The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA II

Wednesday, June 25, 2025 — 9:15 a.m. to 12:15 p.m., only

MODEL RESPONSE SET

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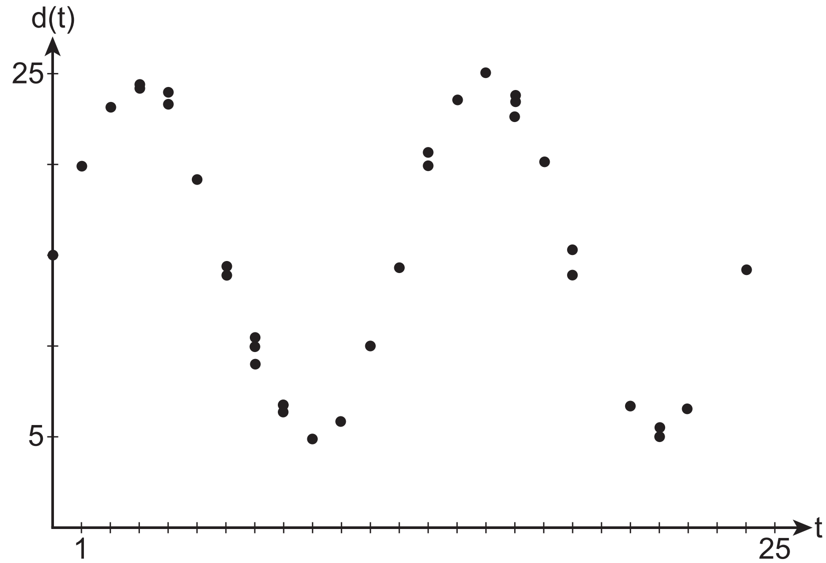
Question 25

25 Data collected showing the depth of the water in a bay during a 24-hour period are shown in the graph below.



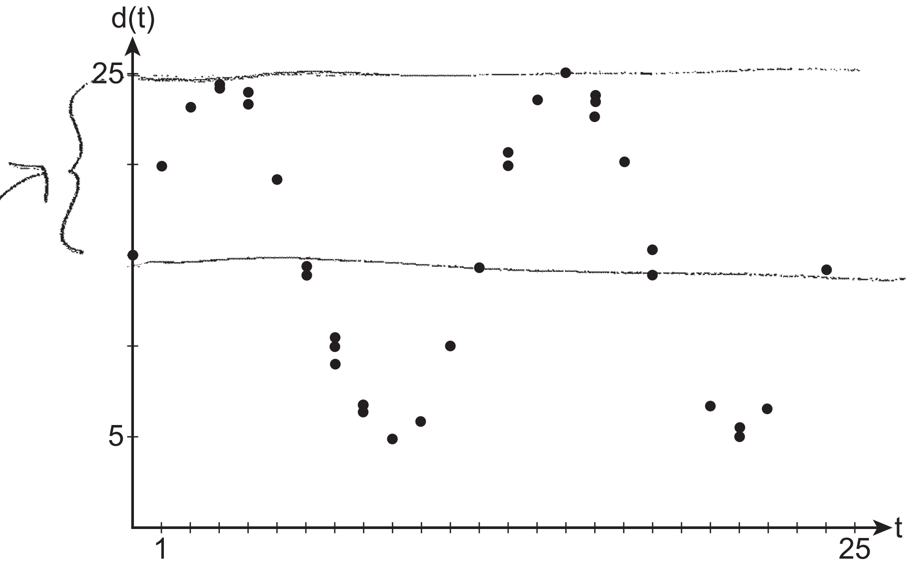
The depth of the water can be modeled with a trigonometric function of the form $d(t) = A \sin\left(\frac{\pi}{6}t\right) + C$. Estimate the value of A, to the *nearest integer*. Justify your answer.

A=10 because c is the midline which is at 15 and from 15 to 25 there is 10 spaces away.

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

Question 25

25 Data collected showing the depth of the water in a bay during a 24-hour period are shown in the graph below.

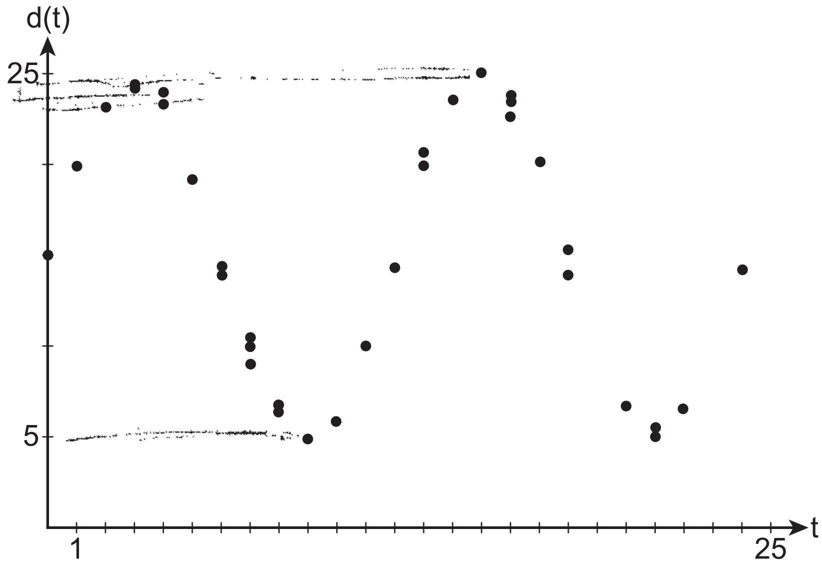


The depth of the water can be modeled with a trigonometric function of the form $d(t) = A\sin\left(\frac{\pi}{6}t\right) + C$. Estimate the value of A, to the *nearest integer*. Justify your answer.

$\boxed{10}$

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

25 Data collected showing the depth of the water in a bay during a 24-hour period are shown in the graph below.



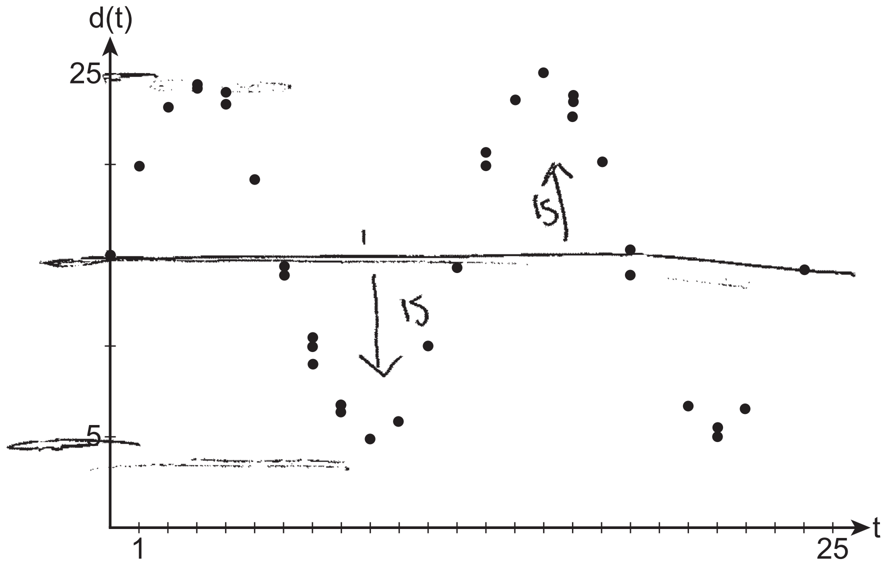
The depth of the water can be modeled with a trigonometric function of the form $d(t) = A\sin\left(\frac{\pi}{6}t\right) + C$. Estimate the value of A, to the *nearest integer*. Justify your answer.

A = 20 because A is the amplitude of the function and looking at the graph, the amplitude can be seen within the minimum value of 5 and maximum value of 25; 25 − 5 = 20.

Score 1: The student did not divide by two when calculating the amplitude.

Question 25

25 Data collected showing the depth of the water in a bay during a 24-hour period are shown in the graph below.



The depth of the water can be modeled with a trigonometric function of the form $d(t) = A\sin\left(\frac{\pi}{6}t\right) + C$. Estimate the value of A, to the *nearest integer*. Justify your answer.

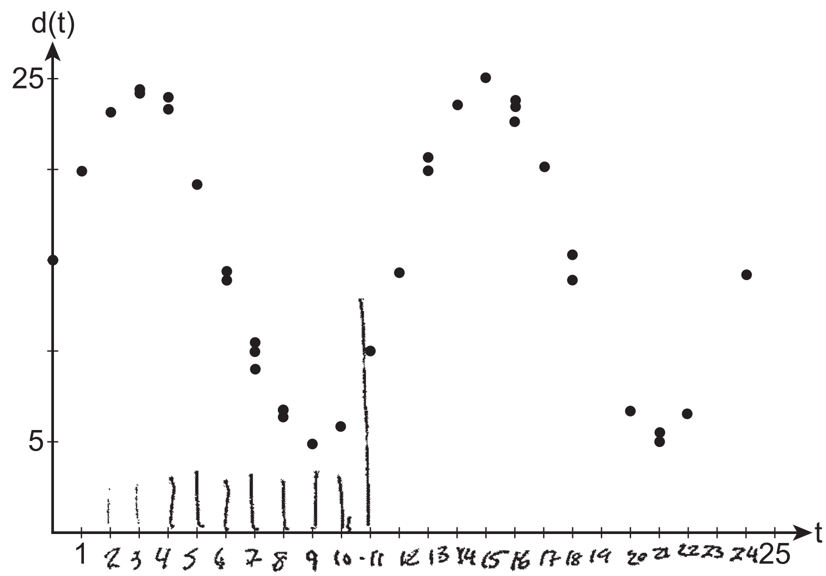
a=amplitude

A=15

Score 1: The student made a computational error.

Question 25

25 Data collected showing the depth of the water in a bay during a 24-hour period are shown in the graph below.



The depth of the water can be modeled with a trigonometric function of the form $d(t) = A\sin\left(\frac{\pi}{6}t\right) + C$. Estimate the value of A, to the *nearest integer*. Justify your answer.

$d(t) = A\sin\left(\frac{\pi}{6}t\right)+C$

$25 = \_\ \sin\left(\frac{\pi}{6}24\right)+$

$\underbrace{\sin(12.56)}$

$25 = 11 \times -2E-13 + C$

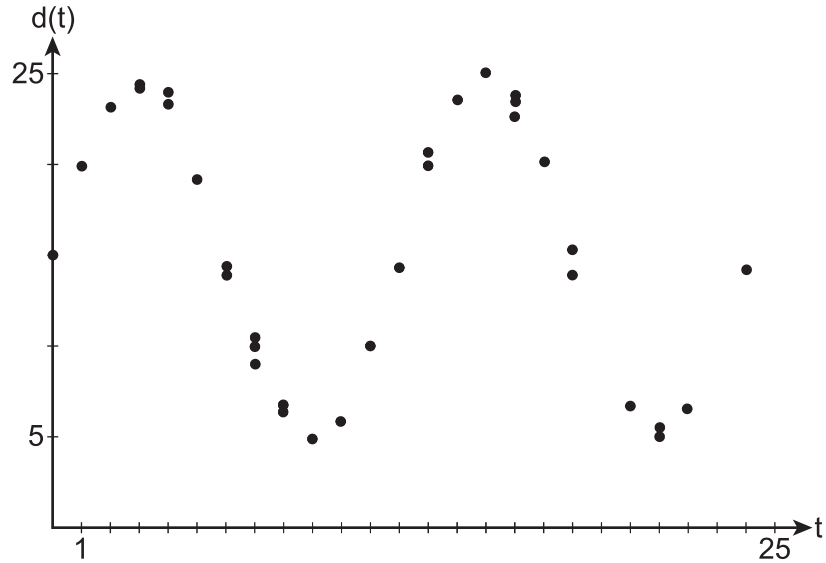
$25 = 11\sin\left(\frac{\pi}{6}24\right)25$

$25 = 11 \times -2E-13 + 25$

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

Question 25

25 Data collected showing the depth of the water in a bay during a 24-hour period are shown in the graph below.



The depth of the water can be modeled with a trigonometric function of the form $d(t) = A\sin\left(\frac{\pi}{6}t\right) + C$. Estimate the value of A, to the *nearest integer*. Justify your answer.

A = 25 because that is the max the line will go

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

26 Algebraically determine the solution to the equation below.

$$\sqrt{x-2}+x=4$$
$$-x \quad -x$$

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

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

$$x-2=x^2-8x+16$$
$$-x+2$$

$$x^2-9x+18=0$$

$$(x-6)(x-3)=0$$

$$\cancel{x=6} \quad x=3$$

$$\sqrt{6-2}+6=4$$

$$2+6\neq 4$$

$$\sqrt{3-2}+3=4$$

$$1+3=4\checkmark$$

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

Question 26

26 Algebraically determine the solution to the equation below.

$$\sqrt{x-2} + x = 4$$

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

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

$$x-2 = 16-4x-4x+x^2$$

$$x-2 = x^2-8x+16$$

$$x^2-9x+18$$

$$(x-3)\ (x-6)$$

$$\boxed{x=3} \quad x=6$$

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

Question 26

26 Algebraically determine the solution to the equation below.

$$\sqrt{x-2} + x = 4$$

$$\left(\sqrt{x-2}\right)^2 = (4-x)^2$$

$$x-2 = 16-8x+x^2$$

$$x^2-9x+18=0$$

$$(x-3)(x-6)$$

$$\boxed{x=\{3,6\}}$$

Score 1: The student did not reject the extraneous root.

Question 26

26 Algebraically determine the solution to the equation below.

$$\sqrt{x-2} + x = 4$$

$-x$

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

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

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

$x - 2 = 16 - 8x + x^2$

$+2 \qquad +2$

$x = 18 - 8x + x^2$

$-x \qquad -x$

$\dfrac{8 \pm \sqrt{(-8)^2 - 4(1)(18)}}{2(1)}$

$0 = 18 - 9x + x^2$

$\dfrac{8 \pm \sqrt{-8}}{2}$

$4 \pm \sqrt{-2}$

$8 \pm \sqrt{4}\sqrt{-2}$

$\dfrac{8 \pm 2\sqrt{-2}}{2}$

$\cancel{4 \pm \sqrt{2}\, i}$

Score 1: The student made a substitution error.

Question 26

26 Algebraically determine the solution to the equation below.

$$\sqrt{x-2} + x = 4$$
$$-x \quad -x$$

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

$$16-4x-4x-x^2$$

$$(4-x)(4-x) \quad x^2-8x+16$$

$$x-2 = x^2-8x+16$$
$$-x^2+8x-16 \quad -x^2+8x-16$$

$$-x^2+9x-18$$

No Solution

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

Question 26

26 Algebraically determine the solution to the equation below.

$$\sqrt{x-2} + x = 4$$

$-x \quad -x$

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

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

$x-2 = x^2 - 4x - 4x + 16$

$x+2 = x^2 - 16x + 16$

$-x-2 \quad - \quad x \quad -2$

$0 = x^2 - 17x + 14$

answer: $\dfrac{17+\sqrt{233}}{2}$

Score 0: The student made multiple errors.

Question 27

27 Factor the expression completely.

$$(x - 1)^2 + 5(x - 1) - 6$$

$= x^2 - 2x + 1 + 5x - 5 - 6$

$= x^2 + 3x - 10$

$= (x - 2)(x + 5)$

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

Question 27

27 Factor the expression completely.

$$(x-1)^2 + 5(x-1) - 6$$

$(x-1)(x-1) + 5x - 5 - 6$

$a^2 + 5a - 6$

$(a+6)(a-1)$

$(x-1+6) \quad (x-2)$

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

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

Question 27

27 Factor the expression completely.

$$(x - 1)^2 + 5(x - 1) - 6$$

$x^2 - 2x + 1 + 5x - 5 - 6$

$= x^2 - 2x + 5x - 11 + 1$

$= x^2 + 3x - 10$

$= (x+5)(x-2)$

$\boxed{x = -5 \quad x = 2}$

Score 1: The student made an error by solving for x.

Question 27

27 Factor the expression completely.

$$(x - 1)^2 + 5(x - 1) - 6$$

	x	-1
x	x^2	$-x$
-1	$-x$	1

$(x-1)(x-1)+5(x-1)-6$

~~x-1 (x-1)(+~~

$x^2 - 2x + 1 + 5x - 5 - 6$

$\boxed{x^2+3x-10}$

Score 1: The student found a correct quadratic expression but did not factor.

Question 27

27 Factor the expression completely.

$$(x - 1)^2 + 5(x - 1) - 6$$

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

$x^2-x-x+1$

$x^2-2x+1+5x-11$

$x^2-3x+10$

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

$x=5 \quad x=2$

$(x-1)^2+5x-5-6$

Score 0: The student made multiple errors.

Question 27

27 Factor the expression completely.

$$(x-1)^2 + 5(x-1) - 6$$

$(x-1)(x-1) + 5(x) - 5(-1) - 6$

$x^2 - 1x - 1x + 1 + 5x - 5 - 6$

$\boxed{x^2 - 2x - 10}$

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

Question 28

28 The results of a survey of the students at the local high school regarding the topic "What I Do to Relax" are displayed in the table below.

	Read	Listen to Music	Exercise	
Female	87	94	21	202
Male	68	110	18	196
	155	204	39	398

If a student from this survey is selected at random, determine the exact probability that the person claims to relax by listening to music given that the person is female.

$$P(M|F) = \frac{\frac{94}{398}}{\frac{202}{398}} = \frac{94}{\cancel{398}} \cdot \frac{\cancel{398}}{202} = \frac{94}{202} = \boxed{\frac{47}{101}}$$

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

Question 28

28 The results of a survey of the students at the local high school regarding the topic "What I Do to Relax" are displayed in the table below.

	Read	Listen to Music	Exercise	
Female	87	94	21	202
Male	68	110	18	196

If a student from this survey is selected at random, determine the exact probability that the person claims to relax by listening to music given that the person is female.

$\boxed{94/202}$

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

Question 28

28 The results of a survey of the students at the local high school regarding the topic “What I Do to Relax” are displayed in the table below.

	Read	Listen to Music	Exercise	
Female	87	94	21	202
Male	68	110	18	

If a student from this survey is selected at random, determine the exact probability that the person claims to relax by listening to music given that the person is female.

$\frac{94}{202} \boxed{= .46535}$

Score 1: The student did not express the final answer as an exact probability.

Question 28

28 The results of a survey of the students at the local high school regarding the topic "What I Do to Relax" are displayed in the table below.

	Read	Listen to Music	Exercise
Female	87	94	21
Male	68	110	18

204

If a student from this survey is selected at random, determine the exact probability that the person claims to relax by listening to music given that the person is female.

$$\frac{94}{204}$$

Score 1: The student calculated the incorrect conditional probability.

Question 28

28 The results of a survey of the students at the local high school regarding the topic "What I Do to Relax" are displayed in the table below.

	Read	Listen to Music	Exercise	
Female	87	94	21	202
Male	68	110	18	196
	155	204	39	

If a student from this survey is selected at random, determine the exact probability that the person claims to relax by listening to music given that the person is female.

204 94

46.1%

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

Question 28

28 The results of a survey of the students at the local high school regarding the topic "What I Do to Relax" are displayed in the table below.

	Read	Listen to Music	Exercise
Female	87	94	21
Male	68	110	18

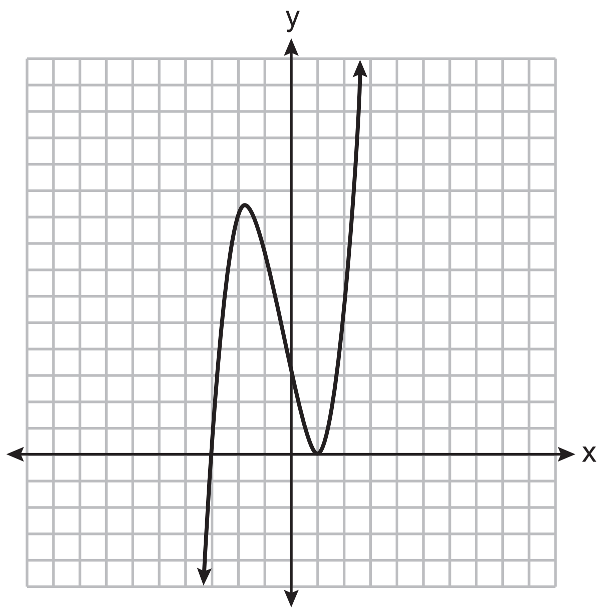
If a student from this survey is selected at random, determine the exact probability that the person claims to relax by listening to music given that the person is female.

$$\frac{94}{204} = \frac{42}{102}$$

Score 0: The student made multiple errors.

Question 29

29 The graph of $y = f(x)$ is shown below. The cubic function has a leading coefficient of 1.



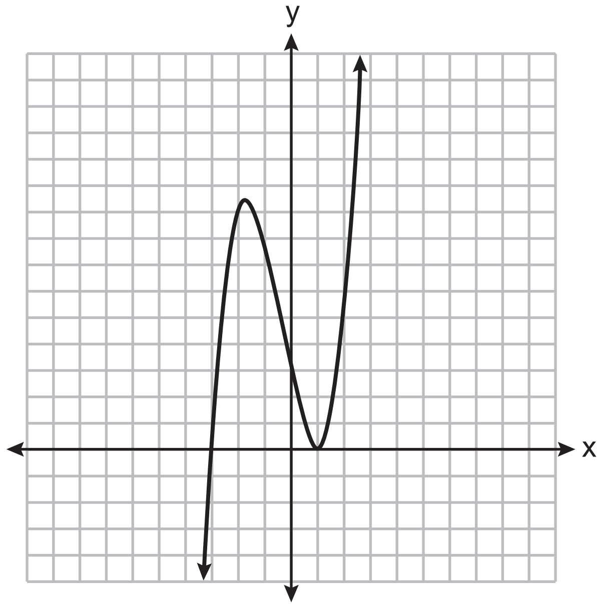
Write an equation for $f(x)$.

$f(x) = (x+3)(x-1)^2$

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

Question 29

29 The graph of $y = f(x)$ is shown below. The cubic function has a leading coefficient of 1.



Write an equation for $f(x)$.

Zeroes: $-3, 1, 1$

$(x+3)(x-1)(x-1)$

$y = 1(x+3)(x-1)(x-1)$

$y = 1(x^2 - x + 3x - 3)(x-1)$

$y = 1(x^2 + 2x - 3)(x-1)$

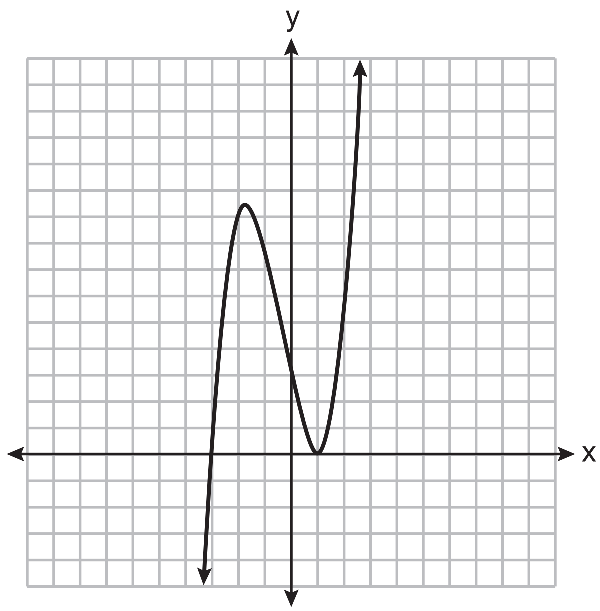
$y = 1\ (x^3 - x^2 + 2x^2 - 2x - 3x + 3)$

$y = x^3 + x^2 - 5x + 3$

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

Question 29

29 The graph of $y = f(x)$ is shown below. The cubic function has a leading coefficient of 1.



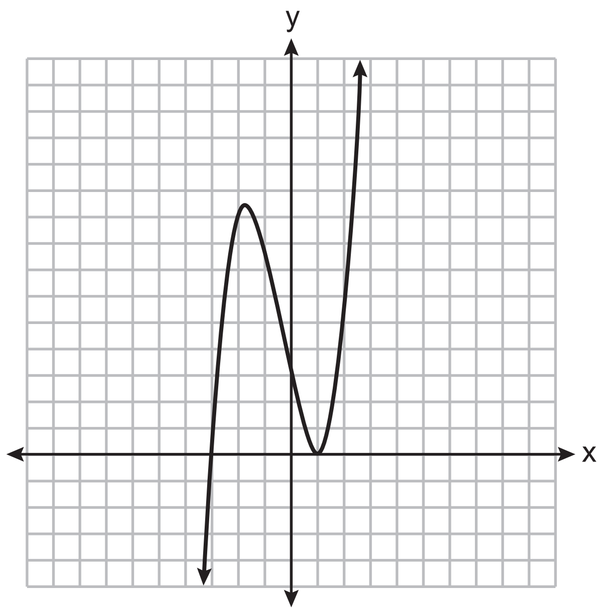
Write an equation for $f(x)$.

$y=(x-1)(x+3)$

Score 1: The student did not recognize the repeated root.

Question 29

29 The graph of $y = f(x)$ is shown below. The cubic function has a leading coefficient of 1.



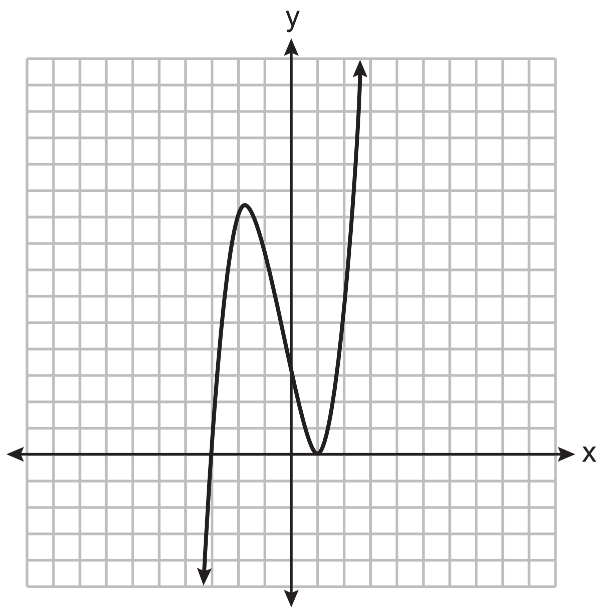
Write an equation for $f(x)$.

$f(x) = (x^3 - 1)$

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

Question 29

29 The graph of $y = f(x)$ is shown below. The cubic function has a leading coefficient of 1.



Write an equation for $f(x)$.

$f(x) = x^3(x-3)(x+1) + 6$

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

Question 30

30 Given $f(x) = \frac{2}{3}x + 6$, write the equation of $f^{-1}(x)$.

$$x = \frac{2}{3}y + 6$$

$$\frac{3}{2}(x-6) = \frac{2}{3}y \quad \cdot\frac{3}{2}$$

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

$$\boxed{f^{-1}(x) = \frac{3}{2}x - 9}$$

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

Question 30

30 Given $f(x) = \frac{2}{3}x + 6$, write the equation of $f^{-1}(x)$.

$$x = \frac{2}{3}y + 6$$
$$-6 \qquad\qquad -6$$

$$\frac{3}{2} \cdot \frac{2}{3}y = \frac{(x-6)3}{2}$$

$$y = \frac{3x-18}{2}$$

$$f^{-1}(x) = \frac{3x-18}{2}$$

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

Question 30

30 Given $f(x) = \frac{2}{3}x + 6$, write the equation of $f^{-1}(x)$.

$$y = \frac{2}{3}x + 6$$

$$x = \frac{2}{3}y + 6$$

$$-6 \qquad -6$$

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

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

$$\frac{3}{2}x - 9 = y$$

$$\boxed{f^{-1}(x) = 3x - 9}$$

Score 1: The student made a transcription error.

Question 30

30 Given $f(x) = \frac{2}{3}x + 6$, write the equation of $f^{-1}(x)$.

$y = \frac{2}{3}x + 6$

$x = \frac{2}{3}y + 6$
$\quad\quad\quad\;\; -6$

$\frac{3}{2}\left(\frac{2}{3}\right)y = (x-6)(3/2)$

$y = 3/2x - 9$

Score 1: The student did not use $f^{-1}(x)$ when writing the equation.

Question 30

30 Given $f(x) = \frac{2}{3}x + 6$, write the equation of $f^{-1}(x)$.

$f(x) = \frac{2}{3}x + 6$

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

Score 0: The student incorrectly found the inverse.

Question 30

30 Given $f(x) = \frac{2}{3}x + 6$, write the equation of $f^{-1}(x)$.

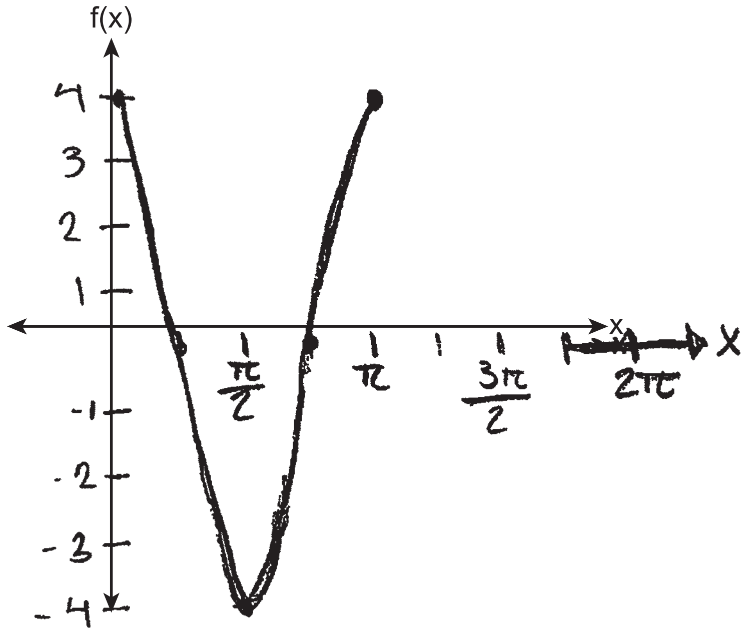
$$f^{-1}(x) = \frac{2}{3}(-1) + 6$$

$$\boxed{f^{-1}(x) = \frac{16}{3}}$$

Score 0: The student evaluated $f(-1)$.

Question 31

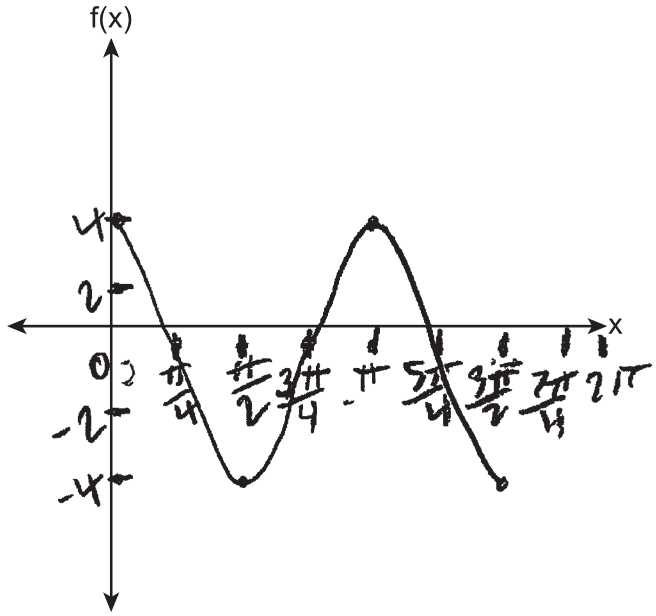
31 On the coordinate plane below, sketch *at least one cycle* of the function $f(x) = 4\cos(2x)$. Label the axes with an appropriate scale.



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

Question 31

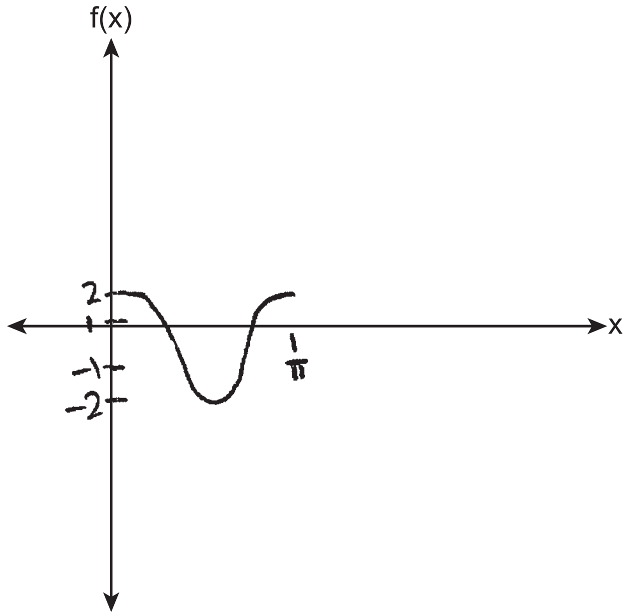
31 On the coordinate plane below, sketch *at least one cycle* of the function $f(x) = 4\cos(2x)$. Label the axes with an appropriate scale.



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

Question 31

31 On the coordinate plane below, sketch *at least one cycle* of the function $f(x) = 4\cos(2x)$. Label the axes with an appropriate scale.

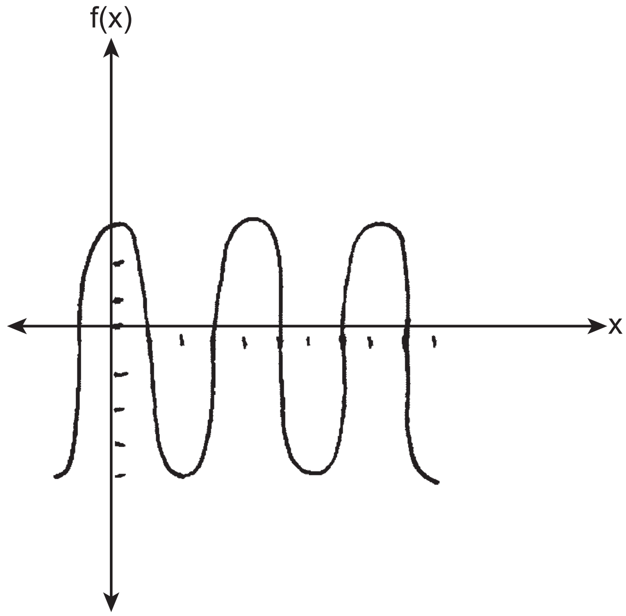


$$\frac{\cancel{2}\pi}{1} \times \frac{1}{\cancel{2}} = \pi$$

Score 1: The student graphed the amplitude incorrectly.

Question 31

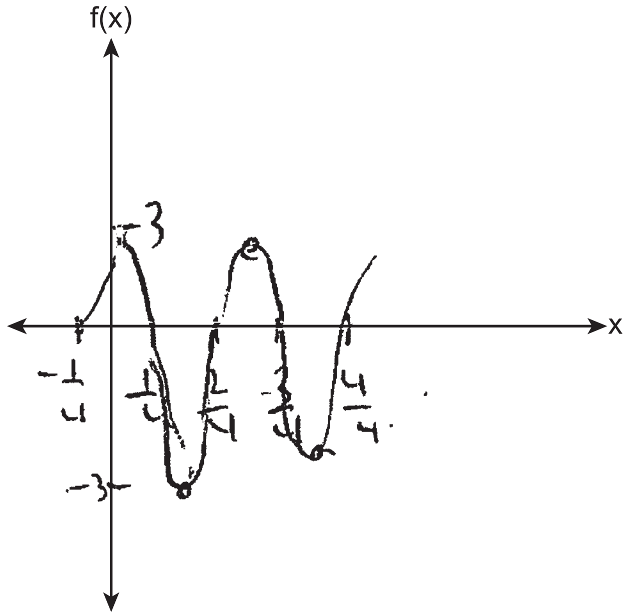
31 On the coordinate plane below, sketch *at least one cycle* of the function $f(x) = 4\cos(2x)$. Label the axes with an appropriate scale.



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

Question 31

31 On the coordinate plane below, sketch *at least one cycle* of the function $f(x) = 4\cos(2x)$. Label the axes with an appropriate scale.



Score 0: The student made multiple graphing errors.

Question 32

32 In a recent online contest with a large number of randomly selected human players, the computer player won 67% of the time. The game-design company claims that the computer player can beat human players 70% of the time. The company runs a simulation of a large number of games, with the same number of human players, assuming that the computer wins 70% of the time. The simulation is approximately normal with a mean of 0.705 and a standard deviation of 0.045.

Does the contest result provide evidence to contradict the designer's claim? Use the simulation results to justify your answer.

$(.615, .795) \rightarrow (61.5\%, 79.5\%)$

No, 67% is within the range between 61.5% and 79.6%

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

Question 32

32 In a recent online contest with a large number of randomly selected human players, the computer player won 67% of the time. The game-design company claims that the computer player can beat human players 70% of the time. The company runs a simulation of a large number of games, with the same number of human players, assuming that the computer wins 70% of the time. The simulation is approximately normal with a mean of 0.705 and a standard deviation of 0.045.

Does the contest result provide evidence to contradict the designer's claim? Use the simulation results to justify your answer.

.7 The contest does not provide

.67 evidence to challenge the claim

.705

± 0.045 .67 is within

INT .66, .75

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

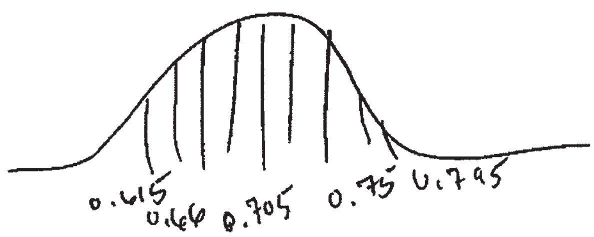
Question 32

32 In a recent online contest with a large number of randomly selected human players, the computer player won 67% of the time. The game-design company claims that the computer player can beat human players 70% of the time. The company runs a simulation of a large number of games, with the same number of human players, assuming that the computer wins 70% of the time. The simulation is approximately normal with a mean of 0.705 and a standard deviation of 0.045.

Does the contest result provide evidence to contradict the designer's claim? Use the simulation results to justify your answer.

mean : 0.705

SD : 0.045



No, the contest result doesn't provide evidence to contradict the designer's claim.

Score 1: The student wrote an incomplete justification.

Question 32

32 In a recent online contest with a large number of randomly selected human players, the computer player won 67% of the time. The game-design company claims that the computer player can beat human players 70% of the time. The company runs a simulation of a large number of games, with the same number of human players, assuming that the computer wins 70% of the time. The simulation is approximately normal with a mean of 0.705 and a standard deviation of 0.045.

Does the contest result provide evidence to contradict the designer's claim? Use the simulation results to justify your answer.

$MOE = 2\sigma \quad 2(0.045) = .09$

The results show the designer's claim being true because ~~70~~. 70% fits in the confidence interval.

(.615, .795)

(61.5, 79.5)

Score 1: The student used 70% in their justification.

Question 32

32 In a recent online contest with a large number of randomly selected human players, the computer player won 67% of the time. The game-design company claims that the computer player can beat human players 70% of the time. The company runs a simulation of a large number of games, with the same number of human players, assuming that the computer wins 70% of the time. The simulation is approximately normal with a mean of 0.705 and a standard deviation of 0.045.

Does the contest result provide evidence to contradict the designer's claim? Use the simulation results to justify your answer.

No cause 67% is close to
the designers claim of 70%.

Score 0: The student wrote an incorrect justification.

Question 33

33 Solve algebraically for x: $x(x-4)\left(\frac{2}{x} = \frac{2x+3}{x-4}\right)$. Express your answers in simplest $a + bi$ form.

$2(x-4) = x(2x+3)$

$2x - 8 = 2x^2 + 3x$

$-2x \quad +8 \qquad -2x \quad +8$

$2x^2 + x + 8 = 0$

$a=2 \quad b=1 \quad c=8$

$\frac{-1 \pm \sqrt{1-4(2)(8)}}{2(2)}$

$\frac{-1 \pm \sqrt{-63}}{4}$ $21 < 3, 7$ $\quad 3$

$\frac{-1 \pm 3i\sqrt{7}}{4}$

$\boxed{\frac{-1}{4} \pm \frac{3i\sqrt{7}}{4}}$

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

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x + 3}{x - 4}$. Express your answers in simplest $a + bi$ form.

$2x - 8 = 2x^2 + 3x$

$-2x + 8 \qquad -2x$

$2x^2 + x + 8$

$a = 2$

$b = 1$

$c = 8$

$\frac{-1 \pm \sqrt{1 - 64}}{4}$

$\sqrt{-63}$

$\frac{-1 \pm 3\sqrt{7}}{4}$

$\boxed{\begin{array}{l} x = \frac{-1}{4} + \frac{3i\sqrt{7}}{4} \\ x = \frac{-1}{4} - \frac{3i\sqrt{7}}{4} \end{array}}$

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

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x + 3}{x - 4}$. Express your answers in simplest $a + bi$ form.

$$2x - 8 = 2x^2 + 3x$$
$$-2x \quad +8$$

$$0 = 2x^2 + x + 8$$

$$(2x \quad)(x \quad)$$

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

$$x = \frac{-1 \pm \sqrt{1 - 64}}{4}$$

$$x = \frac{-1 \pm i\sqrt{63}}{4}$$

$$x = -\frac{1}{4} \pm \frac{i\sqrt{63}}{4}$$

Score 3: The student did not simplify the radical.

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x + 3}{x - 4}$. Express your answers in simplest $a + bi$ form.

$(x-4)\cancel{(x)}$ $\quad$ $\cancel{(x-4)}(x)$ $\quad$ LCD: $(x+4)(x)$

$$\frac{2}{\cancel{x}} = \frac{2x+3}{\cancel{x-4}}$$

$$2x-8 = 2x^2+3$$
$$+8 \qquad\qquad +8$$

$$2x^2-2x+11=0$$
$$a \quad b \quad c$$

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

$$\frac{2 \pm \sqrt{-84}}{4} \qquad \sqrt{21}\ \sqrt{4}$$

$$\frac{\cancel{2}^{1} \pm \cancel{2}^{1}i\sqrt{21}}{2\cancel{4}}$$

$$\boxed{\frac{1}{2} \pm \frac{i\sqrt{21}}{2}} \qquad \boxed{\frac{1}{2} - \frac{i\sqrt{21}}{2}}$$

Score 3: The student made a computational error.

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x+3}{x-4}$. Express your answers in simplest $a + bi$ form.

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

$$2x-8 = 2x^2+3x$$

$$2x^2+x+8=0$$

$$D = b^2-4ac = 1-4(2)(8) = 1-8(8) = 1-64 = -63$$

$$x_{12} = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-1 \pm \sqrt{-63}}{4} = \frac{-1 \pm i\sqrt{63}}{4}$$

$$\boxed{\begin{array}{l} x_1 = \dfrac{-1 + i\sqrt{63}}{4} \\ x_2 = \dfrac{-1 - i\sqrt{63}}{4} \end{array}}$$

Score 2: The student did not express in $a + bi$ form and did not simplify the radical.

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x+3}{x-4}$. Express your answers in simplest $a + bi$ form.

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

$$x(2x+3) = 2(x-4)$$

$$2x^2+3x = 2x-4$$

$$-2x+4 \quad -2x+4$$

$$2x^2+x+4 = 0$$

$$a=2 \quad b=1 \quad c=4$$

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

$$x = \frac{-2 \pm \sqrt{-28}}{4}$$

$$x = \frac{-2}{4} \pm \cancel{\frac{2i\sqrt{7}}{2}}$$

$$\boxed{x = \frac{-1}{2} + i\sqrt{7} \quad x = \frac{-1}{2} - i\sqrt{7}}$$

Score 1: The student made three errors.

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x+3}{x-4}$. Express your answers in simplest $a + bi$ form.

$$2(x-4) = x(2x+3)$$

$$(2x-8) = 2x^2+3x$$

$$-2x \quad +8$$

$$0 = 2x^2+1x+8$$

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

$$x = \frac{-1 \pm \sqrt{1^2-4(2)(8)}}{2(2)}$$

$$x = \frac{-1 \pm \sqrt{-63}}{4}$$

$$x = -1 \pm \frac{63i}{4}$$

Score 1: The student showed work to find a correct quadratic equation in standard form.

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x+3}{x-4}$. Express your answers in simplest $a + bi$ form.

$b^2 - 4ac$

$1 - 64$

-63

$2x - 8 = 2x^2 + 3x$

$2x^2 - x + 8 = 0$

$\frac{-b \pm \sqrt{-63}}{2a}$

$\frac{1 \pm \sqrt{-63}}{2(2)}$

$\frac{1 \pm \sqrt{-63}}{4}$

Score 1: The student made a computational error and did not express the answer in simplest $a + bi$ form.

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x+3}{x-4}$. Express your answers in simplest $a + bi$ form.

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

$$x(2x+3) = 2(x-4)$$

$$2x^2+3x = 2x-8$$

$$-2x+8 \quad -2x \quad +8$$

$$2x^2-x+8=0$$

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

Question 33

33 Solve algebraically for x: $\frac{2}{x} = \frac{2x+3}{x-4}$. Express your answers in simplest $a + bi$ form.

$$\frac{(x-4)}{(x-4)}\frac{2}{(x)} = \frac{(x)2x+3}{(x)(x-4)} \rightarrow \frac{2(x-4)+2x^2+3x}{x(x-4)}$$

$$\downarrow$$

$$x^2+5x-16$$

$$\frac{\cancel{2x}-8+2x^2+\cancel{3x}}{x^2-4x} \rightarrow \frac{2x^2+5x-8}{x^2-4x}$$

$$\boxed{\frac{2x^2+5x-8}{(x^2-4x)}}$$

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

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.

95% = 2 standard deviations

$750 \pm 2(20) = 710, 790$

95% of students score within the interval of $710 \leq p \leq 790$

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

normalcdf$(10^{-99}, 760, 750, 20) = .6914624678$

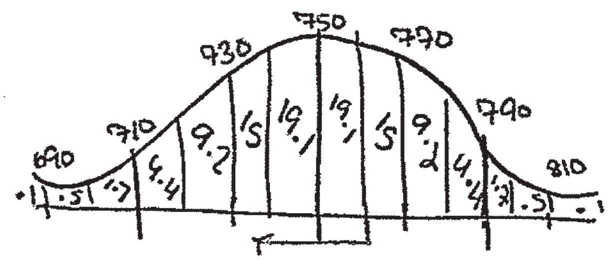
69% of accepted students scored a 760 or less

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

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.



710 - 790

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

19.1 + 19.1 + 15 + 9.2 + 4.4 + 1.7 + .6 =

69%

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

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.

95% is 2 deviations away from the mean.

$20(2) = 40$

40 is 2 standard deviations away

$750 + 40$ $\quad$ $750 - 40$

790 $\quad$ 710

710-750

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

normal cdf$(10^{-99}, 760, 750, 20)$

.691

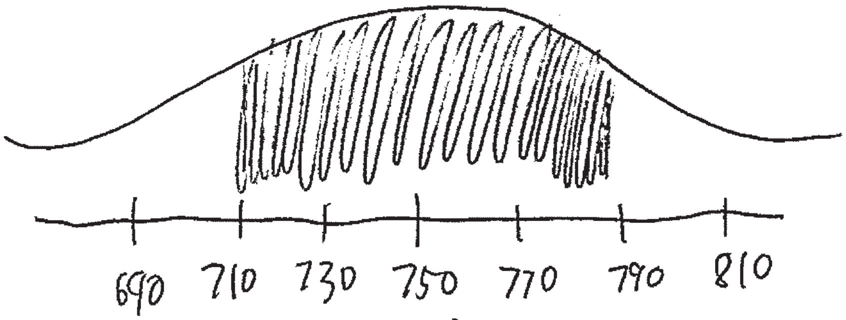
69%

Score 3: The student made a transcription error.

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.



$710 \le X \le 790$

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

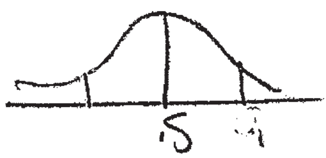
69%

Score 3: The student did not show work to find the percent.

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.



$$\left[710, 790\right]$$

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

$$\frac{760 - 750}{20} = .5$$

$$(-999, .5, 0, 1)$$

$$69.14$$

$$\boxed{70\%}$$

Score 2: The student did not show enough work to determine the interval and incorrectly rounded the percent.

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.

$750+2(20)$ and $750-2(20)$

740

A score between 710 and 790

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

710 & 760

$$\begin{array}{r} 760 \\ -710 \\ \hline 50 \end{array} \qquad \begin{array}{r} 790 \\ -710 \\ \hline 80 \end{array}$$

63%

$\frac{50}{80} = .625$

Score 2: The student correctly determined the interval.

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.

710 - 790

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

Score 1: The student did not show work to determine the interval.

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

normal cdf (0, 760, 750, 20)

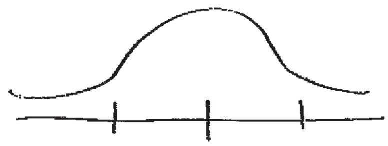
$\hookrightarrow \approx .7 = 70\%$

Score 1: The student incorrectly rounded the percent.

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.



20

$(-730, 770)$

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

$760 - 20 = 740\%$

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

Question 34

34 A highly selective college reports that the mean score earned by accepted students on the Mathematics Level 2 subject test is 750 with a standard deviation of 20 and that the scores are approximately normally distributed.

Given this information, determine the interval representing the middle 95% of student scores.

$(0\ ,\ 712.5)$

To the *nearest whole percent*, determine the percentage of accepted students who scored a 760 or less.

69.1%

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

Question 35

35 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

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

$(x-2)(x-2)$

$3x^3-4x^2+7x-6x^2+8x-14$

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

$(3x^3-10x^2+15x-14)-(x^3-4x^2+4x-2x^2+8x-8)$

$(\cancel{3x^3}\cancel{-10x^2}\cancel{+15x}-14) - (\cancel{x^3}\cancel{-6x^2}\cancel{+12x}-8)$

$\boxed{2x^3-4x^2+3x-6}$

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

Question 35

35 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

$$(3x^2 - 4x + 7)(x-2) - (x-2)^3$$
$$= (x-2)[(3x^2-4x+7) - (x-2)^2]$$
$$= (x-2)[3x^2-4x+7-(x^2+4-4x)]$$
$$= (x-2)(2x^2+3)$$
$$= 2x^3+3x-4x^2-6$$
$$= 2x^3-4x^2+3x-6$$

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

Question 35

35 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

$C(x) \cdot d(x) - [d(x)]^3$

$3x^2 - 4x + 7 \cdot x - 2 - [x-2]^3$

$(3x^3 - 10x^2 + 15x - 14) - x^3 - 6x^2 + 12x - 8$

$\boxed{2x^3 - 16x^2 + 27x - 22}$

	$3x^2$	$-4x$	7
x	$3x^3$	$-4x^2$	$7x$
-2	$-6x^2$	$8x$	-14

$3x^3 - 4x^2 + 7x - 6x^2 + 8$

$3x^3 - 10x^2 + 15x - 14$

$(x-2)^3$

$(x-2)(x-2)(x-2)$

$x^2 - 2x - 2x + 4$

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

$x^3 - 2x^2 - 4x^2 + 8x + 4x$

$x^3 - 6x^2 + 12x - 8$

Score 3: The student made a computational error distributing the negative.

Question 35

35 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

$(3x^2-4x+7)(x-2) - [x-2]^3$

$3x^3 - 4x^2 + 7x - 6x^2 + 8x - 14$

$[x-2][x-2][x-2]$

$x^2 - 2x - 2x + 4$

$[x^2-4x+4][x-2)$

$x^3 - 4x^2 - 8 - 2x^2 + 8x - 8$

$x^3 - 6x^2 + 8x - 16$

$3x^3 - 10x^2 + 15x - 14 \quad - x^3 - 6x^2 + 8x - 16$

$2x^3 - 16x^2 + 23x - 30$

Score 2: The student made two computational errors.

Question 35

35 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

$(x-2)(x-2)(x-2)$

$x^2+x^2-2x+2x$

$-8+4$

$(3x^2-4x+7)\cdot(x-2)$

$3x^3-4x^2-14-6x^2+8x+7x$

$3x^3-10x^2+15x-14$

Score 1: The student correctly determined $c(x) \bullet d(x)$.

Question 35

35 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

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

$\cancel{x^2 - 2x + 4}$

$3x^3 - 6x^2 - 4x^2 + 8x + 7x - 14 - (x^3 + 4x^2 + 8x - 8)$

$2x^3 - 14x^2 + 7x + 6$

Score 1: The student incorrectly determined $[d(x)]^3$ and then made a computational error.

Question 35

35 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

$(3x^2 - 4x + 7)(x - 2) - [x - 2]^3$

$3x^2 - 6x^2 - 4x^2 \boxed{+8x} \boxed{+7x} - 14$

$-7x^2 + 15x - 14 - [x - 2]^3$

$\downarrow$

$x + 2^3 = 18$

$-7x^2 + 15x \boxed{-14} \boxed{+18}$

$\boxed{-7x^2 + 15x + 4}$ - Answer

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

Question 35

35 For $c(x) = 3x^2 - 4x + 7$ and $d(x) = x - 2$, determine $c(x) \bullet d(x) - [d(x)]^3$ as a polynomial in standard form.

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

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

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

$$3x^2 - 4x + 7 - x^3 - 4x^2 + 4x$$

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

Question 36

36 Christopher works for a defense contractor and earned $85,000 his first year. For each additional year he will receive a 2.5% raise.

Write a geometric series formula, C_n, for Christopher's total earnings over *n* years.

$$C_n = \frac{a_1 - a_1 r^n}{1 - r}$$

$$C_n = \frac{85{,}000 - 85{,}000(1.025)^n}{1-(1.025)}$$

Use this formula to find Christopher's total earnings, to the *nearest hundred dollars*, over his first 10 years of employment.

$$C_{10} = \frac{85{,}000 - 85{,}000(1.025)^{10}}{1-(1.025)} \approx \boxed{\$952{,}300}$$

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

Question 36

36 Christopher works for a defense contractor and earned $85,000 his first year. For each additional year he will receive a 2.5% raise.

Write a geometric series formula, C_n, for Christopher's total earnings over n years.

$$C_n = \frac{a_1(1-r^n)}{1-r} \rightarrow C_n = \frac{85000(1-1.025^n)}{1-1.025}$$

Use this formula to find Christopher's total earnings, to the *nearest hundred dollars*, over his first 10 years of employment.

$$C_{10} = \frac{85000(1-1.025^{10})}{1-1.025}$$

$$C_{10} = 952{,}300$$

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

Question 36

36 Christopher works for a defense contractor and earned \$85,000 his first year. For each additional year he will receive a 2.5% raise.

Write a geometric series formula, C_n, for Christopher's total earnings over n years.

$$S_n = \frac{a_1 - a_1 r^n}{1-r}$$

$$S_n = \frac{85{,}000 - 85{,}000(1.025)^n}{1 - 1.025}$$

Use this formula to find Christopher's total earnings, to the *nearest hundred dollars*, over his first 10 years of employment.

$$S_{10} = \frac{85{,}000 - 85{,}000(1.025)^{10}}{1 - 1.025}$$

$$S_{10} = 952{,}287.45$$

$$\$952{,}300$$

Score 3: The student made a notation error.

Question 36

36 Christopher works for a defense contractor and earned \$85,000 his first year. For each additional year he will receive a 2.5% raise.

Write a geometric series formula, C_n, for Christopher's total earnings over n years.

$$C_n = \frac{85000 - 85000(0.025)^n}{1 - 0.025}$$

Use this formula to find Christopher's total earnings, to the *nearest hundred dollars*, over his first 10 years of employment.

$$C_{10} = \frac{85000 - 85000(0.025)^{10}}{1 - 0.025}$$

$$C_{10} = \frac{85000}{0.975}$$

$$\boxed{C_{10} = 87200}$$

Score 3: The student used the incorrect "*r*" value.

Question 36

36 Christopher works for a defense contractor and earned \$85,000 his first year. For each additional year he will receive a 2.5% raise.

Write a geometric series formula, C_n, for Christopher's total earnings over n years.

0,2,5

$$\boxed{S_n = \frac{(85{,}000 - 85{,}000(1.025^n))}{(1 - 1.025)}}$$

Use this formula to find Christopher's total earnings, to the *nearest hundred dollars*, over his first 10 years of employment.

$$S_{10} = \frac{(85{,}000 - 85{,}000(1.025^{10}))}{(1 - 1.025)}$$

$$S_{10} = \frac{-23807.18626}{-0.025}$$

$$S_{10} = 952287.4504$$

$$\boxed{S_{10} = 952{,}300.45}$$

Score 2: The student made a notation error and a rounding error.

Question 36

36 Christopher works for a defense contractor and earned $85,000 his first year. For each additional year he will receive a 2.5% raise.

Write a geometric series formula, C_n, for Christopher's total earnings over n years.

$$S_n = \frac{85000 - 85000(.025)^n}{1 - .025}$$

Use this formula to find Christopher's total earnings, to the *nearest hundred dollars*, over his first 10 years of employment.

$$S_n = \frac{85000 - 85000(.025)^{10}}{1 - .025}$$

$$= \$87179.48718$$

$$\boxed{\$87200}$$

Score 2: The student made a notation error and used the incorrect "r" value.

Question 36

36 Christopher works for a defense contractor and earned \$85,000 his first year. For each additional year he will receive a 2.5% raise.

Write a geometric series formula, C_n, for Christopher's total earnings over n years.

$$S_n = \frac{85000 - 85000(1.025)^n}{1 - 1.025}$$

Use this formula to find Christopher's total earnings, to the *nearest hundred dollars*, over his first 10 years of employment.

$$= \frac{85000 - 85000(1.025)^9}{1 - 1.025}$$

$$= 846134.0978$$

$$\$\ 846134.10$$

Score 1: The student made a notational error writing the series formula, incorrectly substituted for "*n*," and made a rounding error.

Question 36

36 Christopher works for a defense contractor and earned \$85,000 his first year. For each additional year he will receive a 2.5% raise.

Write a geometric series formula, C_n, for Christopher's total earnings over n years.

85,000 + 2.5n

Use this formula to find Christopher's total earnings, to the *nearest hundred dollars*, over his first 10 years of employment.

85,000 + 2.5(10)

= 85,025.

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

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$$A(t) = A_0e^{kt}$$
$$\frac{125}{500} = \frac{\cancel{500}e^{k(60.34)}}{\cancel{500}}$$
$$.25 = e^{60.34k}$$
$$\ln .25 = 60.34k$$
$$\frac{-1.386294361}{60.34} = \frac{\cancel{60.34}k}{\cancel{60.34}}$$
$$k = -.022974716$$
$$\boxed{k = -.023}$$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

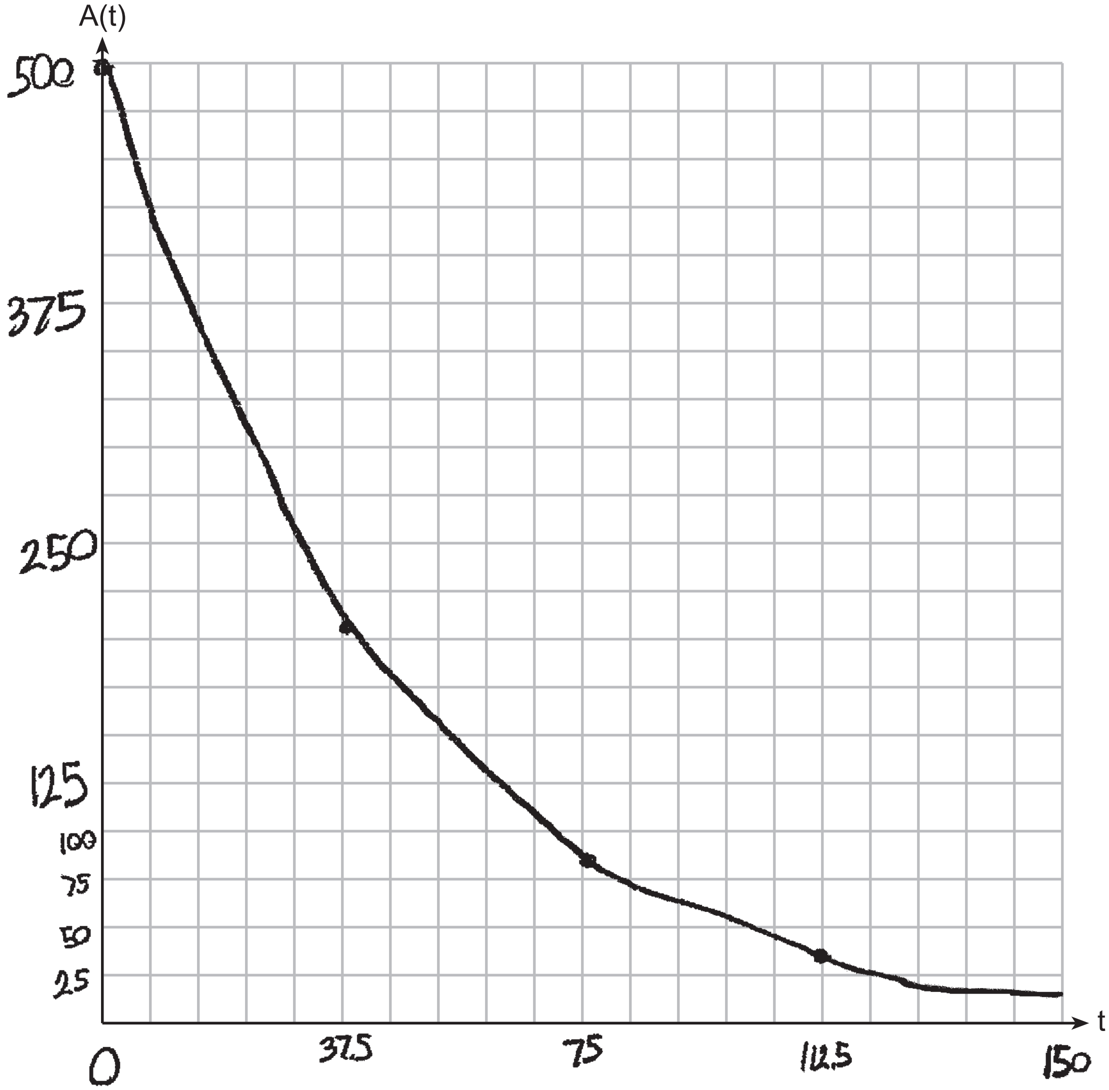
$$A(t) = 500e^{-.023t}$$

Question 37 is continued on the next page.

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

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

$$\frac{\Delta y}{\Delta x} = \frac{125.789 - 500}{60 - 0}$$

$$-6.2 \text{ g/yr}$$

Explain what this value means in the given context.

The mass of the element decreases about 6.2 grams every year

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$$\frac{125}{500} = \frac{500e^{k(60.34)}}{500}$$

$$0.25 = e^{k(60.34)}$$

$$\ln .25 = k60.34$$

$$-1.386294361 = k60.34$$

$$\boxed{k = -0.023}$$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

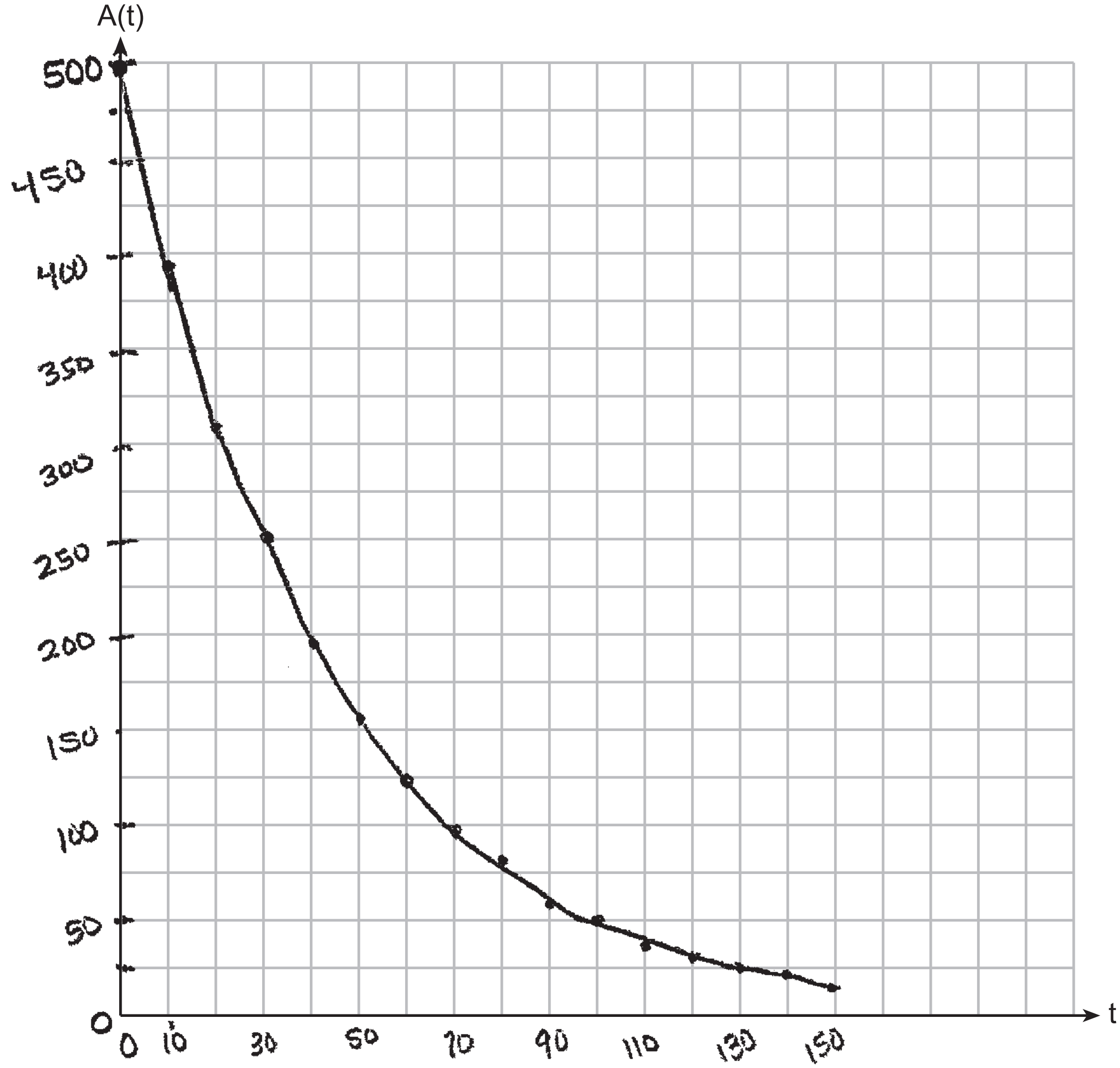
$$A(t) = 500e^{(-0.023)t}$$

Question 37 is continued on the next page.

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

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

500 125.79

(0,500)
(60,125.79) $\frac{\Delta y}{\Delta x} = \frac{500-125.79}{0-60} = \frac{374.21}{-60} = \boxed{-6.2}$

Explain what this value means in the given context.

-6.2 represents that the mass of Cesium-137 decays at an average rate of 6.2 grams per year.

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$$A(t) = A_0e^{kt}$$

$$\frac{125}{500} = \frac{500}{500}e^{k(60.34)}$$

$$.25 = e^{k(60.34}$$

$$\frac{\ln(.25)}{60.34} = \frac{(k * 60.34)}{60.34}\ln e \qquad k \approx -.023$$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

$$A(t) = 500e^{(-.023)(t)}$$

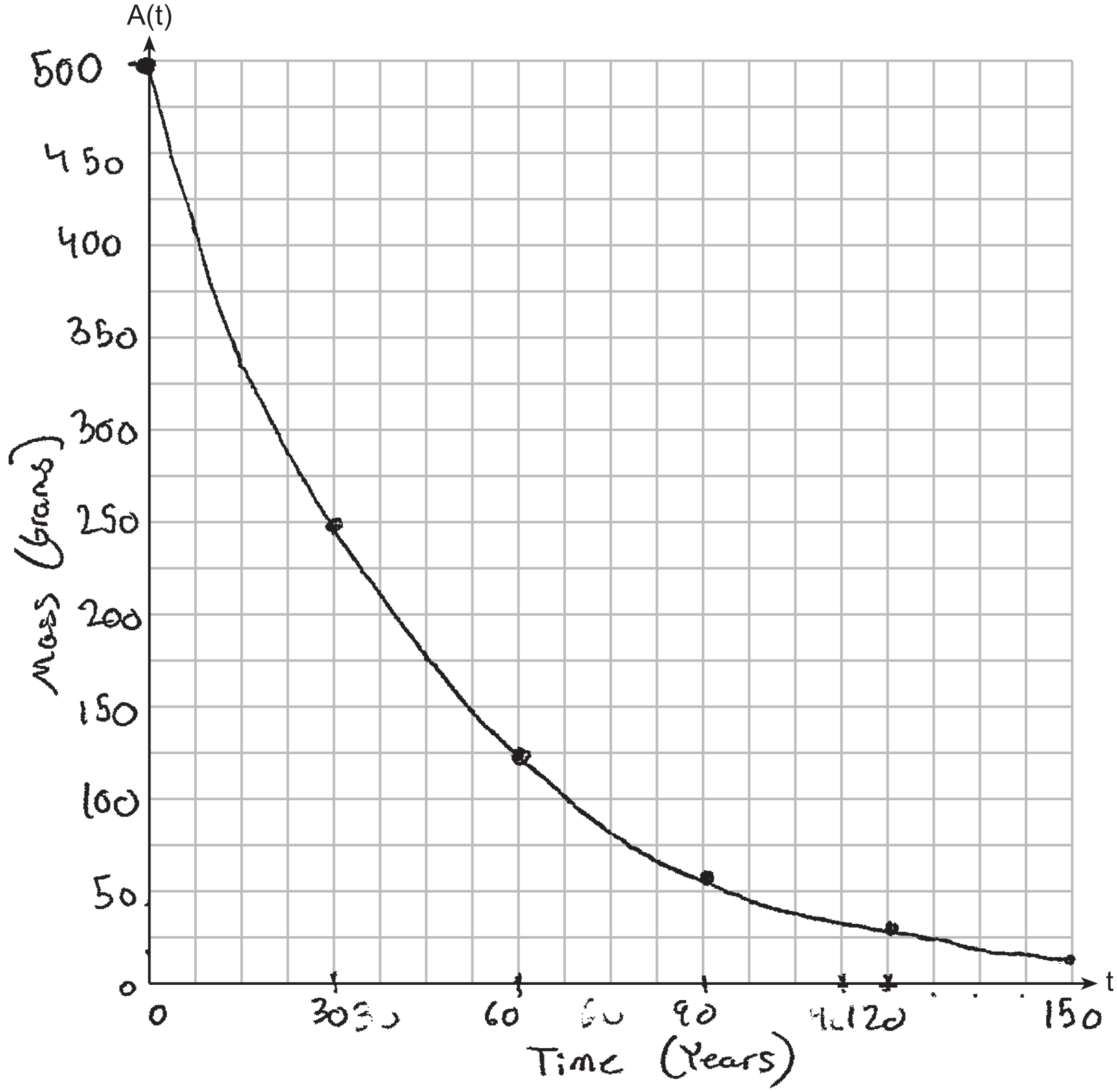
Question 37 is continued on the next page.

Score 5: The student made a rounding error calculating the average rate of change.

Question 37

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

$$\frac{\Delta Y}{\Delta X} \quad \frac{500-125}{0-60} = -6.3$$

Explain what this value means in the given context.

Cesium-137 decays an average 6.3 grams per year between years zero and sixty.

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$125 = 500e^{k(60.34)}$

$\frac{1}{4} = e^{k(60.34)}$

$\frac{\log_e \frac{1}{4}}{60.34} = \frac{k(60.34)}{60.34}$

$k = -.023$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

$A(t) = 500e^{-.023t}$

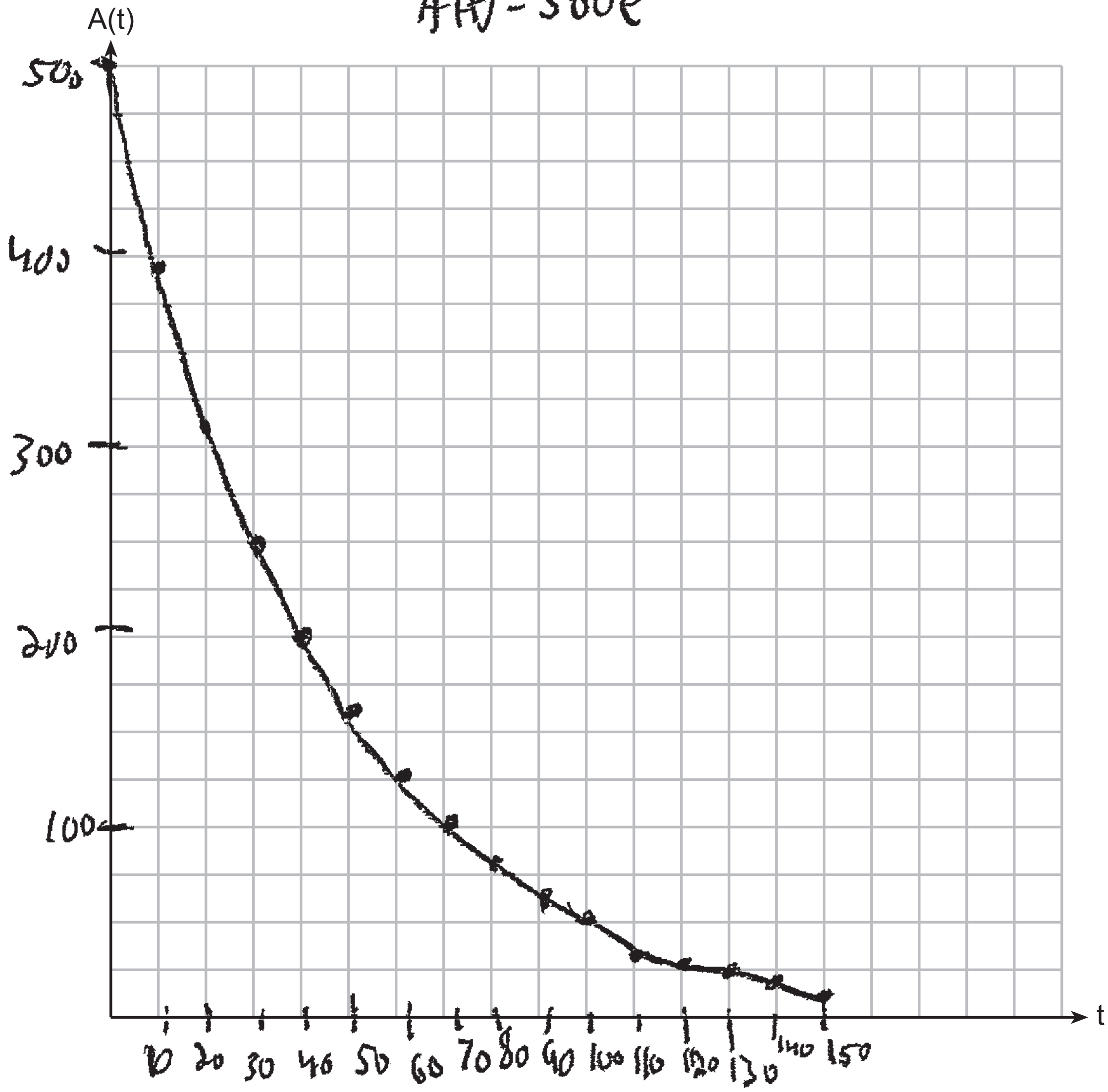
Question 37 is continued on the next page.

Score 5: The student incorrectly calculated the average rate of change.

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.

$A(t) = 500e^{-.023t}$



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

$A(60) = 500e^{-.023(60)}$

$A(60) = 125.78927653$

$\dfrac{125.78927653}{60} = 2.09648794216$

2.1

Explain what this value means in the given context.

between years 0 and 60, the average change per year is 2.1 grams.

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$$\frac{125}{500} = e^{k(60.34)}$$

$$\ln\left(\frac{125}{500}\right) = \ln e^{k(60.34)}$$

$$\ln\left(\frac{125}{500}\right) = 60.34k \cdot \cancel{\ln e}$$

$$\frac{\ln\left(\frac{125}{500}\right)}{60.34} = \frac{60.34k}{60.34}$$

$$\frac{125}{500} = \frac{500e^{k(60.34)}}{500}$$

$$K = -0.022974715962$$

$$\boxed{K = -0.023}$$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

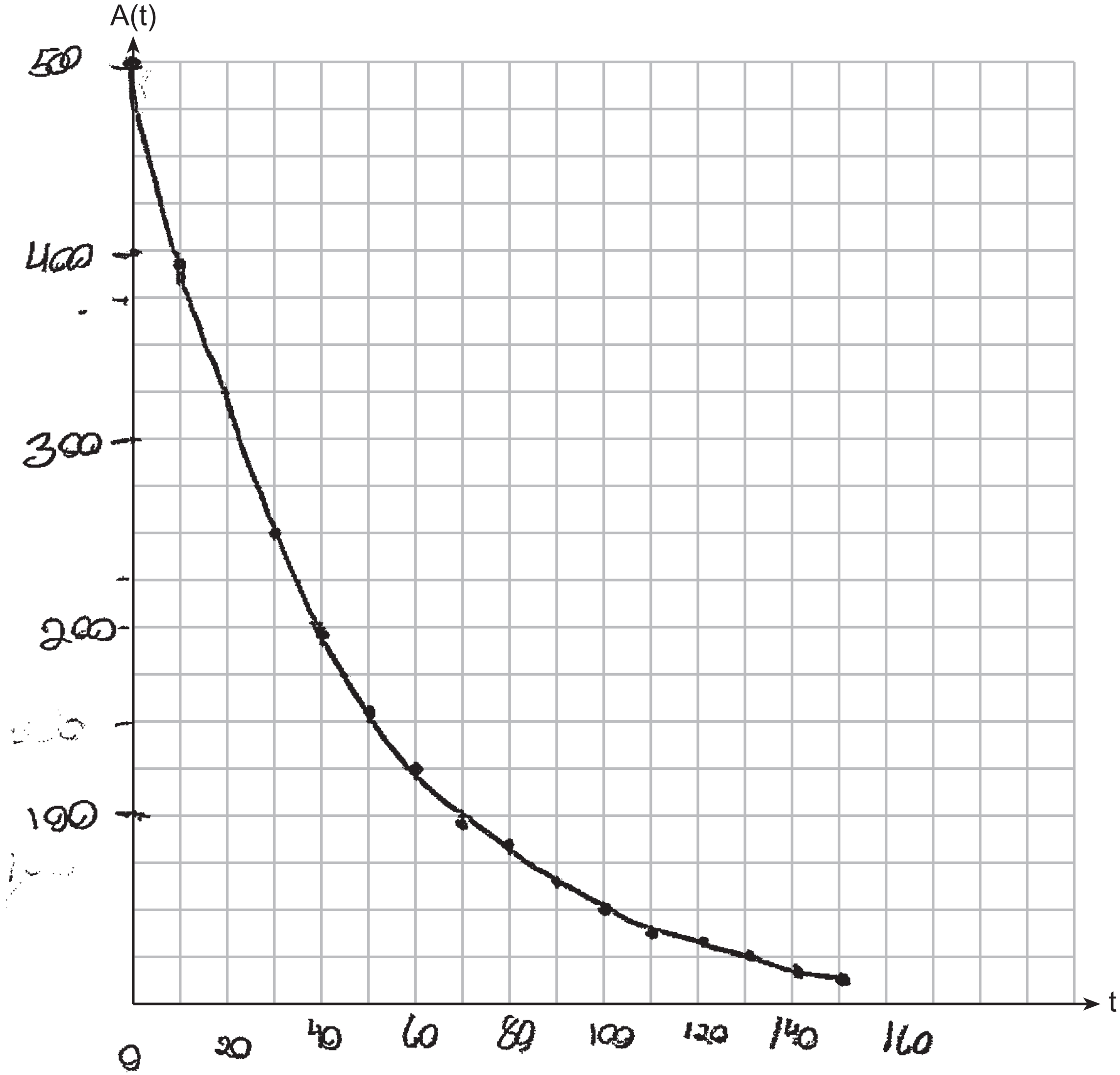
$$\boxed{A(t) = 500e^{-0.023t}}$$

Question 37 is continued on the next page.

Score 4: The student incorrectly calculated the average rate of change, and the explanation was incomplete.

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

$$\frac{125-500}{60-0} = -6.25$$

Explain what this value means in the given context.

The value is the rate by which the line decreases

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$A_0 = 500.$
$t = 60.34$
$A = \cancel{50}125.$

$A_0 = Ae^{kt}.$
$125 = 500 \times e^{60.34k}$
$0.125 = e^{60.34k}.$
$e^k \approx 0.977.$

$e^k = 0.977$
$\ln 0.977 = k$
$k = -0.023$
$\cancel{2.718^k = 0.977.}$
$\cancel{\log_{2.718} 0.977 = k}$
$\cancel{k = -0.023.}$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

$A(t) = 500e^{-0.023t}.$

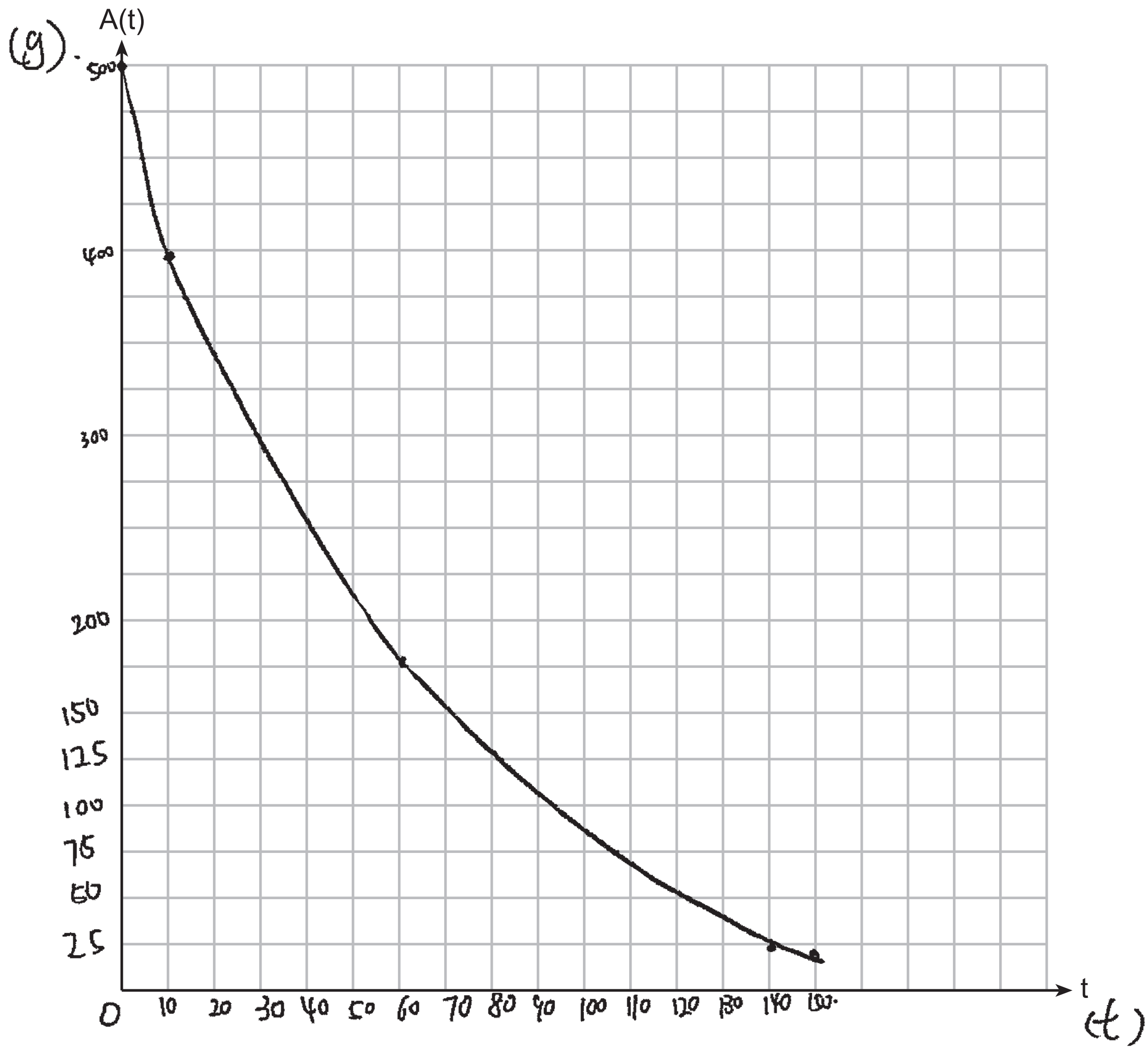
$A(t) = \frac{500}{e^{0.023t}}.$

Question 37 is continued on the next page.

Score 3: The student received credit for finding "k" and writing a correct function.

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

$A(0) = 500 \times e^{-0.023 \times 0}$
$= 500 \times 1$
$= 500$

$A(60) = 500 \times e^{-1.38}$
$= 500 \times 0.25$
≈ 125.79

Explain what this value means in the given context.

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$$\frac{125}{500} = \frac{500e^{k(60.34)}}{500}$$

$$\ln .25 = \cancel{\ln e}\, k(60.34)$$

$$\frac{-1.386}{60.34} = \frac{k(60.34)}{60.34}$$

$$-0.0229 = k$$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

$$A(t) = 500e^{-.0229t}$$

t = time in years

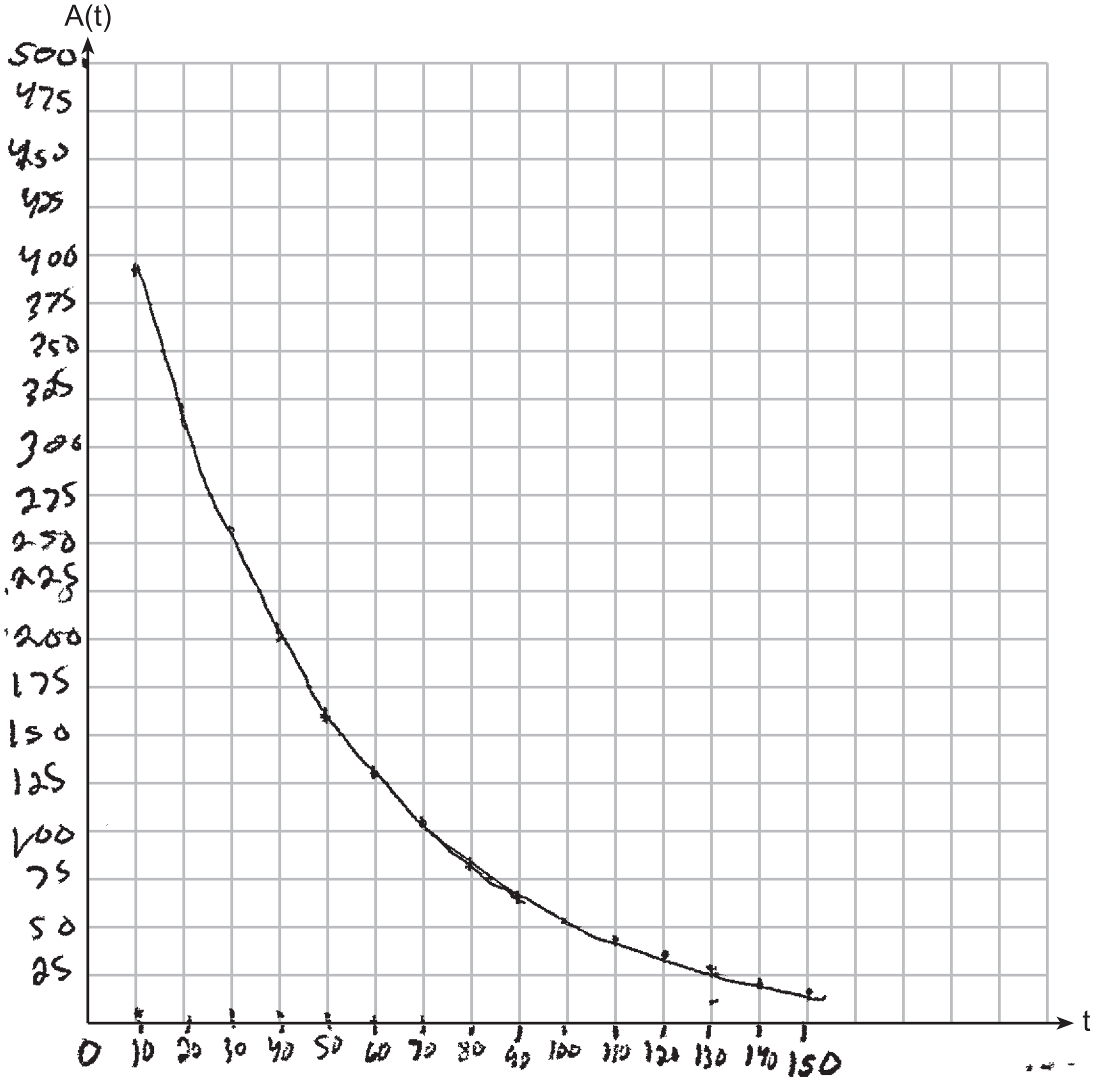
Question 37 is continued on the next page.

Score 3: The student made a rounding error, wrote a correct equation based on their "k" value, and found the correct average rate of change.

Question 37

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

500
126.55

-6.2

Explain what this value means in the given context.

how ~~most~~ many grams it decreases

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$A(t) = Ae^{kt}$

$\frac{125}{500} = \frac{500e^{k(60.34)}}{500}$

$0.25 = e^{k(60.34)}$

$\ln 0.25 = k(60.34)\cancel{\ln e}$

$\frac{\ln 0.25}{60.34} = \frac{k(60.34)}{60.34}$

$\boxed{k = -1.386}$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

$A(t) = A_0 e^{kt}$

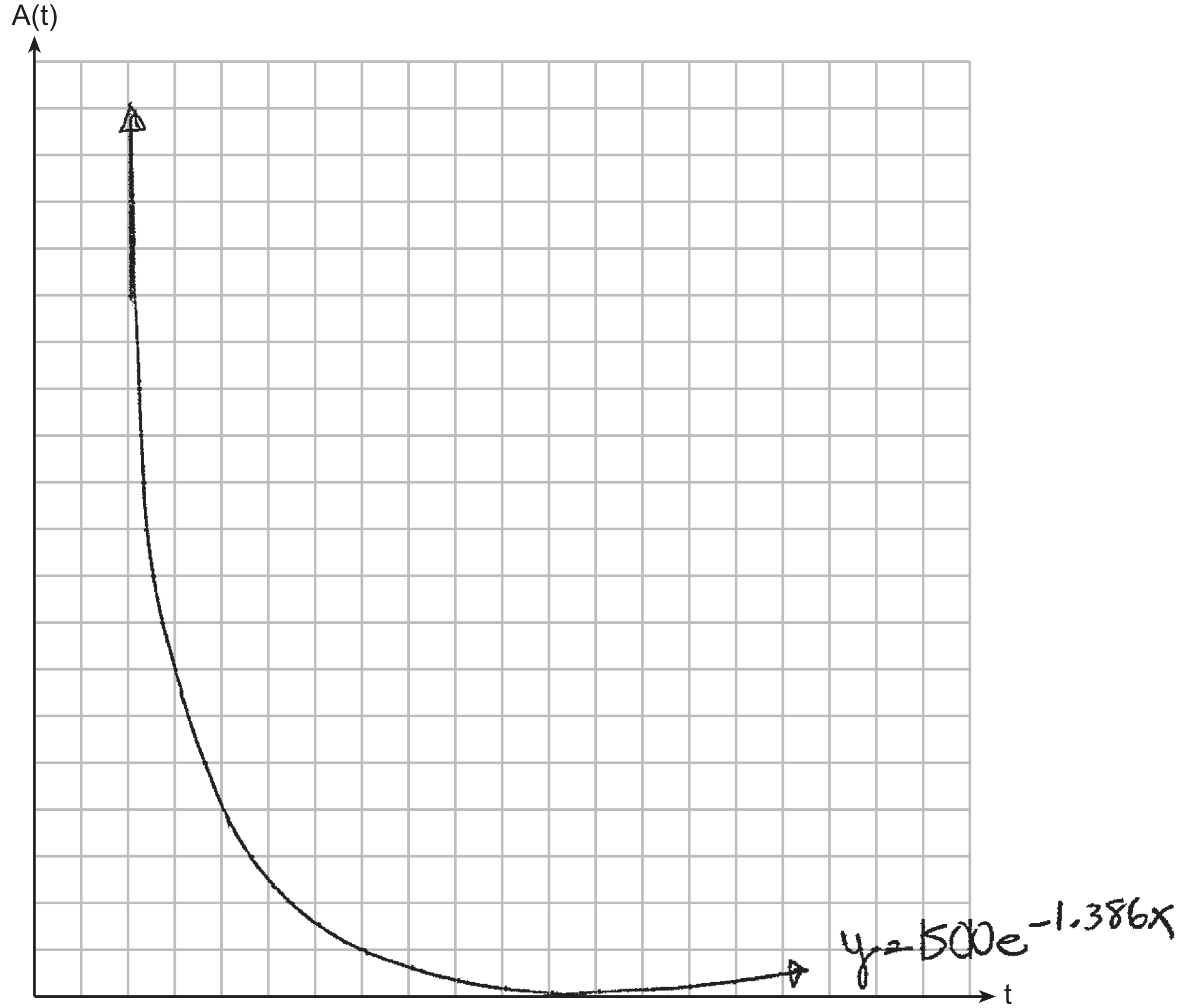
$\boxed{A(t) = 500e^{-1.386t}}$

Question 37 is continued on the next page.

Score 2: The student made a calculation error finding "*k*" but wrote a correct equation based on their "*k*" value.

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

Explain what this value means in the given context.

The sample loses an average

of __ grams.

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$$\frac{125}{500} = \frac{500e^{60.34K}}{500}$$

$$.25 = e^{60.34K}$$

$$\frac{\ln .25}{60.34} = \frac{60.34K}{60.34}$$

$$\boxed{K = -0.0230}$$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

$$\frac{A(t)}{A_0} = \frac{A_0 e^{kt}}{A_0}$$

$$\frac{A(t)}{A_0} = e^{kt}$$

$$\frac{\ln\left(\frac{At}{A_0}\right)}{k} = t$$

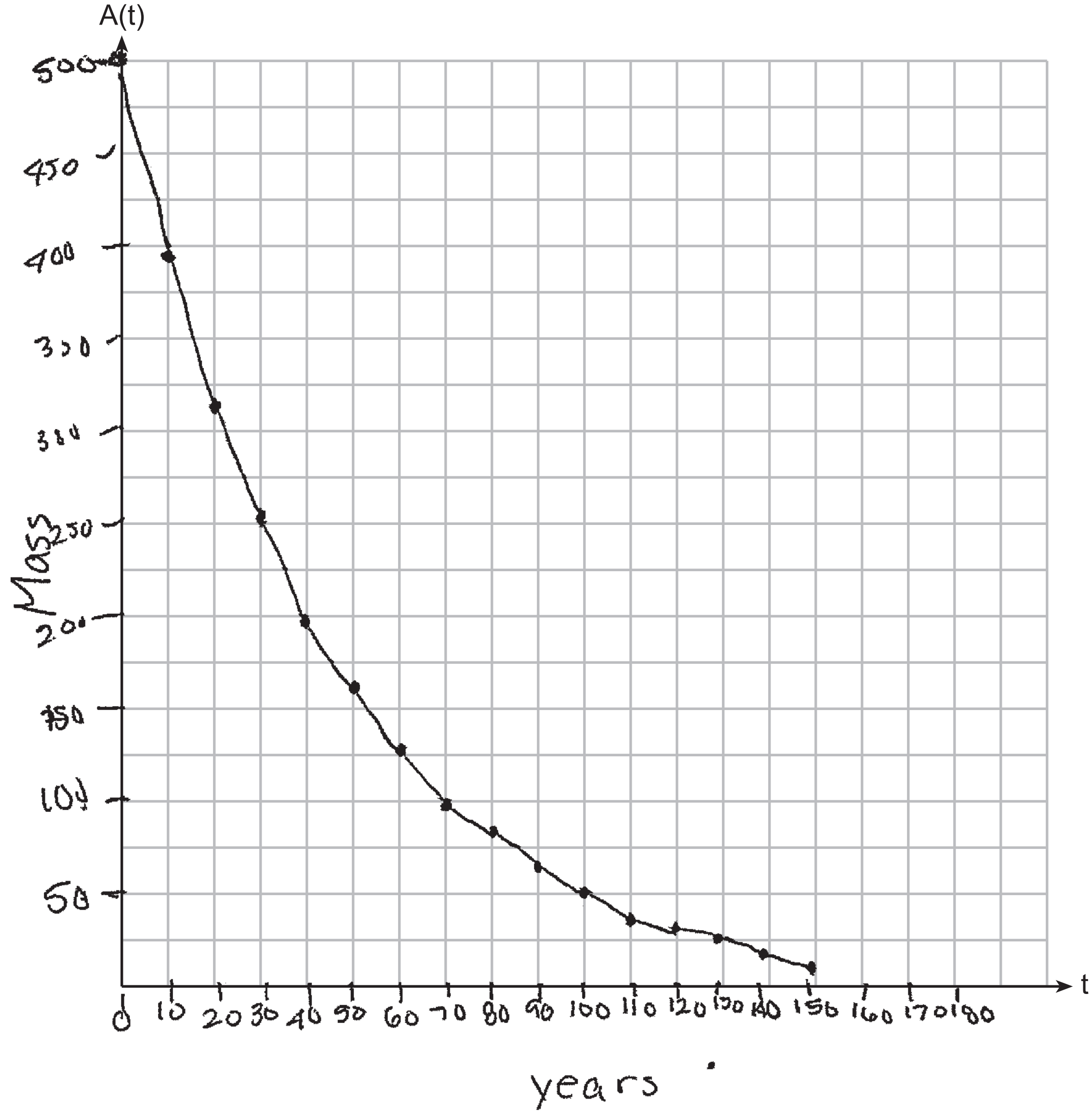
$$\boxed{t = \frac{\ln\left(\frac{A(t)}{A_0}\right)}{k}}$$

Question 37 is continued on the next page.

Score 2: The student made a rounding error solving for "k" and drew a correct graph.

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

Explain what this value means in the given context.

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$$\frac{125}{500} = \frac{500e^{k(60.34)}}{500}$$

$$0.25 = e^{k60.34}$$

$$\ln^{0.25} = k(60.34$$

$$-1.38629 = k(60.34)$$

$$k = -0.022975$$

$$\boxed{k=-0.022}$$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

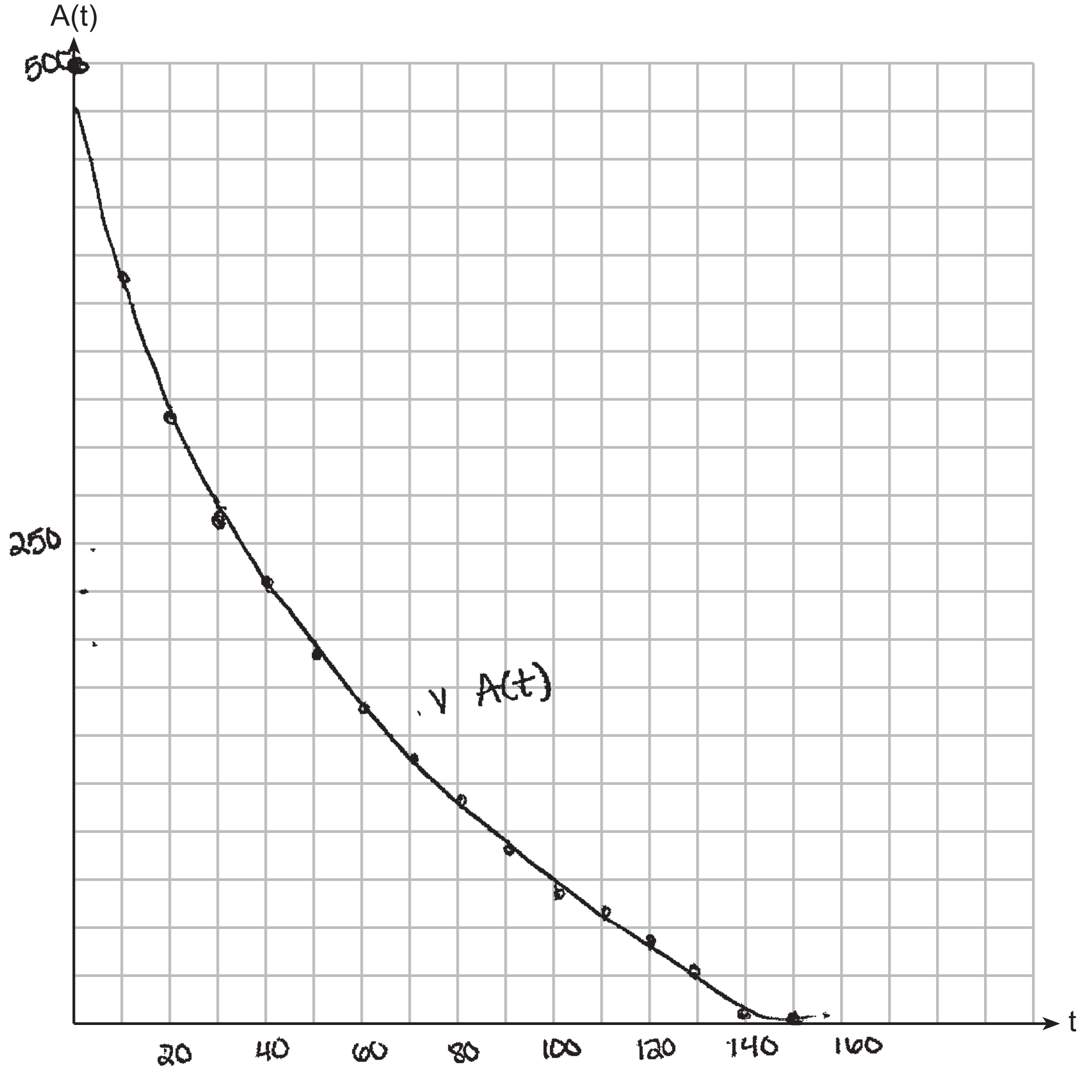
$$A(t) = A_0e^{-0.022t}$$

Question 37 is continued on the next page.

Score 1: The student earned one point for showing correct work to find "k" but made a rounding error stating the value.

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

$$\left| \frac{133.568-500}{60-0} \right| = \left| -6.1072 \right|$$

Explain what this value means in the given context.

it's decreasing

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$K = -.006$

$A(t) = A_0 e^{Kt}$

$\frac{125}{500} = \frac{500e^{K \cdot 125}}{500}$

$\frac{1}{4} = e^{K \cdot 125}$

$\cancel{\log \frac{1}{4} = \log 125K}$

$\log \frac{1}{4} = 125K \cancel{\log e}$

$\frac{-.60206}{125} = \frac{125K}{125}$

$125 = 500(e)^{-.006 \cdot 60.34}$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

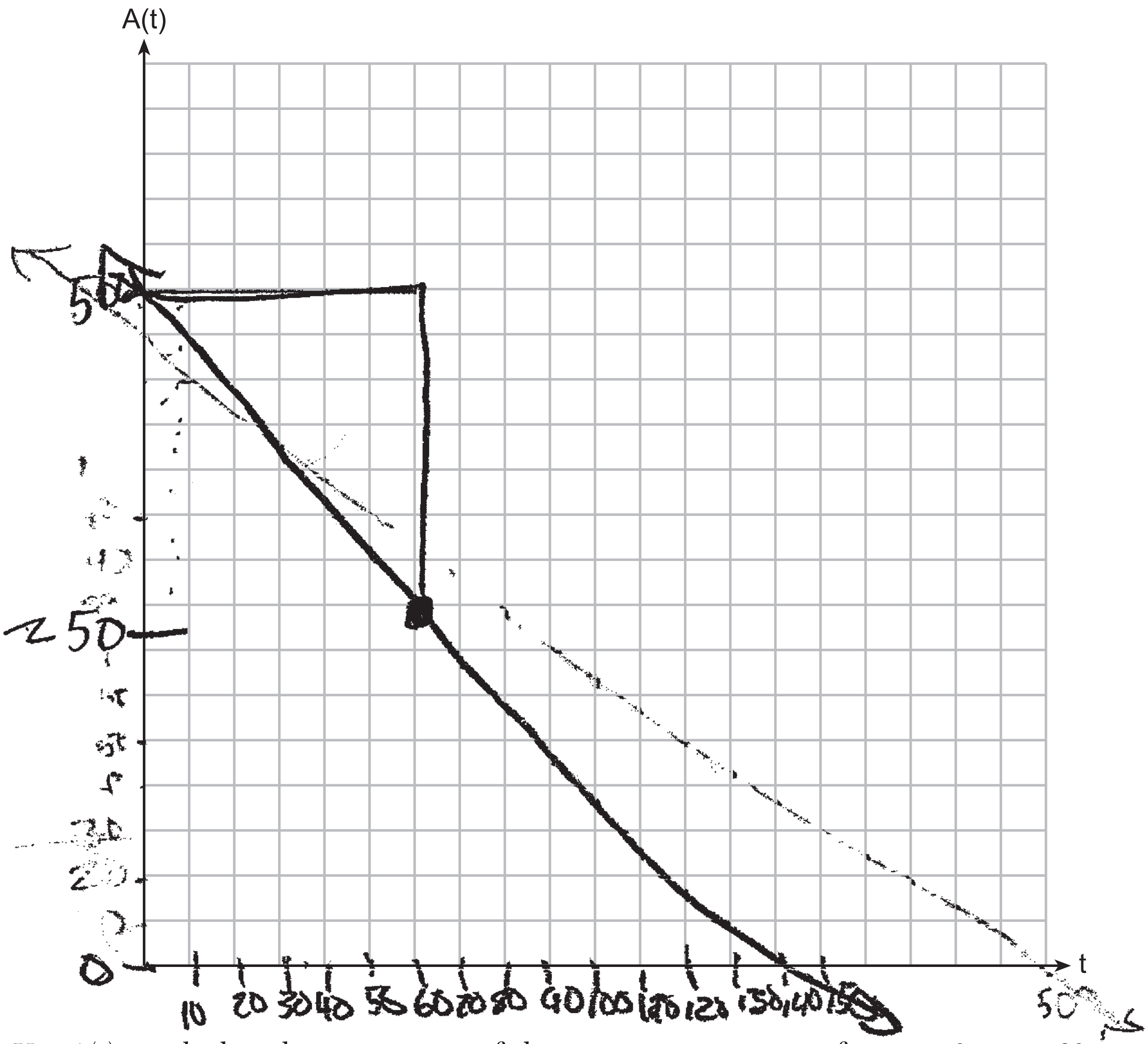
$A(t) = 500e^{-.006t}$

Question 37 is continued on the next page.

Score 1: The student earned credit for the function written using the incorrect value of "*k*."

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

$500 \cdot e^{.006 \cdot 0}$ $\qquad \frac{0}{500}$ $\qquad (60, 348.838)$

$(0, 500)$

$500 \cdot e^{-.006 \cdot 60}$ $\qquad -151.2$ $\qquad \frac{60-0}{348.838-500}$ $\frac{60}{-151.162}$

Explain what this value means in the given context.

This means that over the course of those 60 years the mass decreases

Question 37

37 Cesium-137 decay can be modeled with the formula $A(t) = A_0e^{kt}$, where $A(t)$ represents the mass remaining in grams after t years and A_0 represents the initial mass. A sample of 500 grams of cesium-137 takes approximately 60.34 years to decay to 125 grams. Use this sample with the given formula to determine the constant k, to the *nearest thousandth*.

$$\frac{125}{500} = \frac{500}{500}e^{k(60.34)}$$

$$.25 = e^{k(60.34)}$$

$$\frac{\ln .25}{60.34 \ln} = \frac{k(60.34) \ln}{60.34 \ln} \qquad k = -.34$$

Use this value for k to write a function, $A(t)$, that will find the mass of the 500-gram sample remaining after any amount of time, t, in years.

$$500e^{-.34(t)}$$

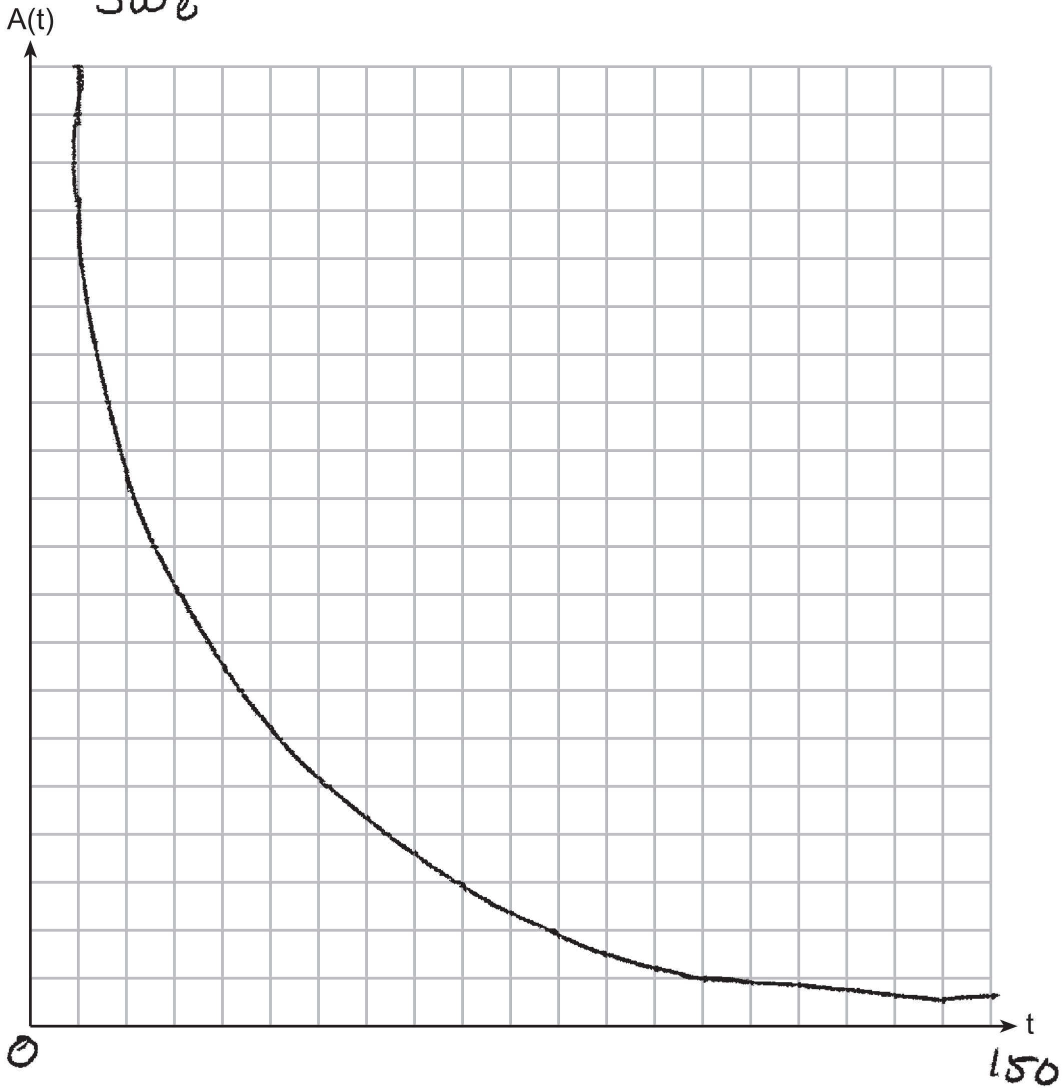
Question 37 is continued on the next page.

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

Question 37 continued

Graph $A(t)$ on the graph below from $t = 0$ to $t = 150$ years.

$500e^{-.34(t)}$



Use $A(t)$ to calculate the average rate of change in grams per year, from $t = 0$ to $t = 60$ years, to the *nearest tenth*.

$t(0)=500$
$t(60)=6.9\times10^{-7}$

$\frac{6.9\times10^{-7}}{500} = 1.38\times10^{-9}$
$= 1.4\times10^{-9}$

Explain what this value means in the given context.

This represents how much the cesium-137
is decaying