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

ALGEBRA I

Wednesday, January 22, 2020 — 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.

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 If $f(x) = 2(3^x) + 1$, what is the value of $f(2)$?

(1) 13 (3) 37

(2) 19 (4) 54

2 A high school sponsored a badminton tournament. After each round, one-half of the players were eliminated. If there were 64 players at the start of the tournament, which equation models the number of players left after 3 rounds?

(1) $y = 64(1 - .5)^3$ (3) $y = 64(1 - .3)^{0.5}$

(2) $y = 64(1 + .5)^3$ (4) $y = 64(1 + .3)^{0.5}$

3 Given $7x + 2 \geq 58$, which number is *not* in the solution set?

(1) 6 (3) 10

(2) 8 (4) 12

4 Which table could represent a function?

x	f(x)
1	4
2	2
3	4
2	6

(1)

x	h(x)
2	6
0	4
1	6
2	2

(3)

x	g(x)
1	2
2	4
3	6
4	2

(2)

x	k(x)
2	2
3	2
4	6
3	6

(4)

Use this space for computations.

5 Which value of x makes $\frac{x-3}{4}+\frac{2}{3}=\frac{17}{12}$ true?

(1) 8 (3) 0

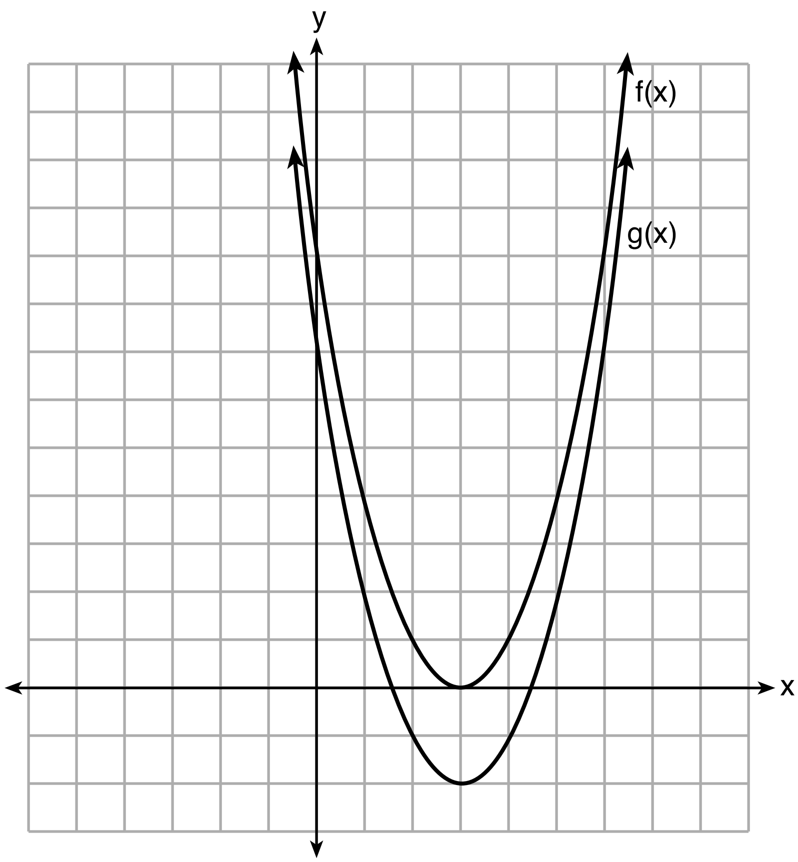
(2) 6 (4) 4

6 Which expression is equivalent to $18x^2 - 50$?

(1) $2(3x + 5)^2$ (3) $2(3x - 5)(3x + 5)$

(2) $2(3x - 5)^2$ (4) $2(3x - 25)(3x + 25)$

7 The functions $f(x) = x^2 - 6x + 9$ and $g(x) = f(x) + k$ are graphed below.



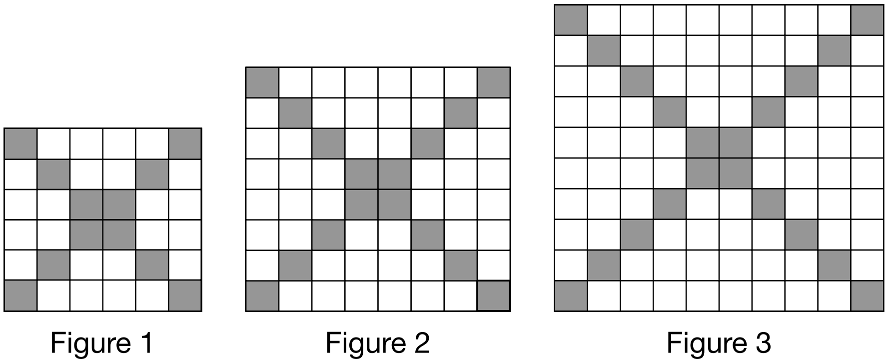
Which value of k would result in the graph of $g(x)$?

(1) 0 (3) -3

(2) 2 (4) -2

Use this space for computations.

8 The shaded boxes in the figures below represent a sequence.



If figure 1 represents the first term and this pattern continues, how many shaded blocks will be in figure 35?

(1) 55 (3) 420

(2) 148 (4) 805

9 The zeros of the function $f(x) = x^3 - 9x^2$ are

(1) 9, only (3) 0 and 3, only

(2) 0 and 9 (4) -3, 0, and 3

10 A middle school conducted a survey of students to determine if they spent more of their time playing games or watching videos on their tablets. The results are shown in the table below.

	Playing Games	Watching Videos	Total
Boys	138	46	184
Girls	54	142	196
Total	192	188	380

Of the students who spent more time playing games on their tablets, approximately what percent were boys?

(1) 41 (3) 72

(2) 56 (4) 75

Use this space for computations.

11 Which statement best describes the solutions of a two-variable equation?

(1) The ordered pairs must lie on the graphed equation.

(2) The ordered pairs must lie near the graphed equation.

(3) The ordered pairs must have $x = 0$ for one coordinate.

(4) The ordered pairs must have $y = 0$ for one coordinate.

12 The expression $x^2 - 10x + 24$ is equivalent to

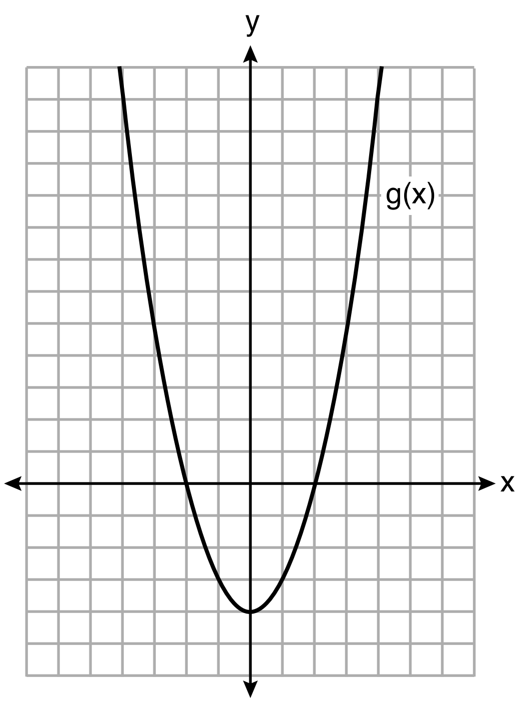
(1) $(x + 12)(x - 2)$

(2) $(x - 12)(x + 2)$

(3) $(x + 6)(x + 4)$

(4) $(x - 6)(x - 4)$

13 Which statement is true about the functions $f(x)$ and $g(x)$, given below?



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

(1) The minimum value of $g(x)$ is greater than the maximum value of $f(x)$.

(2) $f(x)$ and $g(x)$ have the same y-intercept.

(3) $f(x)$ and $g(x)$ have the same roots.

(4) $f(x) = g(x)$ when $x = -4$.

Use this space for computations.

14 The equation $V(t) = 12{,}000(0.75)^t$ represents the value of a motorcycle t years after it was purchased. Which statement is true?

(1) The motorcycle cost \$9000 when purchased.

(2) The motorcycle cost \$12,000 when purchased.

(3) The motorcycle's value is decreasing at a rate of 75% each year.

(4) The motorcycle's value is decreasing at a rate of 0.25% each year.

15 The solutions to $(x + 4)^2 - 2 = 7$ are

(1) $-4 \pm \sqrt{5}$ (3) -1 and -7

(2) $4 \pm \sqrt{5}$ (4) 1 and 7

16 Which expression is *not* equivalent to $-4x^3 + x^2 - 6x + 8$?

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

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

17 Which situation could be modeled as a linear equation?

(1) The value of a car decreases by 10% every year.

(2) The number of fish in a lake doubles every 5 years.

(3) Two liters of water evaporate from a pool every day.

(4) The amount of caffeine in a person's body decreases by $\frac{1}{3}$ every 2 hours.

18 The range of the function $f(x) = |x + 3| - 5$ is

(1) $[-5, \infty)$ (3) $[3, \infty)$

(2) $(-5, \infty)$ (4) $(3, \infty)$

Use this space for computations.

19 A laboratory technician used the function $t(m) = 2(3)^{2m + 1}$ to model her research. Consider the following expressions:

I. $6(3)^{2m}$ II. $6(6)^{2m}$ III. $6(9)^{m}$

The function $t(m)$ is equivalent to

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

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

20 Which system of equations has the same solutions as the system below?

$$3x - y = 7$$
$$2x + 3y = 12$$

(1) $6x - 2y = 14$
$-6x + 9y = 36$

(3) $-9x - 3y = -21$
$2x + 3y = 12$

(2) $18x - 6y = 42$
$4x + 6y = 24$

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

21 A population of paramecia, P, can be modeled using the exponential function $P(t) = 3(2)^t$, where t is the number of days since the population was first observed. Which domain is most appropriate to use to determine the population over the course of the first two weeks?

(1) $t \geq 0$ (3) $0 \leq t \leq 2$

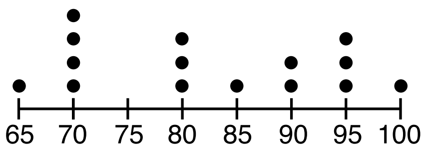
(2) $t \leq 2$ (4) $0 \leq t \leq 14$

Use this space for computations.

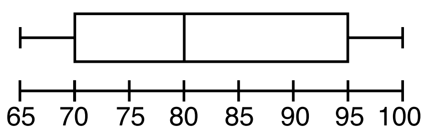
22 Given the following data set:

65, 70, 70, 70, 70, 80, 80, 80, 85, 90, 90, 95, 95, 95, 100

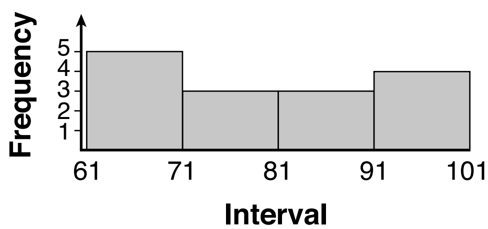
Which representations are correct for this data set?



I



II



III

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

Use this space for computations.

23 A recursively defined sequence is shown below.

$$a_1 = 5$$
$$a_{n+1} = 2a_n - 7$$

The value of a_4 is

(1) -9 (3) 8

(2) -1 (4) 15

24 Which polynomial has a leading coefficient of 4 and a degree of 3?

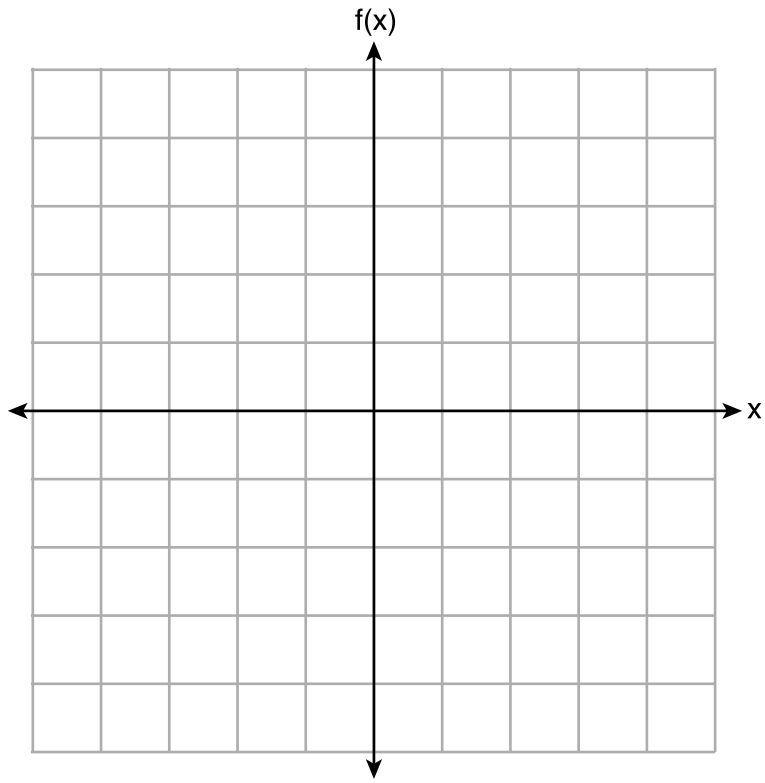
(1) $3x^4 - 2x^2 + 4x - 7$ (3) $4x^4 - 3x^3 + 2x^2$

(2) $4 + x - 4x^2 + 5x^3$ (4) $2x + x^2 + 4x^3$

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 Graph $f(x) = -\sqrt{x} + 1$ on the set of axes below.



26 Maria orders T-shirts for her volleyball camp. Adult-sized T-shirts cost \$6.25 each and youth-sized T-shirts cost \$4.50 each. Maria has \$550 to purchase both adult-sized and youth-sized T-shirts. If she purchases 45 youth-sized T-shirts, determine algebraically the maximum number of adult-sized T-shirts she can purchase.

27 A news report suggested that an adult should drink a minimum of 4 pints of water per day. Based on this report, determine the *minimum* amount of water an adult should drink, in fluid ounces, per week.

28 Express $(3x - 4)(x + 7) - \frac{1}{4}x^2$ as a trinomial in standard form.

29 John was given the equation $4(2a + 3) = -3(a - 1) + 31 - 11a$ to solve. Some of the steps and their reasons have already been completed. State a property of numbers for each missing reason.

$4(2a + 3) = -3(a - 1) + 31 - 11a$	Given
$8a + 12 = -3a + 3 + 31 - 11a$	____________________
$8a + 12 = 34 - 14a$	Combining like terms
$22a + 12 = 34$	____________________

30 State whether the product of $\sqrt{3}$ and $\sqrt{9}$ is rational or irrational. Explain your answer.

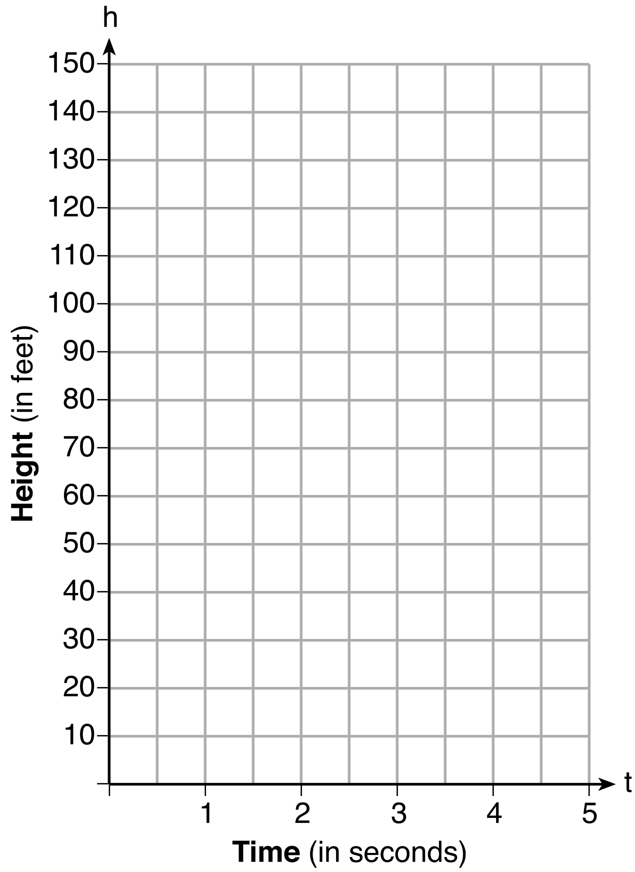
31 Use the method of completing the square to determine the exact values of x for the equation $x^2 - 8x + 6 = 0$.

32 A formula for determining the finite sum, S, of an arithmetic sequence of numbers is $S = \frac{n}{2}(a + b)$, where n is the number of terms, a is the first term, and b is the last term. Express b in terms of a, S, and n.

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]

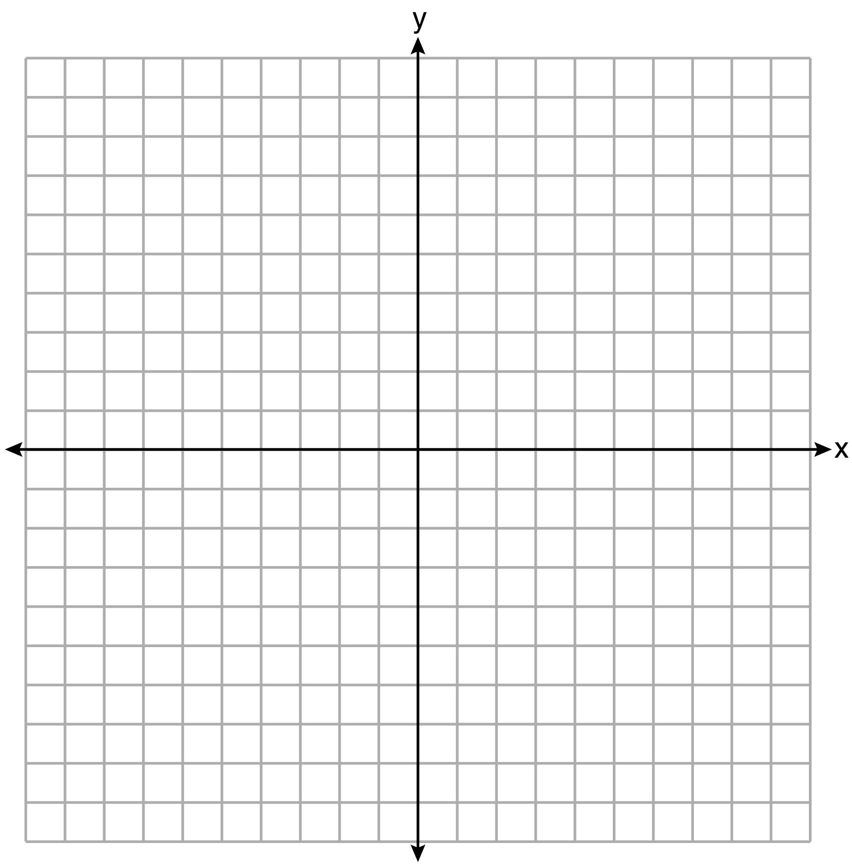
33 Michael threw a ball into the air from the top of a building. The height of the ball, in feet, is modeled by the equation $h = -16t^2 + 64t + 60$, where t is the elapsed time, in seconds. Graph this equation on the set of axes below.



Determine the average rate of change, in feet per second, from when Michael released the ball to when the ball reached its maximum height.

34 Graph the system of inequalities:

$$-x + 2y - 4 < 0$$
$$3x + 4y + 4 \geq 0$$



Stephen says the point (0,0) is a solution to this system. Determine if he is correct, and explain your reasoning.

35 The following table represents a sample of sale prices, in thousands of dollars, and number of new homes available at that price in 2017.

Sale Price, p (in thousands of dollars)	160	180	200	220	240	260	280
Number of New Homes Available f(p)	126	103	82	75	82	40	20

State the linear regression function, $f(p)$, that estimates the number of new homes available at a specific sale price, p. Round all values to the *nearest hundredth*.

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

36 The length of a rectangular sign is 6 inches more than half its width. The area of this sign is 432 square inches. Write an equation in one variable that could be used to find the number of inches in the dimensions of this sign.

Solve this equation algebraically to determine the dimensions of this sign, in inches.

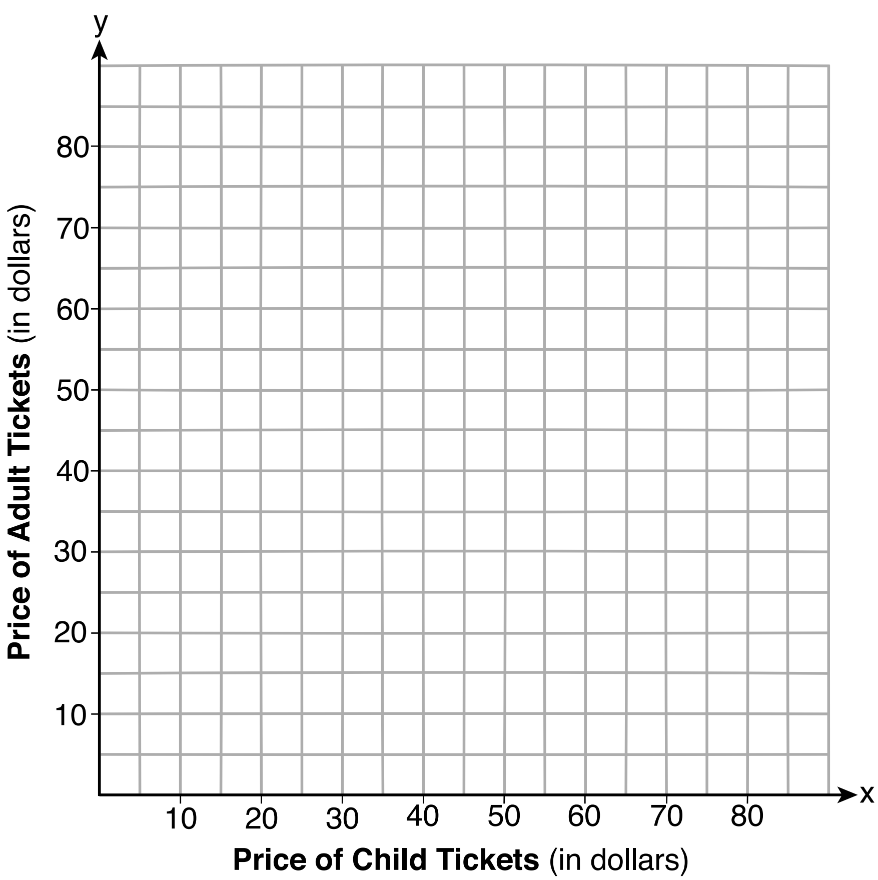
Part IV

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 Two families went to Rollercoaster World. The Brown family paid \$170 for 3 children and 2 adults. The Peckham family paid \$360 for 4 children and 6 adults.

If x is the price of a child's ticket in dollars and y is the price of an adult's ticket in dollars, write a system of equations that models this situation.

Graph your system of equations on the set of axes below.



Question 37 is continued on the next page.

Question 37 continued

State the coordinates of the point of intersection.

Explain what each coordinate of the point of intersection means in the context of the problem.

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

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

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