The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA II

Monday, August 19, 2024 — 12:30 to 3:30 p.m., only
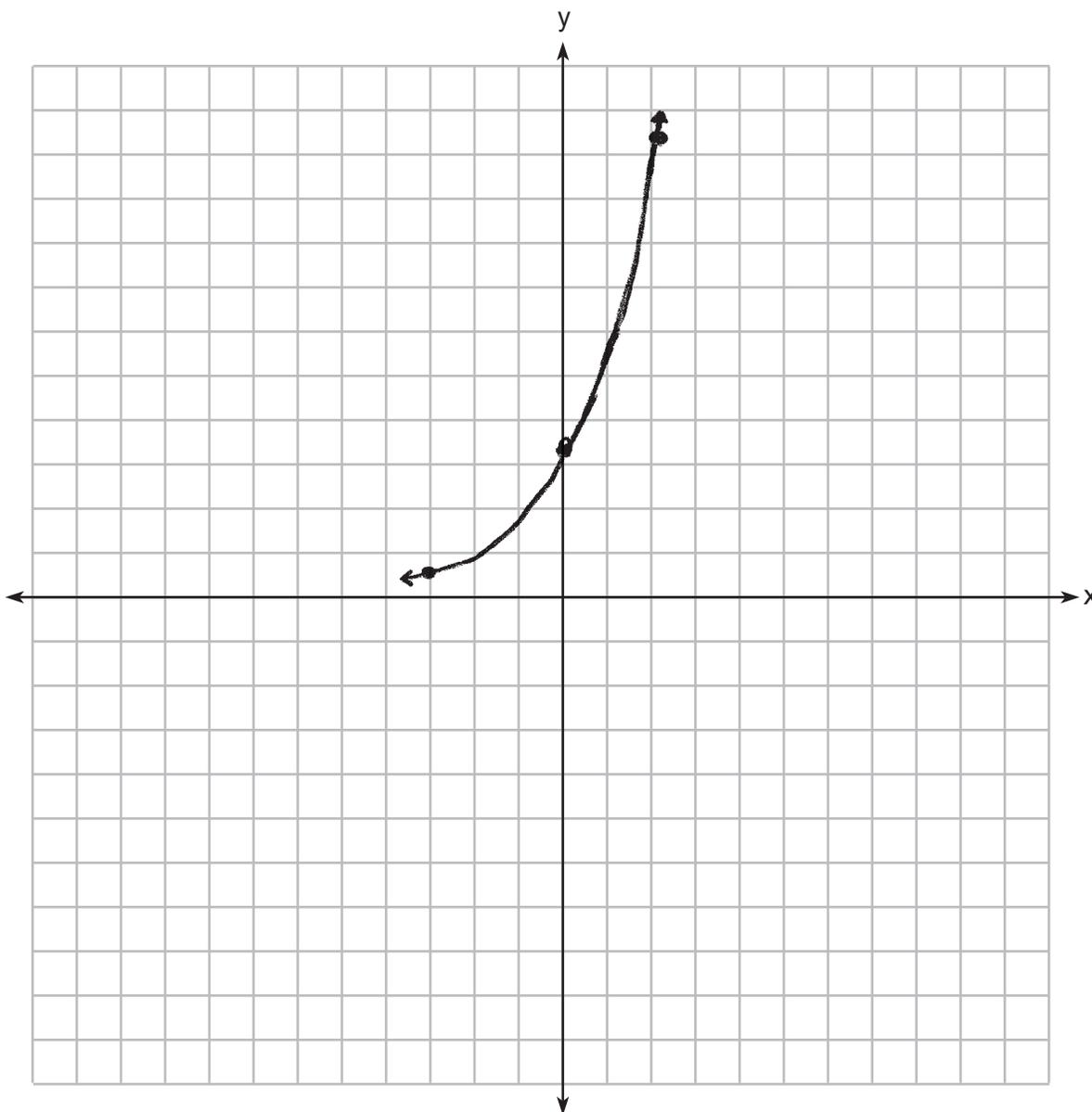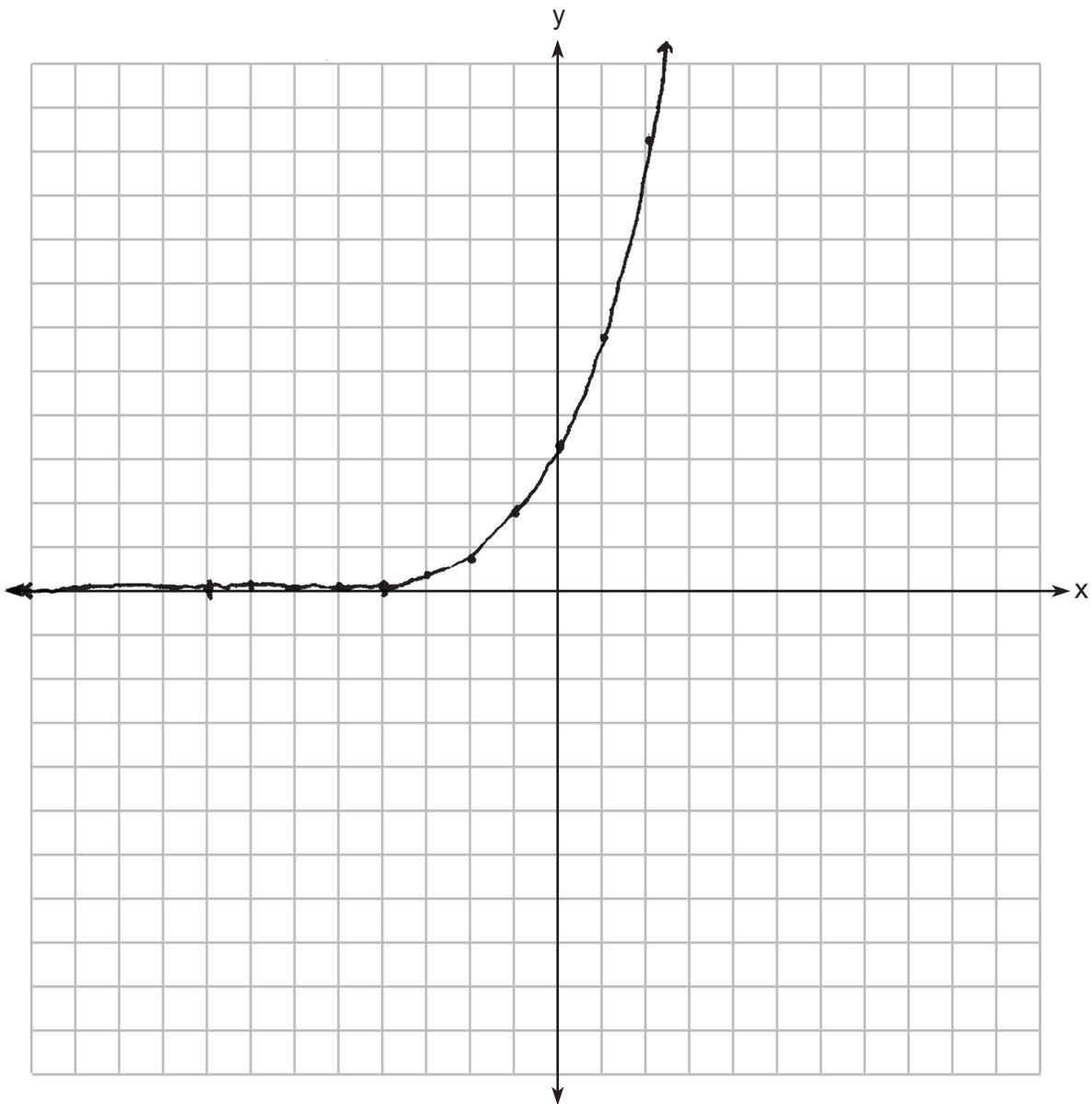
MODEL RESPONSE SET

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25 On the axes below, graph $y = 3.2(1.8)^x$.

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

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

25 On the axes below, graph $y = 3.2(1.8)^x$.

X	y
-9.4	.01257
-7.8	.31
-6.2	.79
-4.7	.200
-3.1	.504
-1.5	1.27
0	3.2
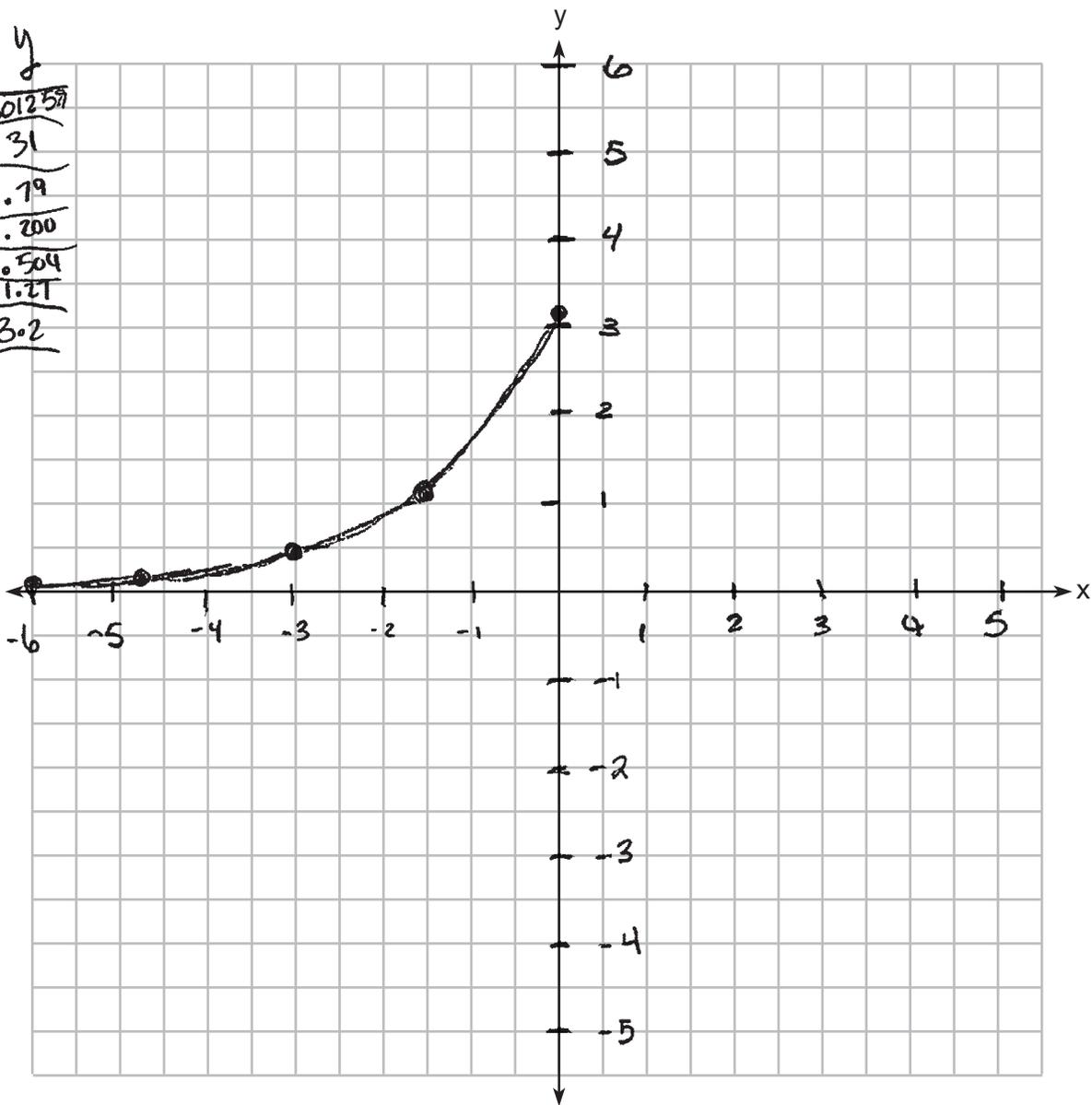
Score 1: The student made an error by terminating the graph at the *y*-intercept.

25 On the axes below, graph $y = 3.2(1.8)^x$.
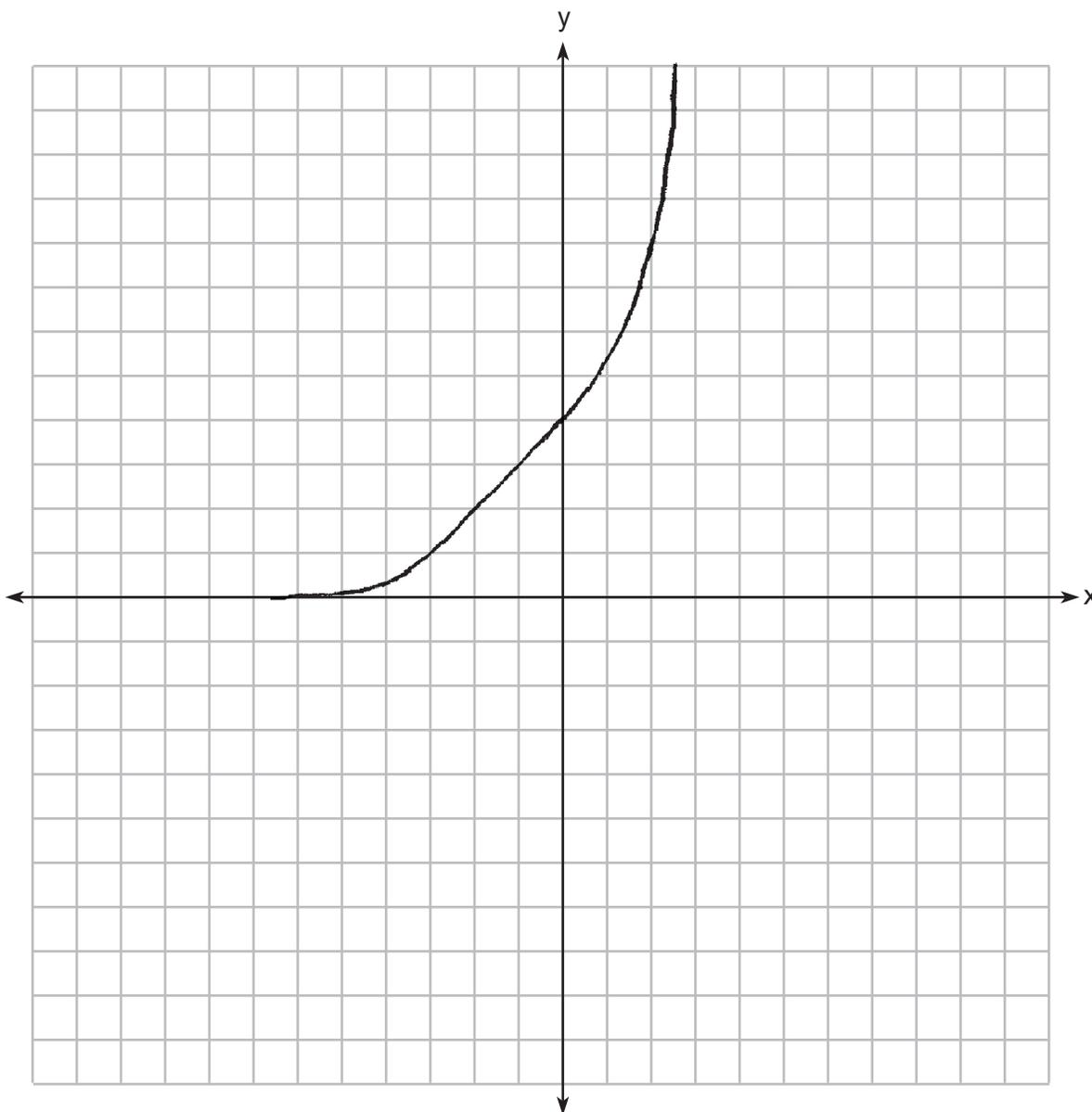
Score 0: The student made multiple graphing errors.

25 On the axes below, graph $y = 3.2(1.8)^x$.
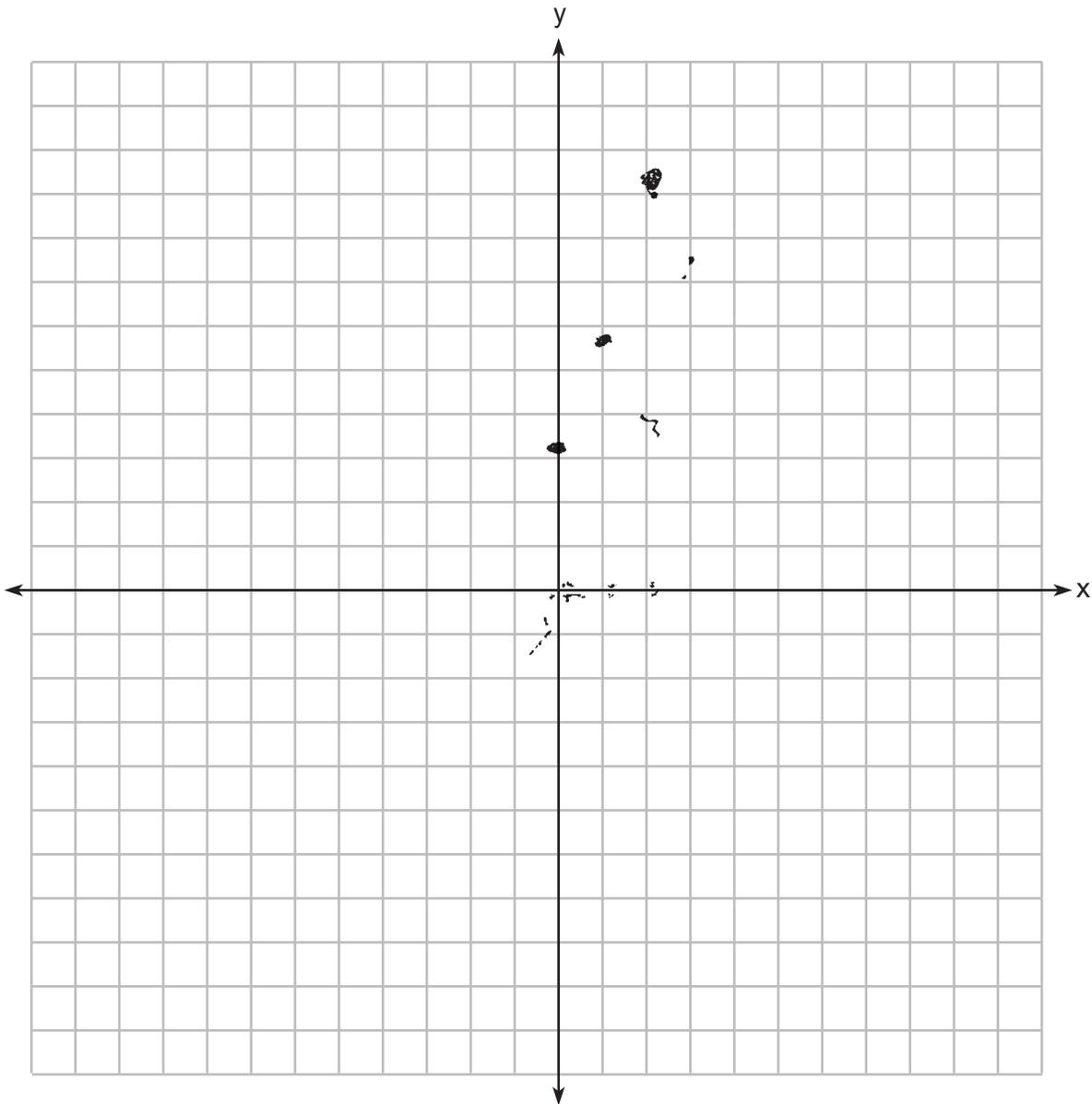
Score 0: The student correctly plotted two points, but did not show enough relevant course-level work to receive any credit.

26 Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$
\begin{array}{r}
7x^2 + 6x - 9 \\
x+3 \overline{)\ 7x^3 + 27x^2 + 9x - 27} \\
-(7x^3 + 21x^2) \downarrow \\
6x^2 + 9x \\
-(6x^2 + 17x) \downarrow \\
-9x - 27 \\
-(-9x - 27) \\
\hline
0
\end{array}
$$

$x+3$ is a factor of $7x^3 + 27x^2 + 9x - 27$ because there's no remainder when you divide them together.

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

26 Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$7(-3)^3 + 27(-3)^2 + 9(-3) - 27$$

$$-189 + 243 + 27 - 27$$

$$= 0$$

$x + 3$ is a factor of $7x^3 + 27x^2 + 9x - 27$

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

26 Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$7(3)^3 + 27(3)^2 + 9(3) - 27 = 0$$
$$189 + 243 + \cancel{27 - 27} = 0$$
$$432 \neq 0$$
$$X+3 \mathbb{I} \text{ It is not a factor}$$

Score 1: The student incorrectly evaluated 3 instead of -3.

26 Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$x + 3$

$$-3 \begin{array}{cccc} 7 & 27 & 9 & -27 \\ & -21 & -24 & 45 \\ \hline 7 & 8 & -15 & 18 \end{array}$$

$$7x^2 + 8x - 15 \ + \dfrac{18}{x+3}$$

$x+3$ is not a factor of
$7x^3 + 2x^2 + 9y - 27$ becan
there is a remainder

Score 1: The student made a computational error.

26 Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$\boxed{-3}$$

$$7x^3 \quad 27x^2 \quad 9x \quad -27$$
$$\downarrow \quad -21 \quad -18 \quad +27$$
$$7x^3 \quad 6 \quad 27 \quad \text{or}$$

$$7x^2 + 6x + 27$$

yes because when preforming
division, x-3 goes into
$7x^3 + 27x^2 + 9x - 27$ perfectly.

Score 0: The student made multiple errors.

26 Is $x + 3$ a factor of $7x^3 + 27x^2 + 9x - 27$?
Justify your answer.

$$7(3)^3 + 27(3)^2 + 9(3) - 27$$

$$7(27) +$$

$$1189 + 243$$

$$= 432$$

Score 0: The student incorrectly substituted 3 and did not indicate no/yes.

27 Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$2x^3(x-5) + 3x(x-5)$$

$$(2x^3 + 3x)(x-5)$$

$$x(2x^2 + 3)$$

$$\boxed{x(2x^2 + 3)(x-5)}$$

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

27 Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$2x^4 - 10x^3 + 3x^2 - 15x$$

$$x(2x^3 - 10x^2 + 3x - 15)$$

$$x(2x^2 + 3)(x - 5)$$

$$x(2x^2 + 3)(x - 5)$$

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

27 Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$\left(2x^4 - 10x^3\right)\left(3x^2 - 15x\right)$$

$$2x^3\left(x-5\right) + 3x\left(x-5\right)$$

$$\left(2x^3 + 3x\right)\left(x-5\right)$$

Score 1: The student did not factor out the greatest common factor.

27 Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$2x^3(x-5) + 3x(x-5)$$
$$(2x^3 + 3x)(x-5)^2$$
$$x(2x^2+3)(x-5)^2$$

Score 1: The student incorrectly squared $(x - 5)$.

27 Over the set of integers, factor the expression $2x^4 - 10x^3 + 3x^2 - 15x$ completely.

$$2x^3(x-5)\ 3x(x-5)$$

$$2\,\cancel{\overset{3}{2}}\Big/\overset{}{1}\qquad (2x^3+3x)(x-5)$$

$$\cancel{x(2x+3)}$$

$$(2x^3+1x)(x-5)$$

Score 0: The student did not factor out the GCF and made a transcription error.

28 The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

31%

normal cdf(6,100,5.2,1.6)

.308

.31

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

28 The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

normCdf

$\mu = .052$

$\sigma = .016$

low: .06

up: ∞

5.2 6
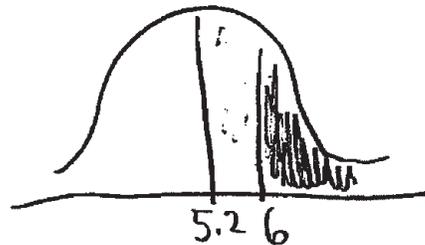
31% of towns

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

28 The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

normal CDF(0.06, aaaaa, 0.052, 0.016)

= 0.309

$\boxed{30.9\%}$

Score 1: The student made a rounding error.

28 The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

normCdf (7,100,5.2,1.6) = 0.13029...

13%

Score 1: The student used 7 as the lower value in the distribution.

28 The monthly unemployment rate of towns in the United States is approximately normally distributed with a mean rate of 5.2% and a standard deviation of 1.6%. Determine the percentage of towns, to the *nearest integer*, that have a monthly unemployment rate greater than 6%.

normal cdf (6, 100, 1.6, 5.2)

0.2

Score 0: The student made multiple errors.

29 The function $d(t) = 2\cos\left(\frac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, t hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.
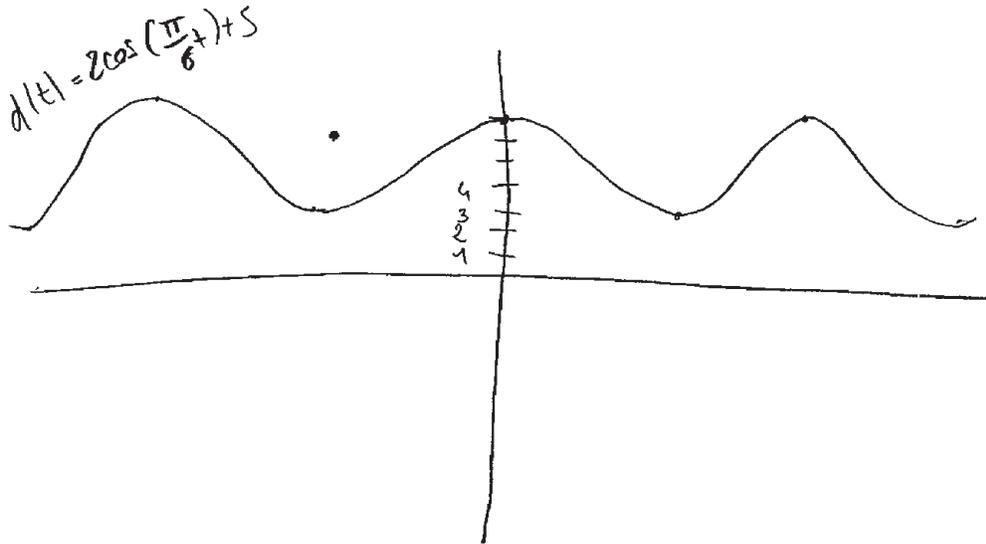
$d(t) = 2\cos\left(\frac{\pi}{6}t\right) + 5$

When graphing the depth we see that it's

at 3feet where is the minimum depth of

the spot.

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

29 The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, t hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

$$d(t) = \widehat{2}\,\cos\left(\frac{\pi}{6}t\right)\widehat{+5}$$

$$a$$

$$\text{midline}$$

$$5 - 2 = \widehat{3}$$

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

29 The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, t hours

since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

$$d(0) = 2\cos\left(\tfrac{\pi}{6}0\right) + 5 = 7$$

$$d(1) = 6.73$$

$$d(2) = 6$$

$$d(5) = 3.27$$

$$d(10) = 6$$

$$d(7) = 3.27$$

$$d(6) = 3$$

$$\boxed{6 \text{ hours}}$$

Score 1: The student found the time at which the tide reached its minimum.

29 The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, t hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

7 because the midline is
at 5 and the amplitude
is 2.

Score 1: The student stated the maximum instead of the minimum.

29 The function $d(t) = 2\cos\left(\dfrac{\pi}{6}t\right) + 5$ models the water depth, in feet, at a location in a bay, t hours since the last high tide. Determine the *minimum* water depth of the location, in feet, and justify your answer.

-3 ft, because it is the minimum altitude

Score 0: The student did not show enough relevant course-level work to receive any credit.

30 A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream t hours after drinking one cup of coffee.

$$C(t) = \cancel{130\left(\tfrac{1}{2}\right)^{t/5.5}}$$

$$C(t) = 130\left(\tfrac{1}{2}\right)^{t/5.5}$$

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

30 A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream t hours after drinking one cup of coffee.

$$65 = 130 e^{r \cdot 5.5}$$

$$\frac{65}{130} \quad \frac{130}{130}$$

$$.5 = e^{r \cdot 5.5}$$

$$\frac{\ln .5}{5.5} = \frac{r \cdot 5.5}{5.5}$$

$$C(t) = 130 e^{-.126t}$$

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

30 A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream t hours after drinking one cup of coffee.

$$C(t) = 130(0.5)^{5.5t}$$

Score 1: The student incorrectly expressed the exponent as a product.

30 A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream t hours after drinking one cup of coffee.

$$130\left(\frac{1}{2}\right)^{\frac{t}{5.5}}$$

Score 1: The student wrote an expression, not an equation.

30 A brewed cup of coffee contains 130 mg of caffeine. The half-life of caffeine in the bloodstream is 5.5 hours. Write a function, $C(t)$ to represent the amount of caffeine in the bloodstream t hours after drinking one cup of coffee.

$$C(t) = 130\, e^{(5.5)t}$$

Score 0: The student did not satisfy the criteria for one or more credits.

31 Markus is a long-distance walker. In one race, he walked 55 miles in t hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, r, for each race. Determine the number of hours that *each* of the two races took.

$$55t + 165 = 65t$$
$$\frac{165}{10} = \frac{10t}{10}$$

16.5 hours

19.5 hours

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

31 Markus is a long-distance walker. In one race, he walked 55 miles in t hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, r, for each race. Determine the number of hours that *each* of the two races took.

$$\frac{10}{3}$$

$$3.33 \, mph$$

$$\frac{55}{t} = \frac{65}{t+3}$$

$$\frac{55}{t} \times \frac{t+3}{65}$$

$$35\cancel{75} = t^2 + 3$$

$$\frac{55}{3.33}$$

$$\frac{65}{3.33}$$

race 1   16.5 h

race 2   19.5 h

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

31 Markus is a long-distance walker. In one race, he walked 55 miles in t hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, r, for each race. Determine the number of hours that *each* of the two races took.

$$\frac{55}{t} = \frac{65}{t+3}$$

$$55(t+3) = 65t$$
$$55t + 160 = 65t$$
$$\frac{10t}{10} = \frac{160}{10}$$
$$t = 16$$
$$t + 3 = 19$$

Score 1: The student made one computational error.

31 Markus is a long-distance walker. In one race, he walked 55 miles in t hours and in another race walked 65 miles in $t + 3$ hours. His rates are shown in the equations below.

$$r = \frac{55}{t} \qquad r = \frac{65}{t + 3}$$

Markus walked at an equivalent rate, r, for each race. Determine the number of hours that *each* of the two races took.

$$t \cdot \frac{55}{t} = \frac{65}{t+3} \cdot t+3$$

$$55t = 65(t+3)$$

$$55t = 65t + 195$$

$$19.5$$

$$19.5 + 3$$

$$= 22.5$$

Score 0: The student made multiple errors.

32 Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$a = 1$$
$$b = 3$$
$$c = 11$$

$$x = \frac{-3 \pm \sqrt{9 - 4(1)(11)}}{2}$$

$$x = \frac{-3 \pm \sqrt{-35}}{2}$$

$$\sqrt{-35} = \sqrt{-1 \cdot 35} = i\sqrt{35}$$

$$x = -\frac{3}{2} \pm \frac{i\sqrt{35}}{2}$$

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

32 Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$x^2 + 3x + \underline{} = -11 + \underline{}$$

$$x^2 + 3x + \frac{9}{4} = -11 + \frac{9}{4}$$

$$\sqrt{\left(x + \frac{3}{2}\right)^2} = \pm\sqrt{-\frac{35}{4}}$$

$$x + \frac{3}{2} = \pm\frac{i\sqrt{35}}{2}$$

$$x = -\frac{3}{2} \pm \frac{i\sqrt{35}}{2}$$

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

32 Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$x^2 + 3x + 11 = 0$$

$$a = 1$$
$$b = 3$$
$$c = 11$$

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

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4(1)(11)}}{2(1)}$$

$$x = \frac{-3 \pm \sqrt{-35}}{2} \quad \sqrt{-1} \to i$$
$$\sqrt{35}$$

$$x = \frac{-3 \pm \sqrt{35}\,i}{2}$$

Score 1: The student did not write the answer in $a + bi$ form.

32 Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$a = 1$$
$$b = 3$$
$$c = 11$$

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(11)}}{2(1)}$$

$$x = \frac{-3 \pm \sqrt{9 - 44}}{2}$$

$$x = \frac{-3 \pm \sqrt{-35}}{2}$$

$$x = \frac{-3 \pm 35i}{2}$$

$$\boxed{x = \frac{-3}{2} \pm \frac{35i}{2}i}$$

Score 1: The student incorrectly removed the radical when simplifying.

32 Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$a \quad b \quad c$$

$$a + bi$$

$$\frac{-3 \pm \sqrt{3^2 - 4(1)(11)}}{2(1)}$$

$$\frac{-3 \pm \sqrt{-35}}{2}$$

$$-3 \pm 7\sqrt{5}$$

$$-15 \pm 5.9i$$

$$\sqrt{35}$$
$$\sqrt{7} \quad \sqrt{5}$$
$$1$$

Score 0: The student made multiple errors simplifying.

32 Solve the equation $x^2 + 3x + 11 = 0$ algebraically. Express the answer in $a + bi$ form.

$$X = \frac{-b \pm \sqrt{b^2 + 2c}}{2a}$$

$$X = \frac{-3 \pm \sqrt{-3^2 \cdot 1(11)}}{2(1)}$$

$$X = -3 \pm \sqrt{9 - 11}$$

$$X = \frac{-3 \pm \sqrt{-2}}{2}$$

$$X = -3 \pm \sqrt{2}\sqrt{-1} \quad \cdot s$$

$$X = \frac{-3 \pm i\sqrt{2}}{2}$$

Score 0: The student did not satisfy the criteria for one or more credits.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

Years since 1900	0	10	20	30	40	50	60	70	80	90	100	110	120
Population (millions)	243	254	268	285	324	376.3	450.6	555.1	699	873.3	1056.6	1234.3	1380

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

$$2020 - 1950 = 70$$

India:
$$1380 - 376.3 = 1003.7$$

China:
$$P(50) = 316.93e^{.0133(50)} =$$
$$P(50) = 616.267$$
$$P(120) = 316.93e^{.0133(120)}$$
$$P(120) = 1563.498$$

$$1563.498 - 616.267 = 947.231$$

$$\frac{1003.7}{70} > \frac{947.231}{70}$$
↓
India had a greater average rate of change

Score 4: The student gave a complete and correct response.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

Years since 1900	0	10	20	30	40	50	60	70	80	90	100	110	120
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Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

China
$(50, 616.27)$
$(120, 1563.50)$

$\dfrac{1563.50 - 616.27}{120 - 50} = \dfrac{947.23}{70} = 13.5$

India
$(50, 376.3)$

$\dfrac{1380 - 376.3}{120 - 50} = \dfrac{1003.7}{70} = 14.3$

India population had a greater average rate of change between 1950 and 2020.

Score 4: The student gave a complete and correct response.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

Years since 1900	0	10	20	30	40	50	60	70	80	90	100	110	120
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Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

India: $\dfrac{120-50}{1380-376.3} = 0.0697419548$

China: $P(120) = 1563.498$ $\dfrac{120-50}{1563.5-616.3} = 0.0739$

$P(50) = 616.207$

China had a greater average rate of change

Question 33

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

Years since 1900	0	10	20	30	40	50	60	70	80	90	100	110	120
Population (millions)	243	254	268	285	324	376.3	450.6	555.1	699	873.3	1056.6	1234.3	1380

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

$\frac{1380 - 376.3}{80} = 14.3$

$\frac{1563 - 16.27}{80} = 13.5$

China is greater avergy of change since it ha a average of 14.3 > 13.

Score 3: The student stated an incorrect conclusion.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{\,0.0133x}$, where x is the number of years since 1900.

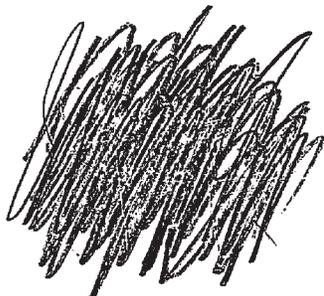The population of India since 1900 is summarized in the table below:

Years since 1900	0	10	20	30	40	50	60	70	80	90	100	110	120
Population (millions)	243	254	268	285	324	376.3	450.6	555.1	699	873.3	1056.6	1234.3	1380

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

70 yrs

India

$$\frac{1380 - 376.3}{120 - 50} = \frac{1003.7}{70} = 14.3385$$

China

$$\frac{70}{316.93} = \frac{316.93\,e^{\,0.0133x}}{316.93}$$

$$\frac{70}{316.93} = e^{\,0.013x}$$

$$\frac{\ln\frac{70}{316.93}}{0.0133} = \frac{e^{\,0.0133x}}{0.0133}$$

$$x = -113.54$$

India had the greatest rate of Change. from 1950 to 2020

Score 2: The student correctly calculated the average rate of change for India, incorrectly calculated China's average rate of change, and wrote a correct conclusion.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

Years since 1900	0	10	20	30	40	50	60	70	80	90	100	110	120
Population (millions)	243	254	268	285	324	376.3	450.6	555.1	699	873.3	1056.6	1234.3	1380

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

$$\frac{1563.5 - 616.267}{2} = \qquad \frac{1380 - 376.3}{2} = 1151$$

$$1254.86$$

China

Score 1: The student showed correct differences in the numerators.

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

Years since 1900	0	10	20	30	40	50	60	70	80	90	100	110	120
Population (millions)	243	254	268	285	324	376.3	450.6	555.1	699	873.3	1056.6	1234.3	1380

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

China: $316.93e^{0.0133(70)} = 804$

India: $\dfrac{120 - 50}{1380 - 376.3} = \dfrac{70}{1003.7} \dfrac{(70)}{1} = 100.37$ Not Correct

India has a greater rate of change between 1950 - 2020

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

33 The population of China, in millions, can be modeled by the function $P(x) = 316.93e^{0.0133x}$, where x is the number of years since 1900.

The population of India since 1900 is summarized in the table below:

Years since 1900	0	10	20	30	40	50	60	70	80	90	100	110	120
Population (millions)	243	254	268	285	324	376.3	450.6	555.1	699	873.3	1056.6	1234.3	1380

Which country's population had a greater average rate of change between 1950 and 2020? Justify your answer.

chart $\dfrac{y_2 - y_1}{x_2 - x_1}$ $\dfrac{20-10}{268-254} = \dfrac{5}{7} = 0.7142857143$

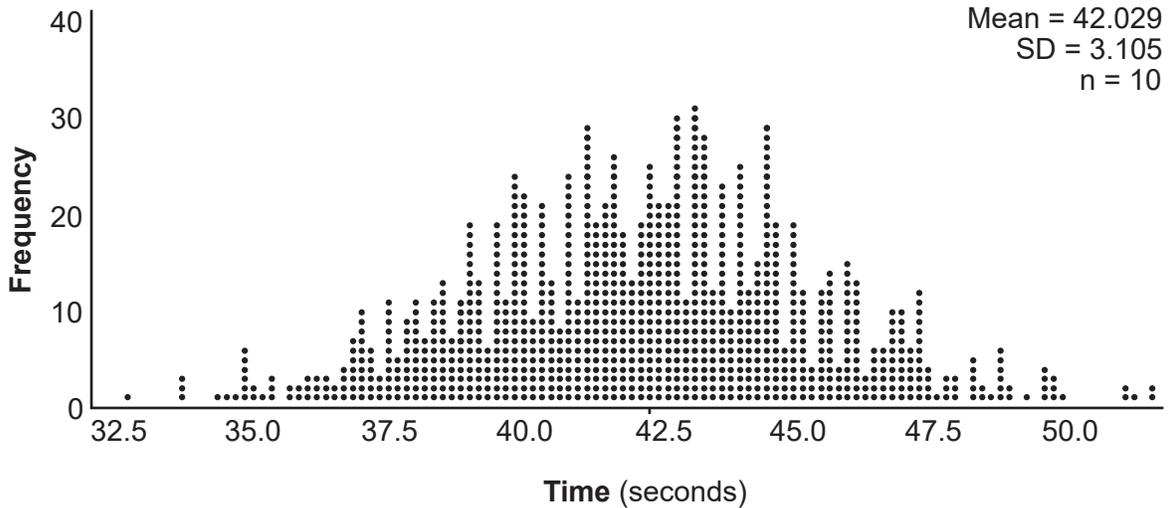p(x) $\dfrac{y_2 - y_1}{x_2 - x_1}$ $\dfrac{20-10}{413.51-364.43}$ $\dfrac{250}{1227} = 0.2037489813$

China's average rate of change between 1950 and 2020 is greater than India's average rate of change because China's average rate of change is 0.7142857143 while India's is 0.2037489813.

Score 0: The student did not satisfy the criteria for one or more credits.

34 In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.

Mean = 42.029
SD = 3.105
n = 10

Time (seconds)

2sd

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

42.029
+ 6.21
‾‾‾‾‾‾‾
·48.239

42.029
- 6.21
‾‾‾‾‾‾‾
35.819

35.82 to 48.24

Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.
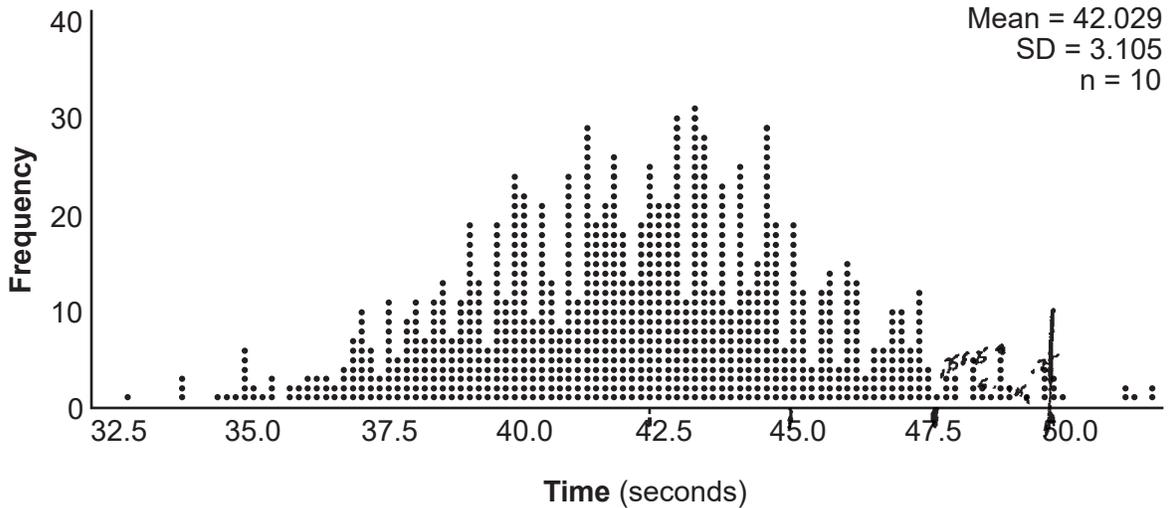
Yes because it falls out of the range in which we could be 95% sure.

Score 4: The student gave a complete and correct response.

34 In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.

Mean = 42.029
SD = 3.105
n = 10

Time (seconds)

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

M.o.c = 2(3.105)
M.oc = 6.21

(35.82, 48.24)

42.029 + 6.21 = 48.239
42.029 - 6.21 = 35.819

Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

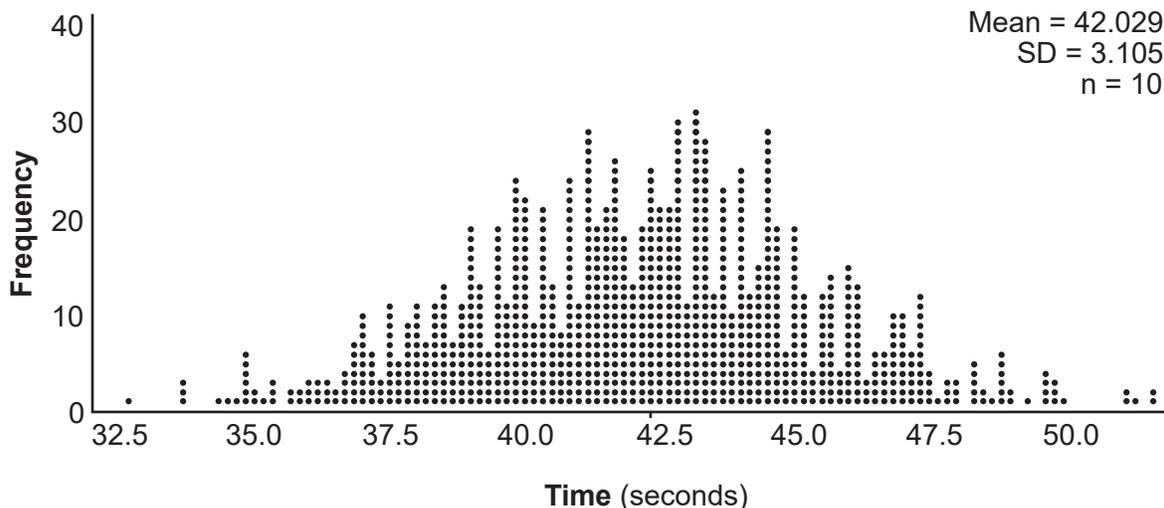$\frac{9}{1000}$ = .009 .9%   Yes very unusual,
it is not within the 95%
confidence interval and
49.8 seconds or greater
only happens .9% of
the time which is statstically
signficant, so much so that
is very small.

Score 4: The student gave a complete and correct response.

34 In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.

Mean = 42.029
SD = 3.105
n = 10

Time (seconds)

-2 to 2

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

mean + 2(SD)   (35.819, 48.239)

mean - 2(SD)

42.029 + 2(3.105) = 48.239

42.029 - 2(3.105) = 35.819

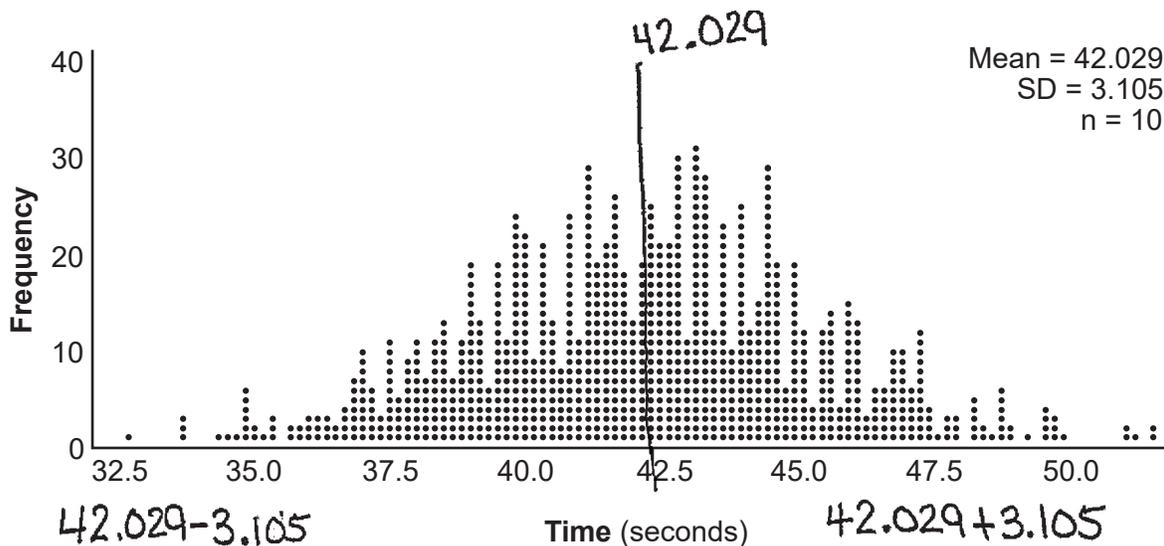Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

yes because 49.8 falls
outside the (35.819, 48.239)
interval

Score 3:   The student did not round to the nearest hundredth.

34 In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.

42.029

Mean = 42.029
SD = 3.105
n = 10

42.029-3.105

42.029+3.105

Time (seconds)

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

38.92 to 45.134

Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.
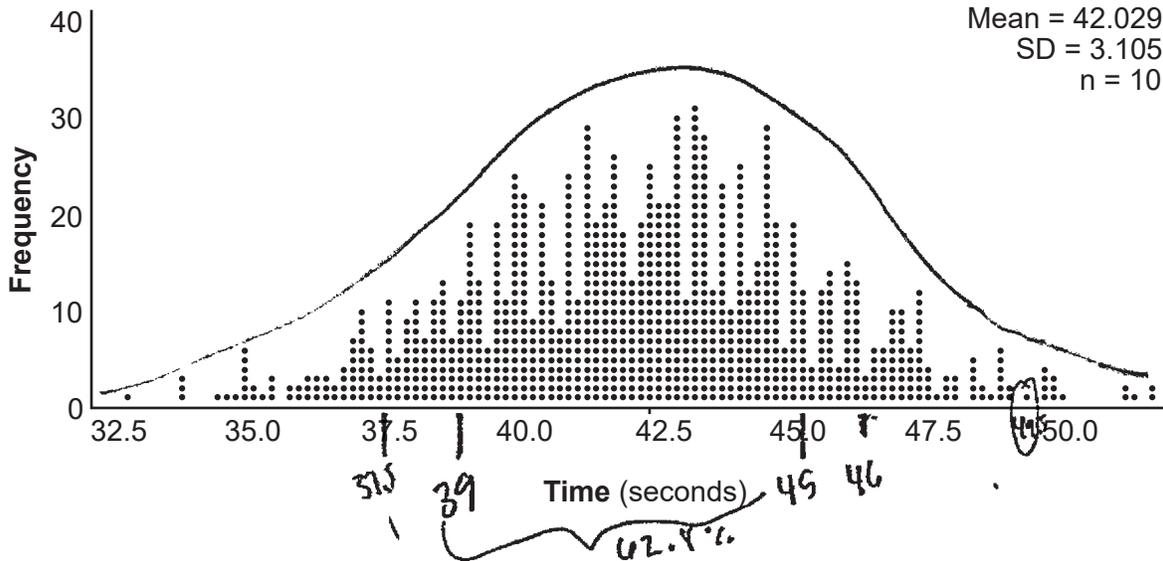
Yes, 49.8 sec. is unusal because
it does not fall between
the intervals.

Score 2: The student provided a complete justification.

34 In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

$$\left(37.50, 46.00\right)$$

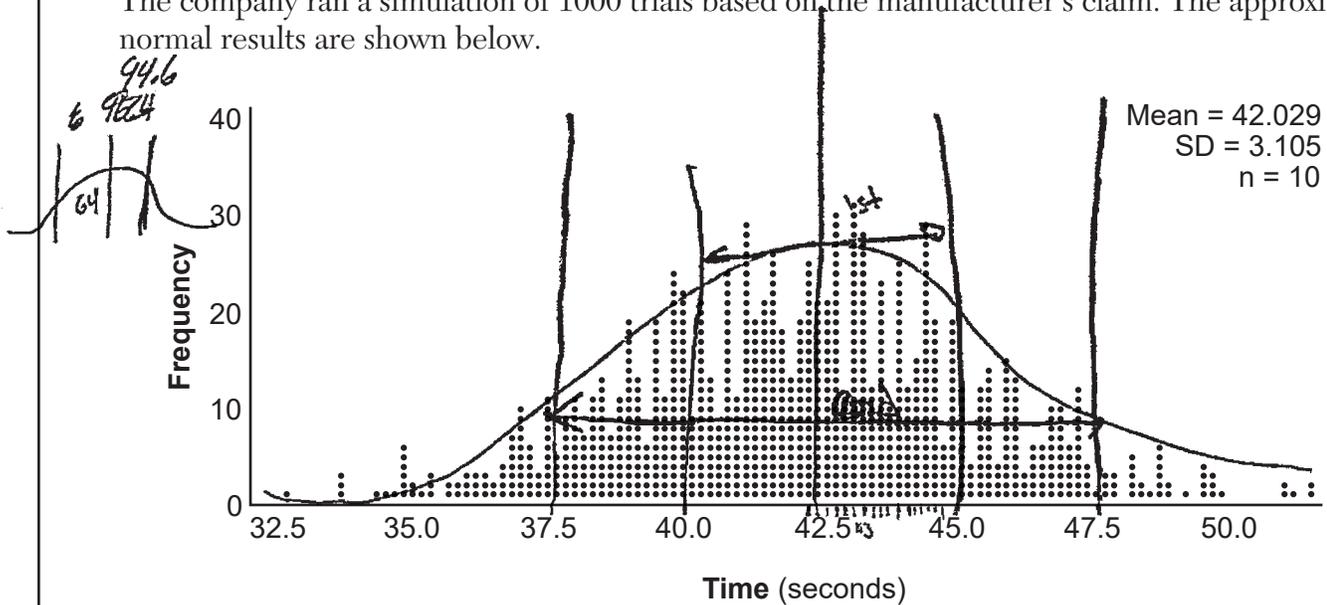Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

yes, 49.8 very rarely occurs

Score 1: The student provided an incomplete justification.

34 In a packaging plant, a machine packs boxes with jars. The machine's manufacturer states that a box is packed, on average, every 42 seconds. To test that claim, the packaging plant randomly selects a sample of 10 boxes and finds the sample mean to be 49.8 seconds.

The company ran a simulation of 1000 trials based on the manufacturer's claim. The approximately normal results are shown below.

94.6
6 964
64

Mean = 42.029
SD = 3.105
n = 10

Frequency — 40, 30, 20, 10, 0

Time (seconds): 32.5, 35.0, 37.5, 40.0, 42.5, 45.0, 47.5, 50.0

Based on the simulation, determine an interval containing the middle 95% of plausible mean times. Round your answer to the *nearest hundredth*.

37.5 ⟶ 47.5

10 secounds

47.5
−37.5
10

Is the time 49.8 seconds unusual? Use statistical evidence to justify your answer.

No it is above the 2nd notation and is greater than the 94.6 percent in the standard deivation

Score 0: The student did not satisfy the criteria for one or more credits.

35 Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

$f(x)$ is not an even function. $f(x) \neq f(-x)$

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2^x + 5$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$x = 2^y + 5$$

$$x - 5 = 2^y$$

$$\log_2(x-5) = \log_2(2^y)$$

$$\log_2(x-5) = y$$

$$h(x) = \log_2(x-5)$$

Score 4: The student gave a complete and correct response.

35 Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

(0,1) $2^x = f(x)$

No   Not Symmetry w/ respect to y at y

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$f(x) + 5 = g(x)$$

Write an equation for $h(x)$, the inverse of $g(x)$.
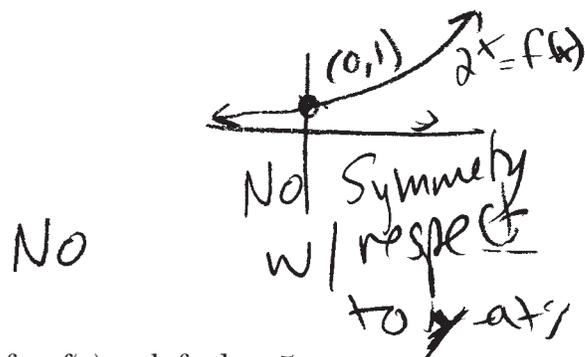
$$x = 2^y + 5$$
$$x - 5 = 2^y$$
$$\log(x-5) = y \log 2$$
$$h(x) = \frac{\log(x-5)}{\log 2}$$

Score 4: The student gave a complete and correct response.

35 Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

$$f(-x) = 2^{-x}$$
$$-f(x) = -2^x \qquad \boxed{No}$$

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$f(x) = 2^x$$
$$\boxed{g(x) = 2^x + 5}$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$y = 2^x + 5$$

$$\boxed{h(x) = \log(x-5) - .36103}$$

$$\begin{array}{cc} x = 2^y + 5 \\ -5 \qquad -5 \end{array}$$

$$\log(x-5) - \log(2)$$

$$x - 5 = 2^y$$

$$\frac{\log(x-5)}{\log(2)} = \frac{y \log 2}{\log 2}$$

$$H(x) = \frac{\log(x-5)}{\log(2)}$$

Score 3: The student did not provide a sufficient justification.

35 Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

$f(x)$ is not an even function,
It's exponential meaning there's
no reflection or rotation on the graph.

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2^x + 5$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$y = 2^x + 5$$
$$x = 2^y + 5$$
$$x - 5 = 2^y$$
$$2^y = x - 5$$
$$\log_2 x - 5 = y$$
$$\boxed{h(x) = \log_2 x - 5}$$

Score 2: The student did not provide a sufficient justification and is missing parentheses when expressing $h(x)$.

Question 35

35 Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

No, it's not symmetrical/equal when mirrored across the y-axis

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2^{x+5}$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$$h(x) = -2^{x-5}$$

Score 1: The student provided a correct justification.

35 Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

F(x) is an even Function because when observing the graph

← a graph of an even function

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$g(x) = 2^x + 5$

Write an equation for $h(x)$, the inverse of $g(x)$.

$h(x) = 2^x + 5$

$y = 2^x + 5$
$ -5$

$y - 5 = 2^x$

$\log_2 y - 5 = x$

Score 1: The student correctly stated an equation for $g(x)$.

35 Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

Yes- slope is going up to the right which makes it even.

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$g(x) = 2 \cdot x - 5$$

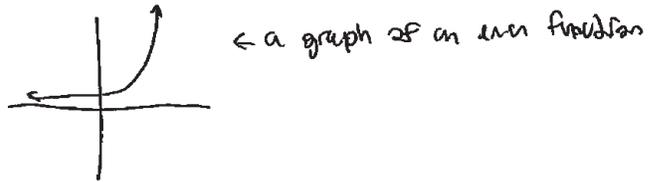Write an equation for $h(x)$, the inverse of $g(x)$.

$$x = 2^y - 5$$

$$x + 5 = 2^y$$

$$\log_2 x+5 = y$$

$$h(x)^{-1} = \log_2 x + 5$$

Score 0: The student did not satisfy the criteria for one or more credits.

35 Consider the function $f(x) = 2^x$.

Is $f(x)$ an even function? Justify your answer.

f(x) is an even function because it is positive and it contains a coefficient and exponent

Write an equation for $g(x)$, the function that results after $f(x)$ is shifted up 5 units.

$$f(x) = 2^x + 5$$

Write an equation for $h(x)$, the inverse of $g(x)$.

$-2x - 5$

Score 0: The student did not satisfy the criteria for one or more credits.

36 Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$$\underline{+y}$$
$$x = \boxed{6+y}$$

$$\left(6+y-4\right)^2 + (y-1)^2 = 9$$

$$\left(2+y\right)^2 + (y-1)^2 = 9$$

$$(2+y)(2+y) + (y-1)(y-1) = 9$$

$$4 + 4y + y^2 + y^2 - 2y + 1 = 9$$

$$2y^2 + 2y + 5 = 9$$

$$2y^2 + 2y - 4 = 0$$

$$2(y^2 + y - 2) = 0$$

$$2(y+2)(y-1) = 0$$

$$2 \neq 0 \quad | \quad y = -2 \quad | \quad y = 1$$

$$\boxed{-2}$$

$$x - y = 6$$
$$x - (-2) = 6$$
$$x + 2 = 6$$
$$\boxed{x = 4}$$

$$\boxed{y = 1}$$

$$x - y = 6$$
$$x - 1 = 6$$
$$\boxed{x = 7}$$

$$\boxed{(4, -2)}$$
$$\boxed{(7, 1)}$$

Score 4:   The student gave a complete and correct response.

36 Solve the system of equations shown below algebraically:

$(x-4)(x-4)$

$$(x-4)^2 + (y-1)^2 = 9$$
$$x - y = 6$$
$$-y = -x + 6$$
$$y = x - 6$$

$$(x-4)^2 + ((x-6)-1)^2 = 9$$
$$(x-7)^2$$
$$x^2 - 8x + 16 + x^2 - 14x + 49 = 9$$
$$2x^2 - 22x + 56 = 0$$
$$2(x^2 - 11x + 28) = 0$$
$$\frac{(x-7)(x-4) = 0}{x=7 \mid x=4}$$

$(7) - y = 6$ $\qquad$ $4 - y = 6$

$-y = -1$ $\qquad\qquad$ $-y = 2$

$\boxed{y = 1}$ $\qquad\qquad$ $\boxed{y = -2}$

$(7, 1)$ $\qquad\qquad$ $(4, -2)$

Score 4:   The student gave a complete and correct response.

36 Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$$\underline{}{}^{-x} \qquad {}^{-x}$$

$$\frac{-y = -x + 6}{-1}$$

$$y = x - 6$$

$$(x-4)^2 + (x - 6 - 1)^2 = 9$$

$$x^2 - 4x - 4x + 16 + (x-7)^2 = 9$$

$$x^2 - 8x + 16 + x^2 - 7x - 7x + 49 = 9$$

$$x^2 - 8x + 16 + x^2 - 14x + 49 = 9$$
$$\qquad\qquad\qquad\qquad\qquad -49 \;\; -49$$

$$\underline{}$$

$$2x^2 - 22x + 16 = -40$$
$$\qquad\quad -16 \qquad -16$$
$$\underline{}$$

$$\frac{2x^2 - 22x = -56}{2}$$

$$x^2 - 11x = -28$$
$$\qquad +28 \quad +28$$
$$\underline{}$$

$$x^2 - 11x + 28 = 0$$

$$(x - 7)(x - 4) = 0$$

$$\boxed{\begin{array}{l} x = 7 \\ x = 4 \end{array}}$$

Score 3:   The student correctly found both values of x.

36 Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$x - y = 6$

$+y \quad +y$

$x = 6 + y$

$x - y = 6$

$\overset{\cdot\cdot}{x} - 1 = 6$

$+1 \quad +1$

$x = 7$

$x = 7$

$y = 1$

or

$y = 2$

$(x-4)(x-4) + (y-1)(y-1) = 9$

$x^2 - 4x - 4x + 16 + y^2 - y - y + 1 = 9$

$x^2 - 8x + 16 + y^2 - 2y + 1 = 9$

$\qquad\qquad -17 \qquad\qquad -17$

$x^2 - 8x + y^2 - 2y = -8$

$(y+6)(y+6) - 8(6+y) + y^2 - 2y = -8$

$\overset{12y}{} \qquad\qquad \overset{-10y}{}$

$y^2 + 6y + 6y + 36 - 48 - 8y + y^2 - 2y = -8$

$2y^2 + 2y - 12 = -8$

$\qquad\qquad +8 \quad +8$

$2y^2 + 2y - 4 = 0$

$2(y^2 + 1y - 2) = 0$

$\dfrac{2(y + 2)(y-1)}{2} = \dfrac{6}{2}$

$(y+2)(y-1) = 0$

$y + 2 = 0 \qquad y - 1 = 0$

$\quad -2 \ -2 \qquad +1 \ +1$

$y = 2 \qquad\qquad y = 1$

Score 3: The student found one correct solution.

36 Solve the system of equations shown below algebraically:

$$(x-4)^2 + (y-1)^2 = 9$$
$$x - y = 6$$

$$x - y = 6$$
$$+y \quad +6$$
$$\overline{}$$
$$x - 6 = y$$

$$(x-4)(x-4) + (y-1)(y-1) = 9$$
$$x^2 - 4x - 4x + 16 \;+\; y^2 - y - y + 1 = 9$$
$$x^2 - 8x + 16 \;+\; y^2 - 2y + 1 = 9$$
$$-16 \qquad\qquad =1 \quad -1$$
$$\overline{ \; 16}$$
$$x^2 - 8x - 1 - y = -8$$
$$xy(x-8) + (y-2) = -8$$

$$(x-4)^2 + ((x-6)-1)^2 = 9$$
$$(x-4)^2 + (x-7)^2 = 9$$

$$x^2 - 4x - 4x + 16 + (x-7)(x-7) = 9$$
$$x^2 - 8x + 16 \;+\; x^2 - 7x - 7x + 49 = 9$$

$$x^2 - 8x + 16 + x^2 - 14x + 49 = 9$$

$$2x^2 - 22x + 69 = 9$$
$$-9 \quad -9$$
$$\overline{}$$
$$2x^2 - 22x + 60 = 0$$
$$(2x - 10)(x - 6) = 0$$

$$\{5, 6\}$$

$$2x = 10 \cdot 0 \qquad x - 6 = 0$$
$$-10 \qquad\qquad x = 6$$
$$\frac{2x}{2} = \frac{10}{2}$$
$$\boxed{x = 5} \qquad x = 6$$

Score 2: The student made a computational error solving for *x* and didn't find either *y*-value.

36 Solve the system of equations shown below algebraically:

$(x-4)^2 + (y-1)^2 = 9$
$x - y = 6$

$(x+4)(x+4)$

$x^2 + 4x + 4x + 16$

$x^2 + 8x + 16$

$\dfrac{-x \quad -x}{\dfrac{-y}{-1} = \dfrac{-x}{-1} + \dfrac{6}{-1}}$

$y = x - 6$

$(x-6-1)(x-6-1)$

$x^2 - 6x - x - 6x + 36 + 6 - x + 6 + 1$

$x^2 - 12x - 2x + 49$

$x^2 - 14 + 49$

$(x-4)^2 + (x-6-1)^2 = 9$

$x^2 + 8x + 16 + x^2 - 14x + 49 = 9$

$2x^2 - 6x + 65 = 9$

$\underline{\qquad -9 \quad\quad -9 \qquad}$

$\dfrac{2x^2}{2} - \dfrac{6x}{2} + \dfrac{56}{2} = 0$

$x^2 - 3x + 28$

$\dfrac{28}{-7 \cdot 4} \Big| \dfrac{-3}{-7+4} \quad (x-7)(x+4)$

$X - 7 = 0 \quad x + 4 = 0$
$\underline{+7 +7} \quad \underline{-4 \ -4}$
$X = 7 \quad\quad X = -4$

$X = \{7, -4\}$

$X = 7 \quad\quad X = -4$
$Y = 1 \quad\quad Y = -10$

Score 2: The student made one computational and one factoring error.

36 Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$$x - y = 6$$
$$\underline{-x \qquad \qquad -x}$$
$$\frac{-y}{-1} = \frac{6-x}{-1}$$

$$y = -6 + x$$

$$(x-4)^2 + (y-1)^2 = 9$$

$$(x-4)(x-4) + (-6+x-1)(-6+x-1) = 9$$

$$x^2 - 4x - 4x +16 +36 - 6x +6 -6x +x^2 -x \cdot 6x$$

$$2x^2 - 20x + 59 = 9$$
$$\qquad \qquad -9 \quad -9$$

$$2x^2 - 20x - 50$$

$$2x^2 - 10x - 10x - 50$$
$$-10 \diagdown -10 \quad 2x(x-5) \big| -10(x-5)$$
$$\qquad -20$$

$$(2x-10)(x-5)$$
$$\underline{\qquad\qquad\qquad}$$
$$2x = 10 \quad x = 5$$
$$x = 5$$

Score 1: The student wrote a correct quadratic equation in one variable.

36 Solve the system of equations shown below algebraically:

$$(x - 4)^2 + (y - 1)^2 = 9$$
$$x - y = 6$$

$(h,k) = (4, 1)$

$r = 3$

$$\frac{-6 + y \quad -6 + y}{x - 6 = y}$$

$x = 7$

$x = 4$
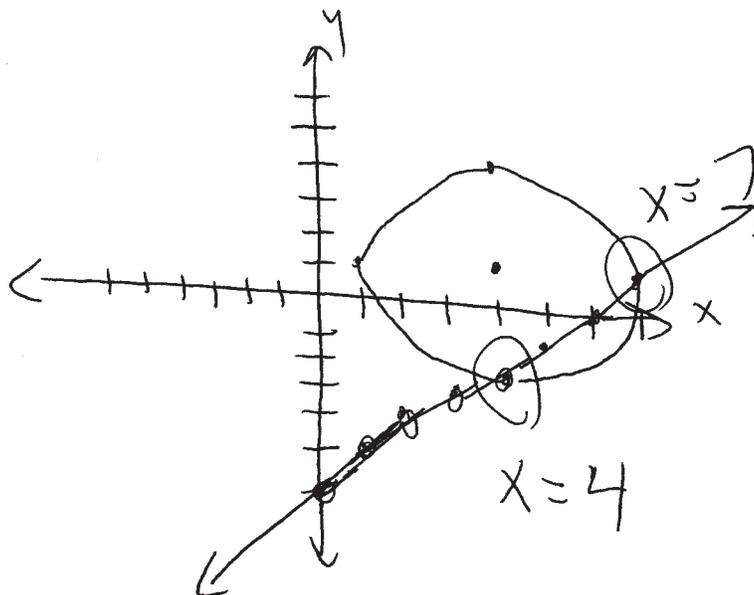
Score 1: The student solved graphically and only stated the *x*-values.

36 Solve the system of equations shown below algebraically:

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

$(x-4)^2 + (y-1)^2 = 9$

$x - y = 6$

$y = x - 6$

$x = y + 6$

$(y+8)(y+4) + (y+1)(y-1) = 9$

$y^2 + 12y + 32 + y^2 - 1 = 9$

$2y^2 + 12y + 31 = 9$

$ -9 \quad -9$

$2y^2 + 12y + 22 = 0$

$x = -b \pm \dfrac{\sqrt{b^2 - 4ac}}{2a}$

$x = \dfrac{-(12) \pm \sqrt{(12)^2 - 4(2)(22)}}{2(2)}$

$x = \dfrac{-12 \pm \sqrt{-32}}{4}$

$y = (-3 \pm 32i) - 6$

$x = -3 \pm \sqrt{\dfrac{-32}{4}}$

$x = -3 \pm 32i$

Score 0: The student did not satisfy the criteria for one or more credits.

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

$$1200 \left(1 + \frac{z}{t}\right)^{xt}$$

$$A(t) = 1200 \left(1 + \frac{0.064}{4}\right)^{4t} \rightarrow A(t) = 1200(1.016)^{4t}$$

$$B(t) = 1200(e)^{0.0635t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200(1.016)^{40} = 2264.28$$

$$B(t) = 1200 e^{0.0635(10)} = \boxed{2264.43}$$

She should choose bank B (Barnyard Bank)

Question 37 is continued on the next page.

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

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600}{1200} = \frac{1200 e^{0.0635t}}{1200}$$

$$3 = e^{0.0635t}$$

$$\log_e 3 = 0.0635t$$

$$\boxed{17.3} = \frac{1.098612289}{0.0635} = \frac{0.0635t}{0.0635}$$

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

$$A(t) = 1200 \left(1 + \frac{.064}{4}\right)^{4t}$$

$$B(t) = 1200 \left(1 + .0635\right)^{t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200 \left(1 + \frac{.064}{4}\right)^{4t}$$

$$A(t) = 1200 \left(1.016\right)^{4(10)}$$

$$A(t) = \$2264.28$$

America's Bank will earn the most money.

$$B(t) = 1200 \left(1 \cdot 0635\right)^{10}$$

$$B(t) \sim \$ 2221.04$$

Question 37 is continued on the next page.

Score 5: The student wrote the incorrect equation for $B(t)$.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600}{120e} = \frac{1200(1.0635)^t}{1200}$$

$$3 = (1.0635)^t$$

$$\frac{\log 3}{\log 1.0635} = \frac{t \log 1.0635}{\log 1.0635}$$

$$\boxed{17.8 \text{ years} = t}$$

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

$$A(t) = 1200\left(1 + \frac{0.064}{4}\right)^{4t}$$

$$B(t) = 1200e^{0.0635t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200\left(1 + \frac{0.064}{4}\right)^{40}$$

$$A(t) = 2264.28$$

American Bank
2264.28 > 1547.01

$$B(t) = 1200e^{0.2540}$$

$$B(t) = 1547.01$$

$$\frac{.0635}{}\frac{4}{2540}$$

Question 37 is continued on the next page.

Score 5: The student incorrectly evaluated $B(4)$ rather than $B(10)$.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$3600 = 1200e^{0.0635t}$$

$$3 = e^{0.0635t}$$

$$\ln(3) = 0.0635t$$

$$\boxed{t = 17.3 \text{ years}}$$

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

$$A(t) = 1200(.064)^{4t}$$

$$B(t) = 1200e^{.0635t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200(.064)^{4(10)} = 2.812021647773$$

$$B(t) = 1200e^{.0635(10)} = 2264.42656975$$

Taylor should choose Barnyard Bank.

Question 37 is continued on the next page.

Score 4: The student wrote an incorrect equation for $A(t)$ and incorrectly evaluated $A(10)$.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600}{1200} = \frac{1200e^{.0635t}}{1200}$$

$$3 = e^{.0635t}$$

$$\ln 3 = \ln e^{.0635t}$$

$$\frac{\ln 3}{.0635} = \frac{.0635t}{.0635}$$

$$t \approx 17.30098809239$$

It will take 17.3 years.

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

$$A(T) = 1200\left(1 + \frac{0.064t}{4}\right)^{4t}$$

America

$$B(T) = 1200e^{0.0635t}$$

Barnyard

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$1200\left(1 + \frac{0.064}{4}\right)^{4(10)} \quad \$2264.277$$

$$1200e^{0.0635(10)} = \$2264.426 \quad \text{Bank of America}$$

$$\underline{Barnyard}$$

Score 4: The student incorrectly solved for the time it takes for the deposit to triple.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600 = 1200e^{0.0635t}}{1200e}$$

$$\frac{8.154 = 0.0635t}{0.0635}$$

$$128.4 \text{ years}$$

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

$$A(t) = 1200(1+.064)^{.4t}$$

$$B(t) = 1200c^{.0635t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$1200(1+.064)^{4(10)} = \boxed{14399.82}$$ She should choose America's bank.

$$(1200)^{.0635(10)} = 762 \;\checkmark\; \text{greater than}$$

Score 3: The student wrote an incorrect equation for $A(t)$, incorrectly evaluated $B(10)$, and made a rounding error.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$17 \text{ years}$$

$$\frac{3600}{1200} = \frac{1200e^{.0635t}}{1200}$$

$$(\ln) \ 3 = e^{.0635t} \ (\ln)$$

$$\ln 3 = .0635t$$

$$P = 1\left(\frac{a}{a}\right)^{\frac{t}{h}}$$

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

America Bank

$A(t) \quad P\left(1+\frac{}{}\right)^{\frac{t}{n}}$

$$A(t) = 1200\left(1+\frac{.064}{4}\right)^{\frac{t}{4}}$$

Barnyard

$$B(t) = 1200e^{(.0635)(t)}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$A(t) = 1200\left(1+\frac{.064}{4}\right)^{\frac{10}{4}}$$

$$A(t) = 1,248.58$$

$$B(t) = 1200e^{(.0635)(10)}$$

$$B(t) \approx 2,264.43$$

∴ taylor should use Barnyard Bank

Question 37 is continued on the next page.

Score 3: The student wrote an incorrect equation for $A(t)$, but provided a correct justification.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$\frac{3600}{1200} = \frac{\cancel{1200}e^{(.0635)(t)}}{\cancel{1200}}$$

$$3 = e^{(.0635)(t)}$$

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

A

$$1200\left(1 + .064\right)^{(t)}$$

B   Pert

$$1200\, e^{(.0635)(t)}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

$$2231.50$$

$$2264.43$$

Barnyard because she will get more money

Question 37 is continued on the next page.

Score 2: The student provided an appropriate justification for choosing Barnyard Bank.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

Around 17 years

$$\frac{3600}{1200} \quad \frac{1200 e^{(.0675)(t)}}{1200}$$

$$3$$

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has
4 narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded
quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.
0.0635   0.064   365
Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank
and Barnyard Bank as a function of time, t, in years.

$$A(t) = 1200\left(\frac{0.064}{4}\right)^{\frac{t}{12}}$$

$$B(t) = 1200\left(\frac{0.0635}{365}\right)^{\frac{t}{12}}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits
and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

America's Bank, recieves $A(10) = 38.25$
more interest in 10
year period   . $B(10) = .884$

Score 1: The student correctly evaluated their incorrect equations at 10 years.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

$$B(t) = 1200\left(\frac{0.0635}{365}\right) \div \frac{.10}{12}$$

$$\overline{3}$$

37 Taylor wants to open an investment account with the $1200 she received for her birthday. She has narrowed her choices down to two banks. America's Bank offers 6.4% annual interest compounded quarterly. Barnyard Bank offers 6.35% annual interest compounded continuously.

Write functions for $A(t)$ and $B(t)$ to represent the value of her investment with America's Bank and Barnyard Bank as a function of time, t, in years.

$$A(t) = 1200(1 + 0.064)^{\frac{t}{4}}$$

$$B(t) = 1200(1 + 0.0635)^{t}$$

Taylor would like to invest the $1200 into one bank for ten years making no additional deposits and no withdrawals. With which bank will Taylor earn the most money? Justify your answer.

she should close America's bank.

Score 0: The student did not satisfy the criteria for one or more credits.

Taylor chooses to invest her money in Barnyard Bank. Algebraically determine how long, to the *nearest tenth of a year*, it will take her initial investment to triple assuming she makes no deposits or withdrawals.

23.6 years