The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA II

Thursday, January 23, 2025 — 1:15 to 4:15 p.m., only

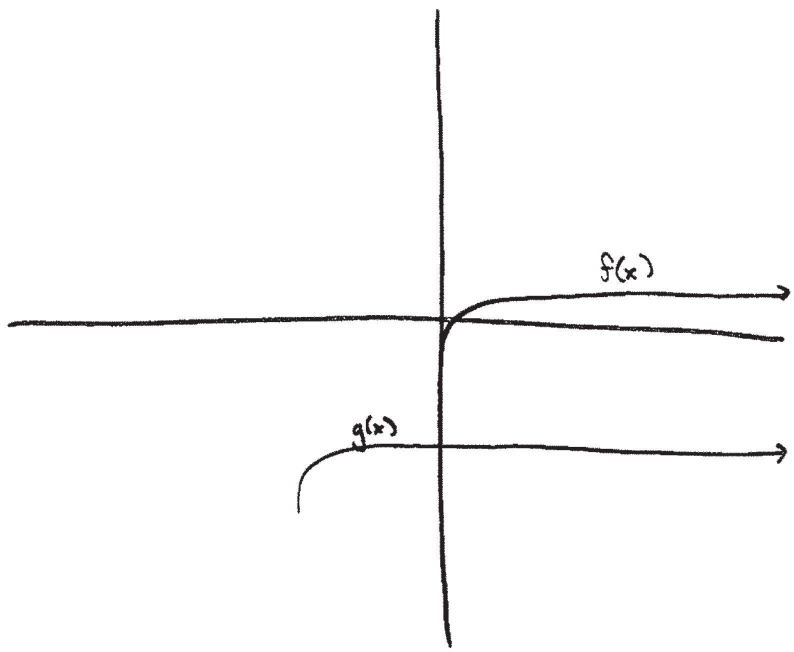
MODEL RESPONSE SET

Table of Contents

Question 25

25 Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

The map translates 3 units to the left & 5 units down.



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

Question 25

25 Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

$T_{(-3,-5)}$

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

Question 25

25 Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

The graph goes 3 units right and 5 units down.

Score 1: The student incorrectly described the horizontal shift.

Question 25

25 Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

Shift down and to the left

Score 1: The student did not include units in the description.

Question 25

25 Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

It would tranisted up 3 units and
to the left 5 units

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

Question 25

25 Describe the translations that map $f(x) = \log x$ to $g(x) = \log(x + 3) - 5$.

log(x) moved 4.5 units down and had a vertical stretch

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

Question 26

26 Solve algebraically for x: $\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$

comon D = 6x

$$\frac{3}{3}\left(\frac{1}{2x}\right) - \left(\frac{5}{6}\right)\frac{x}{x} = \left(\frac{3}{x}\right)\frac{6}{6}$$

$$\frac{3}{\cancel{6x}} - \frac{5x}{\cancel{6x}} = \frac{18}{\cancel{6x}}$$

$$\begin{array}{r} 3 - 5x = 18 \\ -3 \qquad -3 \\ \hline \end{array}$$

$$\frac{-5x}{-5} = \frac{15}{-5}$$

$$\boxed{x = -3}$$

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

Question 26

26 Solve algebraically for x: $\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$

$\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$

$-\frac{3}{x} \quad -\frac{3}{x}$

$\frac{1}{2x} - \frac{5}{6} - \frac{3}{x} = 0$

$+\frac{5}{6} \quad +\frac{5}{6}$

$\frac{1}{2x} - \frac{3}{x} = \frac{5}{6}$

$\frac{1}{2x} - \frac{3}{x} = \frac{5}{6}$

$2x \cdot -\frac{5}{2x} = \frac{5}{6} \cdot 2x$

$6 \cdot -5 = \frac{10x}{6} \cdot 6$

$\frac{-30}{10} = \frac{10x}{10}$

$\boxed{x = -3}$

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

Question 26

26 Solve algebraically for x: $\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$

$$\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$$

$$\frac{3}{x} - \frac{1}{2x} = -\frac{5}{6}$$

$$\frac{6}{2x} - \frac{1}{2x}$$

$$\cancel{\frac{5}{2x} = -\frac{5}{6}}$$

$$10x = 30$$

$$x = 3$$

$$\boxed{-3}$$

Score 1: The student made one computational error.

Question 26

26 Solve algebraically for x: $\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$

$$\frac{1^{(3x)}}{2x(3)} - \frac{5^{(x)}}{6(x)} = \frac{3^{(6)}}{x(6)}$$

$$\frac{3x}{\cancel{6x}} - \frac{5x}{\cancel{6x}} = \frac{18}{\cancel{6x}}$$

$$3x - 5x = 18$$

$$\frac{-2x}{-2} = \frac{18}{-2}$$

$$\boxed{x = -9}$$

Score 1: The student made one computational error.

Question 26

26 Solve algebraically for x: $\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$

$$\frac{1}{3(2x)} - \frac{5}{x(6)} = \frac{3}{6(x)}$$

$$\frac{1}{6x} - \frac{5}{6x} = \frac{3}{6x}$$

$$\frac{4}{6x} = \frac{3}{6x}$$

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

Question 26

26 Solve algebraically for x: $\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$

$$\frac{1}{2x} - \frac{5}{6} = \frac{3}{x}$$

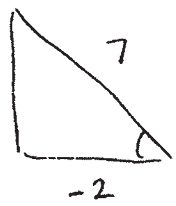
$$\frac{6}{12x} - \frac{10x}{12x} = \frac{36}{12x} \rightarrow \frac{30}{10x} \rightarrow \boxed{x = 3}$$

Score 0: The student made multiple errors.

Question 27

27 Given $\cos\theta = -\frac{2}{7}$ with θ in Quadrant II, find the exact value of $\sin\theta$.

SOH CAH TOA



$a^2 + 4 = 49$

$a^2 = 45$

$a = 3\sqrt{5}$

$\sin\theta = \frac{3\sqrt{5}}{7}$

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

Question 27

27 Given $\cos\theta = -\frac{2}{7}$ with θ in Quadrant II, find the exact value of $\sin\theta$.

$$\left(-\frac{2}{7}\right)^2 + \sin\theta^2 = 1$$

$$\cancel{\frac{4}{49}} + y^2 = 1$$

$$\cancel{-\frac{4}{49}} \qquad -\frac{4}{49}$$

$$\sqrt{y^2} = \pm\sqrt{\frac{45}{49}}$$

$$\boxed{y = \frac{\sqrt{45}}{7}}$$

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

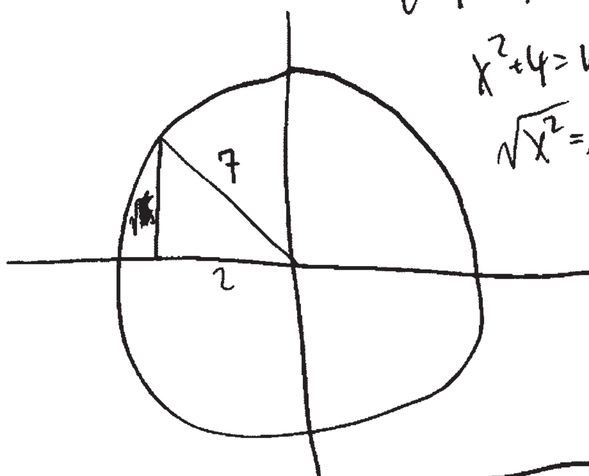
Question 27

27 Given $\cos\theta = -\frac{2}{7}$ with θ in Quadrant II, find the exact value of sin θ.

$2^2+y^2=7^2$

$x^2+4=49$

$\sqrt{x^2}=\sqrt{45}$



$$\boxed{\sin\theta = \frac{\sqrt{45}}{-7}}$$

Score 1: The student made a sign error.

Question 27

27 Given $\cos\theta = -\frac{2}{7}$ with θ in Quadrant II, find the exact value of $\sin\theta$.

$\cos = \frac{a}{h} = \frac{-2}{7}$

$\sin = \frac{o}{h} = \frac{\sqrt{53}}{7}$

$-2^2 + x^2 = 7^2$

$-4 + x^2 = 49$

$+4 \qquad +4$

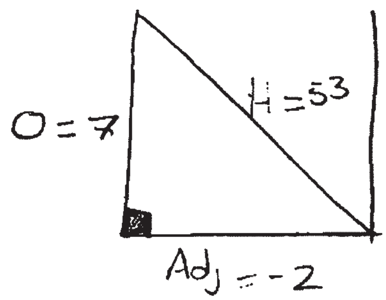
$\sqrt{x^2} = \sqrt{53}$

$x = \sqrt{53}$

Score 1: The student made a computational error.

Question 27

27 Given $\cos \theta = -\frac{2}{7}$ with θ in Quadrant II, find the exact value of $\sin \theta$.



$\cos = \frac{A}{O} = \frac{-2}{7}$

$\sin = \frac{O}{H} = \frac{7}{53}$

$a^2+b^2=c^2$

$7^2+2^2=c^2$

$53=c^2$

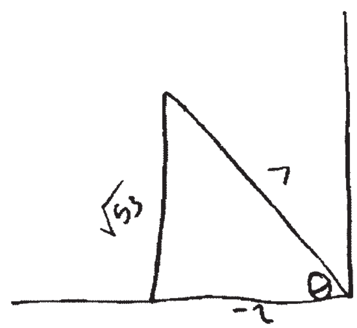
Score 0: The student made multiple errors.

Question 27

27 Given $\cos \theta = -\frac{2}{7}$ with θ in Quadrant II, find the exact value of $\sin \theta$.

SOH
CAH
TOA

$COS = \frac{A}{H}$ ← always a positive



$a^2 + b^2 = c^2$

$-2^2 + b^2 = 7^2$

$-4 + b^2 = 49$

$+4 \qquad +4$

Score 0: The student made multiple errors.

Question 28

28 Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = a^x$$

$$\frac{a^{\frac{10}{5}}}{a^{\frac{3}{2}}} = a^x$$

$$\frac{a^{\frac{20}{10}}}{a^{\frac{15}{10}}} = a^x$$

$$a^{\frac{5}{10}} = a^x$$

$$a^{\frac{1}{2}} = a^x$$

$$\boxed{x = \frac{1}{2}}$$

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

Question 28

28 Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = a^x$$

$$\frac{a^2}{a^{1.5}} = a^{0.5}$$

$$\boxed{x = 0.5}$$

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

Question 28

28 Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = a^x$$

$$\frac{\left(\sqrt[5]{a^{10}}\right)^5}{\left((a^3)^{\frac{1}{2}}\right)^5} = (a^x)^5$$

$$\frac{a^{10}}{(a^3)^{\frac{5}{2}}} = a^{5x}$$

$$\frac{a^{10}}{a^{\frac{15}{2}}} = a^{5x}$$

$$a^{\frac{5}{2}} = a^{5x}$$

Score 1: The student did not determine the value of x.

Question 28

28 Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = a^x$$

$a^{\cancel{2} \cdot 2} + a^{\frac{3}{\cancel{2}} \cdot \cancel{2}}$

$a + a^3 = a^4$

$\sqrt[5]{a^{10}} = a^{\frac{10}{5}} = a^2$

$(a^3)^{\frac{1}{2}} = a^{\frac{3}{2}}$

Score 1: The student correctly expressed the numerator and denominator with singular rational exponents.

Question 28

28 Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = a^x \rightarrow \frac{a^{\frac{10}{5}}}{(a^3)^{\frac{1}{2}}} = a^x$$

$$\downarrow$$

$$\frac{(a^2)^{\frac{2}{1}}}{((a^3)^{\frac{1}{2}})^{\frac{2}{1}}} = ax$$

$$\downarrow$$

$$\frac{a^4}{a^3} = a$$

$$\downarrow$$

$$\cancel{a^x = a^{\frac{4}{3}}}$$

$\frac{2}{1} \times \frac{2}{1} = 4$

$\frac{1}{2} \times \frac{2}{1} = \frac{2}{2} = 1$

$x = \frac{4}{3}$

Score 0: The student made multiple errors.

Question 28

28 Given $a > 1$, use the properties of rational exponents to determine the value of x for the equation below.

$$\frac{\sqrt[5]{a^{10}}}{(a^3)^{\frac{1}{2}}} = a^x$$

$$\frac{a^{\frac{10}{5}}}{a^{\frac{1}{2}}} = a^x$$

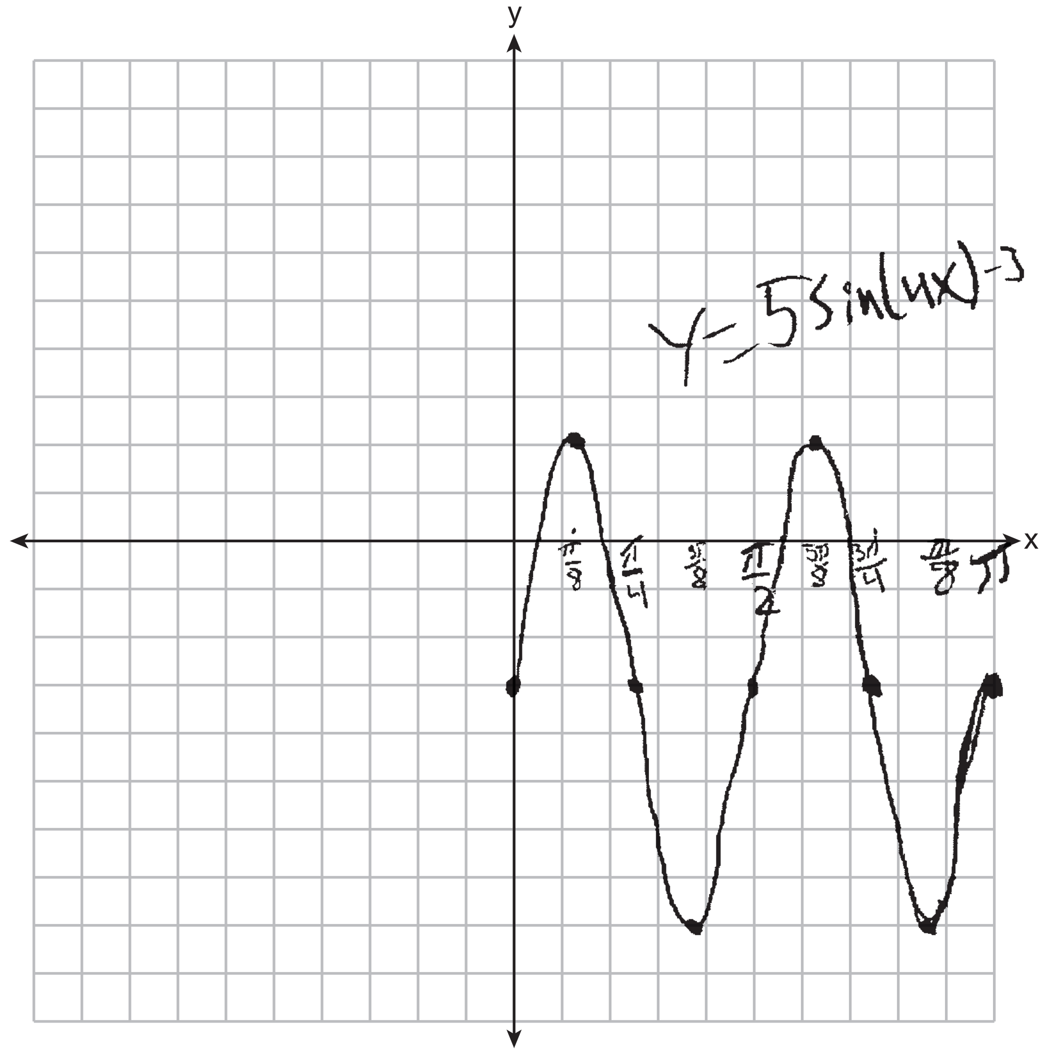
$$\frac{a^2}{a^{\frac{1}{2}}} = a^x$$

$$\boxed{x = \frac{1}{2}}$$

Score 0: The student made multiple errors.

Question 29

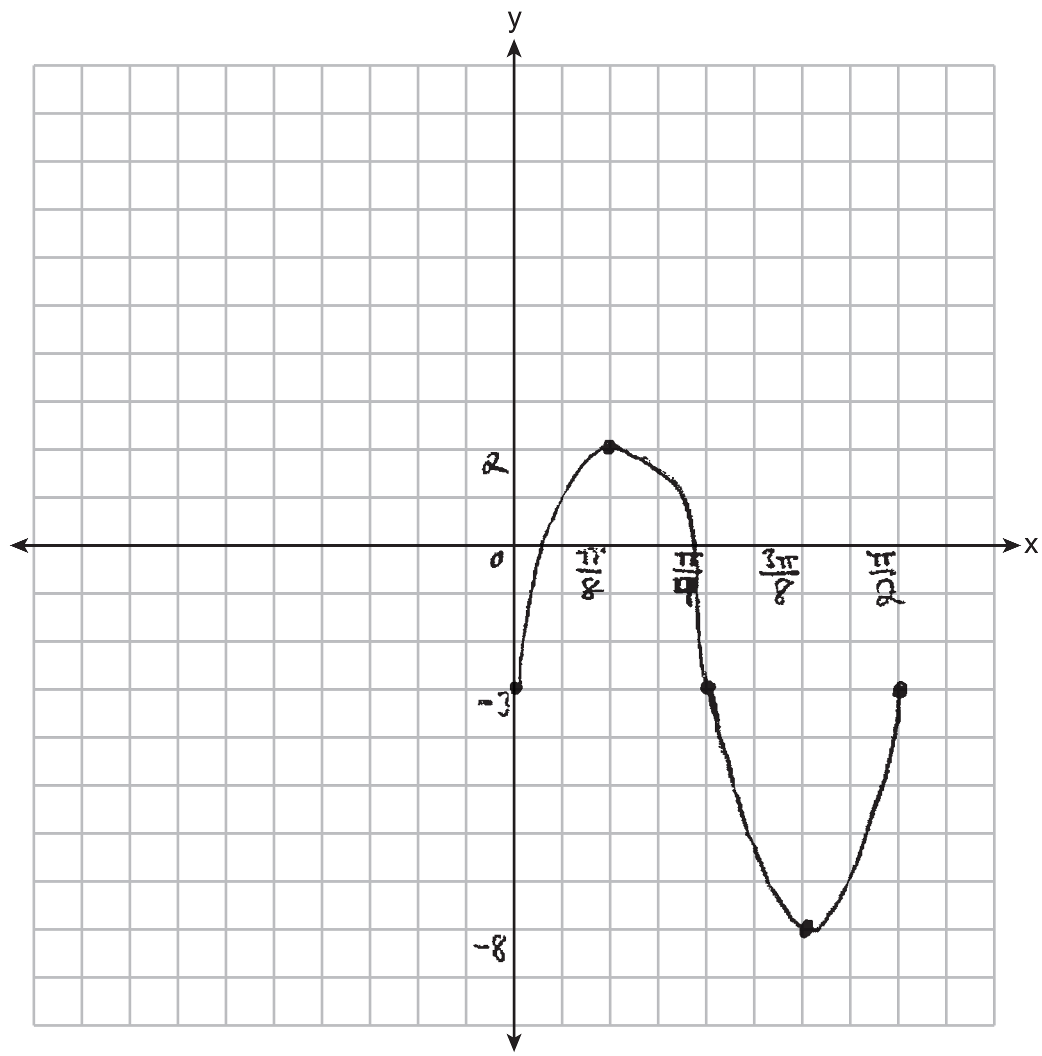
29 Graph *at least one* cycle of $y = 5\sin(4x) - 3$ on the set of axes below.



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

Question 29

29 Graph *at least one* cycle of $y = 5\sin(4x) - 3$ on the set of axes below.



$T = \frac{\pi}{2}$

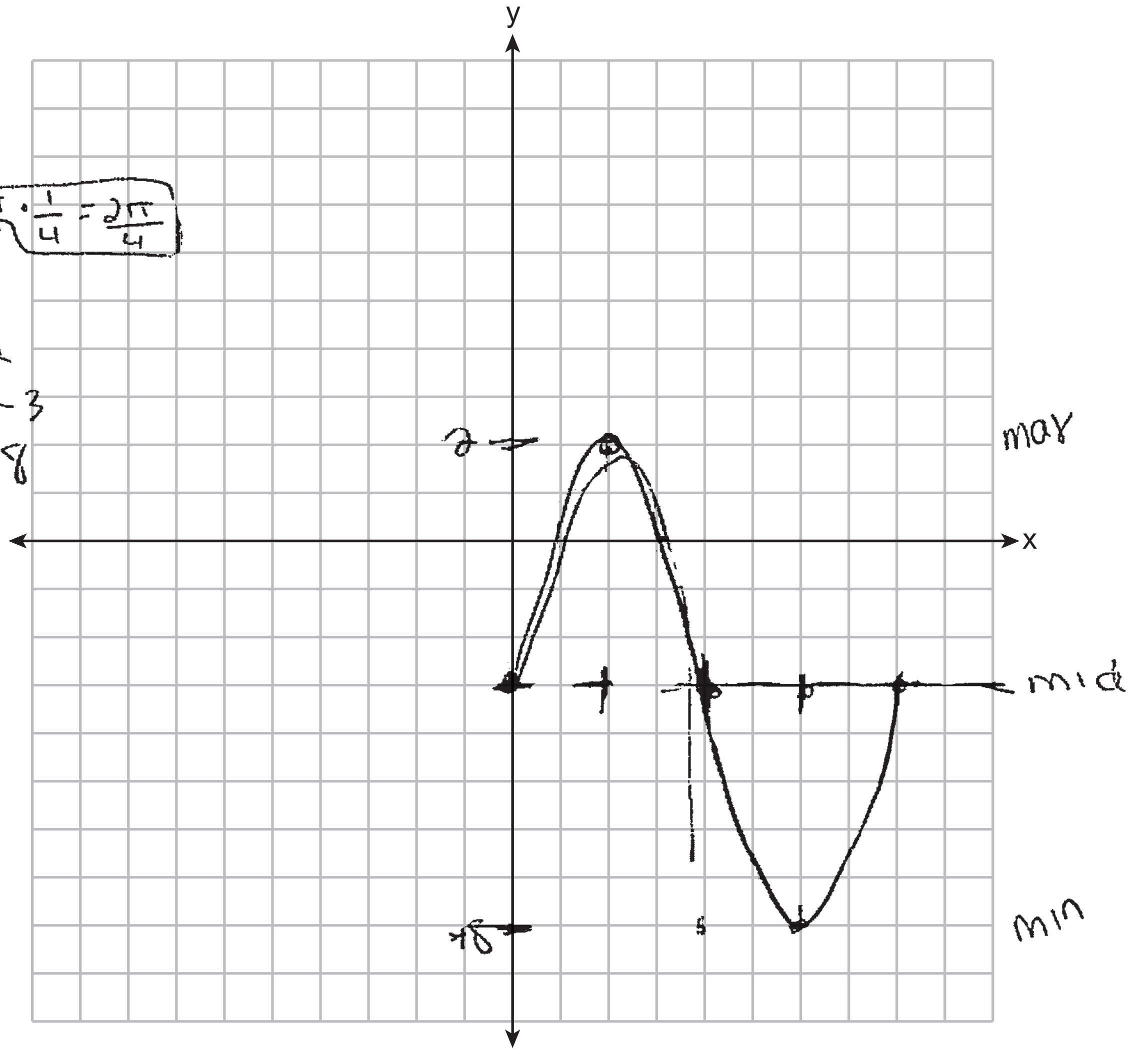
Score 2: The student gave a complete and correct response.

Question 29

29 Graph *at least one* cycle of $y = 5\sin(4x) - 3$ on the set of axes below.

$a = 5$
$b = 4$
$p = \frac{1}{2}\frac{2\pi}{\pi} \cdot \frac{1}{4} = \frac{2\pi}{4}$
$c.p = 4$

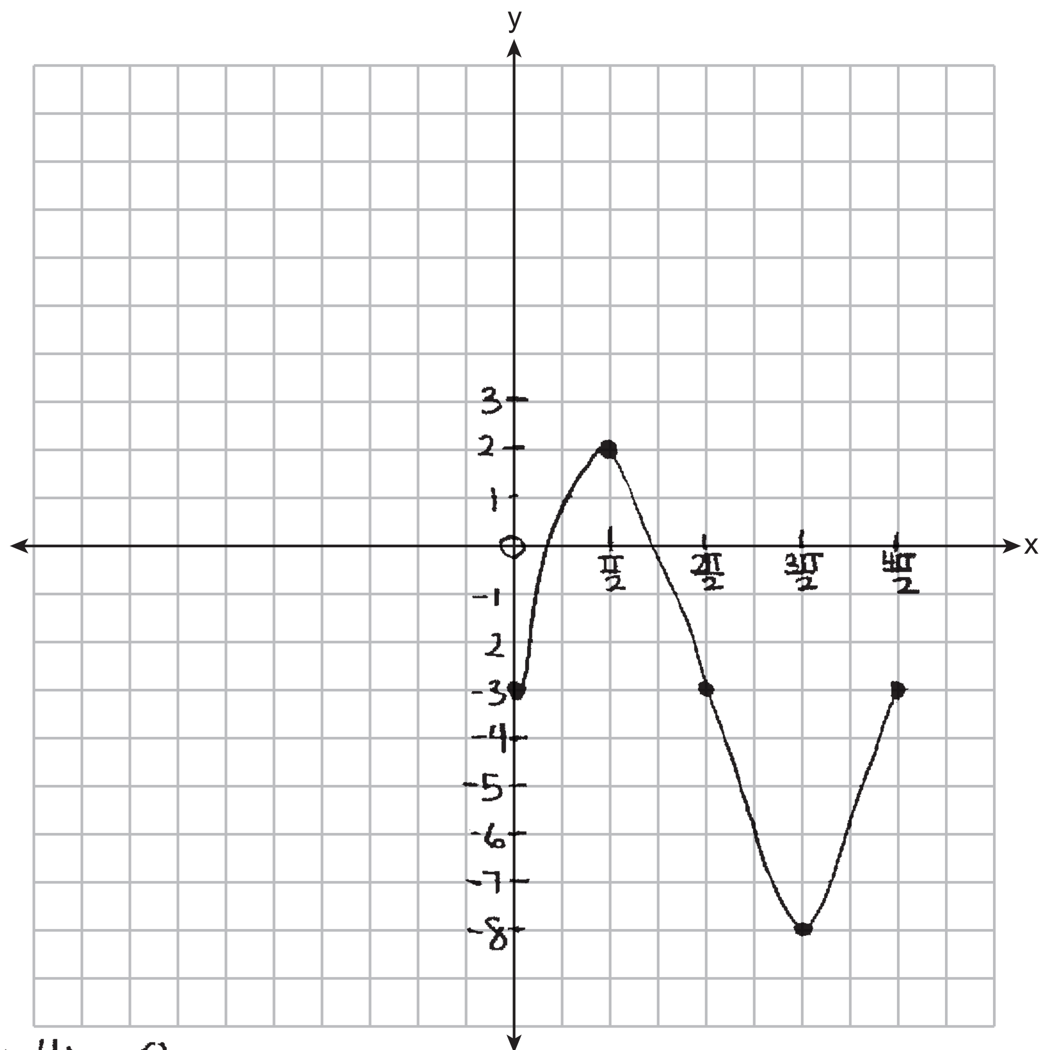
max $= 2$
mid $= -3$
min $= -8$



Score 1: The student did not provide a scale on the *x*-axis.

Question 29

29 Graph *at least one* cycle of $y = 5\sin(4x) - 3$ on the set of axes below.



Period: $\frac{4x=0}{4}$ $x=0$

$\frac{2\pi}{0} = 2\pi$

$\frac{2\pi}{4} = \frac{\pi}{2}$

$0, \frac{\pi}{2}, \frac{2\pi}{2}, \frac{3\pi}{2}, \frac{4\pi}{2}$

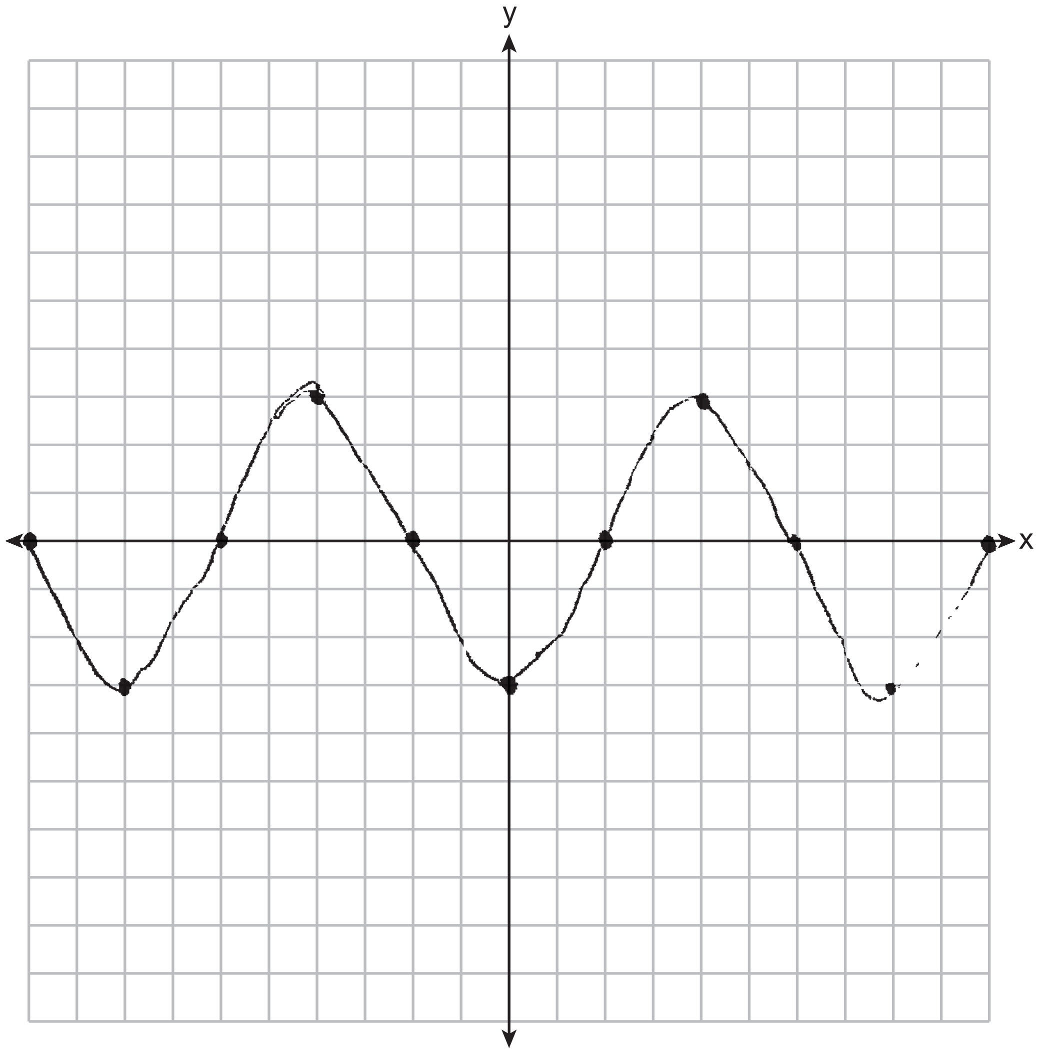
$-1: 5(-1) - 3 = -8$ Min

$1: 5(1) - 3 = 2$ Max

Midline: -3

Score 1: The student has an incorrect scale on the x-axis.

29 Graph *at least one* cycle of $y = 5\sin(4x) - 3$ on the set of axes below.

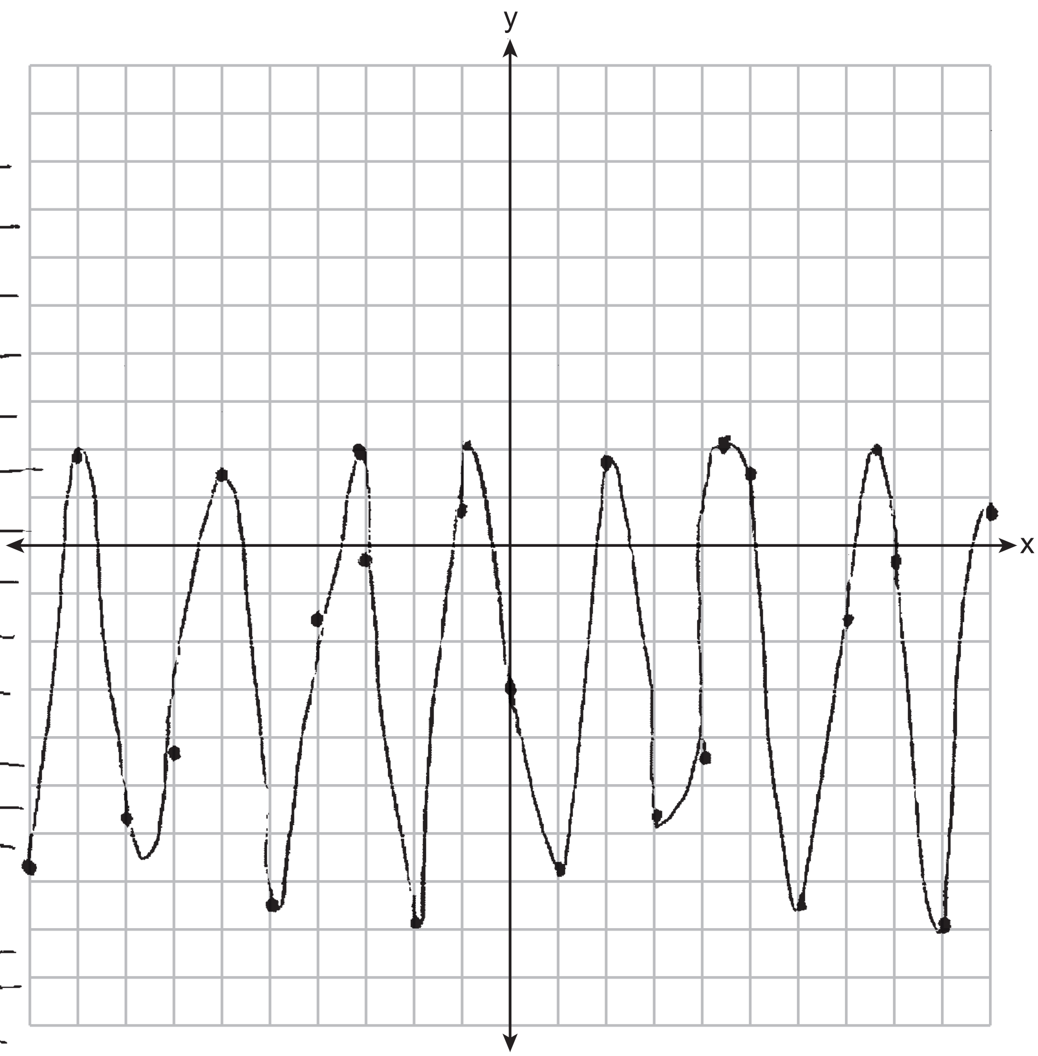


Score 0: The student made multiple graphing errors.

Question 29

29 Graph *at least one* cycle of $\boxed{y = 5\sin(4x) - 3}$ on the set of axes below.

X	Y
-10	-6.726
-9	1.9589
-8	-5.757
-7	-4.355
-6	1.5279
-5	-7.565
-4	-1.56
-3	-.3171
-2	-7.947
-1	.78401
0	-3
1	-6.784
2	1.9468
3	-5.683
4	-4.44
5	1.5647
6	-7.528
7	-1.645
8	-.2429
9	-7.959
10	.72557



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

Question 30

30 The cost of a brand-new electric-hybrid vehicle is listed at \$33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function $V(x) = 33{,}400(0.85)^x$, where x represents the years since purchase.

Julia and Jacob have each written a function that is equivalent to the original.

$$\text{Jacob's function: } V(x) = 33{,}400(0.1422)^{\frac{1}{12}x}$$

$$\text{Julia's function: } V(x) = 33{,}400(0.9865)^{12x}$$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate? Justify your answer.

Julia did, if you raise the original .85 and do 1 month which is 1/12 of a year you get .9865 which is what Julia has.

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

Question 30

30 The cost of a brand-new electric-hybrid vehicle is listed at \$33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function $V(x) = 33{,}400(0.85)^x$, where x represents the years since purchase.

Julia and Jacob have each written a function that is equivalent to the original.

$$\text{Jacob's function: } V(x) = 33{,}400(0.1422)^{\frac{1}{12}x}$$

$$\text{Julia's function: } V(x) = 33{,}400(0.9865)^{12x}$$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate? Justify your answer.

Julia

$0.85^{\frac{1}{12}} = 0.9865$

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

Question 30

30 The cost of a brand-new electric-hybrid vehicle is listed at \$33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function $V(x) = 33{,}400(0.85)^x$, where x represents the years since purchase.

Julia and Jacob have each written a function that is equivalent to the original.

$$\text{Jacob's function: } V(x) = 33{,}400(0.1422)^{\frac{1}{12}x}$$

$$\text{Julia's function: } V(x) = 33{,}400(0.9865)^{12x}$$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate? Justify your answer.

$33,400(.85)^{x \cdot \frac{1}{12}x}$ $\left(.85^{\frac{12}{1}}\right)^x$

Julia's Function

$V(x) = 33,400(.9865)^{12x}$

Score 1: The student gave an incomplete justification.

Question 30

30 The cost of a brand-new electric-hybrid vehicle is listed at $33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function $V(x) = 33{,}400(0.85)^x$, where x represents the years since purchase.

Julia and Jacob have each written a function that is equivalent to the original.

$$\text{Jacob's function: } V(x) = 33{,}400(0.1422)^{\frac{1}{12}x}$$

$$\text{Julia's function: } V(x) = 33{,}400(0.9865)^{12x}$$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate? Justify your answer.

Julia's function is correct beeurse theirs 12 monshs in a year plus the average ~~[illegible]~~ annual would be higher perctange

Score 1: The student gave an incomplete justification.

Question 30

30 The cost of a brand-new electric-hybrid vehicle is listed at \$33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function $V(x) = 33{,}400(0.85)^x$, where x represents the years since purchase.

Julia and Jacob have each written a function that is equivalent to the original.

Jacob's function: $V(x) = 33{,}400(0.1422)^{\frac{1}{12}x}$

Julia's function: $V(x) = 33{,}400(0.9865)^{12x}$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate? Justify your answer.

Julia

$x \log(.85) = 12x(\log .9865)$

$\frac{x}{x} = 12\left(\frac{\log .9865}{\log .85}\right)$

$1 \approx 1$

Score 0: The student gave an incorrect justification.

Question 30

30 The cost of a brand-new electric-hybrid vehicle is listed at \$33,400, and the average annual depreciation for the vehicle is 15%. The car's value can be modeled by the function $V(x) = 33{,}400(0.85)^x$, where x represents the years since purchase.

Julia and Jacob have each written a function that is equivalent to the original.

$$\text{Jacob's function: } V(x) = 33{,}400(0.1422)^{\frac{1}{12}x}$$

$$\text{Julia's function: } V(x) = 33{,}400(0.9865)^{12x}$$

Whose function is correctly rewritten to reveal the approximate monthly depreciation rate? Justify your answer.

$V(x) = 33{,}400(.85)^4$

$V(4) = \$17{,}435.01$

Jacob $= 33400(.1422)^{\frac{1}{12}(4)}$

$V(4) = \$17{,}433.30$

Jacob comes closer

Julia $= 33400(.9865)^{12(4)}$

$V(4) = \$17394.29$

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

Question 31

31 Write a recursive formula for the sequence 8, 20, 50, 125, 312.5,…

$a_1 = 8$

$a_n = 2.5\,a_{n-1}$

$r = 2.5$

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

Question 31

31 Write a recursive formula for the sequence 8, 20, 50, 125, 312.5,…

$a_{(n+1)} = a_{(n)} \cdot 2.5$ when $a_1 = 8$

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

Question 31

31 Write a recursive formula for the sequence 8, 20, 50, 125, 312.5,…

$$a_n = 8(2.5)^{n-1}$$

Score 1: The student wrote an explicit formula.

Question 31

31 Write a recursive formula for the sequence 8, 20, 50, 125, 312.5,…

$a = 2.5(a_{n-1})$

$a_1 = 8$

Score 1: The student made a notation error.

Question 31

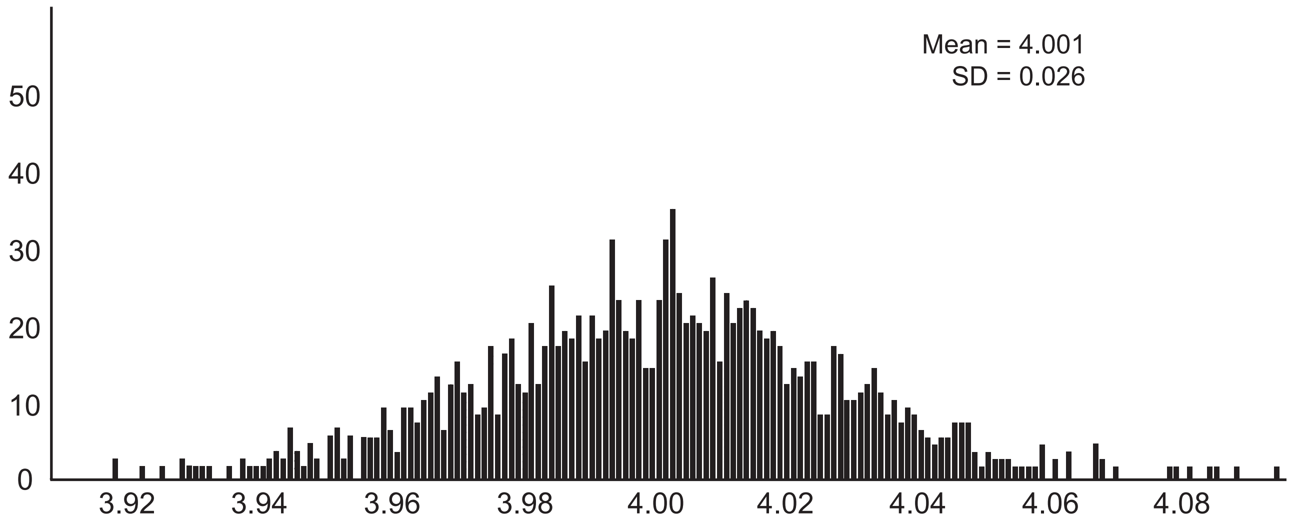
31 Write a recursive formula for the sequence 8, 20, 50, 125, 312.5,…

$8+(3\cdot 5)^2$

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

Question 32

32 A grocery store orders 50 bags of oranges from a company's distribution center. The bags have a mean weight of 3.85 pounds per bag. The company claims that their bags of oranges have a mean weight of 4 pounds. The grocery store ran a simulation of 50 bags, 2500 times, assuming a mean of 4 pounds. The results are shown below.



Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

$4.001 + 2(.026) = 4.053$

$4.001 - 2(.026) = 3.949$

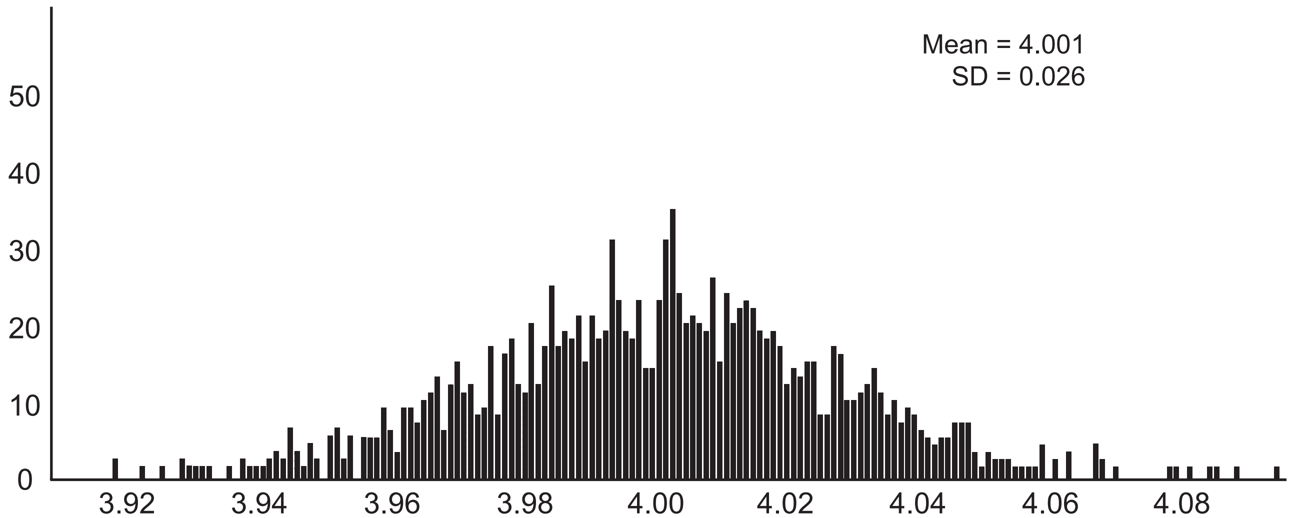
95% Confidence Interval: 3.949–4.053

the mean weight of the storet sample is unusual because it is outside the 95% confidence interval of 3.949–4.053.

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

Question 32

32 A grocery store orders 50 bags of oranges from a company's distribution center. The bags have a mean weight of 3.85 pounds per bag. The company claims that their bags of oranges have a mean weight of 4 pounds. The grocery store ran a simulation of 50 bags, 2500 times, assuming a mean of 4 pounds. The results are shown below.



Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

Yes, a mean of 3.85 pounds is not even shown on the graph, which means it must be extremely unlikely to happen.

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

Question 32

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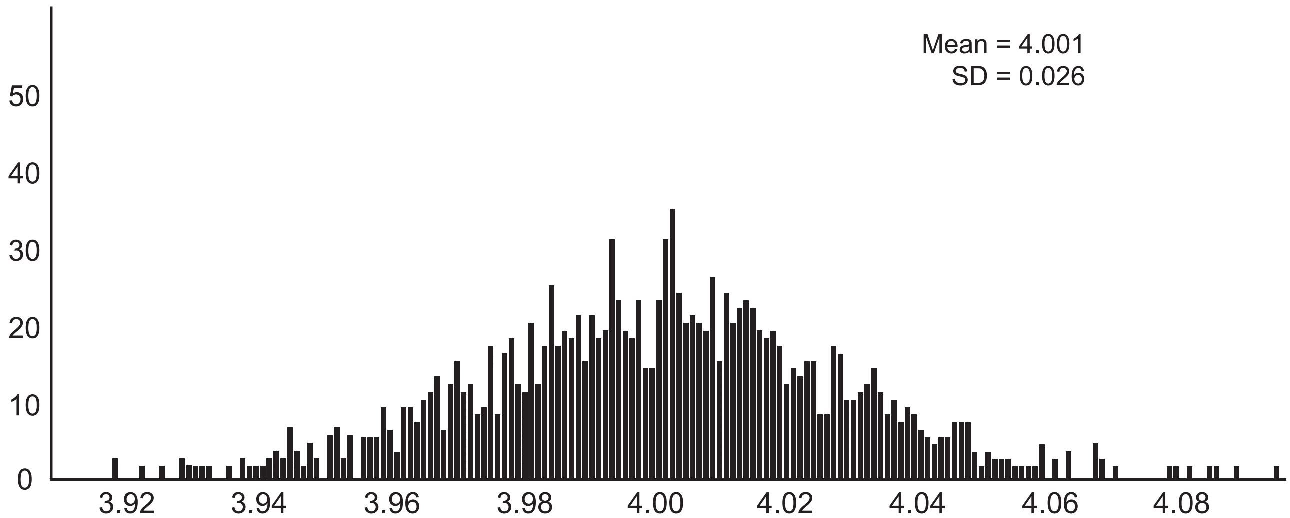


Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

4.001+0.026 4.001−0.026

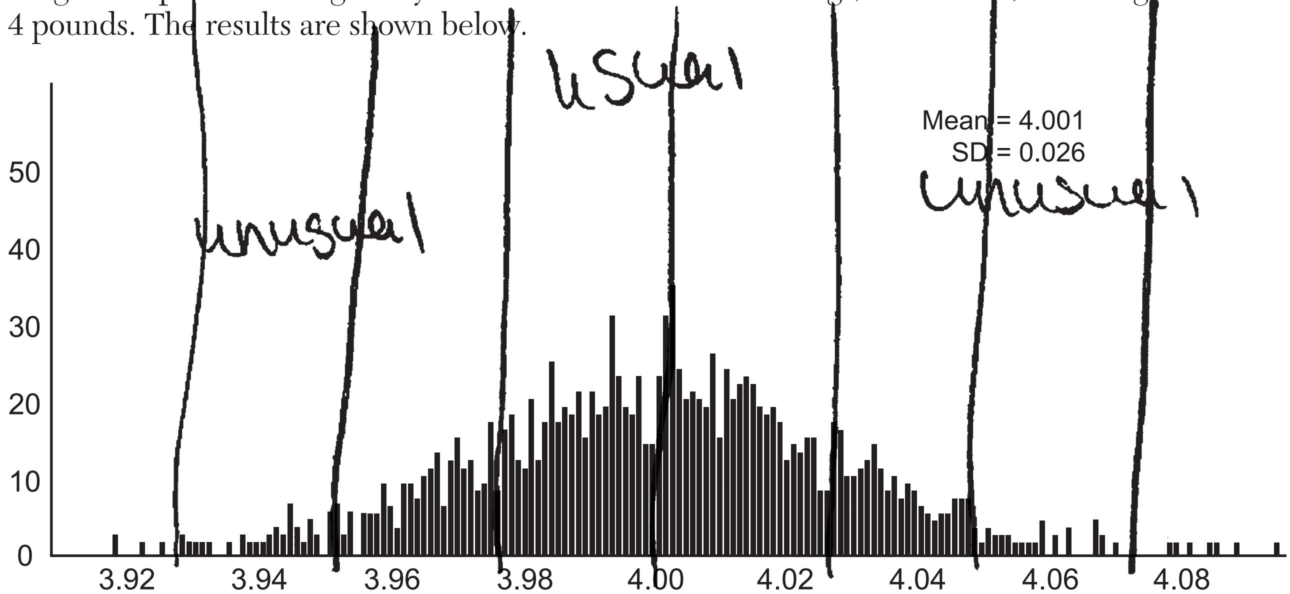
4.027 3.975

Very unusual, it is not within the 95% confidence interval of 3.975 to 4.027.

Score 1: The student used one standard deviation to calculate the interval.

Question 32

32 A grocery store orders 50 bags of oranges from a company's distribution center. The bags have a mean weight of 3.85 pounds per bag. The company claims that their bags of oranges have a mean weight of 4 pounds. The grocery store ran a simulation of 50 bags, 2500 times, assuming a mean of 4 pounds. The results are shown below.



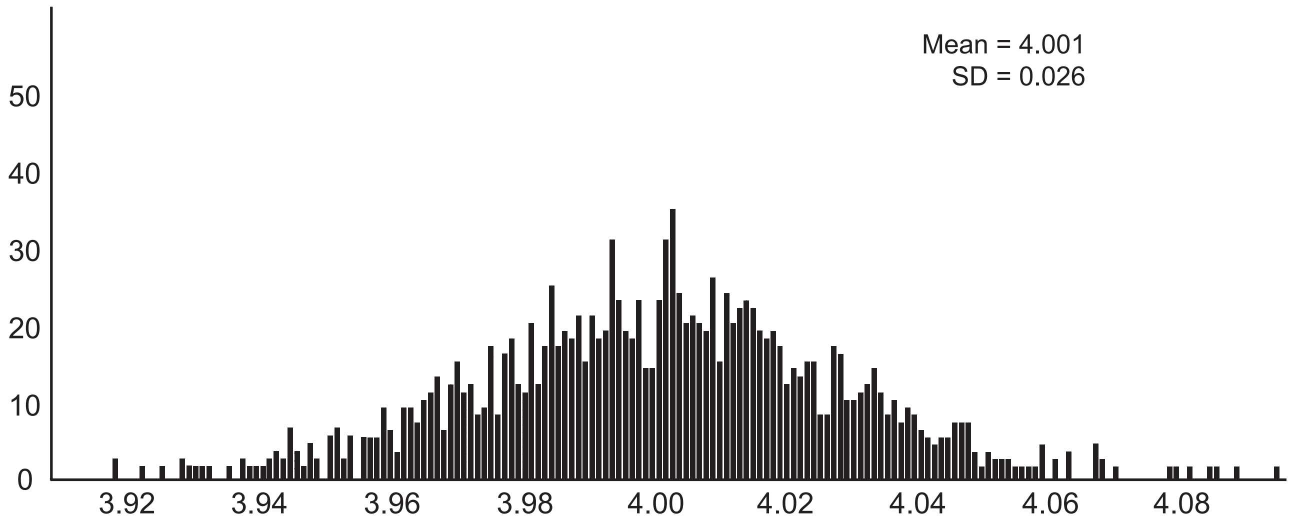
Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

Unusual because two SD 'away.

Score 1: The student gave an incomplete explanation.

Question 32

32 A grocery store orders 50 bags of oranges from a company's distribution center. The bags have a mean weight of 3.85 pounds per bag. The company claims that their bags of oranges have a mean weight of 4 pounds. The grocery store ran a simulation of 50 bags, 2500 times, assuming a mean of 4 pounds. The results are shown below.



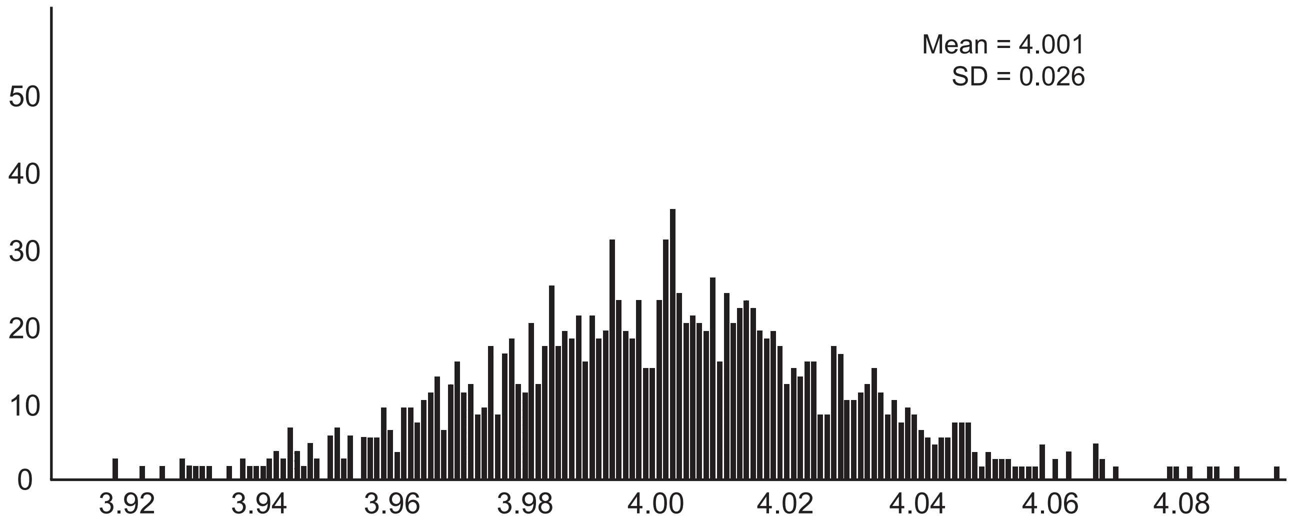
Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

Yes, because the company was claiming that they have a mean weight of 4 but there is a majority that is either more or less than 4.

Score 0: The student gave an incorrect explanation.

Question 32

32 A grocery store orders 50 bags of oranges from a company's distribution center. The bags have a mean weight of 3.85 pounds per bag. The company claims that their bags of oranges have a mean weight of 4 pounds. The grocery store ran a simulation of 50 bags, 2500 times, assuming a mean of 4 pounds. The results are shown below.



Is the mean weight of the grocery store's sample unusual? Explain using the results of the simulation.

No. Mean is the average and 4.001 is in the middle of the data

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

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let *A* be the event that the guest room has a view of the lake, and let *B* be the event that the guest room has a queen-size bed. Events *A* and *B* are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

$P(A \cap B) = P(A) \cdot P(B) =$

0.1776

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A \cup B) = 0.24 + 0.74 - 0.1776$

$= 0.98 - 0.1776$

$P(A \cup B) = 0.8024$

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

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let *A* be the event that the guest room has a view of the lake, and let *B* be the event that the guest room has a queen-size bed. Events *A* and *B* are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

multiply x

p(L) x p(Q)

.24 x .74 = 17.76%

add

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

p(L) + p(Q) - p(L and Q)

.24 + .74

.98% - 17.76%

98% - 17.76%

80.24%

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

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let *A* be the event that the guest room has a view of the lake, and let *B* be the event that the guest room has a queen-size bed. Events *A* and *B* are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

Lake = 0.24
Queen = 0.74

$$\begin{array}{r} 0.24 \\ + 0.74 \\ \hline .1776 \end{array}$$

17.76%. chance

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

$$\begin{array}{r} 0.24 \\ + 0.74 \\ \hline 0.98 \end{array}$$

There is a 98% chance that it will be either.

Score 3: The student did not subtract $P(A \cap B)$ in the second part.

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let *A* be the event that the guest room has a view of the lake, and let *B* be the event that the guest room has a queen-size bed. Events *A* and *B* are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

guest w/ view = .24
guest w/ queen = .74

$.24(.74) = .1776$

$\boxed{.178}$

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

$P(A) + P(B) - P(A \& B)$

$.24 + .74 - .178$

$\boxed{.802}$

Score 3: The student rounded instead of stating the exact value.

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let A be the event that the guest room has a view of the lake, and let B be the event that the guest room has a queen-size bed. Events A and B are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

100-

Lake view .24 Queen .74

P(Lv and Q) = P(Lv) + P(Q) − P(Lv and Q)

.24 + .74 = .98

100 − 98 = .2

.2

There is a .2 probability that a random guest will have both.

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

P(Lv or Q) = P(Lv) + P(Q) − P(Lv and Q)

.24 + .74 − .2

There is a .78 probability that the guest will have the lake view or a Queen bed.

Score 2: The student did not receive any credit for the first part.

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let A be the event that the guest room has a view of the lake, and let B be the event that the guest room has a queen-size bed. Events A and B are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

view of lake: 0.24
queen size bed: 0.74
.98

$P(L+Q) = P(L) \cdot P(Q)$

$= (.24)(.74)$

$= .1776$

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

$.98 = (.24)(.74) - P(L+Q)$

$.98 = .1776 - x$

0.1678

Score 2: The student did not receive any credit for the second part.

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let A be the event that the guest room has a view of the lake, and let B be the event that ~~the guest~~ room has a queen-size bed. Events A and B are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

0.24×0.74

$\frac{6}{25} \times \frac{37}{50}$

$\frac{111}{625}$ or 0.18

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

0.24×0.74

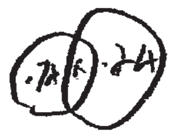
0.18

Score 1: The student rounded in the first part and received no credit for the second part.

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let A be the event that the guest room has a view of the lake, and let B be the event that the guest room has a queen-size bed. Events A and B are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.



.177

.74(.24) =

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

Score 1: The student received one point for the first part.

Question 33

33 At the Lakeside Resort, the probability that a guest room has a view of the lake is 0.24. The probability that a guest room has a queen-size bed is 0.74. Let *A* be the event that the guest room has a view of the lake, and let *B* be the event that the guest room has a queen-size bed. Events *A* and *B* are found to be independent of each other.

Determine the exact probability that a randomly selected guest room has a view of the lake and a queen-size bed.

$P(A \cap B) = P(A) + P(B)$

$.98$

$\boxed{9.8\%}$

Determine the exact probability that a randomly selected guest room has a view of the lake or a queen-size bed.

$P(A|B) = \dfrac{P(A \cup B)}{P(B)}$

$\dfrac{P(A) - P(B) + P(A \cap B)}{P(B)}$

$\dfrac{.24 - .74 + .98}{.74}$

$.648$

$.65$

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

Question 34

34 Which function has a greater average rate of change on the interval $[-1,4]$? Justify your answer.

x	m(x)
−2	−3
−1	1
0	1
1	3
2	13
3	37
4	81
5	151

$p(x) = 3^x + 1$

$p(-1) = 1\frac{1}{3}$

$p(4) = 82$

$\frac{81-1}{4-(-1)} = \frac{80}{5} = 16$

$\frac{82 - 1\frac{1}{3}}{5} = \frac{80\frac{2}{3}}{5} = 16.133\overline{3}$

$16.1\overline{3} > 16$

$p(x) > m(x)$

$\boxed{p(x)}$

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

Question 34

34 Which function has a greater average rate of change on the interval $[-1,4]$? Justify your answer.

x	m(x)
−2	−3
−1	1
0	1
1	3
2	13
3	37
4	81
5	151

$p(x) = 3^x + 1$

x	P(x)
−1	$1.3\bar{3}$
4	82

$$\frac{82 - 1.3\bar{3}}{4 - -1}$$

$$\frac{81 - 1}{4 - -1}$$

m(x) Average rate of change = 16

P(x) Average rate of change is ≈ 16.1

P(x) has a greater rate of change over the interval [-1,4].

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

Question 34

34 Which function has a greater average rate of change on the interval [−1,4]? Justify your answer.

x	m(x)
−2	−3
−1	1
0	1
1	3
2	13
3	37
4	81
5	151

$p(x) = 3^x + 1$

$-3+1$

$y = -2$

$y = 82$

$\frac{82+2}{4+1} = \frac{84}{5} = 16.8$

$\frac{81-1}{4+1} = \frac{80}{5} = 16$

$p(x) = 3^x + 1$ is greater because $16 < 16.8$

Score 3: The student made one computational error.

Question 34

34 Which function has a greater average rate of change on the interval $[-1,4]$? Justify your answer.

x	m(x)
−2	−3
−1	1
0	1
1	3
2	13
3	37
4	81
5	151

$x=-1 \quad m(x)=1$

$x=4 \quad m(x)=81$

$81-1=80$

$p(x) = 3^x + 1$

$x=-1 \quad p(x)=1\frac{1}{3}$

$x=4 \quad p(x)=82$

$82-1\frac{1}{3}=80\frac{2}{3}$

p(x) has a greater avg rate of change because it's $80\frac{2}{3}$ but m(x) has a rate of change of 80

Score 2: The student used an incorrect formula for average rate of change.

Question 34

34 Which function has a greater average rate of change on the interval [−1,4]? Justify your answer.

x	m(x)
−2	−3
−1	1
0	1
1	3
2	13
3	37
4	81
5	151

$p(x) = 3^x + 1$

$p(x) = 3^x + 1$ has the greater average rate of change

$x = -1 \quad y = 1$

$x = 4 \quad y = 81$

$\frac{81 - 1}{2}$

$p(-1) = 3^{-1} + 1$

$p(-1) = 1.3\ldots.$

$p(4) = 3^4 + 1$

$p(4) = 82$

$\frac{82 - 1.3}{2}$

Score 2: The student used an incorrect formula for average rate of change.

Question 34

34 Which function has a greater average rate of change on the interval [−1,4]? Justify your answer.

x	m(x)
−2	−3
−1 x_1	1 y_1
0	1
1	3
2	13
3	37
4 x_2	81 y_2
5	151

$p(x) = 3^x + 1$

$3^{-1} + 1 = 1.\overline{3}$

$3^4 + 1 = 82$

$\boxed{80.\overline{6}}$

$\frac{81-1}{4-(-1)} = \boxed{16}$

Score 1: The student correctly calculated the average rate of change for *m*.

Question 34

34 Which function has a greater average rate of change on the interval [−1,4]? Justify your answer.

x	m(x)
−2	−3
−1	1
0	1
1	3
2	13
3	37
4	81
5	151

$p(x) = 3^x + 1$

$3^1 + 1$

4

$3^4 + 1$

$81 + 1$

82

$x_1 = -1$
$y_1 = 4$
$x_2 = 4$
$y_2 = 82$

$x_1 = -1$
$y_1 = 1$
$x_2 = 4$
$y_2 = 81$

$\frac{x_2 - x_1}{y_2 - y_1}$

$\frac{4-(-1)}{81-1}$

$\frac{5}{80}$

$\frac{x_2 - x_1}{y_2 - y_1}$

$\frac{4-(-1)}{82-4} = \frac{5}{78}$

$\frac{5}{80} < \frac{5}{78}$

p(x) has a greater average rate of change on the given interval because it's rate of change is $\frac{5}{78}$ which is greater then m(x), which is $\frac{5}{80}$.

Score 1: The student made a substitution error and incorrectly calculated the average rate of change.

Question 34

34 Which function has a greater average rate of change on the interval $[-1,4]$? Justify your answer.

x	m(x)
−2	−3
−1	1
0	1
1	3
2	13
3	37
4	81
5	151

$p(x) = 3^x + 1$

x	p(x)
−1	$1.\overline{3}$
0	2
1	4
2	10
3	28
4	82

$$\frac{-3+1}{-2+1} = \frac{-2}{-1} = 2$$

$y = 2x + b$

$-3 = 2(-3)$
$+4 \quad -4$

$-1 = b$

$y = 2x - 1$

p(x) has the greater rate of change because it changes the most as x increases

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

Question 34

34 Which function has a greater average rate of change on the interval [−1,4]? Justify your answer.

x	m(x)
−2	−3
−1	1
0	1
1	3
2	13
3	37
4	81
5	151

$p(x) = 3^x + 1$

x	m(x)
−2	1.1
−1	1.3
0	2
1	4
2	10
3	28
4	82
5	244

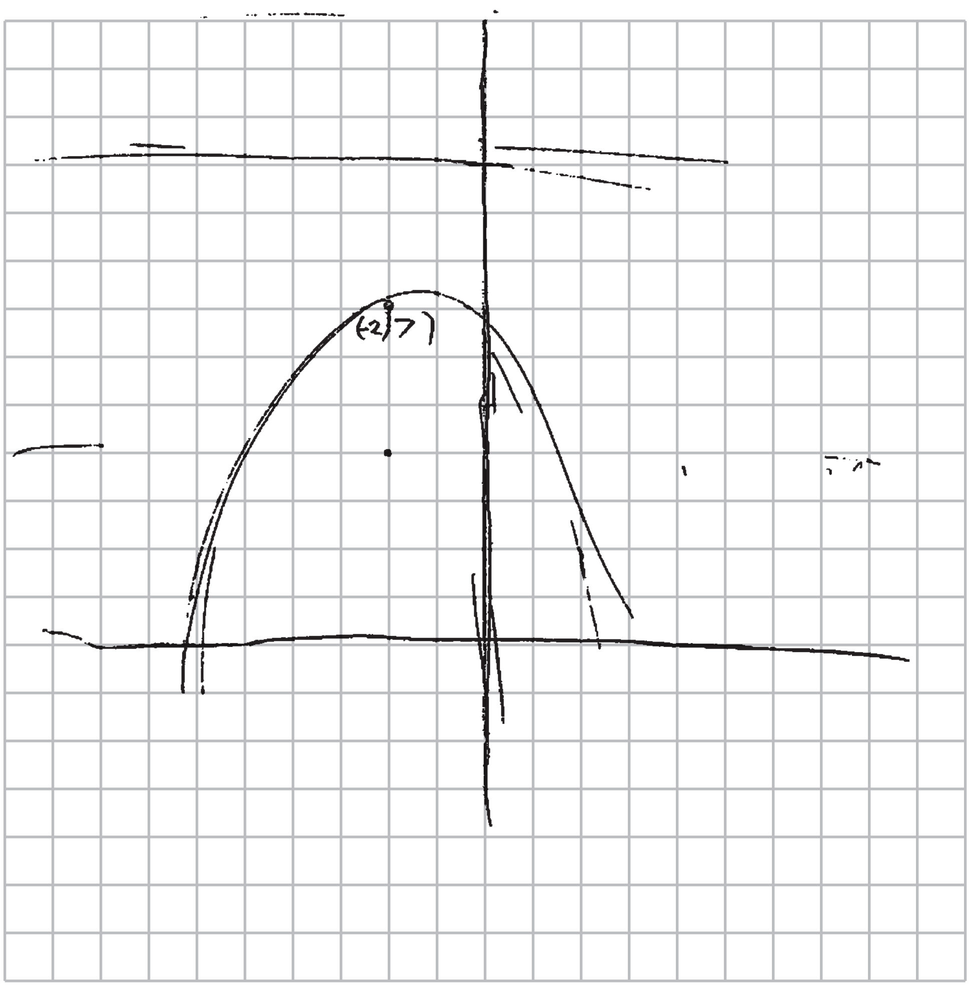
This graph has a greater Average rate of change because the numbers are higher

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

Question 35

35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

$$y = -\frac{1}{4(3)}\left(x - (-2)\right)^2 + 7$$



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

Question 35

35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

$$\sqrt{(x+2)^2+(y-4)^2} = \sqrt{(x-x)^2+(y-10)^2}$$

$$(x+2)^2+(y-4)^2 = (y-10)^2$$

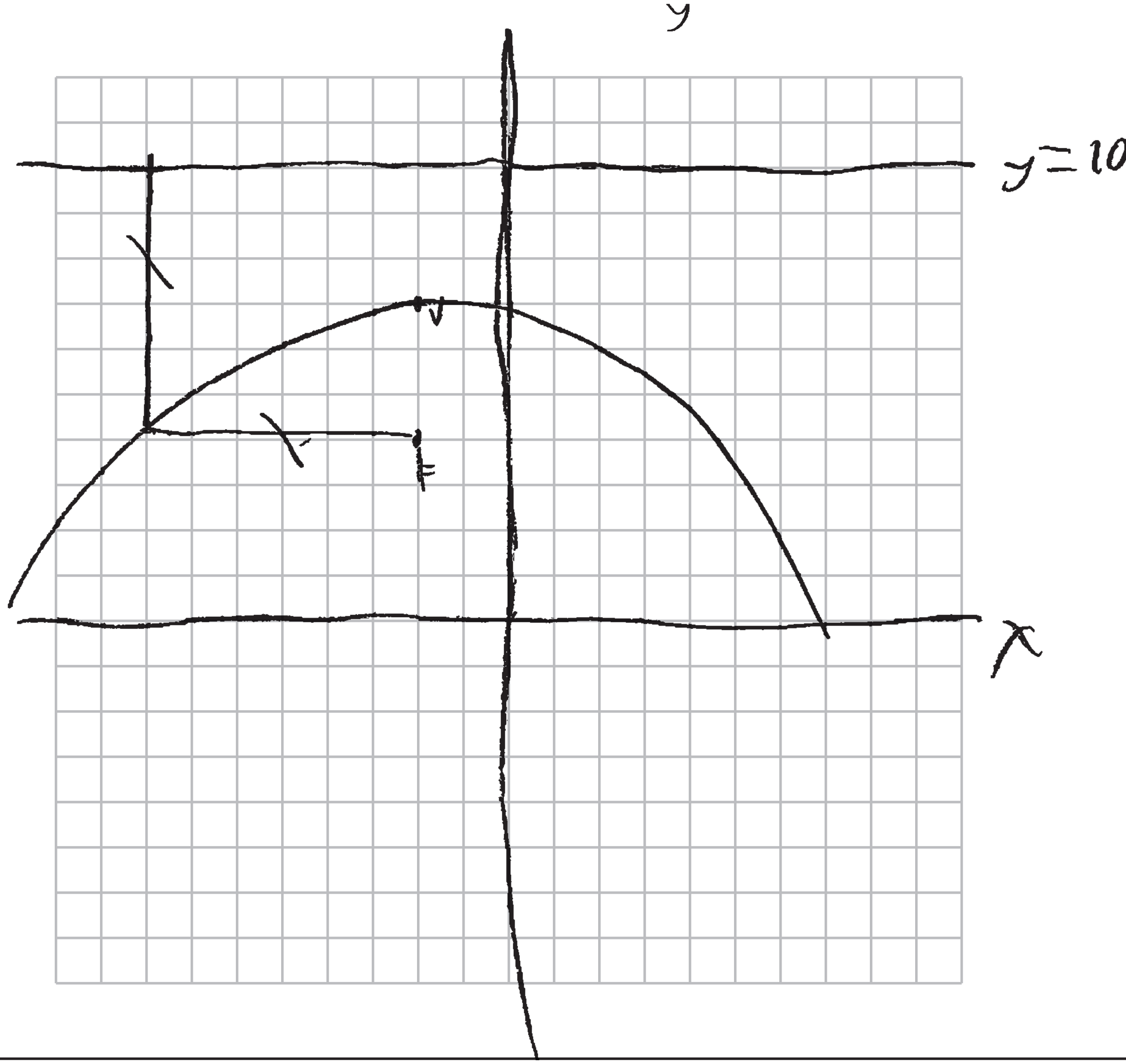
$$x^2+4x+4+y^2-8y+16 = y^2-20y+100$$

$$-y^2+8y-100 \quad -y^2+8y-100$$

$$\frac{x^2+4x-80}{-12} = \frac{-12y}{-12}$$

$$y$$

$$\boxed{y = -\frac{x^2}{12} - \frac{1}{3}x + \frac{20}{3}}$$



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

Question 35

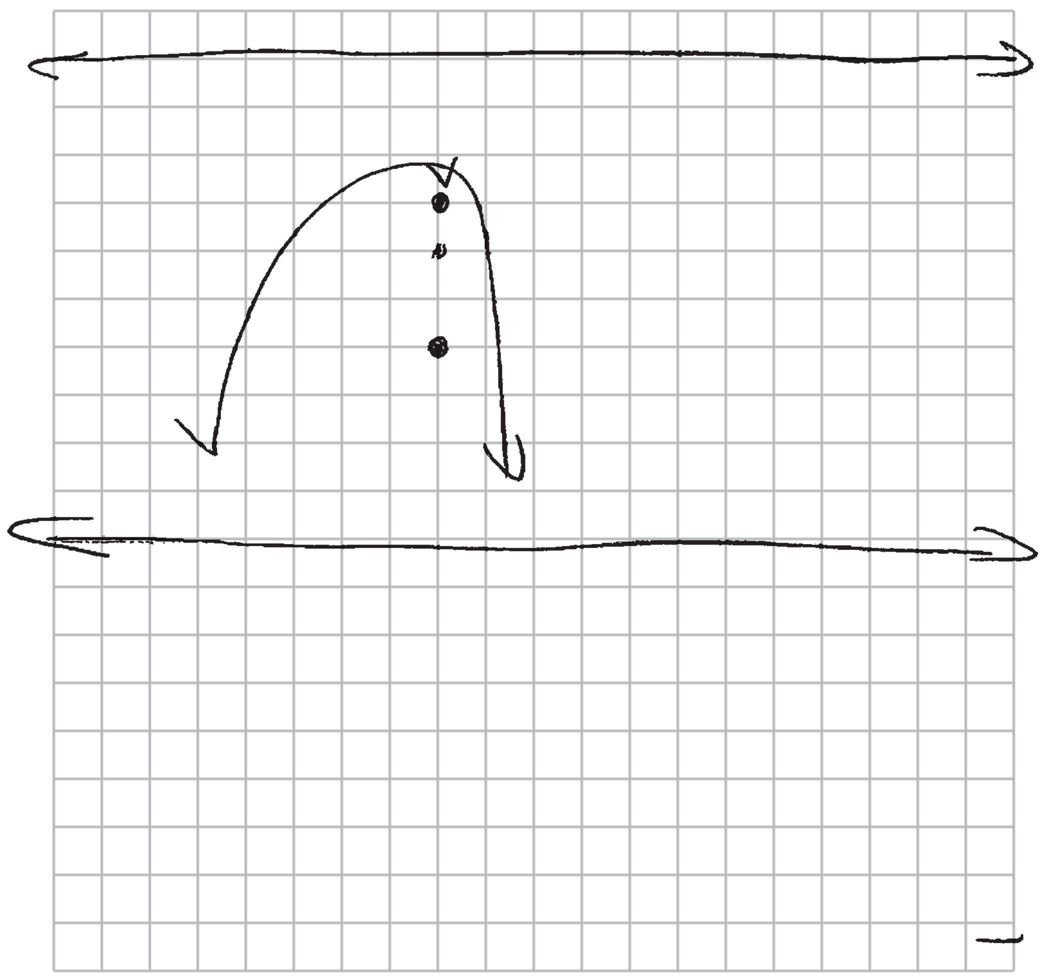
35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

$(-2, 7)$

3

$\frac{1}{4(3)}$

$$\boxed{y = -\frac{1}{7}(x+2)^2 + 7}$$



Score 3: The student made one computational error.

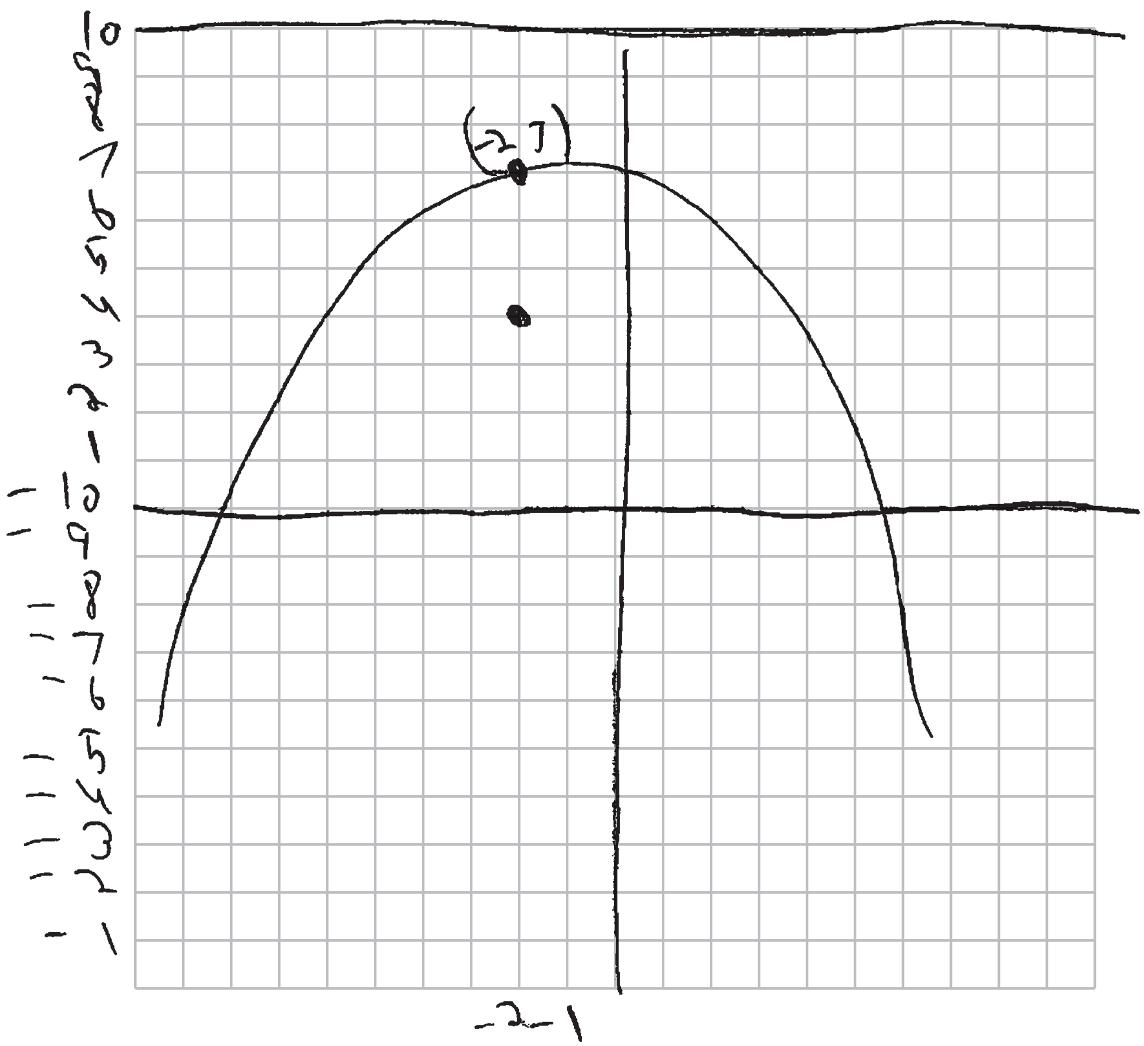
Question 35

35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

$$(x-h)^2 = 4(p)(y-k)$$

$$(x+2)^2 = 4(3)(y-7)$$

$$(x+2)^2 = 12(y-7)$$

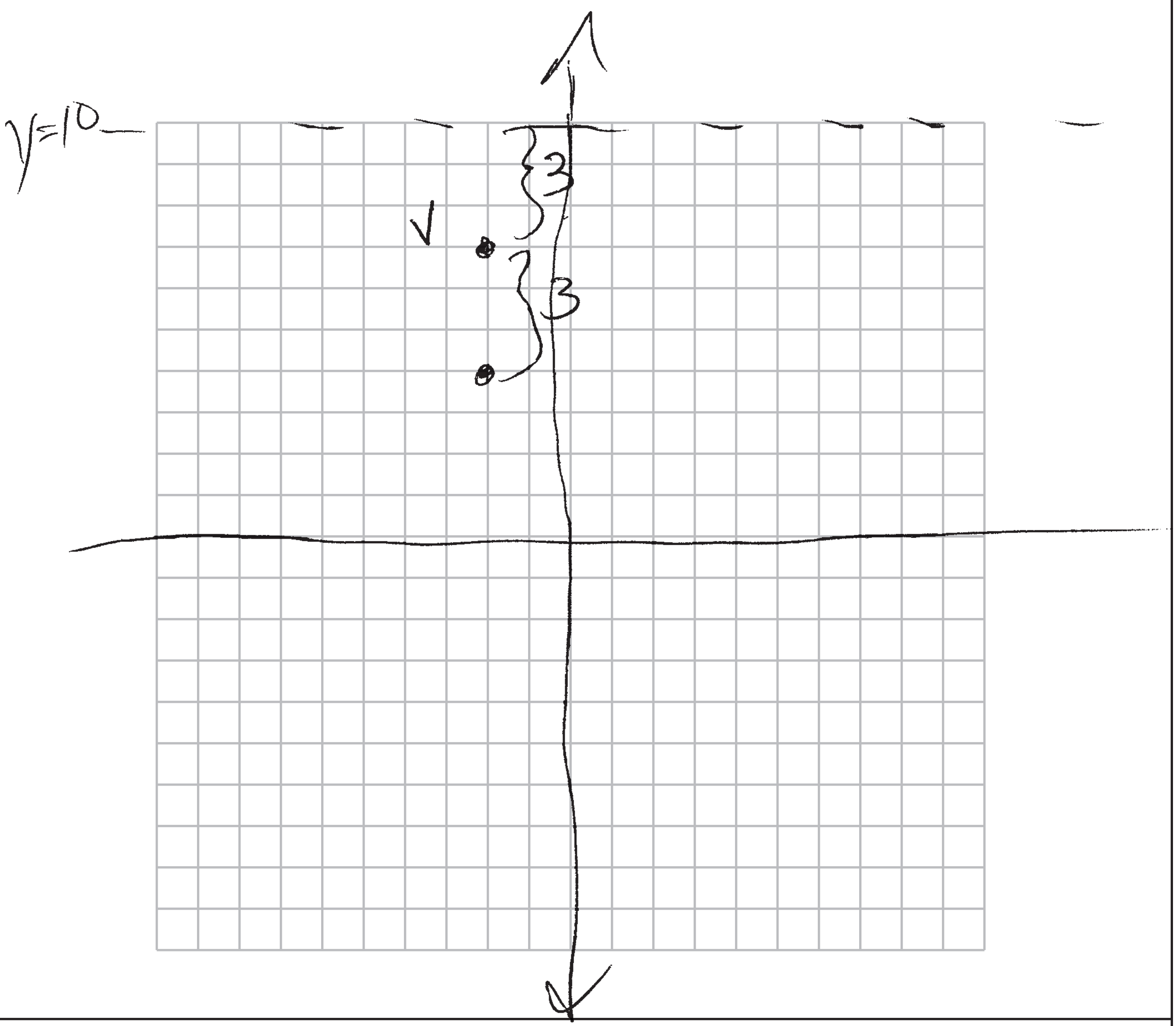


Score 3: The student made a sign error.

Question 35

35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

$$(x+2)^2 = \frac{1}{3}(y-7)$$

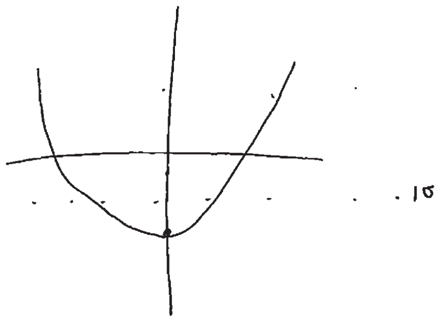


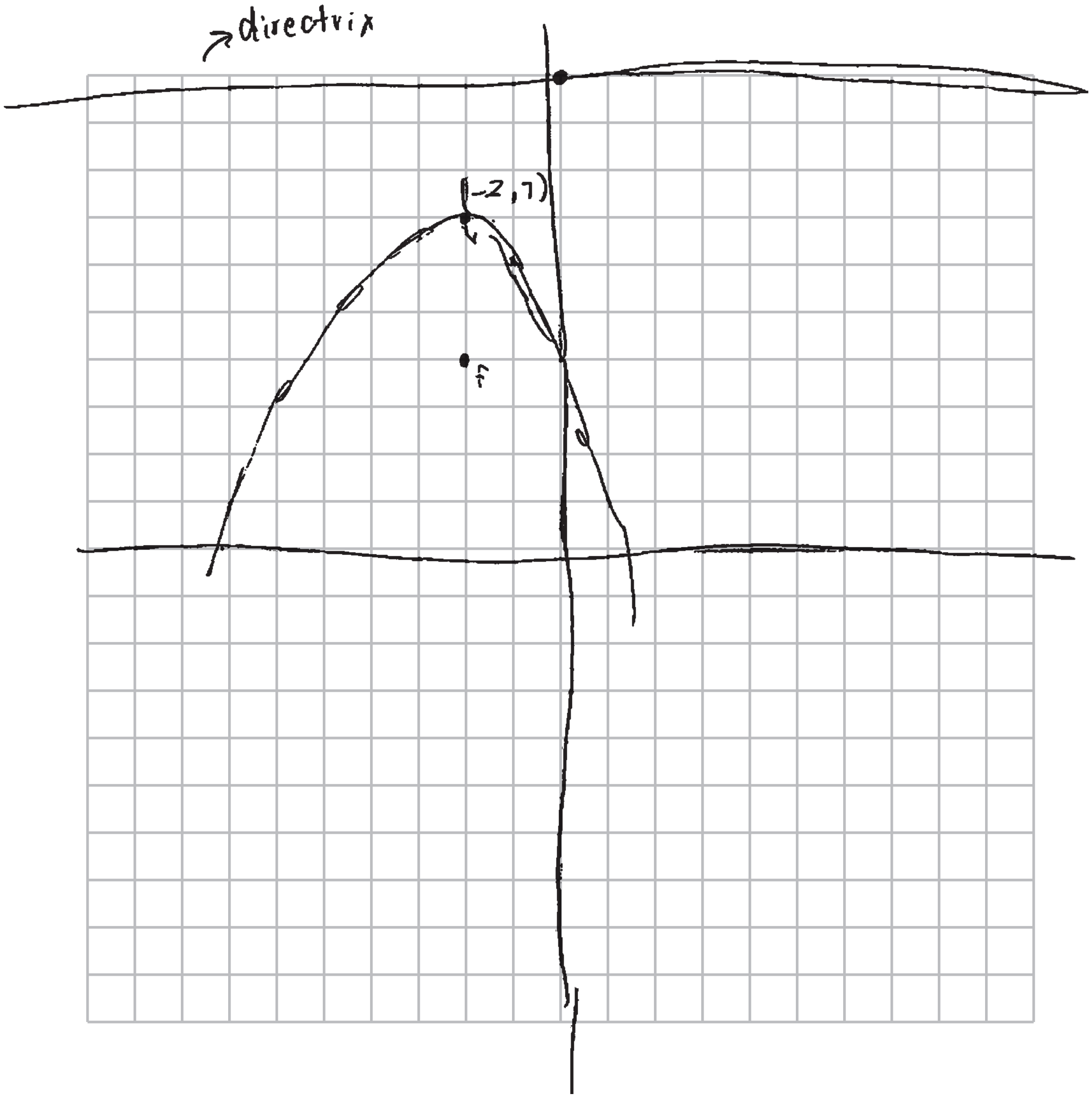
Score 2: The student made a conceptual error writing the equation.

Question 35

35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

$f(x) = (x+2)^2 + (y-7)^2$





Score 1: The student correctly determined the vertex.

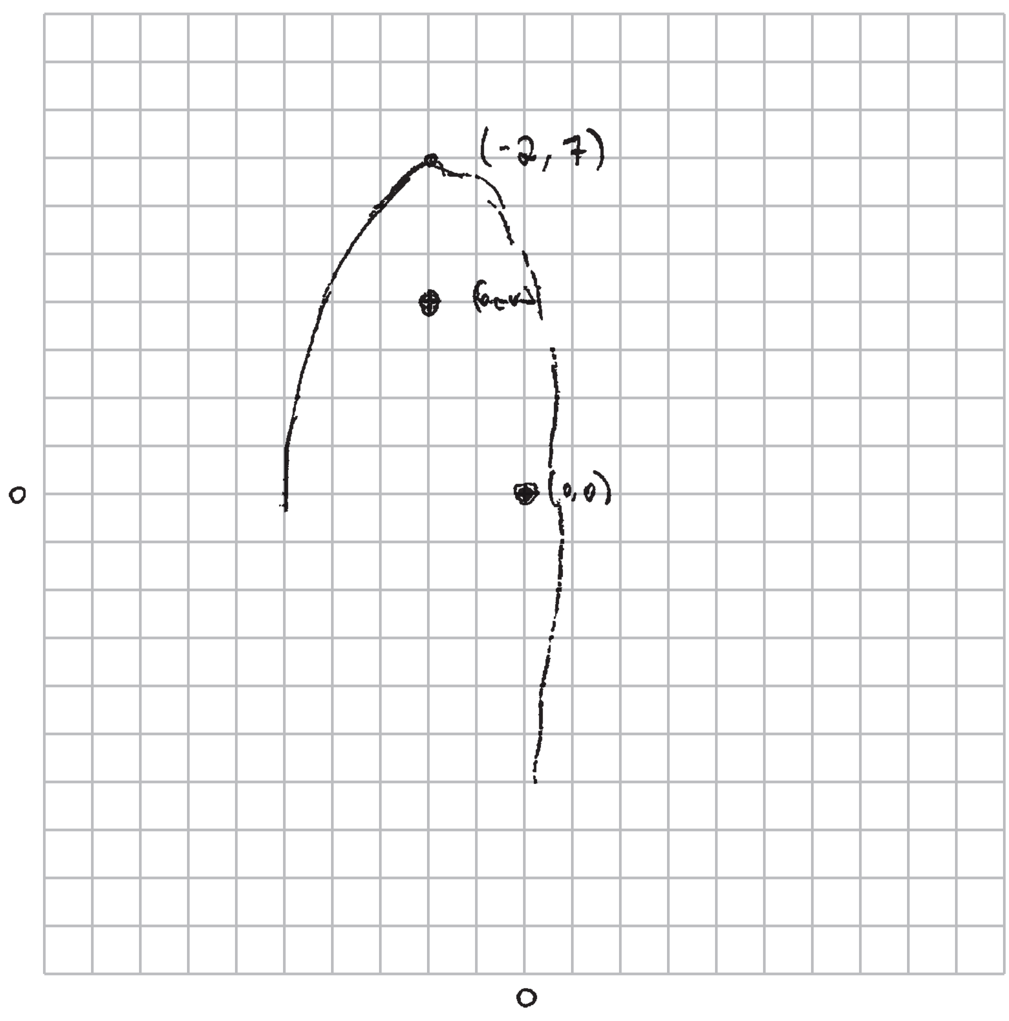
Question 35

35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

focus/directrix form

$$(x+2)^2 = (y+7)$$

directrix



Score 1: The student correctly determined the vertex.

Question 35

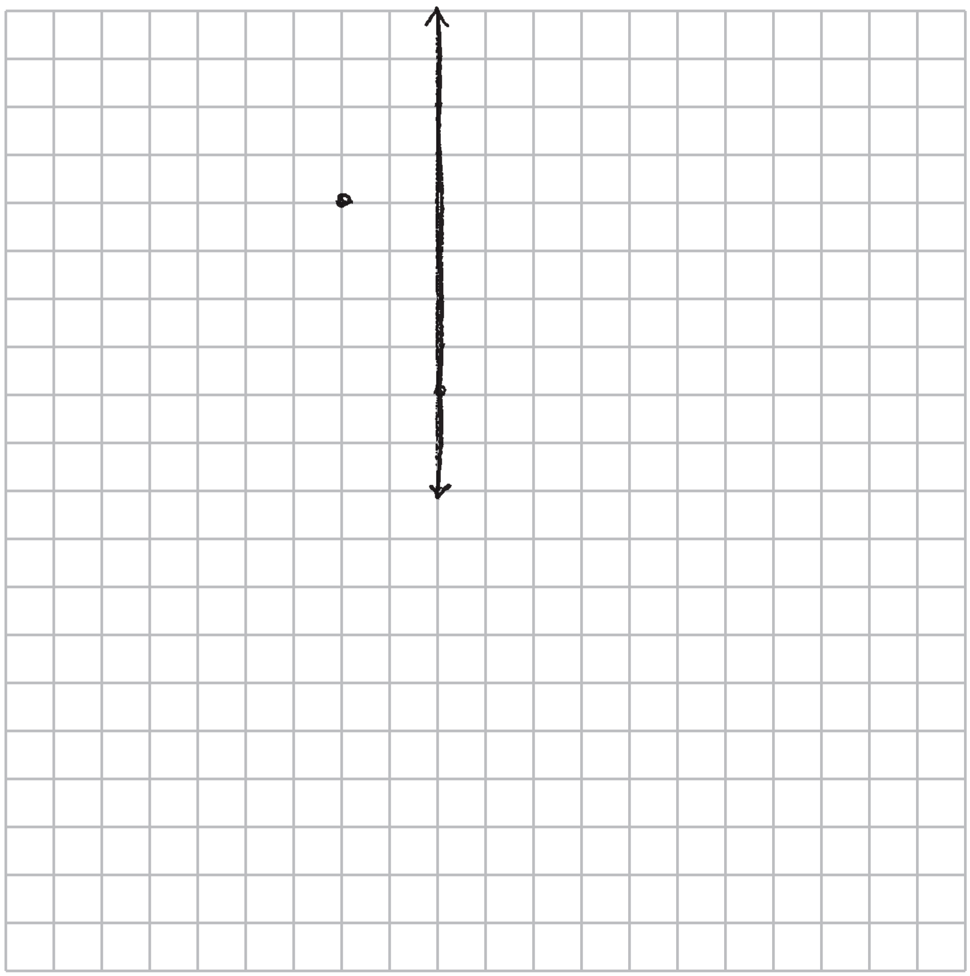
35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

$4p(y-k) = (x-h)^2$

$24(4-k) = (-2-h)^2$

$4 \cdot 6$

$10 - 4 = 6$



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

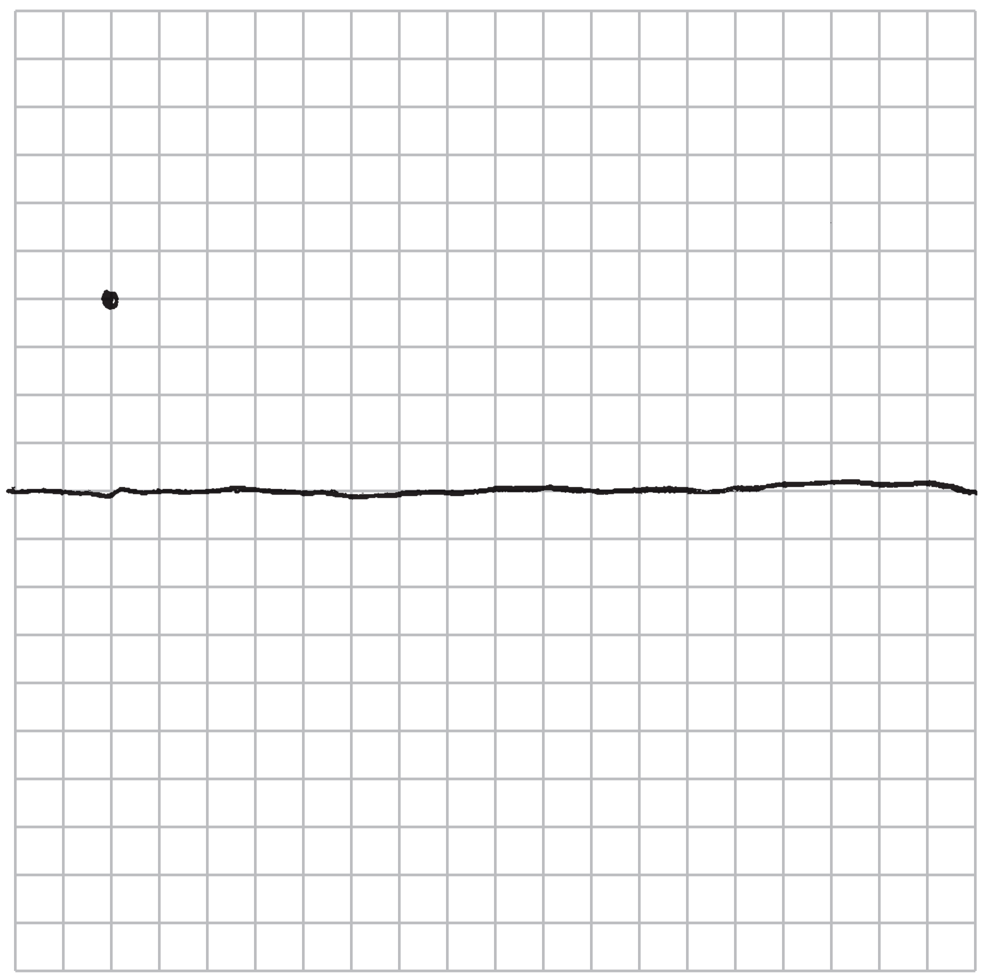
Question 35

35 Determine an equation for the parabola with focus $(-2, 4)$ and directrix $y = 10$. (The use of the grid below is optional.)

$$y = \frac{1}{4(10)}(x-2) + 4$$

$$y = \frac{1}{40}(x-2) + 4$$

$y = 10$



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

Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

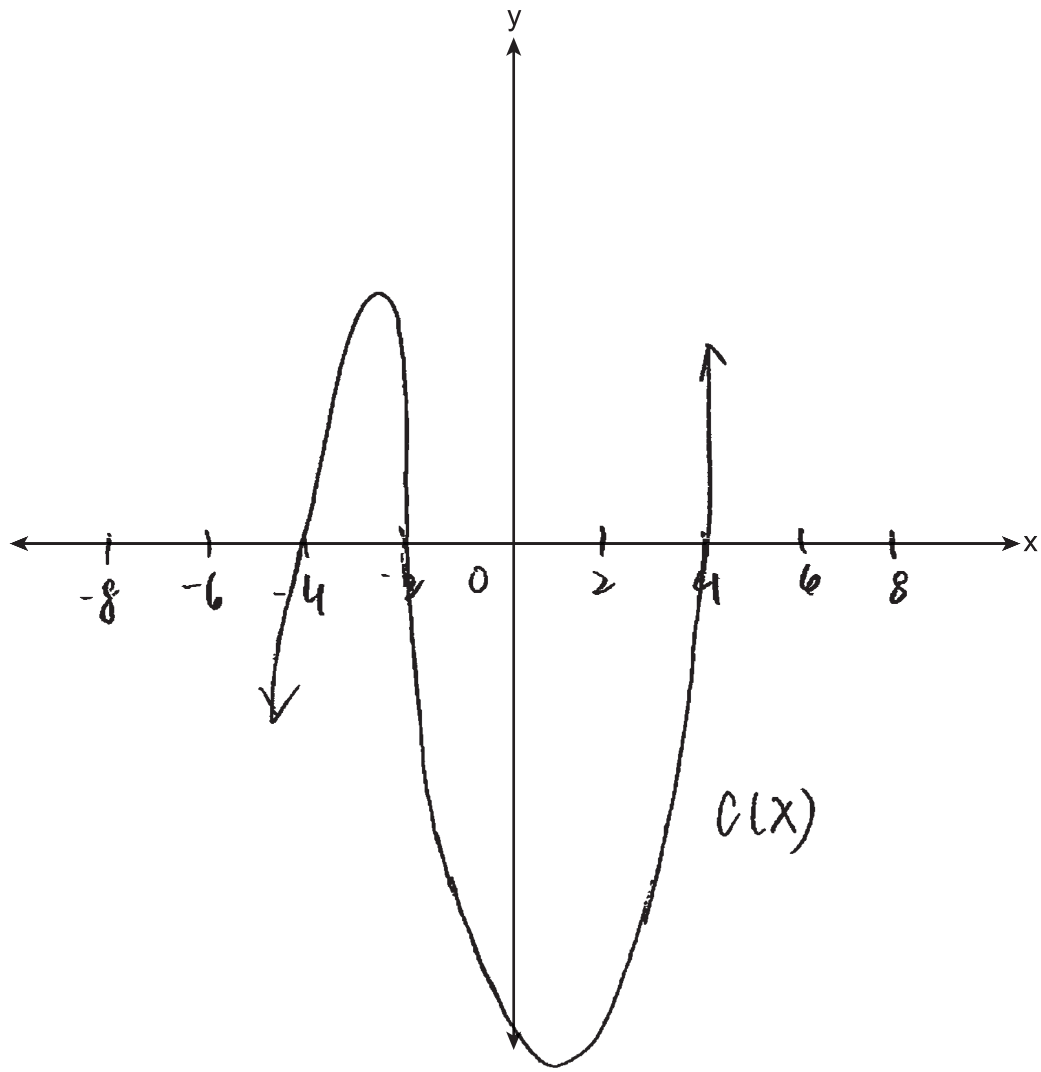
$x^2(x+2) - 16(x+2) = 0$

$(x^2 - 16)(x+2) = 0$

$(x-4)(x+4)(x+2) = 0$

$x = 4, -4, -2$

On the axes below, sketch $y = c(x)$.



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

Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

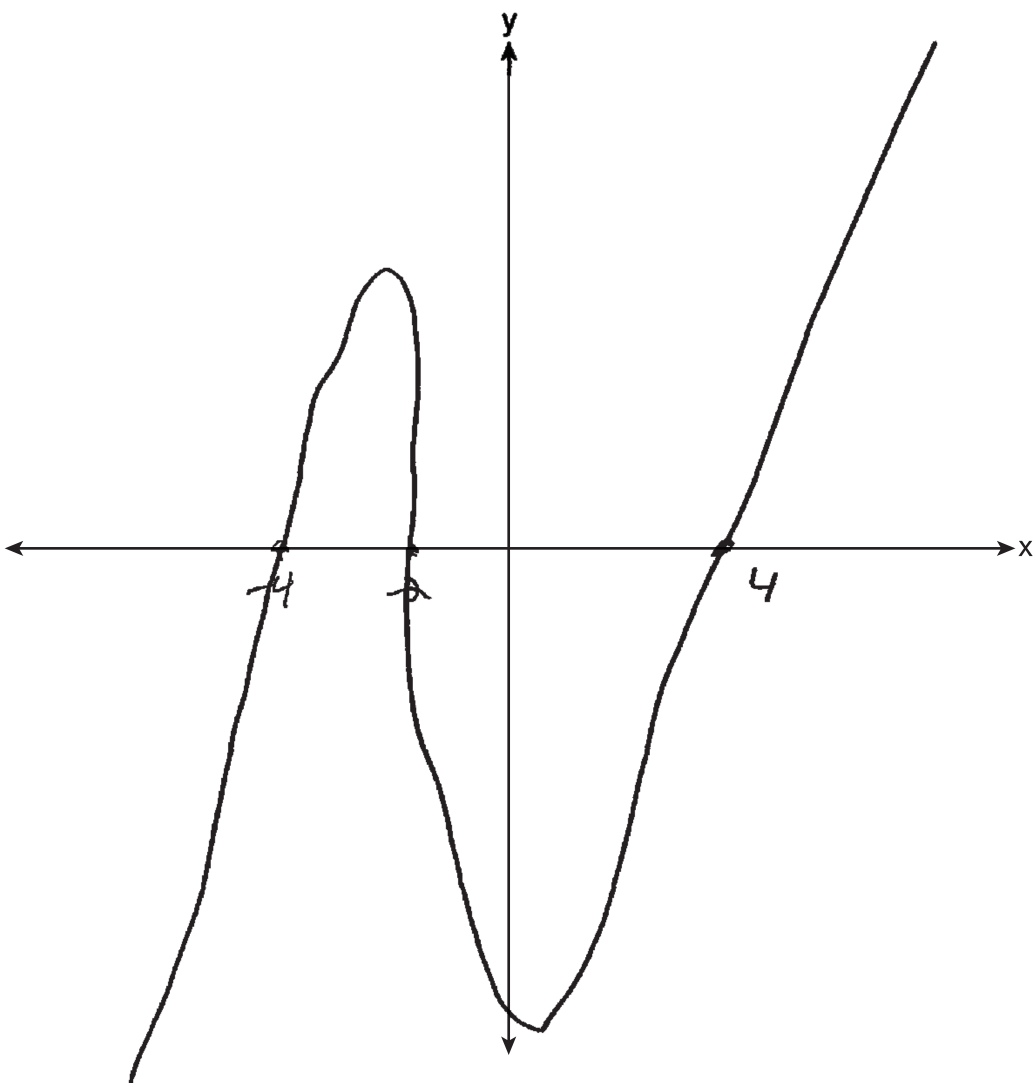
$x^2(x+2) - 16(x+2)$

$(x^2-16)(x+2)$

$(x-4)(x+4)(x+2)$

$\boxed{\begin{array}{l} x=4 \\ x=-4 \\ x=-2 \end{array}}$

On the axes below, sketch $y = c(x)$.



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

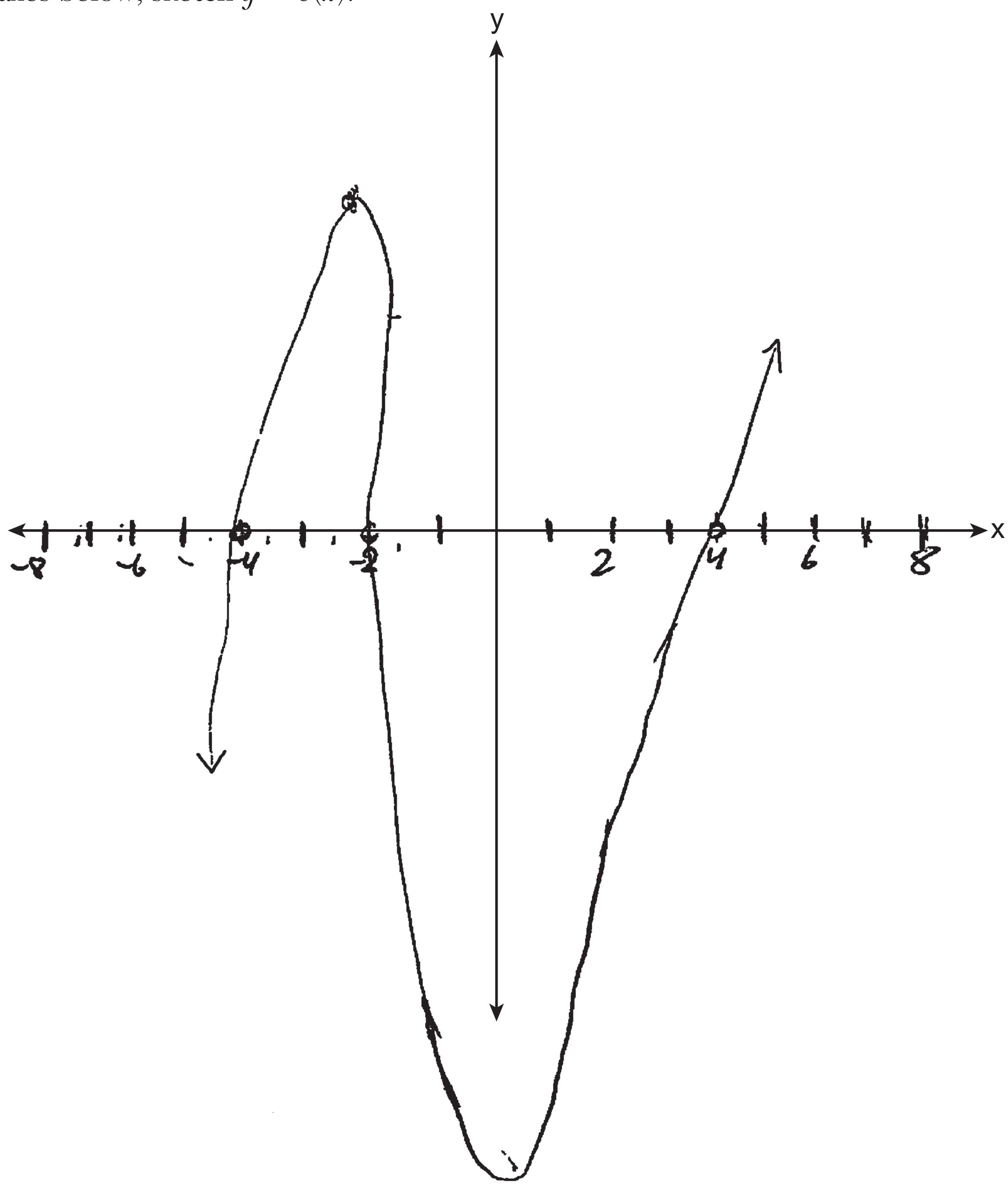
Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

$x = -2$
$x = \pm 4$

$x^2(x+2) - 16(x+2) = 0$
$(x^2 - 16)(x+2)$

On the axes below, sketch $y = c(x)$.



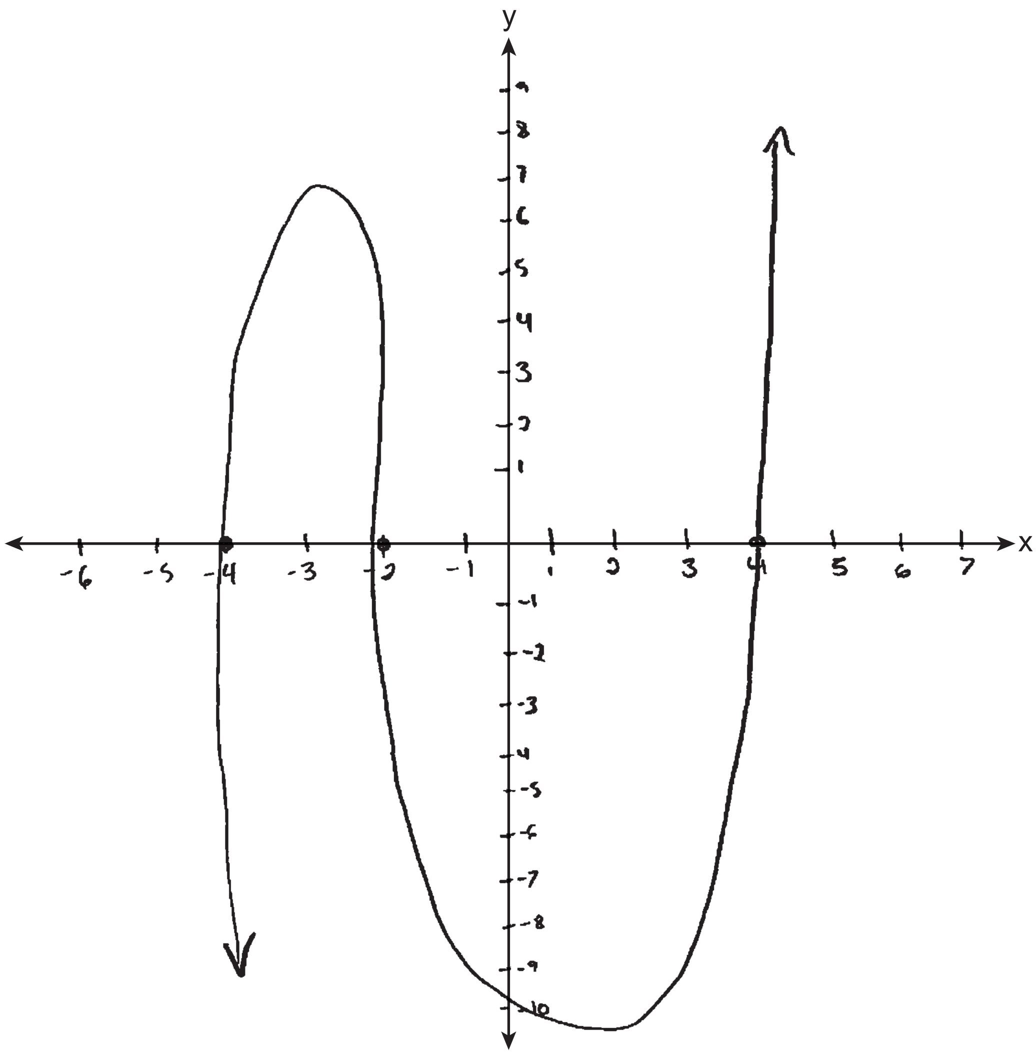
Score 3: The student sketched the relative minimum incorrectly.

Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

$$x^2(x+2) - 16(x+2)$$
$$(x^2-16)(x+2)$$
$$(x-4)(x+4)(x+2)$$
$$x=4 \quad x=-4 \quad x=-2$$

On the axes below, sketch $y = c(x)$.



Score 3: The student graphed an incorrect y-intercept.

Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

$x^3 + 2x \mid -16x - 32$

$x(x^2+2) \mid -16(x+2)$

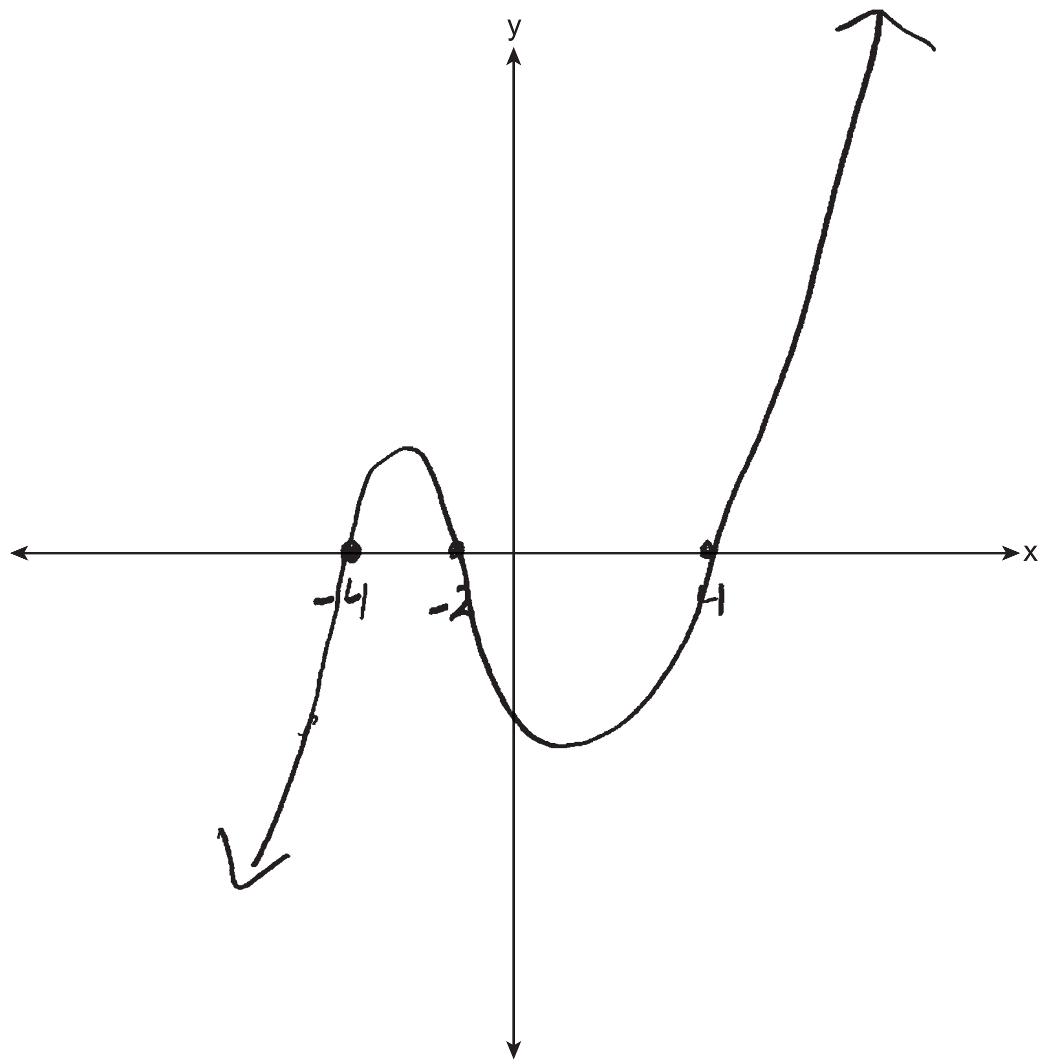
$x^2 - 2 = 0$

$+2 \quad +2$

$\sqrt{x^2} \pm 2$

$x = -2$

On the axes below, sketch $y = c(x)$.



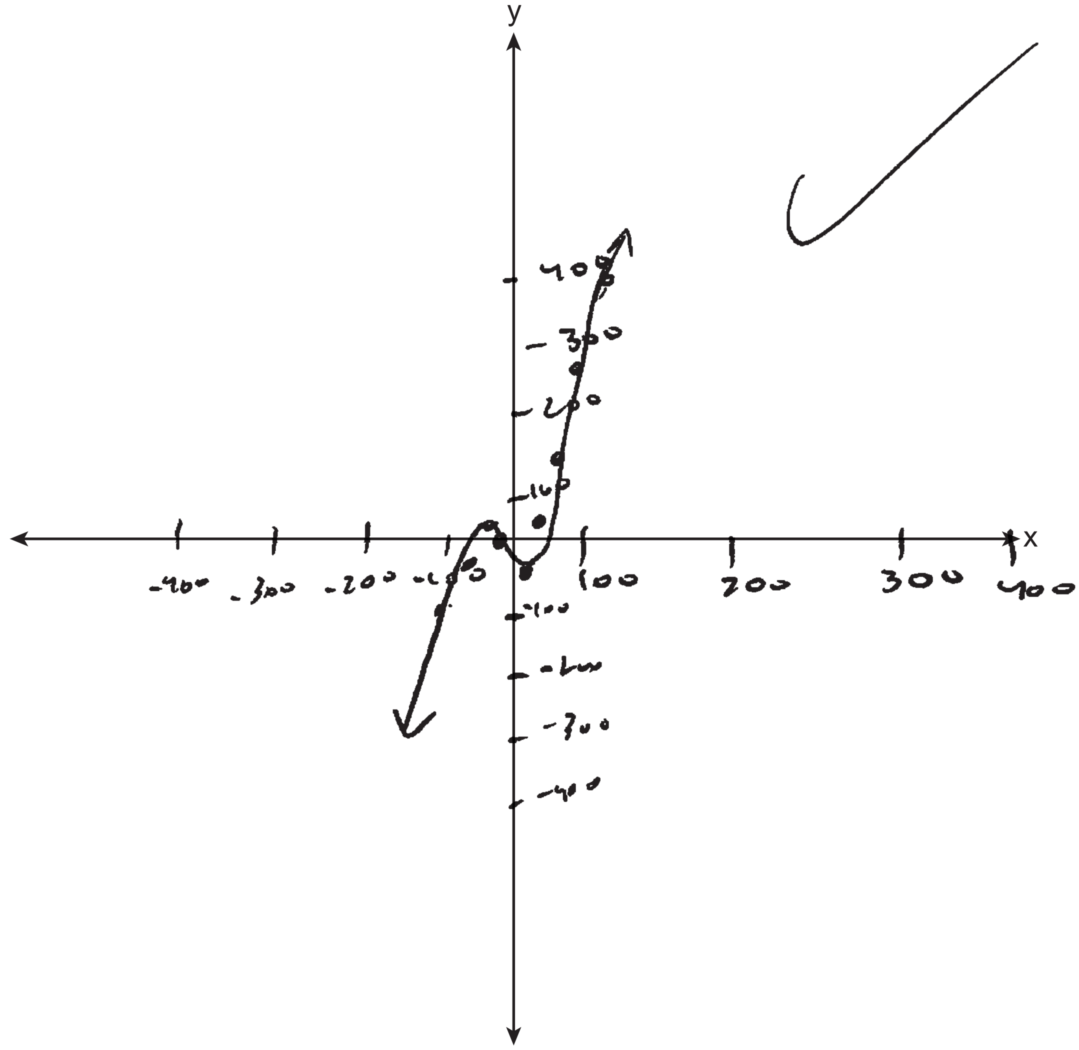
Score 2: The student received two points for their graph.

Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

$$c(x) = x^3 + 2x^2 - 16x - 32$$
$$c(x) = x^2(x+2) - 16(x+2)$$
$$c(x) = (x^2 - 16)(x+2)$$
$$c(x) = (x+4)(x-4)(x+2)$$

On the axes below, sketch $y = c(x)$.



Score 2: The student did not find the zeros, and the intercepts are not correct based on scale.

Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

$(x^3+2x^2)(-16x-32)$

$x^2(x+2)-16(x+2)$

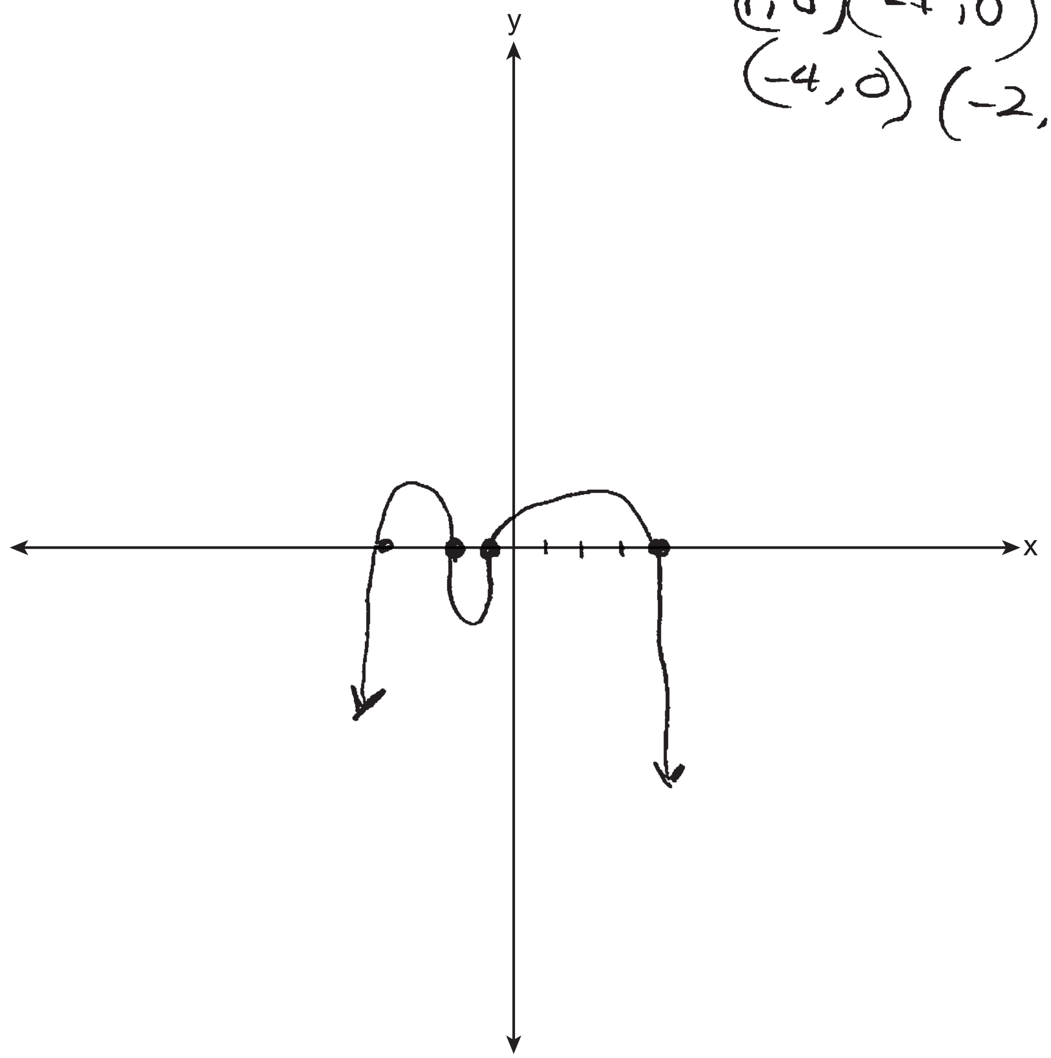
$(x^2-16)(x+2)(x+2)$

$(x+4)(x-4)(x+2)^2$

$x=-4$ $x=4$ $x=-2$

On the axes below, sketch $y = c(x)$.

$(4,0)(-1,0)$
$(-4,0)$ $(-2,0)$



Score 1: The student made a factoring error in the first part and received no credit for the graph.

Question 36

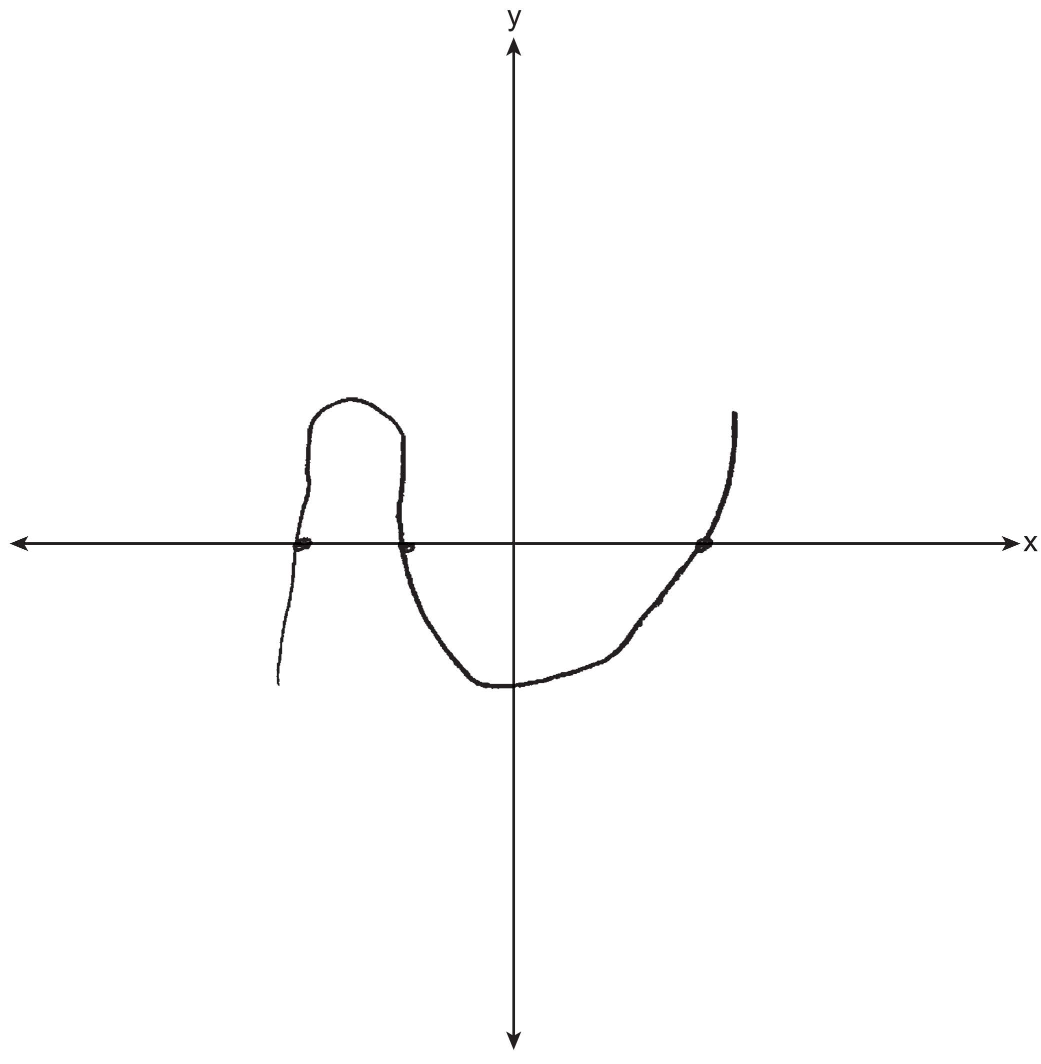
36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

$x^2(x+2) - 16(x+2)$

$(x^2-16)(x+2)$

$(x+4)(x-4)(x+2$

On the axes below, sketch $y = c(x)$.



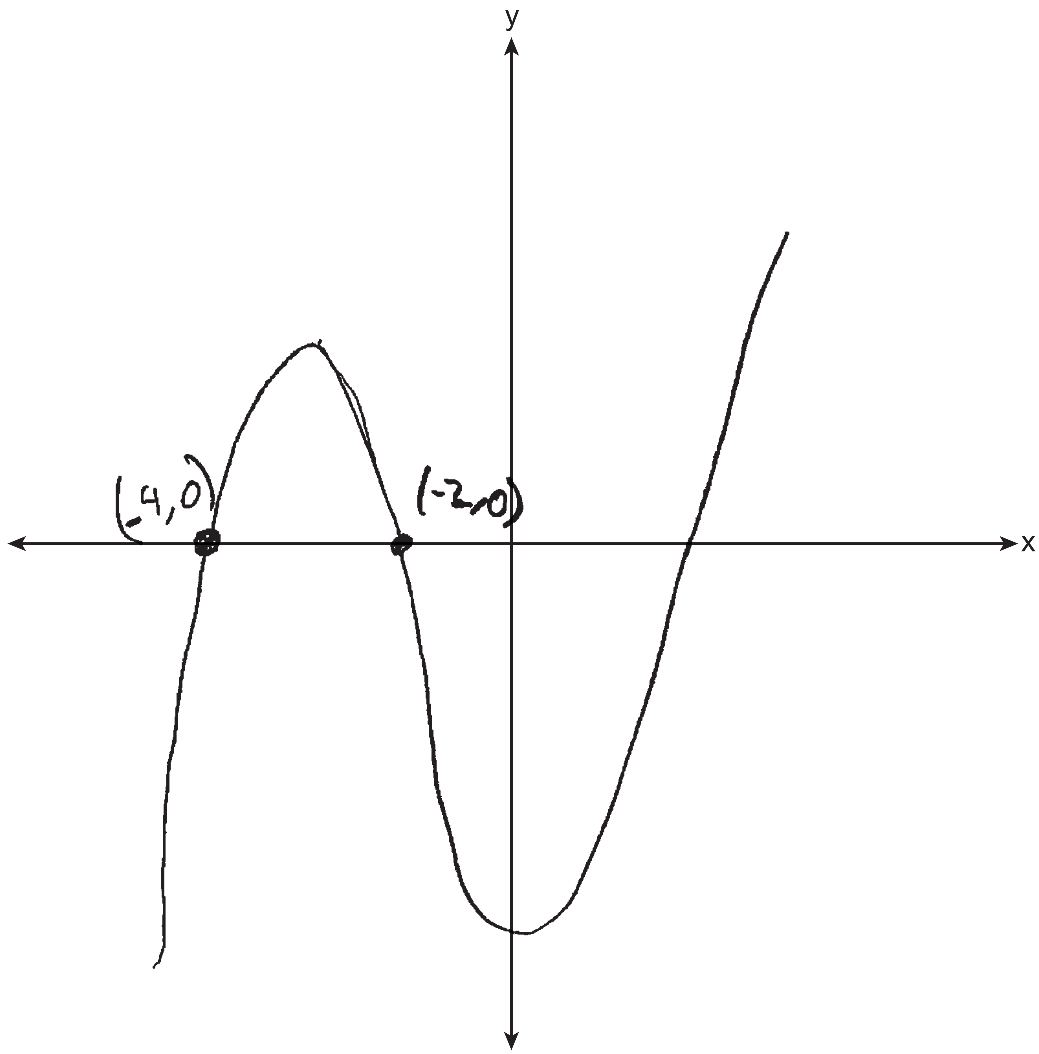
Score 1: The student received one point for factoring $c(x)$ correctly.

Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

$(-4, -2)$

On the axes below, sketch $y = c(x)$.



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

Question 36

36 Algebraically find the zeros of $c(x) = x^3 + 2x^2 - 16x - 32$.

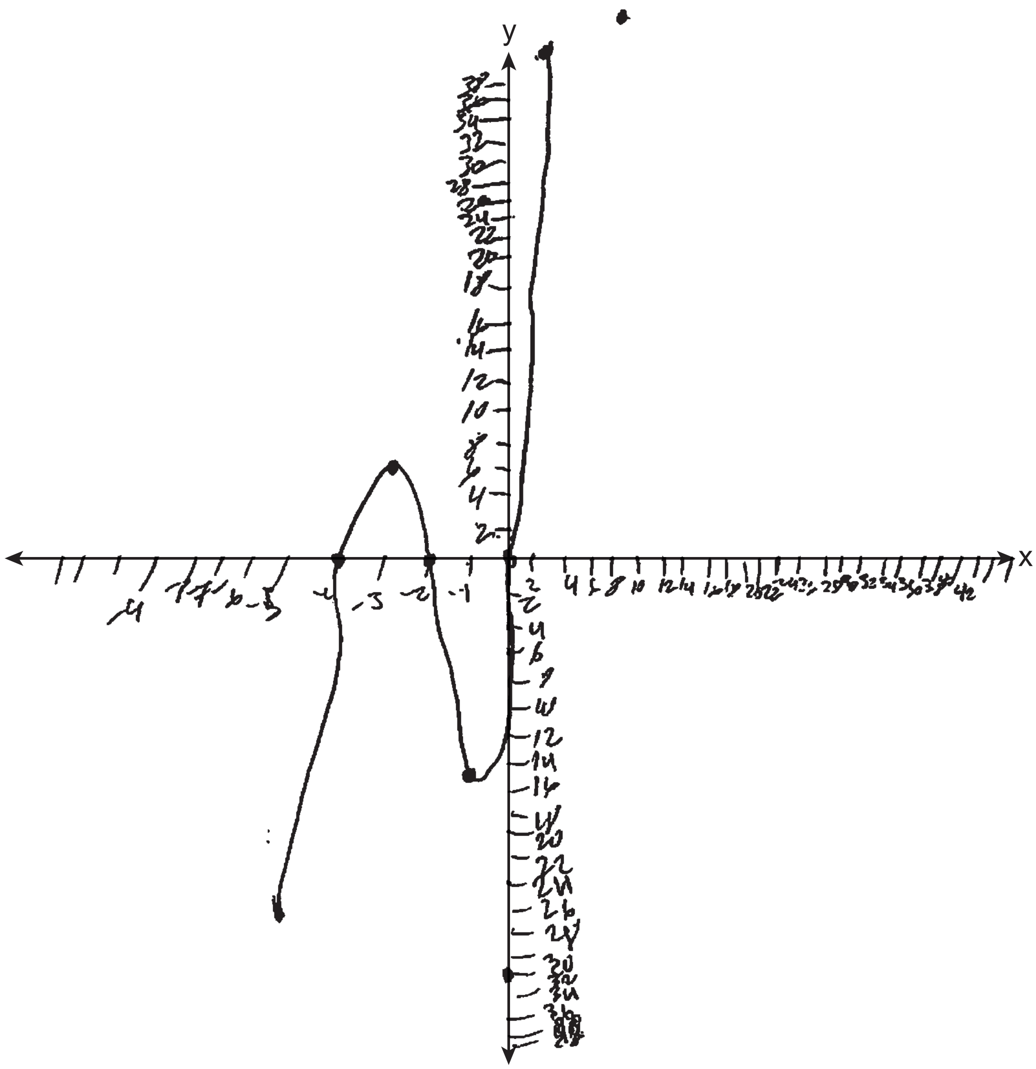
(0, -32)

(4, 0)

(-4, 0)

(-2, 0)

On the axes below, sketch $y = c(x)$.



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

Question 37

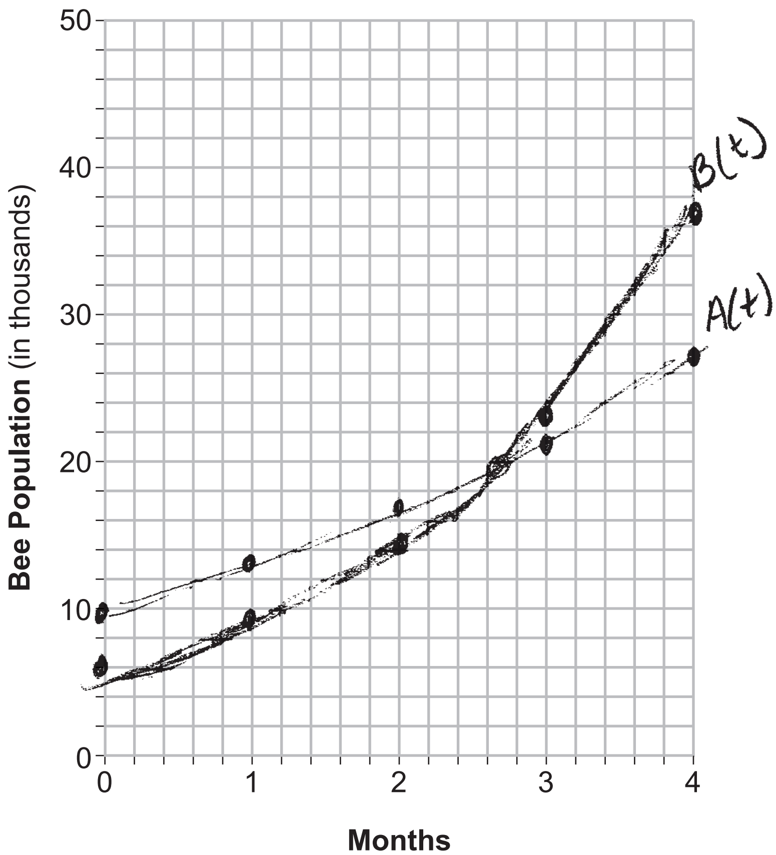
37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$A(t)=10000e^{.25t}$ $\quad$ $B(t)=6000e^{.45t}$

Graph $A(t)$ and $B(t)$ for $0 \le t \le 4$.

t	$A(t)$
0	10000
1	12840
2	16487
3	21170
4	27183



t	$B(t)$
0	6000
1	9409.9
2	14758
3	23145
4	36298

Question 37 is continued on the next page.

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

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

2.6 months

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony A to triple.

$3 = e^{.25t}$

$\ln 3 = .25t$

$\frac{\ln 3}{.25} = t$

$t = 4.4$

Question 37

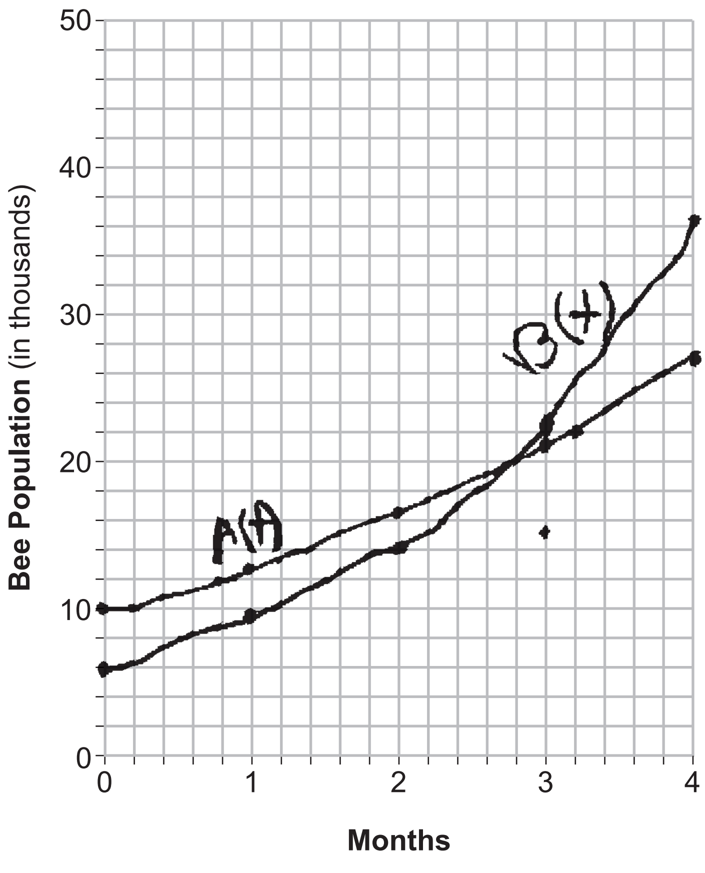
37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$A(t) = 10000(e)^{.25t}$

$B(t) = 6000e^{.45t}$

Graph $A(t)$ and $B(t)$ for $0 \le t \le 4$.



Question 37 is continued on the next page.

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

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

2.6 months

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$$\frac{30000}{10000} = \frac{10000(e)^{.25t}}{10000}$$

$$3 = e^{.25t}$$

$$\frac{\ln 3}{\ln e} = 0.25t\,\frac{\ln e}{\ln e}$$

$$\ln 3 = \frac{0.25t}{0.25}$$

$$4.4 = t$$

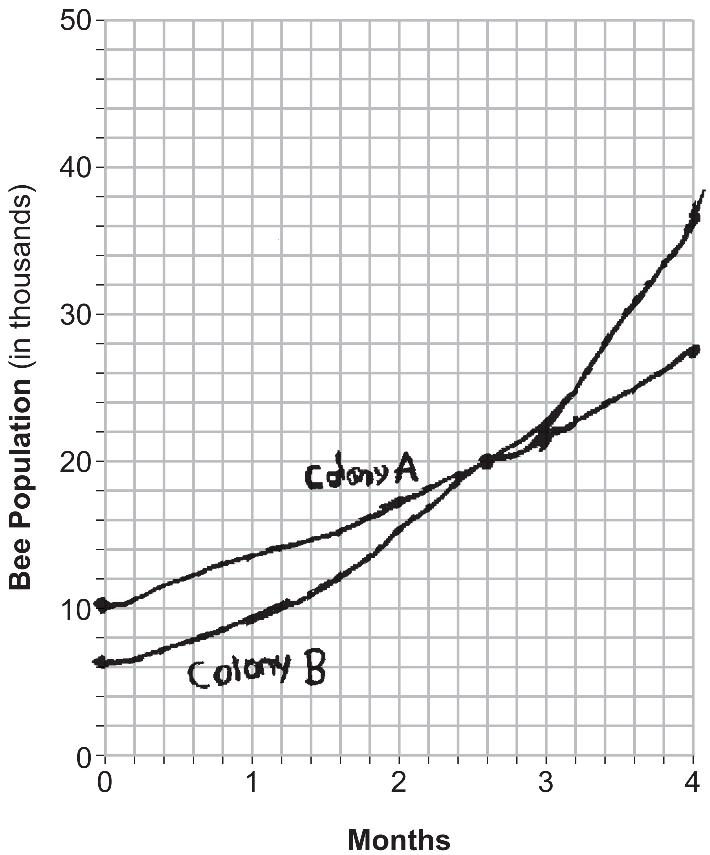
4.4 months

Question 37

37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.



Question 37 is continued on the next page.

Score 5: The student did not write functions for $A(t)$ and $B(t)$.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

According to the Graph it will take 2.6 months for the populations to be the same,

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony A to triple.

$$\frac{30{,}000}{10000} = \frac{\cancel{10{,}000}e^{0.95t}}{\cancel{10{,}000}}$$

$$3 = e^{0.95t}$$

$$\frac{\ln(3)}{0.95} = \frac{\cancel{0.95}t}{\cancel{0.95}}$$

9.9 months

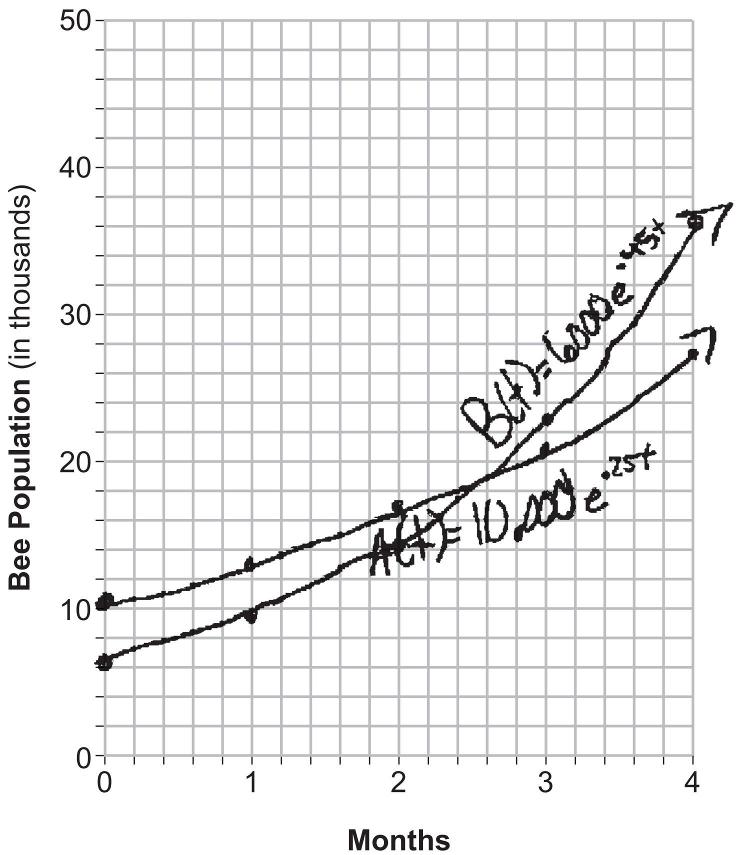
Question 37

37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$A(t) = 10{,}000e^{.25t}$ $B(t) = 6000e^{.45t}$

Graph $A(t)$ and $B(t)$ for $0 \le t \le 4$.



Question 37 is continued on the next page.

Score 5: The student made a domain error when graphing the functions.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

2.6 months

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony A to triple.

$30{,}000 = 10{,}000e^{.25t}$

$3 = e^{.25t}$

$\ln 3 = .25t$

$4.39 = t$

4.4 months

Question 37

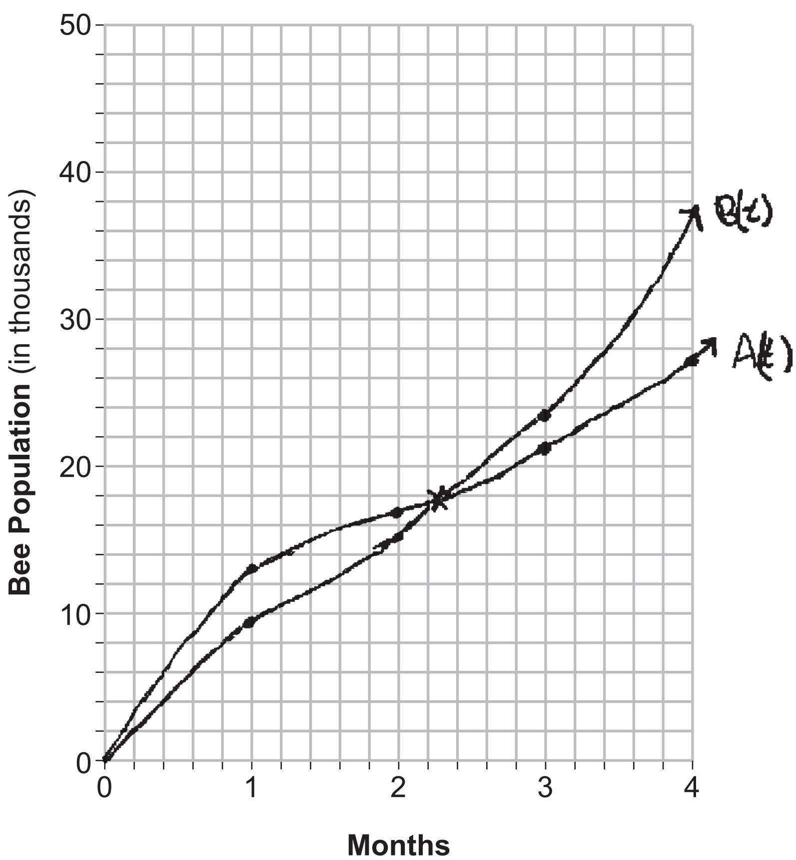
37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$A(t) = 10{,}000e^{0.25t}$

$B(t) = 6000e^{0.45t}$

Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.



Question 37 is continued on the next page.

Score 4: The student made two graphing errors, but determined 2.3 months correctly based on their graph.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

$10{,}000e^{0.25t} = 6000e^{0.45t}$

$\boxed{t = 2.3 \text{ months.}}$

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$\frac{30{,}000}{10{,}000} = \frac{10{,}000e^{0.25t}}{10{,}000}$

$\ln(3 = \ln e^{0.25t}$

$\frac{1.0986}{0.25} = \frac{0.25t}{0.25}$

$\boxed{4.4 \text{ months} = t}$

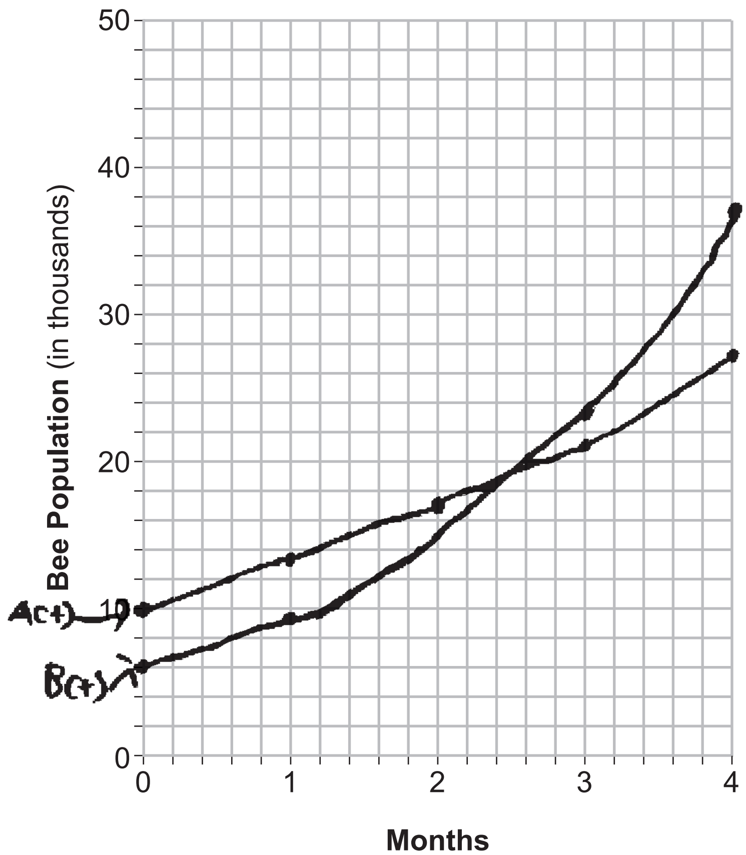
37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$A(t) = 10{,}000e^{.25t}$

$B(t) = 6{,}000e^{.45t}$

Graph $A(t)$ and $B(t)$ for $0 \le t \le 4$.



Question 37 is continued on the next page.

Score 4: The student did not determine $A(t) = B(t)$ and used Colony B in the last part.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

$$\frac{10{,}000e^{.25t}}{6000} = \frac{6000e^{.45t}}{6000} \qquad \frac{5}{3}e^{.25t} = e^{.45t}$$

$$\frac{5}{3}\ \cancel{\ln e}\ .25t$$

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$$\frac{18{,}000}{6000} = \frac{6000e^{.45t}}{6000}$$

$$3 = e^{.45t}$$

$$\frac{\ln(3)}{.45} = \frac{.45t}{.45}\ \cancel{\ln e}$$

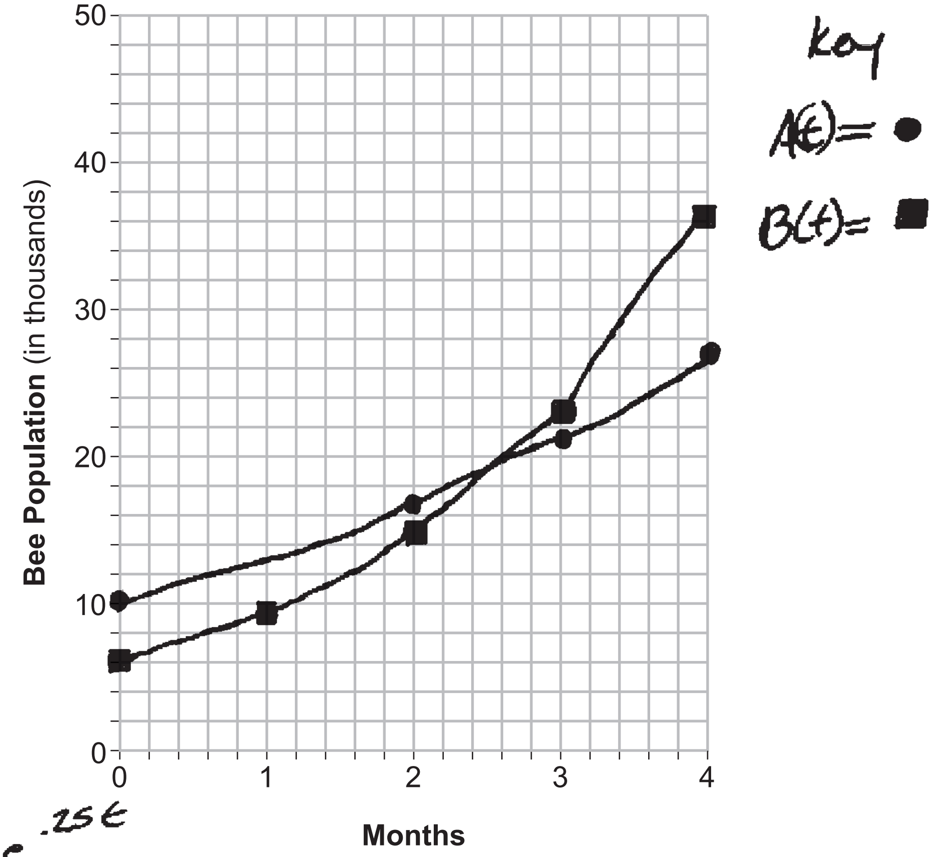
$t = 2.4$ months

Question 37

37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

Graph $A(t)$ and $B(t)$ for $0 \le t \le 4$.



$A(t)=10000e^{.25t}$

$B(t)=6000e^{.45t}$

Question 37 is continued on the next page.

Score 3: The student received no credit for the last two parts.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$$30{,}000 = \frac{10{,}000e^{.25x}}{10000}$$

$$3 = e^{.25x}$$

Question 37

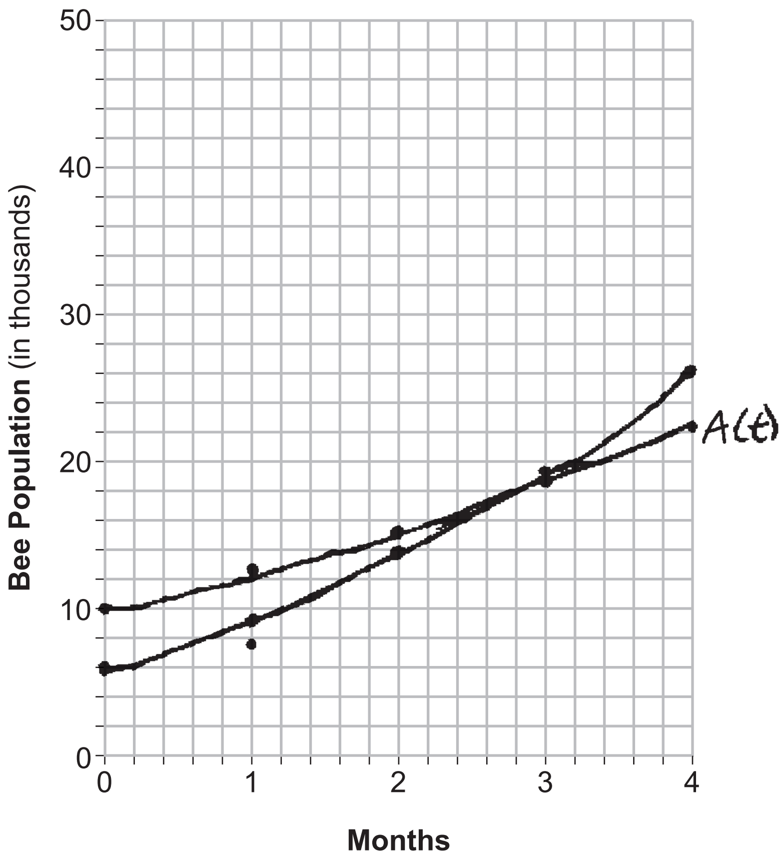
37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$A(t) = 10000 \cdot 1.25^t$

$B(t) = 6000 \cdot 1.45^t$

Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.



Question 37 is continued on the next page.

Score 3: The student wrote incorrect equations, graphed $A(t)$ incorrectly, and rounded incorrectly in the third part.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

$10000 \cdot 1.25^t = 6000 \cdot 1.45^t$

$1.667 \cdot 1.25^t = \frac{1.45^t}{1.45^t}$

$1.667 = 1.16^t$

$\log_{1.16}(1.667) = t$

$t = 3.44$ months

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$30000 = 10000\ 1.25^t$

$3 = 1.25^t$

$t = \log_{1.25}(3)$

$t = 4.9$ months

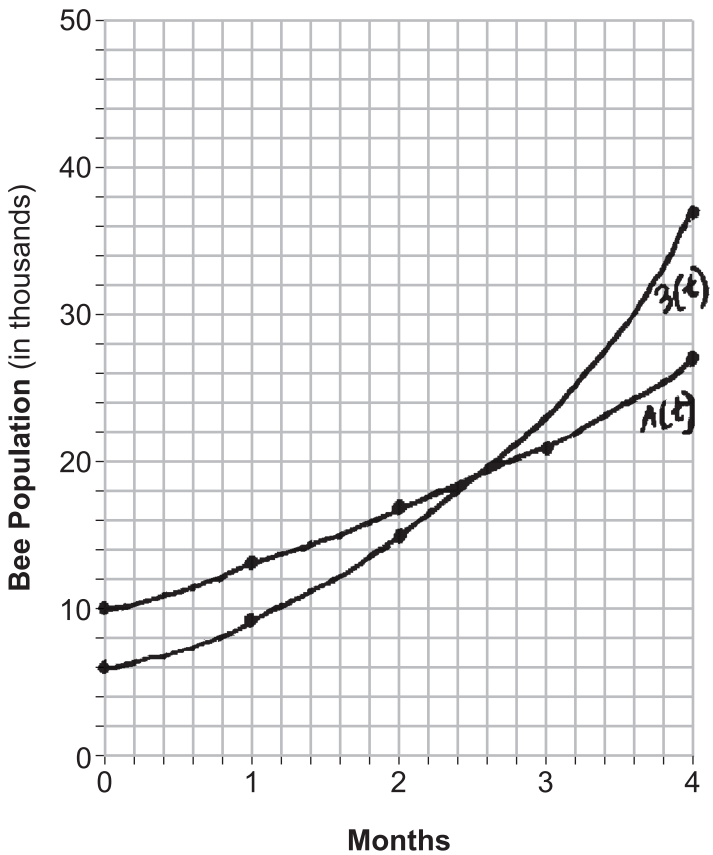
Question 37

37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

A - 10,000

Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.



Question 37 is continued on the next page.

Score 2: The student received two points for the graph.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

4.5

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$10000e^{.25(t)} =$

$10000e^{.25(4.5)} = 30802.16$

4.5 months

Question 37

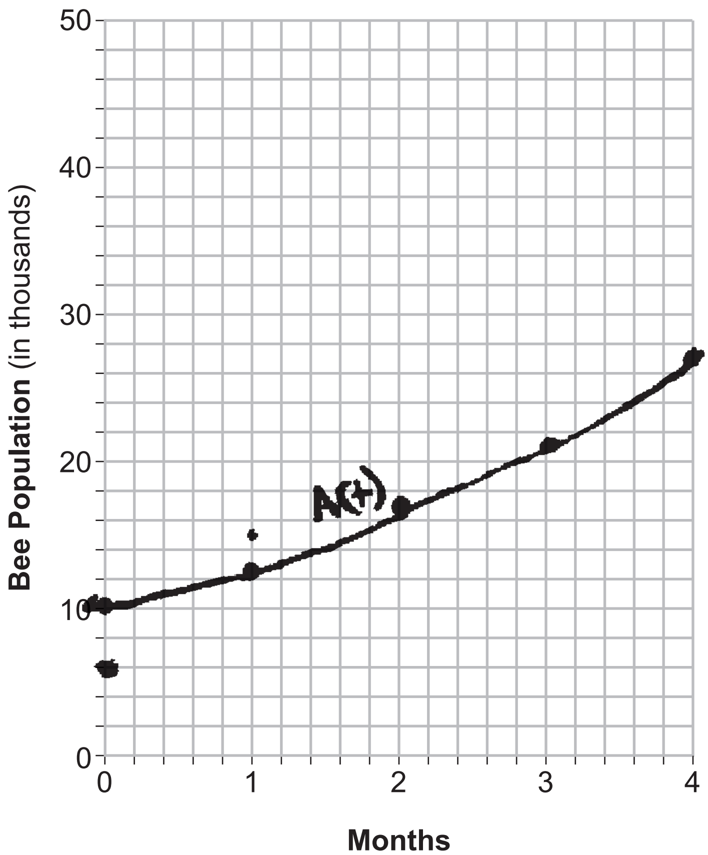
37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0 e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$10000e^{0.25t} = A(t)$

$B(t) = 6000e^{0.45t}$

Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.



Question 37 is continued on the next page.

Score 2: The student received one point for the equations and one point for the graph.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

Question 37

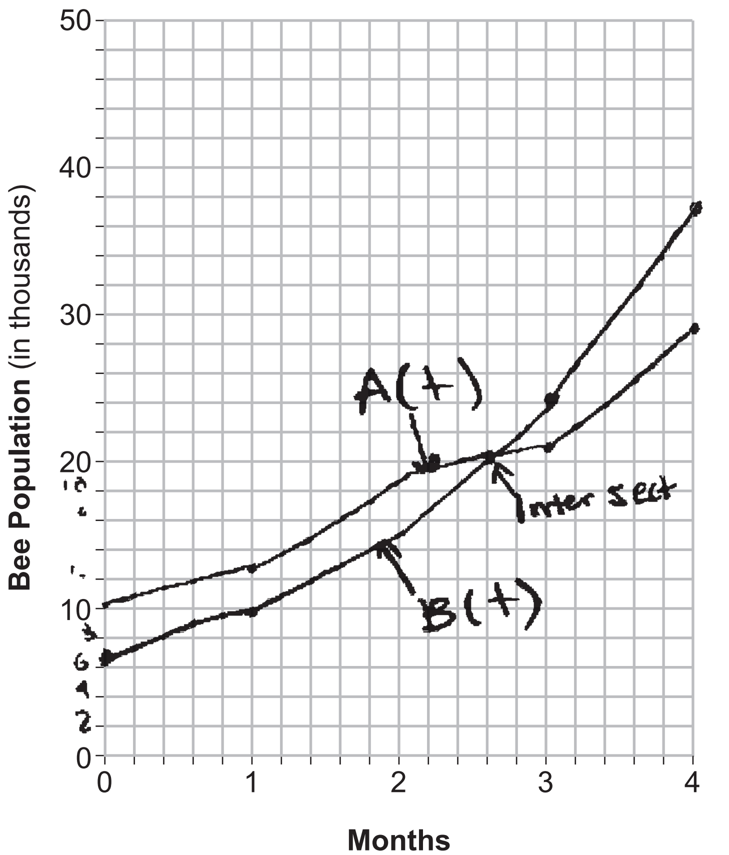
37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$A(t) = P_{10,000}e^{0.25t}$

$B(t) = P_{6,000}e^{0.45t}$

Graph $A(t)$ and $B(t)$ for $0 \leq t \leq 4$.



Question 37 is continued on the next page.

Score 1: The student received one point for graphing $B(t)$ correctly.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

In 2 months time

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$0.25(5t) = 1.25$

$10{,}000e^{1.25} = 34{,}903$

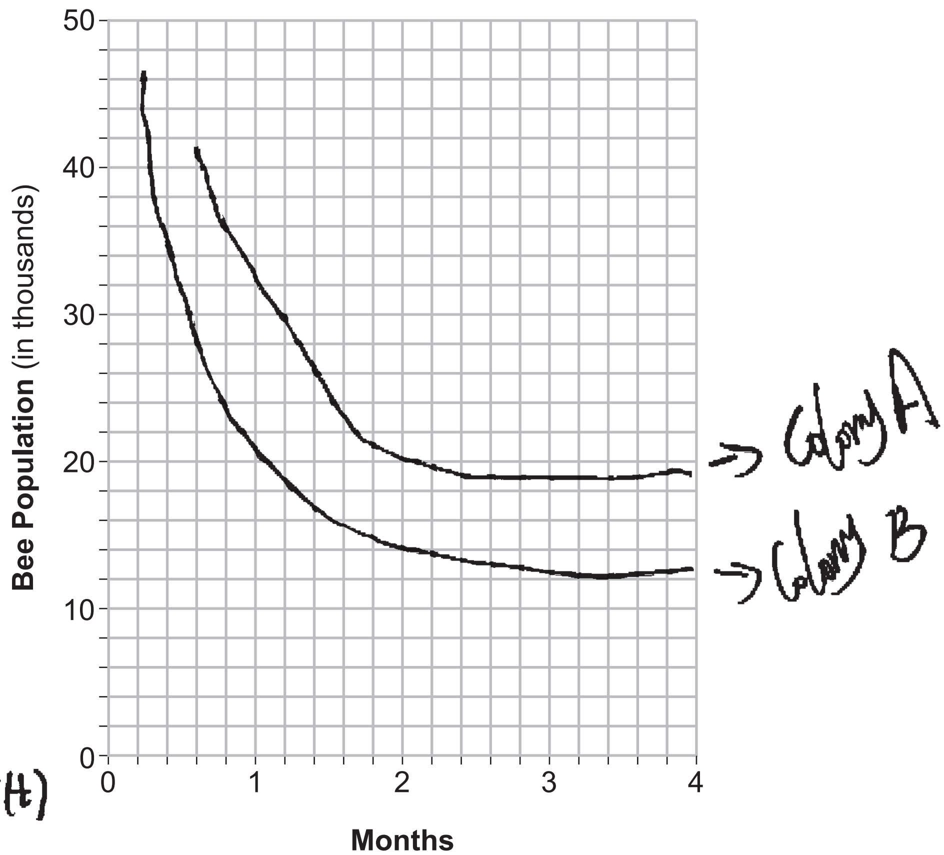
it will take 5 months for the population to triple.

Question 37

37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

Graph $A(t)$ and $B(t)$ for $0 \le t \le 4$.



$A(t) = 10{,}000e^{0.25(t)}$

$B(t) = 6000e^{0.45(t)}$

Question 37 is continued on the next page.

Score 1: The student received one point for writing functions for $A(t)$ and $B(t)$.

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony A to triple.

37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

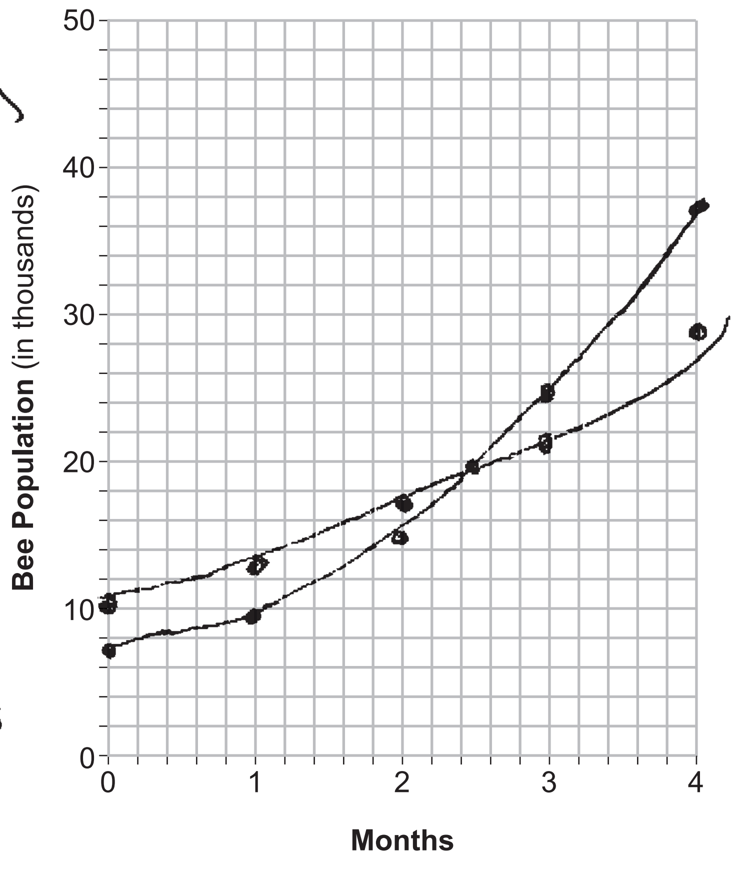
$A(t) = 10{,}000pe^{.25t}$

$B(t) = 6{,}000pe^{45t}$

Graph $A(t)$ and $B(t)$ for $0 \le t \le 4$.

X	Y A(T)
0	10,000
1	12840
2	16487
3	21170
4	27183

X	Y B(T)
0	6,000
1	9409
2	1475
3	23145
4	36298



Question 37 is continued on the next page.

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

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

The colonies will have the same population in 3 months.

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$3^3 = 27$

It will take Colony A three months to triple.

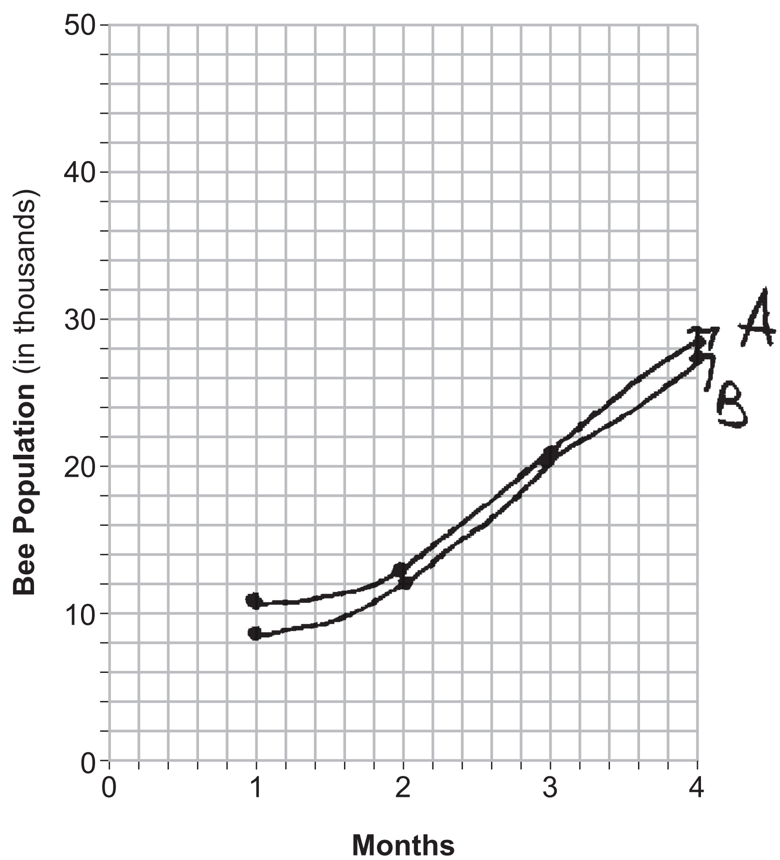
Question 37

37 The populations of honeybees in two different colonies are studied for four months. During this time, the colony population can be approximated by $P(t) = P_0e^{rt}$, where $P(t)$ is the colony population of bees at t months, P_0 is the initial population, and r is the growth rate.

Colony A has an initial population of 10,000 bees and a continuous growth rate of 0.25. Colony B has an initial population of 6000 bees and a continuous growth rate of 0.45. Write functions for both $A(t)$ and $B(t)$ that model the honeybee populations of the colonies after t months.

$10{,}000e^{0.25t}$ $6000e^{0.45t}$

Graph $A(t)$ and $B(t)$ for $0 \le t \le 4$.



Question 37 is continued on the next page.

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

Question 37

State, to the *nearest tenth of a month*, when the colonies will have the same population.

Determine algebraically how long it will take, to *the nearest tenth of a month*, for the population in Colony *A* to triple.

$$\frac{30{,}000 = 10{,}000}{10{,}000} e^{0.25t}$$

$$\ln(3) = \ln(e^{0.25t})$$

$$\frac{\ln(3) = 0.25}{0.25} \ln t$$

$$t = 12$$