ALGEBRA

I

Large-Type Edition

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

ALGEBRA I

Thursday, June 16, 2022 — 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 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. 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 Which correlation shows a causal relationship?

(1) The more minutes an athlete is on the playing field, the more goals he scores.

(2) The more gasoline that you purchase at the pump, the more you pay.

(3) The longer a shopper stays at the mall, the more purchases she makes.

(4) As the price of a gift increases, the size of the gift box increases.

2 Given $f(x) = 3x - 5$, which statement is true?

(1) $f(0) = 0$

(2) $f(3) = 4$

(3) $f(4) = 3$

(4) $f(5) = 0$

Use this space for computations.

3 At Benny's Café, a mixed-greens salad costs \$5.75. Additional toppings can be added for \$0.75 each. Which function could be used to determine the cost, $c(s)$, in dollars, of a salad with s additional toppings?

(1) $c(s) = 5.75s + 0.75$

(2) $c(s) = 0.75s + 5.75$

(3) $c(s) = 5.00s + 0.75$

(4) $c(s) = 0.75s + 5.00$

4 Which expression is equivalent to $x^2 + 5x - 6$?

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

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

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

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

5 Peter has \$100 to spend on drinks for his party. Bottles of lemonade cost \$2 each, and juice boxes cost \$0.50 each.

If x is the number of bottles of lemonade and y is the number of juice boxes, which inequality models this situation?

(1) $0.50x + 2y \leq 100$

(2) $0.50x + 2y \geq 100$

(3) $2x + 0.50y \leq 100$

(4) $2x + 0.50y \geq 100$

Use this space for computations.

6 Which domain is most appropriate for a function that represents the number of items, $f(x)$, placed into a laundry basket each day, x, for the month of January?

(1) integers
(2) whole numbers
(3) rational numbers
(4) irrational numbers

7 What is the solution to $\frac{3}{2}b + 5 < 17$?

(1) $b < 8$
(2) $b > 8$
(3) $b < 18$
(4) $b > 18$

Use this space for computations.

8 Which table of values represents an exponential relationship?

x	f(x)
1	6
2	9
3	12
4	15
5	18

(1)

x	k(x)
1	4
2	16
3	64
4	256
5	1024

(3)

x	h(x)
1	2
2	7
3	12
4	17
5	22

(2)

x	p(x)
1	–9.5
2	–12
3	–14.5
4	–17
5	–19.5

(4)

Use this space for computations.

9 Which expression is *not* equivalent to $(5^{2x})^3$?

(1) $(5^x)^6$

(2) $(5^{3x})^2$

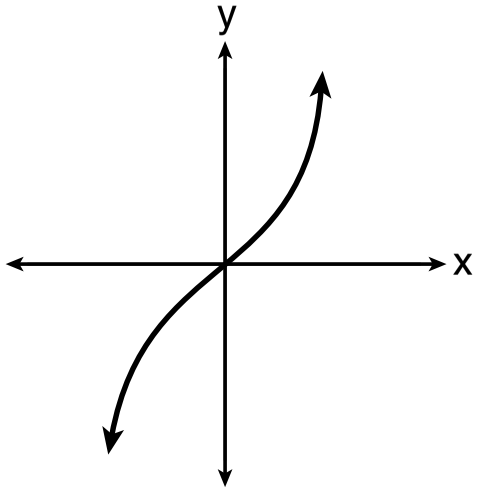
(3) $(5^5)^x$

(4) $(5^2)^{3x}$

10 Which relation is a function?

x	y
−1	1
0	0
1	1
1	2
2	4
3	9

(1)



(3)

$$y = \begin{cases} x, & -1 < x \leq 2 \\ x^2, & 2 \leq x < 4 \end{cases}$$

(2)

$\{(0,1), (2,3), (3,2), (3,4)\}$

(4)

Use this space for computations.

11 The formula $Ax + By = C$ represents the equation of a line in standard form. Which expression represents y in terms of A, B, C, and x?

(1) $\frac{C - Ax}{B}$

(2) $\frac{C - A}{Bx}$

(3) $\frac{C - A}{x + B}$

(4) $\frac{C - B}{Ax}$

12 What are the zeros of $f(x) = (2x - 4)(3x + 4)$?

(1) $\left\{-\frac{4}{3}, 2\right\}$

(2) $\{-4, 4\}$

(3) $\left\{-2, \frac{4}{3}\right\}$

(4) $\{-4, 2\}$

13 Joe has dimes and nickels in his piggy bank totaling \$1.45. The number of nickels he has is 5 more than twice the number of dimes, d. Which equation could be used to find the number of dimes he has?

(1) $0.10d + 0.05(2d + 5) = 1.45$

(2) $0.10(2d + 5) + 0.05d = 1.45$

(3) $d + (2d + 5) = 1.45$

(4) $(d - 5) + 2d = 1.45$

Use this space for computations.

14 Donna and Andrew compared their math final exam scores from grade 8 through grade 12. Their scores are shown below.

Donna	
8th	90
9th	92
10th	87
11th	94
12th	95

Andrew	
8th	78
9th	96
10th	87
11th	94
12th	93

Which statement about their final exam scores is correct?

(1) Andrew has a higher mean than Donna.

(2) Donna and Andrew have the same median.

(3) Andrew has a larger interquartile range than Donna.

(4) The 3rd quartile for Donna is greater than the 3rd quartile for Andrew.

15 The first term in a sequence is 5 and the fifth term is 17. What is the common difference?

(1) 2.4

(2) 12

(3) 3

(4) 4

Use this space for computations.

16 A quadratic function and a linear function are graphed on the same set of axes. Which situation is *not* possible?

(1) The graphs do not intersect.

(2) The graphs intersect in one point.

(3) The graphs intersect in two points.

(4) The graphs intersect in three points.

17 The expression $(m - 3)^2$ is equivalent to

(1) $m^2 + 9$

(2) $m^2 - 9$

(3) $m^2 - 6m + 9$

(4) $m^2 - 6m - 9$

Use this space for computations.

18 Mrs. Rossano asked her students to explain why $(3,-4)$ is a solution to $2y + 3x = 1$. Three student responses are given below.

Andrea:
"When the equation is graphed on a calculator, the point can be found within its table."

Bill:
"Substituting $x = 3$ and $y = -4$ into the equation makes it true."

Christine:
"The graph of the line passes through the point $(3,-4)$."

Which students are correct?

(1) Andrea and Bill, only

(2) Bill and Christine, only

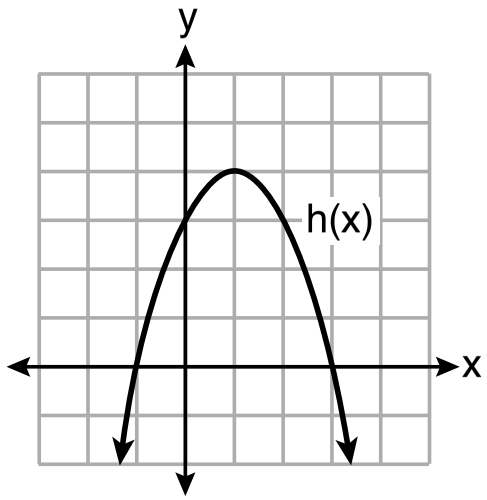
(3) Andrea and Christine, only

(4) Andrea, Bill, and Christine

Use this space for computations.

19 Four quadratic functions are shown below.

x	f(x)
−4	−4
−2	4
−1	5
0	4
2	−4



$g(x) = -(x - 4)^2 + 5$

$j(x) = -\frac{1}{2}x^2 + x + 4$

Which statement is true?

(1) The maximum of $f(x)$ is less than the maximum of $j(x)$.

(2) The maximum of $g(x)$ is less than the maximum of $h(x)$.

(3) The maximum of $f(x)$ equals the maximum of $g(x)$.

(4) The maximum of $h(x)$ equals the maximum of $j(x)$.

Use this space for computations.

20 An example of a sixth-degree polynomial with a leading coefficient of seven and a constant term of four is

(1) $6x^7 - x^5 + 2x + 4$

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

(3) $7x^4 + 6 + x^2$

(4) $5x + 4x^6 + 7$

21 In the equation $A = P(1 \pm r)^t$, A is the total amount, P is the principal amount, r is the annual interest rate, and t is the time in years. Which statement correctly relates information regarding the annual interest rate for each given equation?

(1) For $A = P(1.025)^t$, the principal amount of money is increasing at a 25% interest rate.

(2) For $A = P(1.0052)^t$, the principal amount of money is increasing at a 52% interest rate.

(3) For $A = P(0.86)^t$, the principal amount of money is decreasing at a 14% interest rate.

(4) For $A = P(0.68)^t$, the principal amount of money is decreasing at a 68% interest rate.

Use this space for computations.

22 It takes Tim 4.5 hours to run 50 kilometers. Which expression will allow him to change this rate to minutes per mile?

(1) $\frac{4.5\text{ hr}}{50\text{ km}} \bullet \frac{1.609\text{ km}}{1\text{ mi}} \bullet \frac{60\text{ min}}{1\text{ hr}}$

(2) $\frac{50\text{ km}}{4.5\text{ hr}} \bullet \frac{1\text{ mi}}{1.609\text{ km}} \bullet \frac{60\text{ min}}{1\text{ hr}}$

(3) $\frac{50\text{ km}}{4.5\text{ hr}} \bullet \frac{1\text{ mi}}{1.609\text{ km}} \bullet \frac{1\text{ hr}}{60\text{ min}}$

(4) $\frac{4.5\text{ hr}}{50\text{ km}} \bullet \frac{1\text{ mi}}{1.609\text{ km}} \bullet \frac{60\text{ min}}{1\text{ hr}}$

23 When the equation $\frac{x-1}{2} - \frac{a}{4} = \frac{3a}{4}$ is solved for x in terms of a, the solution is

(1) $\frac{3a}{2} + 1$

(2) $a + 1$

(3) $\frac{4a+1}{2}$

(4) $2a + 1$

24 If a sequence is defined recursively as $a_1 = -3$ and $a_n = -3a_{n-1} - 2$, then a_4 is

(1) -107

(2) -95

(3) 55

(4) 67

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 Is the product of $\sqrt{1024}$ and -3.4 rational or irrational? Explain your answer.

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

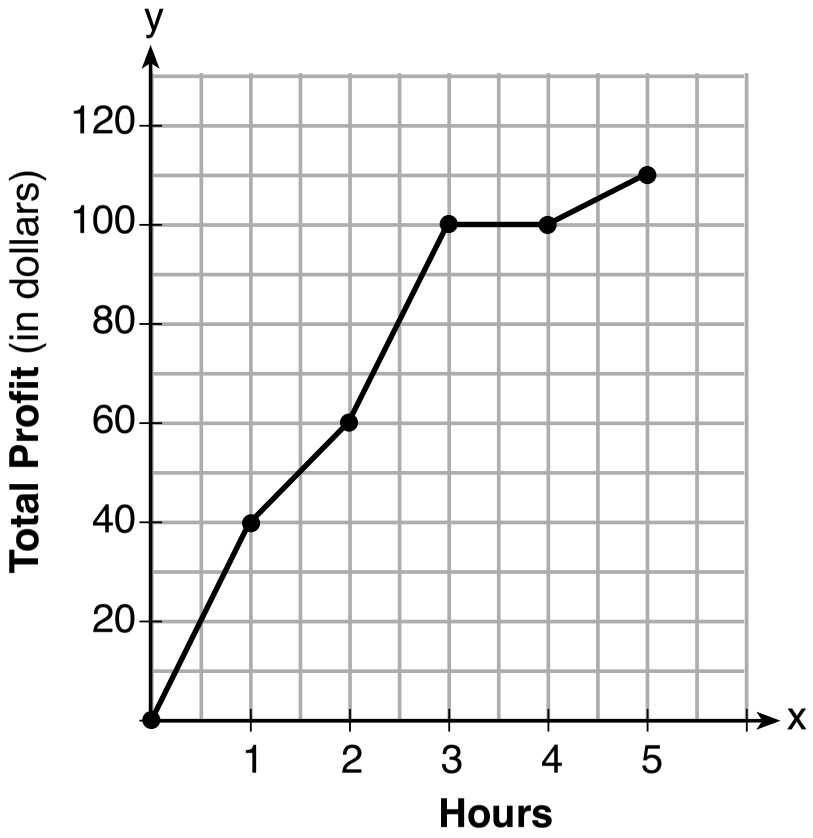
Question 25 continued

26 Describe the transformations performed on the graph of $f(x) = x^2$ to obtain the graph of $g(x)$ when $g(x) = (x - 3)^2 - 4$.

Work space for question 26 is continued on the next page.

Question 26 continued

27 The total profit earned at a garage sale during the first five hours is modeled by the graph shown below.



Question 27 is continued on the next page.

Question 27 continued

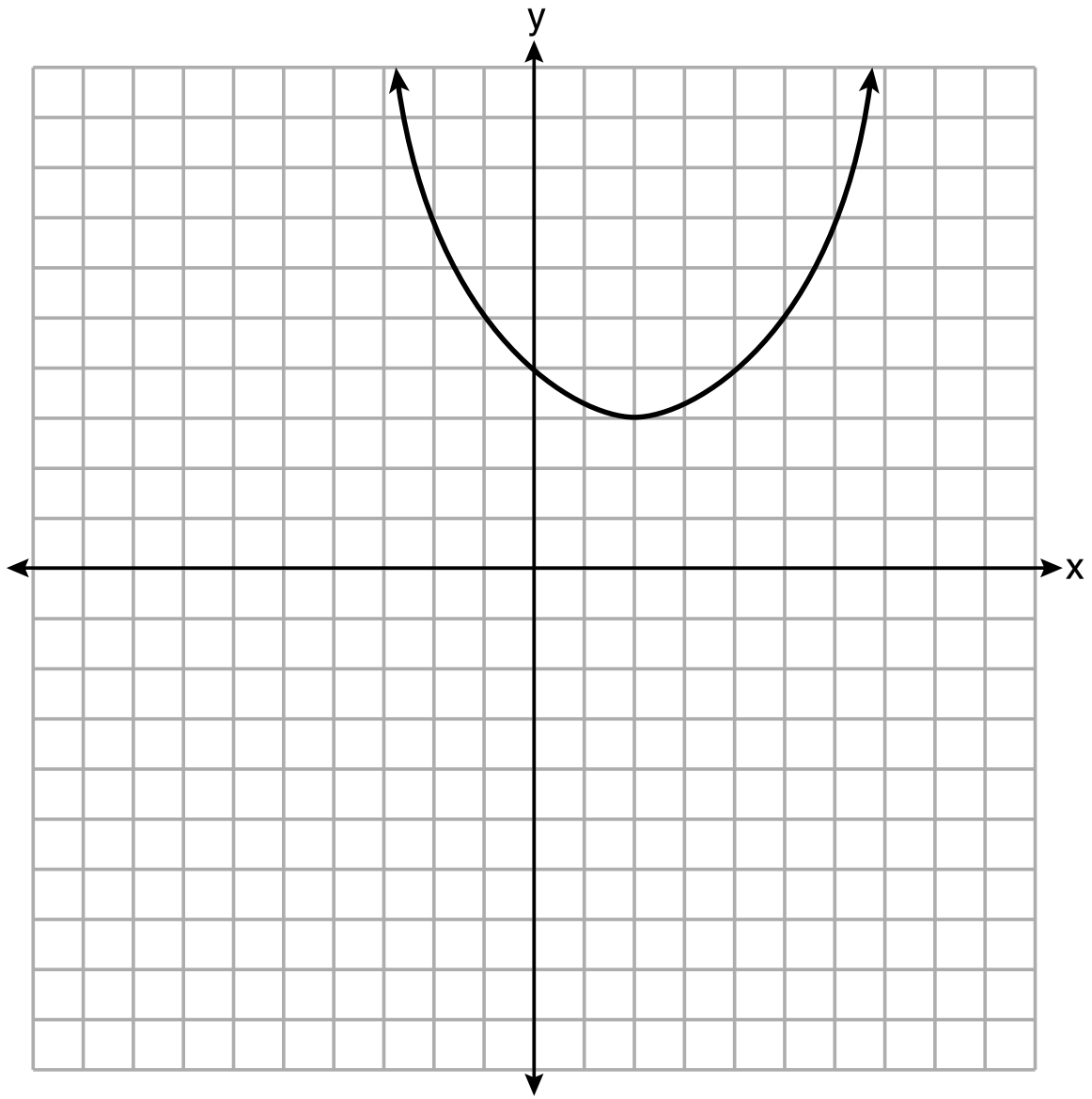
Determine the average rate of change, in dollars per hour, over the interval $1 \leq x \leq 4$.

28 Subtract $3x(x - 2y)$ from $6(x^2 - xy)$ and express your answer as a monomial.

Work space for question 28 is continued on the next page.

Question 28 continued

29 A function is graphed on the set of axes below.



Question 29 is continued on the next page.

Question 29 continued

State the domain of this function.

State the range of this function.

30 Solve $6x^2 + 5x - 6 = 0$ algebraically for the exact values of x.

Work space for question 30 is continued on the next page.

Question 30 continued

31 Factor the expression $x^4 - 36x^2$ completely.

Work space for question 31 is continued on the next page.

Question 31 continued

32 Determine the exact values of x for $x^2 - 8x - 5 = 0$ by completing the square.

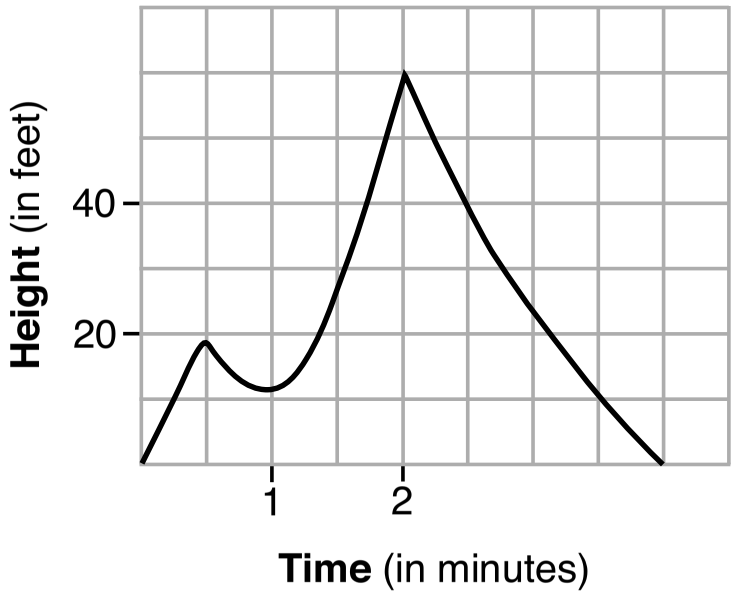
Work space for question 32 is continued on the next page.

Question 32 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]

33 The graph below models the height of Sam's kite over a period of time.



Question 33 is continued on the next page.

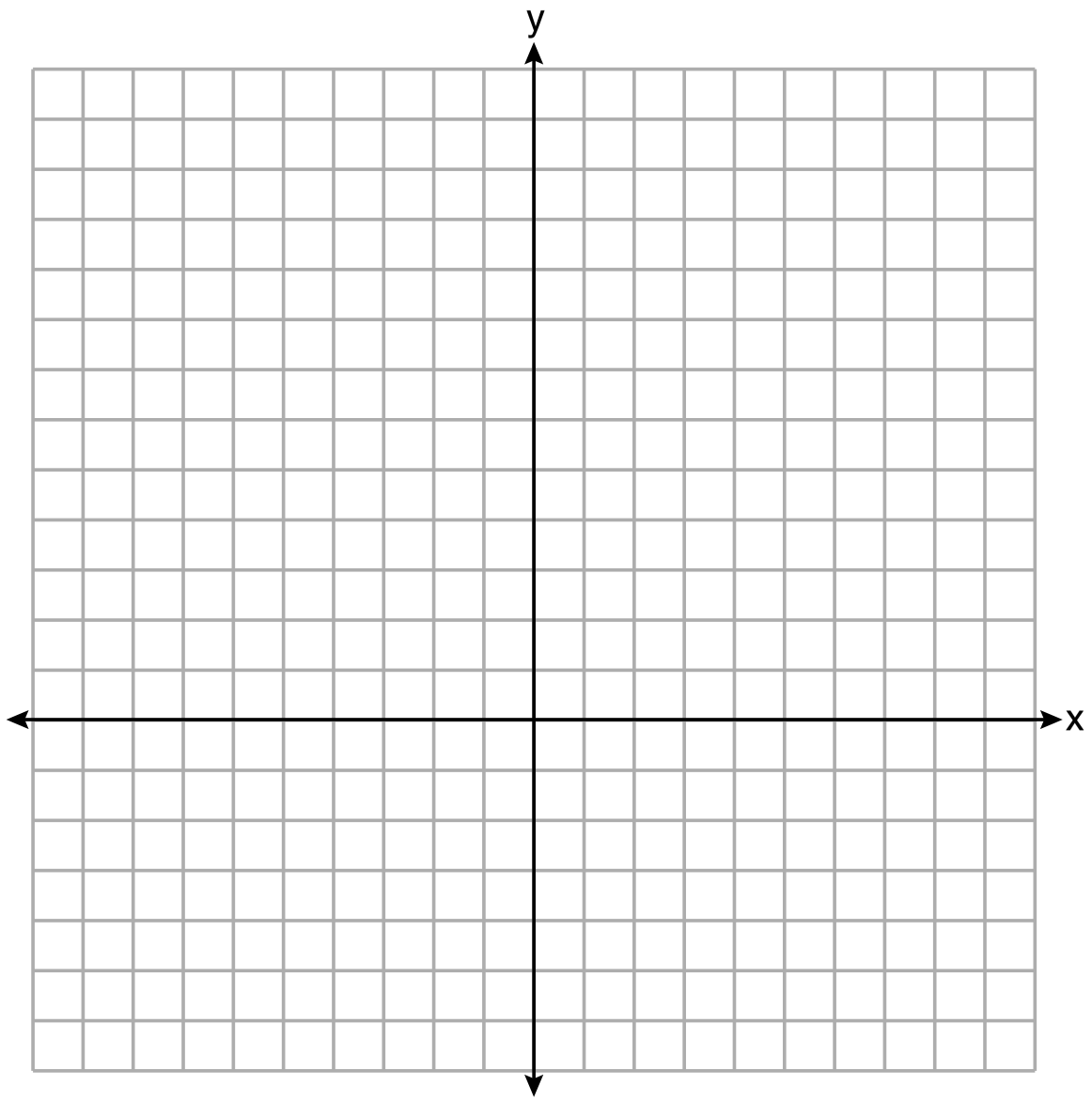
Question 33 continued

Explain what the zeros of the graph represent in the context of the situation.

State the time intervals over which the height of the kite is increasing.

State the maximum height, in feet, that the kite reaches.

34 On the set of axes below, graph $f(x) = x^2 - 1$ and $g(x) = 3^x$.



Question 34 is continued on the next page.

Question 34 continued

Based on your graph, for how many values of x does $f(x) = g(x)$? Explain your reasoning.

35 An insurance agent is looking at records to determine if there is a relationship between a driver's age and percentage of accidents caused by speeding. The table below shows his data.

Age (x)	17	18	21	25	30	35	40	45	50	55	60	65
Percentage of Accidents Caused by Speeding (y)	49	49	48	38	31	33	24	25	16	10	5	6

State the linear regression equation that models the relationship between the driver's age, x, and the percentage of accidents caused by speeding, y. Round all values to the *nearest hundredth*.

Question 35 is continued on the next page.

Question 35 continued

State the value of the correlation coefficient to the *nearest hundredth*. Explain what this means in the context of the problem.

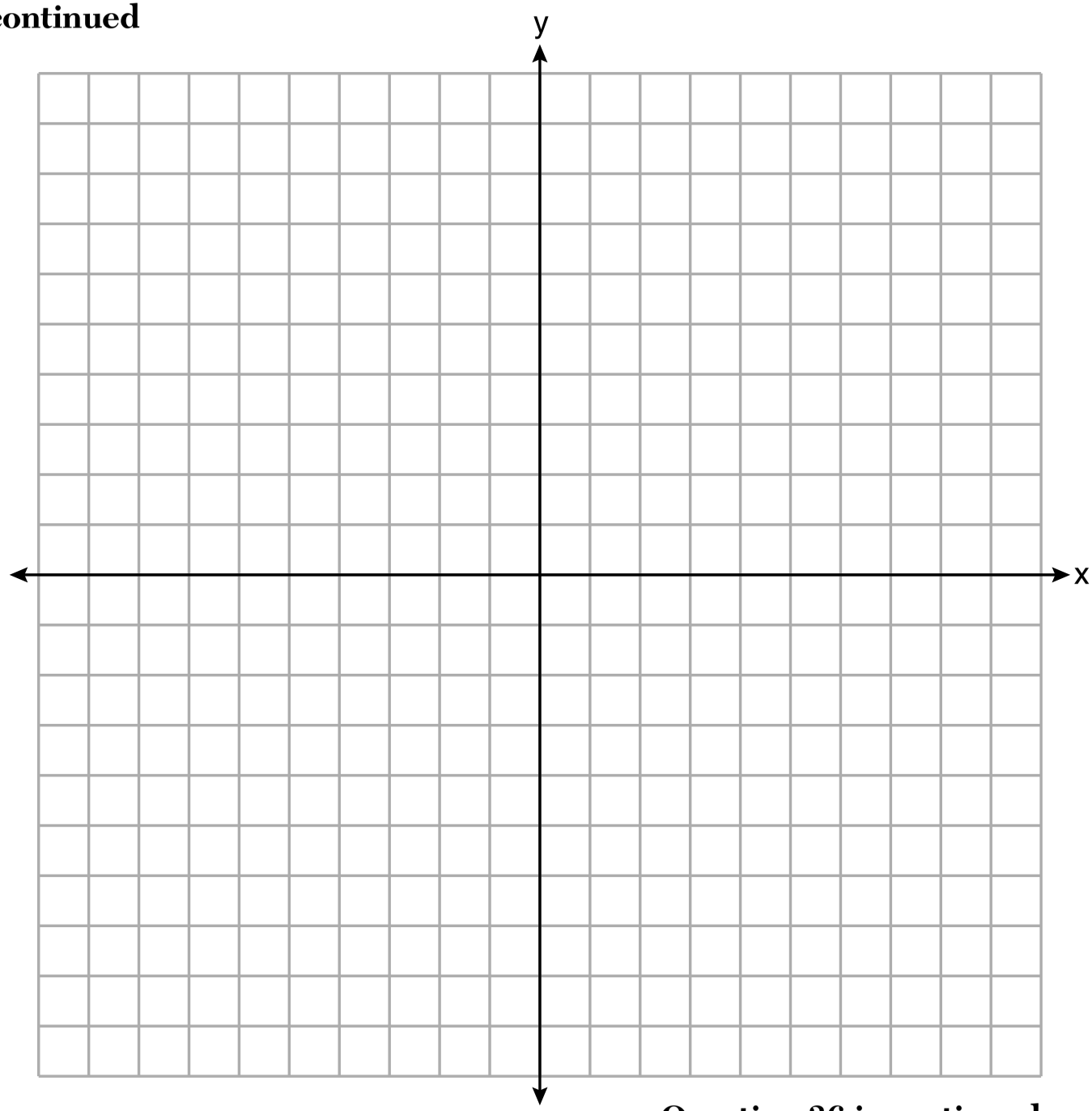
36 Solve the system of inequalities graphically on the set of axes on the next page. Label the solution set S.

$$2x + 3y < 9$$

$$2y \geq 4x + 6$$

The set of axes for question 36 is on the next page.

Question 36 continued



Question 36 is continued on the next page.

Question 36 continued

Determine if the point (0,3) is a solution to this system of inequalities. Justify your answer.

GO RIGHT ON TO THE NEXT PAGE ➡

Part IV

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 At an amusement park, the cost for an adult admission is a, and for a child the cost is c. For a group of six that included two children, the cost was \$325.94. For a group of five that included three children, the cost was \$256.95. All ticket prices include tax.

Write a system of equations, in terms of a and c, that models this situation.

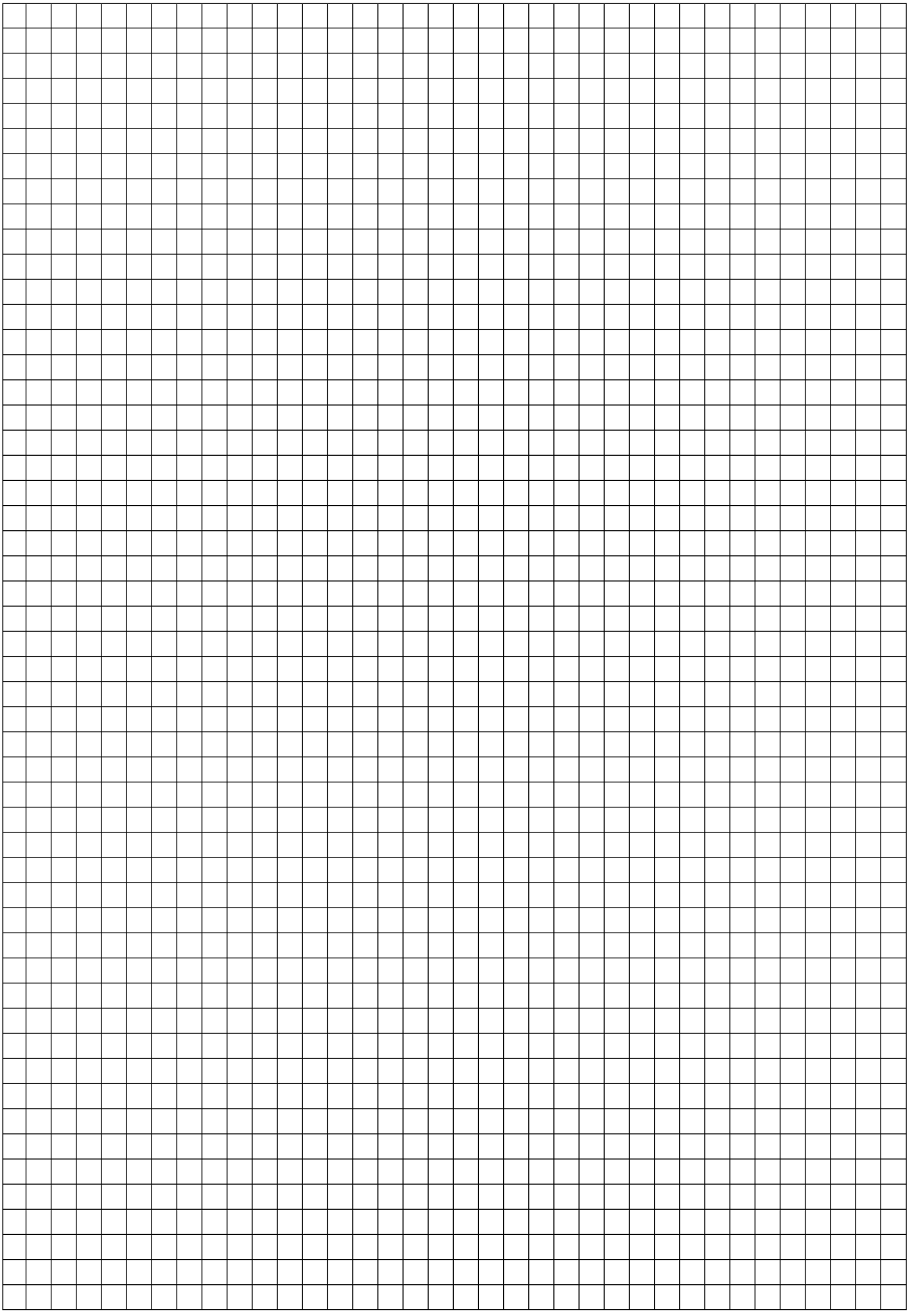
Question 37 is continued on the next page.

Question 37 continued

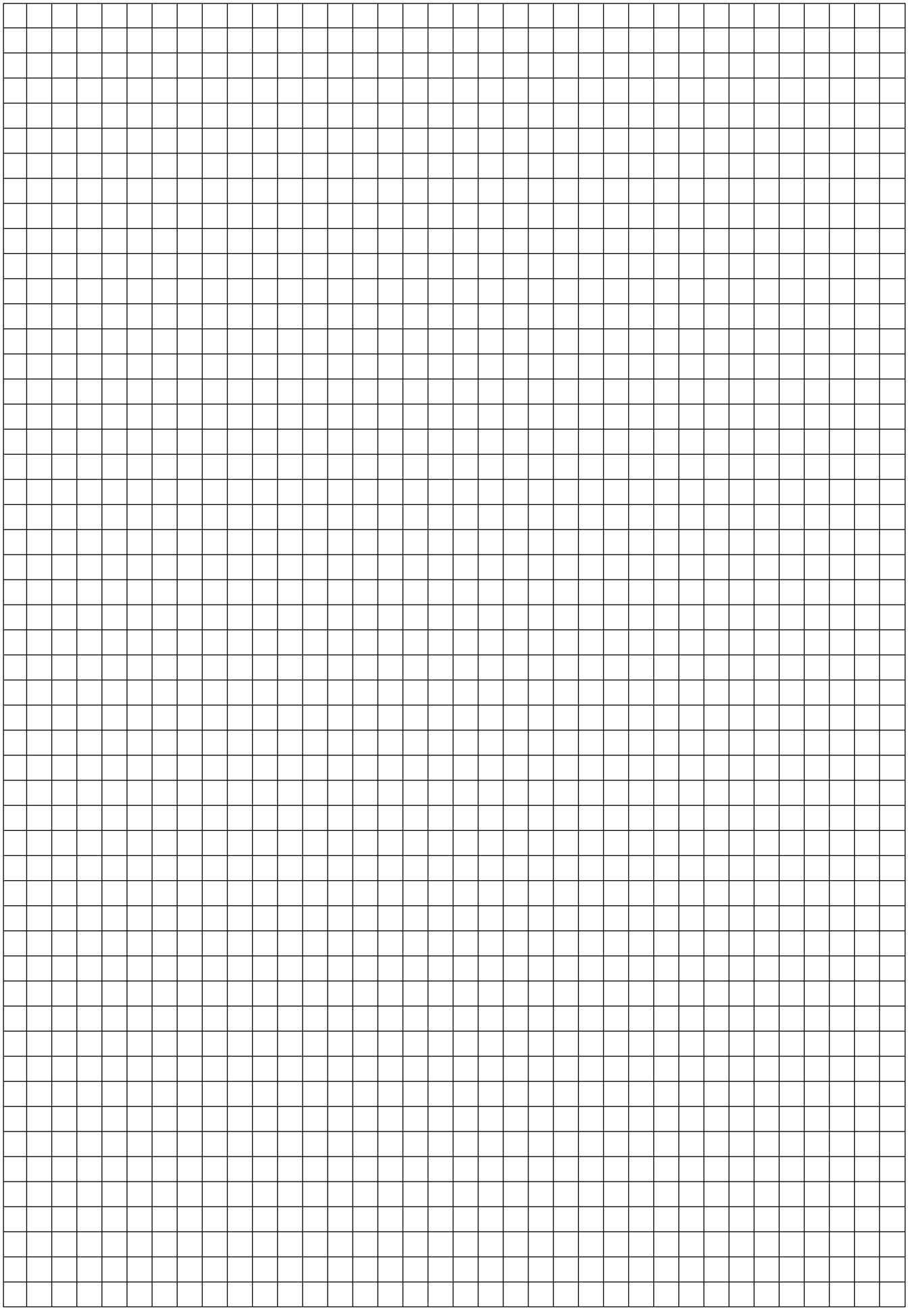
Use your system of equations to determine the exact cost of each type of ticket algebraically.

Determine the cost for a group of four that includes three children.

Scrap Graph Paper — this sheet will *not* be scored.



Scrap Graph Paper — this sheet will *not* be scored.



High School Math Reference Sheet

1 inch = 2.54 centimeters
1 meter = 39.37 inches
1 mile = 5280 feet
1 mile = 1760 yards
1 mile = 1.609 kilometers

1 kilometer = 0.62 mile
1 pound = 16 ounces
1 pound = 0.454 kilogram
1 kilogram = 2.2 pounds
1 ton = 2000 pounds

1 cup = 8 fluid ounces
1 pint = 2 cups
1 quart = 2 pints
1 gallon = 4 quarts
1 gallon = 3.785 liters
1 liter = 0.264 gallon
1 liter = 1000 cubic centimeters

Triangle	$A = \frac{1}{2}bh$
Parallelogram	$A = bh$
Circle	$A = \pi r^2$
Circle	$C = \pi d$ or $C = 2\pi r$
General Prisms	$V = Bh$

Pythagorean Theorem	$a^2 + b^2 = c^2$
Quadratic Formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Arithmetic Sequence	$a_n = a_1 + (n - 1)d$
Geometric Sequence	$a_n = a_1 r^{n-1}$
Geometric Series	$S_n = \frac{a_1 - a_1 r^n}{1 - r}$ where $r \neq 1$

The Reference Sheet is continued on the next page.

Cylinder	$V = \pi r^2 h$
Sphere	$V = \frac{4}{3}\pi r^3$
Cone	$V = \frac{1}{3}\pi r^2 h$
Pyramid	$V = \frac{1}{3}Bh$

Radians	1 radian $= \frac{180}{\pi}$ degrees
Degrees	1 degree $= \frac{\pi}{180}$ radians
Exponential Growth/Decay	$A = A_0 e^{k(t - t_0)} + B_0$