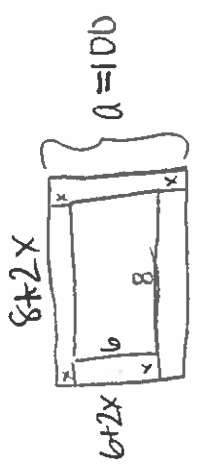


Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. 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 written in pencil. [6]

37. A rectangular picture measures 6 inches by 8 inches. Simon wants to build a wooden frame for the picture so that the framed picture takes up a maximum area of 100 square inches on his wall. The pieces of wood that he uses to build the frame all have the same width.

Write an equation or inequality that could be used to determine the maximum width of the pieces of wood for the frame Simon could create.



Explain how your equation or inequality models the situation.
Add 2x for each border to the picture's width of 6 and same for length of 8.
Area = L · W so (6+2x)(8+2x) = 100

Solve the equation or inequality to determine the maximum width of the pieces of wood used for the frame to the nearest tenth of an inch.

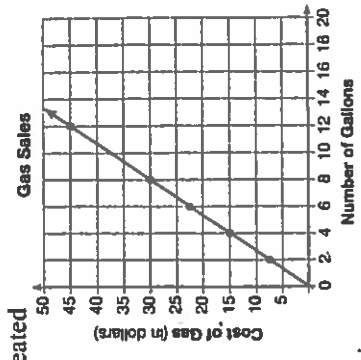
$$\begin{aligned}
 & (6+2x)(8+2x) = 100 \\
 & 4x^2 + 28x + 48 = 100 \\
 & 4x^2 + 28x - 52 = 0 \\
 & x = \frac{-28 \pm \sqrt{(28)^2 - 4(4)(-52)}}{2(4)} \\
 & x = \frac{-28 \pm \sqrt{1600}}{8} \\
 & x = \frac{-28 \pm 40}{8} \\
 & x = 1.5 \text{ inches}
 \end{aligned}$$

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. In the function $f(x) = (x-2)^2 + 4$, the minimum value occurs when x is (2, 4)

- (1) -2 (2) 2 (3) -4 (4) 4 1 2

2. The accompanying graph was created by an employee at a gas station.



Which statement can be justified by using the graph?

- (1) If 10 gallons of gas was purchased, \$35 was paid.
 (2) For every gallon of gas purchased, \$3.75 was paid.
 (3) For every 2 gallons of gas purchased, \$5.00 was paid.
 (4) If zero gallons of gas were purchased, zero miles were driven.

2 2

3. For a recently released movie, the function $y = 119.67(0.61)^x$ models the revenue earned, y , in millions of dollars each week, x , for several weeks after its release.

$\$27.16$ $\$10.10 = 17.06$

Based on the equation, how much more money, in millions of dollars, was earned in revenue for week 3 than for week 5?

- (1) 37.27 (2) 27.16 (3) 17.06 (4) 10.11 3 3

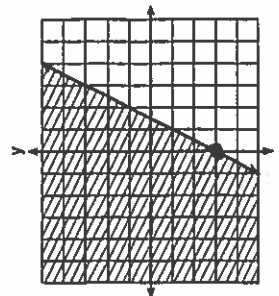
4. Given the following expressions:

~~$x - \frac{5}{8} + \frac{3}{5}$~~ ~~$\frac{1}{2} + \sqrt{2}$~~ ~~$(\sqrt{5}) \cdot (\sqrt{5})$~~ ~~$3 \cdot (\sqrt{49})$~~

Which expression(s) result in an irrational number?

- (1) II, only (2) III, only (3) I, III, IV (4) II, III, IV 4 1

5. Which inequality is represented by the accompanying graph?



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

cont...
 $x = -28 - \sqrt{1600}$
 $x = -28 - 40$
 $x = -68$
 $x = -8.5 \text{ part}$

5 2

$$\left(\frac{I = Prt}{P = \frac{I}{rt}} \right)$$

6. Michael borrows money from his uncle, who is charging him simple interest using the formula $I = Prt$. To figure out what the interest rate, r , is, Michael rearranges the formula to find r . His new formula is r equals

- (1) $\frac{I-P}{t}$ (2) $\frac{P-I}{t}$ (3) $\frac{I}{Pr}$ (4) $\frac{Pr}{I}$ 6 3

7. Which equation is equivalent to $y - 34 = x(x - 12)$? $y - 34 = x^2 - 12x$
 $(4) y = (x - 17)(x + 2)$
 $(3) y = (x - 6)^2 + 2$
 $(2) y = (x - 6)^2 - 2$
 $(1) y = x^2 - 12x + 34$ 7 4

8. The equation $A = 1300(1.02)^t$ is being used to calculate the amount of money in a savings account. What does 1.02 represent in this equation?
 $1.34 = x - 12x + 36$
 $(1) 0.02\%$ decay
 $(2) 0.02\%$ growth
 $(3) 2\%$ decay
 $(4) 2\%$ growth 8 4

9. The zeros of the function $f(x) = 2x^2 - 4x - 6$ are 102%
 $(1) -3$ and -1 (2) 3 and 1 (3) -3 and 1 (4) -3 and -1 9 1

10. When $(2x - 3)^2$ is subtracted from $5x^2$, the result is $(2x - 3)^2$
 $(1) x^2 - 12x - 9$
 $(2) x^2 - 12x + 9$
 $(3) x^2 + 12x - 9$
 $(4) x^2 + 12x + 9$ 10 3

11. Joe has a rectangular patio that measures 10 feet by 12 feet. He wants to increase the area by 50% and plans to increase each dimension by equal lengths, x . Which equation could be used to determine x ?
 $(1) (10 + x)(12 + x) = 120$
 $(2) (10 + x)(12 + x) = 180$
 $(3) (15 + x)(18 + x) = 180$
 $(4) (15)(18) = 120 + x^2$ 11 2

12. When factored completely, $x^3 - 13x^2 - 30x$ is $x(x^2 - 13x - 30)$
 $(1) x(x + 3)(x - 10)$
 $(2) x(x - 3)(x - 10)$
 $(3) x(x + 2)(x - 15)$
 $(4) x(x - 2)(x + 15)$ 12 3

13. The table below shows the cost of mailing a postcard in different years. During which time interval did the cost increase at the greatest average rate?

Year	1898	1971	1985	2006	2012
Cost (¢)	1	6	14	24	35

$\frac{5}{12} = 0.416$
 $\frac{8}{14} = 0.571$
 $\frac{10}{8} = 1.25$
13 4

14. When solving the equation $x^2 - 8x - 7 = 0$ by completing the square, which equation is a step in the process?
 $(1) (x - 4)^2 = 9$
 $(2) (x - 4)^2 = 23$
 $(3) (x - 8)^2 = 9$
 $(4) (x - 8)^2 = 23$
 $x^2 - 8x = 7$
 $x^2 - 8x + 16 = 7 + 16$
 $(x - 4)^2 = 23$ 14 2

15. A construction company uses the function $f(p)$, where p is the number of people working on a project, to model the amount of money it spends to complete a project. A reasonable domain for this function would be
 (1) positive integers
 (2) positive real numbers
 (3) both positive and negative integers
 (4) both positive and negative real numbers 15 1

16. Which function is shown in the accompanying table?

x	f(x)
-2	$\frac{1}{9}$
-1	$\frac{1}{3}$
0	1
1	3
2	9
3	27

 (1) $f(x) = 3x$
 (2) $f(x) = x + 3$
 (3) $f(x) = -x^3$
 (4) $f(x) = 3^x$ 16 4

17. Given the functions $h(x) = \frac{1}{2}x + 3$ and $j(x) = |x|$, which value of x makes $h(x) = j(x)$?
 (1) -2 (2) 2 (3) 3 (4) -6 17 1

18. Which recursively defined function represents the sequence 3, 7, 15, 31, ...?
 (1) $f(1) = 3, f(n + 1) = 2f(n) + 3$
 (2) $f(1) = 3, f(n + 1) = 2f(n) - 1$
 (3) $f(1) = 3, f(n + 1) = 3f(n) + 1$
 (4) $f(1) = 3, f(n + 1) = 3f(n) - 2$ 18 3

19. The range of the function defined as $y = 5^x$ is
 (1) $y < 0$ (2) $y > 0$ (3) $y \leq 0$ (4) $y \geq 0$ 19 2

20. The graph of $y = f(x)$ is shown.

What is the graph of $y = f(x + 1) - 2$?

20 3

21. Which pair of equations could not be used to solve the following equations for x and y ?
 $4x + 2y = 22$
 $-2x + 2y = -8$
 (1) $4x + 2y = 22$ (2) $4x + 2y = 22$ (3) $12x + 6y = 66$ (4) $8x + 4y = 44$
 $2x - 2y = 8$ (5) $-4x + 4y = -16$ (6) $6x - 6y = 24$ (7) $-8x + 8y = -8$
21 4

22. The accompanying graph representing a function is shown.

Which function has a minimum that is less than the one shown in the graph?

- (1) $y = x^2 - 6x + 7$ Min = -2
- (2) $y = |x + 3| - 6$ Min = -6
- (3) $y = x^2 - 2x - 10$ Min = -11
- (4) $y = |x - 8| + 2$ Min = 2

22 3

23. Grisham is considering the three situations below.

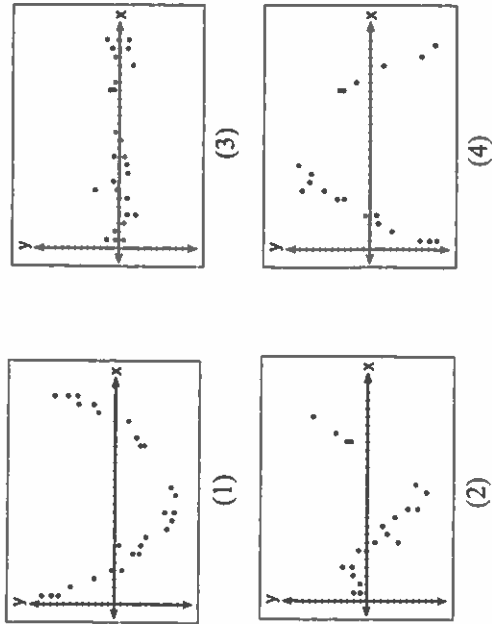
- I. For the first 28 days, a sunflower grows at a rate of 3.5 cm per day.
- II. The value of a car depreciates at a rate of 15% per year after it is purchased.
- III. The amount of bacteria in a culture triples every two days during an experiment.

Which of the statements describes a situation with an equal difference over an equal interval?

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

23 1

24. After performing analyses on a set of data, Jackie examined the scatter plot of the residual values for each analysis. Which scatter plot indicates the best linear fit for the data?



24 3

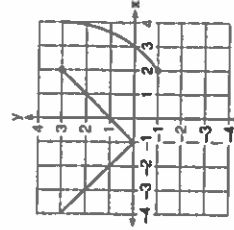
Answer all 8 questions in this part. Each correct answer will receive 2 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided for each question to determine your answer. Note that diagrams are not necessarily 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. The function, $f(x)$, is shown in the accompanying table.

x	f(x)
-3	10
-1	7.5
1	5
3	2.5
5	0

constant rate of change - constant difference

Linear b/c it has a constant rate of change.



26. Marcel claims that the accompanying graph represents a function.

State whether Marcel is correct. Justify your answer.

No b/c when $x=2$, it is paired with 2 y-values and doesn't pass the vertical line test.

ALGEBRA 1
January 2016

27. Solve the equation for y .

$y = \{3, 7\}$

$(y-3)^2 = 4y - 12$

$(y-3)(y-3) = 4y - 12$

$y^2 - 6y + 9 = 4y - 12$

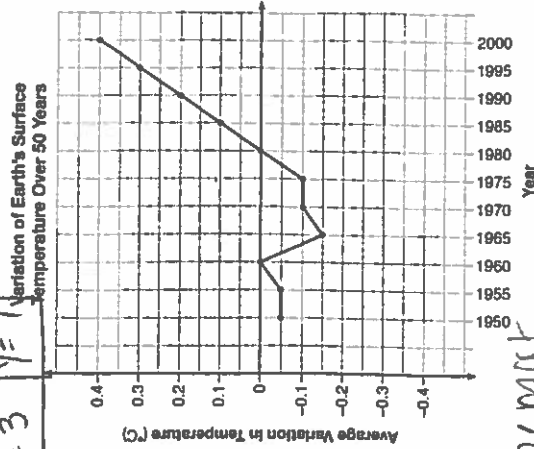
$-4y + 12 - 4y + 12$

$y^2 - 10y + 21 = 0$

$(y-3)(y-7) = 0$

$y = 3$ $y = 7$

28. The accompanying graph shows the variation in the average temperature of Earth's surface from 1950-2000, according to one source.



During which years did the temperature variation change the most per unit time? Explain how you determined your answer.

1960-1965 b/c the line is the steepest meaning it changed the most in that given time period.

29. The cost of belonging to a gym can be modeled by $C(m) = 50m + 79.50$, where $C(m)$ is the total cost for m months of membership.

State the meaning of the slope and y -intercept of this function with respect to the costs associated with the gym membership.

\$50 is the cost per month and \$79.50 is the initial cost.

ALGEBRA 1
January 2016

30. A statistics class surveyed some students during one lunch period to obtain opinions about television programming preferences. The results of the survey are summarized in the accompanying table.

Programming Preferences

	Comedy	Drama
Male	70	35
Female	48	42

$= 105$

Based on the sample, predict how many of the school's 351 males would prefer comedy. Justify your answer.

$\frac{70}{105} = \frac{x}{351}$

$\frac{105x}{105} = \frac{24570}{105}$

$x = 234 \text{ males}$

31. Given that $a > b$, solve for x in terms of a and b : $b(x-3) \geq ax + 7b$

$bx - ax \geq 10b$

$\frac{x(b-a) \geq 10b}{(b-a) (b-a)}$

$x \leq \frac{10b}{b-a}$

$b(x-3) \geq ax + 7b$

$bx - 3b \geq ax + 7b$

$+3b$

$bx \geq ax + 10b$

$-ax$ $-ax$

32. Jacob and Jessica are studying the spread of dandelions. Jacob discovers that the growth over t weeks can be defined by the function $f(t) = (8) \cdot 2^t$. Jessica finds that the growth function over t weeks is $g(t) = 2^{t+3}$.

Calculate the number of dandelions that Jacob and Jessica will each have after 5 weeks.

$f(5) = 8 \cdot 2^5$ $g(5) = 2^{5+3}$

$f(5) = 256$ $g(5) = 256$

Based on the growth from both functions, explain the relationship between $f(t)$ and $g(t)$.

They are the same equation. The tables match.

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

33. Let $h(t) = -16t^2 + 64t + 80$ represent the height of an object above the ground after t seconds. Determine the number of seconds it takes to achieve its maximum height. Justify your answer.

Using the calculator, the vertex is (2, 144) so it takes 2 seconds to achieve its max. height.

State the time interval, in seconds, during which the height of the object decreases. Explain your reasoning.

$2 < t < 5$ b/c the max height is at 2 seconds then it decreases until it hits the ground at 5 sec.

34. Fred's teacher gave the class the quadratic function $f(x) = 4x^2 + 16x + 9$.

a) State two different methods Fred could use to solve the equation $f(x) = 0$.

completing the square + quad. formula

b) Using one of the methods stated in part a, solve $f(x) = 0$ for x , to the nearest tenth.

$$x = \frac{-16 \pm \sqrt{112}}{8} \rightarrow \begin{cases} x = -0.7 \\ x = -3.3 \end{cases}$$

ALGEBRA I
January 2016

35. Erica, the manager at Stellarbeans, collected data on the daily high temperature and revenue from coffee sales. Data from nine days this past fall are shown in the table below.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9
High Temperature, t	54	50	62	67	70	58	52	46	48
Coffee Sales, $f(t)$	\$2900	\$3080	\$2500	\$2380	\$2200	\$2700	\$3000	\$3620	\$3720

State the linear regression function, $f(t)$, that estimates the day's coffee sales with a high temperature of t . Round all values to the nearest integer.

$f(t) = -58t + 6182$

$r = -0.94$

State the correlation coefficient, r , of the data to the nearest hundredth. Does r indicate a strong linear relationship between the variables? Explain your reasoning.

$r = -0.94$

strong negative linear relationship b/c close to -1.

36. A contractor has 48 meters of fencing that he is going to use as the perimeter of a rectangular garden. The length of one side of the garden is represented by x , and the area of the garden is 108 square meters.

Determine, algebraically, the dimensions of the garden in meters.

$$\begin{aligned} 108 &= x(24-x) \\ L \cdot W &= A \\ x(24-x) &= 108 \\ 24x - x^2 &= 108 \\ -24x + x^2 &= -108 \end{aligned}$$

$$\begin{aligned} L = x &\rightarrow 6 \\ W = 24 - x &\rightarrow 18 \\ L = x &\rightarrow 18 \\ W = 24 - x &\rightarrow 6 \end{aligned}$$

$$\begin{aligned} 0 &= x^2 - 24x + 108 \\ 0 &= (x-18)(x-6) \\ x &= 18 \\ x &= 6 \end{aligned}$$

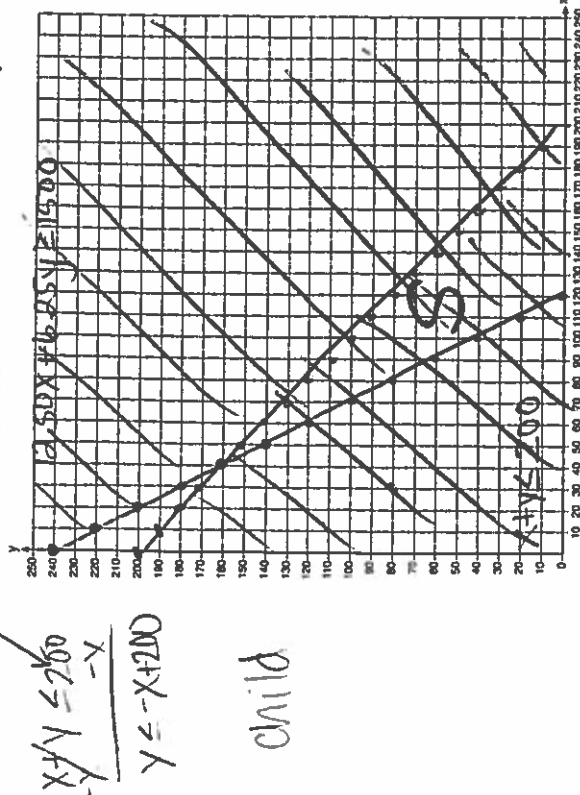
Answer the question in this part. A correct answer will receive 6 credits. Clearly indicate the necessary steps, including appropriate formula substitutions, diagrams, graphs, charts, etc. Utilize the information provided to determine your answer. Note that diagrams are not necessarily drawn to scale. 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. The Reel Good Cinema is conducting a mathematical study. In its theater, there are 200 seats. Adult tickets cost \$12.50 and child tickets cost \$6.25. The cinema's goal is to sell at least \$1500 worth of tickets for the theater.

Write a system of linear inequalities that can be used to find the possible combinations of adult tickets, x , and child tickets, y , that would satisfy the cinema's goal.

$$\begin{aligned}
 & x + y \leq 200 \\
 & 12.50x + 6.25y \geq 1500
 \end{aligned}$$

Graph the solution to this system of inequalities on the set of axes below. Label the solution with an S.



Marta claims that selling 30 adult tickets and 80 child tickets will result in meeting the cinema's goal. Explain whether she is correct or incorrect, based on the graph drawn.

She is incorrect b/c it's not in the double shaded region.

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]

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

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

1 3

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) $7x^5 - 6x^4 + 5$
- (3) $6x^5 - x^4 + 5$
- (4) $7x^5 + 2x^4 + 6$

2 4

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

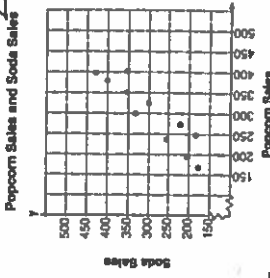
Year	2002	2003	2004	2005	2006	2007
Number of Households	11	16	23	33	42	47

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

$\frac{14}{2} = 7$
 $\frac{19}{2} = 9.5$
 $\frac{14}{2} = 7$

4. The scatterplot 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.

4 2

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) $a + c = 150$
- (2) $10.25a + 7.75c = 1470$
- (3) $a + c = 150$
- (4) $7.75a + 10.25c = 1470$

5 1