 \]

\[ 26x = 120 - x^2 \]

\[ 0 = -x^2 - 26x + 120 \]

\[ x^2 + 26x - 120 \]

\[ (x - 4)(x + 30) \]

\[ x = 4 \quad x = -30 \]

**Score 0:** The student made a computational error and did not check for extraneous roots.
28 Given that \( \left( \frac{y^{17/8}}{y^{10/8}} \right)^{-4} = y^n \), where \( y > 0 \), determine the value of \( n \).

\[
\left( \frac{y^{17/8}}{y^{10/8}} \right)^{-4} = y^n
\]

\[
y = y^{-7/2}
\]

**Score 2:** The student gave a complete and correct response.
28 Given that \( \left( \frac{\frac{17}{y}}{\frac{3}{y}} \right)^{-4} = y^n \), where \( y > 0 \), determine the value of \( n \).

\[
\left( \frac{\frac{17}{y}}{\frac{3}{y}} \right)^{-4} = y^n
\]

\[
\left( \frac{17}{3} \frac{y}{\frac{17}{3}} \right)^{4} = y^n
\]

\[
\left( \frac{17}{3} \frac{y}{\frac{17}{3}} \right)^{4} = y^n
\]

\[
y^{\frac{-7}{2}}
\]

So \( n = -\frac{7}{2} \)

Score 2: The student gave a complete and correct response.
28 Given that \( \left( \frac{\frac{17}{y^{\frac{1}{4}}} \cdot \frac{5}{y^{\frac{3}{4}}}}{y^{\frac{1}{4}}} \right)^{-4} = y^n \), where \( y > 0 \), determine the value of \( n \).

\[
\left( \frac{\frac{17}{y^{\frac{1}{4}}} \cdot \frac{5}{y^{\frac{3}{4}}}}{y^{\frac{1}{4}}} \right)^{-4} = y^n
\]

\[
\frac{17}{y^{\frac{1}{4}}} \cdot \frac{5}{y^{\frac{3}{4}}} \cdot y^{-\frac{1}{4}} = y^n
\]

\[
\frac{17 \cdot 5}{y^{\frac{1}{4}} \cdot y^{\frac{3}{4}} \cdot y^{-\frac{1}{4}}} = y^n
\]

\[
\frac{85}{y} = y^n
\]

\[
y^{\frac{85}{y}} = y^n
\]

\[
\frac{85}{y} = y^{-12}
\]

\[
y = -12
\]

Score 1: The student made a computational error.
Given that \( \left( \frac{17}{y^{\frac{8}{3}}} \right)^{-4} = y^n \), where \( y > 0 \), determine the value of \( n \).

\[
\left( \frac{17}{y^{\frac{8}{3}}} \right)^{-4} = y^n
\]

Score 0: The student did not show enough correct work to receive any credit.
Given \( \cos A = \frac{3}{\sqrt{10}} \) and \( \cot A = -3 \), determine the value of \( \sin A \) in radical form.

\[
\sin A = \frac{-1}{\sqrt{10}}
\]

Score 2: The student gave a complete and correct response.
29 Given \( \cos A = \frac{3}{\sqrt{10}} \) and \( \cot A = -3 \), determine the value of \( \sin A \) in radical form.

Score 2: The student gave a complete and correct response.
29 Given \( \cos A = \frac{3}{\sqrt{10}} \) and \( \cot A = -3 \), determine the value of \( \sin A \) in radical form.

\[
\sin A = \frac{1}{\sqrt{10}} \cdot \frac{\sqrt{10}}{\sqrt{10}} = \frac{\sqrt{10}}{10}
\]

**Score 1:** The student ignored the sign of the function in Quadrant IV.
29 Given \( \cos A = \frac{3}{\sqrt{10}} \) and \( \cot A = -3 \), determine the value of \( \sin A \) in radical form.

\[
\cos A = \frac{3}{\sqrt{10}}
\]

\[
\left( \cos(A) \right)^2 + \left( \sin(A) \right)^2 = 1
\]

\[
\left( \frac{3}{\sqrt{10}} \right)^2 + \left( \sin(A) \right)^2 = 1
\]

\[
0.9 + \left( \sin(A) \right)^2 = 1
\]

\[
\sqrt{\left( \sin(A) \right)^2} = \sqrt{0.1}
\]

\[
\sin A = \sqrt{0.1}
\]

Score 1: The student ignored the sign of the function in Quadrant IV.
29 Given \( \cos A = \frac{3}{\sqrt{10}} \) and \( \cot A = -3 \), determine the value of \( \sin A \) in radical form.

\[
\frac{\cos}{\sin} = \sin A = -0.316
\]

\[-3 = \frac{\frac{3}{\sqrt{10}}}{x} \]

\[-3x = \frac{3}{\sqrt{10}} \]

\[-3x = 0.948 \]

\[-3 \quad -3 \]

Score 1: The student did not give the value in radical form.
29 Given \( \cos A = \frac{3}{\sqrt{10}} \) and \( \cot A = -3 \), determine the value of \( \sin A \) in radical form.

Score 0: The student made multiple errors.
According to a study done at a hospital, the average weight of a newborn baby is 3.39 kg, with a standard deviation of 0.55 kg. The weights of all the newborns in this hospital closely follow a normal distribution. Last year, 9256 babies were born at this hospital. Determine, to the nearest integer, approximately how many babies weighed more than 4 kg.

\[
\text{normalcdf}(4, \infty, 3.39, 0.55) = 0.1336\ldots
\]

\[
0.1336\ldots \times 9256 = 1,237 \text{ babies born last year weighed more than 4 kg.}
\]
Question 30

According to a study done at a hospital, the average weight of a newborn baby is 3.39 kg, with a standard deviation of 0.55 kg. The weights of all the newborns in this hospital closely follow a normal distribution. Last year, 9256 babies were born at this hospital. Determine, to the nearest integer, approximately how many babies weighed more than 4 kg.

Score 2: The student gave a complete and correct response.
30 According to a study done at a hospital, the average weight of a newborn baby is 3.39 kg, with a standard deviation of 0.55 kg. The weights of all the newborns in this hospital closely follow a normal distribution. Last year, 9256 babies were born at this hospital. Determine, to the nearest integer, approximately how many babies weighed more than 4 kg.

\[
\text{normal cdf} \left( 4, 1000, 3.39, 0.55 \right) = 0.1336955 = 12.6955\% \\
9256 \times \frac{12.6955}{100} = 1238 \text{ babies}
\]

Score 1: The student rounded incorrectly.
According to a study done at a hospital, the average weight of a newborn baby is 3.39 kg, with a standard deviation of 0.55 kg. The weights of all the newborns in this hospital closely follow a normal distribution. Last year, 9256 babies were born at this hospital. Determine, to the nearest integer, approximately how many babies weighed more than 4 kg.

\[ \text{normal cdf}(4, \infty, 0.55, 3.39) \]

1388 babies

Score 0: The student did not show enough correct work to receive any credit.
The table below shows the results of gender and music preference. Based on these data, determine if the events “the person is female” and “the person prefers classic rock” are independent of each other. Justify your answer.

<table>
<thead>
<tr>
<th></th>
<th>Rap</th>
<th>Techno</th>
<th>Classic Rock</th>
<th>Classical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>39</td>
<td>17</td>
<td>42</td>
<td>12</td>
</tr>
<tr>
<td>Female</td>
<td>17</td>
<td>37</td>
<td>36</td>
<td>15</td>
</tr>
</tbody>
</table>

\[
P(F \text{ and } CR) = P(F) \cdot P(CR) = \frac{36}{215} \cdot \frac{78}{215}
\]

\[
0.016741805 \neq 0.1771768524
\]

\[
P(CR) = \frac{78}{215}
\]

\[
P(CR | F) = \frac{36}{78} = \frac{105}{215}
\]

\[
0.4615384615 \neq 0.488372093
\]

No, the events are not independent of each other because the probabilities are different.
31 The table below shows the results of gender and music preference. Based on these data, determine if the events “the person is female” and “the person prefers classic rock” are independent of each other. Justify your answer.

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<td>17</td>
<td>37</td>
<td>36</td>
<td>15</td>
</tr>
</tbody>
</table>

\[
\frac{36}{78} = 0.4615, \quad \frac{105}{215} = 0.4922
\]

A \mid B \neq A

No, not independent

Score 2: The student gave a complete and correct response.
31 The table below shows the results of gender and music preference. Based on these data, determine if the events “the person is female” and “the person prefers classic rock” are independent of each other. Justify your answer.

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</tr>
</tbody>
</table>

\[
P(A) = P(B|A) \quad \text{and} \quad P(B) = P(A|B)
\]

\[
\frac{105}{215} = \frac{36}{105} \quad \text{and} \quad \frac{78}{215} \neq \frac{36}{78}
\]

The events “the person is female” and “the person prefers classic rock” are not independent of each other because using the equation \( P(A) \neq P(B|A) \), the probability are not equal.

Score 1: The student stated a correct conclusion based on an incorrect test for independence.
31 The table below shows the results of gender and music preference. Based on these data, determine if the events “the person is female” and “the person prefers classic rock” are independent of each other. Justify your answer.

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</table>

\[ M = \frac{42}{110} \times 100 \]
\[ M = 38.18\% \]

\[ F = \frac{36}{105} \times 100 \]
\[ F = 34.28\% \]

Females are not more likely to like classic rock, so the events are independent.

Score 0: The student did not show enough correct relevant work to receive any credit.
31 The table below shows the results of gender and music preference. Based on these data, determine if the events “the person is female” and “the person prefers classic rock” are independent of each other. Justify your answer.

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</tr>
</tbody>
</table>

\[
P(A) + P(B) = P(A \cap B)
\]

\[
\frac{105}{215} + \frac{78}{215} = \frac{15}{27}
\]

\[
0.488 + 0.3627 = 0.8511
\]

Score 0: The student made multiple errors.
32 Algebraically determine the solution set for the system of equations below.

\[ y = 2x^2 - 7x + 4 \]
\[ y = 11 - 2x \]

\[ 2x^2 - 7x + 4 = 11 - 2x + 2x - 11 - 11 + 2x \]
\[ 2x^2 - 5x - 7 = 0 \]
\[ (2x - 7)(x + 1) = 0 \]
\[ 2x - 7 = 0 \quad x + 1 = 0 \]
\[ 2x = 7 \quad x = -1 \]
\[ x = \frac{7}{2} \]

\[ y = 11 - 2(-1) \quad y = 11 - 2\left(\frac{7}{2}\right) \]
\[ y = 11 + 2 \quad = 11 - \frac{14}{2} \]
\[ y = 13 \]
\[ = \frac{22 - 14}{2} \]
\[ = \frac{8}{2} \]

Solution
\[ x, y \left(\frac{7}{2}, 4\right) \]
\[ x, y \left(-1, 13\right) \]

Score 2: The student gave a complete and correct response.
Algebraically determine the solution set for the system of equations below.

\[ y = 2x^2 - 7x + 4 \]
\[ y = 11 - 2x \]

\[ y = 11 - 2(\frac{3}{2}) \quad \text{or} \quad y = 11 - 2(-1) \]

\[ 11 - 2x = 2x^2 - 7x + 4 \]
\[ -11 + 2x = 2x - 11 \]

\[ 0 = 2x^2 - 5x - 7 \]
\[ 2x^2 + 2x - 7x - 7 \]
\[ 2x(x + 1) - 7(x + 1) \]
\[ (2x - 7)(x + 1) \]
\[ 2x - 7 = 0 \quad \text{or} \quad x + 1 = 0 \]
\[ x = \frac{7}{2} \quad \text{or} \quad x = -1 \]
\[ x = 3.5 \]

\[ y = -2 \quad \text{or} \quad y = 13 \]

\[ 2, -7 = -14 \]

\[ (3.5, 4) \quad (-1, 13) \]

**Score 2:** The student gave a complete and correct response.
32 Algebraically determine the solution set for the system of equations below.

\[ y = 2x^2 - 7x + 4 \]
\[ y = 11 - 2x \]

\[ 11 - 2x = 2x^2 - 7x + 4 \]
\[ -11 + 2x \quad -11 + 2x \]

\[ 0 = 2x^2 - 5x - 7 \]

\[
\begin{array}{c|c|c}
(2x - 7) & (x + 1) \\
2x &= 7 \\
x &= \frac{7}{2} \\
& \begin{array}{c}
\text{\(x = -1\)}
\end{array}
\end{array}
\]

\[ x = -1, \frac{7}{2} \]

\[ y = 4, 13 \]

**Score 1:** The student did not clearly indicate the solution set.
Algebraically determine the solution set for the system of equations below.

\[
\begin{align*}
y &= 2x^2 - 7x + 4 \\
y &= 11 - 2x
\end{align*}
\]
32 Algebraically determine the solution set for the system of equations below.

\[
\begin{align*}
y &= 2x^2 - 7x + 4 \\
y &= 11 - 2x
\end{align*}
\]

\[
\begin{align*}
11 - 2x &= 2x^2 - 7x + 4 \\
2x^2 + 5x - 7 &= 0 \\
2x^2 + 2x + 7x - 7 &= 0 \\
2x(x-1) + 7(x-1) &= 0 \\
(2x+7)(x-1) &= 0 \\
x &= \frac{-7}{2}, x = 1
\end{align*}
\]

\[
\begin{align*}
y &= 11 - 2(\frac{7}{2}) \rightarrow 4 \\
y &= 11 - 2(1) \rightarrow 9
\end{align*}
\]

\[
(\frac{7}{2}, 4) \\
(1, 9)
\]

Score 0: The student made multiple computational errors.
33 When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function, \( p(t) \), that can be used to model the population of bacteria, \( p \), on a smartphone screen, where \( t \) represents the time in minutes after it is first observed under a microscope.

\[
p(t) = 11,000 \left(2\right)^{\frac{t}{20}}
\]

b) Using \( p(t) \) from part \( a \), determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

\[
1,000,000 = 11,000 \left(2\right)^{\frac{t}{20}}
\]

\[
90.90909 = 2 \left(\frac{t}{20}\right)
\]

\[
\log 90.90909 = \log 2 \left(\frac{t}{20}\right)
\]

\[
= \frac{t}{20} \log 2
\]

\[
t = \frac{20 \log 90.90909}{\log 2} \approx 130.13
\]

**Score 4:** The student gave a complete and correct response.
33 When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function, \( p(t) \), that can be used to model the population of bacteria, \( p \), on a smartphone screen, where \( t \) represents the time in minutes after it is first observed under a microscope.

\[
p(t) = 11,000 e^{\left(\frac{\ln 2}{20}\right) t}
\]

b) Using \( p(t) \) from part a, determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

\[
1,000,000 = 11,000 e^{\left(\frac{\ln 2}{20}\right) t}
\]

\[
\ln(90.91) = e^{\left(\frac{\ln 2}{20}\right) t}
\]

\[
\ln(90.91) = \frac{\ln 2 \cdot t}{20}
\]

\[
\frac{\ln 90.91}{\ln 2} = \frac{11.90 t}{20}
\]

\[
t = 130.13 \text{ minutes}
\]

Score 4: The student gave a complete and correct response.
When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function, $p(t)$, that can be used to model the population of bacteria, $p$, on a smartphone screen, where $t$ represents the time in minutes after it is first observed under a microscope.

$$p(t) = 11000(2)^t$$

b) Using $p(t)$ from part a, determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

$$11000(2)^t = 1000000$$

$$\log 2 + t = \frac{\log 1000000}{\log 11000}$$

$$t = \frac{\log 1000000}{\log 2} - \log 2$$

$$t = 6.51$$

Score 3: The student made an error in the exponent in part a.
Question 33

33 When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function, \( p(t) \), that can be used to model the population of bacteria, \( p \), on a smartphone screen, where \( t \) represents the time in minutes after it is first observed under a microscope.

\[
p(t) = 11,000(2)^{\frac{t}{20}}
\]

b) Using \( p(t) \) from part a, determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

\[
\frac{22,000}{11,000} = (2)^{\frac{t}{20}}
\]

\[
\log(22,000) \log(22,000) \frac{t}{20}
\]

\[
\log(1,000,000) = \frac{t}{20} \log(22,000)
\]

\[
1.381717175 = \frac{t}{20}
\]

\[
t = 27.634343435
\]

\[
t = 27.6 \text{ minutes}
\]

Score 2: The student multiplied 11,000 by 2 and made a rounding error.
33 When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function, \( p(t) \), that can be used to model the population of bacteria, \( p \), on a smartphone screen, where \( t \) represents the time in minutes after it is first observed under a microscope.

\[
p(t) = 11,000 \cdot 2^{\frac{t}{20}}
\]

b) Using \( p(t) \) from part a, determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

\[
\frac{1,000,000}{11,000} = \frac{11,000 \cdot 2^{\frac{t}{20}}}{11,000}
= 2^{\frac{t}{20}}
\]

\[
2^{5.72} = 32
\]

\[
t \approx 130.67
\]

Score 2: The student only received credit for part a.
33 When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function, \( p(t) \), that can be used to model the population of bacteria, \( p \), on a smartphone screen, where \( t \) represents the time in minutes after it is first observed under a microscope.

\[ p(t) = 11,000 (1 + 2)^{\frac{t}{20}} \]

b) Using \( p(t) \) from part a, determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

\[ 1,000,000 = 11,000 (1 + 2)^{\frac{t}{20}} \]
\[ 0.90909 = (1 + 2)^{\frac{t}{20}} \]
\[ 0.90909 = (3)^{\frac{t}{20}} \]

**Score 1:** The student had an incorrect base in part a and did not show enough further correct work.
When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function, \( p(t) \), that can be used to model the population of bacteria, \( p \), on a smartphone screen, where \( t \) represents the time in minutes after it is first observed under a microscope.

\[
p(t) = 11000(2)^t \\
\text{for every 20 min}
\]

b) Using \( p(t) \) from part a, determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

\[
6.51 \times 20 = 130.20 \text{ min}
\]

Score 1: The student received 1 credit for the equation in part a.
When observed by researchers under a microscope, a smartphone screen contained approximately 11,000 bacteria per square inch. Bacteria, under normal conditions, double in population every 20 minutes.

a) Assuming an initial value of 11,000 bacteria, write a function, \( p(t) \), that can be used to model the population of bacteria, \( p \), on a smartphone screen, where \( t \) represents the time in minutes after it is first observed under a microscope.

\[
p = 11,000 \left(\frac{1}{2}\right)^t
\]

b) Using \( p(t) \) from part a, determine algebraically, to the nearest hundredth of a minute, the amount of time it would take for a smartphone screen that was not touched or cleaned to have a population of 1,000,000 bacteria per square inch.

\[
\frac{1,000,000}{11,000} = \frac{11,000 \left(\frac{1}{2}\right)^t}{11,000} = \frac{22000}{11,000} = 20000^t
\]

\[
\log_{20000}(1,000,000) = t
\]

\[
t = 138.17 \text{ minutes}
\]

Score 0: The student made multiple errors in the equation and solution.
The function $v(x) = x(3 - x)(x + 4)$ models the volume, in cubic inches, of a rectangular solid for $0 \leq x \leq 3$.

Graph $y = v(x)$ over the domain $0 \leq x \leq 3$.

To the nearest tenth of a cubic inch, what is the maximum volume of the rectangular solid?

Score 4: The student gave a complete and correct response.
The function \( v(x) = x(3 - x)(x + 4) \) models the volume, in cubic inches, of a rectangular solid for \( 0 \leq x \leq 3 \).

Graph \( y = v(x) \) over the domain \( 0 \leq x \leq 3 \).

To the nearest tenth of a cubic inch, what is the maximum volume of the rectangular solid?

\[
\text{Max} = 12.6
\]

**Score 3:** The student made a graphing error at the maximum.
The function \( v(x) = x(3 - x)(x + 4) \) models the volume, in cubic inches, of a rectangular solid for \( 0 \leq x \leq 3 \).

Graph \( y = v(x) \) over the domain \( 0 \leq x \leq 3 \).

To the nearest tenth of a cubic inch, what is the maximum volume of the rectangular solid?

\[ 1 + .5 \approx 12.6. \]

**Score 2:** The student only received credit for stating the maximum.
34 The function \( v(x) = x(3 - x)(x + 4) \) models the volume, in cubic inches, of a rectangular solid for \( 0 \leq x \leq 3 \).

Graph \( y = v(x) \) over the domain \( 0 \leq x \leq 3 \).

To the nearest tenth of a cubic inch, what is the maximum volume of the rectangular solid?

\( (1.7, 12.6) \)

Score 1: The student stated the coordinates of the maximum.
34 The function \( v(x) = x(3 - x)(x + 4) \) models the volume, in cubic inches, of a rectangular solid for \( 0 \leq x \leq 3 \).

Graph \( y = v(x) \) over the domain \( 0 \leq x \leq 3 \).

To the nearest tenth of a cubic inch, what is the maximum volume of the rectangular solid?

Score 1: The student did not graph the correct maximum and showed no further correct work.
Question 34

34 The function \( v(x) = x(3 - x)(x + 4) \) models the volume, in cubic inches, of a rectangular solid for \( 0 \leq x \leq 3 \).

Graph \( y = v(x) \) over the domain \( 0 \leq x \leq 3 \).

To the nearest tenth of a cubic inch, what is the maximum volume of the rectangular solid?

The maximum volume was 12.0...
Question 35

35 Given \( f(x) = 3x^3 - 4x^2 + 2x - 1 \) and \( g(x) = x - 4 \), state the quotient and remainder of \( \frac{f(x)}{g(x)} \), in the form \( q(x) + \frac{r(x)}{g(x)} \).

\[
\begin{array}{c|c}
3x^2 + 8x + 34 & x-4)3x^3-4x^2+2x-1 \\
\hline
& 3x^3 - 12x^2 \\
& - (3x^3 - 12x^2) \\
& 8x^2 + 2x \\
& - 8x^2 + 32x \\
& \hline
& 34x - 1 \\
& - 34x + 136 \\
& \hline
& 135 \\
\end{array}
\]

Is \( x = 4 \) a root of \( f(x) \)? Explain your answer.

\[\text{by } x-4\]

\[\text{no, because when you divide you get a remainder of 136 and not a remainder of 0.}\]

Score 4: The student gave a complete and correct response.
35 Given $f(x) = 3x^3 - 4x^2 + 2x - 1$ and $g(x) = x - 4$, state the quotient and remainder of $\frac{f(x)}{g(x)}$, in the form $q(x) + \frac{r(x)}{g(x)}$.

\[
\begin{array}{c|cccc}
4 & 3 & -4 & 2 & -1 \\
\hline 
& 12 & 32 & 36 \\
\hline 
& 3 & 8 & 34 & 135 \\
\end{array}
\]

\[
3x^2 + 8x + 34 + \frac{135}{x-4}
\]

Is $x = 4$ a root of $f(x)$? Explain your answer.

\[
\text{No because when } f(x) \text{ was divided by } x-4 \text{ there was a remainder}
\]

Score 4: The student gave a complete and correct response.
35 Given \( f(x) = 3x^3 - 4x^2 + 2x - 1 \) and \( g(x) = x - 4 \), state the quotient and remainder of \( \frac{f(x)}{g(x)} \) in the form \( q(x) + \frac{r(x)}{g(x)} \).

\[
\begin{array}{c|ccccc}
& 3x^2 & + 8x & + 34 \\
\hline
x-4 & 3x^3 & - 4x^2 & + 2x & -1 \\
& - 3x^3 & + 12x^2 & & \\
\hline
& 8x^2 & + 2x & -1 \\
& - 8x^2 & - 32x & & \\
\hline
& 34x & -1 \\
& - 34x & - 136 & & \\
\hline
& 135 \\
\end{array}
\]

Is \( x = 4 \) a root of \( f(x) \)? Explain your answer.

No, when 4 is substituted for \( x \), it does not equal to zero meaning it is not a root.

Score 3: The student did not write the quotient and remainder in the correct form.
35 Given \( f(x) = 3x^3 - 4x^2 + 2x - 1 \) and \( g(x) = x - 4 \), state the quotient and remainder of \( \frac{f(x)}{g(x)} \), in the form \( q(x) + \frac{r(x)}{g(x)} \).

\[
\begin{array}{c|ccccc}
\multicolumn{2}{r}{3x^2 - 10x - 62} \\
\hline
x-4 & 3x^3 - 4x^2 + 2x - 1 \\
- \quad 3x^3 + 12x^2 \\
\hline
& -10x^2 + 2x \\
- \quad -10x^2 - 36x \\
\hline
& -24x - 1 \\
- \quad -24x - 96 \\
\hline
& 0 \\
\end{array}
\]

Is \( x = 4 \) a root of \( f(x) \)? Explain your answer.

**No, \( x = 4 \) is not a root of \( f(x) \) because there is a remainder.**

**Score 3:** The student made a computational error in the long division.
35 Given \( f(x) = 3x^3 - 4x^2 + 2x - 1 \) and \( g(x) = x - 4 \), state the quotient and remainder of \( \frac{f(x)}{g(x)} \), in the form \( q(x) + \frac{r(x)}{g(x)} \).

\[
\begin{array}{c|ccccc}
& 3x^3 & -4x^2 & +2x & -1 \\
\hline
x-4 & \downarrow & & & & \\
\end{array}
\]

Is \( x = 4 \) a root of \( f(x) \)? Explain your answer.

No it is not
Because \( f(4) \) does not equal zero.

Score 2: The student wrote a correct explanation but showed no further correct work.
35 Given \( f(x) = 3x^3 - 4x^2 + 2x - 1 \) and \( g(x) = x - 4 \), state the quotient and remainder of \( \frac{f(x)}{g(x)} \), in the form \( q(x) + \frac{r(x)}{g(x)} \).

\[
\begin{array}{c}
3x^3 - 4x^2 + 2x - 1 \\
\hline
x - 4 \\
- x^2 \\
\hline
x^2 - 2x - 1
\end{array}
\]

Is \( x = 4 \) a root of \( f(x) \)? Explain your answer.

\[
f(4) = 3(4)^3 - 4(4)^2 + 2(4) - 1 = 163
\]

No, \( x \) can \( f(x) \neq 0 \)

Score 1: The student received one credit for the explanation.
35 Given \( f(x) = 3x^3 - 4x^2 + 2x - 1 \) and \( g(x) = x - 4 \), state the quotient and remainder of \( \frac{f(x)}{g(x)} \) in the form \( q(x) + \frac{r(x)}{g(x)} \).

\[
\begin{array}{c|cccc}
\text{4} & 3 & -4 & 2 & -1 \\
1 & 1 & 4 & 8 & 20 \\
\hline
4 & 12 & 50 & 199 \\
\end{array}
\]

Answer: \( 4x^2 + 12x + 50 + \frac{199}{x-4} \)

Is \( x = 4 \) a root of \( f(x) \)? Explain your answer.

Score 1: The student has one computational error in the synthetic division and showed no further correct work.
35 Given \( f(x) = 3x^3 - 4x^2 + 2x - 1 \) and \( g(x) = x - 4 \), state the quotient and remainder of \( \frac{f(x)}{g(x)} \) in the form \( q(x) + \frac{r(x)}{g(x)} \).

\[
q(x) = x - 4 \\
F(x) = 3x^3 - 4x^2 + 2x - 1 \\
F(x) = 3x^3 - 4x^2 + 2(-4) - 1 \\
F(x) = 3x^3 - 4x^2 - 8 - 1 \\
F(x) = 3x^3 - 4x^2 - 9
\]

Is \( x = 4 \) a root of \( f(x) \)? Explain your answer.

\[\text{NO because it can't go to 0.}\]

Score 0: The student did not show enough correct work to receive any credit.
35 Given $f(x) = 3x^3 - 4x^2 + 2x - 1$ and $g(x) = x - 4$, state the quotient and remainder of $\frac{f(x)}{g(x)}$, in the form $q(x) + \frac{r(x)}{g(x)}$.

Is $x = 4$ a root of $f(x)$? Explain your answer.

**Score 0:** The student did not show enough correct work to receive any credit.
State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.

Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the nearest thousandth.

\[ 0.819 \pm 2(0.053) \]
\[ 0.713 - 0.925 \]

The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials’ claim.

The organization should question the State officials’ claim because 70% is outside of the 95% interval.

Score 4: The student gave a complete and correct response.
State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.

Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the nearest thousandth.

\[ 95\% \pm z \]
\[ x \pm \frac{z \cdot \text{SD}}{\sqrt{n}} \]
\[ x \pm \frac{1.96 \cdot 0.053}{\sqrt{60}} \]
\[ x \pm 0.016 \]
\[ 0.819 \pm 0.016 \]
\[ 0.793 \text{ to } 0.835 \]

The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials’ claim.

They should question the claim because their survey results are outside the range of plausible proportions.

Score 4: The student gave a complete and correct response.
State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.

Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the nearest thousandth.

\[ 0.819 \pm 2(0.053) \]
\[ 0.819 - 2(0.053) = 0.713 \]
\[ 0.819 + 2(0.053) = 0.925 \]

The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials’ claim.

The organization should question the State officials’ claim because this 70% support does not fall into the 95% plausible proportions (lower than 71.3%).

**Score 3:** The student did not state a correct interval.
36 State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.

Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the nearest thousandth.

\[0.72 - 0.92\]

The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials’ claim.

The officials’ claim should be questioned because 0.70 is outside the interval 0.72 - 0.92.

Score 3: The student did not round the interval to the nearest thousandth.
State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.

Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the nearest thousandth.

\[
\left(0.819 - 2(0.053)\right) = 0.713 \\
\left(0.819 + 2(0.053)\right) = 0.925
\]

The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials’ claim.

70% is lower than the mean of 81.9%.

Score 2: The student stated a correct interval but showed no further correct work.
State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.

Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the nearest thousandth.

\[
0.819 \pm 2(0.053) \\
= 0.925 \\
= 0.713
\]

The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials’ claim.

Because the dot graph does not show that 70% supported the repeal.

**Score 1:** The student wrote the interval incorrectly.
State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.

Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the nearest thousandth.

\[
\frac{31 \div 0.0095}{95 \div 0.0095} = \frac{31}{0.0095} = 32.6
\]

The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials’ claim.

They should question the state officials claim because it is wrong and it states that 70% of the community supported the repeal.

Score 0:  The student did not show enough correct work to receive any credit.
State officials claim 82% of a community want to repeal the 30 mph speed limit on an expressway. A community organization devises a simulation based on the claim that 82% of the community supports the repeal. Each dot on the graph below represents the proportion of community members who support the repeal. The graph shows 200 simulated surveys, each of sample size 60.

Based on the simulation, determine an interval containing the middle 95% of plausible proportions. Round your answer to the nearest thousandth.

0.72 – 0.90

The community organization conducted its own sample survey of 60 people and found 70% supported the repeal. Based on the results of the simulation, explain why the organization should question the State officials’ claim.

The organization should question the State officials claim because they had a 12% difference in results.

Score 0: The student did not give a correct interval and wrote an incorrect explanation.
A technology company is comparing two plans for speeding up its technical support time. Plan $A$ can be modeled by the function $A(x) = 15.7(0.98)^x$ and plan $B$ can be modeled by the function $B(x) = 11(0.99)^x$ where $x$ is the number of customer service representatives employed by the company and $A(x)$ and $B(x)$ represent the average wait time, in minutes, of each customer.

Graph $A(x)$ and $B(x)$ in the interval $0 \leq x \leq 100$ on the set of axes below.

Score 6: The student gave a complete and correct response.
Question 37 continued

To the nearest integer, solve the equation $A(x) = B(x)$.

\[ x = 35 \]

Determine, to the nearest minute, $B(100) - A(100)$. Explain what this value represents in the given context.

\[
\begin{align*}
\frac{B(100)}{2} &= 4.0264 \\
\frac{A(100)}{2} &= -2.0812 \\
1.9 &\approx 2 \text{ min}
\end{align*}
\]

For 100 customer service representatives, the difference in average wait time is 2 minutes.
37 A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function \( A(x) = 15.7(0.98)^x \) and plan B can be modeled by the function \( B(x) = 11(0.99)^x \) where \( x \) is the number of customer service representatives employed by the company and \( A(x) \) and \( B(x) \) represent the average wait time, in minutes, of each customer.

Graph \( A(x) \) and \( B(x) \) in the interval \( 0 \leq x \leq 100 \) on the set of axes below.

Score 5: The student made a domain error in the graph.
Question 37 continued

To the nearest integer, solve the equation $A(x) = B(x)$.

\[ 15.7 \cdot (1.98)^x = 11(94)^x \]

$x \approx 3.5$ customer service reps

Determine, to the nearest minute, $B(100) - A(100)$. Explain what this value represents in the given context.

$B(100) = 4.0264$

$A(100) = 2.0821$

This value represents that with 100 customer service reps, plan B is 2 minutes slower than plan A.  Slower

$4.0264 - 2.0821 = 1.9443 \times 2 \text{ min}$
A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function \( A(x) = 15.7(0.98)^x \) and plan B can be modeled by the function \( B(x) = 11(0.99)^x \) where \( x \) is the number of customer service representatives employed by the company and \( A(x) \) and \( B(x) \) represent the average wait time, in minutes, of each customer.

Graph \( A(x) \) and \( B(x) \) in the interval \( 0 \leq x \leq 100 \) on the set of axes below.

Question 37 is continued on the next page.

**Score 5:** The student gave an incomplete explanation.
Question 37 continued

To the nearest integer, solve the equation \( A(x) = B(x) \).

\[
35
\]

Determine, to the nearest minute, \( B(100) - A(100) \). Explain what this value represents in the given context.

\[
4.0264 - 2.0812 = 1.9
\]

2 min is the difference in wait time.
Question 37

A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function $A(x) = 15.7(0.98)^x$ and plan B can be modeled by the function $B(x) = 11(0.99)^x$ where $x$ is the number of customer service representatives employed by the company and $A(x)$ and $B(x)$ represent the average wait time, in minutes, of each customer.

Graph $A(x)$ and $B(x)$ in the interval $0 \leq x \leq 100$ on the set of axes below.

Score 4: The student made a domain error and wrote an incomplete explanation.
Question 37 continued

To the nearest integer, solve the equation \( A(x) = B(x) \).

\[
x = 35
\]

Determine, to the nearest minute, \( B(100) - A(100) \). Explain what this value represents in the given context.

\[
4 - 2 = 2
\]

2 minutes of faster support line
A technology company is comparing two plans for speeding up its technical support time. Plan $A$ can be modeled by the function $A(x) = 15.7(0.98)^x$ and plan $B$ can be modeled by the function $B(x) = 11(0.99)^x$ where $x$ is the number of customer service representatives employed by the company and $A(x)$ and $B(x)$ represent the average wait time, in minutes, of each customer.

Graph $A(x)$ and $B(x)$ in the interval $0 \leq x \leq 100$ on the set of axes below.

Score 3: The student made a domain error, wrote no labels and an incomplete explanation.
Question 37 continued

To the nearest integer, solve the equation $A(x) = B(x)$.

Determine, to the nearest minute, $B(100) - A(100)$. Explain what this value represents in the given context.
A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function $A(x) = 15.7(0.98)^x$ and plan B can be modeled by the function $B(x) = 11(0.99)^x$ where $x$ is the number of customer service representatives employed by the company and $A(x)$ and $B(x)$ represent the average wait time, in minutes, of each customer.

Graph $A(x)$ and $B(x)$ in the interval $0 \leq x \leq 100$ on the set of axes below.

Score 2: The student only received credit for the second part.
Question 37 continued

To the nearest integer, solve the equation $A(x) = B(x)$.

$$15.7(0.99)^x = 11(0.98)^x$$

$x = 35$

Determine, to the nearest minute, $B(100) - A(100)$. Explain what this value represents in the given context.

$4.0264 - 2.0821 = 1.9443$

This represents the difference.
37 A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function $A(x) = 15.7(0.98)^x$ and plan B can be modeled by the function $B(x) = 11(0.99)^x$ where $x$ is the number of customer service representatives employed by the company and $A(x)$ and $B(x)$ represent the average wait time, in minutes, of each customer.

Graph $A(x)$ and $B(x)$ in the interval $0 \leq x \leq 100$ on the set of axes below.
Question 37 continued

To the nearest integer, solve the equation $A(x) = B(x)$.

Determine, to the nearest minute, $B(100) - A(100)$. Explain what this value represents in the given context.

\[ \begin{align*}
15.7(0.98)^{35.64/2545} &= 11.49^{35.64/2545} \\
15.7(0.99265044955) &= 11.7031466177 \\
7.7341612741 &= 7.7341612741 \\
x &= 35.0412545
\end{align*} \]

\[ 4.0264 - 2.0821 = \]
37 A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function \( A(x) = 15.7(0.98)^x \) and plan B can be modeled by the function \( B(x) = 11(0.99)^x \) where \( x \) is the number of customer service representatives employed by the company and \( A(x) \) and \( B(x) \) represent the average wait time, in minutes, of each customer.

Graph \( A(x) \) and \( B(x) \) in the interval \( 0 \leq x \leq 100 \) on the set of axes below.

Score 1: The student calculated \( B(100) - A(100) \), but showed no further correct work.
Question 37 continued

To the nearest integer, solve the equation $A(x) = B(x)$.

$$\frac{15.7(0.98)^x}{11(0.99)^y}$$

Determine, to the nearest minute, $B(100) - A(100)$. Explain what this value represents in the given context.

$B = 11(0.99)^{100}$

$A = 15.7(0.98)^{100}$

$B(100) - A(100) = 1.94422786$

$2$ minutes
37 A technology company is comparing two plans for speeding up its technical support time. Plan A can be modeled by the function \( A(x) = 15.7(0.98)^x \) and plan B can be modeled by the function \( B(x) = 11(0.99)^x \) where \( x \) is the number of customer service representatives employed by the company and \( A(x) \) and \( B(x) \) represent the average wait time, in minutes, of each customer.

Graph \( A(x) \) and \( B(x) \) in the interval \( 0 \leq x \leq 100 \) on the set of axes below.

Score 0: The student did not show enough correct work to receive any credit.
Question 37 continued

To the nearest integer, solve the equation \( A(x) = B(x) \).

\[
15.7 \left( 0.98 \right)^x = 11 \left( 0.99 \right)^x \\
15.7 x \left( \frac{0.98}{0.99} \right) = 11 x \left( \frac{0.99}{0.98} \right) \\
\quad x = 105.5 \\
\quad x = 0
\]

Determine, to the nearest minute, \( B(100) - A(100) \). Explain what this value represents in the given context.