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Stamford Public Schools
Mathematics Department

CP Algebra II Mid-Term Exam
REVIEW

January 2017

Student Name:_____

School/Teacher:_____

Date: _____

CP Algebra 2 Midterm Exam 2016-2017

BLUEPRINT

Unit	Concepts/Topics	Number of Questions
Unit 1: **Functions and Inverses**	• Compare relations and functions • Domain and range of functions • Library of Parent Functions & characteristics • Transformations of Parent Functions • Find inverse functions algebraically (linear and simple quadratic) • Construct an inverse graph	3pt Multiple Choice 7 3pt Fill-in 2 5pt Short Answer 1

Unit 2:
 	
Quadratic Functions
	• Distributive Property – multiplication and factoring
	• Operations on Imaginary & Complex Numbers
	• Solve quadratic equations
	  ○ Take the square root
	  ○ Factoring
	  ○ Quadratic Formula
	  ○ Complete the Square
	• Graph quadratic functions
	• Use quadratic functions to solve real-life problems
		3pt Multiple Choice 7
		3pt Fill-in 2
		6pt Short Answer 1

Unit 3: **Polynomials**	• Operations on polynomials • Graph polynomial functions • Solve polynomial equations • Write an equation of a graph • Connect the relationship among zeros, factors, roots, and intercepts • Fundamental Theorem of Algebra • Interpret and solve problems involving polynomial functions	3pt Multiple Choice 7 3pt Fill-in 2 5pt Short Answer 1

Totals:

3 pt Short Answer 21
3 pt Fill-in 6
5/6pt Short Answer: 3

1. Consider the system of linear equations below. How many answers does the system have?

$$y = 6x + 5$$
$$y = 6x - 5$$

(A) 0

(B) 1

(C) 2

(D) infinite

2. Consider the system of linear equations below. How many answers does the system have?

$$3x + y = 9$$
$$6x + 2y = 18$$

(A) 0

(B) 1

(C) 2

(D) Infinite

3. Consider the system of linear equations below. How many answers does the system have?

$$y = \frac{1}{2}x + 3$$
$$2y - 6 = x$$

(A) 0

(B) 1

(C) 2

(D) Infinite

4. A food distributor distributes boxes of cans of soup to retail stores. Each can of soup is one unit. A unit is either a can of chicken soup or a can of tomato soup. The cans are put into boxes and each box can have up to 24 units composed of c, chicken and t, tomato cans. In addition, each box must have a least as many chicken cans as tomato cans. Which of the following systems of inequalities best models the situation described above?

(A) $\begin{cases} 24 \leq t + c \\ t \leq c \end{cases}$

(B) $\begin{cases} 24 \leq t + c \\ c \leq t \end{cases}$

(C) $\begin{cases} t + c \leq 24 \\ t \leq c \end{cases}$

(D) $\begin{cases} t + c \leq 24 \\ c \leq t \end{cases}$

5. A Candy Store sells boxes of chocolate. Each box of chocolate contains caramels and cream chocolates. Each box of chocolates contains a most 36 pieces. In each box of chocolates, there needs to be at least twice as many caramels as there are creams. If the number of caramels is represented by *x* and the amount of cream is represented by *y*, Which of the following systems of inequalities best models the situation?

(A) $y \geq 2x$
$x + y \leq 36$

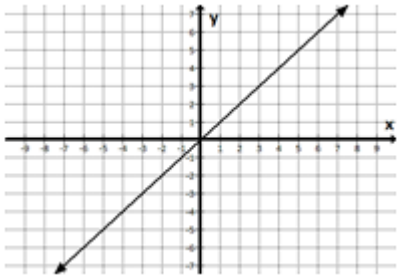
(B) $y \leq 2x$
$x + y \geq 36$

(C) $x \geq 2y$
$x + y \leq 36$

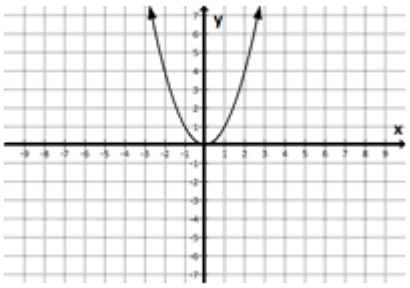
(D) $x \leq 2y$
$x+y \geq 36$

6. Which graph has an inverse that is not a function?

(A)



(B)



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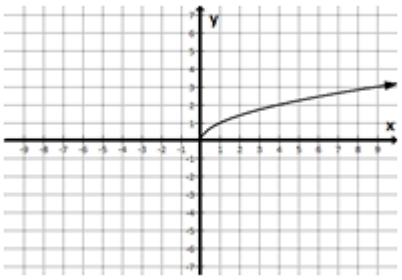
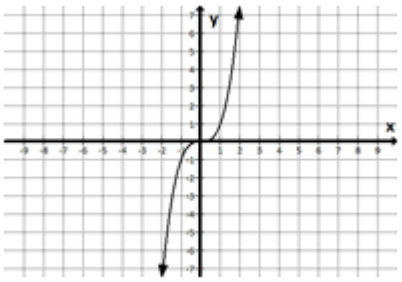
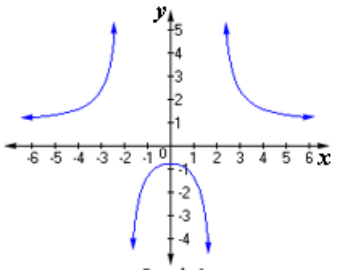


(D)



7. Which graph has an inverse that is not a function?

(A)



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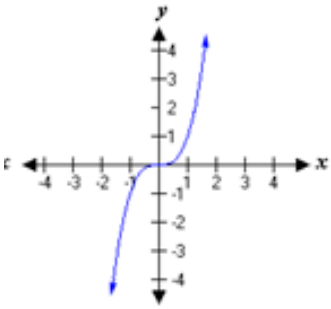

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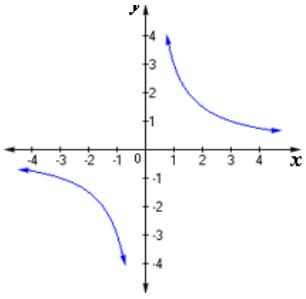

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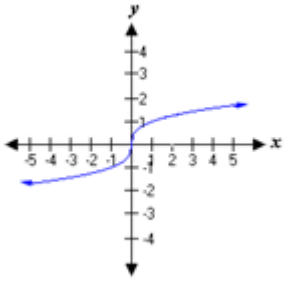
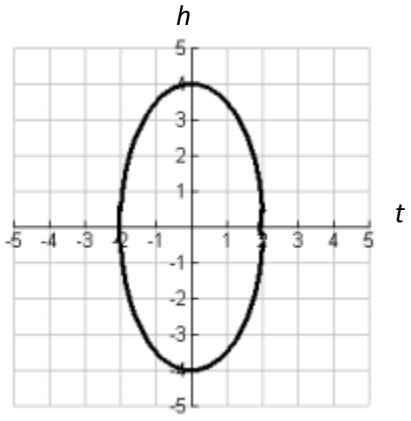


8. What is the domain of the function?



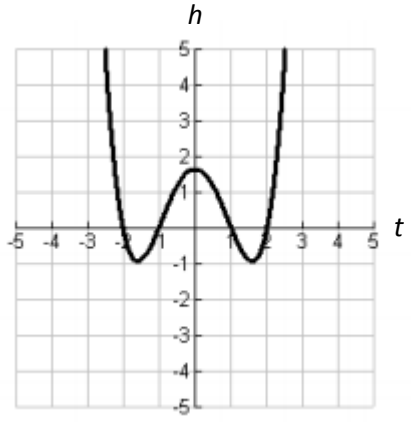
(A) $-4 \leq t \leq 4$

(B) $4 \geq t \geq -4$

(C) $-2 \leq t \leq 2$

(D) $2 \geq t \geq -2$

9. What is the domain of the function?



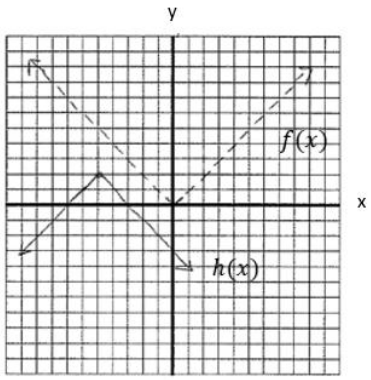
(A) $-\infty \leq t \geq \infty$

(B) $-\infty \geq t \geq \infty$

(C) $-\infty \leq t \leq \infty$

(D) $-\infty \geq t \geq \infty$

10. The graph of $y = h(x)$ is a transformation of the graph of $y = f(x)$. Given that $f(x) = |x|$, write an expression for $h(x)$ in terms of x.



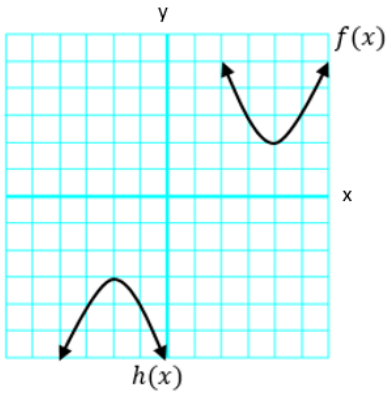
(A) $h(x) = -|x - 5| - 2$

(B) $h(x) = -|x - 5| + 2$

(C) $h(x) = -|x + 5| - 2$

(D) $h(x) = -|x + 5| + 2$

11. The graph of $y = h(x)$ is a transformation of the graph of $y = f(x)$. Given that $f(x) = (x-4)^2 + 2$, write an expression for $h(x)$ in terms of *x*. (Note there is no stretch or compression)



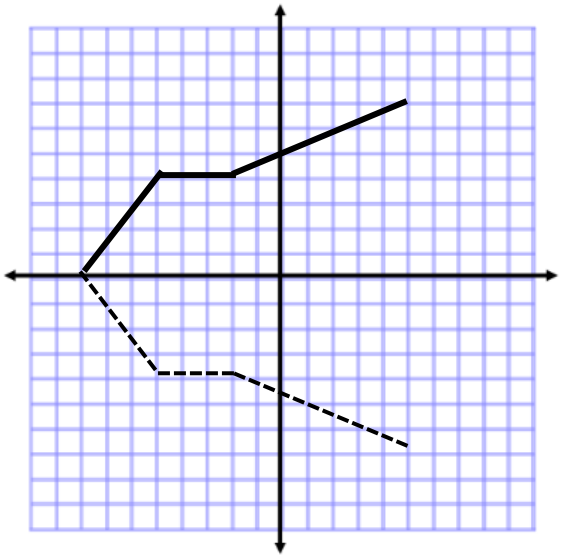
(A) $h(x) = -(x-2)^2 - 3$

(B) $h(x) = -(x-2)^2 - 3$

(C) $h(x) = -(x+2)^2 - 3$

(D) $h(x) = -(x+2)^2 + 3$

12. $g(x)$ is a transformation of $f(x)$. The graph below shows $f(x)$ as a solid line and $g(x)$ as a dashed line. What is $g(x)$ in terms of $f(x)$?



(A) $g(x) = f(-x)$

(B) $g(x) = -2f(x)$

(C) $g(x) = f(-2x)$

(D) $g(x) = -f(x)$

13. $f(x) = xy^2 + 5x^2 - 7x^2y$

$g(x) = -3x^2y + 3xy^2 + 2x^2$

Which of the following is equivalent to $f(x) + g(x)$?

(A) $4xy^2 + 7x^2 - 4x^2y$

(B) $3xy^2 + 7x^2 - 4x^2y$

(C) $-2x^2y - 4xy^2 + 7x^2$

(D) $-10x^2y + 4xy^2 + 7x^2$

14. $f(x) = xy^2 + 5x^2 - 7x^2y$

$g(x) = -3x^2y + 3xy^2 + 2x^2$

Which of the following is equivalent to $f(x) - g(x)$?

(A) $4y^2x + 7x^2 - 4x^2y$

(B) $-2xy^2 + 3x^2 - 4x^2y$

(C) $4x^2y - 2xy^2 + 7x^2$

(D) $-4x^2y + 4xy^2 + 3x^2$

15. $g(x) = ax^2 - 22$

For the function g defined above, a is a constant and $g(3) = 50$.
What is the value of $g(-4)$?

(A) 106

(B) -150

(C) 16

(D) 48

16. $g(x) = ax + 6$

For the function g defined above, a is a constant and $g(5) = 66$.
What is the value of $g(-7)$?

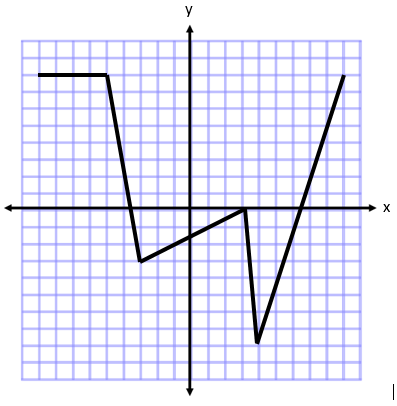
(A) -90

(B) 90

(C) -78

(D) 78

17. The complete graph of the function f is shown in the xy-plane below. For what value of x is the value of $f(x)$ at its minimum? (scale =1)



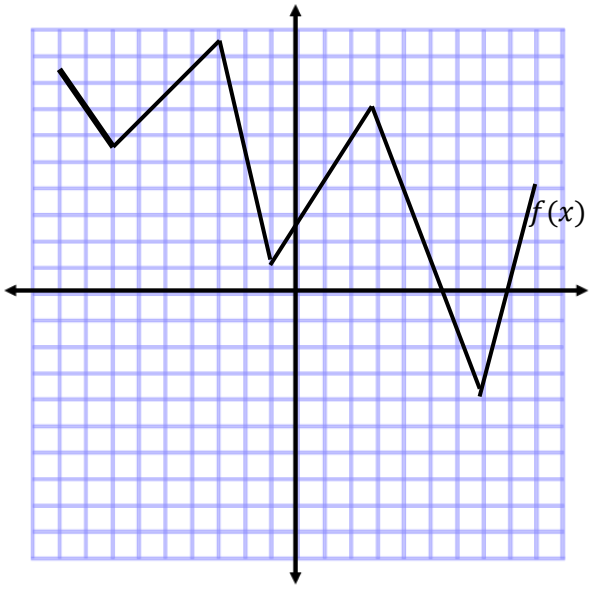
(A) -8

(B) -4

(C) -3

(D) 4

18. The complete graph of the function f is shown in the xy-plane below. For what value of x is the value of $f(x)$ at its minimum? (scale =1)



(A) 7

(B) -1

(C) -9

(D) -4

19. $$3x + 4y = 10$$
$$-2x + 4y = 20$$

According to the system of equations above, what is the value of *x*?

20. $$x - y = 12$$
$$-x + 3y = -6$$

According to the system of equations above, what is the value of *x*?

21. A function f satisfies $f(2) = 12$ and $f(6) = -4$. A function g satisfies $g(2) = 6$ and $g(6) = 2$. What is the value of $f(g(2))$?

(A) 12

(B) -4

(C) 6

(D) 2

22. A function f satisfies $f(-6) = 12$ and $f(0) = -4$. A function g satisfies $g(0) = -6$ and $g(6) = 2$. What is the value of $f(g(0))$?

(A) 12

(B) -4

(C) -6

(D) 2

23. $f(x) = ax^2 + 3$

For the function *f* defined above, *a* is a constant greater than zero. Which of the following is NOT true?

a) Axis of symmetry of the graph is x = 0

b) The line y = 3 intersects the graph of *f* at two points

c) Domain of *f* is (-∞, ∞)

d) Range of *f* is [3, ∞)

24. $h(x) = ax^2 + 12$

For the function f defined above, a is a constant greater than zero. Which of the following is **NOT** true?

(A) Range of *f is* $(-\infty, 12]$

(B) $h(x) = h(-x)$

(C) Axis of symmetry of the graph of h is $x = 0$

(D) The line $y = 12$ intersects the graph of *f* at one point

25. Determine the axis of symmetry of:

(A) $y = x^2 - 4x - 21$ (B) $y = (x - 2)(x + 4)$ (C) $y = (x + 2)^2 + 4$

26. $f(x) = -ax^2 + bx + c$

For the function f defined above, *a*, *b*, and *c* are constants greater than zero. Which of the following is true?

(A) Range of *f* is all real numbers

(B) $h(x) = -h(x)$

(C) Axis of symmetry of the graph of *f* is $x = \frac{-b}{2a}$

(D) Axis of symmetry of the graph of *f* is $x = \frac{b}{2a}$

27. What is the equation of the axis of symmetry for the parabola $y = 3x^2 - 24x + 9$?

(A) $y = 4$

(B) $y = -4$

(C) $x = 4$

(D) $x = -4$

28. $h = -4.9t^2 + 34t$

The equation above expresses the approximate height, h, in meters of a ball t seconds after it is launched vertically upward from the ground with an initial velocity of 34 meters per second. After approximately how many seconds will the ball hit the ground?

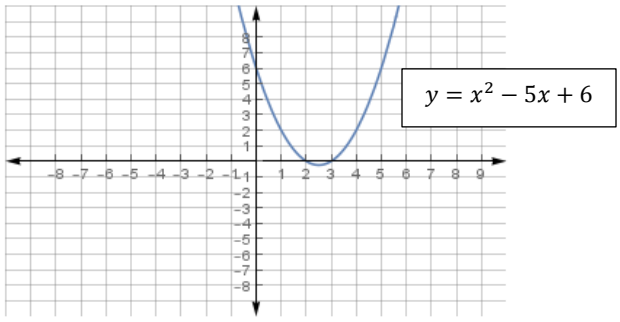
(A) 6.9

(B) 8.0

(C) 8.5

(D) 72.25

29.



Which of the following is an equivalent form of the equation of the graph shown in the xy-plane above, from which the coordinates of vertex A can be identified as constants in the equation?

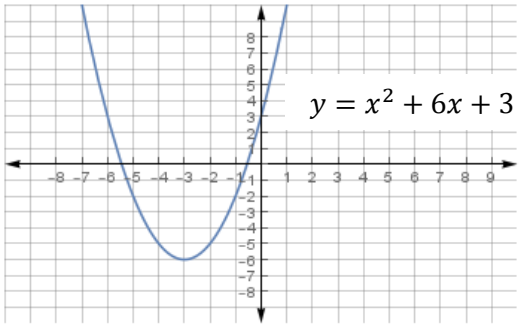
(A) $y = (x + 3)(x - 2)$

(B) $y = (x - 6)(x + 1)$

(C) $y = x(x - 6) - 15$

(D) $y = (x - 2.5)^2 - .25$

30.



Which of the following is an equivalent form of the equation of the graph shown in the xy-plane above, from which the coordinates of vertex A can be identified as constants in the equation?

(A) $y = (x - .5)(x - 5.5)$

(B) $y = (x + .5)(x + 5.5)$

(C) $y = x(x - 6) + 15$

(D) $y = (x + 3)^2 - 6$

31. What is the sum of all values of m that satisfy $m^2 - 9m + 20 = 0$?

(A) 0

(B) 9

(C) -9

(D) -20

32. What is the sum of all values of m that satisfy $m^2 + 3m - 10 = 0$?

(A) 0

(B) 3

(C) -3

(D) -10

33. What is the product of all values of m that satisfy $m^2 + 3m - 10 = 0$?

(A) 10

(B) -10

(C) -3

(D) 3

34. What is the sum of all values of *x* that satisfy $x^2 - 4x - 12 = 0$

(A) 4

(B) -2

(C) 6

(D) -4

35. What is the sum of all values of *x* that satisfy $2x^2 + 7x + 3 = 0$?

(A) $-\frac{1}{2}$

(B) $-\frac{7}{2}$

(C) -1

(D) $-\frac{3}{2}$

36. $y = x^2 - 7x + 10$

The equation above represents a parabola in the xy-plane. Which of the following equivalent forms displays the *x*-intercepts of the parabola as constants or coefficients?

(A) $y - 10 = x^2 - 7x$

(B) $y + 2 = (x + 3)^2$

(C) $y = x(x - 7) + 10$

(D) $y = (x - 5)(x - 2)$

37. $y = x^2 + 9x + 14$

The equation above represents a parabola in the *xy*-plane. Which of the following equivalent forms displays the *x*-intercepts of the parabola as constants or coefficients?

(A) $y - 14 = x^2 + 9x$

(B) $y + 9 = (x + 4)^2$

(C) y = x(x + 9) + 14

(D) y = (x + 7)(x + 2)

38. $y = x^2 - 6x + 5$

The equation above represents a parabola in the xy-plane. Which of the following equivalent forms displays the *x*-intercepts of the parabola as constants or coefficients?

(A) $y - 5 = x^2 - 6x$

(B) $y = (x - 1)(x - 5)$

(C) $y = x(x - 6) + 5$

(D) $y + 4 = (x - 3)^2$

39. $h = -16t^2 + 128t$

The equation above expresses the height, in feet, of an object t seconds after it is launched from the ground vertically upward with an initial velocity of 128 feet per second. What is the maximum height the object will achieve?

(A) 4

(B) 8

(C) 128

(D) 256

40. $h = -16t^2 + 32t + 8$

The equation above expresses the height, in feet, of an object t seconds after it is launched from the ground vertically upward with an initial velocity of 32 feet per second. When will the object be at the maximum height?

(A) 1

(B) 2

(C) 24

(D) 56

41. $y = a(x - 2)(x + 4)$

In the quadratic equation above, a is a nonzero constant. The graph of the equation in the xy-plane is a parabola with vertex (c, d). Which of the following is equal to d?

(A) $-a$

(B) $-3a$

(C) $-4a$

(D) $-9a$

42. Solve a – h:

a) $2x^2 - 50 = 0$

b) $x^2 - 5x - 14 = 0$

c) $x^2 + 27 = 0$

d) $x^2 - 4x = -9$

e) $84 = 4x^2 + 20$

g) $2(x-3)^2 - 32 = 0$

f) $4x^2 - 20x - 24 = 0$

h) $5(x-3)^2 + 45 = 0$

43. What are the solutions to $2x^2 + 8x + 4 = 0$?

(A) $x = -2 \pm \sqrt{2}$

(B) $x = -8 \pm 2$

(C) $x = -8 \pm \sqrt{2}$

(D) $x = -6 \pm 6\sqrt{2}$

44. What are the solutions to $6x^2 + x - 12 = 0$

(A) $x = -3 \; or \; 4$

(B) $x = -\frac{3}{2} \; or \; \frac{4}{3}$

(C) $x = \pm\frac{1}{12}$

(D) $x = \frac{3}{2} \; or \; -\frac{4}{3}$

45. $2x(4x + 6) + 7(4x + 6) = ax^2 + bx + c$

In the equation above, a, b, and c are constants. If the equation is true for all values of x, what is the value of b?

(A) 8

(B) 36

(C) 40

(D) 42

46. $6x(3x - 5) + 2(4x + 2) = ax^2 + bx + c$

In the equation above, a,b, and c are constants. If the equation is true for all values of x, what is the value of b?

47. $-2x(3x + 6) - (4x - 3) = ax^2 + bx + c$

In the equation above, a, b, and c are constants. If the equation is true for all values of x, what is the value of b?

48. $x(2x + 7) - 9(2x + 7) = ax^2 + bx + c$

In the equation above, *a*, *b*, and c are constants. If the equation is true for all values of *x*, what is the value of *b*?

(A) 2

(B) -9

(C) -11

(D) -63

49. If $i = \sqrt{-1}$, what is the product of $(3 - 4i)(6 + 8i)$?

(A) 50

(B) -50

(C) 24

(D) -24

50. If $i = \sqrt{-1}$, what is the product of $(7 + 3i)(-8 + 9i)$?

51. Simplify :

a) $(5 + 3i) - (2 - 2i)$

b) $(7 + 2i) + (-3 - 4i)$

c) $(4 + 2i)(-3 + 4i)$

d) $(4 + 2i)(4 - 2i)$

e) $(5 - 2i)(4 - i) + 3i$

f) $(3 + i)(5 - 2i) + (7 + 5i)$

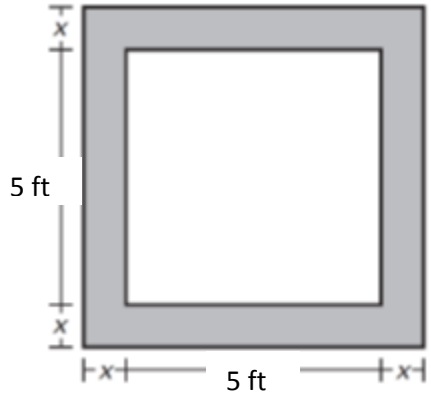
52. What is the degree of the polynomial:

(A) $f(x) = 8x^4 + 6x^9 + 4x - 24$

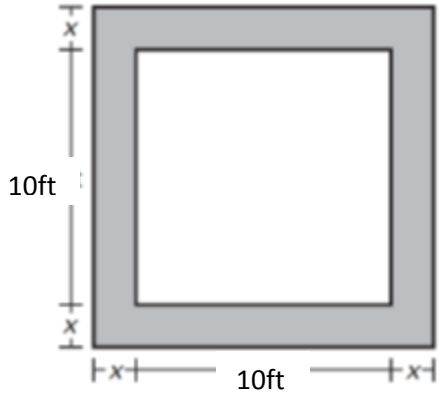
(B) $g(x) = x^5 + 4x^3 + 2x$

(C) $h(x) = 250 + 125x$

53. You are make a garden with a sidewalk going around the garden. The garden is 5 feet by 5 feet. You want the boarder to be a uniform width. You have 36 square feet of material to make the boarder. What width should the boarder be?



54. You are make a table with a glass top surrounded by a maple wood border. The glass is 10 feet by 10 feet. You want the wood border to be a uniform width. You have 224 square feet of material to make the border. What width should the border be?



55. John threw a ball off the top of Stamford High School. The height as a function of time can be modeled by the function $h(t) = -16t^2 + 48t + 160$, where t is the time in seconds and h is the height in feet.

a. How long did it take for the ball to reach its maximum height?

b. What was the highest point that the ball reached?

c. When did the ball hit the ground?

56. Which of the following is **NOT** a polynomial?

(A) $2x^3 + 4x^2 - 9x + 6$

(B) $-7x^4 + \frac{2}{3}x^3 - 5x^2 - x$

(C) $7x^4 - 2x^3 + 4x^2 + x^{\frac{1}{3}} + 6$

(D) 9

57. Which of the following is **NOT** a polynomial?

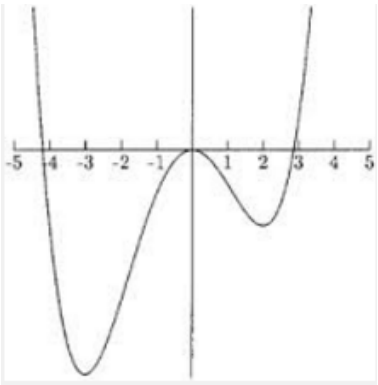
(A) $2x^3 + 4x^2 - \sqrt{9x} + 6$

(B) $-7x^4 + \frac{2}{3}x^3 - 5x^2 - x + \sqrt{8}$

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

(D) $9x + 7$

58. Determine the x-intervals for which the graph of *f(x)* below is increasing.



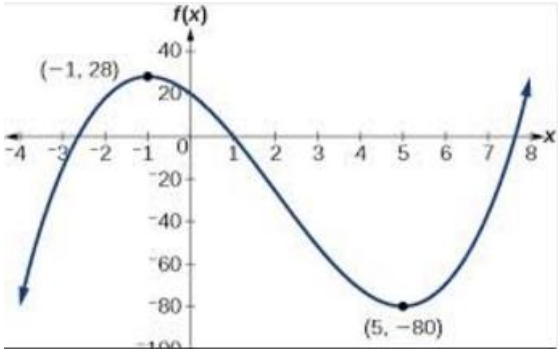
(A) $(-\infty, \infty)$

(B) $(-\infty, -3), (0,2)$

(C) $(-3,0), (2, \infty)$

(D) $(-3,2)$

59. Determine the *x*-intervals for which the graph of *f(x)* below is decreasing.



(A) $(-\infty, -1), (5, \infty)$

(B) $(-\infty, \infty)$

(C) $(-1,5)$

(D) $(28, -80)$

60. Given that $x = 2$ is a zero of the polynomial $f(x) = x^3 - 5x^2 - 12x + 36$ which of the following is a <u>factor</u> of the polynomial?

(A) $x - 6$

(B) $x - 1$

(C) $x + 1$

(D) $x + 4$

61. Given that $x = 2$ is a zero of the polynomial $f(x) = 2x^3 + x^2 - 8x - 4$ which of the following is a <u>factor</u> of the polynomial?

(A) $x + 6$

(B) $x + 2$.

(C) $x + 1$

(D) $x + 4$

62. For a polynomial *p(x)*, the value of $p(5) = 7$. Which of the following must be true about $p(x)$?

(A) $x - 5$ is a factor of $p(x)$

(B) $x - 7$ is a factor of $p(x)$

(C) $x + 7$ is a factor of $p(x)$

(D) The remainder when $p(x)$ is divided by $x - 5$ is 7

63. Simplify:

a. $(3x^3 + 2x^2 - 9x + 16) + (5x^3 + 5x - 8)$

b. $(-5x^3 + 4x^5 - 11x^2 + 6) - (x^5 + 7x^2 + 5)$

64. Which of the following is equivalent to the expression $16a^4 - 25b^4$

(A) $(4a^2 - 5b^2)^2$

(B) $(4a^2 - 5b^2)(4a^2 + 5b^2)$

(C) $(4a - 5b)(4a + 5b)$

(D) $(4a - 5b)^4$

65. Which of the following is equivalent to the expression $2x^3 + 13x^2 - 8x - 52$

(A) $15x^5 - 64x$

(B) $(x^2 - 4)(2x + 13)$

(C) $(2x + 5)(x + 6)(x - 2)$

(D) $2x(x + 13)(-15x + 4)$

66. Determine the complex zeros of the polynomial $f(x) = (x + 2)(x - 6)(x^2 + 9)$

(A) $-2, 6, 3, -3$

(B) $-2, 6, 3i, -3i$

(C) $2, -6, 9, -9$

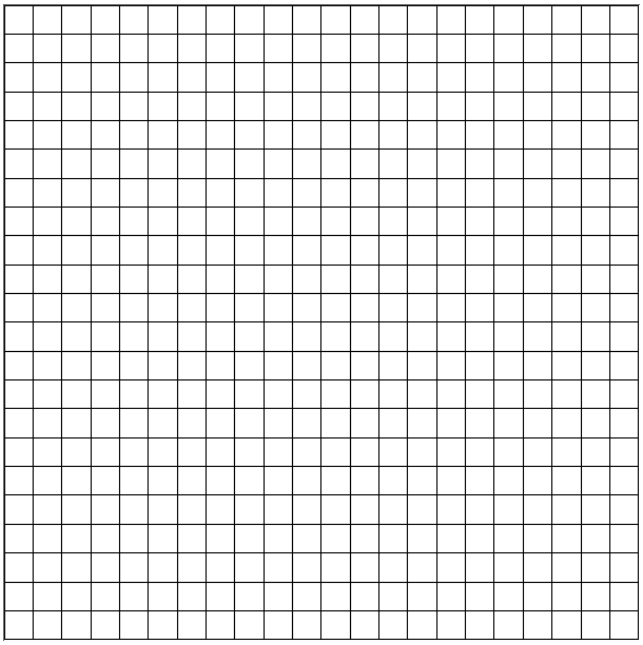
(D) $2, -6, 9i, -9i$

67. Use the following equation $f(x) = -(x+3)^2 + 4$ to answer questions.

a. Identify and describe all of the transformations from the parent function to the given function.

b. Graph the parent function with a dashed line.
c. Graph the function with a solid line.

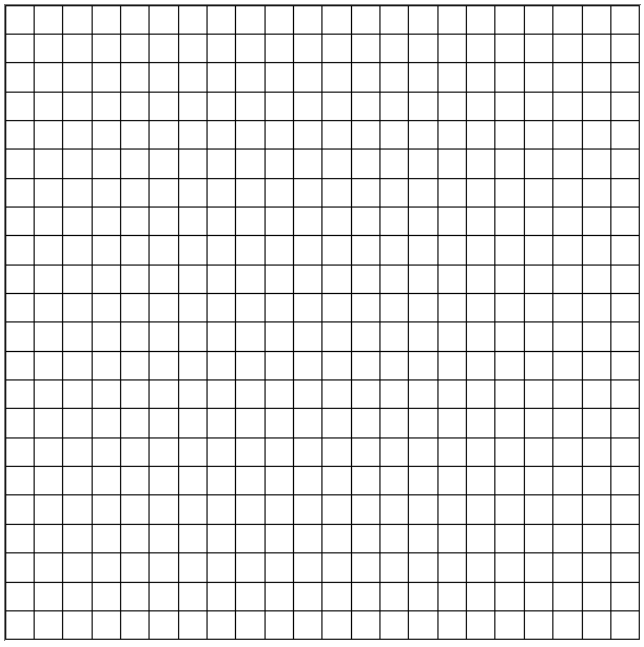
Be accurate on drawing your graph.



68. Use the following equation $f(x) = 2|x-1| - 6$ to answer questions.

a. Identify and describe all of the transformations from the parent function to the given function.

b. Graph the parent function with a dashed line.
c. Graph the function with a solid line.



69. Jason jumped off of a cliff into the ocean in Acapulco while vacationing with some friends. His height as a function of time could be modeled by the function $h(t) = -16t^2 + 16t + 480$, where *t* is the time in seconds and *h* is the height in feet.

a. How long did it take for Jason to reach his maximum height?

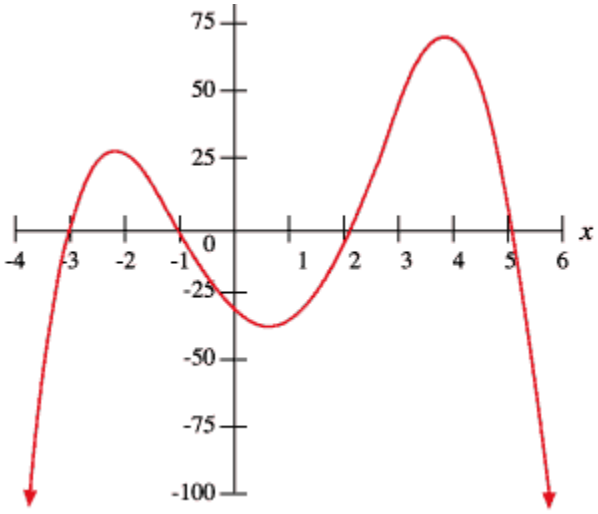
b. What was the highest point that Jason reached?

c. Jason hit the water after how many seconds?

70. A penny is dropped from the top of Dubai's newest skyscraper. The distance *d*, in feet, between the penny and the ground *t* seconds after it dropped is given by:
$d = -16t^2 + 2700$

How long after the penny is dropped does it hit the ground?

71. Use the graph below.



a. Is the leading coefficient positive or negative? Why?

b. How many real zeros do you see in the graph?

c. Approximate the value of each zero(s).

d. What is the smallest degree for this function? Why?

e. Describe the end behavior.

ALGEBRA II FORMULA SHEET

Properties of Logarithm

$$\log_b(x \cdot y) = \log_b x + \log_b y$$

$$\log_b\left(\frac{x}{y}\right) = \log_b x = \log_b y$$

$$\log_b a^n = n\log_b a$$

The Quadratic Formula

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

Exponential Models

$$y = y_0(1+r)^t$$

$$y = y_0(1-r)^t$$

Compound Interest

Compounded yearly

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

Compounded n times in a year

$$A = P(1+\tfrac{r}{n})^{nt}$$

Compounded Continuously

$$A = Pe^{rt}$$

Arc Length of a circle

1. If θ is in degrees:

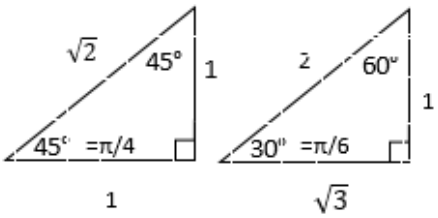
$$\text{Arc Length} = \frac{\theta}{360} \cdot 2\pi r$$

2. If θ is in radians:

Pythagorean Identity

$$\sin^2\theta + \cos^2\theta = 1$$

Special Triangles



Sum and Difference of Cubes

$$x^3 + y^3 = (x+y)(x^2 - xy + y^2)$$

$$x^3 - y^3 = (x-y)(x^2 + xy + y^2)$$

Sum and Difference Formulas (+)

$$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$$

$$\sin(\alpha-\beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$$

$$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$$

$$\cos(\alpha-\beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$$