ALGEBRA

I

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA I

Thursday, June 15, 2023 — 1:15 to 4:15 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 37 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. This sheet is perforated so you may remove it 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 perforated 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.

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 The expression $9m^2 - 100$ is equivalent to

(1) $(3m - 10)(3m + 10)$ (3) $(3m - 50)(3m + 50)$

(2) $(3m - 10)(3m - 10)$ (4) $(3m - 50)(3m - 50)$

2 Which expression represents an irrational number?

(1) $\sqrt{16} + \sqrt{1}$ (3) $\sqrt{36} + \sqrt{7}$

(2) $\sqrt{25} + \sqrt{4}$ (4) $\sqrt{49} + \sqrt{9}$

3 Which linear equation represents a line that passes through the point $(-3, -8)$?

(1) $y = 2x - 2$ (3) $y = 2x + 13$

(2) $y = 2x - 8$ (4) $y = 2x - 14$

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

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

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

5 The 24th term of the sequence $-5, -11, -17, -23, \dots$ is

(1) -149 (3) 133

(2) -143 (4) 139

6 When completing the square for $x^2 - 18x + 77 = 0$, which equation is a correct step in this process?

(1) $(x - 9)^2 = 4$ (3) $x = \pm 13$

(2) $(x - 3)^2 = 2$ (4) $x - 9 = \pm 9$

7 Which function will have the greatest value when $x > 1$?

(1) $g(x) = 2(5)^x$ (3) $h(x) = 2x^2 + 5$

(2) $f(x) = 2x + 5$ (4) $k(x) = 2x^3 + 5$

8 Mike uses the equation $b = 1300(2.65)^x$ to determine the growth of bacteria in a laboratory setting. The exponent represents

(1) the total number of bacteria currently present

(2) the percent at which the bacteria are growing

(3) the initial amount of bacteria

(4) the number of time periods

9 A company ships an average of 30,000 items each week. The approximate number of items shipped each minute is calculated using the conversion

(1) $\dfrac{30,000 \text{ items}}{1 \text{ week}} \cdot \dfrac{7 \text{ days}}{1 \text{ week}} \cdot \dfrac{60 \text{ min}}{1 \text{ hr}} \cdot \dfrac{1 \text{ day}}{24 \text{ hrs}}$
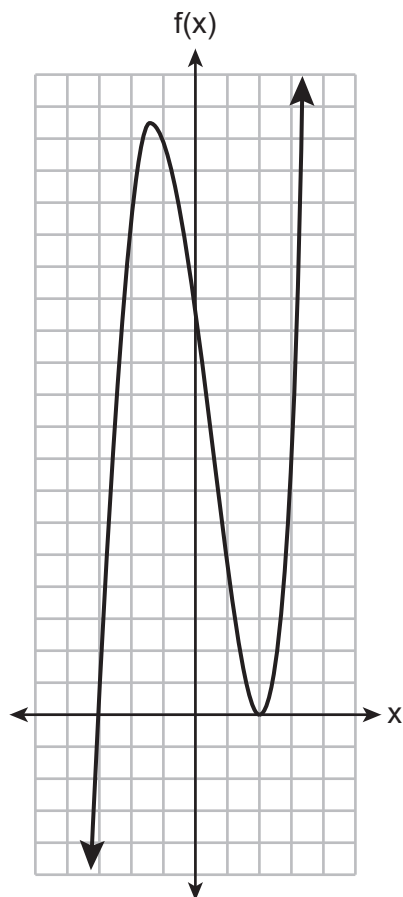
(2) $\dfrac{30,000 \text{ items}}{1 \text{ week}} \cdot \dfrac{1 \text{ week}}{7 \text{ days}} \cdot \dfrac{1 \text{ day}}{24 \text{ hrs}} \cdot \dfrac{1 \text{ hr}}{60 \text{ min}}$

(3) $\dfrac{1 \text{ week}}{30,000 \text{ items}} \cdot \dfrac{1 \text{ week}}{7 \text{ days}} \cdot \dfrac{1 \text{ day}}{24 \text{ hrs}} \cdot \dfrac{1 \text{ hr}}{60 \text{ min}}$

(4) $\dfrac{1 \text{ week}}{30,000 \text{ items}} \cdot \dfrac{7 \text{ days}}{1 \text{ week}} \cdot \dfrac{24 \text{ hrs}}{1 \text{ day}} \cdot \dfrac{60 \text{ min}}{1 \text{ hr}}$

Use this space for computations.

10 A function is graphed below.

f(x)

A possible equation for this function is

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

(2) $f(x) = (x - 2)(x + 3)$ (4) $f(x) = (x - 2)(x + 3)(x - 12)$

11 If $g(x) = -x^2 - x + 5$, then $g(-4)$ is equal to

(1) -15 (3) 17

(2) -7 (4) 25

12 A movie theater's popcorn box is a rectangular prism with a base that measures 6 inches by 4 inches and has a height of 8 inches. To create a larger box, both the length and the width will be increased by x inches. The height will remain the same. Which function represents the volume, $V(x)$, of the larger box?

(1) $V(x) = (6 + x)(4 + x)(8 + x)$

(2) $V(x) = (6 + x)(4 + x)(8)$

(3) $V(x) = (6 + x) + (4 + x) + (8 + x)$

(4) $V(x) = (6 + x) + (4 + x) + (8)$

13 The expression $300(4)^{x+3}$ is equivalent to

(1) $300(4)^x(4)^3$ (3) $300(4)^x + 300(4)^3$

(2) $300(4^x)^3$ (4) $300^x(4)^3$

14 Ashley only has 7 quarters and some dimes in her purse. She needs at least \$3.00 to pay for lunch. Which inequality could be used to determine the number of dimes, d, she needs in her purse to be able to pay for lunch?

(1) $1.75 + d \geq 3.00$ (3) $1.75 + d \leq 3.00$

(2) $1.75 + 0.10d \geq 3.00$ (4) $1.75 + 0.10d \leq 3.00$

15 The formula for the area of a trapezoid is $A = \frac{1}{2}(b_1 + b_2)h$.

The height, h, of the trapezoid may be expressed as

(1) $2A - b_1 - b_2$ (3) $\frac{1}{2}A - b_1 - b_2$

(2) $\dfrac{2A - b_1}{b_2}$ (4) $\dfrac{2A}{b_1 + b_2}$

16 The function $f(x) = |x|$ is multiplied by k to create the new function $g(x) = k|x|$. Which statement is true about the graphs of $f(x)$ and $g(x)$ if $k = \frac{1}{2}$?

(1) $g(x)$ is a reflection of $f(x)$ over the y-axis.
(2) $g(x)$ is a reflection of $f(x)$ over the x-axis.
(3) $g(x)$ is wider than $f(x)$.
(4) $g(x)$ is narrower than $f(x)$.

17 Some adults were surveyed to find out if they would prefer to buy a sports utility vehicle (SUV) or a sports car. The results of the survey are summarized in the table below.

	SUV	Sports Car	Totals
Male	21	38	59
Female	135	46	181
Totals	156	84	240

Of the number of adults that preferred sports cars, approximately what percent were males?

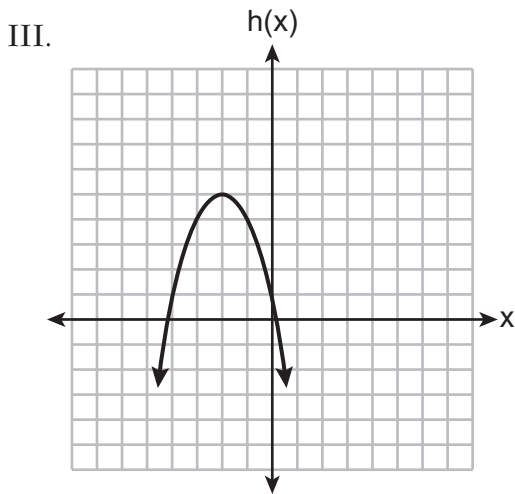(1) 15.8   (3) 64.4

(2) 45.2   (4) 82.6

18 The solution to $2x^2 = 72$ is

(1) {9,4}   (3) {6}

(2) {−4,9}   (4) {±6}

19 Three quadratic functions are given below.

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

II.

x	−4	−3	−2	−1	0	1
g(x)	−3	2	5	5	2	−3

III.

h(x)

Which of these functions have the same vertex?

(1) I and II, only   (3) I and III, only

(2) II and III, only   (4) I, II, and III

20 The domain of the function $f(x) = x^2 + x - 12$ is

(1) $(-\infty, -4]$ (3) $[-4, 3]$

(2) $(-\infty, \infty)$ (4) $[3, \infty)$

21 A father makes a deal with his son regarding his weekly allowance. The first year, he agrees to pay his son a weekly allowance of $10. Every subsequent year, the allowance is recalculated by doubling the previous year's weekly allowance and then subtracting 8. Which recursive formula could be used to calculate the son's weekly allowance in future years?

(1) $a_n = 2n - 8$

(2) $a_n = 2(n + 1) - 8$

(3) $a_1 = 10$
$a_{n+1} = 2a_n - 8$

(4) $a_1 = 10$
$a_{n+1} = 2(a_n - 8)$

22 What is the solution to the inequality below?

$$4 - \frac{2}{5}x \geq \frac{1}{3}x + 15$$

(1) $x \leq 11$ (3) $x \leq -15$

(2) $x \geq 11$ (4) $x \geq -15$

23 Which statement is correct about the polynomial $3x^2 + 5x - 2$?

(1) It is a third-degree polynomial with a constant term of -2.

(2) It is a third-degree polynomial with a leading coefficient of 3.

(3) It is a second-degree polynomial with a constant term of 2.

(4) It is a second-degree polynomial with a leading coefficient of 3.

24 A store manager is trying to determine if they should continue to sell a particular brand of nails. To model their profit, they use the function $p(n)$, where n is the number of boxes of these nails sold in a day. A reasonable domain for this function would be

(1) nonnegative integers   (3) real numbers

(2) rational numbers   (4) integers

Part II

Answer all 8 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. [16]

25 Solve the equation algebraically for x:

$$-2.4(x + 1.4) = 6.8x - 22.68$$

26 The function $f(x)$ is graphed on the set of axes below.
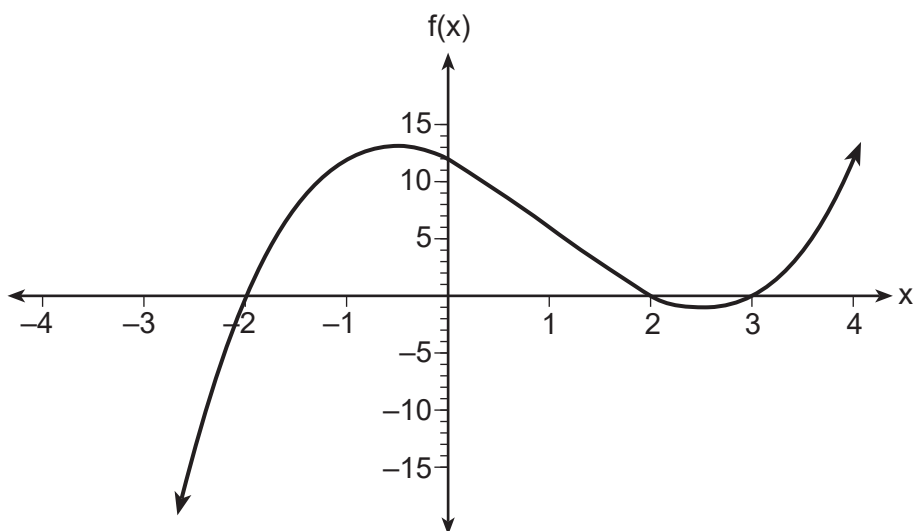
State the zeros of $f(x)$.

Explain your reasoning.

27 Breanna creates the pattern of blocks below in her art class.

I II III IV
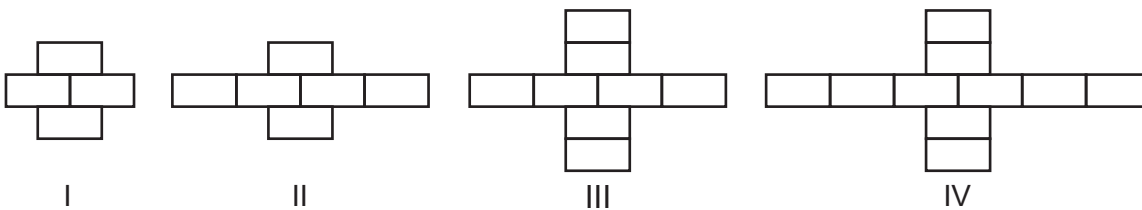
A friend tells her that the number of blocks in the pattern is increasing exponentially.

Is her friend correct?

Explain your reasoning.

28 The data set 20, 36, 52, 56, 24, 16, 40, 4, 28 represents the number of books purchased by nine book club members in a year.

Construct a box plot for these data on the number line below.
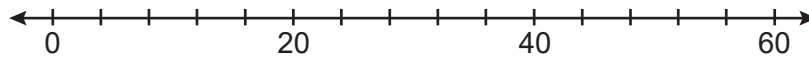
29 Given:

$$A = x + 5$$
$$B = x^2 - 18$$

Express $A^2 + B$ in standard form.

30 The two relations shown below are *not* functions.

Relation I: Relation II:

$\{(-5,-2), (-4,0), (-2,1), (-1,3), (-4,4)\}$
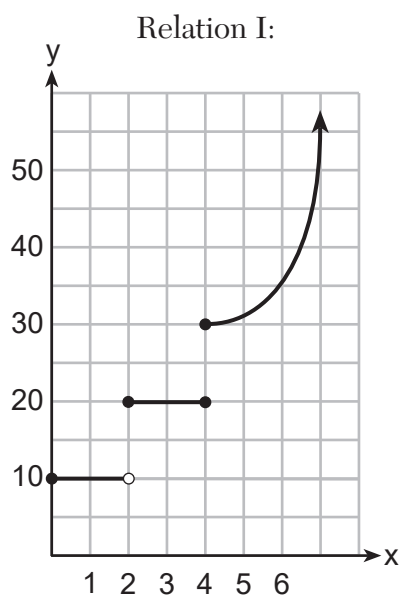
Explain how you could change each relation so that they each become a function.

31 Factor $2x^2 + 16x - 18$ completely.

32 Solve $3d^2 - 8d + 3 = 0$ algebraically for all values of d, rounding to the *nearest tenth*.

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]

33 Graph $f(x) = |x| + 1$ and $g(x) = -x^2 + 6x + 1$ on the set of axes below.
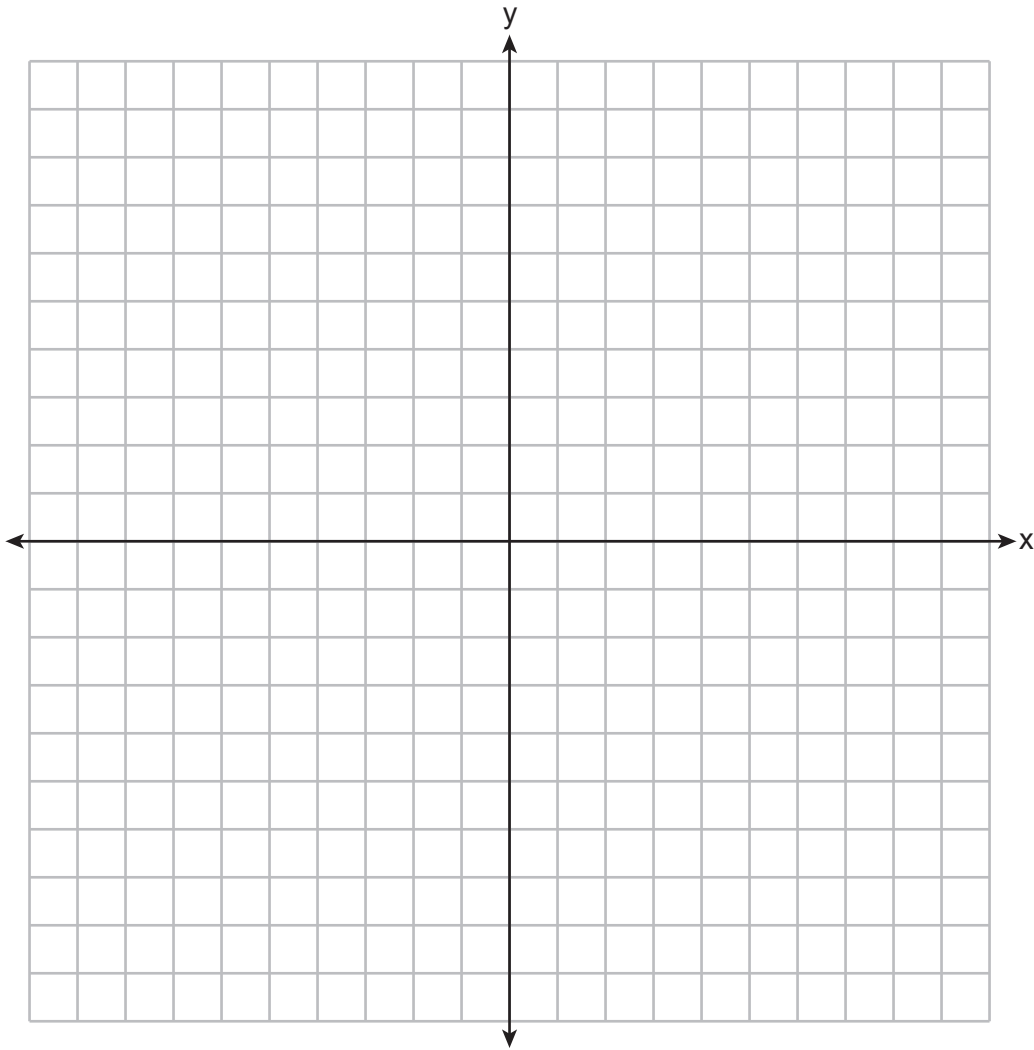
Based on your graph, determine all values of x for which $f(x) = g(x)$.

34 Jean recorded temperatures over a 24-hour period one day in August in Syracuse, NY. Her results are shown in the table below.

Time (hour)	0	3	6	9	12	15	18	21	24
Temperature (°F)	80	75	70	78	92	89	85	80	74

Her data are modeled on the graph below.
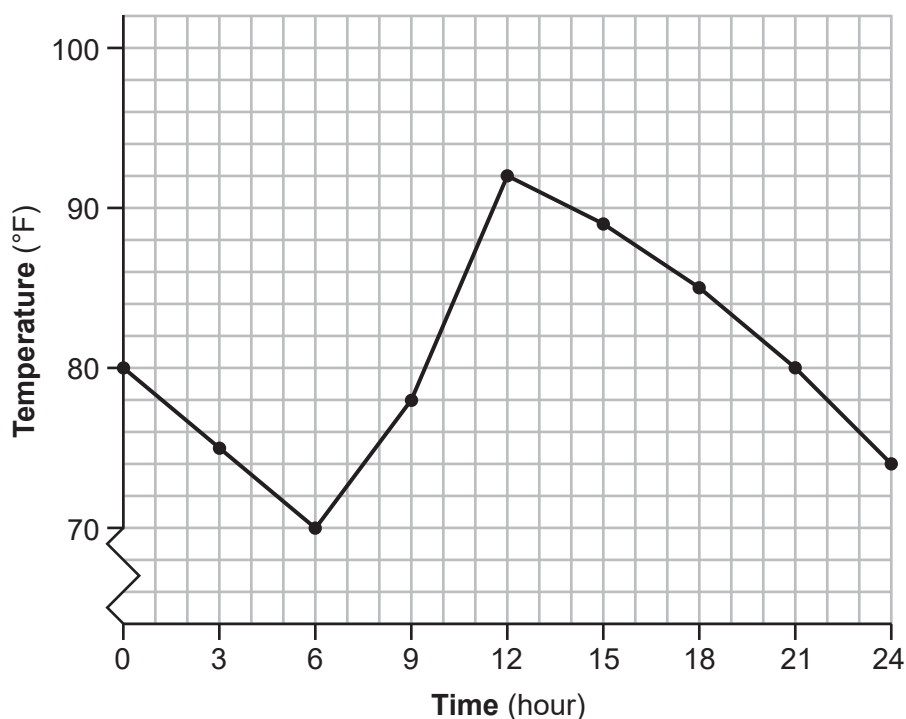
State the entire interval over which the temperature is increasing.

State the three-hour interval that has the greatest rate of change in temperature.

State the average rate of change from hour 12 to hour 24. Explain what this means in the context of the problem.

35 Solve the following system of inequalities graphically on the set of axes below.

$$2x + 3y \geq -6$$
$$x < 3y + 6$$

Label the solution set S.
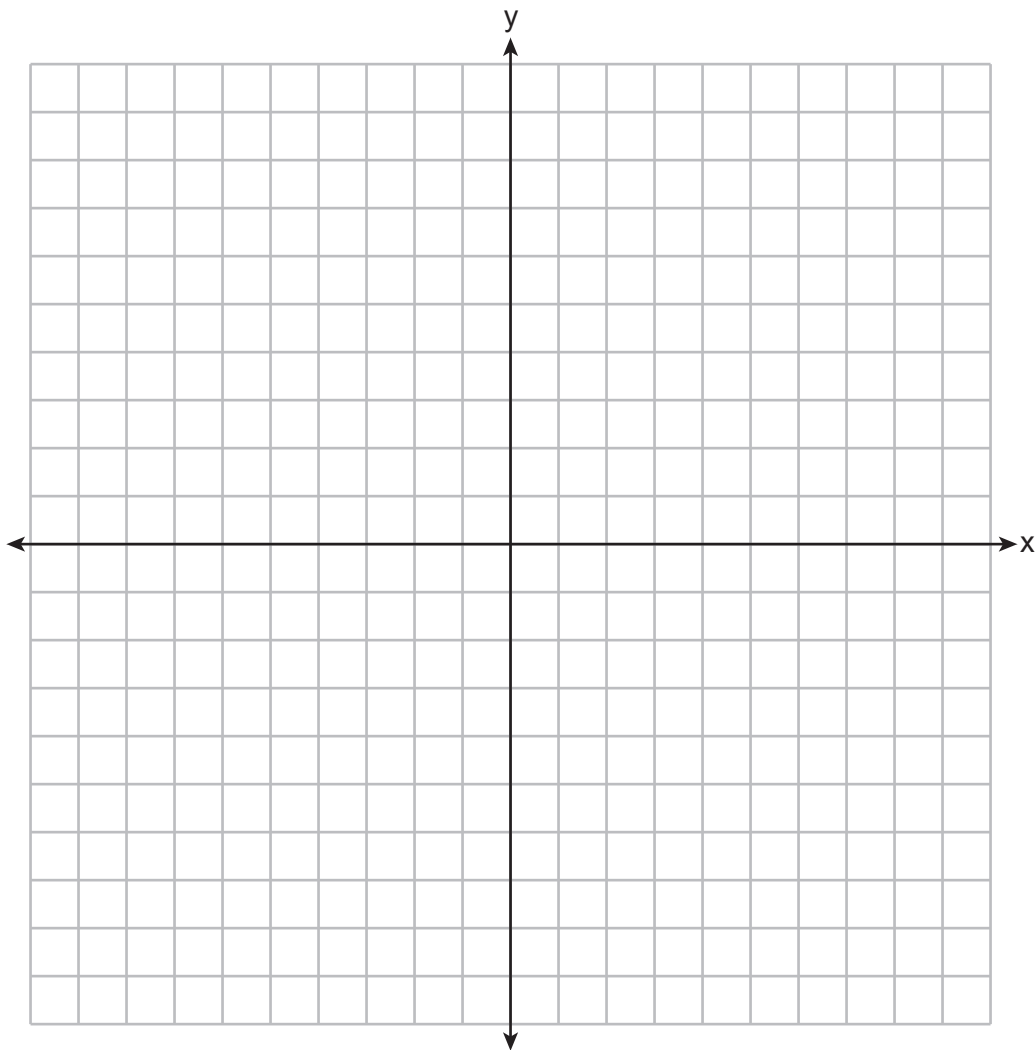
Is the point $(4,-2)$ in the solution set?

Explain your answer.

36 Suzanna collected information about a group of ponies and horses. She made a table showing the height, measured in hands (hh), and the weight, measured in pounds (lbs), of each pony and horse.

Height (hh) x	Weight (lbs) y
11	264
12	638
13	700
14	850
15	1000
16	1230
17	1495

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

State the correlation coefficient for the linear regression. Round your answer to the *nearest hundredth*.

Explain what the correlation coefficient indicates about the linear fit of the data in the context of the problem.

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]

37 Dana went shopping for plants to put in her garden. She bought three roses and two daisies for $31.88. Later that day, she went back and bought two roses and one daisy for $18.92.

If r represents the cost of one rose and d represents the cost of one daisy, write a system of equations that models this situation.

Use your system of equations to algebraically determine both the cost of one rose and the cost of one daisy.
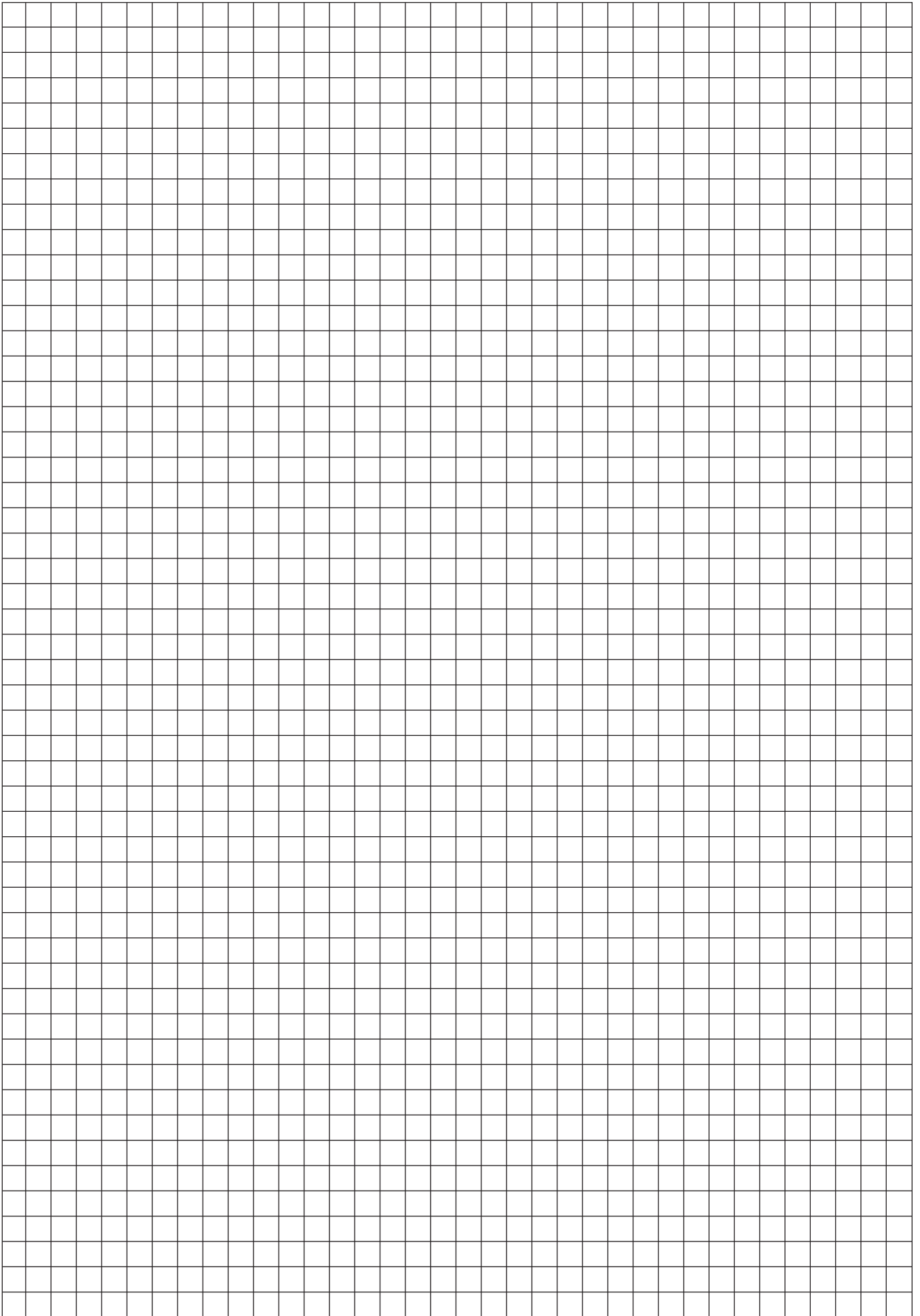
If Dana had waited until the plants were on sale, she would have paid $4.50 for each rose and $6.50 for each daisy. Determine the total amount of money she would have saved by buying all of her flowers during the sale.
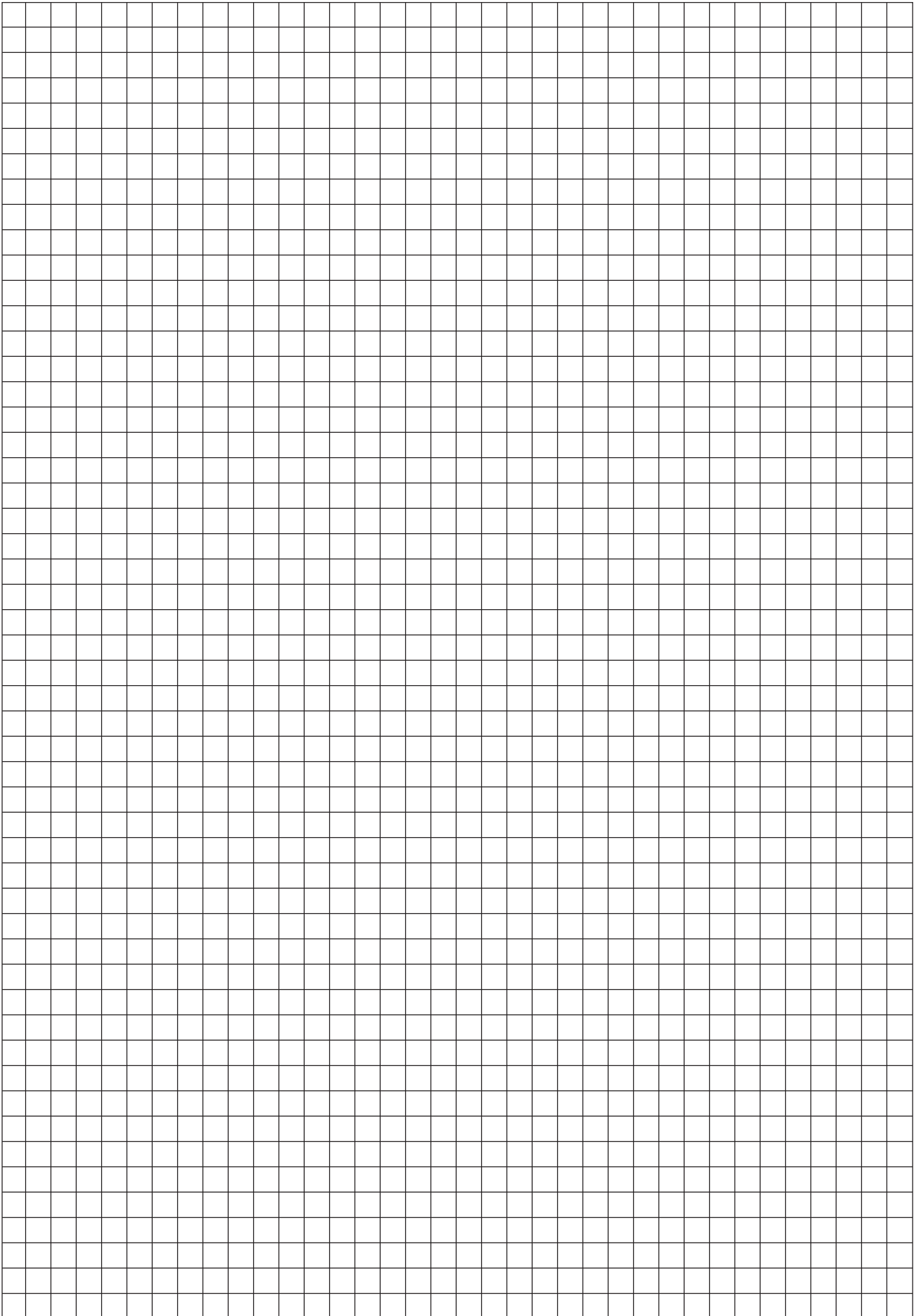
High School Math Reference Sheet

1 inch = 2.54 centimeters   1 kilometer = 0.62 mile   1 cup = 8 fluid ounces
1 meter = 39.37 inches   1 pound = 16 ounces   1 pint = 2 cups
1 mile = 5280 feet   1 pound = 0.454 kilogram   1 quart = 2 pints
1 mile = 1760 yards   1 kilogram = 2.2 pounds   1 gallon = 4 quarts
1 mile = 1.609 kilometers   1 ton = 2000 pounds   1 gallon = 3.785 liters
1 liter = 0.264 gallon
1 liter = 1000 cubic centimeters

Triangle	$A = \frac{1}{2}bh$	Pythagorean Theorem	$a^2 + b^2 = c^2$
Parallelogram	$A = bh$	Quadratic Formula	$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Circle	$A = \pi r^2$	Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Circle	$C = \pi d$ or $C = 2\pi r$	Geometric Sequence	$a_n = a_1 r^{n-1}$
General Prisms	$V = Bh$	Geometric Series	$S_n = \dfrac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$
Cylinder	$V = \pi r^2 h$	Radians	1 radian = $\dfrac{180}{\pi}$ degrees
Sphere	$V = \frac{4}{3}\pi r^3$	Degrees	1 degree = $\dfrac{\pi}{180}$ radians
Cone	$V = \frac{1}{3}\pi r^2 h$	Exponential Growth/Decay	$A = A_0 e^{k(t - t_0)} + B_0$
Pyramid	$V = \frac{1}{3}Bh$		

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