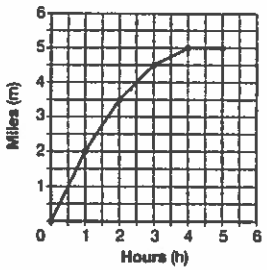
ALGEBRA 1
August 2016
Part I

Answer all 24 questions in this part. Each correct answer will receive 2 credits. No partial credit will be allowed. 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 in the space provided. [48]

1. The accompanying graph shows the distance in miles, m, hiked from a camp in h hours. Which hourly interval had the greatest rate of change?



(1) hour 0 to hour 1 → 2
(2) hour 1 to hour 2 → 1.5
(3) hour 2 to hour 3 → 1
(4) hour 3 to hour 4 → 0.5

1 1

2. The solution of an equation with two variables, x and y, is
(1) the set of all x values that make $y = 0$
(2) the set of all y values that make $x = 0$
(3) the set of all ordered pairs, (x, y), that make the equation true
(4) the set of all ordered pairs, (x, y), where the graph of the equation crosses the y-axis

box + whisker plot

2 3

3. Which statistic can *not* be determined from a box plot representing the scores on a math test in Mrs. DeRidder's algebra class?
(1) the lowest score
(2) the median score
(3) the highest score
(4) the score that occurs most frequently

3 4

4. Which chart could represent the function $f(x) = -2x + 6$? — check table on calc.

x	f(x)
0	6
2	10
4	14
6	18

(1)

x	f(x)
0	4
2	6
4	8
6	10

(2)

x	f(x)
0	8
2	10
4	12
6	14

(3)

x	f(x)
0	6
2	2
4	−2
6	−6

(4)

4 4

5. If $f(n) = (n - 1)^2 + 3n$, which statement is true?
(1) $f(3) = -2$ (2) $f(-2) = 3$ (3) $f(-2) = -15$ (4) $f(-15) = -2$

5 2

6. The table shows 6 students' overall averages and their averages in their math class. If a linear model is applied to these data, which statement best describes the correlation coefficient?

Overall Student Average	92	98	84	80	75	82
Math Class Average	91	95	85	85	75	78

(1) It is close to −1.
(2) It is close to 1.
(3) It is close to 0.
(4) It is close to 0.5.

6 2

7. What is the solution to $2h + 8 > 3h - 6$? $-2h+6 \quad -2h+6$

(1) $h < 14$ (2) $h < \frac{14}{5}$ (3) $h > 14$ (4) $h > \frac{14}{5}$

7 1

$14 > h$ or $h < 14$

$4(9x^2 - 25)$
$4(3x+5)(3x-5)$

8. Which expression is equivalent to $36x^2 - 100$?
(1) $4(3x - 5)(3x - 5)$
(2) $4(3x + 5)(3x - 5)$
(3) $2(9x - 25)(9x - 25)$
(4) $2(9x + 25)(9x - 25)$

8 2

9. Patricia is trying to compare the average rainfall of New York to that of Arizona. A comparison between these two states for the months of July through September would be best measured in
(1) feet per hour
(2) inches per hour
(3) inches per month
(4) feet per month

9 3

$-4 \quad -4 \quad -4$

10. Which function defines the sequence $-6, -10, -14, -18, \ldots$, where $f(6) = -26$?
(1) $f(x) = -4x - 2$
(2) $f(x) = 4x - 2$
(3) $f(x) = -x + 32$
(4) $f(x) = x - 26$

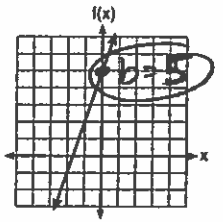
10 1

11. Which function has the greatest y-intercept?
(1) $f(x) = 3x$ (3) the line that has a slope of 2 and passes through $(1, -4)$
(2) $2x + 3y = 12$ (4)

$-2x \quad -2x$

$\frac{3y}{3} = \frac{-2x}{3} + \frac{12}{3}$

$y = -\frac{2}{3}x + 4$



$y = mx + b$
$-4 = 2(1) + b$
$-4 = 2 + b$
$-2 \quad -2$
$-6 = b$

11 4

12. What is the product of $2x + 3$ and $4x^2 - 5x + 6$?
(1) $8x^3 - 2x^2 + 3x + 18$
(2) $8x^3 + 2x^2 - 3x + 18$
(3) $8x^3 - 2x^2 - 3x + 18$
(4) $8x^3 + 2x^2 + 3x + 18$

$8x^3 - 10x^2 + 12x + 12x^2 - 15$

12 3

13. The height of a rocket, at selected times, is shown in the table below.

Time (sec)	0	1	2	3	4	5	6	7
Height (ft)	180	260	308	324	308	260	180	68

Based on these data, which statement is *not* a valid conclusion?
(1) The rocket was launched from a height of 180 feet.
(2) The maximum height of the rocket occurred 3 seconds after launch.
(3) The rocket was in the air approximately 6 seconds before hitting the ground.
(4) The rocket was above 300 feet for approximately 2 seconds.

13 3

14. A parking garage charges a base rate of \$3.50 for up to 2 hours, and an hourly rate for each additional hour. The sign below gives the prices for up to 5 hours of parking. Which linear equation can be used to find x, the additional hourly parking rate?

Parking Rates	
2 hours	\$3.50
3 hours	\$9.00
4 hours	\$14.50
5 hours	\$20.00

$+5.50$ $+5.50$ $+5.50$

→ 5.50

(1) $9.00 + 3x = 20.00$
(2) $9.00 + 3.50x = 20.00$
(3) $2x + 3.50 = 14.50$
(4) $2x + 9.00 = 14.50$

$x = 5.50$

14 3

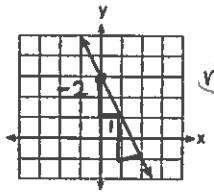
15. Which function has a constant rate of change equal to –3?

(1)

x	y
0	2
1	5
2	8
3	11

+3 +3 +3 m = 3

(3)



m = -2

(2) {(1, 5), (2, 2), (3, –5), (4, 4)}

(4) $\frac{2y}{2} = \frac{-6x}{2} + \frac{10}{2}$ $y = -3x + 10$ $m = -3$ 15 4

16. Kendal bought x boxes of cookies to bring to a party. Each box contains 12 cookies. She decides to keep two boxes for herself. She brings 60 cookies to the party. Which equation can be used to find the number of boxes, x, Kendal bought?

(1) $2x - 12 = 60$ $12x - 24 = 60$

(2) $12x - 2 = 60$

(3) $12x - 24 = 60$

(4) $24 - 12x = 60$ 16 3

17. The table shows the temperature, $T(m)$, of a cup of hot chocolate that is allowed to chill over several minutes, m.

Time, m (minutes)	0	2	4	6	8
Temperature, T(m) (°F)	150	108	78	56	41

Which expression best fits the data for $T(m)$?

(1) $150(0.85)^m$

(2) $150(1.15)^m$

(3) $150(0.85)^{m-1}$

(4) $150(1.15)^{m-1}$ 17 1

18. As x increases beyond 25, which function will have the largest value?

(1) $f(x) = 1.5^x$

(2) $g(x) = 1.5x + 3$

(3) $h(x) = 1.5x^2$

(4) $k(x) = 1.5x^3 + 1.5x^2$ 18 1

$3x^2 + 10x - 8 = 0$

19. What are the solutions to the equation $3x^2 + 10x = 8$?

(1) $\frac{2}{3}$ and –4 (2) $-\frac{2}{3}$ and 4 (3) $\frac{4}{3}$ and –2 (4) $-\frac{4}{3}$ and 2 19 1

20. An online company lets you download songs for $0.99 each after you have paid a $5 membership fee. Which domain would be most appropriate to calculate the cost to download songs?

(1) rational numbers greater than zero

(2) whole numbers greater than or equal to one

(3) integers less than or equal to zero

(4) whole numbers less than or equal to one 20 2

# of songs

range

$3x^2 + 10x - 24 = 0$

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

3

$(x + 4)(3x - 2) = 0$

$x = -4 \mid 3x = 12$

$x = \frac{+2}{3}$

21. The function $f(x) = 3x^2 + 12x + 11$ can be written in vertex form as

(1) $f(x) = (3x + 6)^2 - 25$

(2) $f(x) = 3(x + 6)^2 - 25$

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

(4) $f(x) = 3(x + 2)^2 + 7$ 21 3

22. A system of equations is given. $x + 2y = 5$ $2x + y = 4$

Which system of equations does *not* have the same solution?

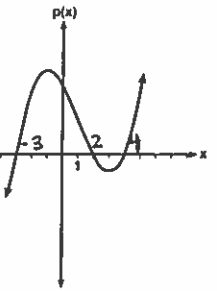
(1) $3x + 6y = 15$ $2x + y = 4$

(2) $4x + 8y = 20$ $2x + y = 4$

(3) $x + 2y = 5$ $6x + 3y = 12$

(4) $x + 2y = 5$ $4x + 2y = 12$ 22 4

23. Based on the graph, which expression is a possible factorization of $p(x)$?



(1) $(x + 3)(x - 2)(x - 4)$ $x = -3, 2, 4$

(2) $(x - 3)(x + 2)(x + 4)$ $x = 3, -2, -4$

(3) $(x + 3)(x - 5)(x - 2)(x - 4)$ $x = -3, 5, 2, 4$

(4) $(x - 3)(x + 5)(x + 2)(x + 4)$ $x = 3, -5, -2, -4$ 23 1

24. Milton has his money invested in a stock portfolio. The value, $v(x)$, of his portfolio can be modeled with the function $v(x) = 30{,}000(0.78)^x$, where x is the number of years since he made his investment. Which statement describes the rate of change of the value of his portfolio?

(1) It decreases 78% per year.

(2) It decreases 22% per year.

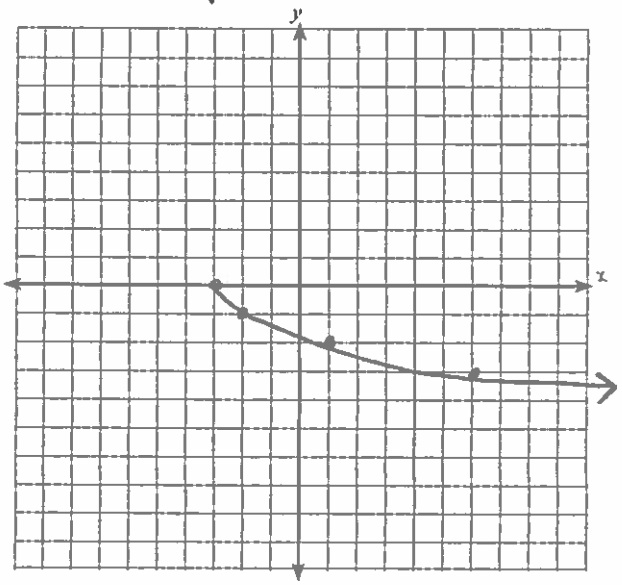
(3) It increases 78% per year.

(4) It increases 22% per year. 24 2

Part II

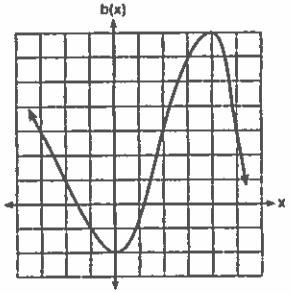
Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily 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 the function $y = -\sqrt{x + 3}$ on the set of axes below.



26. Richard is asked to transform the graph of $b(x)$.

The graph of $b(x)$ is transformed using the equation $h(x) = b(x - 2) - 3$. Describe how the graph of $b(x)$ changed to form the graph of $h(x)$.



right 2
down 3

27. Consider the pattern of squares shown below:

Which type of model, linear or exponential, should be used to determine how many squares are in the nth pattern? Explain your answer.

exponential because the pattern is multiplying by 2.

28. When multiplying polynomials for a math assignment, Pat found the product to be $-4x + 8x^2 - 2x^3 + 5$. He then had to state the leading coefficient of this polynomial. Pat wrote down –4. Do you agree with Pat's answer? Explain your reasoning.

Disagree, once in standard form, $-2x^3 + 8x^2 - 4x + 5$, the leading coefficient is -2.

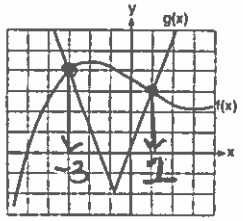
29. Is the sum of $3\sqrt{2}$ and $4\sqrt{2}$ rational or irrational? Explain your answer.

$3\sqrt{2} + 4\sqrt{2} = 7\sqrt{2}$

$\approx 9.899494937...$

irrational b/c it's a never-ending decimal.

30. The graph shows two functions, $f(x)$ and $g(x)$. State all the values of x for which $f(x) = g(x)$.



$x = -3$
and
$x = 1$

31. Find the zeros of $f(x) = (x - 3)^2 - 49$, algebraically.

one method →

$0 = (x-3)^2 - 49$
$+49 \quad +49$
$\sqrt{(x-3)^2} = \sqrt{49}$
$x - 3 = \pm 7$
$+3 \quad +3$
$x = 3 \pm 7$

$x = 3 + 7 = 10$
$x = 3 - 7 = -4$

another method

$0 = (x-3)^2 - 49$
$0 = (x-3)(x-3) - 49$
$x^2 - 6x + 9 - 49 = 0$
$x^2 - 6x - 40 = 0$
$(x-10)(x+4) = 0$

$x = 10$	$x = -4$

32. Solve the equation below for x in terms of a.

$4(ax + 3) - 3ax = 25 + 3a$

$4ax + 12 - 3ax = 25 + 3a$

$ax + 12 = 25 + 3a$
$-12 \quad -12$

$\frac{ax}{a} = \frac{13 + 3a}{a}$

$x = \frac{13 + 3a}{a}$

ALGEBRA 1
August 2016
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 I credit. All answers should be written in pen, except for graphs and drawings, which should be done in pencil. [16]

33. The data table below shows the median diameter of grains of sand and the slope of the beach for 9 naturally occurring ocean beaches.

L_1	Median Diameter of Grains of Sand, in Millimeters (x)	0.17	0.19	0.22	0.235	0.235	0.3	0.35	0.42	0.85
L_2	Slope of Beach, in Degrees (y)	0.63	0.7	0.82	0.88	1.15	1.5	4.4	7.3	11.3

UNREG(ax+b)

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

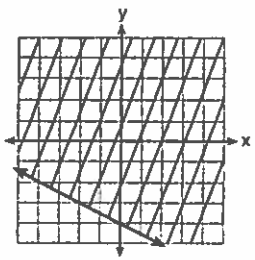
$y = 17.159x - 2.476$

Using this equation, predict the slope of a beach, to the *nearest tenth of a degree*, on a beach with grains of sand having a median diameter of 0.65 mm.

$y = 17.159(.65) - 2.476$

$y = 8.7°$

34. Shawn incorrectly graphed the inequality $-x - 2y \geq 8$ as shown.



Explain Shawn's mistake.

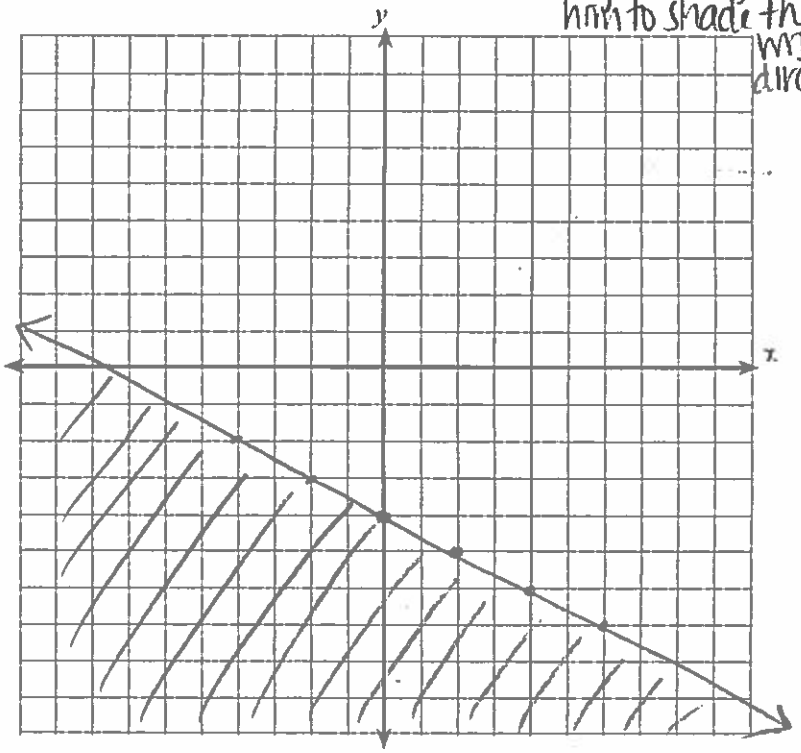
$-x - 2y \geq 8$
$+x \quad +x$

$\frac{-2y}{-2} \leq \frac{x}{-2} + \frac{8}{-2}$

$y \leq -\frac{1}{2}x - 4$

He didn't flip the inequality when he divided by the negative 2, causing him to shade the wrong direction

Graph the inequality correctly on the set of axes below.



35. A drama club is selling tickets to the spring musical. The auditorium holds 200 people. Tickets cost $12 at the door and $8.50 if purchased in advance. The drama club has a goal of selling at least $1000 worth of tickets to Saturday's show.

d = # of door tix.
a = # of advanced tix.

$d + a \leq 200$
$12d + 8.50a \geq 1000$

Write a system of inequalities that can be used to model this scenario.

If 50 tickets are sold in advance, what is the minimum number of tickets that must be sold at the door so that the club meets its goal? Justify your answer.

$12d + 8.50(50) \geq 1000$
$12d + 425 \geq 1000$
$-425 \quad -425$
$\frac{12d}{12} \geq \frac{575}{12}$
$d \geq 47.916$

48 tickets must be sold at the door to meet the goal.

36. Janice is asked to solve $0 = 64x^2 + 16x - 3$. She begins the problem by writing the following steps:

Line 1 $0 = (64)x^2 + (16)x - 3$
Line 2 $0 = B^2 + 2B - 3$
Line 3 $0 = (B+3)(B-1)$

$B = 8x$

Use Janice's procedure to solve the equation for x.

$(8x+3)(8x-1) = 0$

$8x + 3 = 0$ | $8x - 1 = 0$
$-3 \quad -3$ | $+1 \quad +1$
$\frac{8x}{8} = \frac{-3}{8}$ | $\frac{8x}{8} = \frac{1}{8}$

$x = \frac{1}{8}$ and $-\frac{3}{8}$

Explain the method Janice used to solve the quadratic equation.

She used "B" for 8x.

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. For a class picnic, two teachers went to the same store to purchase drinks. One teacher purchased 18 juice boxes and 32 bottles of water, and spent $19.92. The other teacher purchased 14 juice boxes and 26 bottles of water, and spent $15.76.

Write a system of equations to represent the costs of a juice box, j, and a bottle of water, w.

$18j + 32w = 19.92$
$14j + 26w = 15.76$

Kara said that the juice boxes might have cost 52 cents each and that the bottles of water might have cost 33 cents each. Use your system of equations to justify that Kara's prices are *not* possible.

$18(.52) + 32(.33) = 19.92$
$19.92 = 19.92$ ✓
$14(.52) + 26(.33) = 15.76$
$15.86 \neq 15.76$

Solve your system of equations to determine the actual cost, in dollars, of each juice box and each bottle of water.

$14(18j + 32w = 19.92)$
$-18(14j + 26w = 15.76)$

$252j + 448w = 278.88$
$-252j - 468w = -283.68$
$-20w = -4.80$
$-20 \quad -20$
$w = 0.24$

$18j + 32(0.24) = 19.92$
$18j + 7.68 = 19.92$
$-7.68 \quad -7.68$
$\frac{18j}{18} = \frac{12.24}{18}$
$j = 0.68$