NYS
Algebra 1
Regents Exams

June 2016

June 2017

June 2018

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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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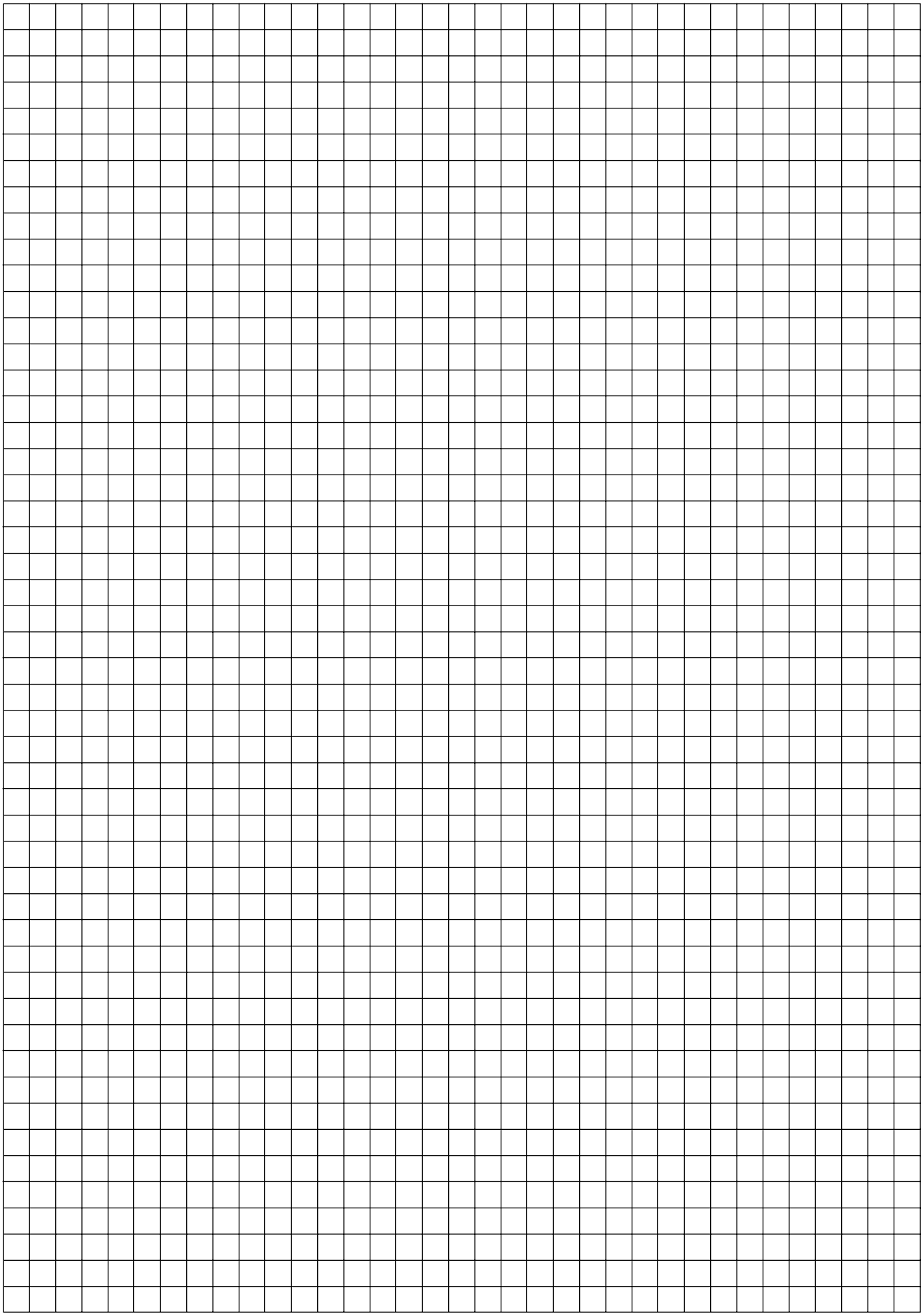

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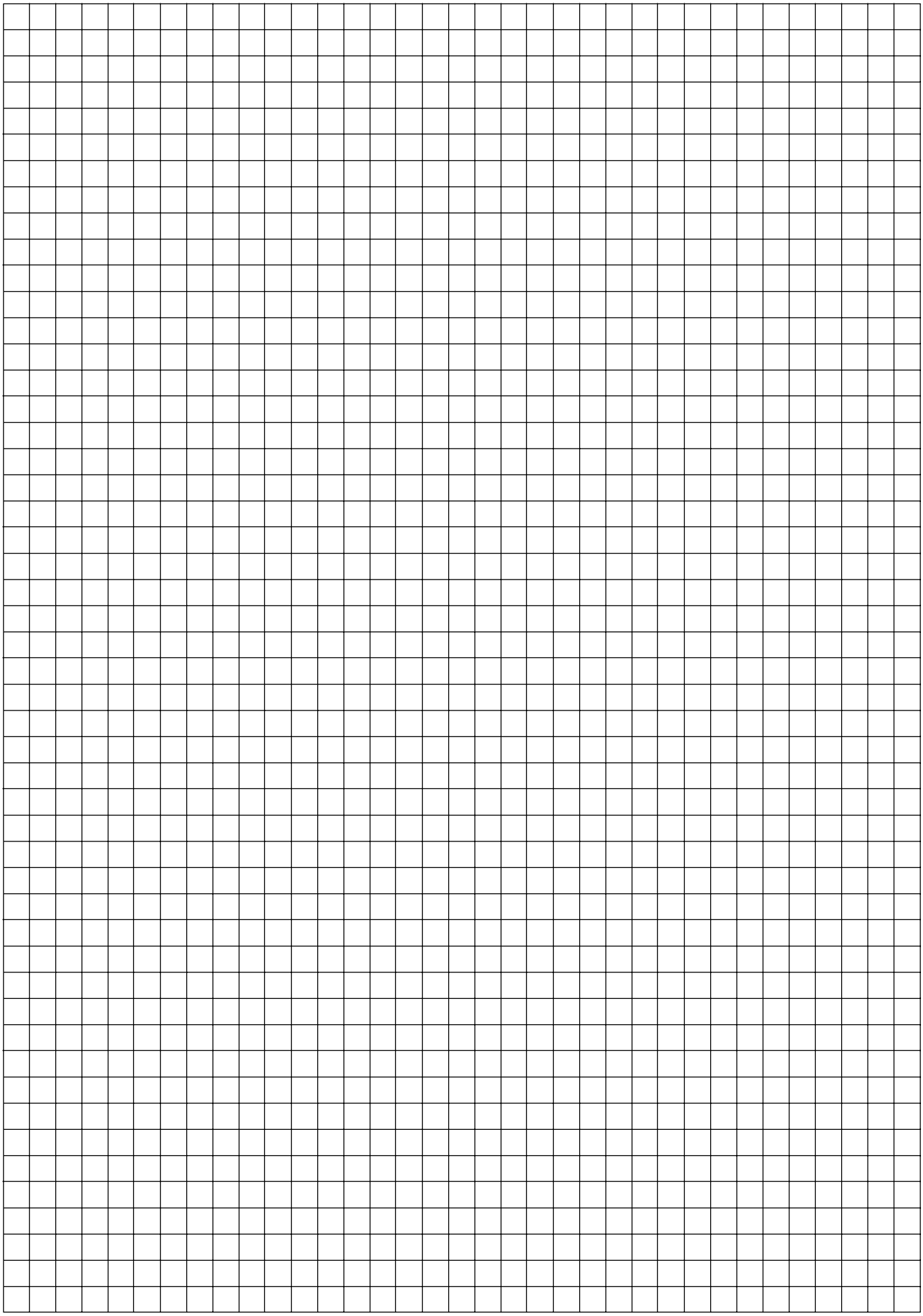

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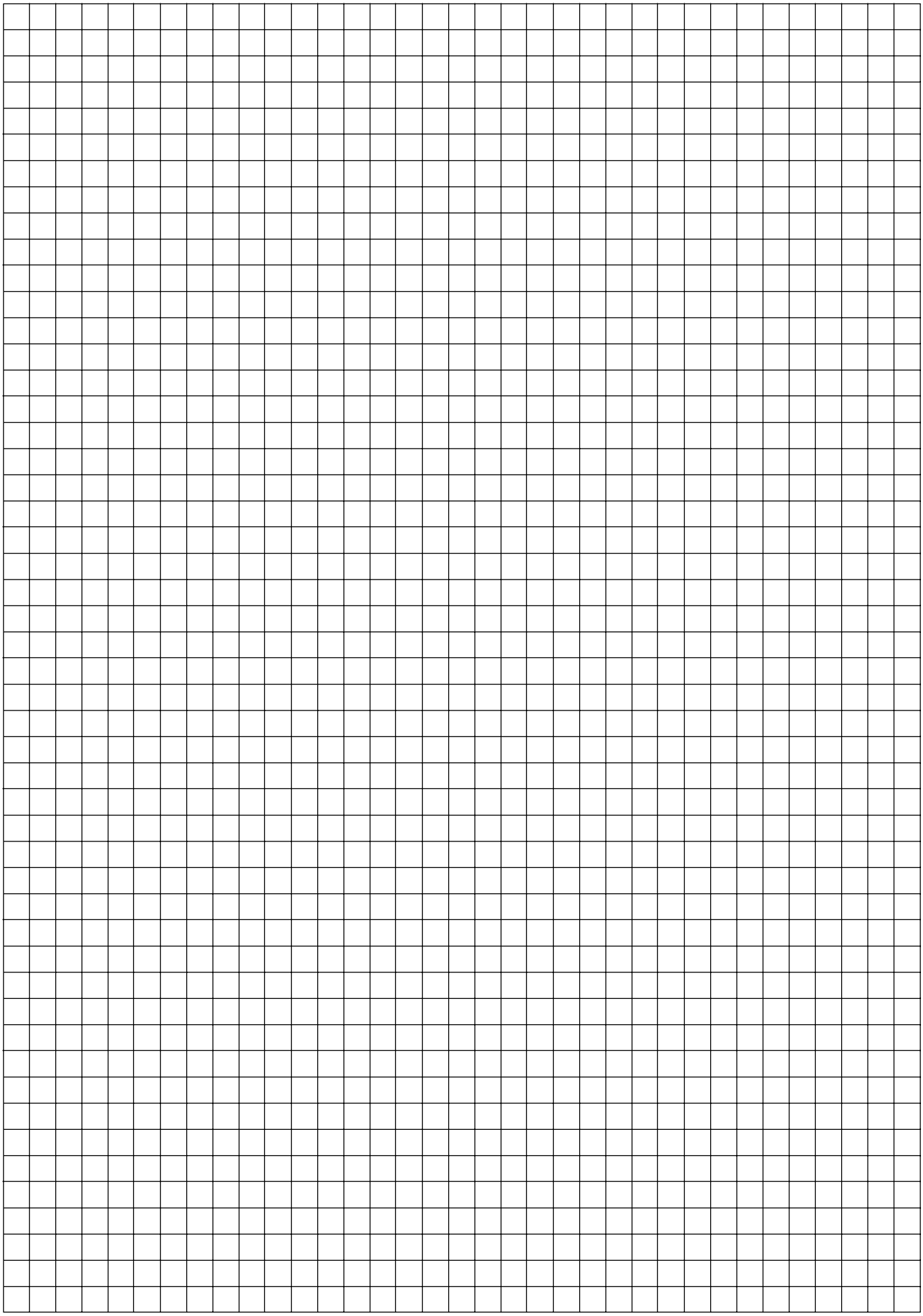

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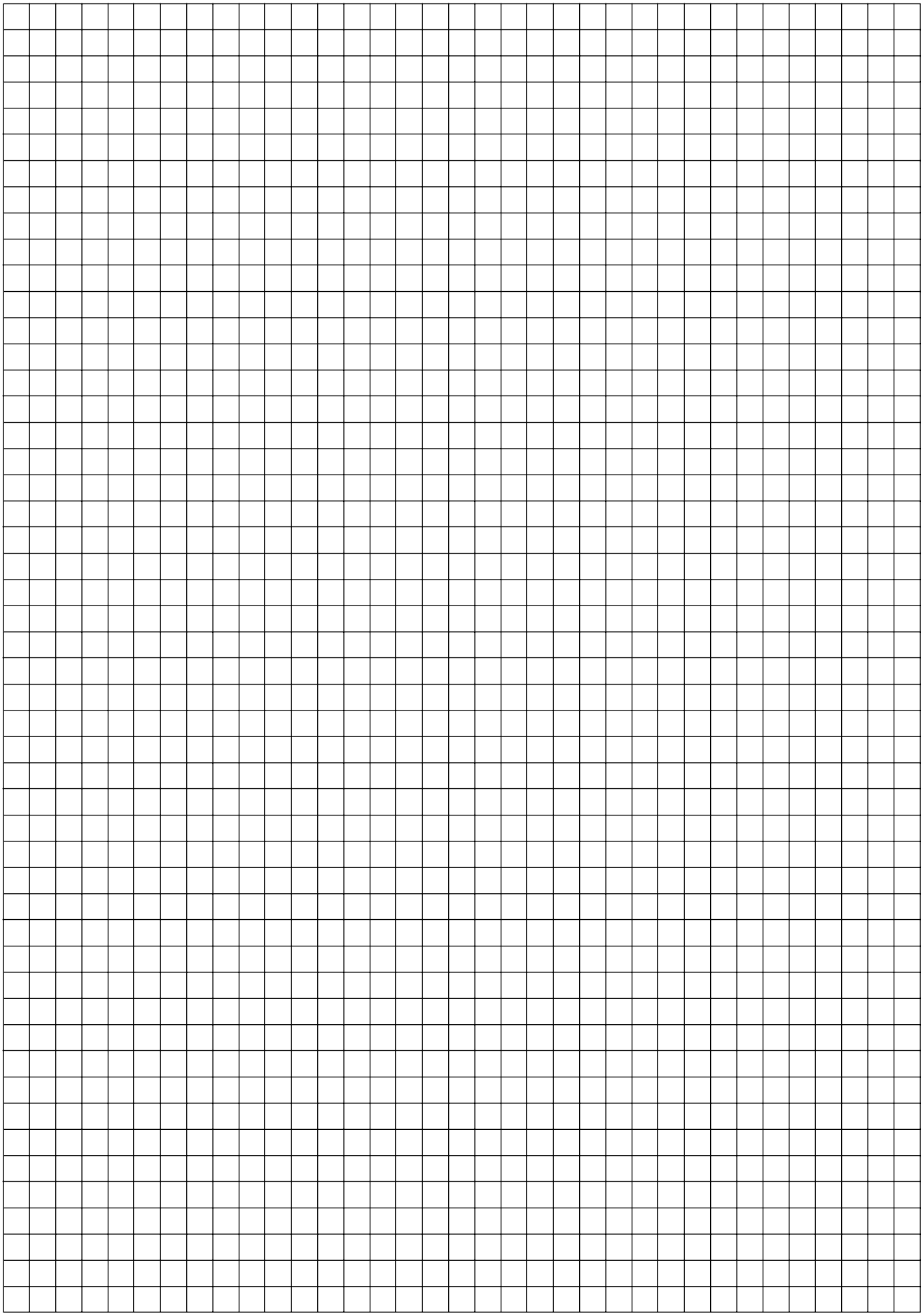

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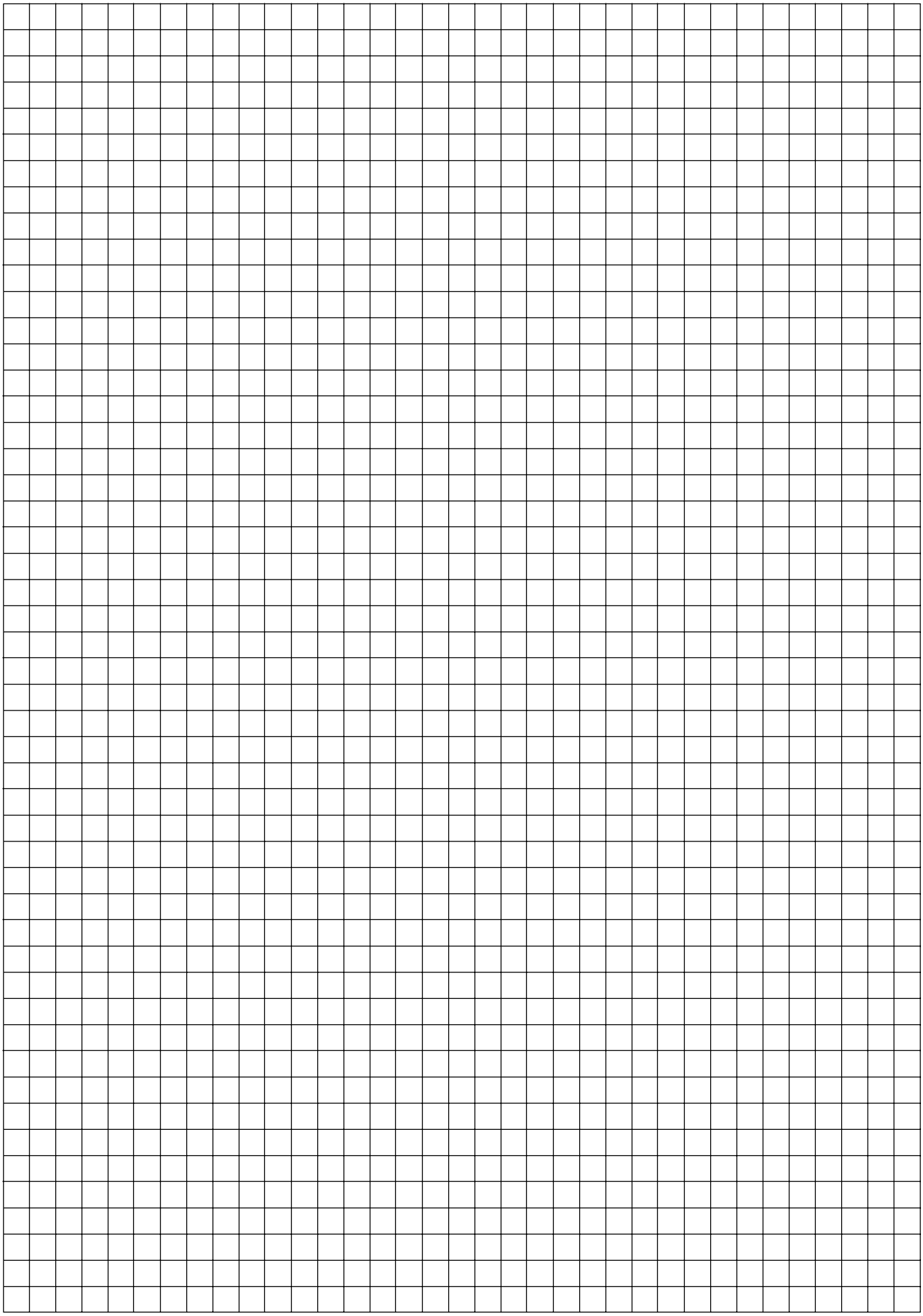

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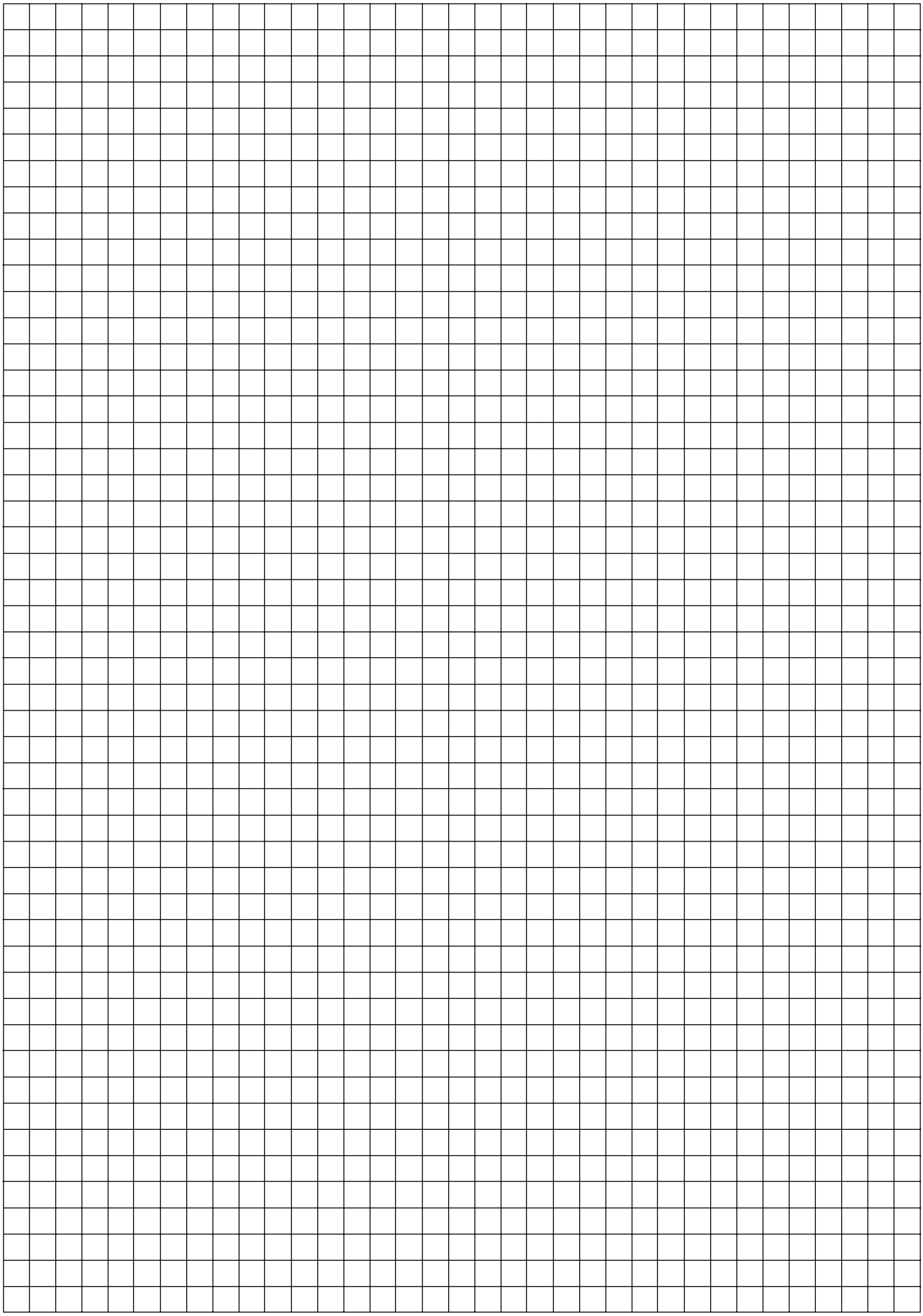

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June 2016

Algebra Regents

And

Answers

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

ALGEBRA I (Common Core)

Thursday, June 16, 2016 — 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. 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 The expression $x^4 - 16$ is equivalent to

(1) $(x^2 + 8)(x^2 - 8)$

(2) $(x^2 - 8)(x^2 - 8)$

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

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

2 An expression of the fifth degree is written with a leading coefficient of seven and a constant of six. Which expression is correctly written for these conditions?

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

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

(3) $6x^7 - x^5 + 5$

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

3 The table below shows the year and the number of households in a building that had high-speed broadband internet access.

Number of Households	11	16	23	33	42	47
Year	2002	2003	2004	2005	2006	2007

For which interval of time was the average rate of change the *smallest*?

(1) 2002 – 2004

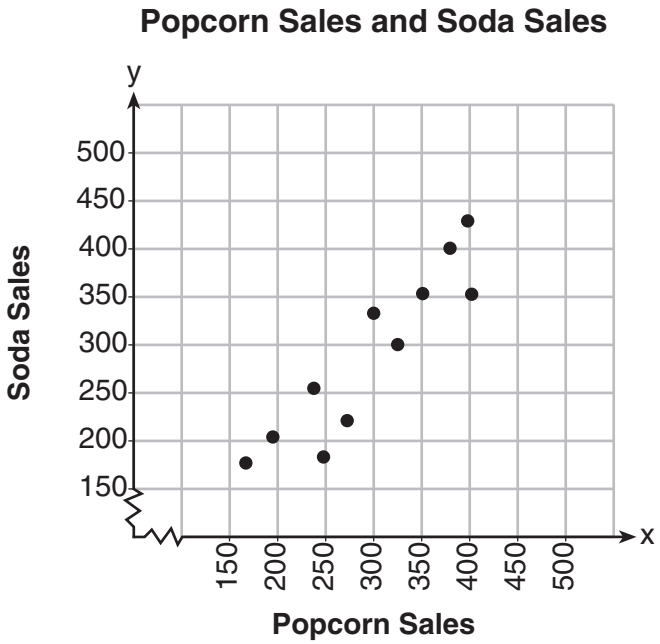
(2) 2003 – 2005

(3) 2004 – 2006

(4) 2005 – 2007

Use this space for computations.

4 The scatterplot below compares the number of bags of popcorn and the number of sodas sold at each performance of the circus over one week.



Which conclusion can be drawn from the scatterplot?

(1) There is a negative correlation between popcorn sales and soda sales.

(2) There is a positive correlation between popcorn sales and soda sales.

(3) There is no correlation between popcorn sales and soda sales.

(4) Buying popcorn causes people to buy soda.

5 The Celluloid Cinema sold 150 tickets to a movie. Some of these were child tickets and the rest were adult tickets. A child ticket cost \$7.75 and an adult ticket cost \$10.25. If the cinema sold \$1470 worth of tickets, which system of equations could be used to determine how many adult tickets, a, and how many child tickets, c, were sold?

(1) $a + c = 150$
$10.25a + 7.75c = 1470$

(2) $a + c = 1470$
$10.25a + 7.75c = 150$

(3) $a + c = 150$
$7.75a + 10.25c = 1470$

(4) $a + c = 1470$
$7.75a + 10.25c = 150$

Use this space for computations.

6 The tables below show the values of four different functions for given values of x.

x	f(x)
1	12
2	19
3	26
4	33

x	g(x)
1	–1
2	1
3	5
4	13

x	h(x)
1	9
2	12
3	17
4	24

x	k(x)
1	–2
2	4
3	14
4	28

Which table represents a linear function?

(1) $f(x)$
(2) $g(x)$
(3) $h(x)$
(4) $k(x)$

7 The acidity in a swimming pool is considered normal if the average of three pH readings, p, is defined such that $7.0 < p < 7.8$. If the first two readings are 7.2 and 7.6, which value for the third reading will result in an overall rating of normal?

(1) 6.2
(2) 7.3
(3) 8.6
(4) 8.8

8 Dan took 12.5 seconds to run the 100-meter dash. He calculated the time to be approximately

(1) 0.2083 minute
(2) 750 minutes
(3) 0.2083 hour
(4) 0.52083 hour

9 When $3x + 2 \leq 5(x - 4)$ is solved for x, the solution is

(1) $x \leq 3$
(2) $x \geq 3$
(3) $x \leq -11$
(4) $x \geq 11$

Use this space for computations.

10 The expression $3(x^2 - 1) - (x^2 - 7x + 10)$ is equivalent to

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

(2) $2x^2 + 7x - 13$

(3) $2x^2 - 7x + 9$

(4) $2x^2 + 7x - 11$

11 The range of the function $f(x) = x^2 + 2x - 8$ is all real numbers

(1) less than or equal to -9

(2) greater than or equal to -9

(3) less than or equal to -1

(4) greater than or equal to -1

12 The zeros of the function $f(x) = x^2 - 5x - 6$ are

(1) -1 and 6

(2) 1 and -6

(3) 2 and -3

(4) -2 and 3

13 In a sequence, the first term is 4 and the common difference is 3. The fifth term of this sequence is

(1) -11

(2) -8

(3) 16

(4) 19

14 The growth of a certain organism can be modeled by $C(t) = 10(1.029)^{24t}$, where $C(t)$ is the total number of cells after t hours. Which function is approximately equivalent to $C(t)$?

(1) $C(t) = 240(.083)^{24t}$

(2) $C(t) = 10(.083)^t$

(3) $C(t) = 10(1.986)^t$

(4) $C(t) = 240(1.986)^{\frac{t}{24}}$

Use this space for computations.

15 A public opinion poll was taken to explore the relationship between age and support for a candidate in an election. The results of the poll are summarized in the table below.

Age	For	Against	No Opinion
21–40	30	12	8
41–60	20	40	15
Over 60	25	35	15

What percent of the 21–40 age group was for the candidate?

(1) 15
(2) 25
(3) 40
(4) 60

16 Which equation and ordered pair represent the correct vertex form and vertex for $j(x) = x^2 - 12x + 7$?

(1) $j(x) = (x - 6)^2 + 43, \quad (6,43)$
(2) $j(x) = (x - 6)^2 + 43, \quad (-6,43)$
(3) $j(x) = (x - 6)^2 - 29, \quad (6,-29)$
(4) $j(x) = (x - 6)^2 - 29, \quad (-6,-29)$

17 A student invests \$500 for 3 years in a savings account that earns 4% interest per year. No further deposits or withdrawals are made during this time. Which statement does *not* yield the correct balance in the account at the end of 3 years?

(1) $500(1.04)^3$
(2) $500(1 - .04)^3$
(3) $500(1 + .04)(1 + .04)(1 + .04)$
(4) $500 + 500(.04) + 520(.04) + 540.8(.04)$

Use this space for computations.

18 The line represented by the equation $4y + 2x = 33.6$ shares a solution point with the line represented by the table below.

x	y
–5	3.2
–2	3.8
2	4.6
4	5
11	6.4

The solution for this system is

(1) $(-14.0,-1.4)$

(2) $(-6.8,5.0)$

(3) $(1.9,4.6)$

(4) $(6.0,5.4)$

19 What is the solution of the equation $2(x + 2)^2 - 4 = 28$?

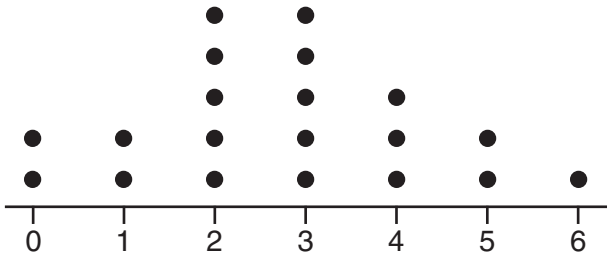
(1) 6, only

(2) 2, only

(3) 2 and -6

(4) 6 and -2

20 The dot plot shown below represents the number of pets owned by students in a class.



Which statement about the data is *not* true?

(1) The median is 3.

(2) The interquartile range is 2.

(3) The mean is 3.

(4) The data contain no outliers.

Use this space for computations.

21 What is the largest integer, x, for which the value of $f(x) = 5x^4 + 30x^2 + 9$ will be greater than the value of $g(x) = 3^x$?

(1) 7
(2) 8
(3) 9
(4) 10

22 The graphs of the functions $f(x) = |x - 3| + 1$ and $g(x) = 2x + 1$ are drawn. Which statement about these functions is true?

(1) The solution to $f(x) = g(x)$ is 3.
(2) The solution to $f(x) = g(x)$ is 1.
(3) The graphs intersect when $y = 1$.
(4) The graphs intersect when $x = 3$.

23 A store sells self-serve frozen yogurt sundaes. The function $C(w)$ represents the cost, in dollars, of a sundae weighing w ounces. An appropriate domain for the function would be

(1) integers
(2) rational numbers
(3) nonnegative integers
(4) nonnegative rational numbers

24 Sara was asked to solve this word problem: "The product of two consecutive integers is 156. What are the integers?"

What type of equation should she create to solve this problem?

(1) linear
(2) quadratic
(3) exponential
(4) absolute value

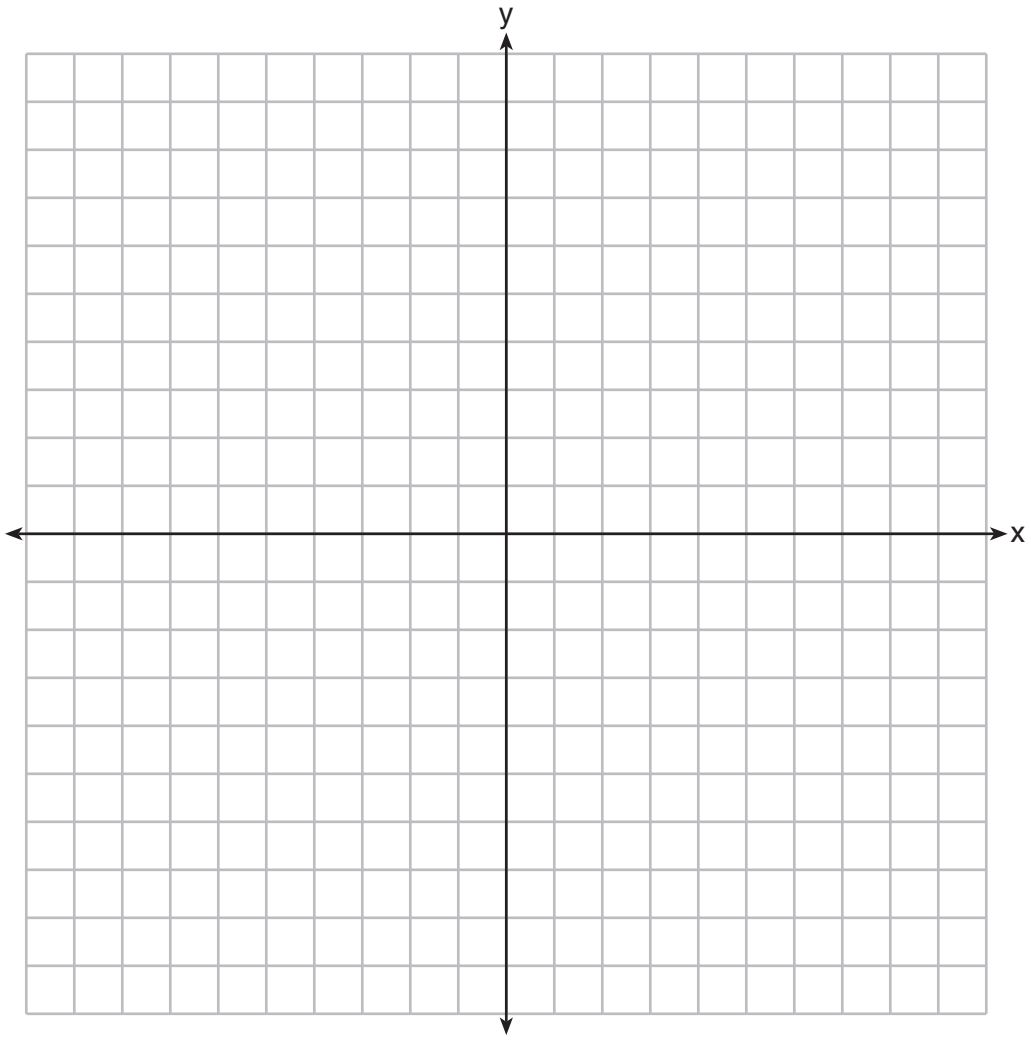
Part II

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 Given that $f(x) = 2x + 1$, find $g(x)$ if $g(x) = 2[f(x)]^2 - 1$.

26 Determine if the product of $3\sqrt{2}$ and $8\sqrt{18}$ is rational or irrational. Explain your answer.

27 On the set of axes below, draw the graph of $y = x^2 - 4x - 1$.



State the equation of the axis of symmetry.

28 Amy solved the equation $2x^2 + 5x - 42 = 0$. She stated that the solutions to the equation were $\frac{7}{2}$ and -6. Do you agree with Amy's solutions? Explain why or why not.

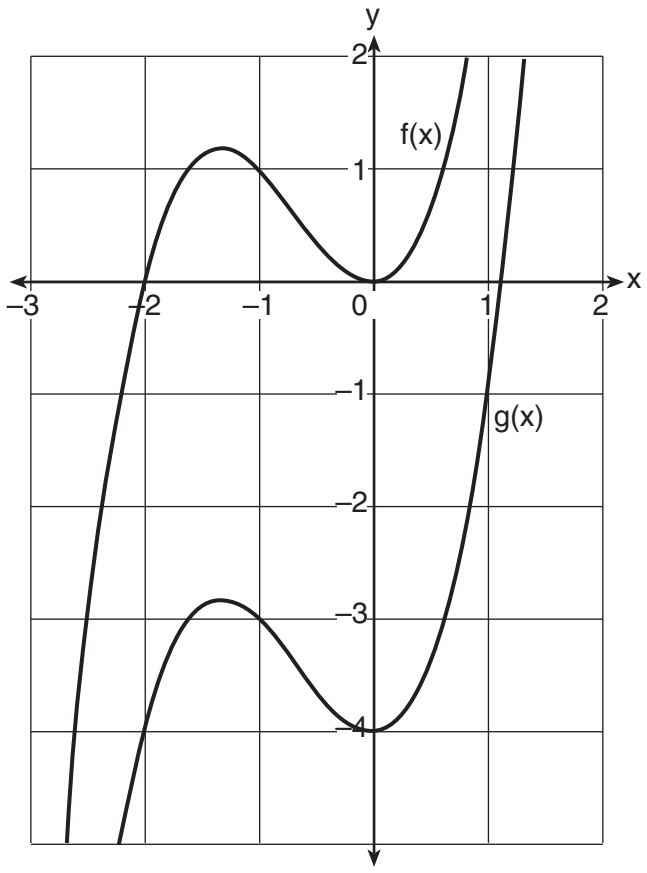
29 Sue and Kathy were doing their algebra homework. They were asked to write the equation of the line that passes through the points $(-3,4)$ and $(6,1)$. Sue wrote $y - 4 = -\frac{1}{3}(x + 3)$ and Kathy wrote $y = -\frac{1}{3}x + 3$. Justify why both students are correct.

30 During a recent snowstorm in Red Hook, NY, Jaime noted that there were 4 inches of snow on the ground at 3:00 p.m., and there were 6 inches of snow on the ground at 7:00 p.m.

If she were to graph these data, what does the slope of the line connecting these two points represent in the context of this problem?

31 The formula for the sum of the degree measures of the interior angles of a polygon is $S = 180(n - 2)$. Solve for n, the number of sides of the polygon, in terms of S.

32 In the diagram below, $f(x) = x^3 + 2x^2$ is graphed. Also graphed is $g(x)$, the result of a translation of $f(x)$.



Determine an equation of $g(x)$. Explain your reasoning.

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]

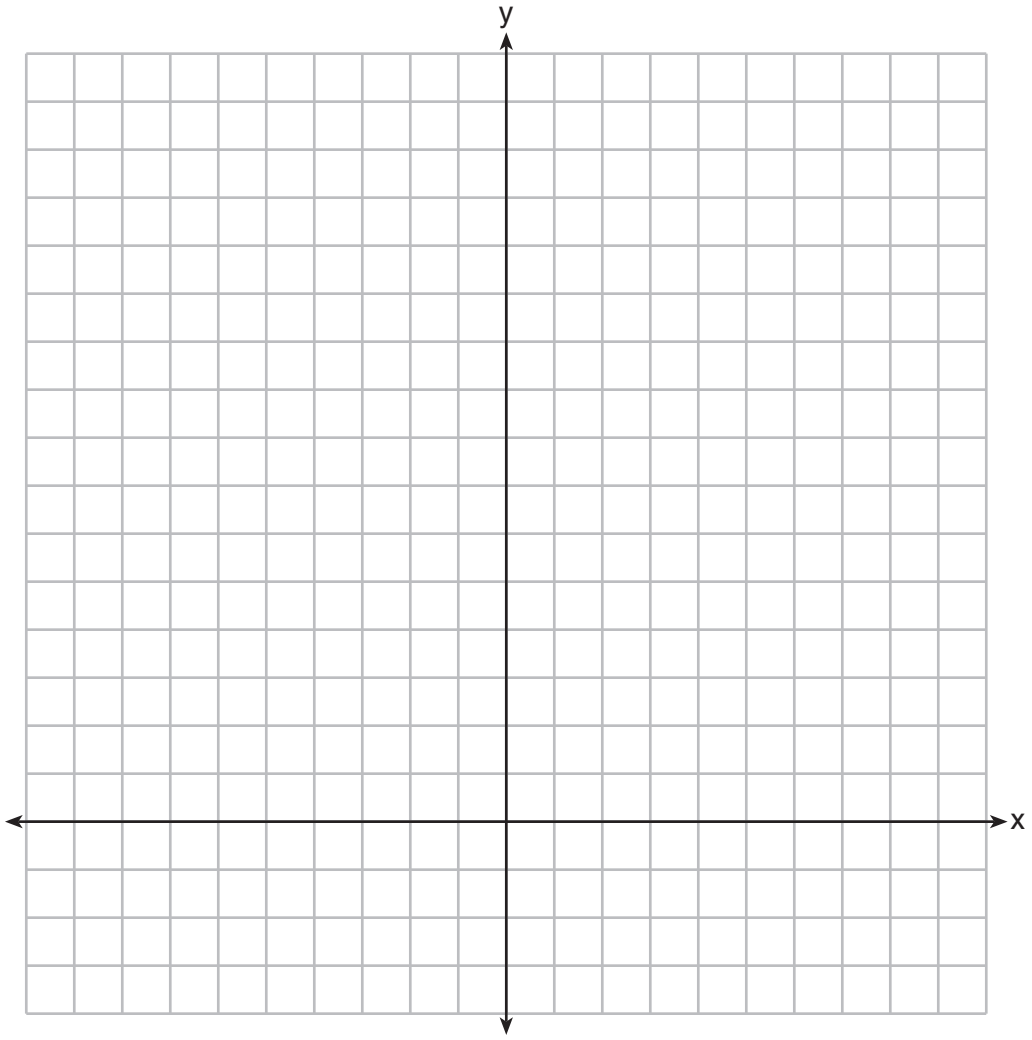
33 The height, H, in feet, of an object dropped from the top of a building after t seconds is given by $H(t) = -16t^2 + 144$.

How many feet did the object fall between one and two seconds after it was dropped?

Determine, algebraically, how many seconds it will take for the object to reach the ground.

34 The sum of two numbers, x and y, is more than 8. When you double x and add it to y, the sum is less than 14.

Graph the inequalities that represent this scenario on the set of axes below.



Kai says that the point (6,2) is a solution to this system. Determine if he is correct and explain your reasoning.

35 An airplane leaves New York City and heads toward Los Angeles. As it climbs, the plane gradually increases its speed until it reaches cruising altitude, at which time it maintains a constant speed for several hours as long as it stays at cruising altitude. After flying for 32 minutes, the plane reaches cruising altitude and has flown 192 miles. After flying for a total of 92 minutes, the plane has flown a total of 762 miles.

Determine the speed of the plane, at cruising altitude, in miles per minute.

Write an equation to represent the number of miles the plane has flown, y, during x minutes at cruising altitude, only.

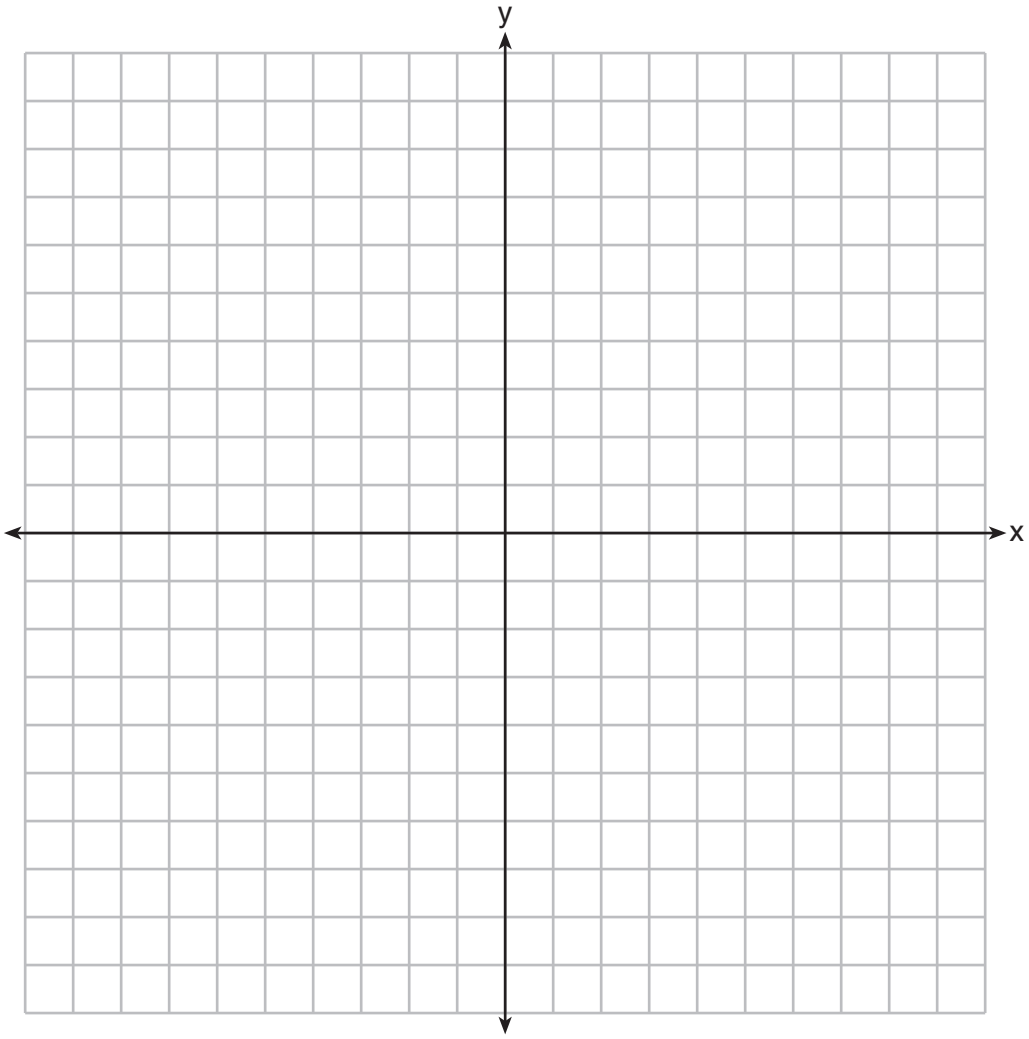
Assuming that the plane maintains its speed at cruising altitude, determine the total number of miles the plane has flown 2 hours into the flight.

36 On the set of axes below, graph

$$g(x) = \frac{1}{2}x + 1$$

and

$$f(x) = \begin{cases} 2x + 1, & x \leq -1 \\ 2 - x^2, & x > -1 \end{cases}$$



How many values of x satisfy the equation $f(x) = g(x)$? Explain your answer, using evidence from your graphs.

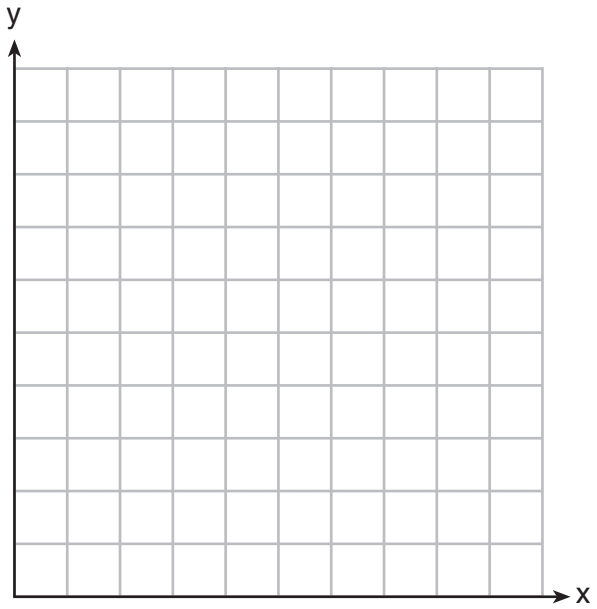
Part IV

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 Franco and Caryl went to a bakery to buy desserts. Franco bought 3 packages of cupcakes and 2 packages of brownies for \$19. Caryl bought 2 packages of cupcakes and 4 packages of brownies for \$24. Let x equal the price of one package of cupcakes and y equal the price of one package of brownies.

Write a system of equations that describes the given situation.

On the set of axes below, graph the system of equations.



Determine the exact cost of one package of cupcakes and the exact cost of one package of brownies in dollars and cents. Justify your solution.

Part I

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Difference of Perfect Squares

Use this space for computations.

1 The expression $x^4 - 16$ is equivalent to

(1) $(x^2 + 8)(x^2 - 8)$

(2) $(x^2 - 8)(x^2 - 8)$

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

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

$a^2 - b^2 = (a+b)(a-b)$

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

highest exponent of a variable is 5

2 An expression of the fifth degree is written with a leading coefficient of seven and a constant of six. Which expression is correctly written for these conditions?

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

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

(3) $6x^7 - x^5 + 5$

(4) $7x^5 + 2x^2 + 6$ ← constant is 6

leading coefficient is 7 ↑ highest exponent is 5

3 The table below shows the year and the number of households in a building that had high-speed broadband internet access.

Number of Households	11	16	23	33	42	47
Year	2002	2003	2004	2005	2006	2007

$m = \frac{y_2 - y_1}{x_2 - x_1}$

For which interval of time was the average rate of change the *smallest*?

(1) 2002 – 2004 6

(2) 2003 – 2005 8½

(3) 2004 – 2006 9½

(4) 2005 – 2007 7

(1) $m = \frac{23-11}{2004-2002} = \frac{12}{2} = 6$

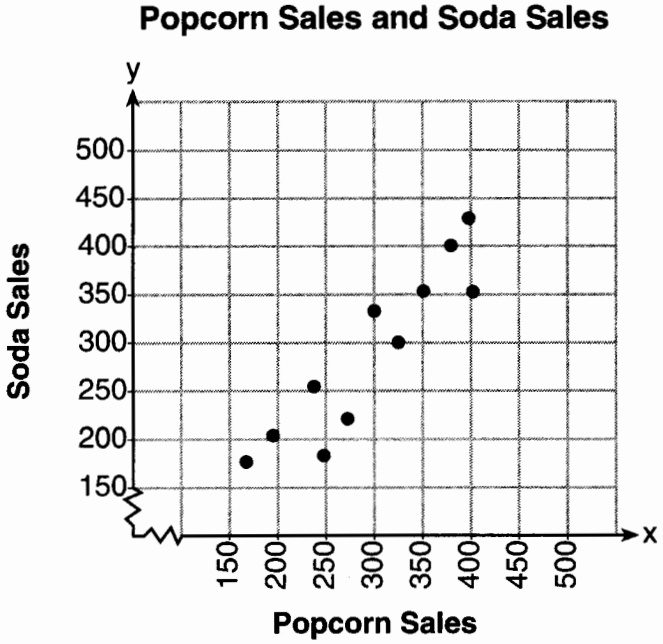
(3) $m = \frac{42-23}{2006-2004} = \frac{19}{2} = 9\frac{1}{2}$

(2) $m = \frac{33-16}{2005-2003} = \frac{17}{2} = 8\frac{1}{2}$

(4) $m = \frac{47-33}{2007-2005} = \frac{14}{2} = 7$

Use this space for computations.

4 The scatterplot below compares the number of bags of popcorn and the number of sodas sold at each performance of the circus over one week.



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1st sentence
$a + c = 150$
2nd sentence
$10.25a + 7.75c = 1470$

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3	26
4	33

x	g(x)
1	−1
2	1
3	5
4	13

x	h(x)
1	9
2	12
3	17
4	24

x	k(x)
1	−2
2	4
3	14
4	28

Which table represents a linear function?

(1) $f(x)$
(2) $g(x)$
(3) $h(x)$
(4) $k(x)$

A linear function must have a constant rate of change.

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x}$

$f(x)$ is the only table that shows a constant rate of change

7 The acidity in a swimming pool is considered normal if the average of three pH readings, p, is defined such that $7.0 < p < 7.8$. If the first two readings are 7.2 and 7.6, which value for the third reading will result in an overall rating of normal?

(1) 6.2 $14.8+6.2=21$
(2) 7.3 $14.8+7.3=22.1$
(3) 8.6 $14.8+8.6=23.4$
(4) 8.8 $14.8+8.8=23.6$

$p = \frac{p_1 + p_2 + p_3}{3}$

$3p = p_1 + p_2 + p_3$

$3(7) < 3p < 3(7.8)$

$21 < 14.8 + p_3 < 23.4$

$p_1 + p_2 = 14.8$

8 Dan took 12.5 seconds to run the 100-meter dash. He calculated the time to be approximately

(1) 0.2083 minute
(2) 750 minutes
(3) 0.2083 hour
(4) 0.52083 hour

$\frac{12.5 \text{ seconds}}{60 \text{ seconds per minute}} = .208\overline{3} \text{ minutes}$

9 When $3x + 2 \leq 5(x - 4)$ is solved for x, the solution is

(1) $x \leq 3$
(2) $x \geq 3$
(3) $x \leq -11$
(4) $x \geq 11$

$3x + 2 \leq 5(x-4)$

$3x + 2 \leq 5x - 20$

$22 \leq 2x$

$11 \leq x$

$x \geq 11$

10 The expression $3(x^2 - 1) - (x^2 - 7x + 10)$ is equivalent to

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

(2) $2x^2 + 7x - 13$

(3) $2x^2 - 7x + 9$

(4) $2x^2 + 7x - 11$

Use this space for computations.

$3(x^2-1) - (x^2 - 7x + 10)$

$3x^2 - 3 - x^2 + 7x - 10$

$2x^2 + 7x - 13$

11 The range of the function $f(x) = x^2 + 2x - 8$ is all real numbers

(1) less than or equal to -9

(2) greater than or equal to -9

(3) less than or equal to -1

(4) greater than or equal to -1

range of y

domain of x

X	Y
-3	-5
-2	-8
-1	-9
0	-8
1	-5

smallest y-value

values of x when y = zero.

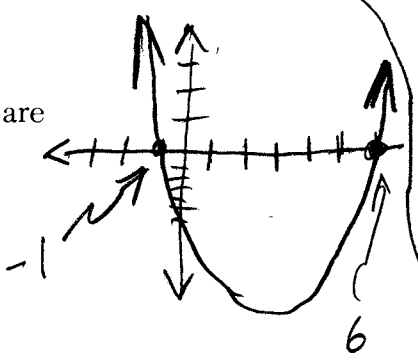
12 The zeros of the function $f(x) = x^2 - 5x - 6$ are

(1) -1 and 6

(2) 1 and -6

(3) 2 and -3

(4) -2 and 3



13 In a sequence, the first term is 4 and the common difference is 3. The fifth term of this sequence is

(1) -11

(2) -8

(3) 16

(4) 19

4 7 10 13 16

1st 2nd 3rd 4th 5th

Term Term

14 The growth of a certain organism can be modeled by $C(t) = 10(1.029)^{24t}$, where $C(t)$ is the total number of cells after t hours. Which function is approximately equivalent to $C(t)$?

(1) $C(t) = 240(.083)^{24t}$

(2) $C(t) = 10(.083)^t$

(3) $C(t) = 10(1.986)^t$

(4) $C(t) = 240(1.986)^{\frac{t}{24}}$

$C(t) = 10(1.029)^{24t}$

$C(t) = 10(1.029^{24})^t$

$C(t) = 10(1.986)^t$

$1.029^{24} = 1.985953129$

Use this space for computations.

15 A public opinion poll was taken to explore the relationship between age and support for a candidate in an election. The results of the poll are summarized in the table below.

Age	For	Against	No Opinion
21–40	30	12	8
41–60	20	40	15
Over 60	25	35	15

Total = 30 + 12 + 8 = 50

What percent of the 21–40 age group was for the candidate?

(1) 15
(2) 25
(3) 40
(4) 60

$\frac{30 \text{ for}}{50 \text{ total}}$

$\frac{30}{50} = \frac{x}{100}$

$x = 60$

16 Which equation and ordered pair represent the correct vertex form and vertex for $j(x) = x^2 - 12x + 7$?

(1) $j(x) = (x - 6)^2 + 43$, (6,43)
(2) $j(x) = (x - 6)^2 + 43$, (−6,43)
(3) $j(x) = (x - 6)^2 - 29$, (6,−29)
(4) $j(x) = (x - 6)^2 - 29$, (−6,−29)

the vertex has coordinates (6, -29).

Step 1 Input equation in graphing calculator and find vertex.

Step 2 Eliminate wrong answers.

17 A student invests $500 for 3 years in a savings account that earns 4% interest per year. No further deposits or withdrawals are made during this time. Which statement does *not* yield the correct balance in the account at the end of 3 years?

(1) $500(1.04)^3 = 562.432$
(2) $500(1 - .04)^3 = 442.368$
(3) $500(1 + .04)(1 + .04)(1 + .04) = 562.432$
(4) $500 + 500(.04) + 520(.04) + 540.8(.04) = 562.432$

$A = P(1+r)^t$

$A = 500(1+.04)^3$

$A = 500(1.04)^3$

$A = 500(1.04)(1.04)(1.04)$

Isolate y

Use this space for computations.

18 The line represented by the equation $4y + 2x = 33.6$ shares a solution point with the line represented by the table below.

Step 1 Use linear regression and the table values to find $y = .2x + 4.2$

x	y
−5	3.2
−2	3.8
2	4.6
4	5
11	6.4

Step 2 $4y + 2x = 33.6$

$4y = -2x + 33.6$

$y = \frac{-2x + 33.6}{4}$

Step 3 Input both equations in graphing calculator and find solution.

The solution for this system is

(1) (−14.0,−1.4)
(3) (1.9,4.6)
(2) (−6.8,5.0)
(4) (6.0,5.4)

19 What is the solution of the equation $2(x + 2)^2 - 4 = 28$?

(1) 6, only
(3) 2 and −6
(2) 2, only
(4) 6 and −2

formula sheet → $a = 2$ $b = 8$ $c = -24$

$2(x+2)^2 - 4 = 28$

$2(x^2+4x+4) - 4 = 28$

$2x^2+8x+8-4 = 28$

$2x^2+8x-24 = 0$

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

$x = \frac{-8 \pm \sqrt{8^2-4(2)(-24)}}{2(2)}$

$x = \frac{-8 \pm \sqrt{64+192}}{4}$

$x = \frac{-8 \pm \sqrt{256}}{4}$

$x = \frac{-8 \pm 16}{4}$

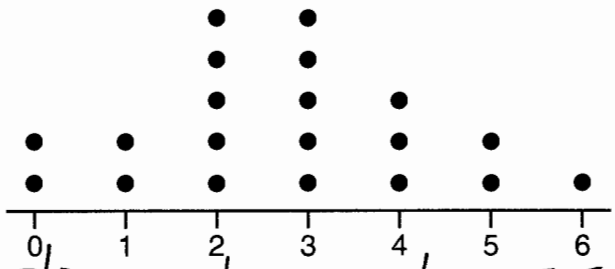
$x = \frac{-8-16}{4}$ | $x = \frac{-8+16}{4}$

$x = \frac{-24}{4}$ | $x = \frac{8}{4}$

$x = -6$ | $x = 2$

20 The dot plot shown below represents the number of pets owned by students in a class.

$Q_1 = 2$
$Q_2 = 3$
$Q_3 = 4$



0 0 1 1 2 | 2 2 2 2 3 | 3 3 3 3 4 | 4 4 5 5 6

Which statement about the data is *not* true?

(1) The median is 3. True $Q_2 = 3$
(2) The interquartile range is 2. True $Q_3 - Q_1 = 2$
(3) The mean is 3. Not true $\bar{x} = \frac{55}{20} = 2.75$
(4) The data contain no outliers. True

21 What is the largest integer, x, for which the value of $f(x) = 5x^4 + 30x^2 + 9$ will be greater than the value of $g(x) = 3^x$?

(1) 7
(2) 8
(3) 9
(4) 10

Step 2 Inspect table of values

Step 1
Strategy: Input both functions in a graphing calculator

Use this space for computations.

x	f(x)	g(x)
7	13484	2187
8	22409	6561
9	35244	19683
10	53009	59049

22 The graphs of the functions $f(x) = |x - 3| + 1$ and $g(x) = 2x + 1$ are drawn. Which statement about these functions is true?

(1) The solution to $f(x) = g(x)$ is 3.
(2) The solution to $f(x) = g(x)$ is 1.
(3) The graphs intersect when $y = 1$.
(4) The graphs intersect when $x = 3$.

The graphs intersect at (1, 3) (x, y)

Step 1 Input both function in graphing calculator + inspect graph and table views to find solutions or intersections.

Step 2 Eliminate wrong answers

23 A store sells self-serve frozen yogurt sundaes. The function $C(w)$ represents the cost, in dollars, of a sundae weighing w ounces. An appropriate domain for the function would be

(1) integers — negative numbers make no sense
(2) rational numbers — negative fractions make no sense
(3) nonnegative integers — this is good
(4) nonnegative rational numbers — this is better

24 Sara was asked to solve this word problem: "The product of two consecutive integers is 156. What are the integers?"
What type of equation should she create to solve this problem?

(1) linear
(2) quadratic
(3) exponential
(4) absolute value

Let (x) represent the first integer
Let (x+1) represent the next consecutive integer.
Write $(x)(x+1) = 156$

$x^2 + x = 156$
$x^2 + x - 156 = 0$

This is a quadratic equation

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 Given that $f(x) = 2x + 1$, find $g(x)$ if $g(x) = 2[f(x)]^2 - 1$.

Answer

$g(x) = 2(2x+1)^2 - 1$

or

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

$g(x) = 8x^2 + 8x + 2 - 1$

$g(x) = 8x^2 + 8x + 1$

26 Determine if the product of $3\sqrt{2}$ and $8\sqrt{18}$ is rational or irrational. Explain your answer.

$3\sqrt{2} \cdot 8\sqrt{18}$

$3 \cdot 8 \cdot \sqrt{2} \cdot \sqrt{18}$

$24 \cdot \sqrt{36}$

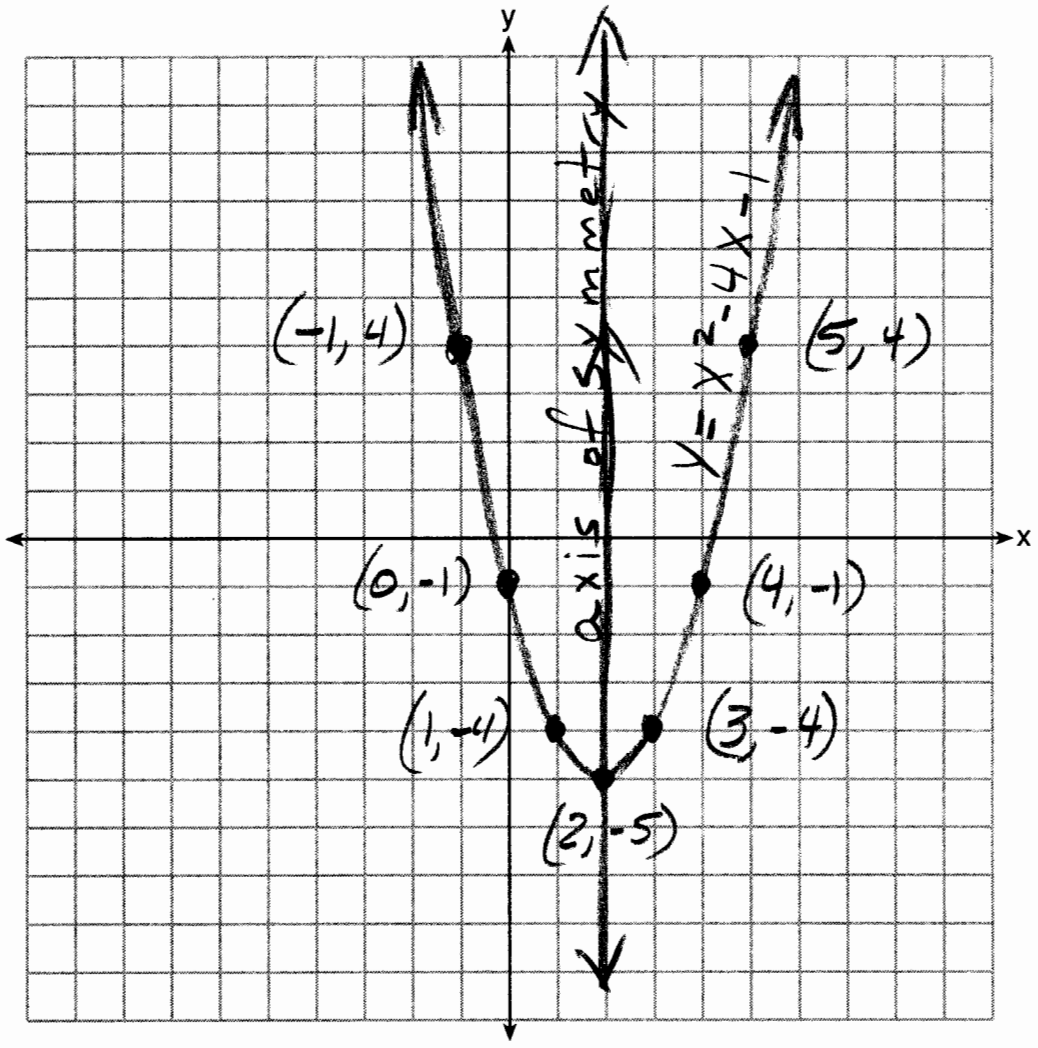
$24 \cdot 6$

144

Answer

The product is rational because 144 can be expressed as $\frac{144}{1}$, which is a ratio of two integers.

27 On the set of axes below, draw the graph of $y = x^2 - 4x - 1$.



x	y
-1	4
0	-1
1	-4
2	-5
3	-4
4	-1
5	4

State the equation of the axis of symmetry.

answer

$x = 2$

28 Amy solved the equation $2x^2 + 5x - 42 = 0$. She stated that the solutions to the equation were $\frac{7}{2}$ and -6. Do you agree with Amy's solutions? Explain why or why not.

Strategy #1
Substitution

$\left(\frac{7}{2}\right)$

$2x^2+5x-42=0$

$2\left(\frac{7}{2}\right)^2+5\left(\frac{7}{2}\right)-42=0$

$2\left(\frac{49}{4}\right)+\frac{35}{2}-42=0$

$\frac{98}{4}+17.5-42=0$

$24.5+17.5-42=0$

$42-42=0$

$0=0$ ✓

(-6)

$2x^2+5x-42=0$

$2(-6)^2+5(-6)-42=0$

$2(36)-30-42=0$

$72-72=0$

$0=0$ ✓

Amy's solutions make the equation true. I agree with Amy.

Strategy #2
Complete the Square

$2x^2+5x-42=0$

$x^2+\frac{5}{2}x-21=0$

$x^2+\frac{5}{2}x=21$

$\left(x+\frac{5}{4}\right)^2=21+\left(\frac{5}{4}\right)^2$

$\left(x+\frac{5}{4}\right)^2=21+\frac{25}{16}$

$\left(x+\frac{5}{4}\right)^2=\frac{336+25}{16}$

$\left(x+\frac{5}{4}\right)^2=\frac{361}{16}$

$x+\frac{5}{4}=\pm\sqrt{\frac{361}{16}}$

$x+\frac{5}{4}=\pm\frac{19}{4}$

$x=\frac{-5}{4}\pm\frac{19}{4}$

$x=\frac{14}{4}$ | $x=\frac{-24}{4}$

$x=\frac{7}{2}$ ✓ | $x=-6$ ✓

I agree. Amy's solutions are correct. Solving the equation by completing the square produces the same solutions

Strategy #3
Factor by Grouping

$2x^2+5x-42=0$

$|ac|=84$

Factors of 84: $1\cdot84$, $2\cdot42$, $3\cdot28$, $4\cdot21$, $6\cdot14$, $12\cdot7$

Replace $5x$ with $12x-7x$

$2x^2+12x-7x-42=0$

$(2x^2+12x)+(-7x-42)=0$

$2x(x+6)-7(x+6)=0$

$(2x-7)(x+6)=0$

$2x-7=0$ | $x+6=0$

$2x=7$ | $x=-6$ ✓

$x=\frac{7}{2}$ ✓ |

I agree. Amy's solutions are correct. Solving the equation by factoring produces the same solutions.

Note: Only one strategy is required.

29 Sue and Kathy were doing their algebra homework. They were asked to write the equation of the line that passes through the points $(-3,4)$ and $(6,1)$. Sue wrote $y - 4 = -\frac{1}{3}(x + 3)$ and Kathy wrote $y = -\frac{1}{3}x + 3$. Justify why both students are correct.

Sue (Y_1)

$Y_1 - 4 = -\frac{1}{3}(x+3)$

$Y_1 = -\frac{1}{3}(x+3) + 4$

Kathy (Y_2)

$Y_2 = -\frac{1}{3}x + 3$

Input both equations in a graphing calculator and inspect the graphs and tables.

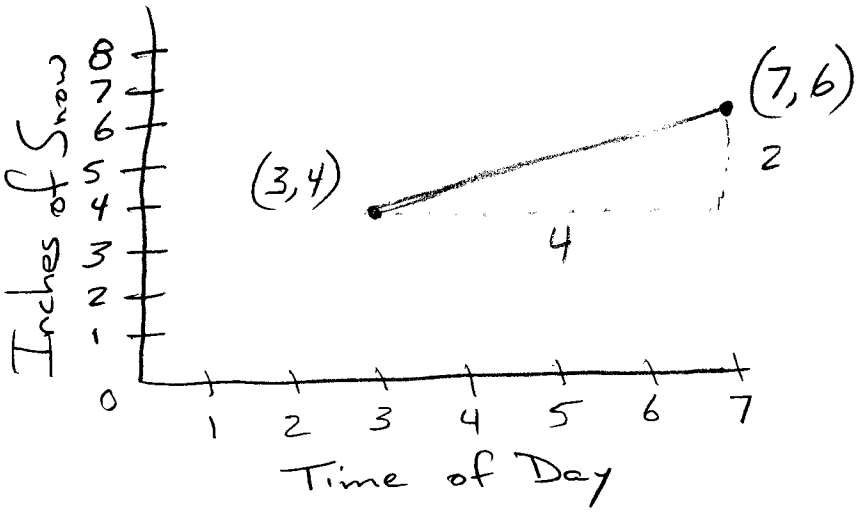
X	Y_1	Y_2
-6	5	5
-3	4	4
0	3	3
3	2	2
6	1	1

Answer

Both students are correct, because the graphs of both equations pass through the points $(-3,4)$ and $(6,1)$. The equations describe the same relationship between the x and y variables.

30 During a recent snowstorm in Red Hook, NY, Jaime noted that there were 4 inches of snow on the ground at 3:00 p.m., and there were 6 inches of snow on the ground at 7:00 p.m.

If she were to graph these data, what does the slope of the line connecting these two points represent in the context of this problem?



$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{2}{4} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6-4}{7-3} = \frac{2}{4}$$

Answer

In the context of this problem, the slope of the line represents the rate of snow falling per hour. The rate of $\frac{2 \text{ inches of snow}}{4 \text{ hours}}$ means that it is snowing at an average rate of $\frac{1}{2}$ inch per hour.

31 The formula for the sum of the degree measures of the interior angles of a polygon is $S = 180(n - 2)$. Solve for n, the number of sides of the polygon, in terms of S.

$S = 180(n-2)$

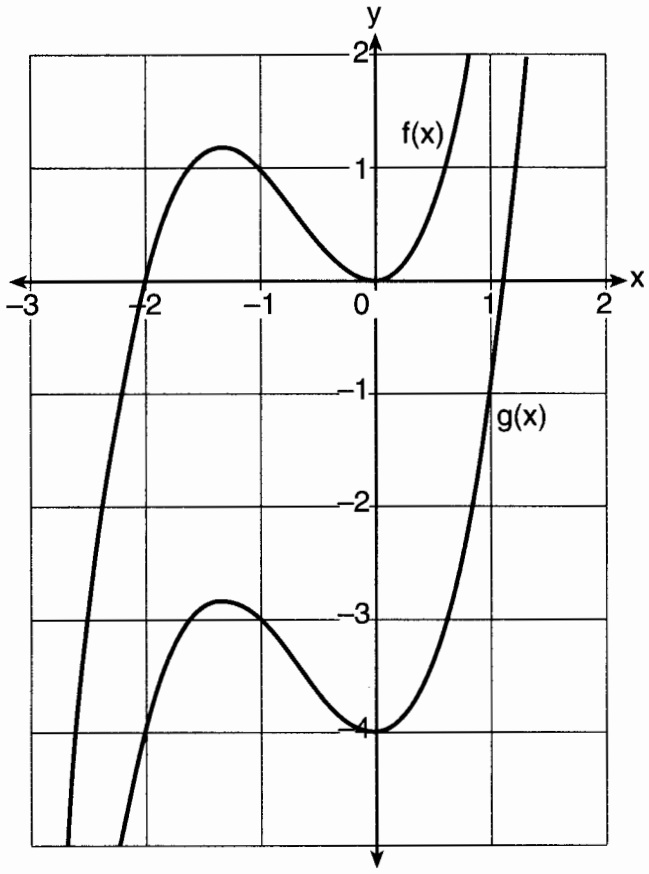
$S = 180n - 360$

$S + 360 = 180n$

$\frac{S+360}{180} = n$

Answer

32 In the diagram below, $f(x) = x^3 + 2x^2$ is graphed. Also graphed is $g(x)$, the result of a translation of $f(x)$.



Determine an equation of $g(x)$. Explain your reasoning.

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

$f(x)$ has a y-intercept of 0.
$g(x)$ has a y-intercept of −4
Every point on $f(x)$ shifts down 4 units to create $g(x)$.

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 height, H, in feet, of an object dropped from the top of a building after t seconds is given by $H(t) = -16t^2 + 144$.

How many feet did the object fall between one and two seconds after it was dropped?

Strategy - Input the function rule in a graphing calculator.

t	$H(t)$
0	144
1	128
2	80
3	0

$H(1) = 128$

$H(2) = 80$

Answer

$H(2) - H(1) = 128 - 80 = \boxed{48}$

Determine, algebraically, how many seconds it will take for the object to reach the ground.

$H(t) = -16t^2 + 144$

$0 = -16t^2 + 144$

$16t^2 = 144$

$t^2 = \frac{144}{16}$

$t^2 = 9$

$t = \pm\sqrt{9}$

$t = \pm 3$ reject -3

Answer

3 seconds

34 The sum of two numbers, x and y, is more than 8. When you double x and add it to y, the sum is less than 14.

Step 1 Isolate y_1 and y_2

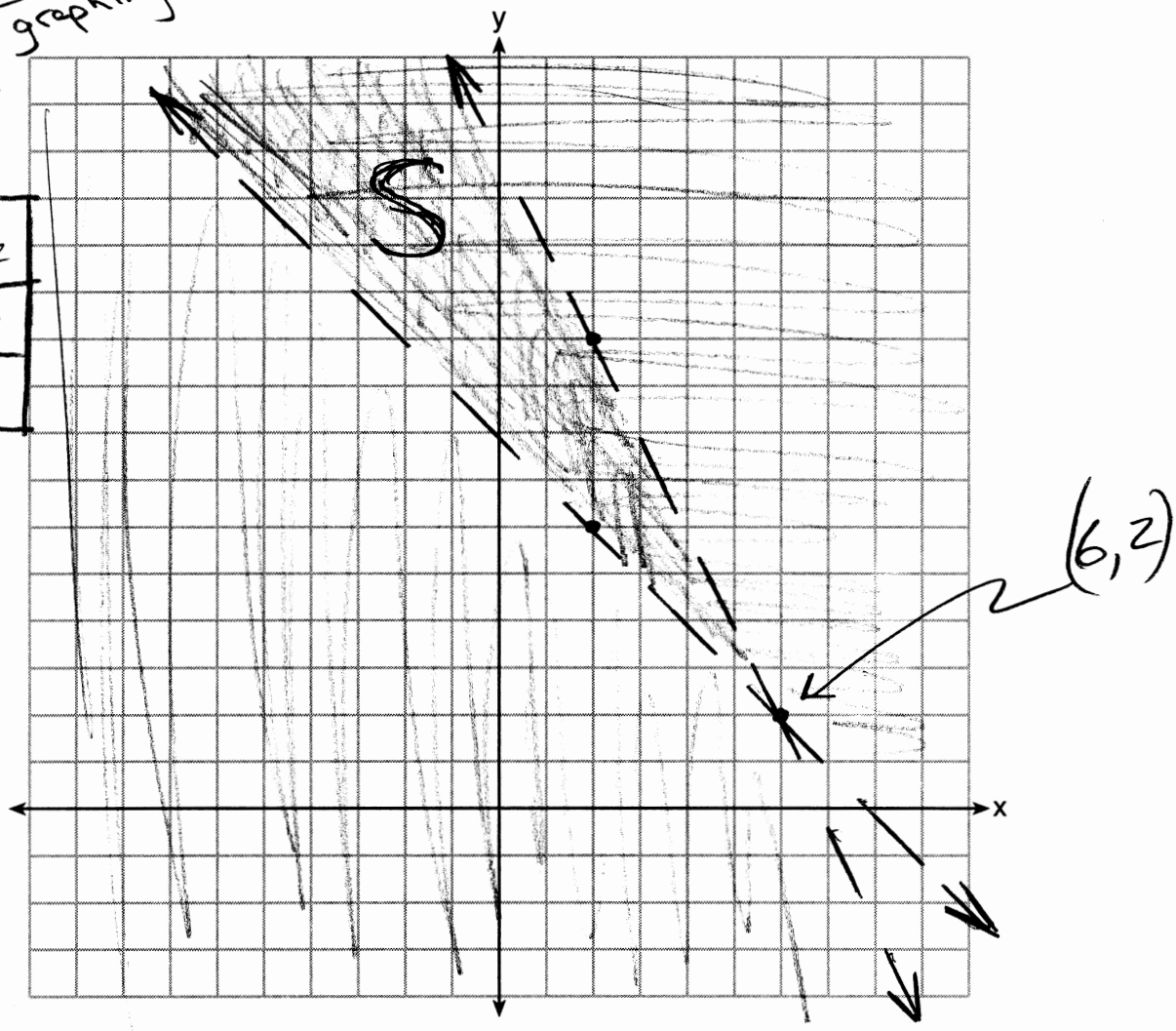
$x + y_1 > 8 \Rightarrow y_1 > -x + 8$

$2x + y_2 < 14 \Rightarrow y_2 < -2x + 14$

Graph the inequalities that represent this scenario on the set of axes below.

Step 2 Input in graphing calculator

x	y_1	y_2
2	6	10
6	2	2



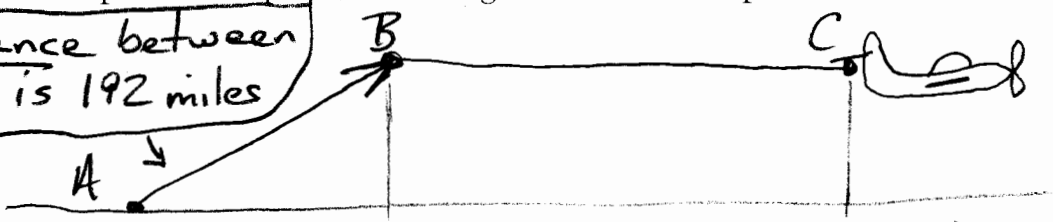
Kai says that the point (6,2) is a solution to this system. Determine if he is correct and explain your reasoning.

Kai is wrong. The point (6,2) falls on both lines, but the lines themselves are boundaries and are not part of the solution set.

35 An airplane leaves New York City and heads toward Los Angeles. As it climbs, the plane gradually increases its speed until it reaches cruising altitude, at which time it maintains a constant speed for several hours as long as it stays at cruising altitude. After flying for 32 minutes, the plane reaches cruising altitude and has flown 192 miles. After flying for a total of 92 minutes, the plane has flown a total of 762 miles.

Determine the speed of the plane, at cruising altitude, in miles per minute.

The distance between A and B is 192 miles



miles	0 mi.	192 mi.	762 mi.
minutes	0 min.	32 min.	92 min.

The plane flies between B and C at a speed of 9.5 miles per minute

570 miles / 60 minutes

$\frac{570}{60} = \frac{x}{1}$

Answer → $x = 9.5$ miles per minute

Write an equation to represent the number of miles the plane has flown, y, during x minutes at cruising altitude, only.

(This is $\overline{BC}$ in the picture above.)

$y = 9.5x$

x ← minutes at cruising altitude.

Assuming that the plane maintains its speed at cruising altitude, determine the total number of miles the plane has flown 2 hours into the flight.

2 hours = 120 minutes

$y = 9.5x + 192$

Distance flown after cruising altitude.

Distance flown before cruising altitude.

$y = 9.5(120 - 32) + 192$

$y = 9.5(88) + 192$

$y = 836 + 192$

$y = 1,028$ miles

36 On the set of axes below, graph

$$g(x) = \frac{1}{2}x + 1$$

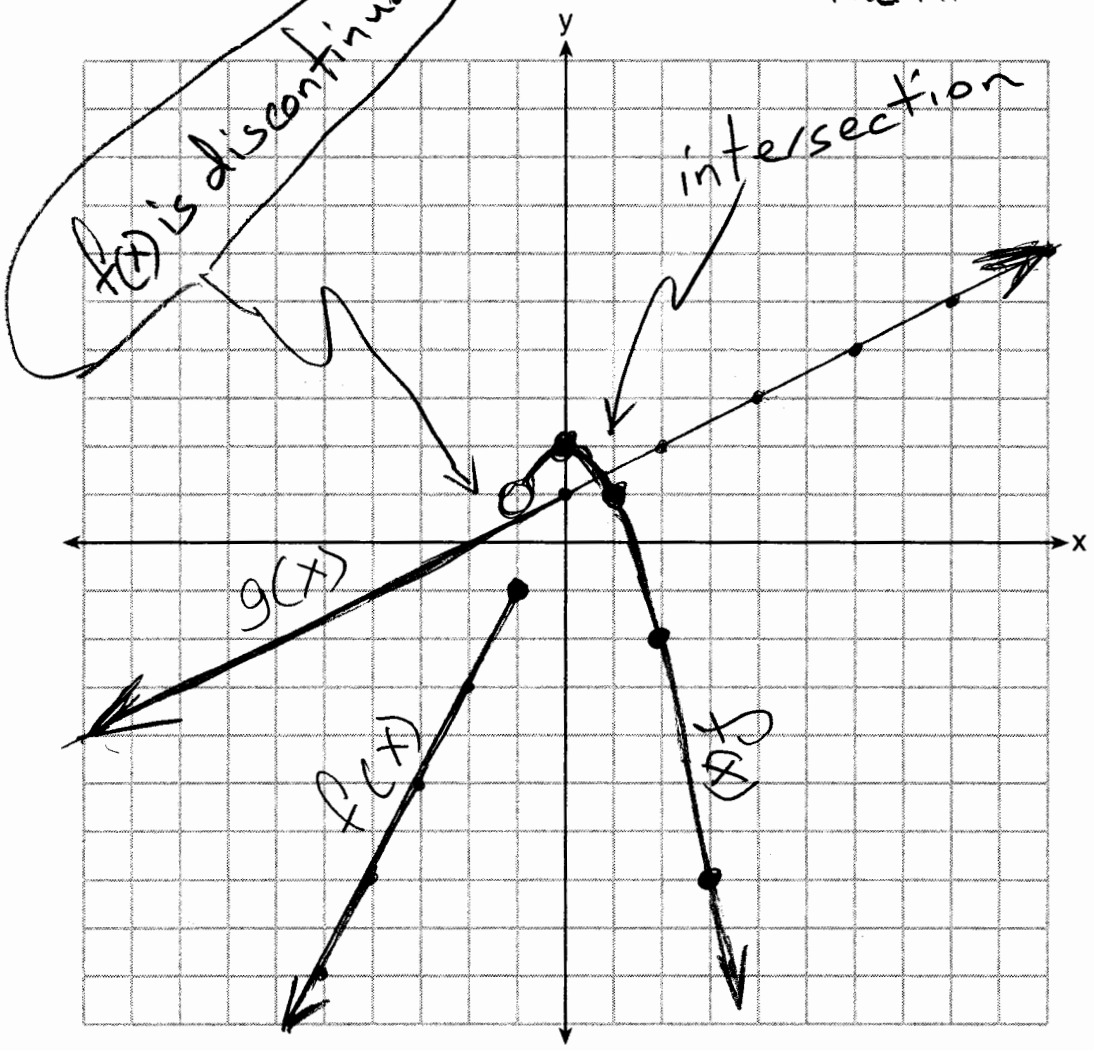
and

$$f(x) = \begin{cases} 2x + 1, & x \leq -1 \\ 2 - x^2, & x > -1 \end{cases}$$

STEP 1 Plot
$g(x) = \frac{1}{2}x + 1$

STEP 2 Plot
$f(x) = 2x + 1$ over the interval $x \leq -1$

STEP 3 Plot
$f(x) = 2 - x^2$ over the interval $x > -1$



How many values of x satisfy the equation $f(x) = g(x)$? Explain your answer, using evidence from your graphs.

1 answer

The graphs intersect at only one point.

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 Franco and Caryl went to a bakery to buy desserts. Franco bought 3 packages of cupcakes and 2 packages of brownies for \$19. Caryl bought 2 packages of cupcakes and 4 packages of brownies for \$24. Let x equal the price of one package of cupcakes and y equal the price of one package of brownies.

Write a system of equations that describes the given situation.

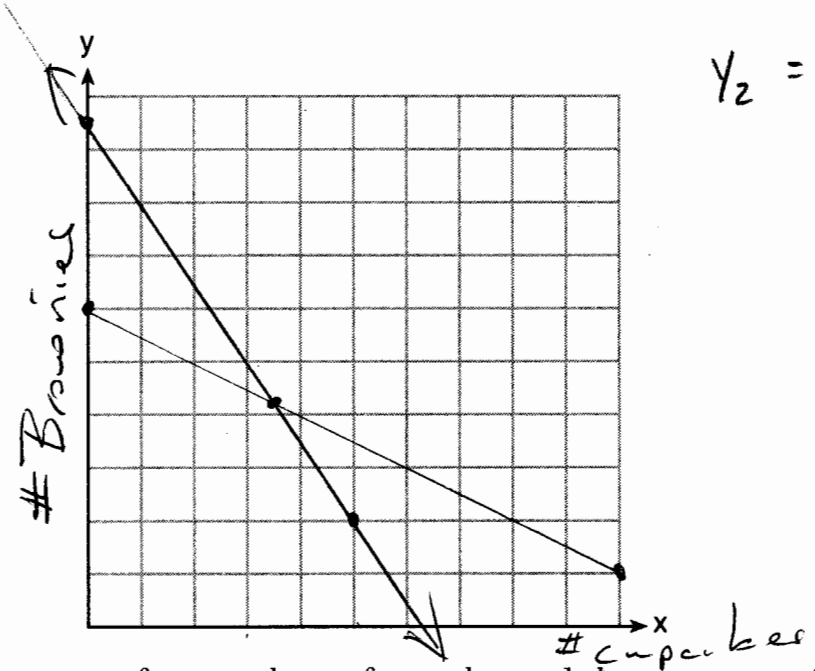
$Y_1 \quad 3c + 2b = 19$ $\qquad$ $Y_1 \quad 3x + 2y = 19$

$Y_2 \quad 2c + 4b = 24$ $\qquad$ $Y_2 \quad 2x + 4y = 24$

On the set of axes below, graph the system of equations.

$Y_1 = \frac{19 - 3x}{2}$

$Y_2 = \frac{24 - 2x}{4}$



Determine the exact cost of one package of cupcakes and the exact cost of one package of brownies in dollars and cents. Justify your solution.

$2(Y_1) \quad 6x + 4y = 38$

$(Y_2) \quad 2x + 4y = 24$

$4x = 14$

$x = \frac{14}{4}$

$x = \frac{7}{2}$

$x = \$3.50$ ← Cost of Package of Cupcakes

$Y_2 \quad 2(3.5) + 4y = 24$

$7 + 4y = 24$

$4y = 17$

$y = \frac{17}{4}$

$y = \$4.25$ ← Cost of Package of Brownies

June 2017

Algebra Regents

And

Answers

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

ALGEBRA I
(Common Core)

Tuesday, June 13, 2017 — 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.

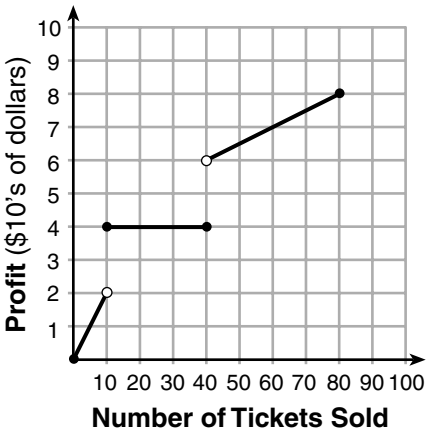
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

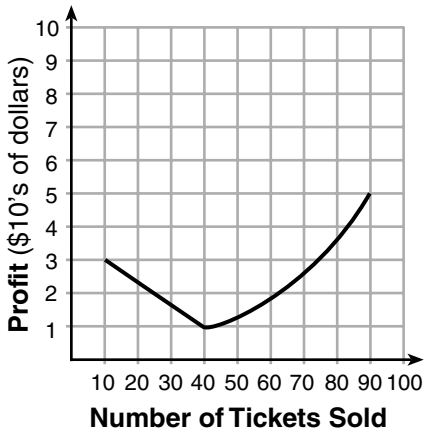
Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily drawn to scale. For each statement or question, choose the word or expression 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 To keep track of his profits, the owner of a carnival booth decided to model his ticket sales on a graph. He found that his profits only declined when he sold between 10 and 40 tickets. Which graph could represent his profits?



(1)



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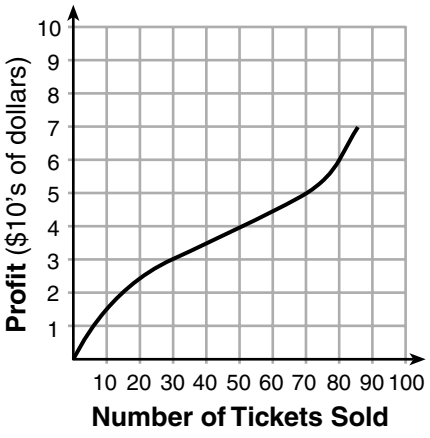

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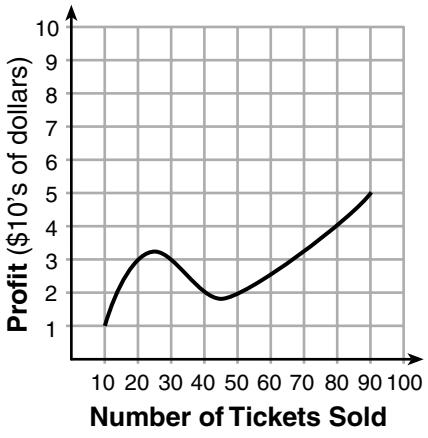


(4)

Use this space for computations.

2 The formula for the surface area of a right rectangular prism is $A = 2lw + 2hw + 2lh$, where l, w, and h represent the length, width, and height, respectively. Which term of this formula is *not* dependent on the height?

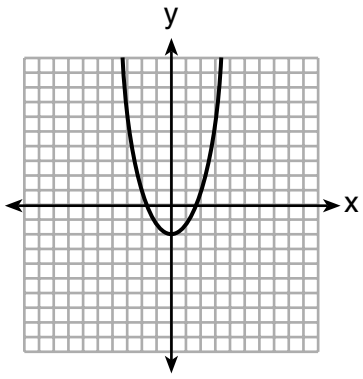
(1) A

(2) $2lw$

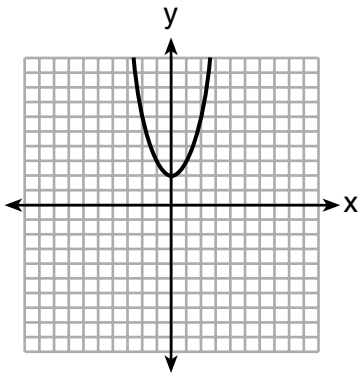
(3) $2hw$

(4) $2lh$

3 Which graph represents $y = \sqrt{x - 2}$?



(1)



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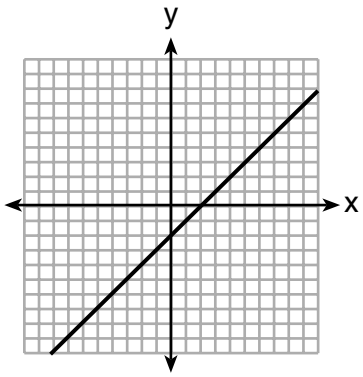

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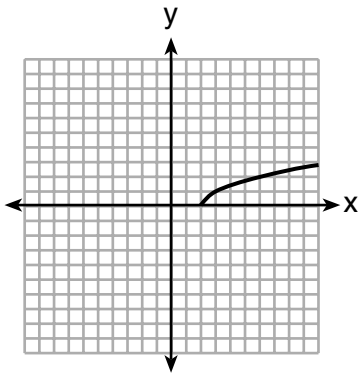
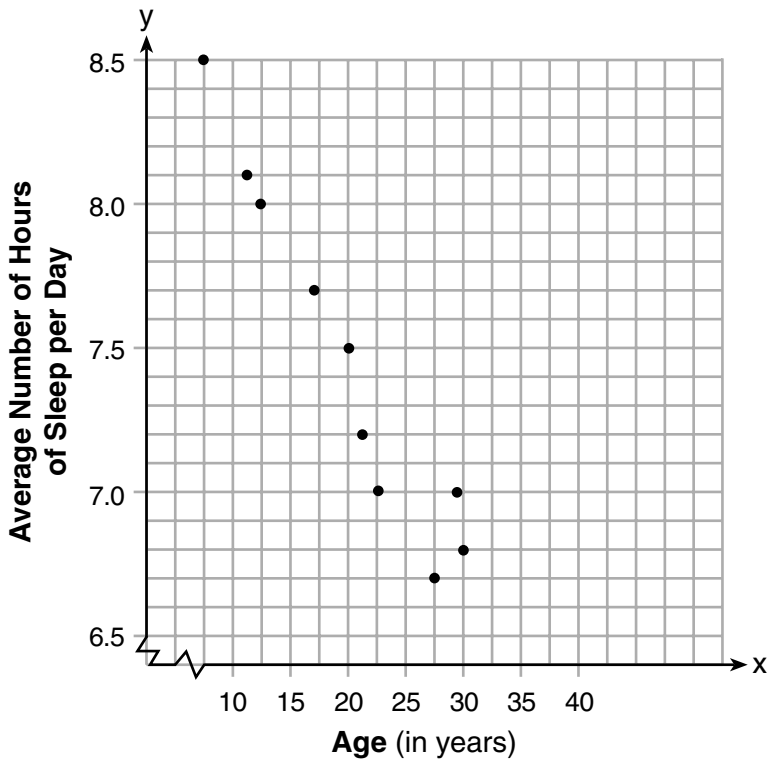


(4)

Use this space for computations.

4 A student plotted the data from a sleep study as shown in the graph below.



The student used the equation of the line $y = -0.09x + 9.24$ to model the data. What does the rate of change represent in terms of these data?

(1) The average number of hours of sleep per day increases 0.09 hour per year of age.

(2) The average number of hours of sleep per day decreases 0.09 hour per year of age.

(3) The average number of hours of sleep per day increases 9.24 hours per year of age.

(4) The average number of hours of sleep per day decreases 9.24 hours per year of age.

Use this space for computations.

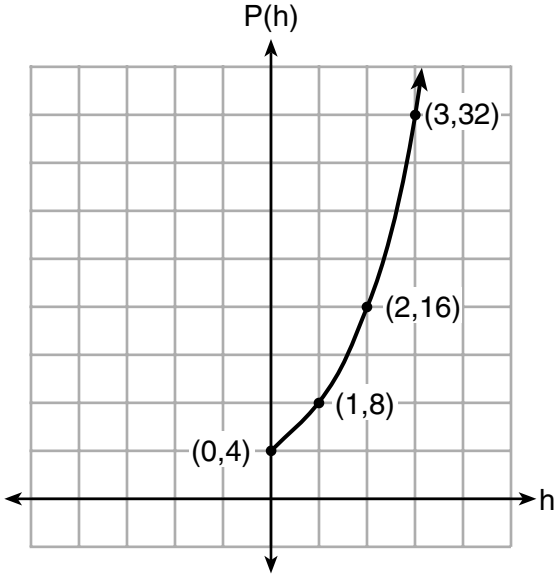
5 Lynn, Jude, and Anne were given the function $f(x) = -2x^2 + 32$, and they were asked to find $f(3)$. Lynn's answer was 14, Jude's answer was 4, and Anne's answer was ± 4. Who is correct?

(1) Lynn, only
(2) Jude, only
(3) Anne, only
(4) Both Lynn and Jude

6 Which expression is equivalent to $16x^4 - 64$?

(1) $(4x^2 - 8)^2$
(2) $(8x^2 - 32)^2$
(3) $(4x^2 + 8)(4x^2 - 8)$
(4) $(8x^2 + 32)(8x^2 - 32)$

7 Vinny collects population data, $P(h)$, about a specific strain of bacteria over time in hours, h, as shown in the graph below.



Which equation represents the graph of $P(h)$?

(1) $P(h) = 4(2)^h$
(2) $P(h) = \frac{46}{5}h + \frac{6}{5}$
(3) $P(h) = 3h^2 + 0.2h + 4.2$
(4) $P(h) = \frac{2}{3}h^3 - h^2 + 3h + 4$

Use this space for computations.

8 What is the solution to the system of equations below?

$$y = 2x + 8$$
$$3(-2x + y) = 12$$

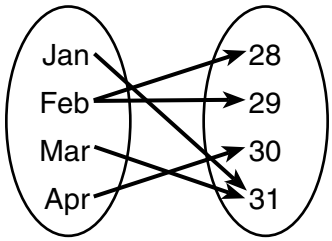
(1) no solution

(2) infinite solutions

(3) $(-1,6)$

(4) $\left(\frac{1}{2},9\right)$

9 A mapping is shown in the diagram below.



This mapping is

(1) a function, because Feb has two outputs, 28 and 29

(2) a function, because two inputs, Jan and Mar, result in the output 31

(3) not a function, because Feb has two outputs, 28 and 29

(4) not a function, because two inputs, Jan and Mar, result in the output 31

10 Which polynomial function has zeros at -3, 0, and 4?

(1) $f(x) = (x + 3)(x^2 + 4)$

(2) $f(x) = (x^2 - 3)(x - 4)$

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

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

Use this space for computations.

11 Jordan works for a landscape company during his summer vacation. He is paid \$12 per hour for mowing lawns and \$14 per hour for planting gardens. He can work a maximum of 40 hours per week, and would like to earn at least \$250 this week. If m represents the number of hours mowing lawns and g represents the number of hours planting gardens, which system of inequalities could be used to represent the given conditions?

(1) $m + g \leq 40$
$12m + 14g \geq 250$

(2) $m + g \geq 40$
$12m + 14g \leq 250$

(3) $m + g \leq 40$
$12m + 14g \leq 250$

(4) $m + g \geq 40$
$12m + 14g \geq 250$

12 Anne invested \$1000 in an account with a 1.3% annual interest rate. She made no deposits or withdrawals on the account for 2 years. If interest was compounded annually, which equation represents the balance in the account after the 2 years?

(1) $A = 1000(1 - 0.013)^2$

(2) $A = 1000(1 + 0.013)^2$

(3) $A = 1000(1 - 1.3)^2$

(4) $A = 1000(1 + 1.3)^2$

13 Which value would be a solution for x in the inequality $47 - 4x < 7$?

(1) -13

(2) -10

(3) 10

(4) 11

14 Bella recorded data and used her graphing calculator to find the equation for the line of best fit. She then used the correlation coefficient to determine the strength of the linear fit.

Which correlation coefficient represents the strongest linear relationship?

(1) 0.9

(2) 0.5

(3) -0.3

(4) -0.8

Use this space for computations.

15 The heights, in inches, of 12 students are listed below.

61, 67, 72, 62, 65, 59, 60, 79, 60, 61, 64, 63

Which statement best describes the spread of these data?

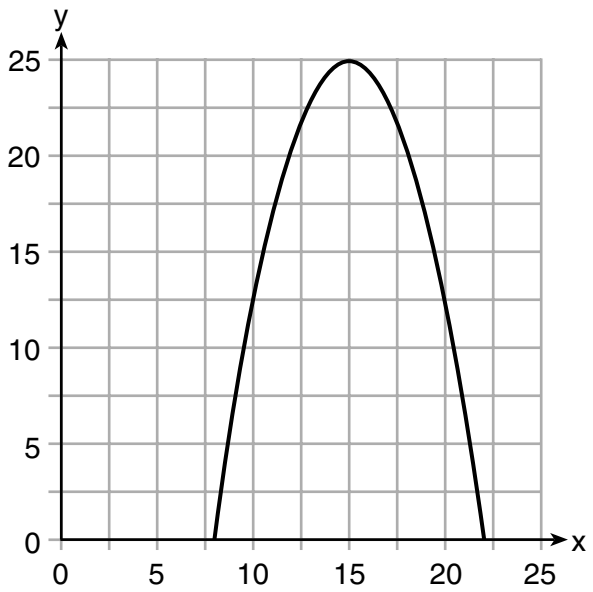
(1) The set of data is evenly spread.

(2) The median of the data is 59.5.

(3) The set of data is skewed because 59 is the only value below 60.

(4) 79 is an outlier, which would affect the standard deviation of these data.

16 The graph of a quadratic function is shown below.



An equation that represents the function could be

(1) $q(x) = \frac{1}{2}(x + 15)^2 - 25$

(2) $q(x) = -\frac{1}{2}(x + 15)^2 - 25$

(3) $q(x) = \frac{1}{2}(x - 15)^2 + 25$

(4) $q(x) = -\frac{1}{2}(x - 15)^2 + 25$

Use this space for computations.

17 Which statement is true about the quadratic functions $g(x)$, shown in the table below, and $f(x) = (x - 3)^2 + 2$?

x	g(x)
0	4
1	–1
2	–4
3	–5
4	–4
5	–1
6	4

(1) They have the same vertex.

(2) They have the same zeros.

(3) They have the same axis of symmetry.

(4) They intersect at two points.

18 Given the function $f(n)$ defined by the following:

$$f(1) = 2$$
$$f(n) = -5f(n - 1) + 2$$

Which set could represent the range of the function?

(1) $\{2, 4, 6, 8,\ldots\}$

(2) $\{2, -8, 42, -208,\ldots\}$

(3) $\{-8, -42, -208, 1042,\ldots\}$

(4) $\{-10, 50, -250, 1250,\ldots\}$

19 An equation is given below.

$$4(x - 7) = 0.3(x + 2) + 2.11$$

The solution to the equation is

(1) 8.3

(2) 8.7

(3) 3

(4) -3

Use this space for computations.

20 A construction worker needs to move 120 ft^3 of dirt by using a wheelbarrow. One wheelbarrow load holds 8 ft^3 of dirt and each load takes him 10 minutes to complete. One correct way to figure out the number of hours he would need to complete this job is

(1) $\frac{120\ ft^3}{1} \cdot \frac{10\ min}{1\ load} \cdot \frac{60\ min}{1\ hr} \cdot \frac{1\ load}{8\ ft^3}$

(2) $\frac{120\ ft^3}{1} \cdot \frac{60\ min}{1\ hr} \cdot \frac{8\ ft^3}{10\ min} \cdot \frac{1}{1\ load}$

(3) $\frac{120\ ft^3}{1} \cdot \frac{1\ load}{10\ min} \cdot \frac{8\ ft^3}{1\ load} \cdot \frac{1\ hr}{60\ min}$

(4) $\frac{120\ ft^3}{1} \cdot \frac{1\ load}{8\ ft^3} \cdot \frac{10\ min}{1\ load} \cdot \frac{1\ hr}{60\ min}$

21 One characteristic of all linear functions is that they change by

(1) equal factors over equal intervals

(2) unequal factors over equal intervals

(3) equal differences over equal intervals

(4) unequal differences over equal intervals

22 What are the solutions to the equation $x^2 - 8x = 10$?

(1) $4 \pm \sqrt{10}$

(2) $4 \pm \sqrt{26}$

(3) $-4 \pm \sqrt{10}$

(4) $-4 \pm \sqrt{26}$

Use this space for computations.

23 The formula for blood flow rate is given by $F = \frac{p_1 - p_2}{r}$, where F is the flow rate, p_1 the initial pressure, p_2 the final pressure, and r the resistance created by blood vessel size. Which formula can *not* be derived from the given formula?

(1) $p_1 = Fr + p_2$

(2) $p_2 = p_1 - Fr$

(3) $r = F(p_2 - p_1)$

(4) $r = \frac{p_1 - p_2}{F}$

24 Morgan throws a ball up into the air. The height of the ball above the ground, in feet, is modeled by the function $h(t) = -16t^2 + 24t$, where t represents the time, in seconds, since the ball was thrown. What is the appropriate domain for this situation?

(1) $0 \le t \le 1.5$

(2) $0 \le t \le 9$

(3) $0 \le h(t) \le 1.5$

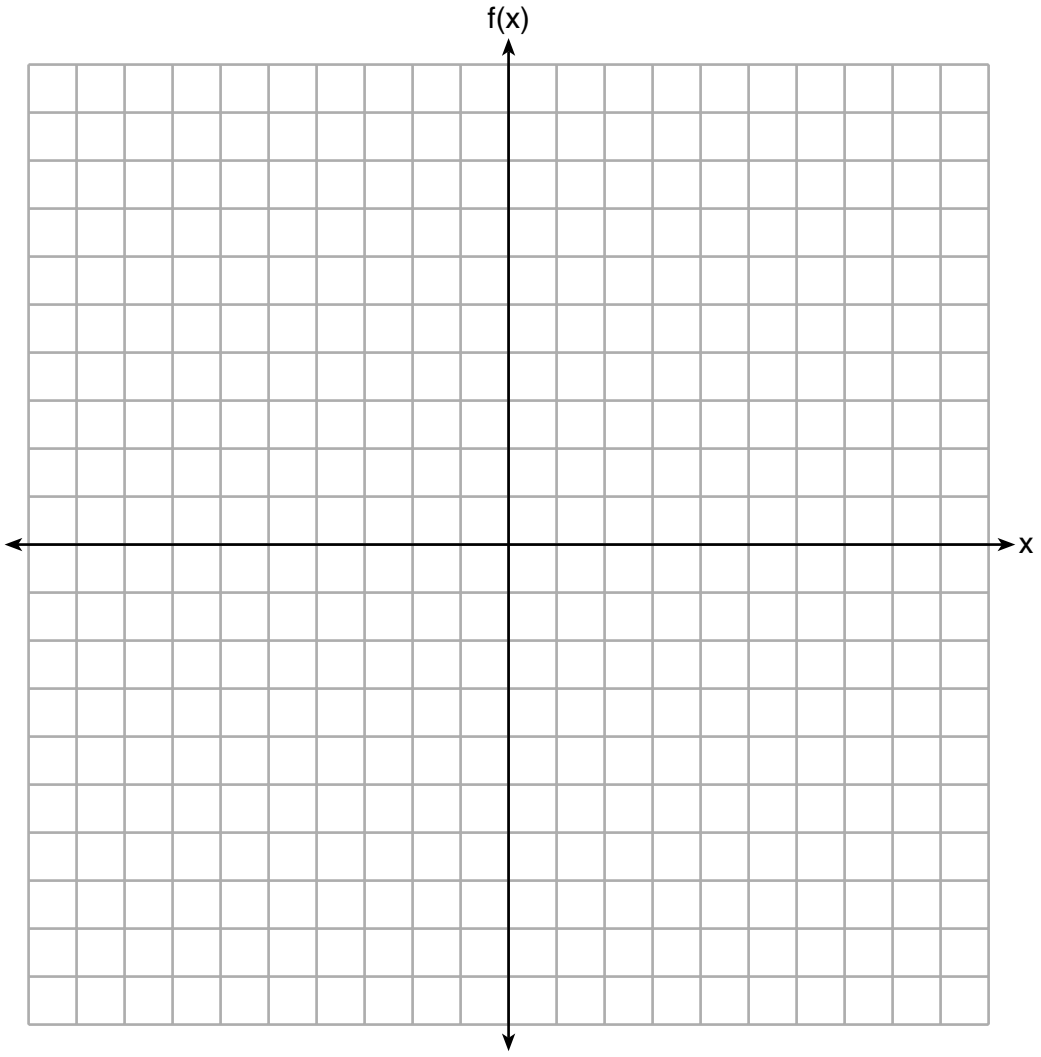
(4) $0 \le h(t) \le 9$

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 Express in simplest form: $(3x^2 + 4x - 8) - (-2x^2 + 4x + 2)$

26 Graph the function $f(x) = -x^2 - 6x$ on the set of axes below.



State the coordinates of the vertex of the graph.

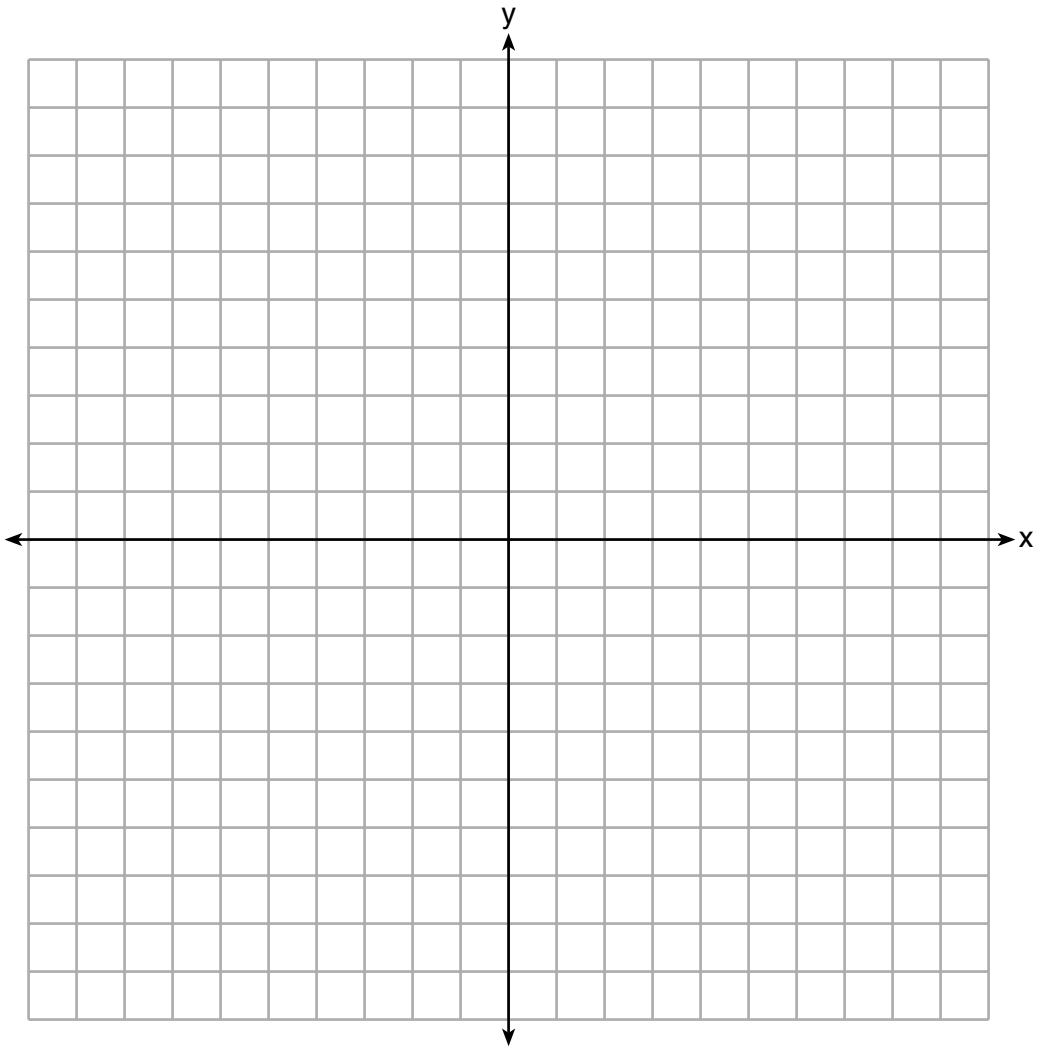
27 State whether $7 - \sqrt{2}$ is rational or irrational. Explain your answer.

28 The value, $v(t)$, of a car depreciates according to the function $v(t) = P(.85)^t$, where P is the purchase price of the car and t is the time, in years, since the car was purchased. State the percent that the value of the car *decreases* by each year. Justify your answer.

29 A survey of 100 students was taken. It was found that 60 students watched sports, and 34 of these students did not like pop music. Of the students who did *not* watch sports, 70% liked pop music. Complete the two-way frequency table.

	Watch Sports	Don't Watch Sports	Total
Like Pop			
Don't Like Pop			
Total			

30 Graph the inequality $y + 4 < -2(x - 4)$ on the set of axes below.



31 If $f(x) = x^2$ and $g(x) = x$, determine the value(s) of x that satisfy the equation $f(x) = g(x)$.

32 Describe the effect that each transformation below has on the function $f(x) = |x|$, where $a > 0$.

$g(x) = |x - a|$

$h(x) = |x| - a$

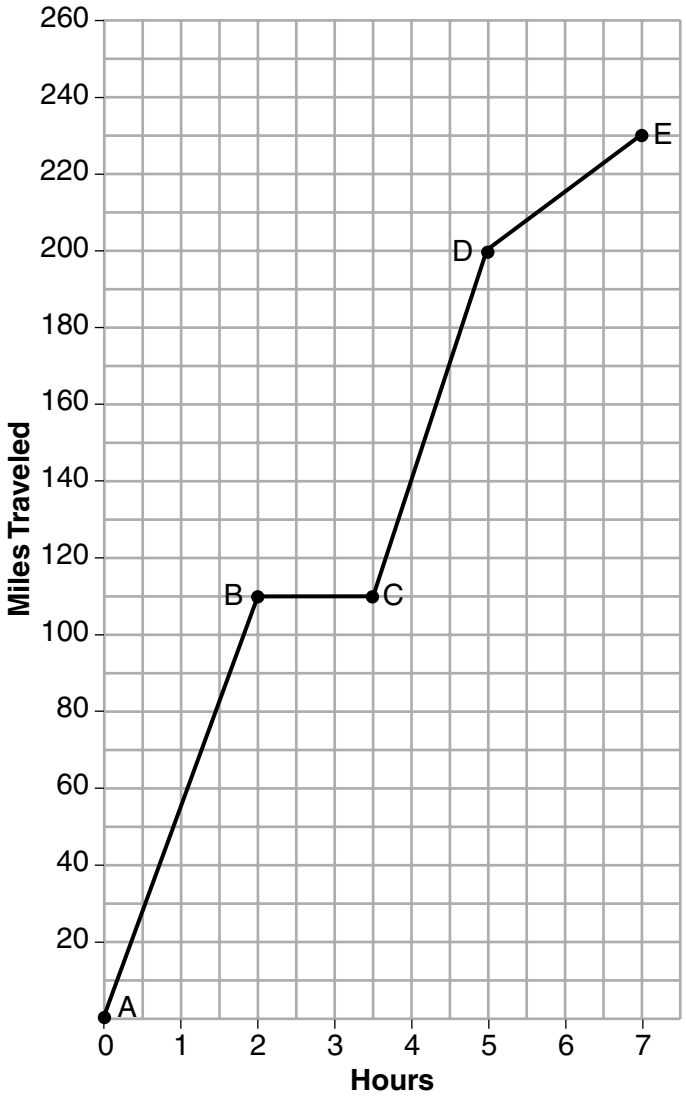
Part III

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 function $r(x)$ is defined by the expression $x^2 + 3x - 18$. Use factoring to determine the zeros of $r(x)$.

Explain what the zeros represent on the graph of $r(x)$.

34 The graph below models Craig's trip to visit his friend in another state. In the course of his travels, he encountered both highway and city driving.



Based on the graph, during which interval did Craig most likely drive in the city? Explain your reasoning.

Question 34 is continued on the next page.

Question 34 continued.

Explain what might have happened in the interval between B and C.

Determine Craig's average speed, to the *nearest tenth of a mile per hour*, for his entire trip.

35 Given:

$$g(x) = 2x^2 + 3x + 10$$
$$k(x) = 2x + 16$$

Solve the equation $g(x) = 2k(x)$ algebraically for x, to the *nearest tenth*.

Explain why you chose the method you used to solve this quadratic equation.

36 Michael has \$10 in his savings account. Option 1 will add \$100 to his account each week. Option 2 will double the amount in his account at the end of each week.

Write a function in terms of x to model each option of saving.

Michael wants to have at least \$700 in his account at the end of 7 weeks to buy a mountain bike. Determine which option(s) will enable him to reach his goal. Justify your answer.

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]

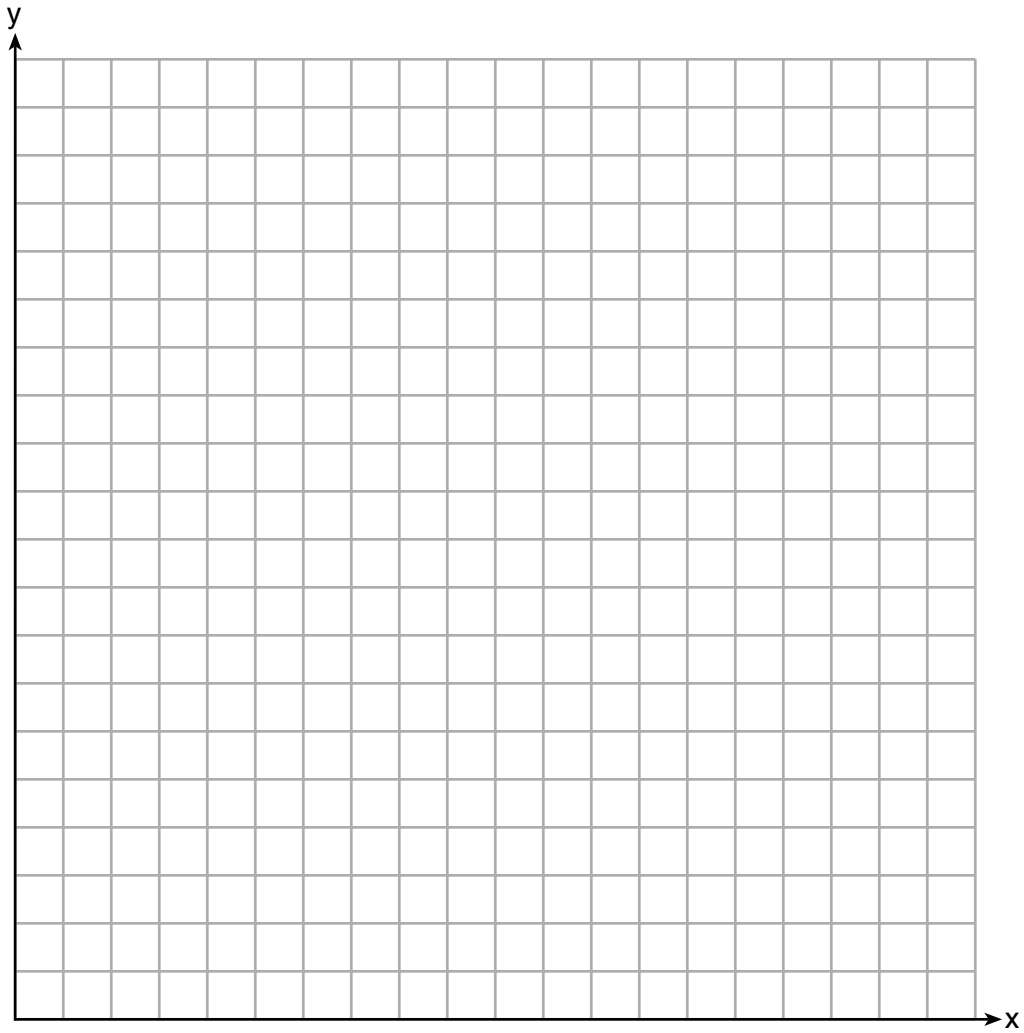
37 Central High School had five members on their swim team in 2010. Over the next several years, the team increased by an average of 10 members per year. The same school had 35 members in their chorus in 2010. The chorus saw an increase of 5 members per year.

Write a system of equations to model this situation, where x represents the number of years since 2010.

Question 37 is continued on the next page.

Question 37 continued.

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



Explain in detail what each coordinate of the point of intersection of these equations means in the context of this problem.

Part I

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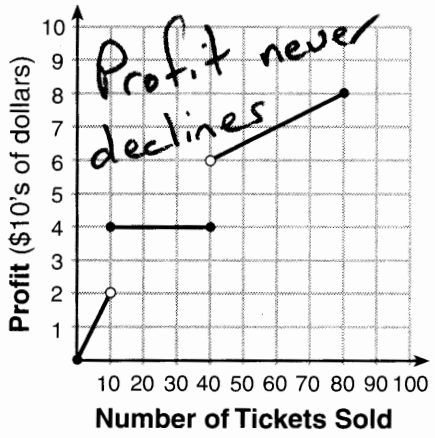
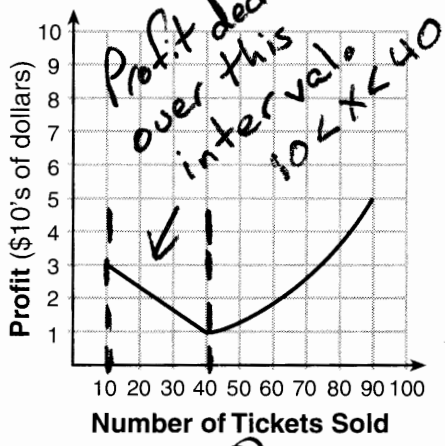
Use this space for computations.

1 To keep track of his profits, the owner of a carnival booth decided to model his ticket sales on a graph. He found that his profits only declined when he sold between 10 and 40 tickets. Which graph could represent his profits?



(1)



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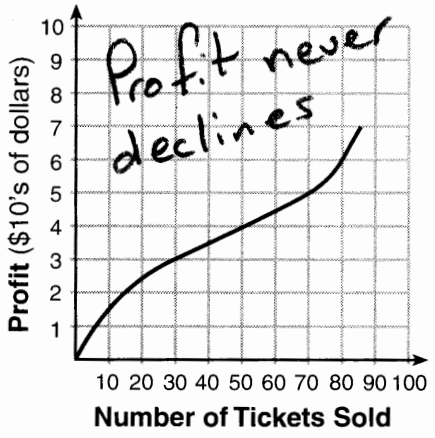

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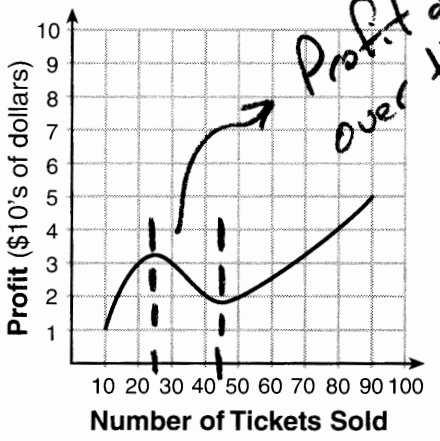


(4)

Vocabulary: Decline means to reduce or go down.

Use this space for computations.

2 The formula for the surface area of a right rectangular prism is $A = 2lw + 2hw + 2lh$, where l, w, and h represent the length, width, and height, respectively. Which term of this formula is *not* dependent on the height?

(1) A Dependent Variable

(2) $2lw$

(3) $2hw$

(4) $2lh$

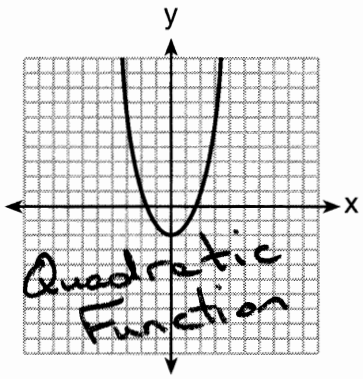
$A = 2lw + 2hw + 2lh$

Term #1 Term #2 Term #3 Term #4

3 Which graph represents $y = \sqrt{x - 2}$?

This is a root function.

(1)



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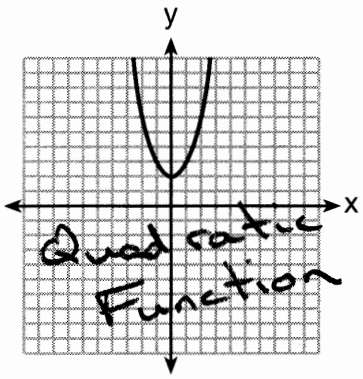

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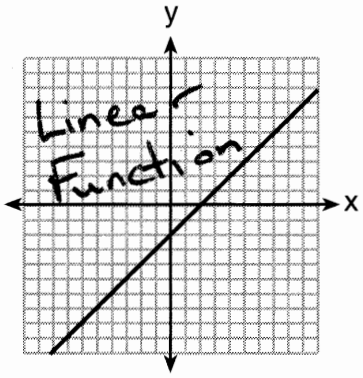
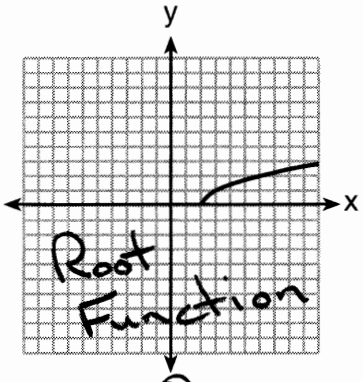
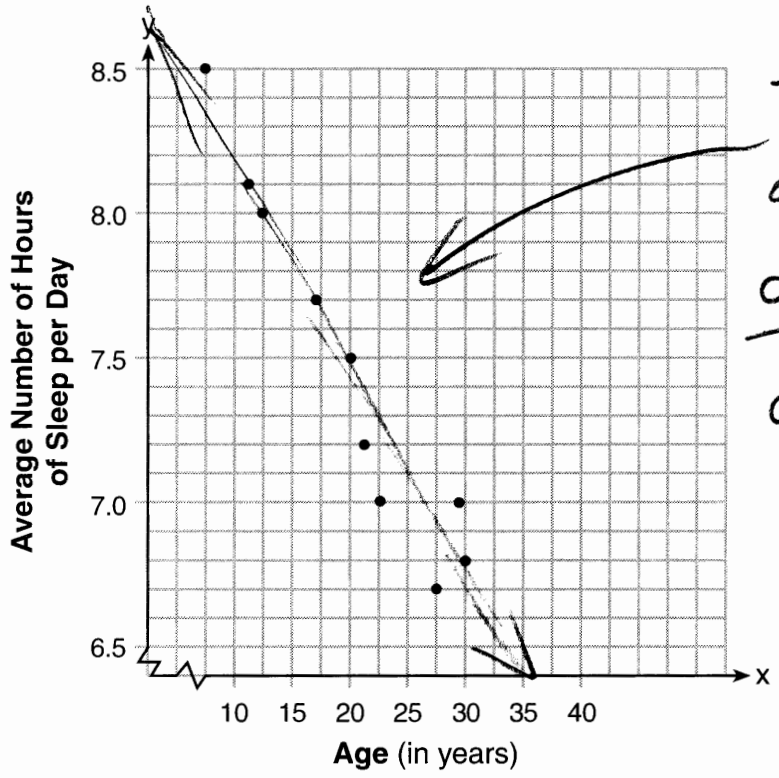


(4)



Use this space for computations.

4 A student plotted the data from a sleep study as shown in the graph below.



average
The number of hours of sleep per day decreases as age increases.

The student used the equation of the line $y = -0.09x + 9.24$ to model the data. What does the rate of change represent in terms of these data?

(1) The average number of hours of sleep per day increases 0.09 hour per year of age.

(2) The average number of hours of sleep per day decreases 0.09 hour per year of age.

(3) The average number of hours of sleep per day increases 9.24 hours per year of age.

(4) The average number of hours of sleep per day decreases 9.24 hours per year of age.

$y = -0.09x + 9.24$

$y = mx + b$

m = slope = -0.09

b = y-intercept = 9.24

Use this space for computations.

5 Lynn, Jude, and Anne were given the function $f(x) = -2x^2 + 32$, and they were asked to find $f(3)$. Lynn's answer was 14, Jude's answer was 4, and Anne's answer was ± 4. Who is correct?

(1) Lynn, only
(2) Jude, only
(3) Anne, only
(4) Both Lynn and Jude

$f(x) = -2x^2 + 32$
$f(3) = -2(3)^2 + 32$
$f(3) = -2(9) + 32$
$f(3) = -18 + 32$
$f(3) = 14$

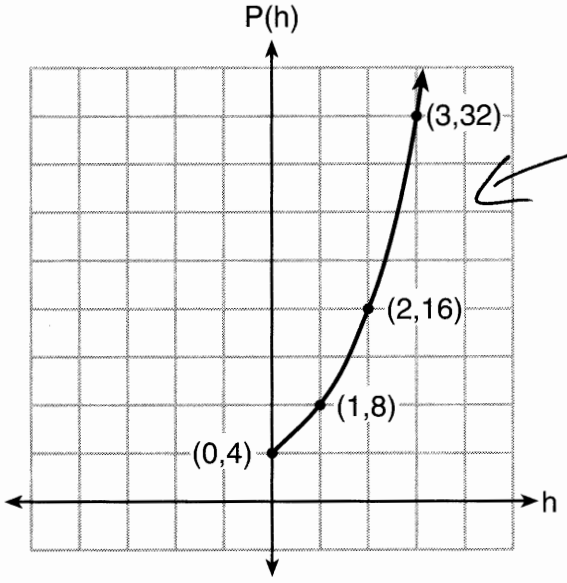
Difference of Perfect Squares

6 Which expression is equivalent to $16x^4 - 64$?

(1) $(4x^2 - 8)^2$
(2) $(8x^2 - 32)^2$
(3) $(4x^2 + 8)(4x^2 - 8)$
(4) $(8x^2 + 32)(8x^2 - 32)$

$a^2 - b^2 = (a+b)(a-b)$
$16x^4 - 64 = (4x^2+8)(4x^2-8)$

7 Vinny collects population data, $P(h)$, about a specific strain of bacteria over time in hours, h, as shown in the graph below.



This is the graph of an exponential function.

Which equation represents the graph of $P(h)$?

(1) $P(h) = 4(2)^h$ ← exponent
(2) $P(h) = \frac{46}{5}h + \frac{6}{5}$
(3) $P(h) = 3h^2 + 0.2h + 4.2$ ← quadratic function $y = ax^2 + bx + c$
(4) $P(h) = \frac{2}{3}h^3 - h^2 + 3h + 4$ ← cubic function

linear function $y = mx + b$

Use this space for computations.

8 What is the solution to the system of equations below?

$$y = 2x + 8$$
$$3(-2x + y) = 12$$

(1) no solution
(2) infinite solutions
(3) $(-1,6)$
(4) $\left(\frac{1}{2},9\right)$

Use Substitution

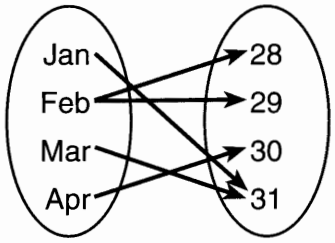
$3[-2x+(2x+8)] = 12$

$3(-2x+2x+8) = 12$

$3(8) = 12$

$24 \neq 12$

9 A mapping is shown in the diagram below.



A function has one and only one output for each input.

This mapping is

(1) a function, because Feb has two outputs, 28 and 29

(2) a function, because two inputs, Jan and Mar, result in the output 31

(3) not a function, because Feb has two outputs, 28 and 29

(4) not a function, because two inputs, Jan and Mar, result in the output 31

10 Which polynomial function has zeros at -3, 0, and 4?

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

Zeros	Factors
$x = -3$	$(x+3)$
$x = 0$	(x)
$x = 4$	$(x-4)$

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

Use this space for computations.

11 Jordan works for a landscape company during his summer vacation. He is paid $12 per hour for mowing lawns and $14 per hour for planting gardens. He can work a maximum of 40 hours per week, and would like to earn at least $250 this week. If m represents the number of hours mowing lawns and g represents the number of hours planting gardens, which system of inequalities could be used to represent the given conditions?

(1) $m + g \leq 40$
$12m + 14g \geq 250$

(2) $m + g \geq 40$
$12m + 14g \leq 250$

(3) $m + g \leq 40$
$12m + 14g \geq 250$

(4) $m + g \geq 40$
$12m + 14g \geq 250$

Eq #1
$m + g \leq 40$

Eq #2
$12m + 14g \geq 250$

12 Anne invested $1000 in an account with a 1.3% annual interest rate. She made no deposits or withdrawals on the account for 2 years. If interest was compounded annually, which equation represents the balance in the account after the 2 years?

(1) $A = 1000(1 + 0.013)^2$

(2) $A = 1000(1 + 0.013)^2$

(3) $A = 1000(1 + 1.3)^2$

(4) $A = 1000(1 + 1.3)^2$

P = .013 ← r, t

$A = P(1+r)^t$

$A = 1000(1+0.013)^2$

$P = 1,000$
$r = 0.013$
$t = 2$

13 Which value would be a solution for x in the inequality $47 - 4x < 7$?

(1) -13

(2) -10

(3) 10

(4) 11

$47 - 4x < 7$
$-47 \quad -47$
$-4x < -40$
$x > \frac{-40}{-4}$
$x > 10$

D-4

14 Bella recorded data and used her graphing calculator to find the equation for the line of best fit. She then used the correlation coefficient to determine the strength of the linear fit.

Which correlation coefficient represents the strongest linear relationship?

(1) 0.9

(2) 0.5

(3) $|-0.3| = .3$

(4) $|-0.8| = .8$

The correlation coefficient whose absolute value is closest to 1 is the strongest.

Use this space for computations.

15 The heights, in inches, of 12 students are listed below.

61, 67, 72, 62, 65, 59, 60, 79, 60, 61, 64, 63

Use a graphing calculator to find one variable stats.

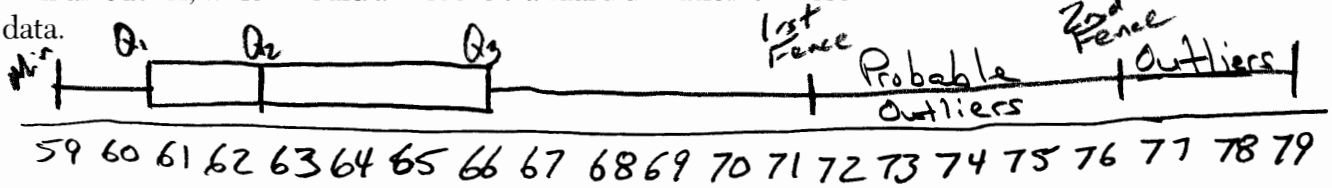
Which statement best describes the spread of these data?

(1) The set of data is evenly spread.

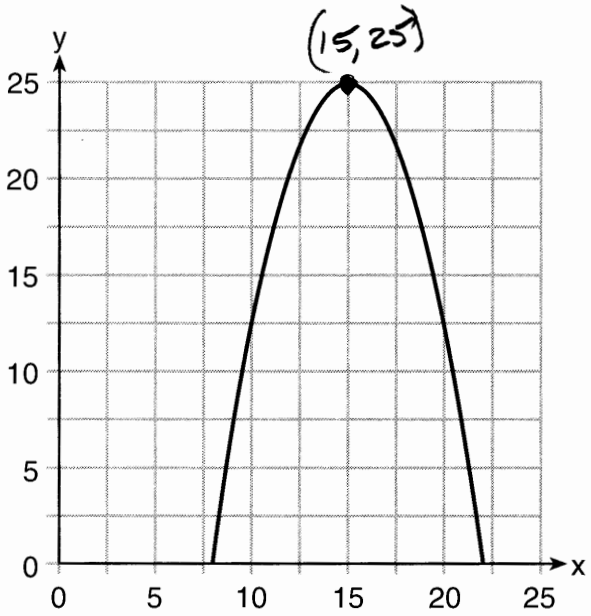
(2) The median of the data is 59.5.

(3) The set of data is skewed because 59 is the only value below 60.

(4) 79 is an outlier, which would affect the standard deviation of these data.



16 The graph of a quadratic function is shown below.



An equation that represents the function could be

(1) $q(x) = \frac{1}{2}(x + 15)^2 - 25$

(2) $q(x) = -\frac{1}{2}(x + 15)^2 - 25$

(3) $q(x) = \frac{1}{2}(x - 15)^2 + 25$

(4) $q(x) = -\frac{1}{2}(x - 15)^2 + 25$ ← Vertex Form shows the vertex at (15, 25)

Change this sign

keep this sign

Use this space for computations.

17 Which statement is true about the quadratic functions $g(x)$, shown in the table below, and $f(x) = (x - 3)^2 + 2$?

x	g(x)
0	4
1	−1
2	−4
3	−5
4	−4
5	−1
6	4

axis of symmetry $x = 3$

Vertex is $(3, -5)$

$f(x) = (x-3)^2 + 2$ ← Vertex form

change sign keep sign

Vertex is $(3, 2)$

axis of symmetry $x = 3$

$(3, 2) \neq (3, -5)$

(1) They have the same vertex.

(2) They have the same zeros.

(3) They have the same axis of symmetry.

(4) They intersect at two points.

18 Given the function $f(n)$ defined by the following:

$$f(1) = 2$$
$$f(n) = -5f(n - 1) + 2$$

Which set could represent the range of the function?

(1) {2, 4, 6, 8,...}

(2) {2, −8, 42, −208,...}

(3) {−8, −42, −208, 1042,...}

(4) {−10, 50, −250, 1250,...}

the set must begin with 2

$f(1) = 2$

$f(2) = -5f(1) + 2$

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

$f(2) = -10 + 2$

$f(2) = -8$ ← second # in set

19 An equation is given below.

$$4(x - 7) = 0.3(x + 2) + 2.11$$

The solution to the equation is

(1) 8.3

(2) 8.7

(3) 3

(4) −3

$4x - 28 = .3x + .6 + 2.11$

$4x - .3x = 28 + .6 + 2.11$

$3.7x = 30.71$

$x = 8.3$

Use this space for computations.

20 A construction worker needs to move 120 ft^3 of dirt by using a wheelbarrow. One wheelbarrow load holds 8 ft^3 of dirt and each load takes him 10 minutes to complete. One correct way to figure out the number of hours he would need to complete this job is

(1) $\frac{120\ ft^3}{1} \cdot \frac{10\ min}{1\ load} \cdot \frac{60\ min}{1\ hr} \cdot \frac{1\ load}{8\ ft^3}$ $\frac{min^2}{h}$ ← makes no sense

(2) $\frac{120\ ft^3}{1} \cdot \frac{60\ min}{1\ hr} \cdot \frac{8\ ft^3}{10\ min} \cdot \frac{1}{1\ load}$ $\frac{ft^3}{load}$

(3) $\frac{120\ ft^3}{1} \cdot \frac{1\ load}{10\ min} \cdot \frac{8\ ft^3}{1\ load} \cdot \frac{1\ hr}{60\ min}$ $\frac{ft^3 hr}{min^2}$

(4) $\frac{120\ ft^3}{1} \cdot \frac{1\ load}{8\ ft^3} \cdot \frac{10\ min}{1\ load} \cdot \frac{1\ hr}{60\ min}$ $\frac{hr}{1}$ ← The answer needs to be in hour units.

21 One characteristic of all linear functions is that they change by

(1) equal factors over equal intervals

(2) unequal factors over equal intervals

(3) equal differences over equal intervals

(4) unequal differences over equal intervals

Constant rate of change

22 What are the solutions to the equation $x^2 - 8x = 10$?

(1) $4 \pm \sqrt{10}$

(2) $4 \pm \sqrt{26}$

(3) $-4 \pm \sqrt{10}$

(4) $-4 \pm \sqrt{26}$

$x^2 - 8x = 10$

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

$(x-4)^2 = 10 + 16$

$(x-4)^2 = 26$

$\sqrt{(x-4)^2} = \sqrt{26}$

$x - 4 = \pm\sqrt{26}$

$x = 4 \pm \sqrt{26}$

Use this space for computations.

23 The formula for blood flow rate is given by $F = \frac{p_1 - p_2}{r}$, where F is the flow rate, p_1 the initial pressure, p_2 the final pressure, and r the resistance created by blood vessel size. Which formula can *not* be derived from the given formula?

(1) $p_1 = Fr + p_2$

(2) $p_2 = p_1 - Fr$

(3) $r = F(p_2 - p_1)$

(4) $r = \frac{p_1 - p_2}{F}$

$F = \frac{P_1 - P_2}{r}$

$rF = P_1 - P_2$

$r = \frac{P_1 - P_2}{F}$

I (r) is this

It can't be this

24 Morgan throws a ball up into the air. The height of the ball above the ground, in feet, is modeled by the function $h(t) = -16t^2 + 24t$, where t represents the time, in seconds, since the ball was thrown. What is the appropriate domain for this situation?

(1) $0 \le t \le 1.5$

(2) $0 \le t \le 9$

(3) $0 \le h(t) \le 1.5$

(4) $0 \le h(t) \le 9$

$h(t) = -16t^2 + 24t$

$0 = -16t^2 + 24t$

$0 = -8t(2t - 3)$

$-8t = 0$

$t = \frac{0}{-8}$

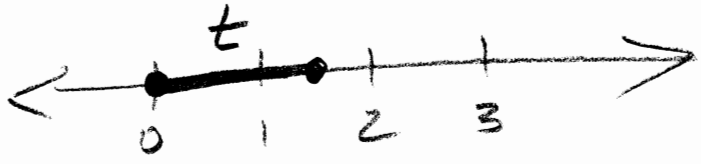
$t = 0$

$2t - 3 = 0$

$2t = 3$

$t = \frac{3}{2}$

$t = 1.5$



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]

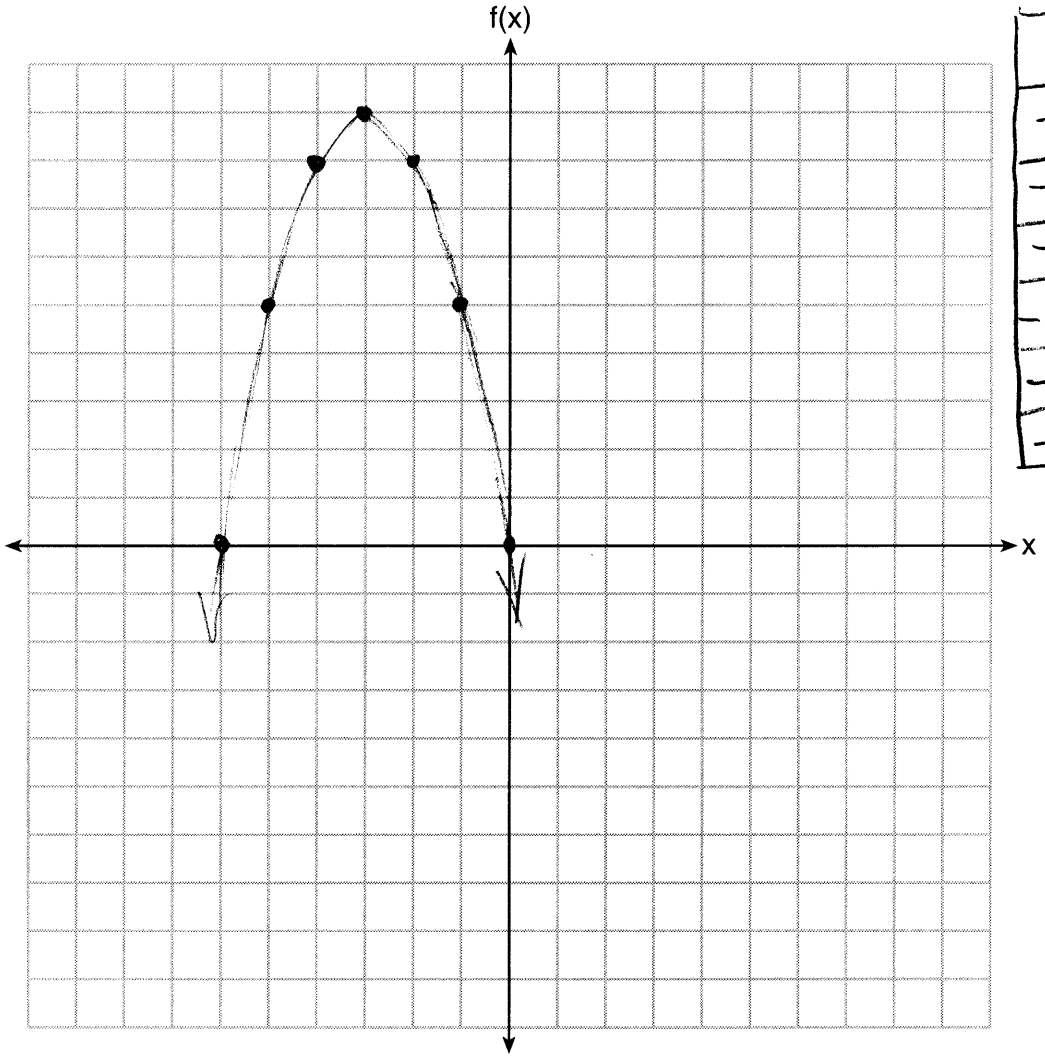
25 Express in simplest form: $(3x^2 + 4x - 8) - (-2x^2 + 4x + 2)$

$3x^2 + 4x - 8$

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

$5x^2 \quad -10$

26 Graph the function $f(x) = -x^2 - 6x$ on the set of axes below.



x	f(x)
0	0
-1	5
-2	8
-3	9
-4	8
-5	5
-6	0

State the coordinates of the vertex of the graph.

(-3, 9)

27 State whether $7 - \sqrt{2}$ is rational or irrational. Explain your answer.

Irrational

A rational number and an irrational number under addition and subtraction is always irrational.

$7 - \sqrt{2} \approx 5.585786438$

Does not repeat
Does not end
} Irrational

28 The value, $v(t)$, of a car depreciates according to the function $v(t) = P(.85)^t$, where P is the purchase price of the car and t is the time, in years, since the car was purchased. State the percent that the value of the car *decreases* by each year. Justify your answer.

Find r

$A = P(1 \pm r)^t$

$V(t) = P(.85)^t$

$1 - r = .85$

$-r = .85 - 1$

$-r = -.15$ $\quad r = .15$

The percent that the value of the car decreases each year is 15%.

total total

total sports

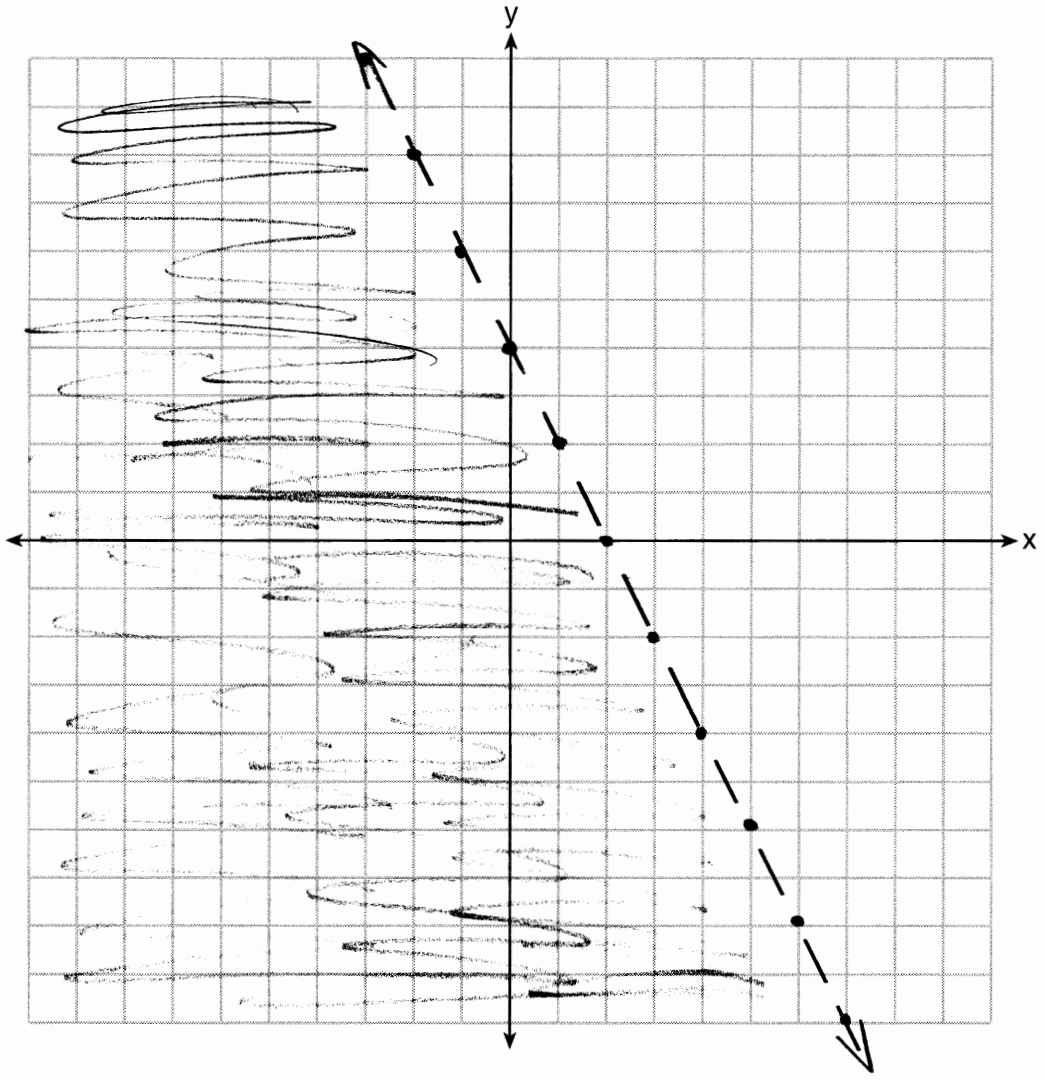
29 A survey of 100 students was taken. It was found that 60 students watched sports, and 34 of these students did not like pop music. Of the students who did *not* watch sports, 70% liked pop music. Complete the two-way frequency table.

	Watch Sports	Don't Watch Sports	Total
Like Pop	60 - 34 = 26	.70 x 40 = 28	26 + 28 = 54
Don't Like Pop	34	40 - 28 = 12	34 + 12 = 46
Total	60	100 - 60 = 40	100

30 Graph the inequality $y + 4 < -2(x - 4)$ on the set of axes below.

$y+4 < -2x+8$

$y < -2x+4$



31 If $f(x) = x^2$ and $g(x) = x$, determine the value(s) of x that satisfy the equation $f(x) = g(x)$.

$f(x) = x^2$

$g(x) = x$

$f(x) = g(x)$

$x^2 = x$

$x^2 - x = 0$

$x(x-1) = 0$

$x = 0$

$x - 1 = 0$

$x = 1$

32 Describe the effect that each transformation below has on the function $f(x) = |x|$, where $a > 0$.

$g(x) = |x - a|$

Moves f(x) "a" units to the right.

$h(x) = |x| - a$

Lowers f(x) by "a" units.

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 function $r(x)$ is defined by the expression $x^2 + 3x - 18$. Use factoring to determine the zeros of $r(x)$.

$x^2+3x-18=0$

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

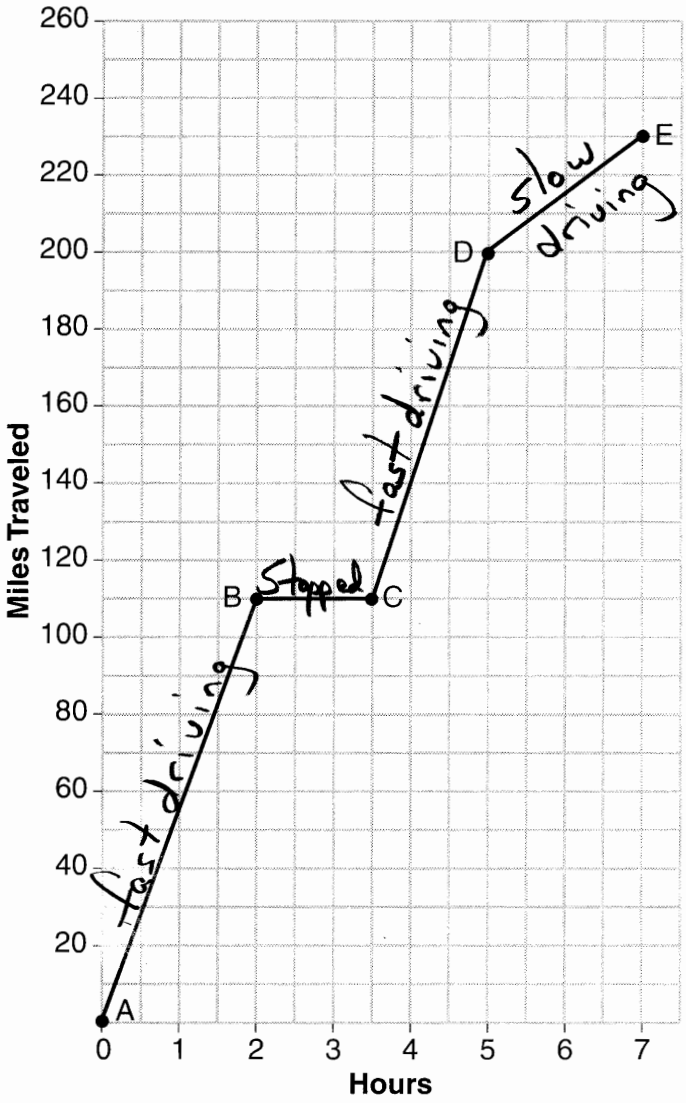
$x+6=0$ $\quad$ $x-3=0$

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

Explain what the zeros represent on the graph of $r(x)$.

The zeros of a function are the x-values when $y=0$.

34 The graph below models Craig's trip to visit his friend in another state. In the course of his travels, he encountered both highway and city driving.



Based on the graph, during which interval did Craig most likely drive in the city? Explain your reasoning.

$\overline{DE}$, because you should drive slower in the city than on the highway.

Question 34 is continued on the next page.

Question 34 continued.

Explain what might have happened in the interval between B and C.

Craig might have stopped for lunch.

Determine Craig's average speed, to the *nearest tenth of a mile per hour*, for his entire trip.

$$\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{230 \text{ miles}}{7 \text{ hours}}$$

$$\frac{230}{7} = 32.857$$

32.9 miles per hour

35 Given:

$$g(x) = 2x^2 + 3x + 10$$
$$k(x) = 2x + 16$$

Solve the equation $g(x) = 2k(x)$ algebraically for x, to the *nearest tenth*.

$g(x) = 2k(x)$

$2x^2 + 3x + 10 = 2(2x + 16)$

$2x^2 + 3x + 10 = 4x + 32$

$2x^2 - x - 22 = 0$

$a = 2 \quad b = -1 \quad c = -22$

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

$$x = \frac{1 \pm \sqrt{1 - 4(2)(-22)}}{4}$$

$$x = \frac{1 \pm \sqrt{177}}{4}$$

$$x = \frac{1 + \sqrt{177}}{4} = 3.576033 \approx \boxed{3.6}$$

$$x = \frac{1 - \sqrt{177}}{4} = -3.076033 \approx \boxed{-3.1}$$

Explain why you chose the method you used to solve this quadratic equation.

Quadratic formula always works.

36 Michael has \$10 in his savings account. Option 1 will add \$100 to his account each week. Option 2 will double the amount in his account at the end of each week.

Write a function in terms of x to model each option of saving.

Option 1

Week	Amount
0	10
1	110
2	210
3	310
4	410
5	510

$A(x) = 10 + 100x$

Option 2

Week	Amount
0	10
1	20
2	40
3	80
4	160

$B(x) = 10(2)^x$

Michael wants to have at least \$700 in his account at the end of 7 weeks to buy a mountain bike. Determine which option(s) will enable him to reach his goal. Justify your answer.

$A(7) = 10 + 100(7)$

$A(7) = 10 + 700$

$A(7) = 710$

$B(7) = 10(2)^7$

$B(7) = 10(128)$

$B(7) = 1280$

Either option will enable Michael to reach his goal.

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 Central High School had five members on their swim team in 2010. Over the next several years, the team increased by an average of 10 members per year. The same school had 35 members in their chorus in 2010. The chorus saw an increase of 5 members per year.

Write a system of equations to model this situation, where x represents the number of years since 2010.

	2010	2011	2012	2013	2014	
x	0	1	2	3	4	
Swim Y_1	5	15	25	35	45	rate of change = 10
Chorus Y_2	35	40	45	50	55	rate of change = 5

y-intercepts

$Y_1 = 10x + 5$

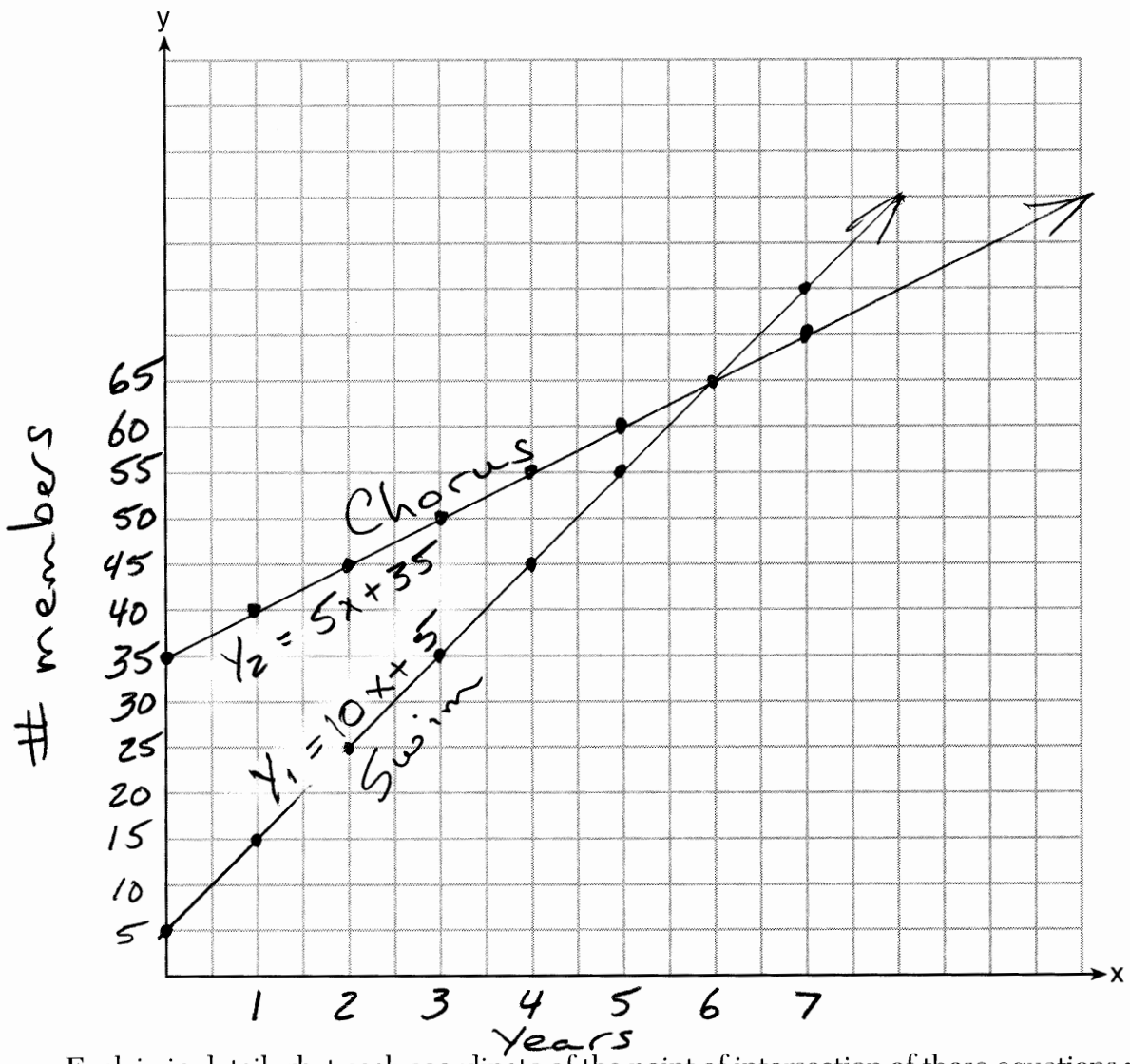
$Y_2 = 5x + 35$

$y = mx + b$

Question 37 is continued on the next page.

Question 37 continued.

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



Explain in detail what each coordinate of the point of intersection of these equations means in the context of this problem.

In the sixth year, the swim team and the chorus will both have 65 members.

June 2018

Algebra Regents

And

Answers

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

ALGEBRA I

Tuesday, June 12, 2018 — 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 The solution to $4p + 2 < 2(p + 5)$ is

(1) $p > -6$

(2) $p < -6$

(3) $p > 4$

(4) $p < 4$

2 If $k(x) = 2x^2 - 3\sqrt{x}$, then $k(9)$ is

(1) 315

(2) 307

(3) 159

(4) 153

3 The expression $3(x^2 + 2x - 3) - 4(4x^2 - 7x + 5)$ is equivalent to

(1) $-13x - 22x + 11$

(2) $-13x^2 + 34x - 29$

(3) $19x^2 - 22x + 11$

(4) $19x^2 + 34x - 29$

4 The zeros of the function $p(x) = x^2 - 2x - 24$ are

(1) -8 and 3

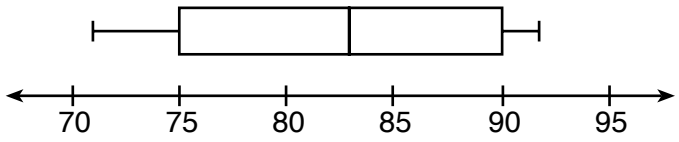
(2) -6 and 4

(3) -4 and 6

(4) -3 and 8

Use this space for computations.

5 The box plot below summarizes the data for the average monthly high temperatures in degrees Fahrenheit for Orlando, Florida.



The third quartile is

(1) 92 (3) 83

(2) 90 (4) 71

6 Joy wants to buy strawberries and raspberries to bring to a party. Strawberries cost \$1.60 per pound and raspberries cost \$1.75 per pound. If she only has \$10 to spend on berries, which inequality represents the situation where she buys x pounds of strawberries and y pounds of raspberries?

(1) $1.60x + 1.75y \leq 10$ (3) $1.75x + 1.60y \leq 10$

(2) $1.60x + 1.75y \geq 10$ (4) $1.75x + 1.60y \geq 10$

7 On the main floor of the Kodak Hall at the Eastman Theater, the number of seats per row increases at a constant rate. Steven counts 31 seats in row 3 and 37 seats in row 6. How many seats are there in row 20?

(1) 65 (3) 69

(2) 67 (4) 71

8 Which ordered pair below is *not* a solution to $f(x) = x^2 - 3x + 4$?

(1) (0,4) (3) (5,14)

(2) (1.5,1.75) (4) $(-1,6)$

Use this space for computations.

9 Students were asked to name their favorite sport from a list of basketball, soccer, or tennis. The results are shown in the table below.

	Basketball	Soccer	Tennis
Girls	42	58	20
Boys	84	41	5

What percentage of the students chose soccer as their favorite sport?

(1) 39.6%

(2) 41.4%

(3) 50.4%

(4) 58.6%

10 The trinomial $x^2 - 14x + 49$ can be expressed as

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

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

(3) $(x - 7)(x + 7)$

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

11 A function is defined as {(0,1), (2,3), (5,8), (7,2)}. Isaac is asked to create one more ordered pair for the function. Which ordered pair can he add to the set to keep it a function?

(1) (0,2)

(2) (5,3)

(3) (7,0)

(4) (1,3)

12 The quadratic equation $x^2 - 6x = 12$ is rewritten in the form $(x + p)^2 = q$, where q is a constant. What is the value of p?

(1) -12

(2) -9

(3) -3

(4) 9

Use this space for computations.

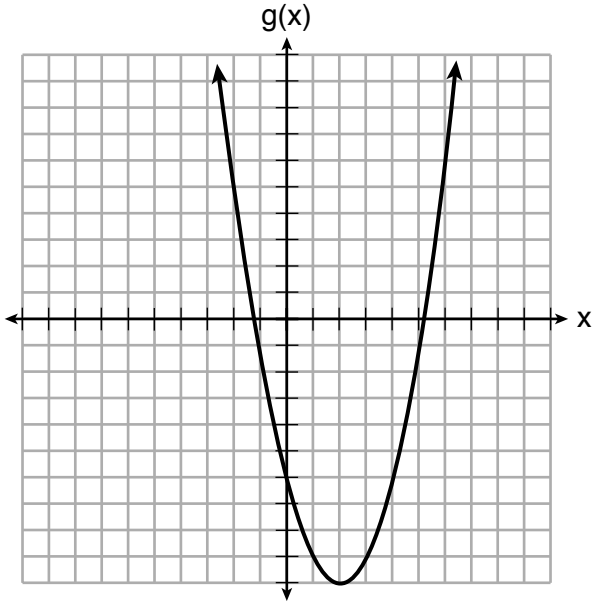
13 Which of the quadratic functions below has the *smallest* minimum value?

$h(x) = x^2 + 2x - 6$

(1)

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

(3)



(2)

x	f(x)
−1	−2
0	−5
1	−6
2	−5
3	−2

(4)

14 Which situation is *not* a linear function?

(1) A gym charges a membership fee of \$10.00 down and \$10.00 per month.

(2) A cab company charges \$2.50 initially and \$3.00 per mile.

(3) A restaurant employee earns \$12.50 per hour.

(4) A \$12,000 car depreciates 15% per year.

Use this space for computations.

15 The Utica Boilermaker is a 15-kilometer road race. Sara is signed up to run this race and has done the following training runs:

I. 10 miles
II. 44,880 feet
III. 15,560 yards

Which run(s) are at least 15 kilometers?

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

16 If $f(x) = x^2 + 2$, which interval describes the range of this function?

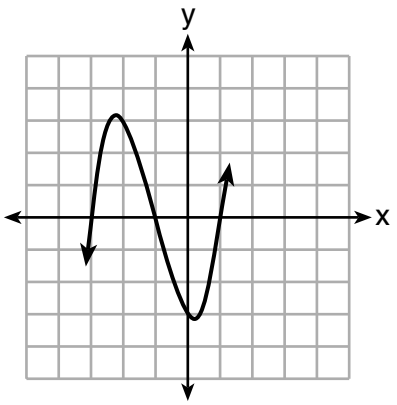
(1) $(-\infty,\infty)$
(2) $[0,\infty)$
(3) $[2,\infty)$
(4) $(-\infty,2]$

17 The amount Mike gets paid weekly can be represented by the expression $2.50a + 290$, where a is the number of cell phone accessories he sells that week. What is the constant term in this expression and what does it represent?

(1) $2.50a$, the amount he is guaranteed to be paid each week
(2) $2.50a$, the amount he earns when he sells a accessories
(3) 290, the amount he is guaranteed to be paid each week
(4) 290, the amount he earns when he sells a accessories

Use this space for computations.

18 A cubic function is graphed on the set of axes below.



Which function could represent this graph?

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

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

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

(4) $k(x) = (x + 3)(x + 1)(x - 3)$

Use this space for computations.

19 Mrs. Allard asked her students to identify which of the polynomials below are in standard form and explain why.

I. $15x^4 - 6x + 3x^2 - 1$

II. $12x^3 + 8x + 4$

III. $2x^5 + 8x^2 + 10x$

Which student's response is correct?

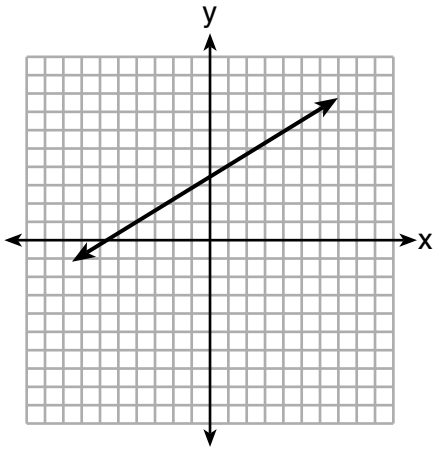
(1) Tyler said I and II because the coefficients are decreasing.

(2) Susan said only II because all the numbers are decreasing.

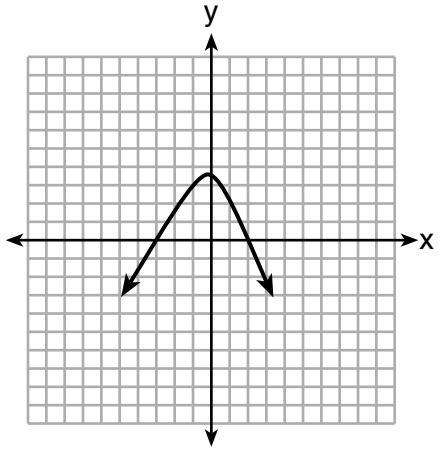
(3) Fred said II and III because the exponents are decreasing.

(4) Alyssa said II and III because they each have three terms.

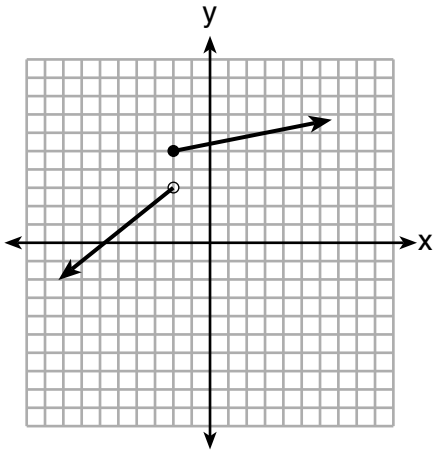
20 Which graph does *not* represent a function that is always increasing over the entire interval $-2 < x < 2$?



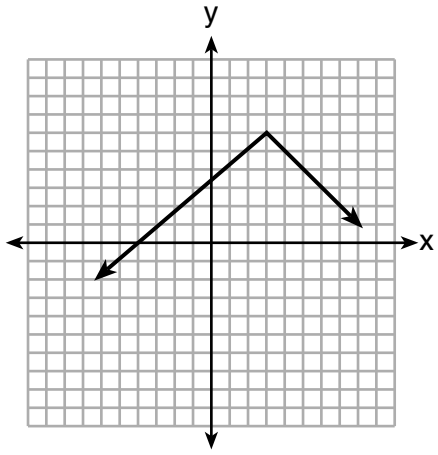
(1)



(3)



(2)



(4)

Use this space for computations.

21 At an ice cream shop, the profit, $P(c)$, is modeled by the function $P(c) = 0.87c$, where c represents the number of ice cream cones sold. An appropriate domain for this function is

(1) an integer ≤ 0

(2) an integer ≥ 0

(3) a rational number ≤ 0

(4) a rational number ≥ 0

22 How many real-number solutions does $4x^2 + 2x + 5 = 0$ have?

(1) one

(2) two

(3) zero

(4) infinitely many

23 Students were asked to write a formula for the length of a rectangle by using the formula for its perimeter, $p = 2\ell + 2w$. Three of their responses are shown below.

I. $\ell = \frac{1}{2}p - w$

II. $\ell = \frac{1}{2}(p - 2w)$

III. $\ell = \frac{p - 2w}{2}$

Which responses are correct?

(1) I and II, only

(2) II and III, only

(3) I and III, only

(4) I, II, and III

24 If $a_n = n(a_{n-1})$ and $a_1 = 1$, what is the value of a_5?

(1) 5

(2) 20

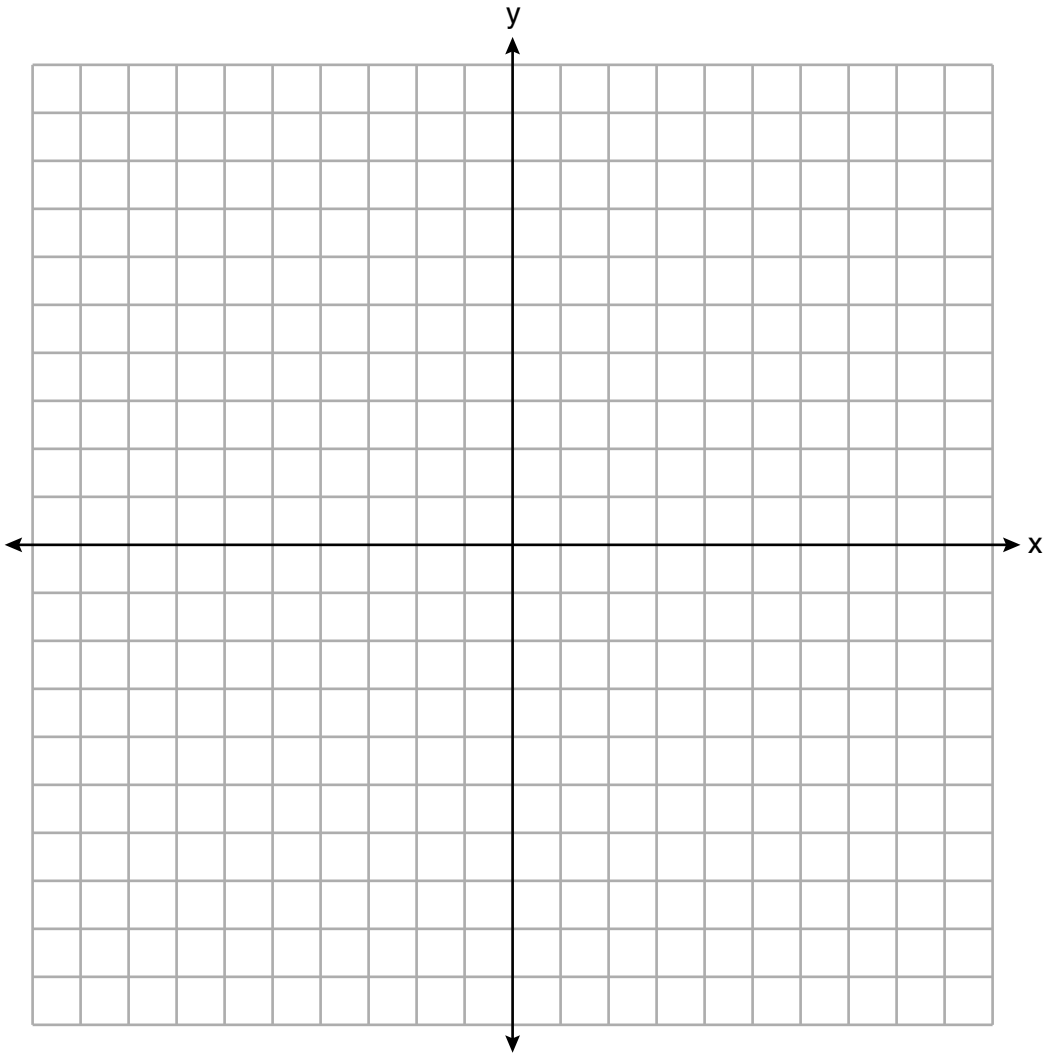
(3) 120

(4) 720

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 $f(x) = \sqrt{x+2}$ over the domain $-2 \leq x \leq 7$.



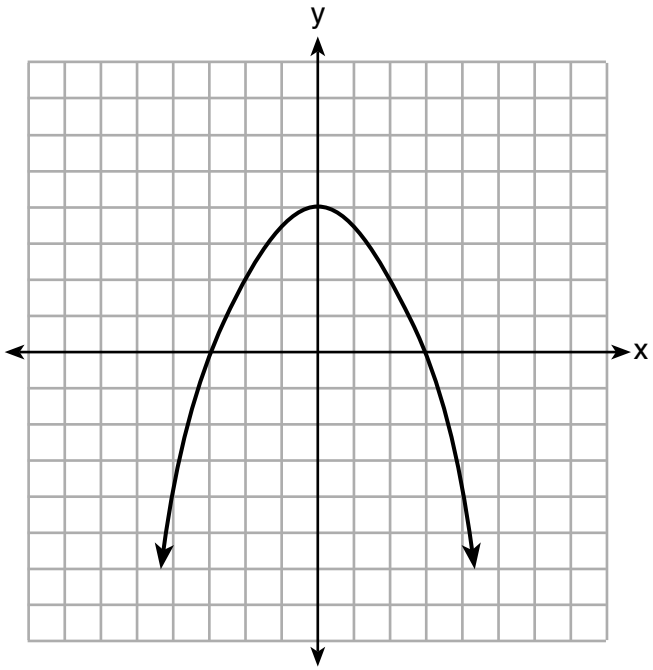
26 Caleb claims that the ordered pairs shown in the table below are from a nonlinear function.

x	f(x)
0	2
1	4
2	8
3	16

State if Caleb is correct. Explain your reasoning.

27 Solve for x to the *nearest tenth*: $x^2 + x - 5 = 0$.

28 The graph of the function $p(x)$ is represented below. On the same set of axes, sketch the function $p(x + 2)$.



29 When an apple is dropped from a tower 256 feet high, the function $h(t) = -16t^2 + 256$ models the height of the apple, in feet, after t seconds. Determine, algebraically, the number of seconds it takes the apple to hit the ground.

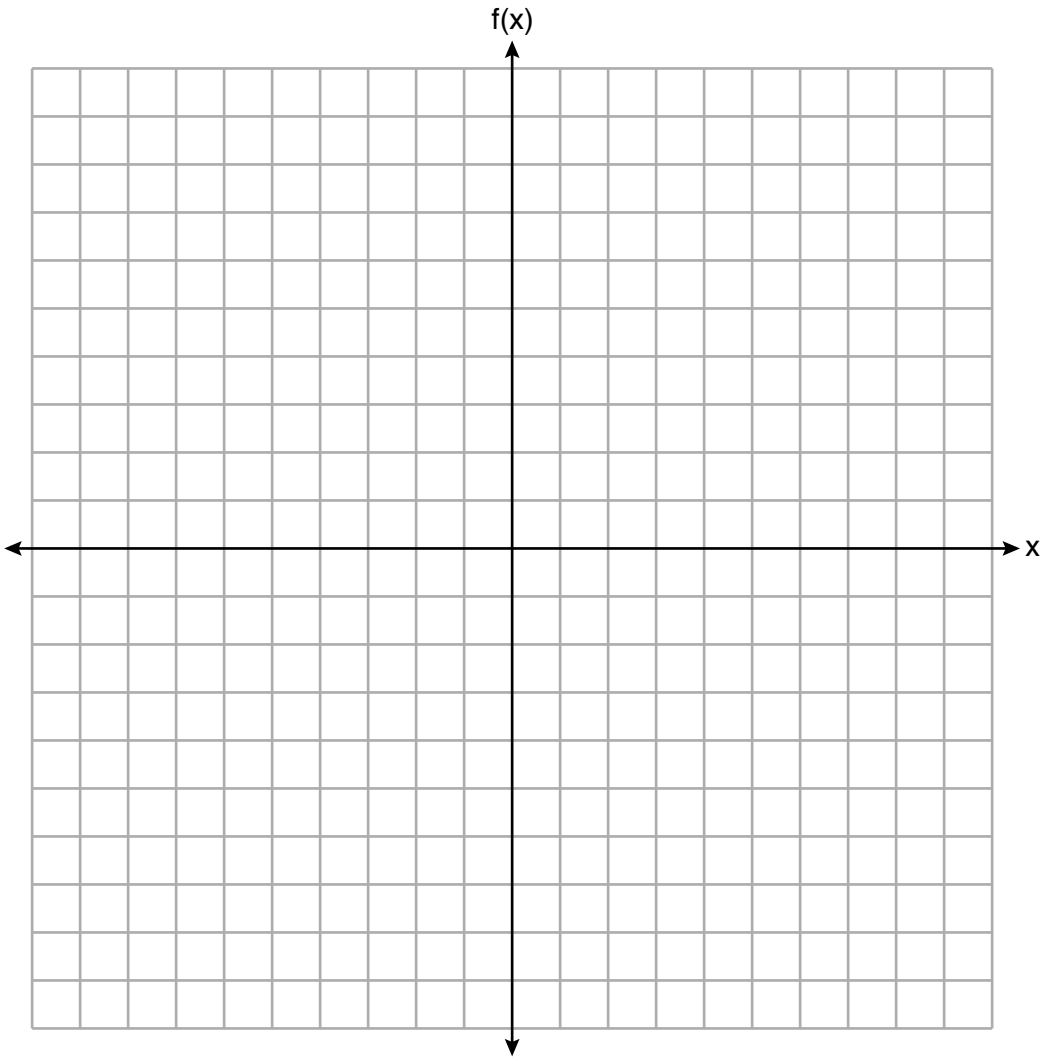
30 Solve the equation below algebraically for the exact value of x.

$$6 - \frac{2}{3}(x + 5) = 4x$$

31 Is the product of $\sqrt{16}$ and $\frac{4}{7}$ rational or irrational? Explain your reasoning.

32 On the set of axes below, graph the piecewise function:

$$f(x) = \begin{cases} -\frac{1}{2}x, & x < 2 \\ x, & x \geq 2 \end{cases}$$



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 A population of rabbits in a lab, $p(x)$, can be modeled by the function $p(x) = 20(1.014)^x$, where x represents the number of days since the population was first counted.

Explain what 20 and 1.014 represent in the context of the problem.

Determine, to the *nearest tenth*, the average rate of change from day 50 to day 100.

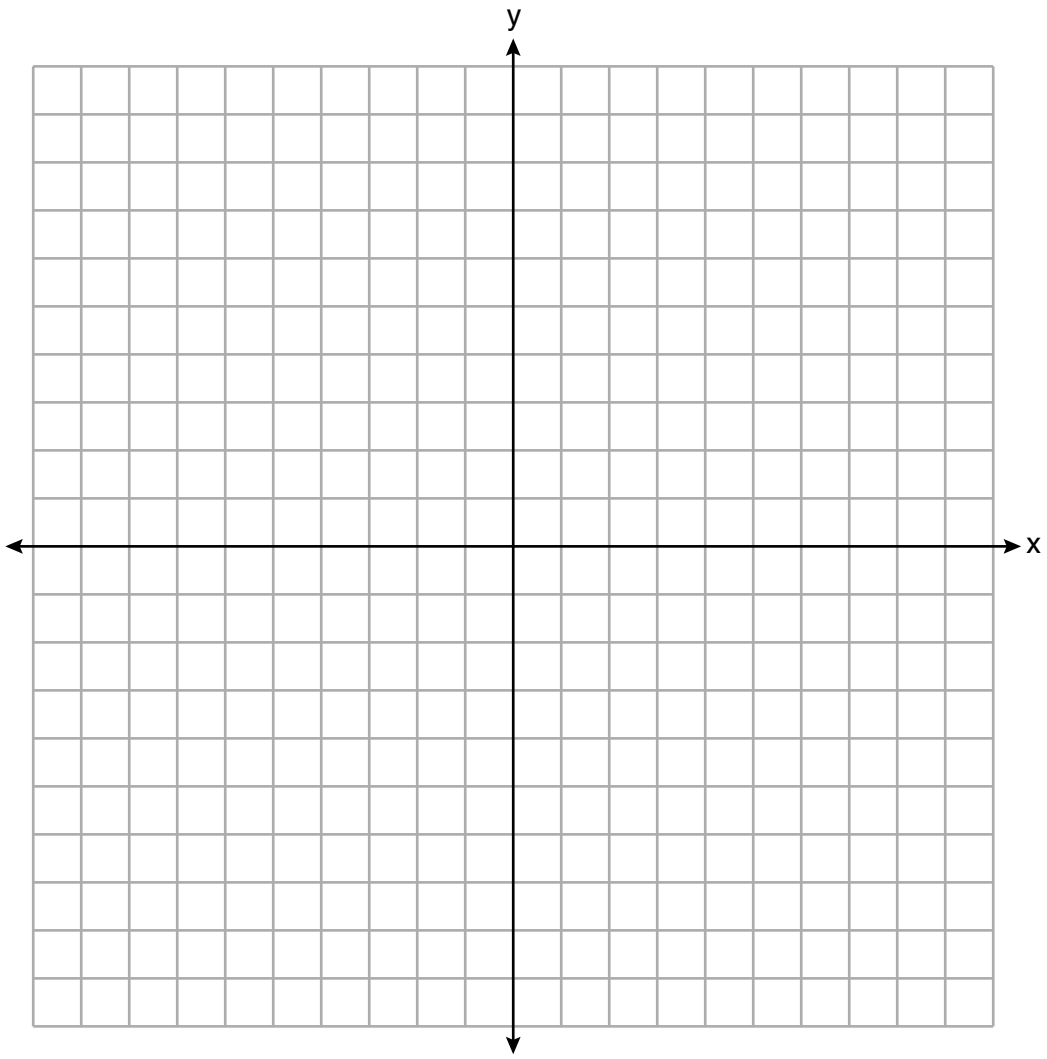
34 There are two parking garages in Beacon Falls. Garage *A* charges \$7.00 to park for the first 2 hours, and each additional hour costs \$3.00. Garage *B* charges \$3.25 per hour to park.

When a person parks for at least 2 hours, write equations to model the cost of parking for a total of x hours in Garage *A* and Garage *B*.

Determine algebraically the number of hours when the cost of parking at both garages will be the same.

35 On the set of axes below, graph the following system of inequalities:

$$2y + 3x \leq 14$$
$$4x - y < 2$$



Determine if the point (1,2) is in the solution set. Explain your answer.

36 The percentage of students scoring 85 or better on a mathematics final exam and an English final exam during a recent school year for seven schools is shown in the table below.

Percentage of Students Scoring 85 or Better	
Mathematics, x	**English, y**
27	46
12	28
13	45
10	34
30	56
45	67
20	42

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

State the correlation coefficient of the linear regression equation, to the *nearest hundredth*. Explain the meaning of this value in the context of these data.

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 Dylan has a bank that sorts coins as they are dropped into it. A panel on the front displays the total number of coins inside as well as the total value of these coins. The panel shows 90 coins with a value of $17.55 inside of the bank.

If Dylan only collects dimes and quarters, write a system of equations in two variables or an equation in one variable that could be used to model this situation.

Using your equation or system of equations, algebraically determine the number of quarters Dylan has in his bank.

Question 37 is continued on the next page.

Question 37 continued

Dylan's mom told him that she would replace each one of his dimes with a quarter. If he uses all of his coins, determine if Dylan would then have enough money to buy a game priced at $20.98 if he must also pay an 8% sales tax. Justify your answer.

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]

1 The solution to $4p + 2 < 2(p + 5)$ is

(1) $p > -6$

(2) $p < -6$

(3) $p > 4$

(4) $p < 4$

D_2 5_P 5_1

$4p + 2 < 2(p+5)$

$2p + 1 < p + 5$

$p + 1 < 5$

$p < 4$

Use this space for computations.

2 If $k(x) = 2x^2 - 3\sqrt{x}$, then $k(9)$ is

(1) 315

(2) 307

(3) 159

(4) 153

$k(x) = 2x^2 - 3\sqrt{x}$

$k(9) = 2(9)^2 - 3\sqrt{9}$

$k(9) = 2(81) - 3(3)$

$k(9) = 162 - 9$

$k(9) = 153$

3 The expression $3(x^2 + 2x - 3) - 4(4x^2 - 7x + 5)$ is equivalent to

(1) $-13x - 22x + 11$

(2) $-13x^2 + 34x - 29$

(3) $19x^2 - 22x + 11$

(4) $19x^2 + 34x - 29$

$3(x^2+2x-3) - 4(4x^2-7x+5)$

$3x^2+6x-9-16x^2+28x-20$

$3x^2-16x^2+6x+28x-9-20$

$-13x^2 + 34x - 29$

4 The zeros of the function $p(x) = x^2 - 2x - 24$ are

(1) -8 and 3

(2) -6 and 4

(3) -4 and 6

(4) -3 and 8

$p(x) = x^2 - 2x - 24$

$0 = x^2 - 2x - 24$

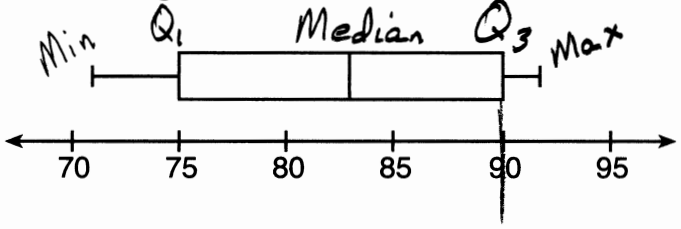
$0 = (x-6)(x+4)$

if $x - 6 = 0$ then $x = 6$

if $x + 4 = 0$ then $x = -4$

Use this space for computations.

5 The box plot below summarizes the data for the average monthly high temperatures in degrees Fahrenheit for Orlando, Florida.



The third quartile is

(1) 92
(2) 90
(3) 83
(4) 71

6 Joy wants to buy strawberries and raspberries to bring to a party. Strawberries cost \$1.60 per pound and raspberries cost \$1.75 per pound. If she only has \$10 to spend on berries, which inequality represents the situation where she buys x pounds of strawberries and y pounds of raspberries?

(1) $1.60x + 1.75y \leq 10$
(2) $1.60x + 1.75y \geq 10$
(3) $1.75x + 1.60y \leq 10$
(4) $1.75x + 1.60y \geq 10$

7 On the main floor of the Kodak Hall at the Eastman Theater, the number of seats per row increases at a constant rate. Steven counts 31 seats in row 3 and 37 seats in row 6. How many seats are there in row 20?

(1) 65
(2) 67
(3) 69
(4) 71

(X) Row #	(Y) # Seats
3	31
4	33
5	35
6	37

8 Which ordered pair below is *not* a solution to $f(x) = x^2 - 3x + 4$?

(1) (0,4)
(2) (1.5,1.75)
(3) (5,14)
(4) (−1,6)

Input function in graphing calculator and inspect table of values.

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

X	Y
-1	8
0	4
1	2
2	2
3	4
4	8
5	14

Use this space for computations.

9 Students were asked to name their favorite sport from a list of basketball, soccer, or tennis. The results are shown in the table below.

	Basketball	Soccer	Tennis
Girls	42	58	20
Boys	84	41	5

Totals 126 + 99 + 25 = 250

What percentage of the students chose soccer as their favorite sport?

(1) 39.6%
(2) 41.4%
(3) 50.4%
(4) 58.6%

Like Soccer: 58+41 = 99
Total: 126+99+25=250

$\frac{99}{250} = \frac{x}{100}$

$9900 = 250x$

$\frac{9900}{250} = x$

$39.6 = x$

10 The trinomial $x^2 - 14x + 49$ can be expressed as

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

$(x-7)(x-7)$

$x^2 - 7x - 7x + 49$

$x^2 - 14x + 49$ ✓

11 A function is defined as {(0,1), (2,3), (5,8), (7,2)}. Isaac is asked to create one more ordered pair for the function. Which ordered pair can he add to the set to keep it a function?

(1) (0,2) zero is paired w/ 1
(2) (5,3) 5 is paired w/ 8
(3) (7,0) 7 is paired with 2
(4) (1,3)

For each value of x in a function, there can be one and only one value of y.

12 The quadratic equation $x^2 - 6x = 12$ is rewritten in the form $(x + p)^2 = q$, where q is a constant. What is the value of p?

(1) −12
(2) −9
(3) −3
(4) 9

Complete the Square

$x^2 - 6x = 12$

$x^2 - 6x + (-3)^2 = 12 + (-3)^2$

$(x-3)^2 = 12 + 9$

$(x-3)^2 = 21$

$(x+p)^2 = q$

$p = -3$

13 Which of the quadratic functions below has the *smallest* minimum value?

Use this space for computations.

Vertex is at (1, -7)
so min is -7

$h(x) = x^2 + 2x - 6$

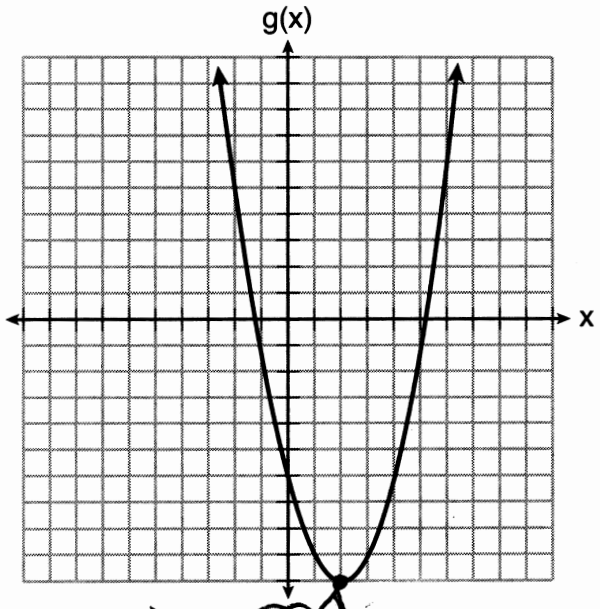
(1)

Vertex is at (-3.5, -2.25)
so min is (-2.25)

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

(3)

Use a graphing calculator!



Answer → (2)

Vertex is at (2, -10)
so min is -10

x	f(x)
−1	−2
0	−5
1	−6
2	−5
3	−2

← Vertex is at (1, -6)
so min is -6

(4)

14 Which situation is *not* a linear function?

(1) A gym charges a membership fee of \$10.00 down and \$10.00 per month.

(2) A cab company charges \$2.50 initially and \$3.00 per mile.

(3) A restaurant employee earns \$12.50 per hour.

(4) A \$12,000 car depreciates 15% per year.

constant rates of change mean linear functions

exponential rate of change

Use this space for computations.

15 The Utica Boilermaker is a 15-kilometer road race. Sara is signed up to run this race and has done the following training runs:

✓ I. 10 miles
✗ II. 44,880 feet
✗ III. 15,560 yards

Which run(s) are at least 15 kilometers?

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

Use the formula page!

1 km = 0.62 miles
15 km = 15(0.62) miles
15 km = 9.3 miles
15 km < 10 miles

1 mile = 5280 ft
9.3 miles = 9.3(5280 ft)
9.3 miles = 49,104 ft.
44,800 ft < 49,104 ft.

1 mile = 1760 yards
9.3 miles = 9.3(1760 yards)
9.3 miles = 16,368 yards
15,560 yds < 16,368 yds

16 If $f(x) = x^2 + 2$, which interval describes the range of this function?

✗(1) $(-\infty,\infty)$ domain
(2) $[0,\infty)$
(3) $[2,\infty)$ range
(4) $(-\infty,2]$

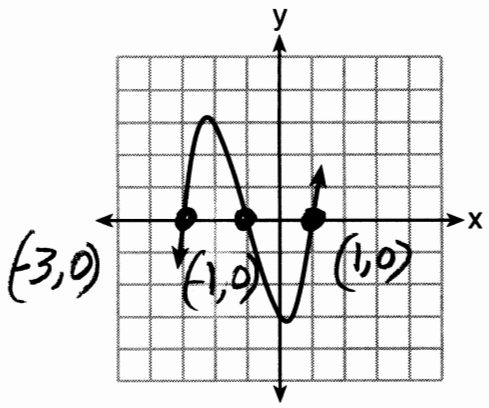
Put in graphing calculator and inspect the graph!

17 The amount Mike gets paid weekly can be represented by the expression $2.50a + 290$, where a is the number of cell phone accessories he sells that week. What is the constant term in this expression and what does it represent?

(1) $2.50a$, the amount he is guaranteed to be paid each week
(2) $2.50a$, the amount he earns when he sells a accessories
(3) 290, the amount he is guaranteed to be paid each week
(4) 290, the amount he earns when he sells a accessories

Mike gets $2.50 for every cell phone accessory plus a constant amount of $290.00 each week.

18 A cubic function is graphed on the set of axes below.



Which function could represent this graph?

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

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

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

(4) $k(x) = (x + 3)(x + 1)(x - 1)$

Use this space for computations.

Zeros	Factors
$x = -3$	$(x+3)$
$x = -1$	$(x+1)$
$x = 1$	$(x-1)$

$0 = (x+3)(x+1)(x-1)$

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

Check by inputting function in a graphing calculator and inspecting the graph.

Use this space for computations.

19 Mrs. Allard asked her students to identify which of the polynomials below are in standard form and explain why.

I. $15x^4 - 6x + 3x^2 - 1$ No

II. $12x^3 + 8x + 4$ Yes

III. $2x^5 + 8x^2 + 10x$ Yes

Which student's response is correct?

(1) Tyler said I and II because the coefficients are decreasing.

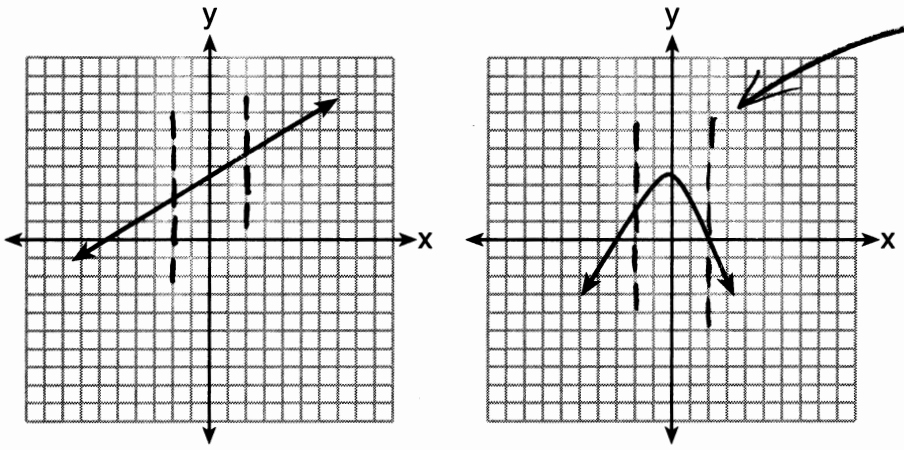
(2) Susan said only II because all the numbers are decreasing.

(3) Fred said II and III because the exponents are decreasing.

(4) Alyssa said II and III because they each have three terms.

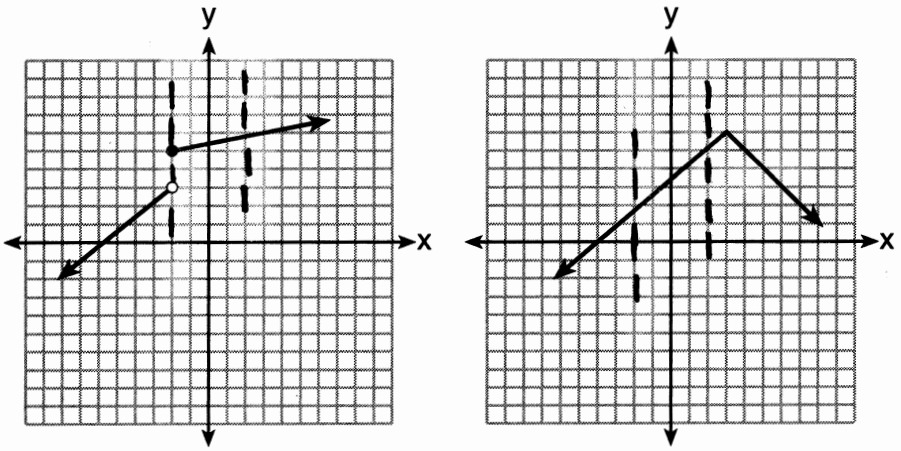
20 Which graph does *not* represent a function that is always increasing over the entire interval $-2 < x < 2$?

- goes up left to right
- goes up, then goes down.



(1)

(3)



(2)

(4)

Use this space for computations.

21 At an ice cream shop, the profit, $P(c)$, is modeled by the function $P(c) = 0.87c$, where c represents the number of ice cream cones sold. An appropriate domain for this function is

(1) an integer ≤ 0

(2) an integer ≥ 0

(3) a rational number ≤ 0

(4) a rational number ≥ 0

You can't sell a negative # of cones or a fraction of a cone.

22 How many real-number solutions does $4x^2 + 2x + 5 = 0$ have?

(1) one

(2) two

(3) zero

(4) infinitely many

$b^2 - 4ac$

$a=4, b=2, c=5$

$(2)^2 - 4(4)(5)$

$4 - 80$

-76 No real solutions

Check in graphing calculator: The parabola does not cross the x-axis, so there are no zeros (solutions)

23 Students were asked to write a formula for the length of a rectangle by using the formula for its perimeter, $p = 2\ell + 2w$. Three of their responses are shown below.

I. $\ell = \frac{1}{2}p - w$

II. $\ell = \frac{1}{2}(p - 2w)$

III. $\ell = \frac{p - 2w}{2}$

$p = 2\ell + 2w$

$p - 2w = 2\ell$

$\frac{p-2w}{2} = \ell$

$\frac{1}{2}(p-2w) = \ell$

$\frac{1}{2}p - w = \ell$

Which responses are correct?

(1) I and II, only

(2) II and III, only

(3) I and III, only

(4) I, II, and III

24 If $a_n = n(a_{n-1})$ and $a_1 = 1$, what is the value of a_5?

(1) 5

(2) 20

(3) 120

(4) 720

n	1	2	3	4	5
a_n	1	2	6	24	120
		2×1	3×2	4×6	5×24

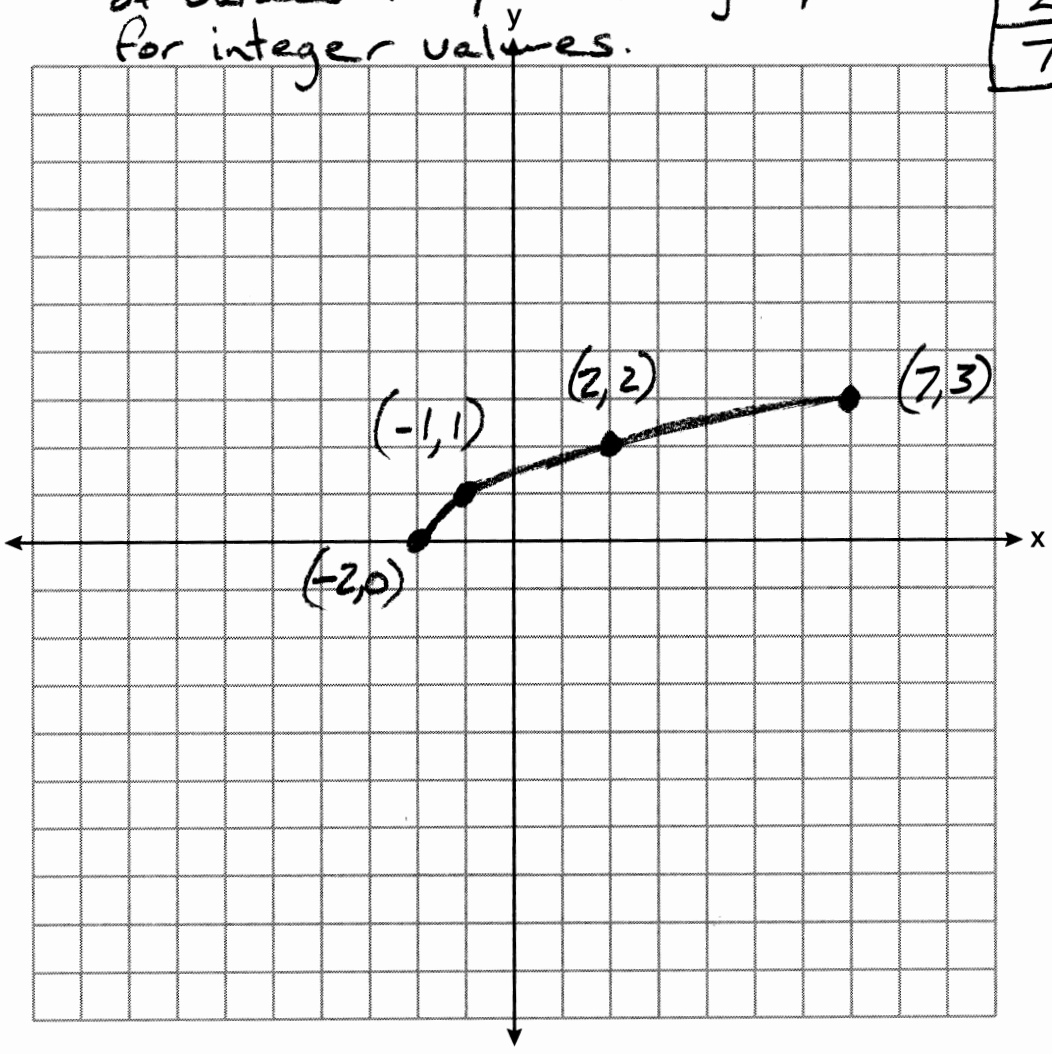
Part II

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 $f(x) = \sqrt{x+2}$ over the domain $-2 \leq x \leq 7$.

Strategy: Input function in graphing calculator and use table of values to plot the graph for integer values.

x	$f(x)$
-2	0
-1	1
2	2
7	3



26 Caleb claims that the ordered pairs shown in the table below are from a nonlinear function.

x	f(x)
0	2
1	4
2	8
3	16

Δx: 1, 1, 1 — Δy: 2, 4, 8

$\frac{\Delta y}{\Delta x}$ | $\frac{2}{1} \neq \frac{4}{1} \neq \frac{8}{1}$

State if Caleb is correct. Explain your reasoning.

Caleb is correct. The function does not have a constant rate of change, so it is not a linear function.

27 Solve for x to the *nearest tenth*: $x^2 + x - 5 = 0$.

$a = 1 \quad b = 1 \quad c = -5$

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

$$x = \frac{-(1) \pm \sqrt{(1)^2 - 4(1)(-5)}}{2(1)}$$

$$x = \frac{-1 \pm \sqrt{1 + 20}}{2}$$

$$x = \frac{-1 \pm \sqrt{21}}{2}$$

$$x = \frac{-1 \pm 4.58}{2}$$

$$x = \frac{-1 + 4.58}{2} = \frac{3.58}{2} = 1.79 = \boxed{1.8}$$

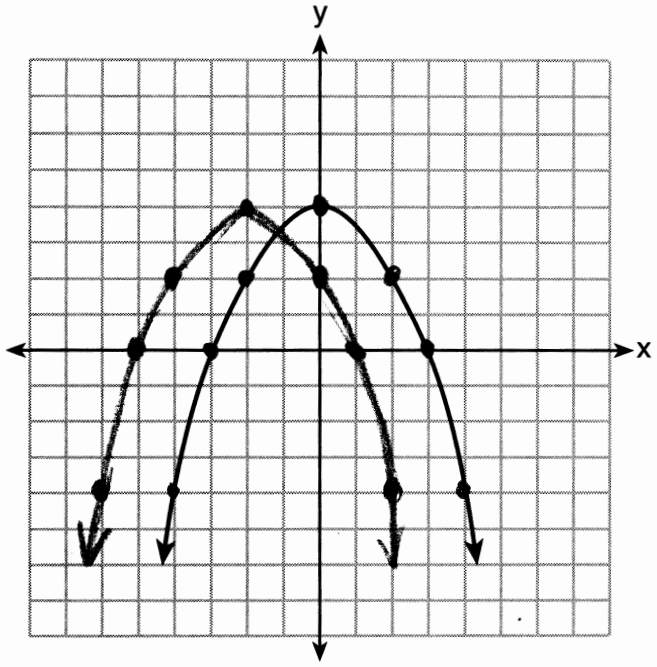
$$x = \frac{-1 - 4.58}{2} = \frac{-5.58}{2} = -2.79 = \boxed{-2.8}$$

Check using graphing calculator.

$x = 1.7912878 \quad Y = 0$ ✓

$x = -2.791288 \quad Y = 0$ ✓

28 The graph of the function $p(x)$ is represented below. On the same set of axes, sketch the function $p(x + 2)$.



Every point moves 2 units left.

29 When an apple is dropped from a tower 256 feet high, the function $h(t) = -16t^2 + 256$ models the height of the apple, in feet, after t seconds. Determine, algebraically, the number of seconds it takes the apple to hit the ground.

$h(t) = -16t^2 + 256$

$h(t) = 0$ $\quad 0 = -16t^2 + 256$

$16t^2 = 256$

$t^2 = 16$

$t = \boxed{4 \text{ seconds}}$

answer

Check

$h(4) = -16(4)^2 + 256$

$h(4) = -16(16) + 256$

$h(4) = -256 + 256$

$h(4) = 0$ ✓

30 Solve the equation below algebraically for the exact value of x.

$$6 - \frac{2}{3}(x + 5) = 4x$$

$6 = 4x + \frac{2}{3}(x+5)$

$6 = 4x + \frac{2x}{3} + \frac{10}{3}$

M(3) $18 = 12x + 2x + 10$

$8 = 14x$

D(14) $\frac{8}{14} = x$

answer $\boxed{\frac{4}{7}} = x$

Check $6 - \frac{2}{3}\left(\frac{4}{7} + 5\right) = 4\left(\frac{4}{7}\right)$

$6 - \frac{2}{3}\left(5\frac{4}{7}\right) = \frac{16}{7}$

$6 - \frac{2}{3}\left(\frac{39}{7}\right) = \frac{16}{7}$

$6 - \frac{78}{21} = \frac{16}{7}$

$\frac{126}{21} - \frac{78}{21} = \frac{48}{21}$

$\frac{48}{21} = \frac{48}{21}$ ✓

31 Is the product of $\sqrt{16}$ and $\frac{4}{7}$ rational or irrational? Explain your reasoning.

A rational number is a number that can be expressed as the ratio of two integers, as in $\frac{a}{b}$, where both a and b are integers.

$\sqrt{16}$ is rational because $\sqrt{16} = 4 = \frac{4}{1}$.

$\frac{4}{7}$ is rational because it is a ratio of two integers.

$$\left(\sqrt{16}\right)\left(\frac{4}{7}\right) = \left(\frac{4}{1}\right)\left(\frac{4}{7}\right) = \frac{16}{7}$$

(16/7: ← integer; ← integer)

Answer

Rational

Explanation

The product of two rational numbers is always rational.

32 On the set of axes below, graph the piecewise function:

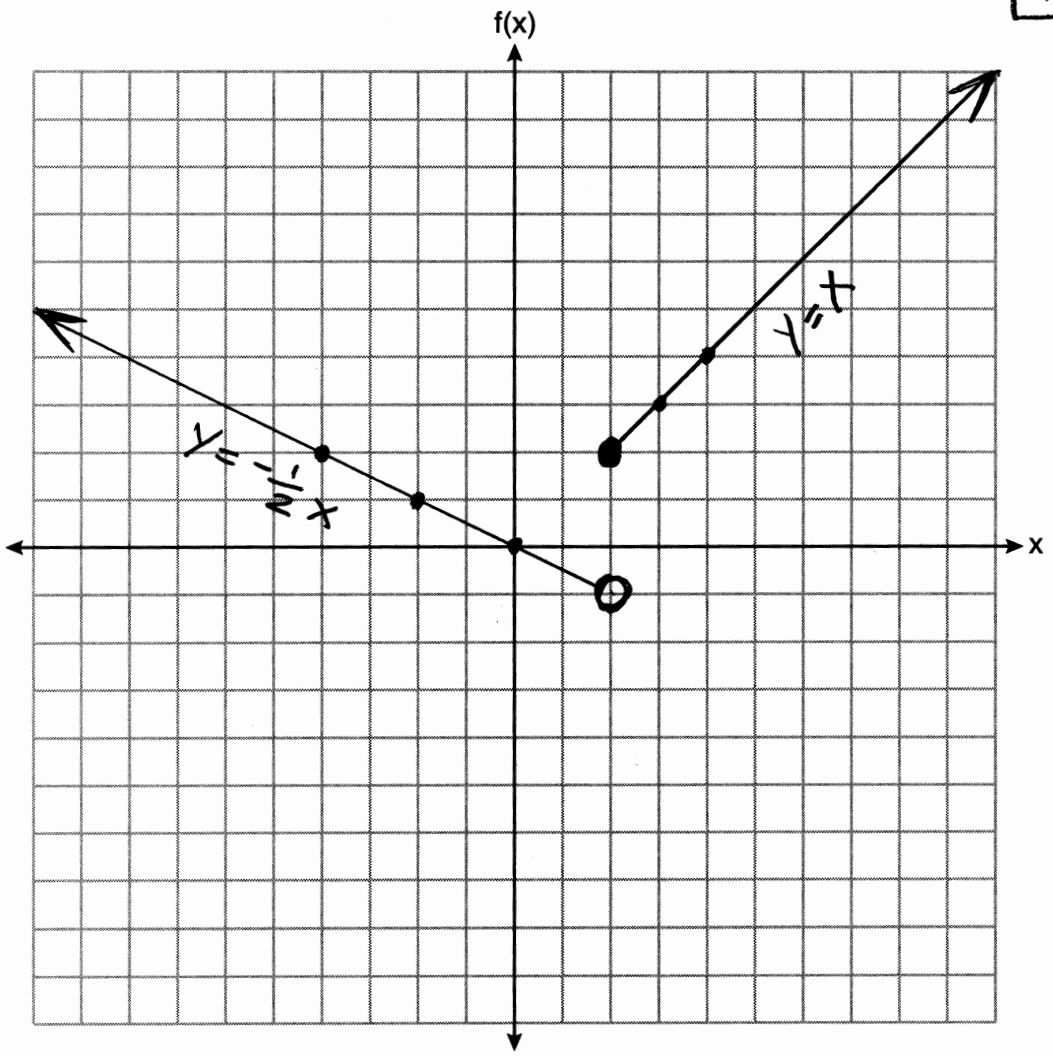
$$f(x) = \begin{cases} -\frac{1}{2}x, & x < 2 \\ x, & x \geq 2 \end{cases}$$

$f(x) = \frac{1}{2}x$

x	y
-2	1
0	0
1	-.5
(2)	(-1)

$f(x) = x$

x	y
2	2
3	3
4	4



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 A population of rabbits in a lab, $p(x)$, can be modeled by the function $p(x) = 20(1.014)^x$, where x represents the number of days since the population was first counted.

Explain what 20 and 1.014 represent in the context of the problem.

20 represents the initial # of rabbits

1.014 represents the rate of growth

Determine, to the *nearest tenth*, the average rate of change from day 50 to day 100.

Step 1 Input $p(x) = 20(1.014)^x$ in graphing calculator

Step 2 Use table to find # of rabbits on day 50 and day 100

Day	P(x) # Rabbits
50	40.08
100	80.32

Step 3 Calculate average rate of change.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{80.32 - 40.08}{100 - 50} = \frac{40.24}{50} \approx \boxed{.8}$$ rabbits per day

34 There are two parking garages in Beacon Falls. Garage *A* charges \$7.00 to park for the first 2 hours, and each additional hour costs \$3.00. Garage *B* charges \$3.25 per hour to park.

When a person parks for at least 2 hours, write equations to model the cost of parking for a total of x hours in Garage *A* and Garage *B*.

For $x \geq 2$, $A(x) = 7 + 3(x-2)$

For $x \geq 2$, $B(x) = 6.50 + 3.25(x-2)$

Determine algebraically the number of hours when the cost of parking at both garages will be the same.

$$A(x) = B(x)$$
$$7 + 3(x-2) = 6.50 + 3.25(x-2)$$
$$7 + 3x - 6 = 6.50 + 3.25x - 6.50$$
$$3x + 1 = 3.25x$$
$$1 = .25x$$
$$\frac{1}{.25} = x$$
$$\boxed{4} = x$$

Check ✓

Hrs	Acost	Bcost
2	\$7	\$6.50
3	\$10	\$9.75
4	\$13	\$13

35 On the set of axes below, graph the following system of inequalities:

$2y + 3x \leq 14$

$4x - y < 2$

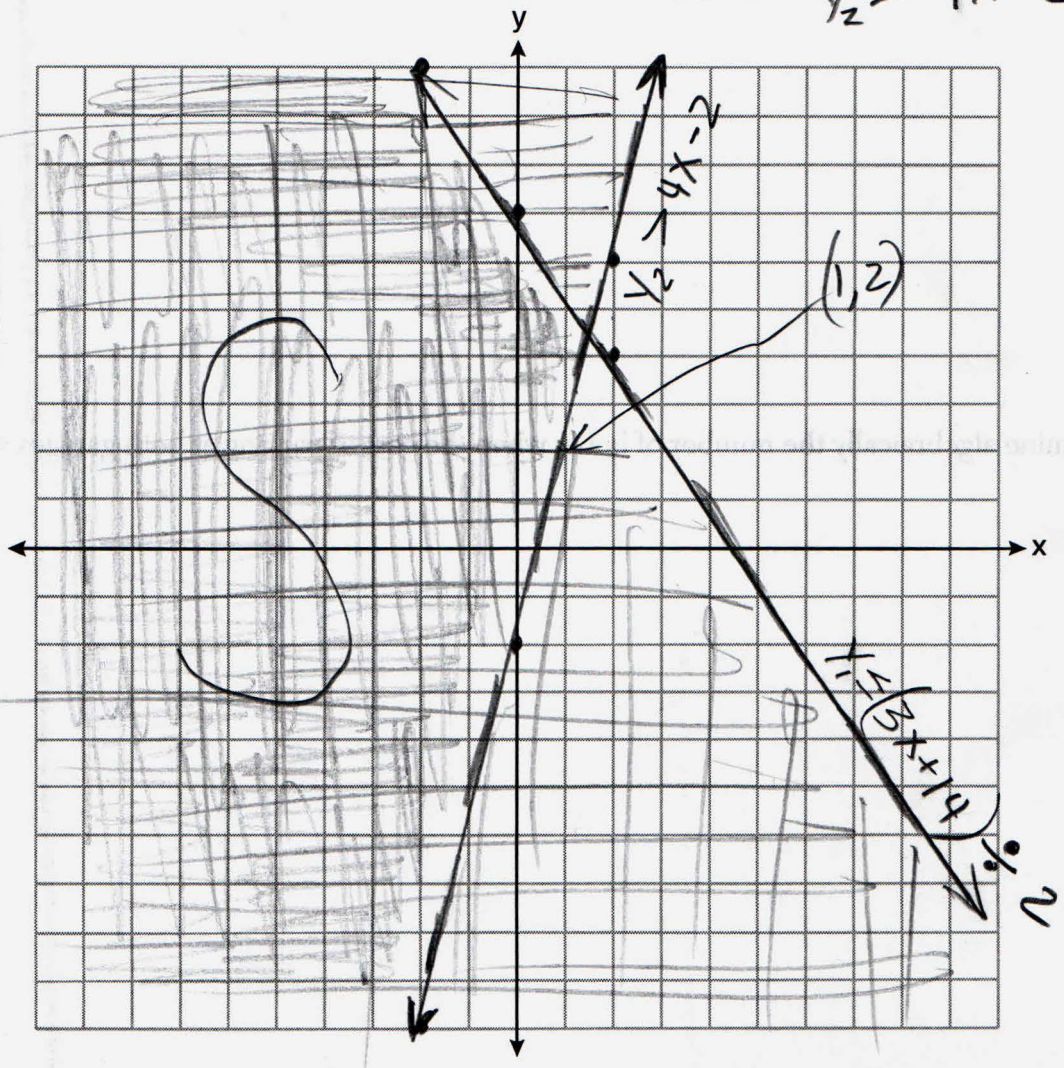
$y_1 \leq \frac{-3x+14}{2}$ ← $2y + 3x \leq 14$

$4x - y < 2$ → $-y < -4x + 2$

$y_2 > 4x - 2$

Input in EC

X	Y_1	Y_2
-2	10	-10
0	7	-2
2	4	6



Determine if the point (1,2) is in the solution set. Explain your answer.

(1, 2) $2y + 3x \leq 14$

$2(2) + 3(1) \leq 14$

$4 + 3 \leq 14$

$7 \leq 14$ ✓

(1, 2) $4x - y < 2$

$4(1) - (2) < 2$

$4 - 2 < 2$

$2 < 2$ No

Explanation: (1,2) is not in the solution set because it does not satisfy both inequalities.

36 The percentage of students scoring 85 or better on a mathematics final exam and an English final exam during a recent school year for seven schools is shown in the table below.

Percentage of Students Scoring 85 or Better	
Mathematics, x	**English, y**
27	46
12	28
13	45
10	34
30	56
45	67
20	42

Input in graphing calculator.

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

$y = ax + b$

$a = .9577$

$b = 23.9486$

$r = .9205$

$y = .96x + 23.95$

State the correlation coefficient of the linear regression equation, to the *nearest hundredth*. Explain the meaning of this value in the context of these data.

.92

Explanation:

There is a strong positive correlation between scores ≥ 85 on the mathematics and English exams in the seven schools.

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 Dylan has a bank that sorts coins as they are dropped into it. A panel on the front displays the total number of coins inside as well as the total value of these coins. The panel shows 90 coins with a value of \$17.55 inside of the bank.

d = # dimes

q = # quarters

↖ convert to 1755 cents

If Dylan only collects dimes and quarters, write a system of equations in two variables or an equation in one variable that could be used to model this situation.

Eq. 1 $10d + 25q = 1755$

Eq. 2 $d + q = 90$

Eq 2 times 10 $10d + 10q = 900$

Using your equation or system of equations, algebraically determine the number of quarters Dylan has in his bank.

$10d + 25q = 1755$

subtract $10d + 10q = 900$

$15q = 855$

$q = \frac{855}{15}$

$q = \boxed{57}$

Question 37 is continued on the next page.

Question 37 continued

Dylan's mom told him that she would replace each one of his dimes with a quarter. If he uses all of his coins, determine if Dylan would then have enough money to buy a game priced at $20.98 if he must also pay an 8% sales tax. Justify your answer.

If Dylan's mom replaces each dime with a quarter, then Dylan will have 90 quarters.

$90 \times 25 = 2250$ cents
or $\$22.50$

The game costs $\$20.98$ plus 8% sales tax.

$$\begin{array}{r} \$20.98 \\ \times\ 1.08 \\ \hline \approx \$22.65 \end{array}$$

Dylan will not have enough. He needs $\$22.65$, but only has $\$22.50$.