ALGEBRA

I

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA I

Tuesday, June 4, 2024 — 9:15 a.m. to 12:15 p.m., only

Student Name _____

School Name _____

> **The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.**

Print your name and the name of your school on the lines above.

A separate answer sheet for **Part I** has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

This examination has four parts, with a total of 35 questions. You must answer all questions in this examination. Record your answers to the Part I multiple-choice questions on the separate answer sheet. Write your answers to the questions in **Parts II**, **III**, and **IV** directly in this booklet. All work should be written in pen, except for graphs and drawings, which should be done in pencil. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale.

The formulas that you may need to answer some questions in this examination are found at the end of the examination. You may remove this sheet from this booklet.

Scrap paper is not permitted for any part of this examination, but you may use the blank spaces in this booklet as scrap paper. A sheet of scrap graph paper is provided at the end of this booklet for any question for which graphing may be helpful but is not required. You may remove this sheet from this booklet. Any work done on this sheet of scrap graph paper will *not* be scored.

When you have completed the examination, you must sign the statement printed at the end of the answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice …

A graphing calculator and a straightedge (ruler) must be available for you to use while taking this examination.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression that, of those given, best completes the statement or answers the question. Record your answers on your separate answer sheet. [48]

Use this space for computations.

1 A ball was launched into the air, and its height above the ground was recorded each second, as shown in the table below.

Time (sec)	0	1	2	3	4
Height (ft)	11	59	75	59	11

Based on these data, which statement is a valid conclusion?

(1) The ball lands on the ground at 4 seconds.

(2) The ball reaches a maximum height of 11 feet.

(3) The ball was launched from a height of 0 feet.

(4) The ball reaches its maximum height at 2 seconds.

2 A tour bus can seat, at most, 48 passengers. An adult ticket costs $18 and a child ticket costs $12. The bus company must collect at least $650 to make a profit. If a represents the number of adult tickets sold and c represents the number of child tickets sold, which system of inequalities models this situation if they make a profit?

(1) $a + c < 48$
  $18a + 12c > 650$

(3) $a + c < 48$
  $18a + 12c < 650$

(2) $a + c \leq 48$
  $18a + 12c \geq 650$

(4) $a + c \leq 48$
  $18a + 12c \leq 650$

3 Which equation is always true?

(1) $x^2 \cdot x^3 = x^5$

(3) $-z^2 = z^2$

(2) $3^x \cdot 3^2 = 9^{2x}$

(4) $7^a \cdot 7^b = 7^{ab}$

4 The expression $-2(x^2 - 2x + 1) + (3x^2 + 3x - 5)$ is equivalent to

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

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

(2) $x^2 - x - 7$

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

5 Which sum is irrational?

(1) $-2\sqrt{12} + \sqrt{100}$

(3) $\frac{1}{2}\sqrt{25} + \sqrt{64}$

(2) $-\sqrt{4} + \frac{1}{3}\sqrt{900}$

(4) $\sqrt{49} + 3\sqrt{121}$

6 The solution to $\dfrac{4(x - 5)}{3} + 2 = 14$ is

(1) 15

(3) 6

(2) 14

(4) 4

7 On an island, a rare breed of rabbit doubled its population each month for two years. Which type of function best models the increase in population at the end of two years?

(1) linear growth   (3) exponential growth

(2) linear decay   (4) exponential decay

8 What is the degree of the polynomial $2x - x^2 + 4x^3$?

(1) 1   (3) 3

(2) 2   (4) 4

9 The zeros of the function $f(x) = x(x - 5)(3x + 6)$ are

(1) 0, -5, and 2   (3) -5 and 2, only

(2) 0, 5, and -2 (4) 5 and -2, only

10 What is the y-intercept of the line that passes through the points $(-1,5)$ and $(2,-1)$?

(1) -1 (3) 3

(2) -2 (4) 5

11 Nancy has just been hired for her first job. Her company gives her four choices for how she can collect her annual salary over the first eight years of employment.

Each function below represents the four choices she has for her annual salary in thousands of dollars, where t represents the number of years after she is hired.

$$a(t) = 2^t + 25$$
$$b(t) = 10t + 75$$
$$c(t) = \sqrt{400t} + 80$$
$$d(t) = 2(t + 1)^2 - 10t + 50$$
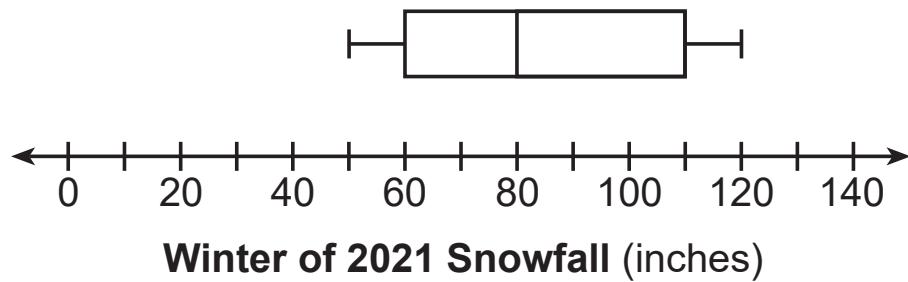
Which pay plan should Nancy choose in order to have the highest salary in her eighth year?

(1) $a(t)$ (3) $c(t)$

(2) $b(t)$ (4) $d(t)$

12 The third term in a sequence is 25 and the fifth term is 625. Which number could be the common ratio of the sequence?

(1) $\dfrac{1}{5}$ (3) $\dfrac{1}{25}$

(2) 5   (4) 25

13 The box plot below summarizes the data for the amount of snowfall, in inches, during the winter of 2021 for 12 locations in western New York.

Winter of 2021 Snowfall (inches)

What is the interquartile range?

(1) 30   (3) 80

(2) 50   (4) 110
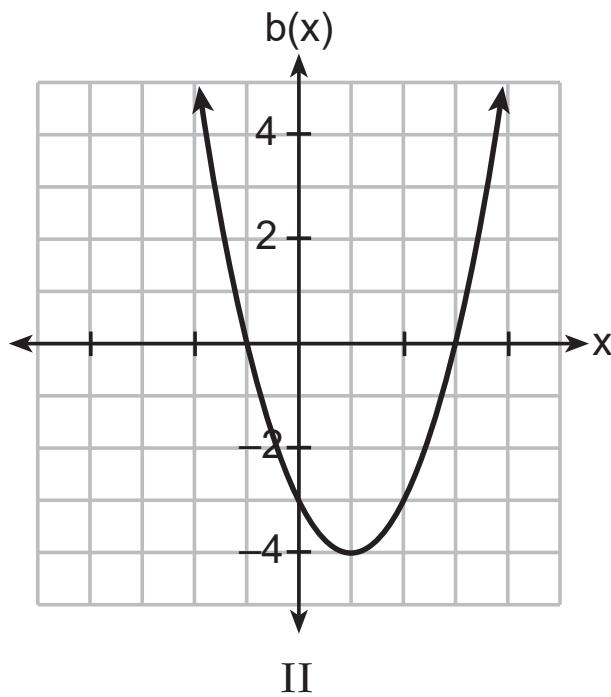
14 Four quadratic functions are represented below.

$$a(x) = (x - 3)^2 - 7$$

I

$$c(x) = x^2 + 6x + 3$$

III

II

x	d(x)
−4	−1
−3	−4
−2	−5
−1	−4
0	−1

IV

Which function has the *smallest* minimum value?

(1) I

(2) II

(3) III

(4) IV
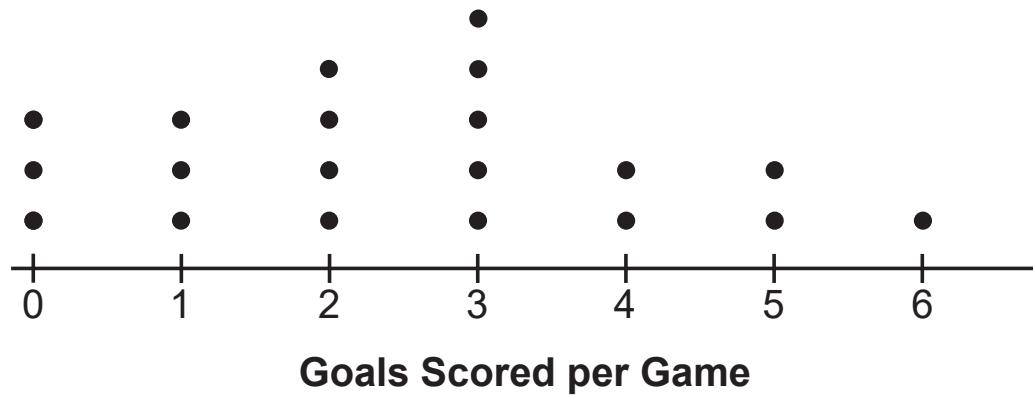
15 The equation that represents the sequence $-2,\ -5,\ -8,\ -11,$ $-14, \ldots$ is

(1) $a_n = -3 + (-2)(n-1)$ (3) $a_n = 3 + (-2)(n-1)$

(2) $a_n = -2 + (-3)(n-1)$ (4) $a_n = -2 + (3)(n-1)$

16 The dot plot below shows the number of goals Jessica scored in each lacrosse game last season.

Goals Scored per Game

Which statement about the dot plot is correct?

(1) mean > mode   (3) mode = median

(2) mean = median   (4) median > mean
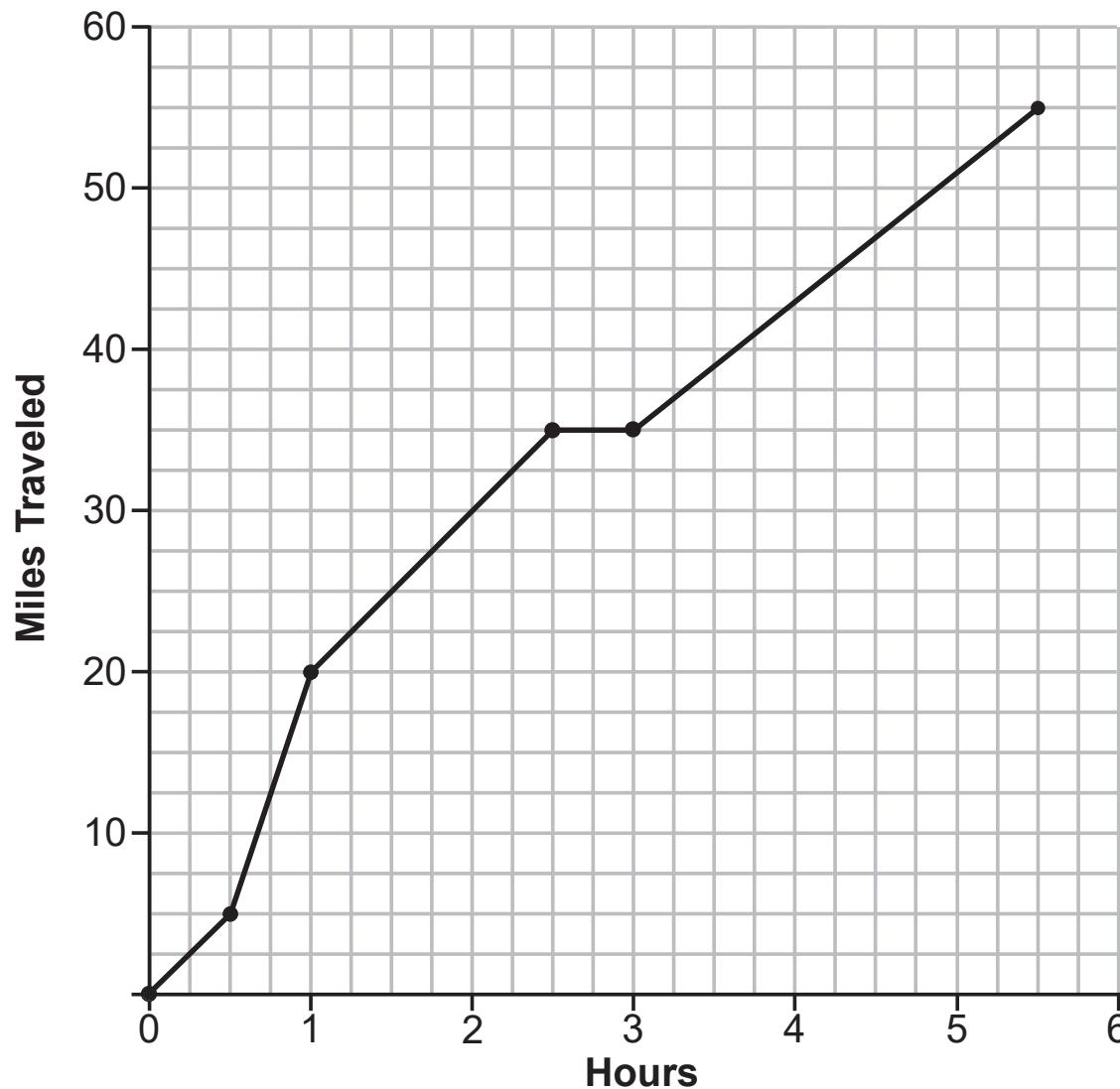
17 The students in Mrs. Smith's algebra class were asked to describe the graph of $g(x) = 2(x - 3)^2$ compared to the graph of $f(x) = x^2$.

Which student response is correct?

(1) Ashley said that the graph of $g(x)$ is wider and shifted left 3 units.

(2) Beth said that the graph of $g(x)$ is narrower and shifted left 3 units.

(3) Carl said that the graph of $g(x)$ is wider and shifted right 3 units.

(4) Don said that the graph of $g(x)$ is narrower and shifted right 3 units.

18 One Saturday, Dave took a long bike ride. The graph below models his trip.
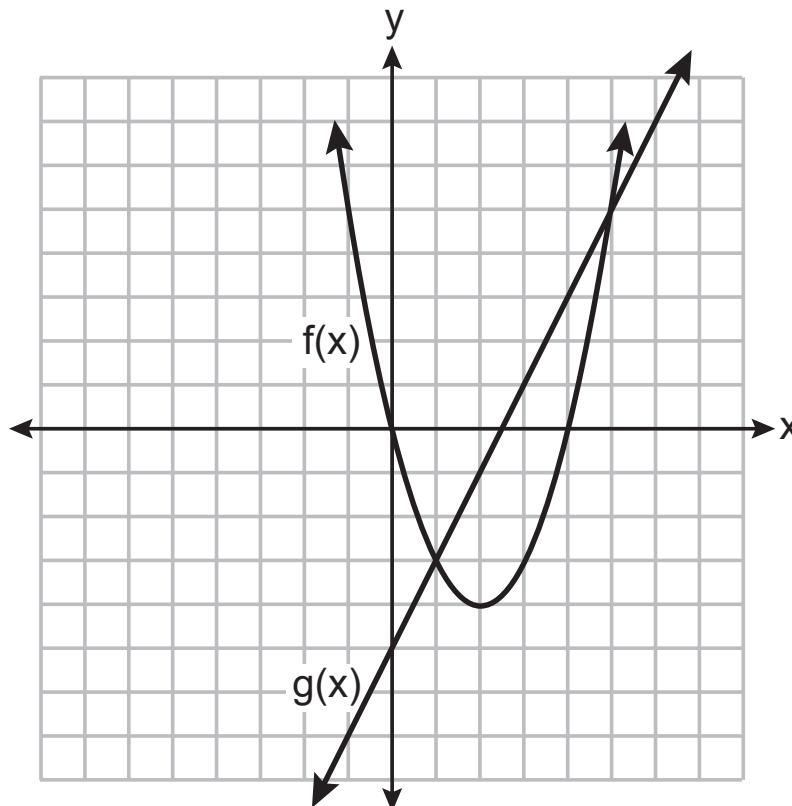
What was Dave's average rate of change, in miles per hour, on this trip?

(1) 10   (3) 11.6

(2) 11   (4) 14.5

**19** Which expression is equivalent to $(x - 5)(2x + 7) - (x + 5)$?

(1) $2x^2 - 2x - 30$ (3) $2x^2 - 4x - 30$

(2) $2x^2 - 2x - 40$ (4) $2x^2 - 4x - 40$

20 The functions $f(x)$ and $g(x)$ are graphed on the set of axes below.

What is the solution to the equation $f(x) = g(x)$?

(1) 1 and 5   (3) -3 and 5

(2) -5 and 0   (4) 0 and 4

Algebra I – June '24   14

21 When babysitting, Nicole charges an hourly rate and an additional charge for gas. She uses the function $C(h) = 6h + 5$ to determine how much to charge for babysitting. The constant term of this function represents

(1) the additional charge for gas

(2) the hourly rate Nicole charges

(3) the number of hours Nicole babysits

(4) the total Nicole earns from babysitting

22 When solved for x in terms of a, the solution to the equation $3x - 7 = ax + 5$ is

(1) $\dfrac{12}{3a}$ (3) $\dfrac{3a}{12}$

(2) $\dfrac{12}{3 - a}$ (4) $\dfrac{3 - a}{12}$

23 Wayde van Niekerk, a runner from South Africa, ran 400 meters in 43.03 seconds to set a world record. Which calculation would determine his average speed, in miles per hour?

(1) $\dfrac{400 \text{ m}}{43.03 \text{ sec}} \cdot \dfrac{1000 \text{ m}}{0.62 \text{ mi}} \cdot \dfrac{1 \text{ hr}}{3600 \text{ sec}}$

(2) $\dfrac{400 \text{ m}}{43.03 \text{ sec}} \cdot \dfrac{0.62 \text{ mi}}{1000 \text{ m}} \cdot \dfrac{1 \text{ hr}}{3600 \text{ sec}}$

(3) $\dfrac{400 \text{ m}}{43.03 \text{ sec}} \cdot \dfrac{0.62 \text{ mi}}{1000 \text{ m}} \cdot \dfrac{3600 \text{ sec}}{1 \text{ hr}}$

(4) $\dfrac{400 \text{ m}}{43.03 \text{ sec}} \cdot \dfrac{1000 \text{ m}}{0.62 \text{ mi}} \cdot \dfrac{3600 \text{ sec}}{1 \text{ hr}}$

24 Which function has a domain of all real numbers and a range greater than or equal to three?

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

(2) $g(x) = x^2 + 3$ (4) $m(x) = |x + 3|$

Part II

Answer all 6 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [12]

25 Solve $5(x - 2) \leq 3x + 20$ algebraically.

Work space for question 25 is continued on the next page.

Question 25 continued

26 Given $g(x) = x^3 + 2x^2 - x$, evaluate $g(-3)$.

Question 26 continued

27 Given the relation $R = \{(-1,1), (0,3), (-2,-4), (x,5)\}$.

State a value for x that will make this relation a function.

Explain why your answer makes this a function.

Question 27 continued

28 A survey of 150 students was taken. It was determined that $\frac{2}{3}$ of the students play video games.

Of the students that play video games, 85 also use social media.
Of the students that do not play video games, 20% do not use social media.

Complete the two-way frequency table.

	Play Video Games	Do Not Play Video Games	Total
Social Media			
No Social Media			
Total			

Question 28 continued

29 Use the method of completing the square to determine the exact values of x for the equation $x^2 + 10x - 30 = 0$.

Question 29 continued

30 Factor $20x^3 - 45x$ completely.

Question 30 continued

Part III

Answer all 4 questions in this part. Each correct answer will receive 4 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For all questions in this part, a correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]
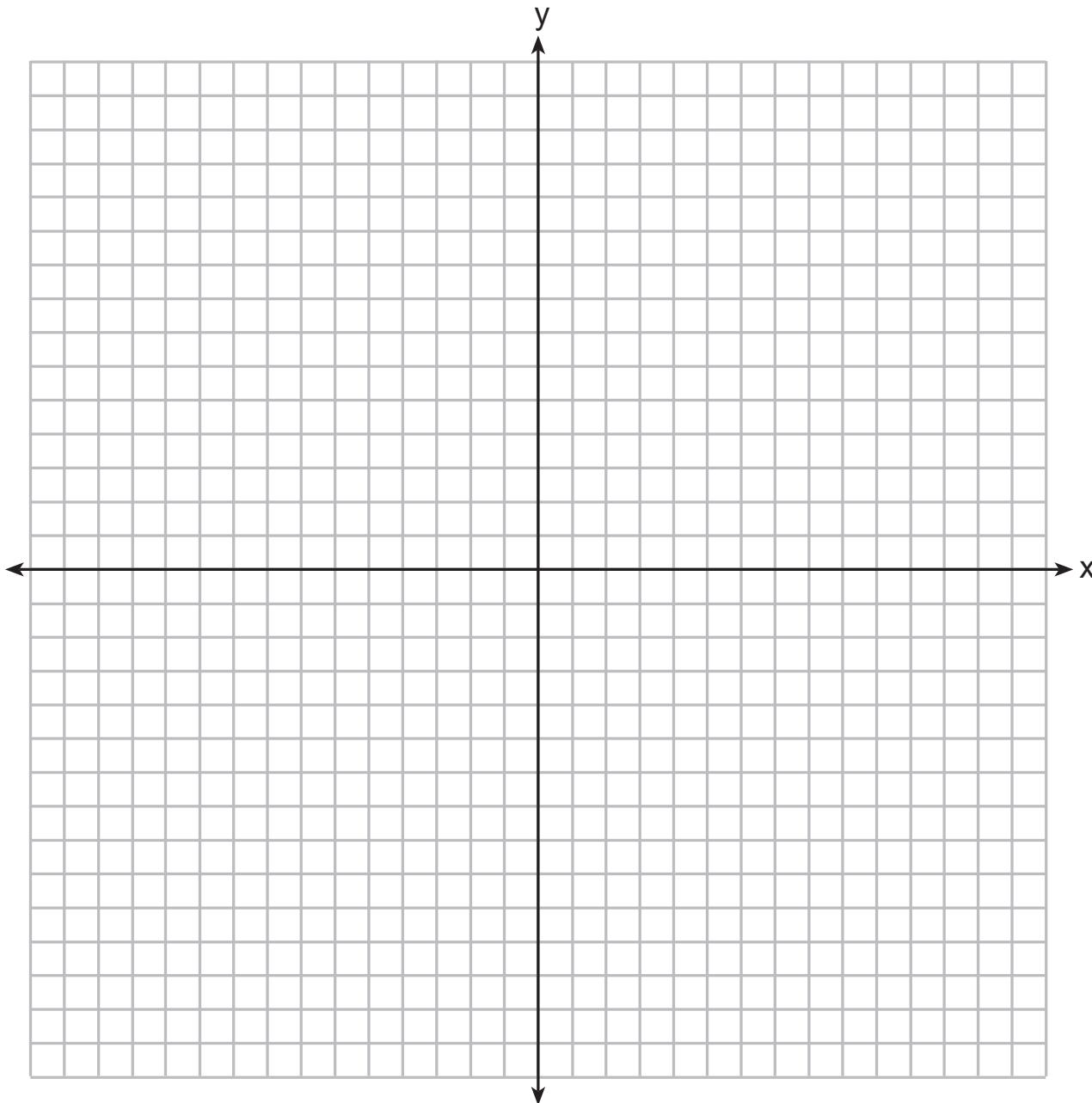
31 Graph the following system of equations on the set of axes on the next page.

$$y = x^2 - 3x - 6$$
$$y = x - 1$$

The set of axes for question 31 is on the next page.

State the coordinates of all solutions.

GO RIGHT ON TO THE NEXT PAGE ➡

32 The table below shows the amount of money a popular movie earned, in millions of dollars, during its first six weeks in theaters.

Week (x)	1	2	3	4	5	6
Dollars Earned, in Millions (y)	185	150	90	50	25	5

Write the linear regression equation for this data set, rounding all values to the *nearest hundredth*.

State the correlation coefficient to the *nearest hundredth*.

State what this correlation coefficient indicates about the linear fit of the data.

33 Use the quadratic formula to solve the equation $3x^2 - 10x + 5 = 0$. Express the answer in simplest radical form.

Question 33 continued
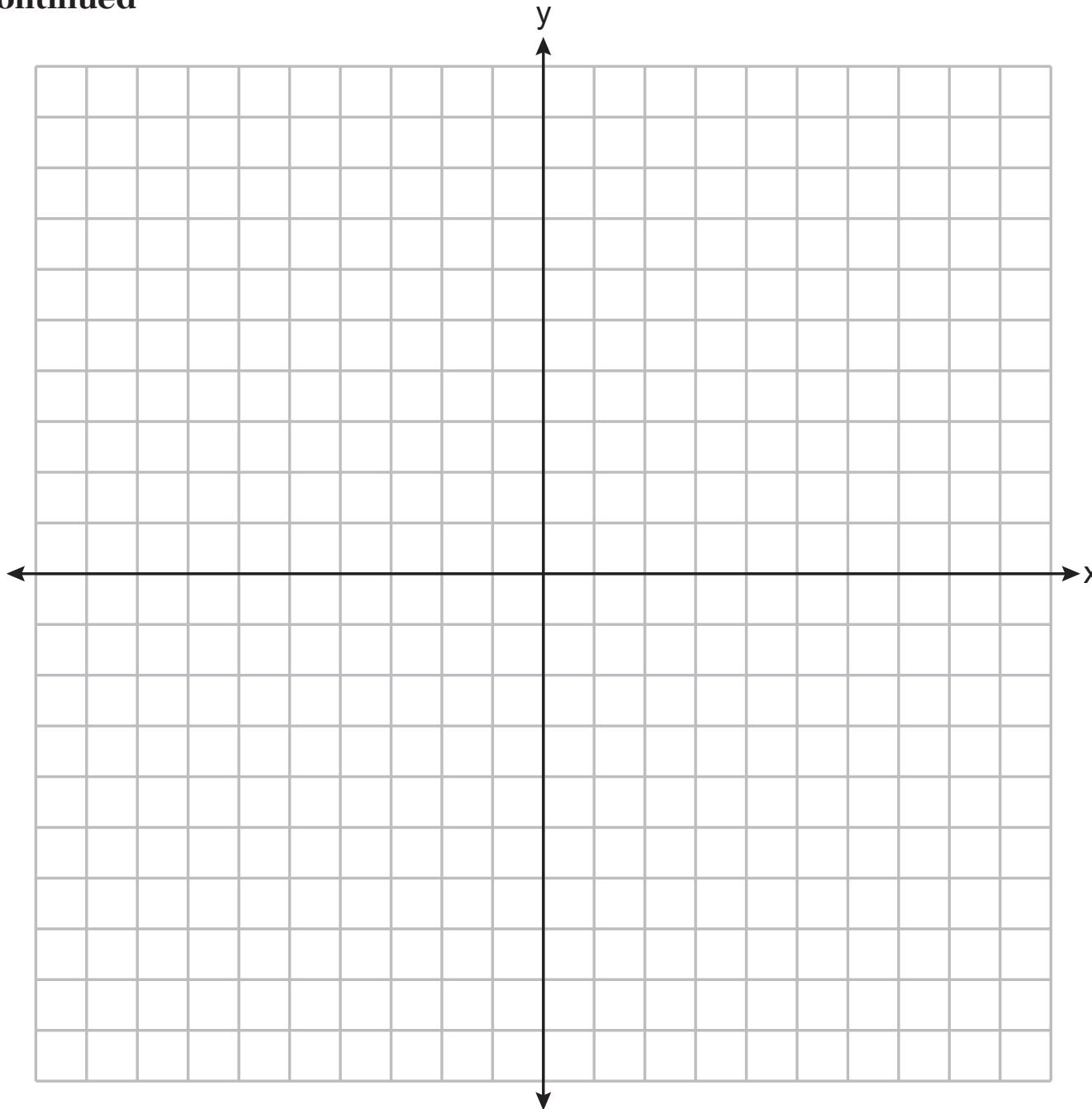
34 Graph the system of inequalities on the set of axes on the next page.

$$3y + 2x \leq 15$$
$$y - x > 1$$

Question 34 continued

State the coordinates of a point in the solution to this system. Justify your answer.

Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. A correct numerical answer with no work shown will receive only 1 credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil.   [6]

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35 Courtney went to a coffee shop to purchase lattes and donuts for her friends. One day she spent a total of $15.50 on four lattes and two donuts. The next day she spent a total of $18.10 on three lattes and five donuts. All prices included tax.

If x represents the cost of one latte and y represents the cost of one donut, write a system of equations that can be used to model this situation.
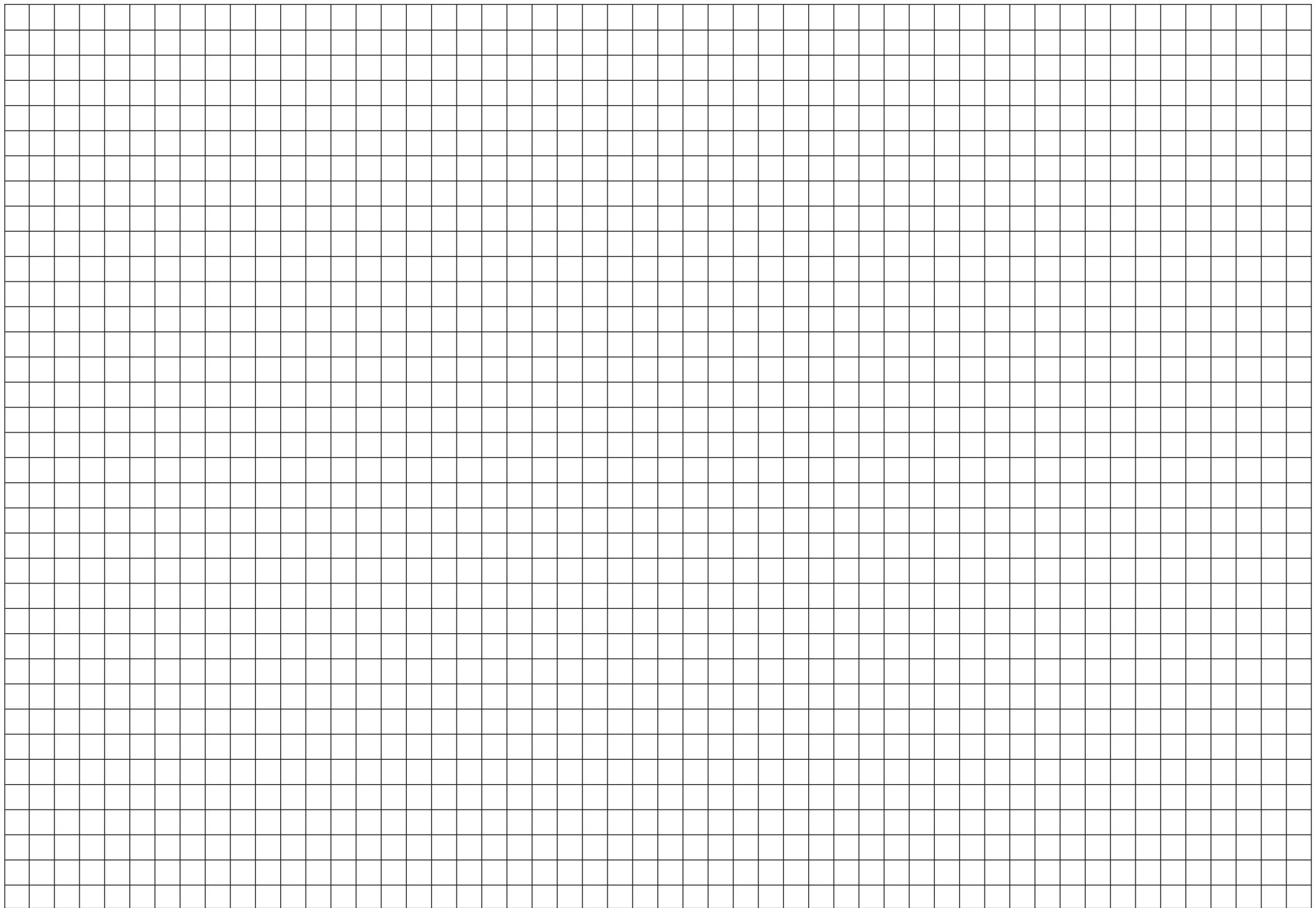
Question 35 continued
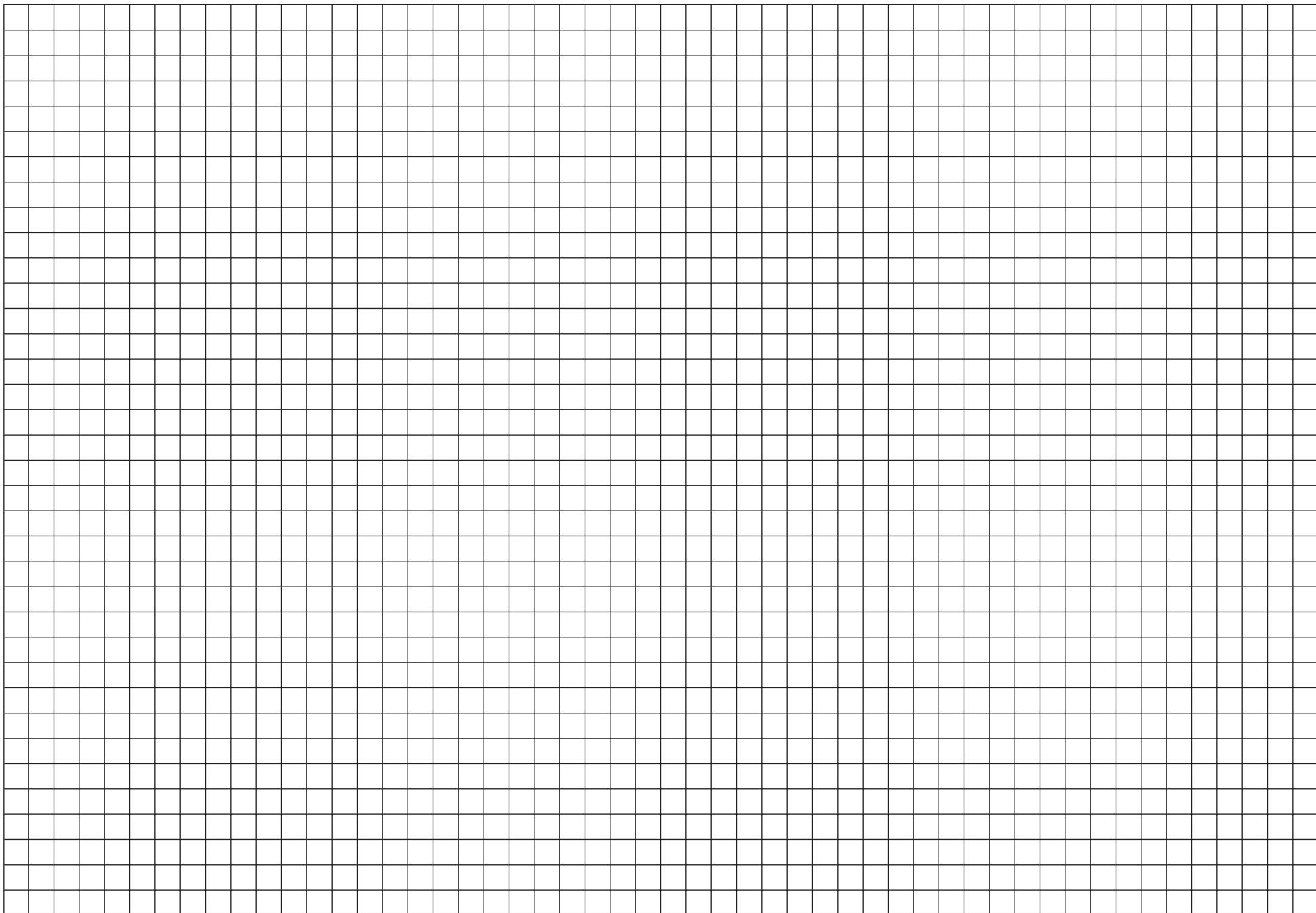
Courtney thinks that one latte costs $2.75 and one donut costs $2.25.
Is Courtney correct? Justify your answer.

Use your equations to determine algebraically the exact cost of one latte and the exact cost of one donut.

Reference Sheet for Algebra I

Conversions

1 mile = 5280 feet
1 mile = 1760 yards
1 pound = 16 ounces
1 ton = 2000 pounds

Conversions Across Measurement Systems

1 inch = 2.54 centimeters
1 meter = 39.37 inches
1 mile = 1.609 kilometers
1 kilometer = 0.6214 mile
1 pound = 0.454 kilogram
1 kilogram = 2.2 pounds

Quadratic Equation	$y = ax^2 + bx + c$	Exponential Equation	$y = ab^x$
Quadratic Formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	Annual Compound Interest	$A = P(1 + r)^n$
Equation of the Axis of Symmetry	$x = -\dfrac{b}{2a}$	Arithmetic Sequence	$a_n = a_1 + d(n - 1)$
Slope	$m = \dfrac{y_2 - y_1}{x_2 - x_1}$	Geometric Sequence	$a_n = a_1 r^{n-1}$

The Reference Sheet is continued on the next page.

Linear Equation Slope Intercept	$y = mx + b$	Interquartile Range (IQR)	$IQR = Q_3 - Q_1$
Linear Equation Point Slope	$y - y_1 = m(x - x_1)$	Outlier	Lower Outlier Boundary $= Q_1 - 1.5(IQR)$
			Upper Outlier Boundary $= Q_3 + 1.5(IQR)$