QUIZ DATES: ______________ & ______________ TEST DATE: ____________________

Math 2 – Honors Name____________________

Unit 2 – Quadratic Functions Date____________________Pd____

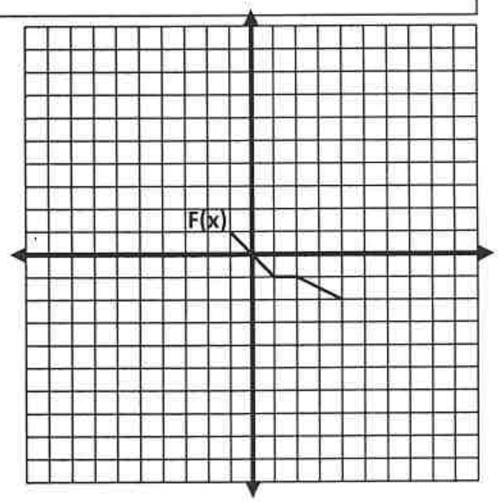
Lesson 1 – Transformations

➤ **Review:**

- A ____________________ is any set of ordered pairs.
- ____________________: set of all x values in a relation
- ____________________: set of all y values in a relation
- A ____________________ is a relation in which each element of the domain is paired with exactly one element of the range.
- Graphically, a function must pass the __________ __________ __________ (VLT) in order to be classified as a function.

➤ Examine the graph of $F(x)$ to the right:

x	$F(x)$
–1	
1	
2	
4	



1. Is $F(x)$ a function? Why or why not?

2. What is the domain of $F(x)$?

3. What is the range of $F(x)$?

4. Evaluate each of the following key points on $F(x)$:

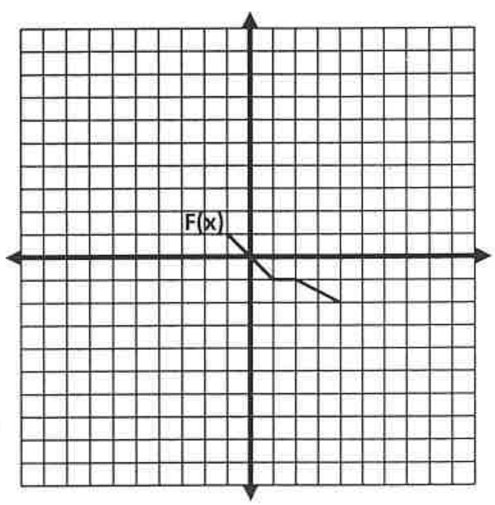
$F(1)$ = ______ $F(2)$ = _______ $F($______$) = -2$ $F($______$) = 1$

❖ Remember that $F(x)$ is another name for the $y - values$ → the equation of the function is $y = F(x)$.

➤ Now let's try graphing: $y = F(x) + 4$.

➤ Complete the table below for this new function and then graph on the coordinate.

x	y
–1	
1	
2	
4	

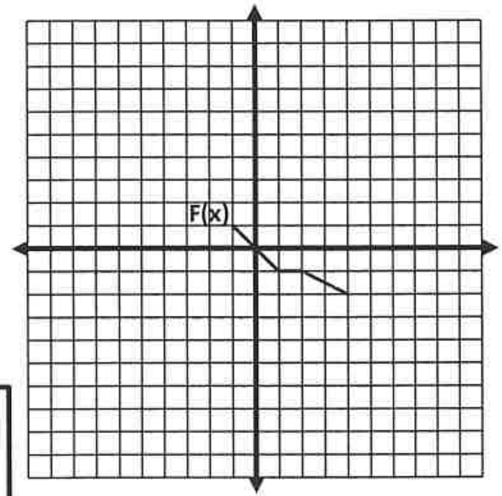


Describe the transformation:

Did the transformation affect the domain or the range of the function?

- Graph: $y = F(x) - 3$.

x	y
−1	
1	
2	
4	



Describe the transformation:

Did the transformation affect the domain or the range of the function?

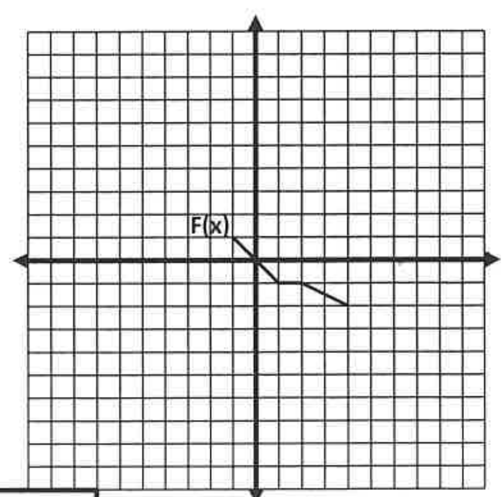
❖ **Checkpoint:** Describe the affect for the following functions.

Equation	Effect to the graph
Example: $y = F(x) + 18$	Translate up 18 units
1. $y = F(x) - 10$	
2. $y = F(x) + 3$	
3. $y = F(x) + 32$	
4. $y = F(x) - 1$	

- Graph: $y = F(x + 4)$.

Complete the table.

x	$x + 4$	y
−5	−1	1
	1	−1
	2	−1
	4	−2



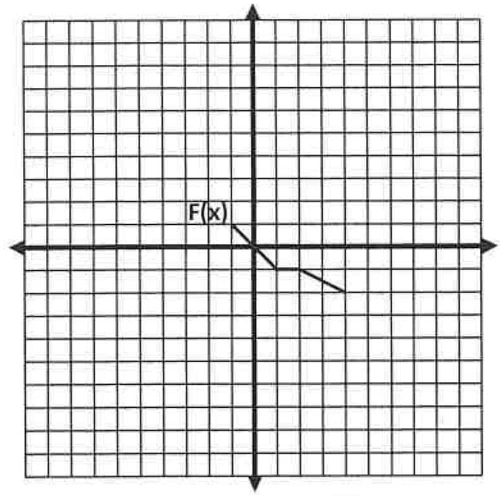
Describe the transformation:

Did the transformation affect the domain or the range of the function?

➢ Graph: $y = F(x - 3)$.

Complete the table.

x	$x - 3$	y
	−1	
	1	
	2	
	4	



Describe the transformation:

Did the transformation affect the domain or the range of the function?

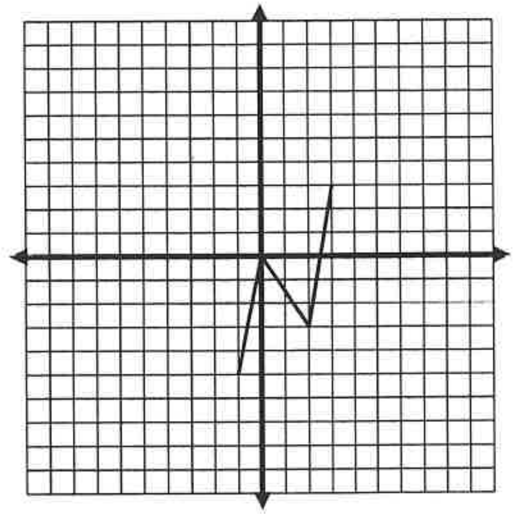
❖ **Checkpoint:** Describe the affect for the following functions.

Equation	Effect to the graph
Example: $y = F(x + 18)$	Translate left 18 units
1. $y = F(x - 10)$	
2. $y = F(x) + 7$	
3. $y = F(x + 48)$	
4. $y = F(x) - 22$	
5. $y = F(x + 30) + 18$	

❖ **Checkpoint:** Write the equation for each translation:

Equation	Effect to the graph
Example: $y = F(x + 8)$	Translate left 8 units
1.	Translate up 29 units
2.	Translate right 7
3.	Translate left 45
4.	Translate left 5 and up 14
5.	Translate down 2 and right 6

➢ Now let's look at a new function.
Its notation is $\boldsymbol{H(x)}$.



1. What are the key points?

____

2. Describe the effect on the graph for each of the following.

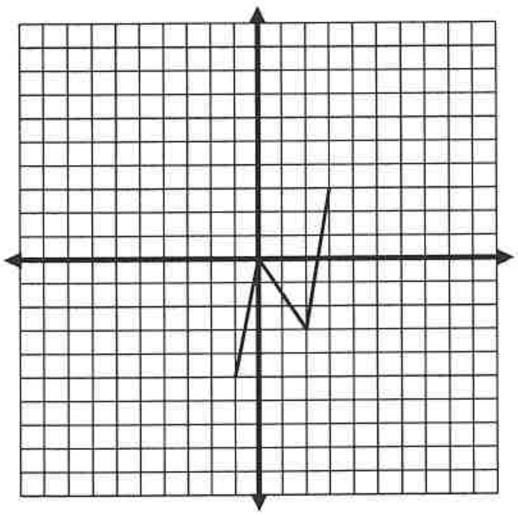
a. $H(x-2)$ ___________________________

b. $H(x)+7$ ___________________________

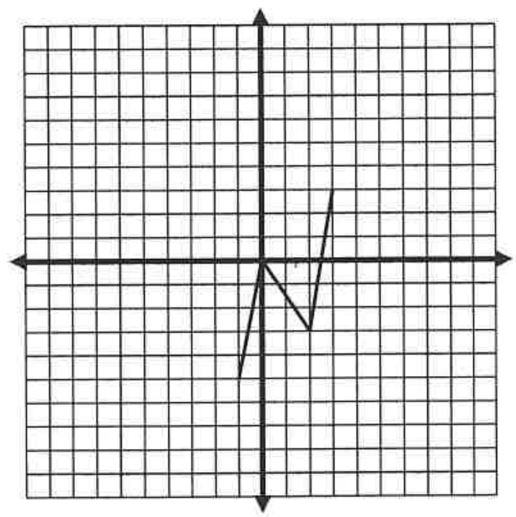
c. $H(x+2)-3$ ____

3. Use your answers to questions 1 and 2 to help you sketch each graph *without using a table*.
Then state the **DOMAIN & RANGE** of the image.

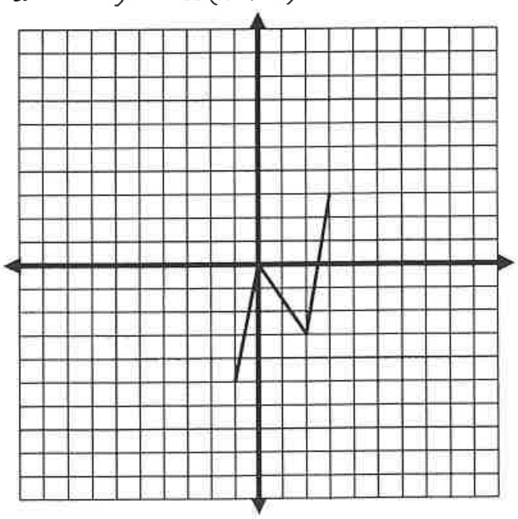
a. $y = H(x-2)$



b. $y = H(x)+7$



c. $y = H(x+2)-3$

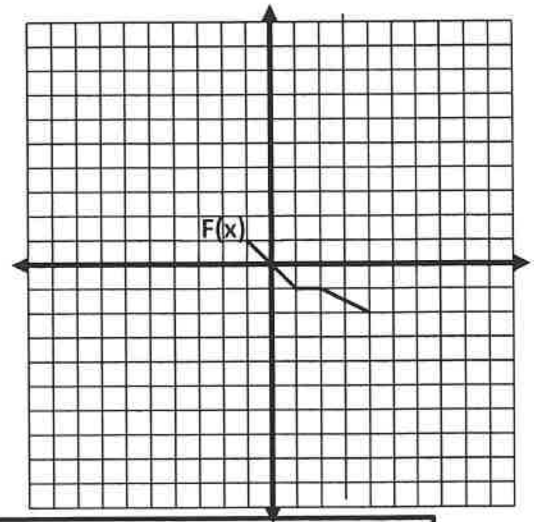


Recall that the equation: $y = F(x)$

- Now let's graph: $y = -F(x)$

x	$F(x)$	y
−1	1	−1
1		
2		
4		

$(x, y) \rightarrow ($ $\qquad\qquad$ $)$



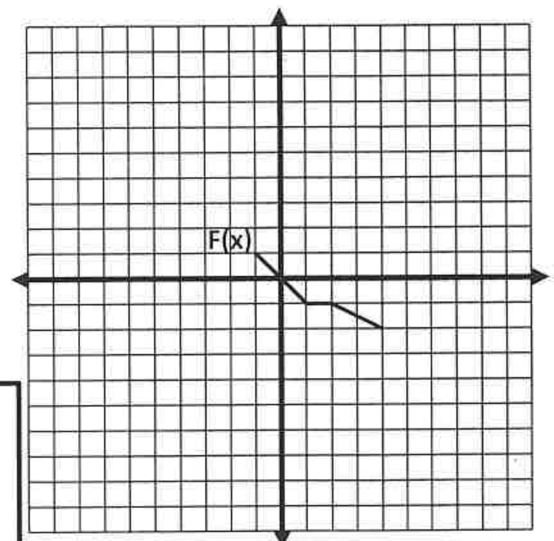
Describe the transformation:

Did the transformation affect the domain or the range of the function?

- Graph: $y = F(-x)$

x	$-x$	y
	−1	
	1	
	2	
	4	

$(x, y) \rightarrow ($ $\qquad\qquad$ $)$

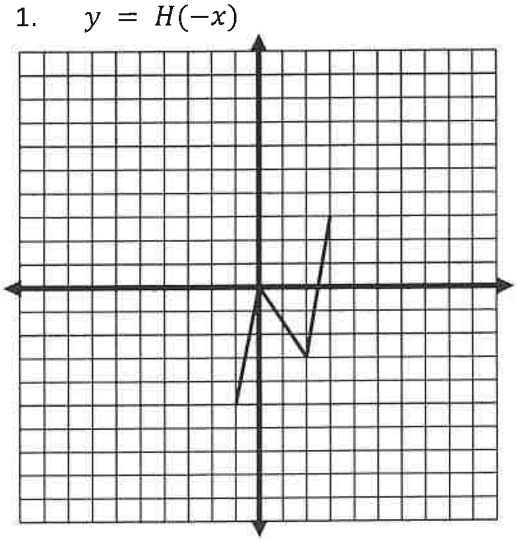


Describe the transformation:

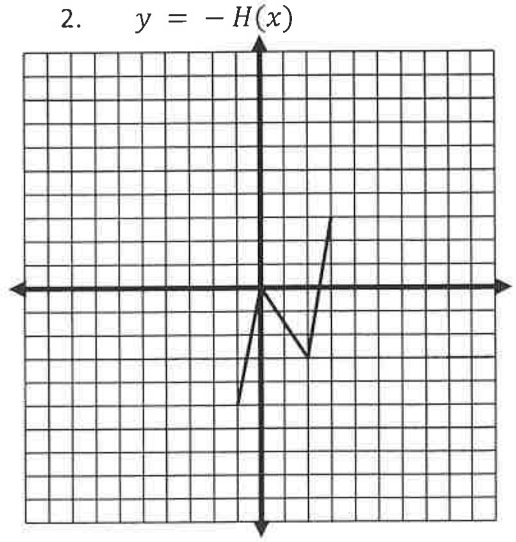
Did the transformation affect the domain or the range of the function?

❖ **Checkpoint: $H(x)$ is shown on each grid.**
Graph without making a table

1. $y = H(-x)$



2. $y = -H(x)$

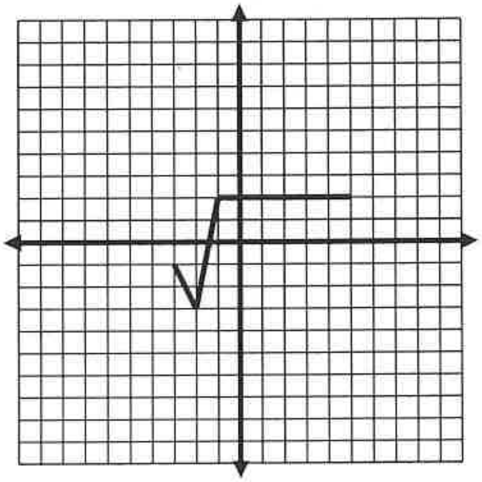


Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 1 – Transformations Homework

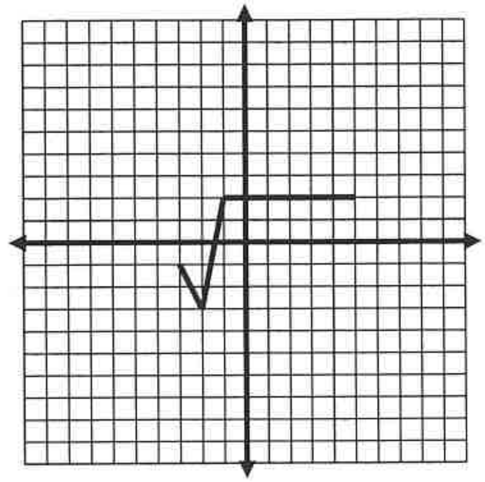
Name______________________________
Date__________________________Pd____

I. On each grid, $G(x)$ is graphed. Graph the given function.

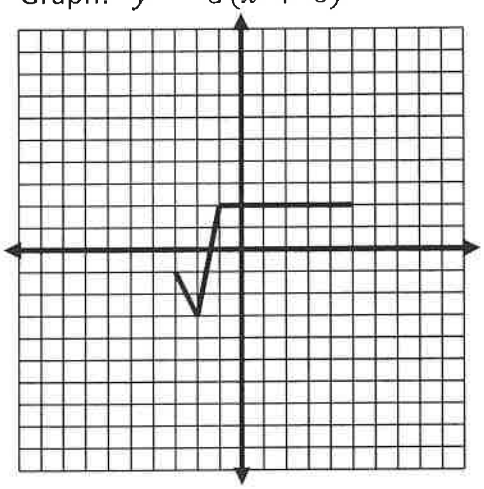
1. Graph: $y = G(x) - 6.$



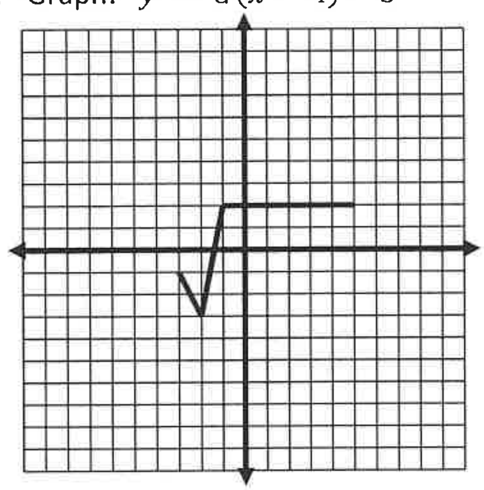
3. Graph: $y = G(x + 2) + 5$



2. Graph: $y = G(x + 6)$



4. Graph: $y = G(x - 4) - 5$



II. Using the understanding you have gained so far, describe the effect to the following functions.

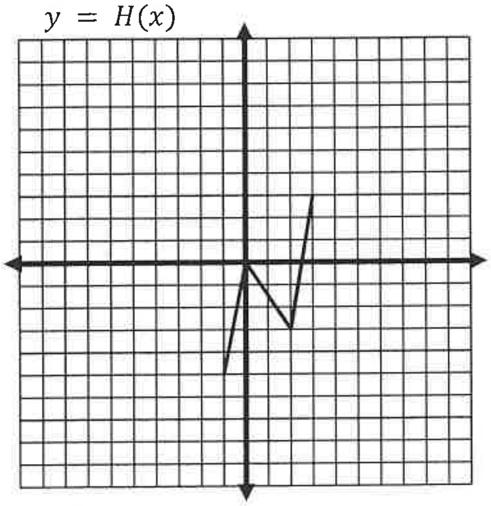
Equation	Effect to Fred's graph
1. $y = F(x) + 82$	
2. $y = F(x - 13)$	
3. $y = F(x + 9)$	
4. $y = F(x) - 55$	
5. $y = F(x - 25) + 11$	

III. Using the understanding you have gained so far, write the equation that would have the following effect on the graph.

Equation	Effect to the graph
1.	Translate left 51 units
2.	Translate down 76
3.	Translate right 31
4.	Translate right 8 and down 54
5.	Translate down 12 and left 100

IV. Determine the domain and range of each parent function.

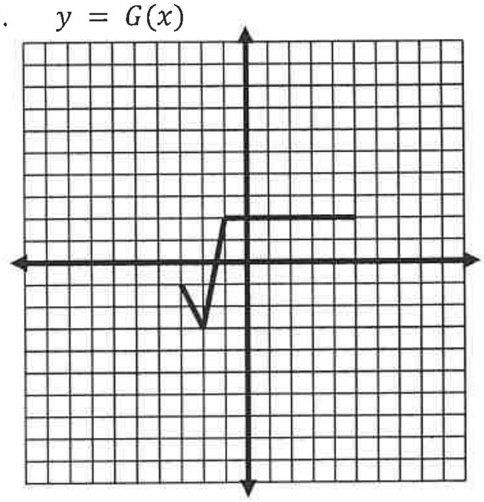
1. $y = H(x)$



Domain: ____________________

Range: ____________________

2. $y = G(x)$



Domain: ____________________

Range: ____________________

V. Consider a new function $y = P(x)$.
Domain is $[-2, 2]$ and range is $[-3, 1]$

Use your understanding of transformations of functions to determine the domain and range of each of the following functions.

1. $P(x) + 5$

Domain: ____________________

Range: ____________________

2. $P(x + 5)$

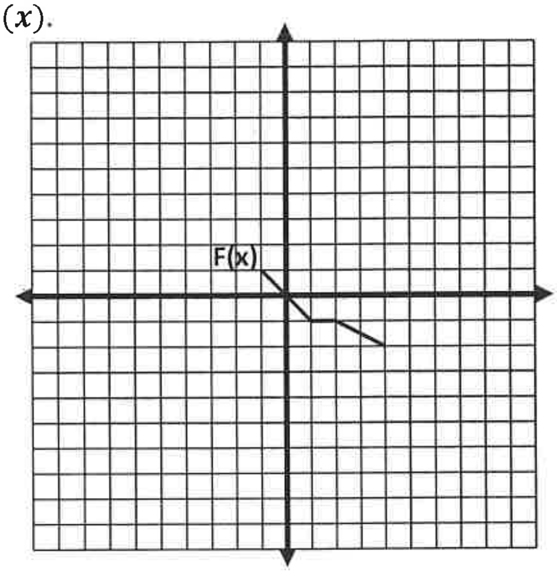
Domain: ____________________

Range: ____________________

Math 2 – Honors
Unit 2 – Quadratic Function
Lesson 2 – Transformations Continued

Name________________________________
Date: ____________________ Pd: _______

➢ Now let's return to the function whose equation is $y = F(x)$.



Complete the chart with the key points.

x	$F(x)$

➢ Let's suppose that $y = 4F(x)$

x	$F(x)$	y
−1		
1		
2		
4		

$(x, y) \rightarrow ($ $\quad\quad\quad\quad\quad$ $)$

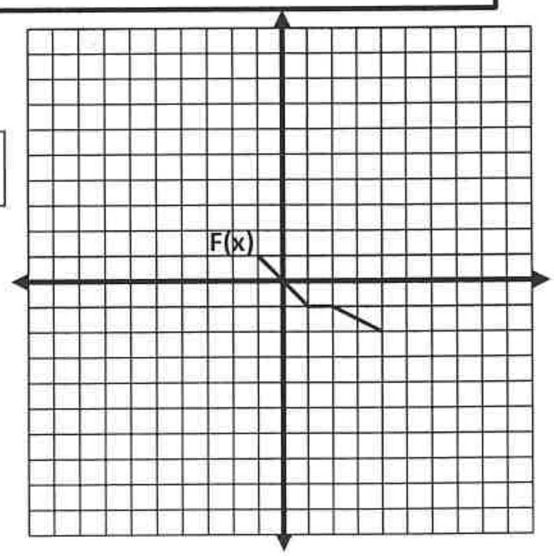
Describe the transformation:

Did the transformation affect the domain or the range of the function?

➢ Graph: $y = ½F(x)$

x	$F(x)$	y
−1		
1		
2		
4		

$(x, y) \rightarrow ($ $\quad\quad\quad\quad\quad$ $)$



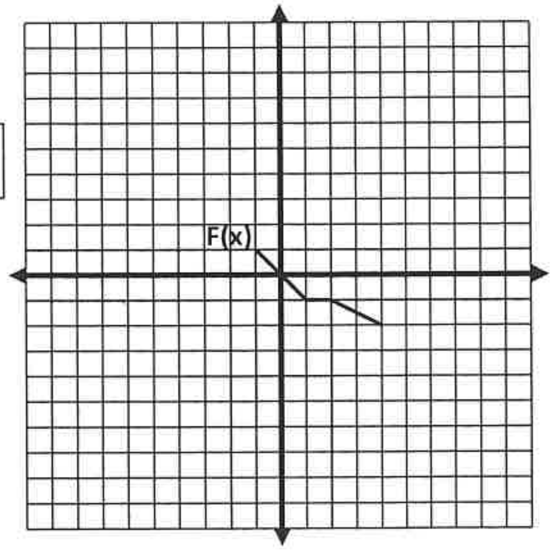
Describe the transformation:

Did the transformation affect the domain or the range of the function?

➤ Graph: $y = -3F(x)$

x	$F(x)$	y
−1		
1		
2		
4		

$(x, y) \rightarrow ($ $\qquad\qquad$ $)$



Describe the transformations:

Did the transformation affect the domain or the range of the function?

➤ **Checkpoint: Let's revisit $H(x)$.**

1. Describe the effect on Harry's graph for each of the following.

   Example: $y = -5H(x)$ Each point is reflected across the x-axis and stretched by a factor of 5

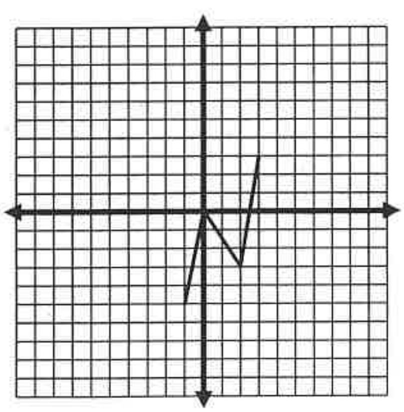
   a. $y = 3H(x)$ ____

   b. $y = -2H(x)$ ____

   c. $y = \frac{1}{2}H(x)$ ____

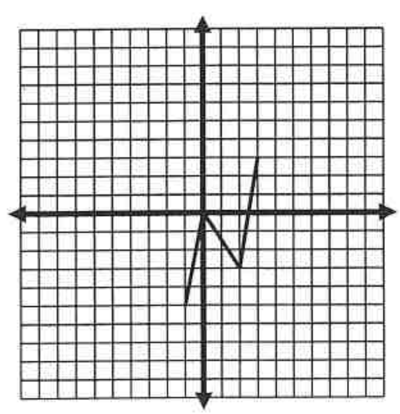
2. Sketch each graph *without using a table*. Then state the DOMAIN & RANGE of the image.

a. $y = 3H(x)$



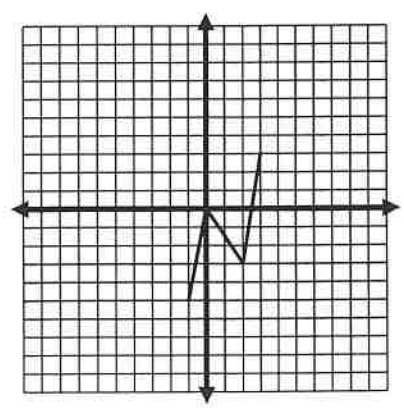
$(x, y) \rightarrow ($ $\qquad\qquad$ $)$

b. $y = -2H(x)$



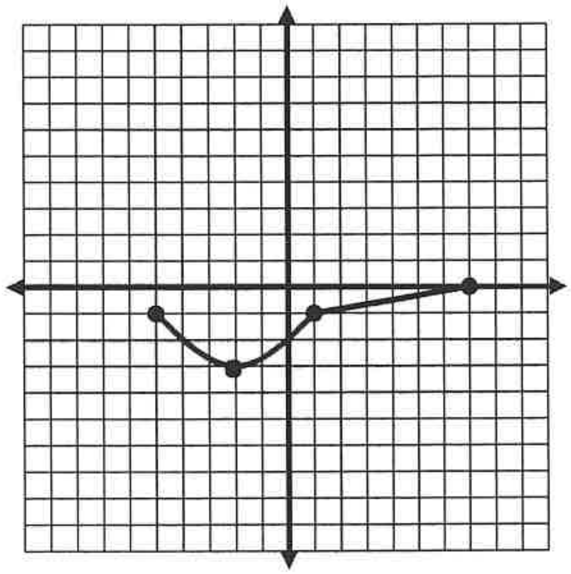
$(x, y) \rightarrow ($ $\qquad\qquad$ $)$

c. $y = \frac{1}{2}H(x)$



$(x, y) \rightarrow ($ $\qquad\qquad$ $)$

➢ The graph of $\boldsymbol{D(x)}$ is shown.



List the key points of $y = D(x)$.

____

Since $\boldsymbol{D(x)}$ is our original function, we will refer to it as the **parent function**.

> **Note:** In transformational graphing where there are multiple steps, it is important to perform the **translations** last.

➢ **Example:** Let's explore the steps to graph $\boldsymbol{y = 2D(x + 3) + 5}$, without using tables.

Step 1. The transformations represented in this new function are listed below in the order they will be performed. (See note above.)

- Vertical stretch by 2 (Multiply $y - coordinate$ by 2)
- Translate left 3
- Translate up 5

$(\boldsymbol{x, y}) \rightarrow ($ $)$

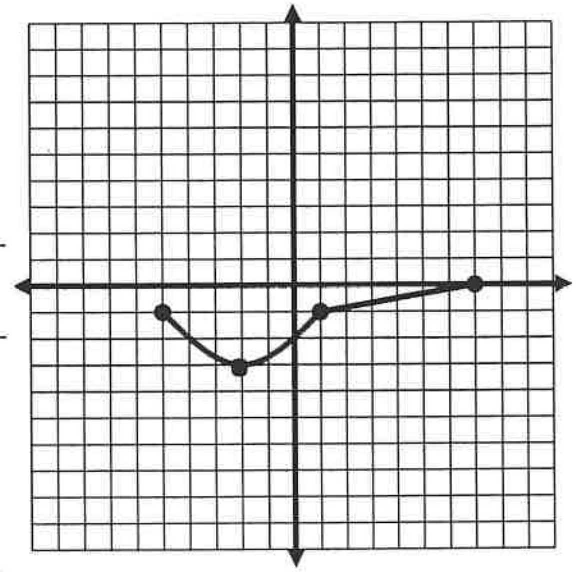
Step 2. Follow the process used in Step 1 above to perform all the transformations on the other 3 points.

Step 3. After completing Step 2, you will have all four key points for the graph. Be sure you use a curve in the appropriate place.

✓ What are the **domain** and **range** of $y = D(x)$?

✓ What are the **domain** and **range** of $y = D(x)$ after the transformations?

➢ Graph: $y = -D(x) - 4$



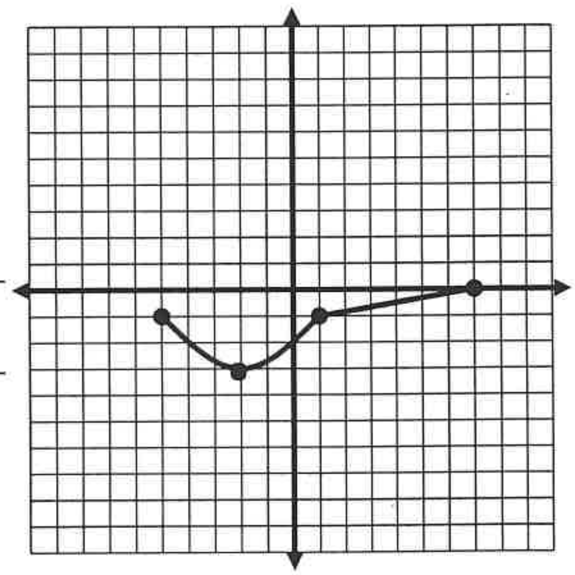
1. List the transformations needed to sketch the graph.
   (Remember, to be careful with order.)

- ______________________________
- ______________________________

2. Plot the new points and sketch the graph.

3. $(x, y) \rightarrow (\qquad\qquad\qquad)$

➢ Graph: $y = 3D(-x)$



1. List the transformations needed to sketch the graph.
   (Remember, to be careful with order.)

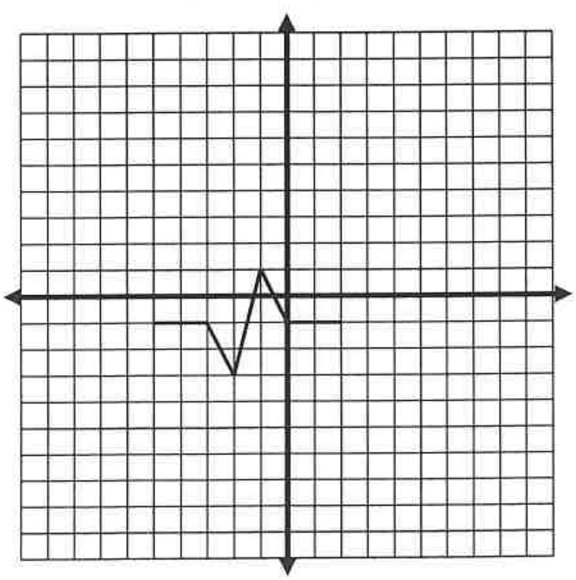
- ______________________________
- ______________________________

2. Plot the new points and sketch the graph.

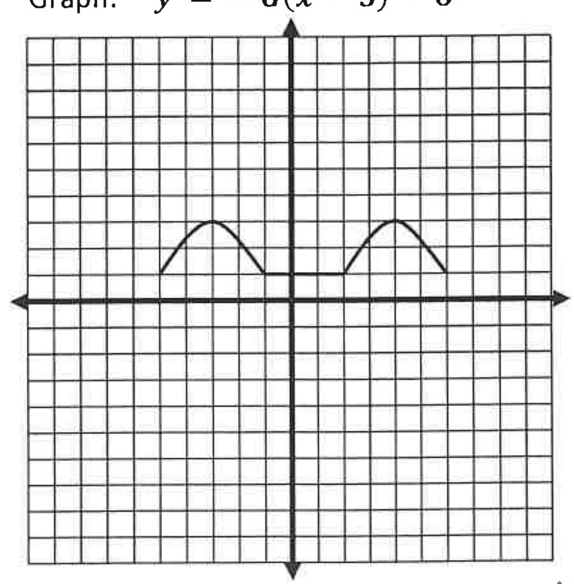
3. $(x, y) \rightarrow (\qquad\qquad\qquad)$

➢ **Checkpoint:**

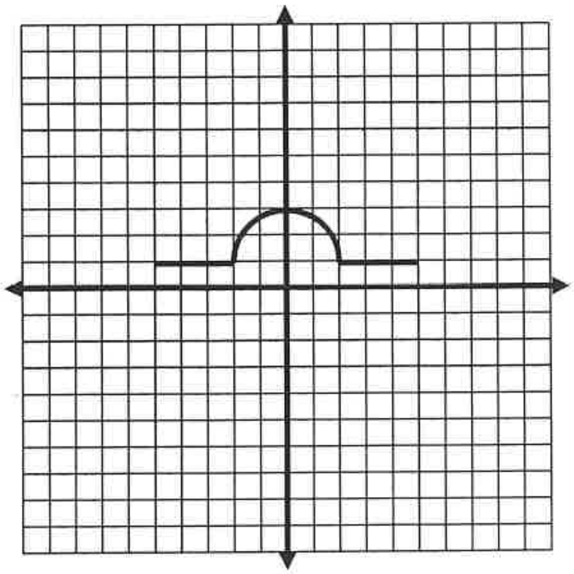
Graph: $y = 3C(x) + 5$



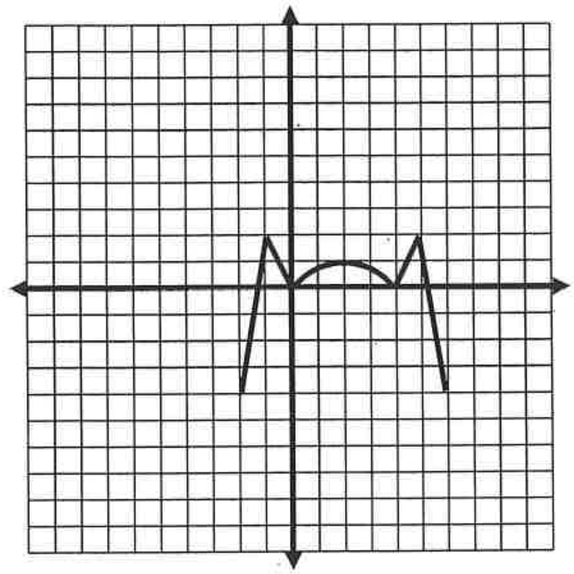
Graph: $y = -G(x - 3) - 6$



Graph: $y = -3H(x)$



Graph: $y = B(-x) + 8$



➢ **Finally, let's examine a reflection in the line $y = x$.**

1. Graph this line $y = x$ on the grid.

2. Complete the charts below with the characteristic points:

$y = H(x)$

x	y

Reflection

x	y

3. Describe what happens when we reflect in the line $y = x$.

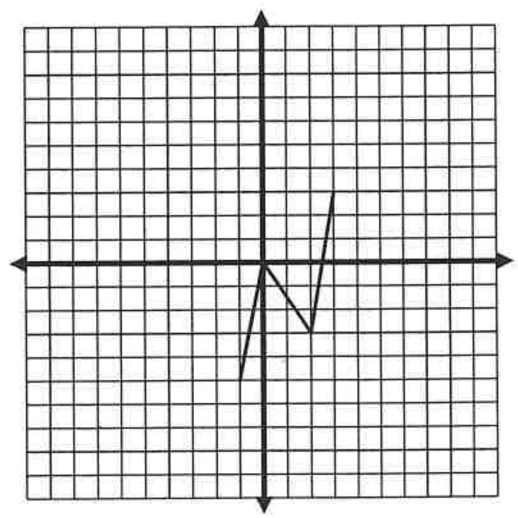
4. What is the domain of $H(x)$? __________

   What is the range of $H(x)$? __________

5. What is the domain of the reflection?__________

   What is the range of the reflection?

   ____



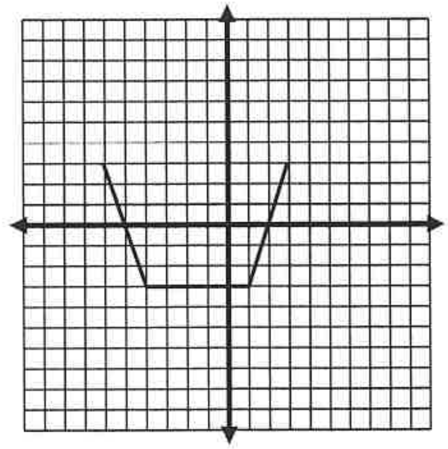
$(x, y) \rightarrow ($ $)$

6. A reflection in the line $y = x$, shows a graph's **inverse.** Look at the graph of the inverse. Is the inverse a function? Explain how you know.

Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 2 – Transformations HOMEWORK

Name____________________________
Date_______________________Pd____

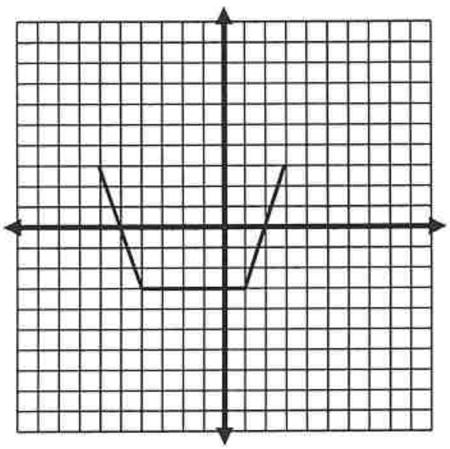
This is the function: $y = \boldsymbol{B(x)}$



1. List its key points: ________________________________
2. What is the domain of $y = \boldsymbol{B(x)}$?
3. What is the range of $y = \boldsymbol{B(x)}$?

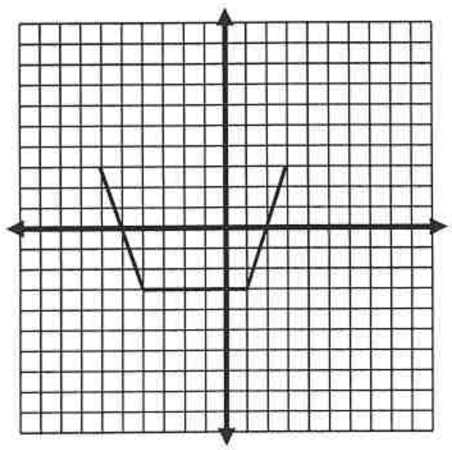
For each of the following, examine the transformation on the graph of $y = \boldsymbol{B(x)}$ and then graph the new function. Write the domain and range in interval notation.

4. $y = B(-x)$



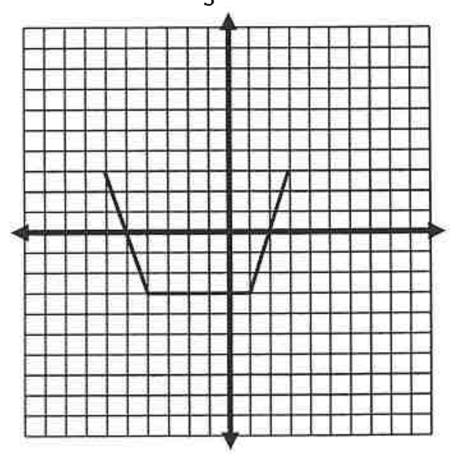
D: __________ R: __________

5. $y = -B(x)$



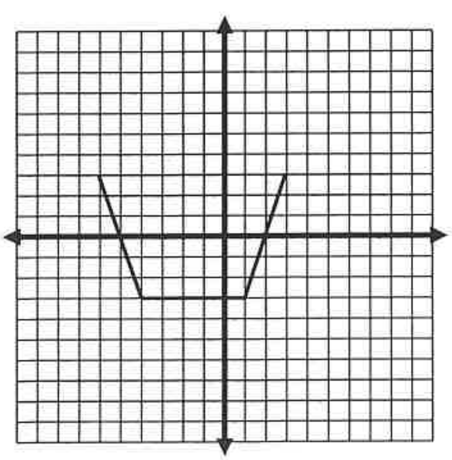
D: __________ R: __________

6. $y = \frac{1}{3}B(x)$



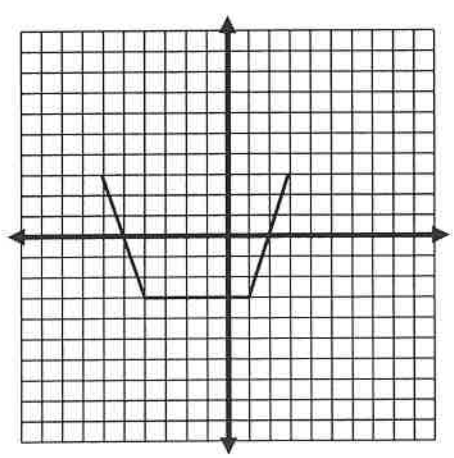
D: __________ R: __________

7. $y = 3B(x)$



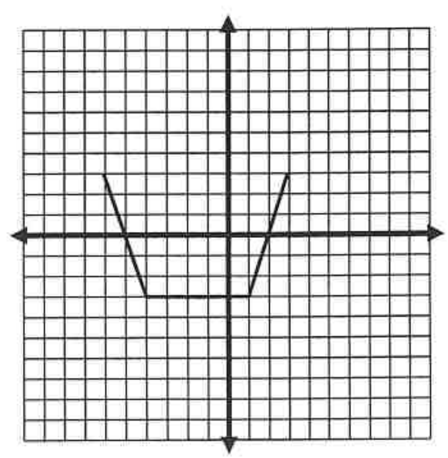
D: __________ R: __________

8. $y = B(x - 3)$



D: __________ R: __________

9. $y = B(x + 2) - 1$



D: __________ R: __________

10. List the transformations needed to graph the following. Remember that translations are done last.

a. $y = 2F(x) + 2$

____

____

b. $y = \frac{1}{3}F(x - 6)$

____

____

c. $y = -F(x) - 12$

____

____

d. $y = 3F(-x)$

____

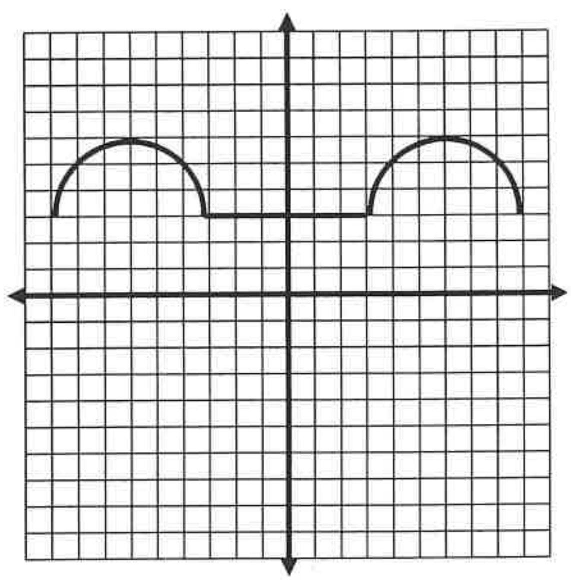
____

e. $y = -5F(x)$

____

____

11. Let: $y = M(x)$



a. How can you tell your graph is a function?

b. What is the domain? ______________

c. What is the range? ______________

d. Write an equation for your function that will have the following effects.

- Stretch vertically by 2 and translate left 4.

____

- Reflect in the x-axis and compress vertically by $\frac{1}{2}$

____

- Translate up 6 and right 4

____

Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 3 – Graphs of Quadratic Functions

Name______________________________
Date______________________________Pd_____

I. **Parts of a Quadratic Graph:** $y = x^2$

A) The graph of a quadratic function is called a ______________________________.

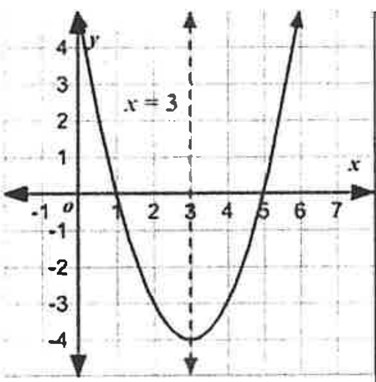
B) All quadratic functions have either a ________________________ or a ________________________ located at the ________________________.

C) The ____________ of ____________________________ is a line of reflection that runs vertically through the vertex and divides the parabola into two equal parts. It is always written as $\boxed{x =}$.

D) The ____ – ____________________ is where the parabola crosses the y – axis.

E) The ____ – ____________________ is where the parabola crosses the x – axis. These are also referred to as the ______________________ or _____________________ of the quadratic function.

F) If the function is equal to 0, then the x-intercepts are also called the _________________________.



Vertex:

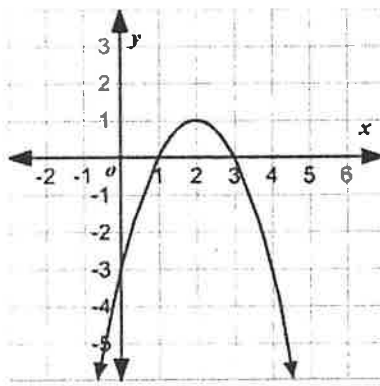
Maximum or Minimum

Axis of Symmetry:

y – intercept:
x – intercepts:

Domain:

Range:



Vertex:

Maximum or Minimum

Axis of Symmetry:

y – intercept:
x – intercepts:

Domain:

Range:

II. Ways to write quadratic functions:

A) **Standard Form:** $y = ax^2 + bx + c$

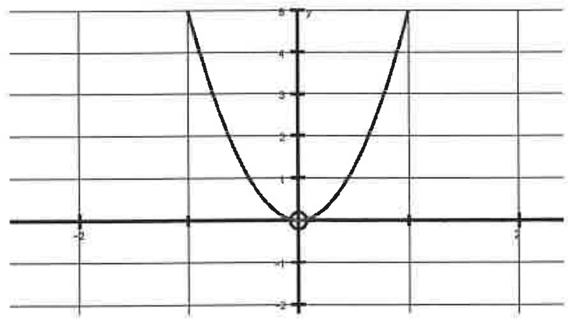
C) **x – intercept Form:** $y = a(x - intercept\ \#)(x - intercept\ \#)$

B) **Vertex Form:** $y = a(x - h)^2 + k$

- Vertex: (h, k)
- Translation left or right: h
- Translation up or down: k
- Dilation: If $a > 1$ *the graph stretches*; $0 < a < 1$ *the graph compresses*
- Reflection: a *is negative*

Different Forms of a Quadratic Equation:

1. $y = 5x^2$



Vertex (,   )

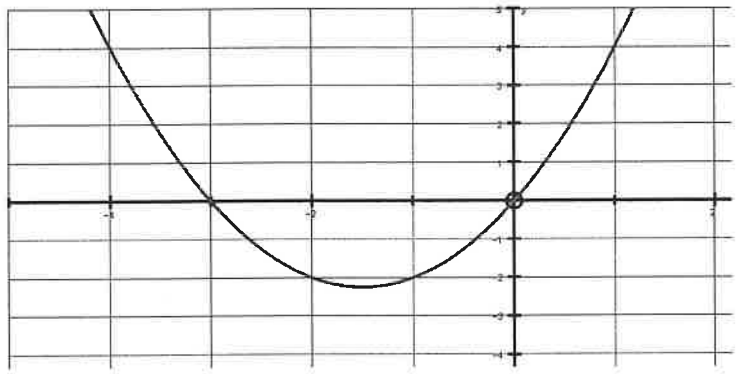
Max or Min

Axis of Symmetry: $x =$ __

y-intercept:

x-intercept(s) :

2. $y = x^2 + 3x$



Vertex (,   )

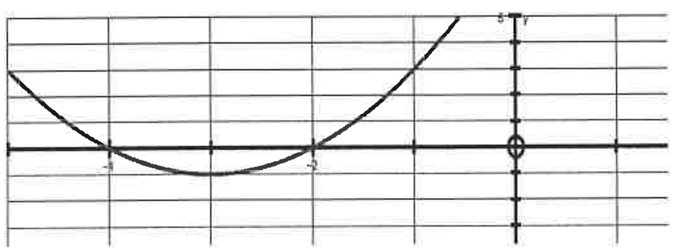
Max or Min

Axis of Symmetry: $x =$ __

y-intercept:

x-intercept(s):

3. $y = (x + 4)(x + 2)$



Vertex (,   )

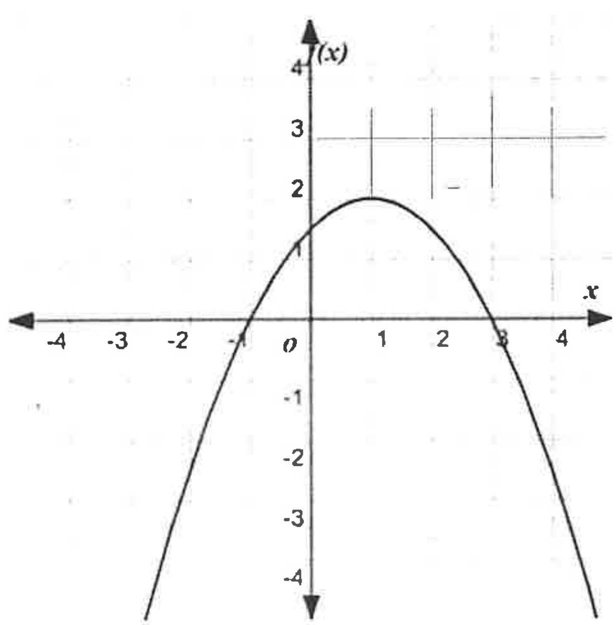
Max or Min

Axis of Symmetry: $x =$ __

y-intercept:

x-intercept(s):

4. $y = -\frac{1}{2}(x - 1)^2 + 2$



Vertex (,   )

Max or Min

Axis of Symmetry: $x =$ __

y-intercept:

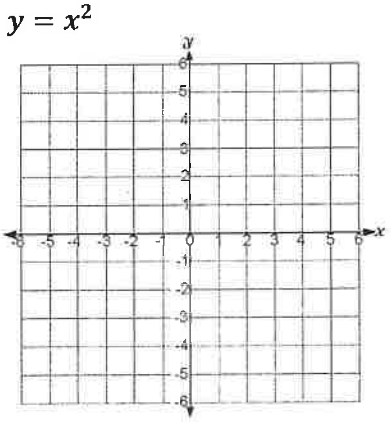
x-intercept(s):

❖ Example: Complete the following chart using the vertex form, $y = a(x-h)^2 + k$, of a quadratic function.

Function	Vertex	Left/Right Translation	Up/Down Translation	Dilation (Stretch or Compress)	Reflection (Yes or No)	Domain	Range
1. $y = x^2$ (Parent Function)							
2. $y = (x+2)^2 + 3$							
3. $y = x^2 - 3$							
4. $y = 2(x-5)^2$							
5. $y = -3x^2 + 1$							
6. $y = \frac{1}{2}(x+1)^2 - 4$							

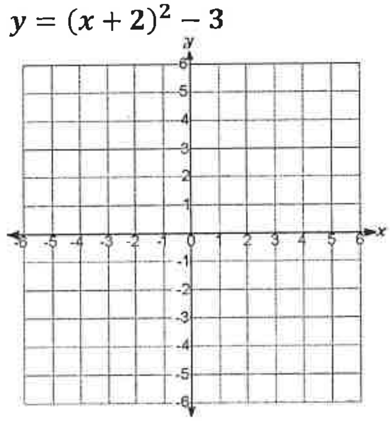
III. Graphing quadratic functions using vertex form.

1. $y = x^2$



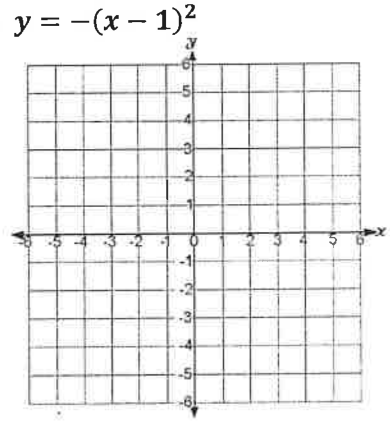
Vertex_______________________

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



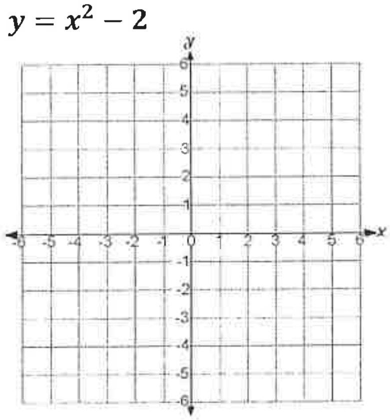
Vertex_______________________

3. $y = -(x-1)^2$



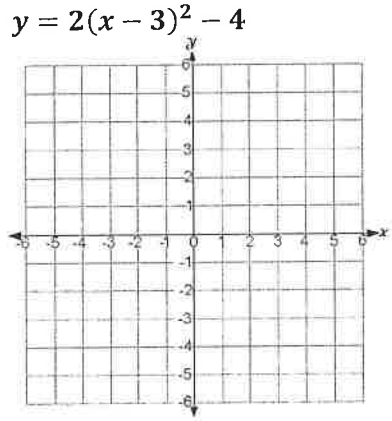
Vertex_______________________

4. $y = x^2 - 2$



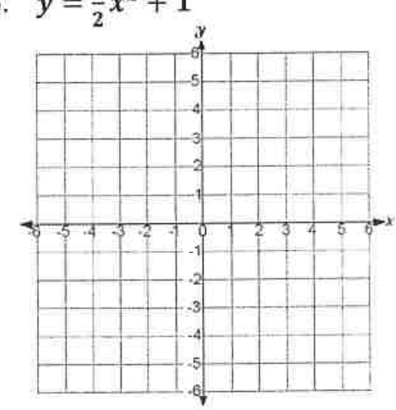
Vertex_______________________

5. $y = 2(x-3)^2 - 4$



Vertex_______________________

6. $y = \frac{1}{2}x^2 + 1$



Vertex_______________________

Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 3 – Graphs of Quadratic Functions – HOMEWORK

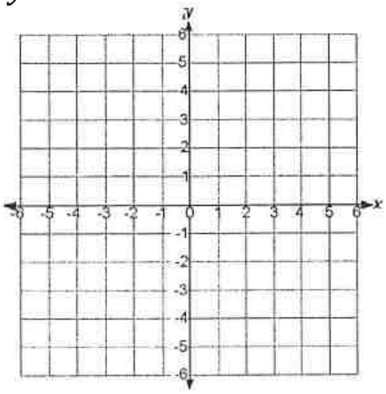
Name________________________________
Date__________________________Pd_____

I. Complete the following chart using the vertex form, $y = a(x-h)^2 + k$, of a quadratic function.

Function	Vertex	Left/Right Translation	Up/Down Translation	Dilation (Stretch or Compress)	Reflection (Yes or No)	Domain	Range
1. $y = x^2$ (Parent Function)							
2. $y = x^2 - 7$							
3. $y = -2(x+1)^2$							
4. $y = (x-3)^2 + 8$							
5. $y = 4x^2$							
6. $y = -\frac{2}{3}(x-2)^2$							
7. $y = -x^2$							
8. $y = \frac{1}{2}(x+6)^2 - 2$							
9. $y = -x^2 + 9$							
10. $y = -\frac{1}{4}(x-4)^2$							

II. Graph each of the following quadratic functions using the vertex form $y = a(x-h)^2 + k$. Name the vertex, domain and range.

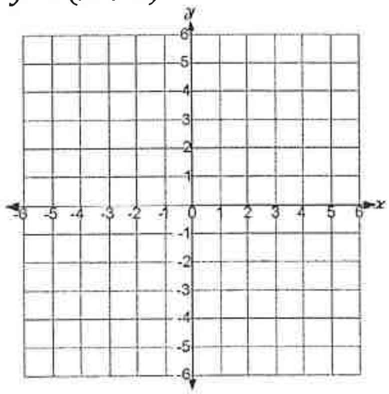
1. $y = x^2$



Vertex__________________

Domain:________ Range:________

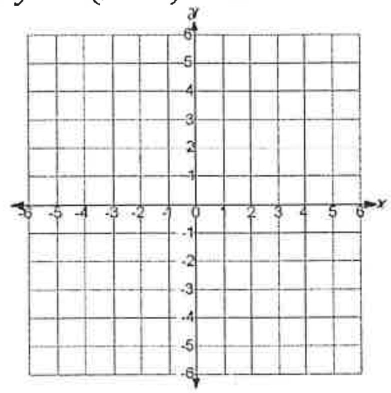
2. $y = (x+3)^2 - 2$



Vertex__________________

Domain:________ Range:________

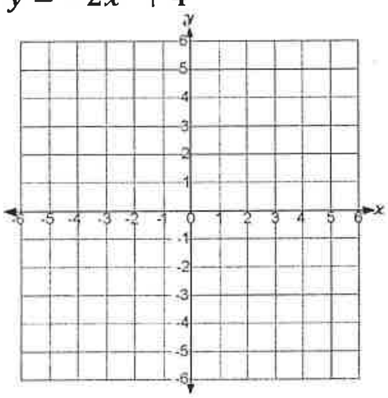
3. $y = 4(x-5)^2 - 5$



Vertex__________________

Domain:________ Range:________

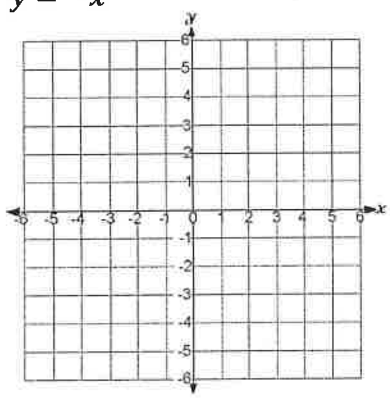
4. $y = -2x^2 + 4$



Vertex__________________

Domain:________ Range:________

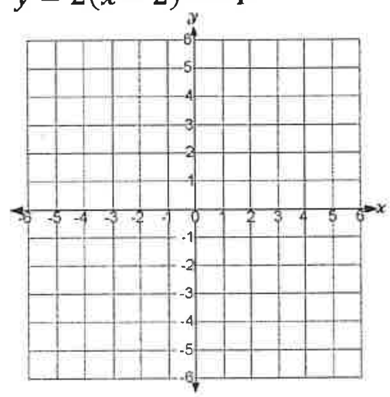
5. $y = -x^2$



Vertex__________________

Domain:________ Range:________

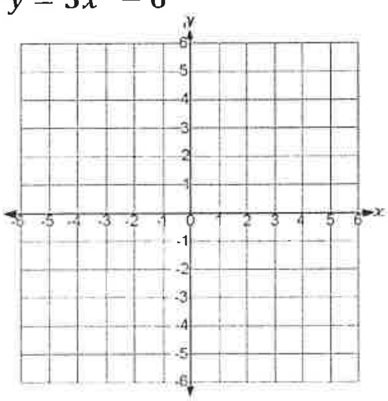
6. $y = 2(x-2)^2 - 4$



Vertex__________________

Domain:________ Range:________

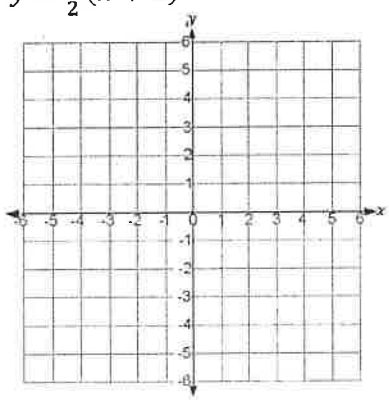
7. $y = 3x^2 - 6$



Vertex__________________

Domain:________ Range:________

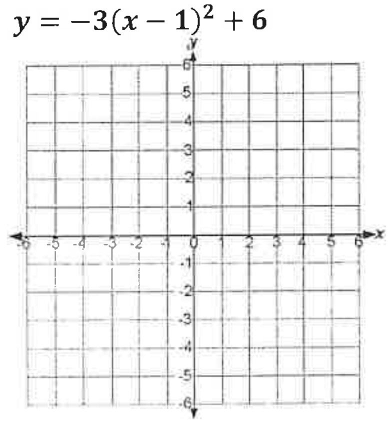
8. $y = \frac{1}{2}(x+2)^2$



Vertex__________________

Domain:________ Range:________

9. $y = -3(x-1)^2 + 6$



Vertex__________________

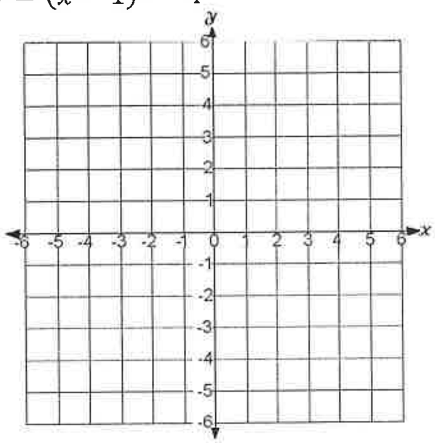
Domain:________ Range:________

Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 4 → X – Intercept Form

Name______________________________
Date________________________ Pd_____

- Review: Graph the following quadratic function and find the following information.

Graph: $y = (x-1)^2 - 4$



1. Vertex:
2. Maximum or Minimum
3. Axis of Symmetry:
4. y – intercept:
5. x – intercepts:
6. Domain:
7. Range:

I. Writing quadratic equations using x – intercept form: $y = a(x - int.)(x - int.)$

A) Let's use the above information to help write the same equation in x – intercept form

✓ Step 1: $y = a(x -$ ______$)(x -$ ______$)$

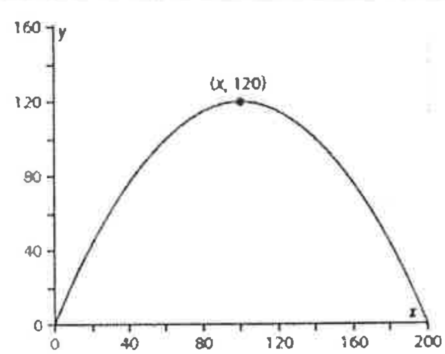
✓ Step 2: Now we need to find a. We can do this by substituting in any other ordered pair that lies on the parabola. (For example try using either the vertex or the y – intercept)

✓ Step 3: Now write the final equation using the a and the intercepts together: $y =$ ________________

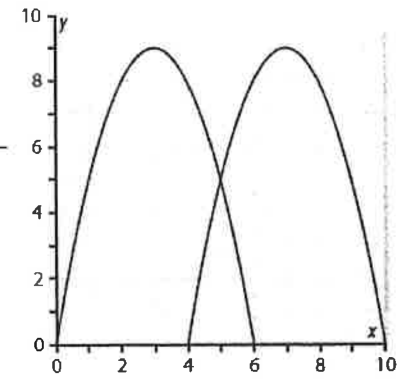
- Think back to MATH 1 and let's prove why $y = (x-1)^2 - 4$ and $y =$ ____________________ are the same equations, just in different forms.

B) Given the following graph, write a quadratic function in $x -$ *intercept form* that describes the graph.

Remember: $y = a(x - int.)(x - int.)$



C) The logo chosen for Magic Moments uses a parabola theme with a large letter M drawn using two intersecting parabolas. The idea of the logo is shown on the graph.



1. What are the x – intercepts of the parabola on the left?

2. What is the vertex of the parabola on the left?

3. Write an equation in x – intercept form that describes the parabola on the left? (Don't forget to find a).

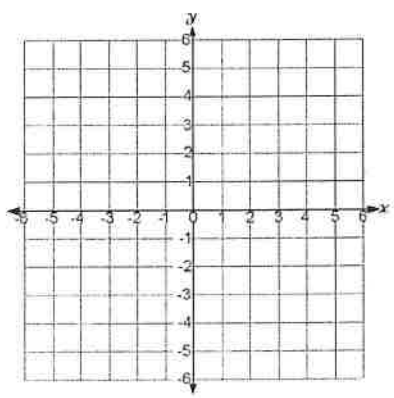
4. What are the x – intercepts of the parabola on the right?

5. What is the vertex of the parabola on the right?

6. Write an equation in x – intercept form that describes the parabola on the right? (Don't forget to find a).

II. Graphing equations using x – intercept form: Use the information you have learned to sketch the following graphs. As you are graphing, make a list of the key points of each graph and write the vertex form of the equation.

1. $y = (x+3)(x-1)$



x – intercepts:________________

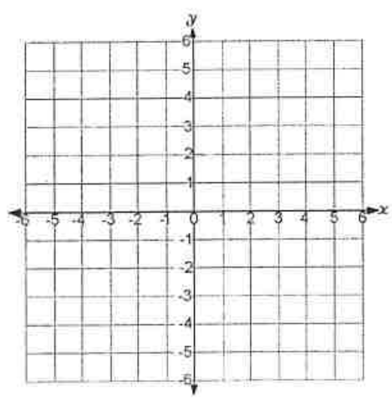
y – intercept:________________

Axis of Symmetry:________________

Vertex________________

Vertex form of the equation:

2. $y = (x-1)(x-3)$



x – intercepts:________________

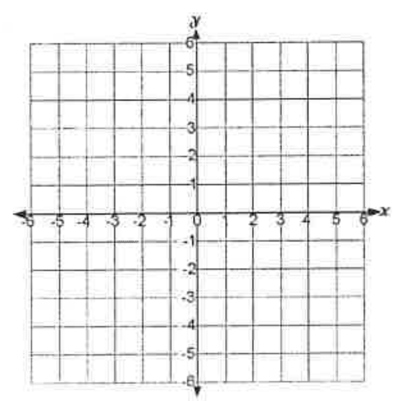
y – intercept:________________

Axis of Symmetry:________________

Vertex________________

Vertex form of the equation:

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



x – intercepts:________________

y – intercept:________________

Axis of Symmetry:________________

Vertex________________

Vertex form of the equation:

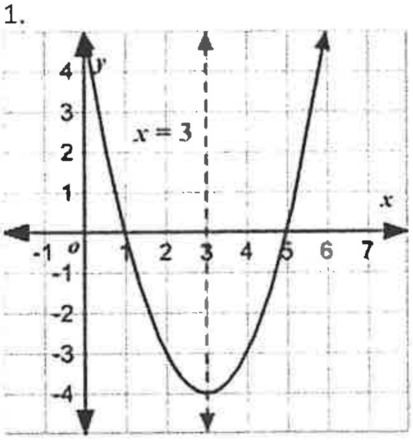
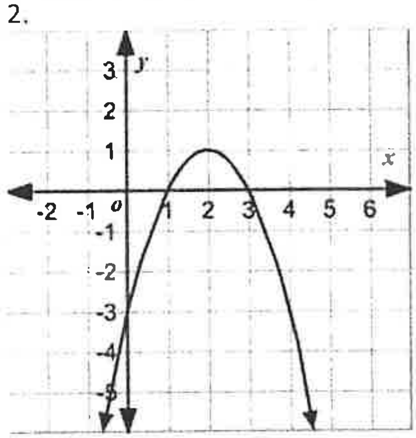
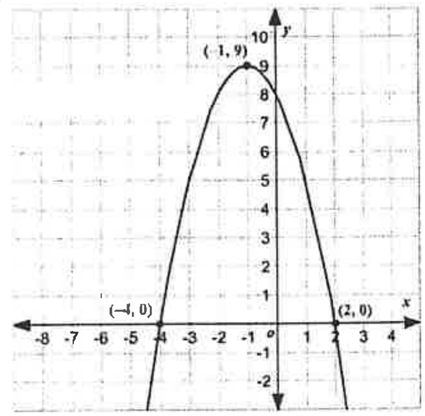
III. Write a quadratic function in x – intercept form whose graphs have the following properties.
If possible, find a. If it is not possible to find a, then describe a as: $a > 0, a < 0, or\ a = All\ Real\ Numbers.$

1. $x - intercepts\ at\ (4, 0)\ and\ (-1, 0)$
2. $x - intercepts\ at\ (7, 0)\ and\ (1, 0)\ and\ the\ graph\ opening\ upward$
3. $x - intercepts\ at\ (7, 0)\ and\ (1, 0)\ and\ \ a\ minimum\ point\ at\ (4, -10)$
4. $x - intercepts\ at\ (-5, 0)\ and\ (0, 0)\ and\ the\ graph\ opening\ downward$
5. $x - intercepts\ at\ (3, 0)\ and\ (-5, 0)\ and\ \ a\ maximum\ point\ at\ (-1, 8)$
6. $x - intercepts\ at\ (3.5, 0)\ and\ (0, 0)\ and\ the\ graph\ opening\ upward$
7. $x - intercepts\ at\ (4.5, 0)\ and\ (1, 0)\ and\ y - intercept\ at\ (0, 9)$
8. $x - intercepts\ at\ (m, 0)\ and\ (n, 0)$
9. $only\ one\ x - intercept\ at\ (0, 0)$
10. $only\ one\ x - intercept\ at\ (2, 0)\ and\ y - intercept\ at\ (0, 6)$

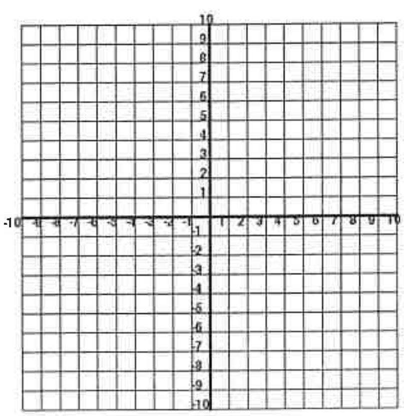
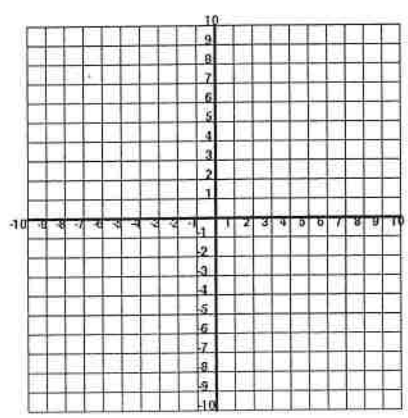
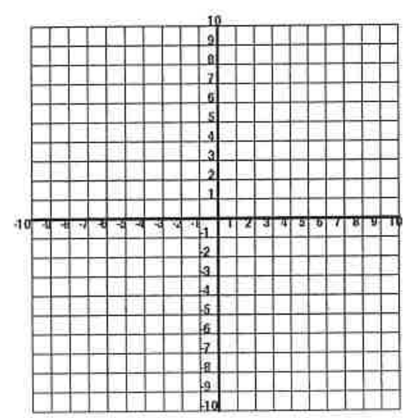
Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 4 → X – Intercept Form – HOMEWORK

Name______________________________
Date________________________ Pd______

I. Given the following graphs, write an equation in x – intercept form that best describes it.

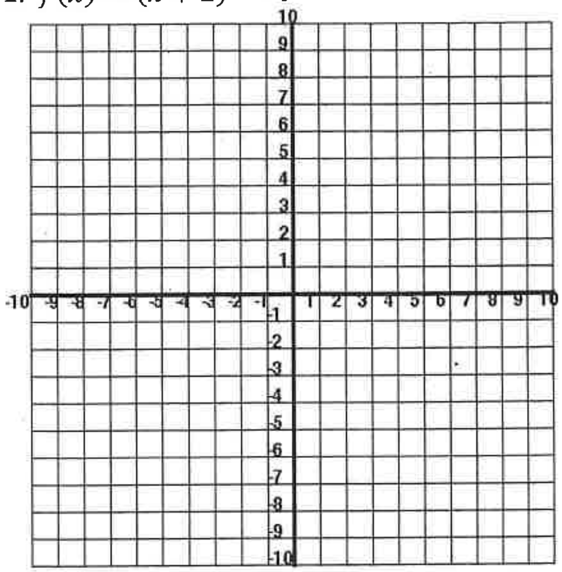
1.	2.	3.
		
x – intercepts:______________	x – intercepts:______________	x – intercepts:______________
a = __________	a = __________	a = __________
Equation: ______________________	Equation: ______________________	Equation: ______________________

II. Make a sketch of the following graphs. Make a list of the key points of each graph.

1. $y = (x-2)(x+2)$	2. $y = -(x)(x+6)$	3. $y = 2(x+1)(x-4)$
		
x – intercepts:______________	x – intercepts:______________	x – intercepts:______________
y – intercept:______________	y – intercept:______________	y – intercept:______________
Axis of Symmetry:__________	Axis of Symmetry:__________	Axis of Symmetry:__________
Vertex__________________	Vertex__________________	Vertex__________________
Vertex form of the equation:	Vertex form of the equation:	Vertex form of the equation:

III. Graph each of the following functions and find the vertex, x – intercepts and y – intercept.

1. $f(x) = (x+2)^2 - 9$



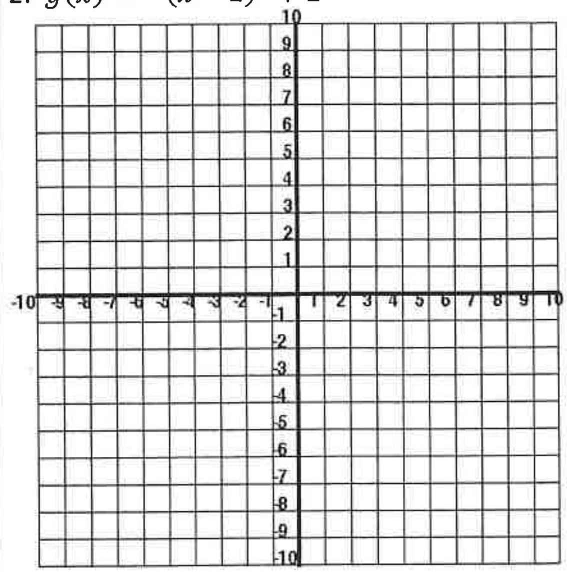
Vertex:__________________

x – intercepts:______________________________

y – intercept:____________________

x-intercept form of equation:

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



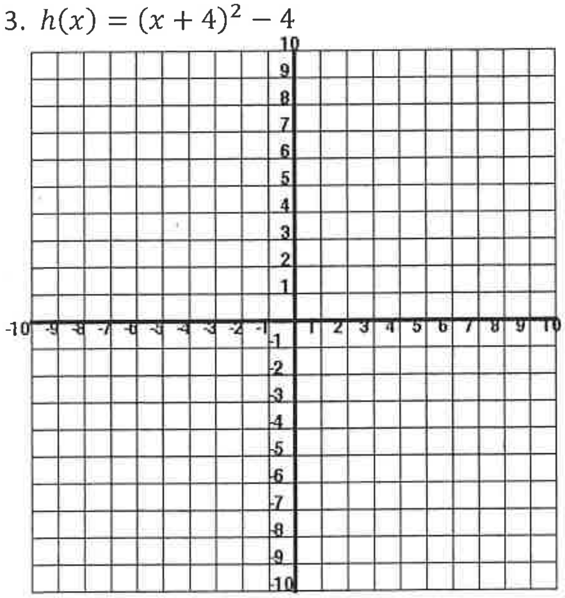
Vertex:__________________

x – intercepts:______________________________

y – intercept:____________________

x-intercept form of equation:

3. $h(x) = (x+4)^2 - 4$



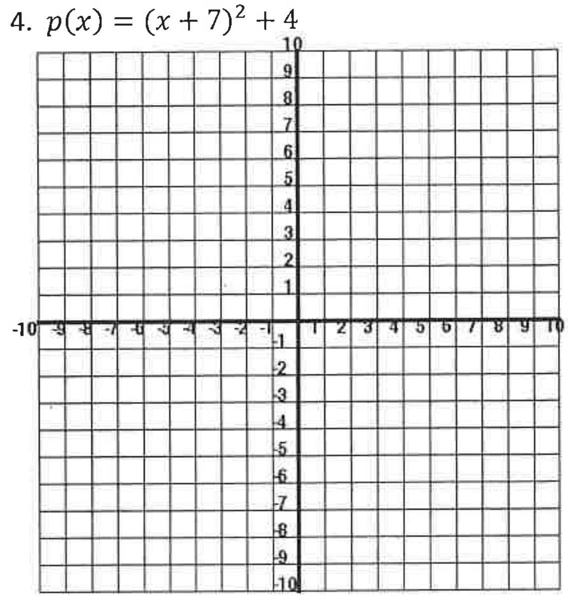
Vertex:__________________

x – intercepts:______________________________

y – intercept:____________________

x-intercept form of equation:

4. $p(x) = (x+7)^2 + 4$



Vertex:__________________

x – intercepts:______________________________

y – intercept:____________________

x-intercept form of equation:

Math 2 – Honors
Rule of Exponents

RULE	EXAMPLE	EXPLANANTION
$a^m \cdot a^n = a^{m+n}$	A) $x^2 \cdot x^6 =$ B) $x^4y^8x^3yz^2 =$	When **multiplying** with **like bases,** keep the base and add the exponents.
$\frac{a^m}{a^n} = a^{m-n}\ OR\ \frac{a^n}{a^m} = \frac{1}{a^{m-n}}$ $m > n$	A) $\frac{x^8}{x^3} =$ B) $\frac{x^2y^5}{x^7y^6} =$	When **dividing** with **like bases,** keep the base and subtract the exponents.
$(a^m)^n = a^{mn}$	A) $(x^5)^3 =$	**Power to a Power** – keep the base and multiply the exponents.
$(ab)^m = a^mb^m$	A) $(x^5y^3)^3 =$ B) $(2x^3z^4)^4 =$	**Power to a Product** – Raise everything in the parentheses to the power.
$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	A) $\left(\frac{x^2}{y^4}\right)^2 =$ B) $\left(\frac{3x^4y^5}{4x^2y^7}\right)^3 =$	**Power to a Quotient** – Raise everything in the parentheses to the power.
$a^{-m} = \frac{1}{a^m}\ OR\ \frac{1}{a^{-m}} = a^m$	A) $\frac{x^2y^{-3}}{z^{-5}x^6} =$ B) $\frac{2x^{-4}}{3y^{-2}} =$	Change a **negative exponent** to a **positive exponent** by moving the base to either the denominator or the numerator of a fraction.
$b^0 = 1$	A) $(2x^4)^0 =$ B) $3x^0y^5 =$	Any base raised to the **zero** power equals **1**.

Never leave a NEGATIVE EXPONENT or a ZERO EXPONENT in an answer in simplest form!!!!!

Math 2 – Honors
Unit 2 – Quadratic Functions
After Quiz #1 **HOMEWORK**

Name______________________________
Date__________________________Pd______

➢ Write each expression in simplest form:

1. $4(x+2)+8$	2. $-2(4g-3)$	3. $-7(2x+1)+18$
4. $6a+2b-3a+c$	5. $-7(2a^2+6)+8a^2$	6. $8(6x+12)-4(2x-3)$
7. $2x(11-3x)-22x^2$	8. $5x^2+6y-7x^2+2y$	9. $8(2y^2-3)+2(5y^2-1)$
10. $7a^2b^3+5a^2b^3-2a^3b^2$	11. $-6x(x+15)$	12. $5-(z-6)$
13. $x^3 \cdot x^5$	14. $(x^3)^7$	15. $(5c^3d)(-2d^4)$
16. $(-5w^4)^3$	17. $x^6 \cdot x^5 \cdot x$	18. $(-7x^2)(5x^8)$
19. $(2+5)^2$	20. $(5-3)^4$	21. $3 \cdot 3^4$
22. $(3xy)^0$	23. $5x^0$	24. $x^2(x^3+x^4)$
25. $\frac{x^7}{x^5}$	26. $\frac{6x^9}{2x^4}$	27. $\frac{5x^2}{x^7}$

Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 5 – Operations with Polynomials

Name____________________
Date________________Pd____

- A **POLYNOMIAL** is a monomial or the sum of two or more monomials.
- A polynomial is in simplest form when there are no parentheses and no like terms.

❖ Operations with Polynomials
- **Addition**: Combine Like Terms
- **Subtraction**: Distribute (-1) and then combine like terms
- **Multiplication**: FOIL or Box Multiplication or Distribute and then combine like terms

EXAMPLES:

1. $(4x^3 + 2x^2 + 5x + 8) + (3x^3 - 4x^2 - 9x + 2)$	2. $(7p^2 - 4p) + (3p^2 + 2p - 5)$
3. $(4x^3 + 2x^2 + 5x + 8) - (3x^3 - 4x^2 - 9x + 2)$	4. $(7p^2 - 4p) - (3p^2 + 2p - 5)$
5. $(x - 2)(x + 3)$	6. $(2x - 5)(3x + 1)$
7. $(4x - 1)^2$	8. $(3x - 1)(2x^2 + 5x - 2)$

Classwork:

1. $f(x) = 3p^2 - 2p + 3$ and $g(x) = p^2 - 7p + 7$

Sum: ____________________ Difference: ____________________

2. $f(x) = 3x^3 + 5x - 7$ and $g(x) = 4x^3 - 2x^2 + 4x - 3$

Sum: ____________________ Difference: ____________________

3. $f(x) = 2x - 5$ and $g(x) = 4x + 1$

Product: ____________________

4. $f(x) = (3x + 4)^2$ and $g(x) = 2x$

Product: ____________________

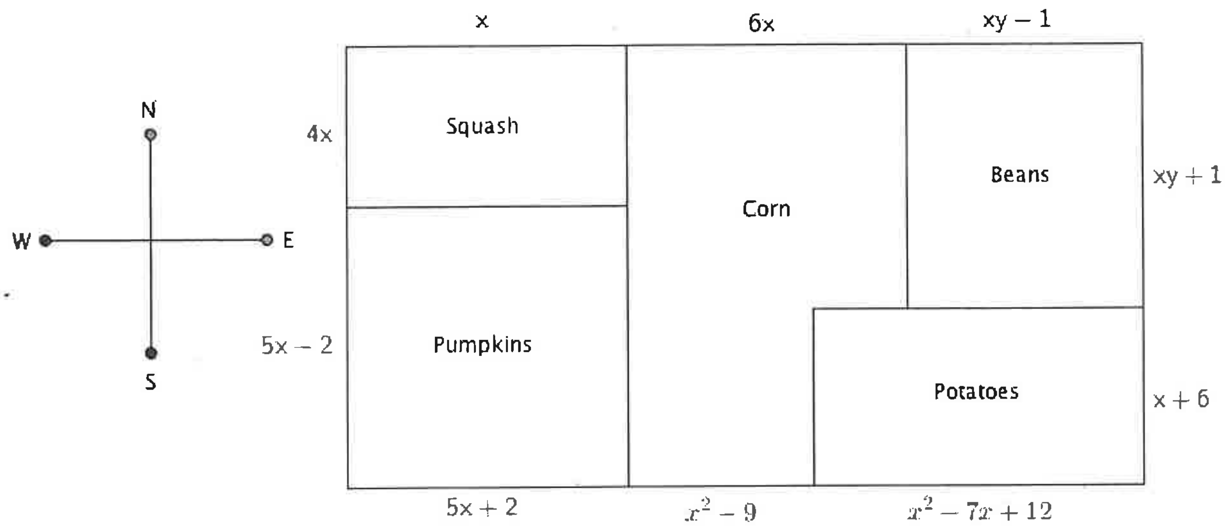
5. $f(x) = 2x - 3$ and $g(x) = 2x^2 + 3x - 5$

Sum: ____________________ Difference: ____________________

Product: ____________________

➢ **Applications of Polynomials:**

1. Farmer Bob is planting a garden this spring. He wants to plant squash, pumpkins, corn, beans, and potatoes. His plan for the field layout in feet is shown in the figure below. Use the figure and your knowledge of polynomials, perimeter, and area to solve the following:



a. Write a polynomial expression in simplest form that represents the length of the south side of the field.

b. Write a polynomial expression in simplest form that represents the perimeter of the pumpkin field.

c. Write a polynomial expression in simplest form that represents the area of the potato field.

d. Write a polynomial expression in simplest form that represents the area of the bean field.

e. Write a polynomial expression in simplest form that represents the perimeter of the entire garden.

2. If the base of a triangle has a length of $8x$ units, and the height is $x + 6$ units, write a simplified algebraic expression for the ***area*** of the triangle in terms of x.

3. A square has a side length of k. If the length of the square is increased by 6 $units$, and the width of the square is increased by 4 $units$ to create a new, larger rectangle, write a simplified algebraic expression for the ***area*** of the new rectangle in terms of k.

Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 5 – Polynomials HOMEWORK

Name____________________________
Date________________________Pd____

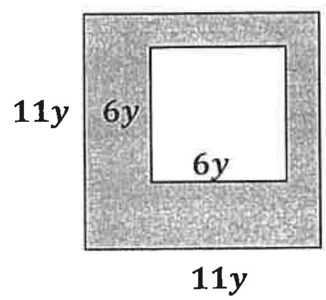
Perform the indicated operation:

1. $(3x-4)+(-2x+1)$	2. $(7y^3-6y^2+3y-9)+(-8y^3+y^2+4)$
3. $(x^3+5x^2-7x+3)+(4x^3-2x^2+3x-11)$	4. $(-6p^3+9pq^2-7q^3)+(-5p^3-13p^2q+12q^3)$
5. $(p^2-7p+5)-(10p^2-7p+8)$	6. $(7y^3-6y^2+3y-9)-(-8y^3+y^2+4)$
7. $(2q^2-q-15)-(q^2+3q-11)$	8. $(x^3-3x^2)+(3x^3-5x-12)-(-x^3-8x^2+4x-9)$
9. $[-3x^2-(7x-4d)]-[x^2-(5x+10d)]$	10. $2[-3x-7(4-x)]-8[x-(2x-5)]$
11. $(2x-1)(5x+3)$	12. $(3x+1)(3x-1)$
13. $(5-x)(5+x)$	14. $(4-7x^3)^2$
15. $(3x-7)^2$	16. $(3c+5d)(2c-7d)$
17. $(2x-3)(2x^2+3x-5)$	18. $(x-4)(x^2+4x+16)$

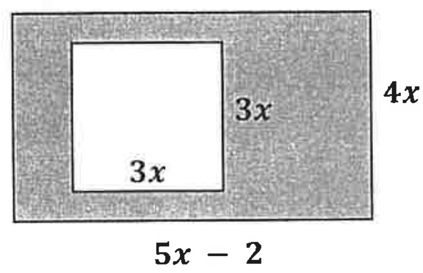
19) The measure of the perimeter of a triangle is $37s + 42$. It is known that two of the sides of the triangle have measures of $14s + 16$ and $10s + 20$. Find the length of the third side.

20) Find the area of the shaded region: $(BIG\ SHAPE) - (LITTLE\ SHAPE\ \text{“}HOLE\text{”}) = SHADED\ REGION$

A)

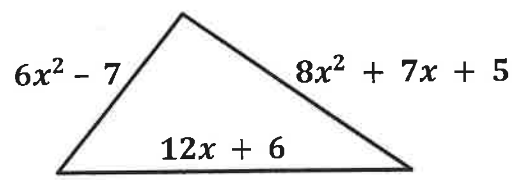


B)



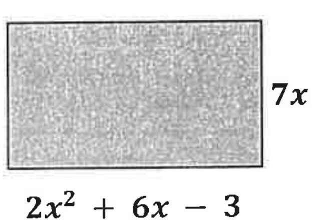
21) For a rectangle with length of $3x + 4$ and width of $10x + 18$, what is the area of the rectangle?

22) Find the perimeter:



23) Michelle borrowed $3r^3 + 5r^2 + 18r + 20$ dollars from her brother. If she paid back $3r^3 + 2r^2 - 2r + 11$ dollars, then how much more money does she still owe her brother?

24) Find the area:



25) What polynomial must be added to $5x^4 - 3x^3 + 7x^2 - x + 1$ to obtain the polynomial $x - 4$?

Math 2 – Honors
Unit 2 – Quadratic Functions
Lesson 6 – Factoring

Date: ________

Factoring

Finding a Greatest Common Factor (GCF)

2 TERMS

3 TERMS

4 TERMS

1. If a polynomial can not be factored, it is ________________.
2. Always check for a ________________ first!!!
3. Count the number of terms to see which method to try.
4. Always check to see if your polynomial can be factored further.
5. You can always check your factors by multiplying the factors back together.

I. Greatest Common Factor (GCF) → if possible, always do this FIRST.

A. $24a^2b - 18ab^2$	B. $5x^2y - 20xy^2z + 35y^3z^2$	C. $2x^3yz^3 - 7xy^5z^2$

II. Factoring 4 term polynomials → Group by 2's

A. $4x - 20 + 3xy - 15y$	B. $15ab^2 - 3a + 10b^2 - 2$
C. $3a^2 - ab - 12a + 4b$	D. $16x^3 - 128x^2 + 2x - 16$

II. Difference of Two Squares Factoring → $a^2 - b^2 = (a - b)(a + b)$ *** Always check for a GCF first!!!!

A. $x^2 - 9$	B. $x^2 - 49$	C. $x^2 - 36y^2$
D. $16x^2 - 1$	E. $x^2 + 25$	F. $-1 + x^2$
G. $24x^5 - 54xy^6$	H. $4x^2 - 64$	I. $x^4 - 16$

III. Factoring Trinomials → $\boxed{x^2 + bx + c}$ "SHORTCUT" *** Always check for a GCF first!!!

A. $x^2 + 9x + 20$	B. $x^2 - 7x + 10$	C. $x^2 + 3x - 40$
D. $x^2 - 3x - 10$	E. $2x^2 - 8x - 90$	F. $x^4 - 7x^2 + 12$

IV. Factoring Trinomials → $\boxed{\boxed{a}x^2 + bx + c}$ *** Always check for a GCF first!!!!

A. $2x^2 + 7x + 6$	B. $2x^2 - 9x + 4$	C. $3x^2 + 5x + 2$
D. $6x^2 - 4x - 42$	E. $6x^2 + 11xy + 4y^2$	F. $5x^4 - 17x^2 + 14$

V. Solving Quadratic Equations by Factoring → Equation must be equal to 0 and factored completely

A. $(x-4)(3x-1)=0$ $x =$ ______	B. $x^2-5x-6=0$ $x =$ ______	C. $3x^2-5x+2=0$ $x =$ ______
D. $x^2-3x=0$ $x =$ ______	E. $x^2=36$ $x =$ ______	F. $x^3-3x^2=10x$ $x =$ ______

Math 2 – Honors
Unit 2 – Quadratic Function
Lesson 6 – Factoring HOMEWORK #1

Name_______________________________
Date: _________________ Pd: ______

FACTOR COMPLETELY:

1. $15x^2y - 10xy^2$	**2.** $2x^3y - x^2y + 5xy^2$	**3.** $7k^2 + 9k$
4. $2p^3 + 5p^2 + 6p + 15$	**5.** $m^3 - m^2 + 2m - 2$	**6.** $12xy - 28x - 15y + 35$
7. $16r^2 - 169$	**8.** $x^2 - 49$	**9.** $2y^2 - 242$
10. $x^2 + 64$	**11.** $x^4 - 81$	**12.** $25 - 4x^2$
13. $4x^6 - 4x^2$	**14.** $45x^2 - 80y^2$	**15.** $16 - 81x^2$
16. $x^2 - 9x + 8$	**17.** $x^2 - 3x - 10$	**18.** $x^2 + 5x - 14$
19. $x^2 - 7x - 18$	**20.** $y^2 + 20y + 96$	**21.** $x^2 - 8x + 16$
22. $x^2 + 16x + 63$	**23.** $2x^3 + 32x^2 + 128x$	**24.** $k^3 - 2k^2r - 3kr^2$

Math 2 – Honors
Unit 2 – Quadratic Function
Lesson 6 – Factoring HOMEWORK #2

Name________________________________
Date: __________________ Pd: ______

Factor completely:

1. $3x^2 + 8x + 4$	**2.** $4x^2 + 4x - 15$
3. $8x^2 + 65x + 8$	**4.** $15x^2 - 19x + 6$
5. $7x^2 - 31x - 20$	**6.** $5x^2 - x - 18$
7. $3x^3 - 5x^2 + 2x$	**8.** $9x^2 - 5x - 10$

Solve each equation by factoring:

9. $x^2 - 5x = 0$ $x =$ ____________	**10.** $x^2 + x - 30 = 0$ $x =$ ____________
11. $3x^2 - 5x = 0$ $x =$ ____________	**12.** $4x^2 - 25 = 0$ $x =$ ____________
13. $4x^2 - 13x - 12 = 0$ $x =$ ____________	**14.** $4x^2 - 17x = -4$ $x =$ ____________
15. $6x^2 + 7x = 3$ $x =$ ____________	**16.** $18x^2 - 34x + 16 = 0$ $x =$ ____________

Math 2 – Honors Name________________________________

Unit 2 – Quadratic Function Date: __________________ Pd: ______

Lesson 6 – More Practice with Factoring

Part I – GCF

1. $2z^2 + 16 =$	6. $6c^4 - 9c =$
2. $8g^2 + 20g =$	7. $-9a^6 - 27a^5 - 12a^3 =$
3. $8r^3 - 36r - 4 =$	8. $18c^2 + 4c =$
4. $28s^2 + 20s =$	9. $-8y^6 + 4y^4 + 8 =$
5. $16x^3 + 4x^2 + 36x =$	10. $35v^6 - 15v^3 - 15v^2 =$

Part II – Difference of Two Squares

11. $x^2 - 16 =$	16. $x^4 - 1$
12. $36u^6 - 81w^2 =$	17. $100k^4 - 49 =$
13. $h^2 + 36 =$	18. $p^8 - 25 =$
14. $64 - 25j^{10} =$	19. $4 - 36v^{12} =$
15. $9s^2 - 16t^2 =$	20. $144 + y^4 =$

Part III – Trinomial Squares

21. $x^2 + 8x + 16 =$	26. $x^2 - 4xy + 4y^2 =$
22. $x^2 - 14x + 49 =$	27. $2x^2 - 40x + 200 =$
23. $9x^2 + 18xy + 9y^2 =$	28. $12x^2 + 36xy + 27y^2 =$
24. $16x^2 - 56xy + 49y^2 =$	29. $a^4 + 14a^2 + 49 =$
25. $x^2 - 6x + 9 =$	30. $4x^4 + 4x^2 + 1 =$

Part IV – Trinomials in the form $x^2 + bx + c$

31. $x^2 - 6x - 7 =$	36. $x^2 + 5x + 6 =$
32. $s^2 + 12s + 35 =$	37. $w^2 - 6w - 5 =$
33. $p^2 - 9p + 20 =$	38. $k^2 + 3k - 4 =$
34. $b^2 + 5b - 36 =$	39. $h^2 - 9h - 36 =$
35. $p^2 - 8p - 9 =$	40. $w^2 + 2w - 15 =$

Part V – Trinomials in the form $ax^2 + bx + c$

41. $2x^2 + 9x - 5 =$	46. $2a^3 - 38a^2 + 176a =$
42. $16m^2 - 48m + 11 =$	47. $2q^5 - 12q^4 - 80q^3 =$
43. $3x^2 - 5x - 2 =$	48. $3d^2 + 18d + 15 =$
44. $20c^2 - 63c + 49 =$	49. $2x^2 - x - 15 =$
45. $4u^2 + 37u + 63 =$	50. $3a^2 - 4a + 1 =$

Part VI – Grouping

51. $4x^5 + 6x^3 + 6x^2 + 9 =$	56. $7y^2 - 14y + by - 2b =$
52. $c^6 - c^4 - c^2 + 1 =$	57. $12xy + 3yz - 4x - z =$
53. $4y^5 + 6y^4 + 6y^3 + 9y^2 =$	58. $20a + 12 - 25ax - 15x =$
54. $x^{13} + x^7 + 2x^6 + 2 =$	59. $4mna + 4mnb + 5na + 5nb =$
55. $20g^3 - 4g^2 - 25g + 5 =$	60. $t^2 - 9t + 3t - 27 =$

Part VII– Mixed Factoring

61. $d^2 + d - 132 =$	66. $3n^2 - 43n + 84 =$
62. $p^2 - 100 =$	67. $f^2 + 121 =$
63. $3v^4 + 9v^3 - 12v^2 =$	68. $4x^4 + 4x^2 + 1 =$
64. $3h^2 + 44h + 121 =$	69. $18c^3 - 21c^2 - 30c + 35 =$
65. $9x^{10} + 12x^5 + 4 =$	70. $z^2 - 6z - 72 =$

Math 2 – Honors
Unit 2 – Quadratic Functions
Unit 2 Test Review

Name______________________________
Date________________________Pd____

➢ Perform the indicated operation:

1. $3(-5x^2+2x+1)+(16x^2+5x)+4(6-x)$	2. $(3x^2-5x+1)-(2x^2+6x-4)-(-6x^2-2)$
3. $3x^4(4x^4-x^3+2x)$	4. $(2x-5)(x+3)$
5. $(4x-3y)^2$	6. $(x+9)(x-9)$
7. $(2x+3)(4x^2-6x+9)$	8. $(3x-5)(2x+1)(x-3)$

➢ Factor Completely:

9. $36x^4-24x^3$	10. $2x^3+5x^2-18x-45$
11. $25x^2-49$	12. $x^2-4x-12$
13. $2x^2y-4xy-30y$	14. $3x^2-13x-10$
15. $25x^2+64$	16. $3x^4-3$

➢ Solve by Factoring:

17. $(3x+7)(2x-5)=0$	18. $2x^2-5x=12$
19. $x^2+2x-8=0$	20. $2x+35=x^2$
21. $4x^3-25x=0$	22. $4x^2-x=0$

➢ Write the equation of the parabola in $x-\boldsymbol{intercept\ form}$:

23. $x-intercepts$: $(-3,0)$ & $(-1,0)$ $and\ vertex$ $(-2,-1)$	24. $x-intercepts$: $(3,0)$ & $(2,0)$ $and\ a\ point$ $(5,-18)$

➢ Write the equations from #23-24 in $\boldsymbol{vertex\ form}$:

25.	26.

➢ Complete the missing information:

27. $y = (x + 4)^2 - 4$

Vertex____________________

Axis of Symmetry:____________

x – intercepts:____________

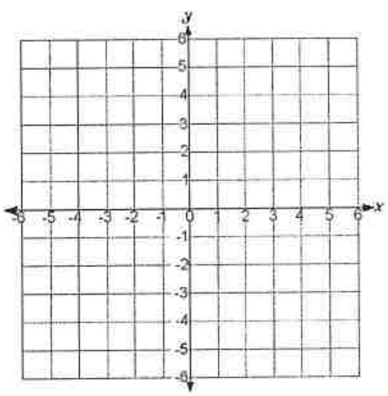
y – intercept:____________

Domain: ____________

Range: ____________

X − intercept form of the equation:

$y =$ ____________________



28. $y = -2(x + 3)(x + 1)$

Vertex____________________

Axis of Symmetry:____________

x – intercepts:____________

y – intercept:____________

Domain: ____________

Range: ____________

Vertex form of the equation:

$y =$ ____________________