Foundations 11 - Week 5: May 11 – May 15

Anticipated time required: 3 hours

New learning objective: **Applications of vertex form and quadratics summary assignment**

Goals to be completed:

1. Identify practical uses of vertex form, and be able to identify the information it provides

2. Summarize your knowledge of quadratics

This PDF package contains several notes, examples and practice problems. The only formal portion that you are required to submit is the section at the end of this package. This can be sent to Charlie.feht@yesnet.yk.ca either as a scanned and uploaded PDF attachment to email, or as a jpeg image file. Midterm assignments will be scored and sent back to you as I receive them.

Upcoming next week:

Linear inequalities

Lesson 3.1: Investigating Quadratic Functions in Vertex Form

Specific Outcome: Analyze quadratic functions of the form and determine the vertex, domain and range, direction of opening, axis of symmetry x- and y- intercepts. (Achievement Indicators ~ 3.1- 3.9)

PART A: Comparing the graphs of $f(x) = x^2$ and $f(x) = ax^2$:

Graph the following functions on the same set of coordinate axis.

We have previously seen how "a" values influence parabolas

$f(x) = x^2$

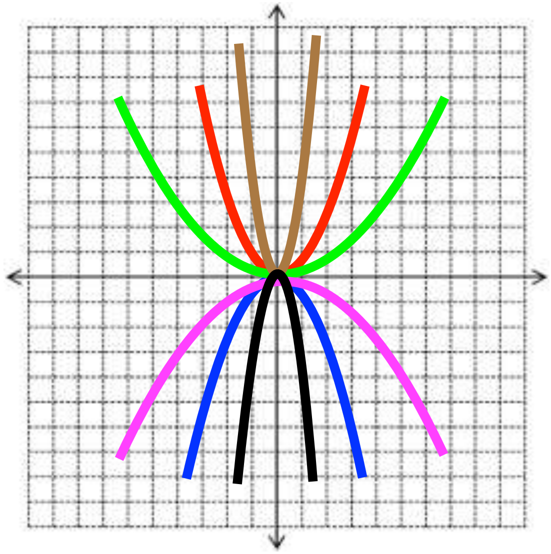
$f(x) = -x^2$

$f(x) = 2x^2$

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

$f(x) = \frac{1}{2}x^2$

$f(x) = -\frac{1}{2}x^2$



Develop a rule that describes how the value of a in $f(x) = ax^2$ changes the graph of $f(x) = x^2$ when a is:

- $a > 0$ **When a is greater than zero, parabolas open up**
- $a < 0$ **When a is less than than zero, parabolas open down**
- $-1 < a < 1$ **When a is a fraction, parabolas get wider**
- $a > 1$ or $a < -1$ **When a is an interger greater than 1, parabolas get skinnier**

Note: The parameter a gives the direction of the opening and the vertical stretch factor. When looking directly at an ordered pair, the value of a will only effect the y-values of the ordered pair.

PART B: Comparing the graphs of $f(x) = x^2$ and $f(x) = x^2 + q$:

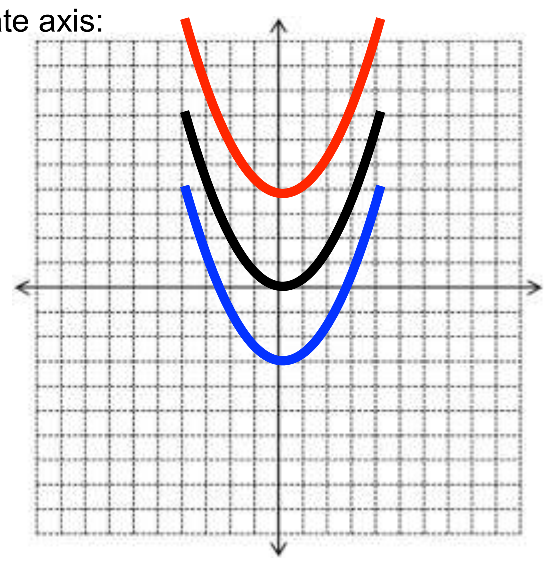
Graph the following functions on the same set of coordinate axis:

$f(x) = x^2$

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

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

In this scenario, the q variable controls when the function moves up or down



Develop a rule that describes how the value of q in $f(x) = x^2 + q$ changes the graph of $f(x) = x^2$ when q is:

- $q > 0$ **The parabola and vertex moves up**
- $q < 0$ **The parabola and vertex moves down**

Note: The parameter q gives the vertical translation.
When looking directly at an ordered pair, the value of q will only effect the y-values of the ordered pair.

PART C: Comparing the graphs of $f(x) = x^2$ and $f(x) = (x - p)^2$:

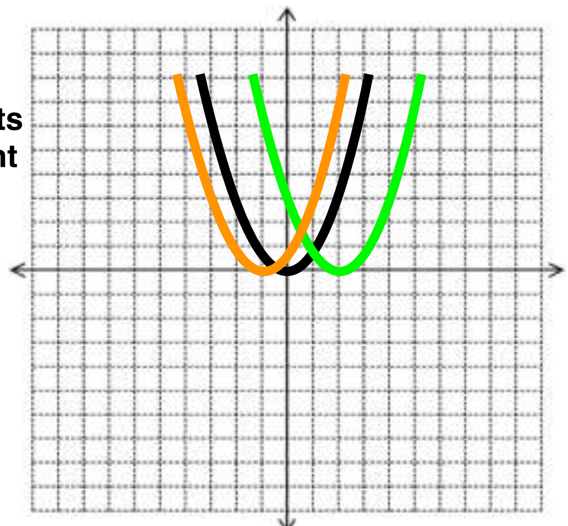
Graph the following functions on the same set of coordinate axis:

$f(x) = x^2$

A coefficient inside the brackets moves the parabola left or right

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

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



Develop a rule that describes how the value of p in $f(x) = (x - p)^2$ changes the graph of $f(x) = x^2$ when p is:

- $p > 0$ **When p is greater than zero, the parabola moves left**
- $p < 0$ **When p is less than zero, the parabola moves right**

Note: The parameter p gives the horizontal translation.
When looking directly at an ordered pair, the value of p will only effect the x-values of the ordered pair.

For the quadratic function in vertex form, $f(x) = a(x - p)^2 + q$, $a \neq 0$, the graph

- Has the shape of a parabola
- Has a vertex at (p, q)
- Has an axis of symmetry with equation $x = p$
- Is congruent to $f(x) = ax^2$ translated horizontally by p units and vertically by q units.
- Domain: $\{x | x \in R\}$, Range: If the graph opens up → $\{y | y \geq q, y \in R\}$
  If the graph opens down → $\{y | y \leq q, y \in R\}$

The parameter a gives the direction of opening and the vertical stretch factor.

- If a is positive, the graph opens upward and has a minimum y-value.
- If a is negative, the graph opens downward and has a maximum y-value.
- If $-1 < a < 1$, the parabola is compressed vertically.
- If $a > 1$ or $a < -1$, the parabola is stretched vertically.

Important to note: the vertex equation y = (x – p) + q has a negative in front of the p variable. That means that if you insert a positive integer, the value appears negative and the graph moves to the right (because you inserted a positive integer). If the integer is negative, then the p appears positive and the graph moves to the left because you inserted a negative integer).

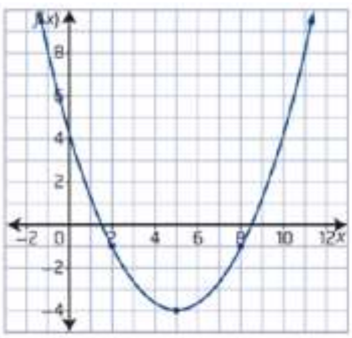
For example: When I insert -2 for the p variable y = (x – [-2]) + q, the function appears positive (because of a double negative) y = (x + 2) + q, but the x value of the vertex is still -2, NOT POSITIVE 2.
When I insert +2 for the p variable y = (x - [+2]) + q, the function appears negative (because of opposite signs) y = (x - 2) + q, but the x value of the vertex is still +2, NOT NEGATIVE 2.

Example 1: Complete the table below.

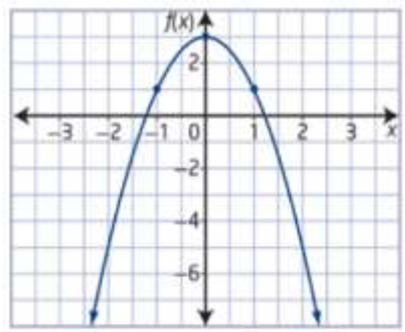
Equation	Vertex	Transformations	Axis of Symmetry	Domain and Range
$y = (x - 3)^2 + 2$	(3, 2)	parabola slid right 3, up 2	x = 3	x = all real #s, y is greater than 2
$y = -2(x + 5)^2$	(-5, 0)	moved 5 units left		
$y = -2x^2 - 1$				
$y = 3x^2$				

Example 2: Determine a quadratic function in vertex form for each graph:

a)



b)



Example 3: The graph of $y = x^2$ is reflected in the x-axis, has a horizontal translation of 2 units left, and a vertical translation of 5 units up. The equation of the transformed graph is

a) $y = -(x-2)^2 + 5$

b) $y = -(x+2)^2 + 5$

c) $y = -(x-5)^2 + 2$

d) $y = -(x+5)^2 + 2$

Example 4: When $y = 3(x+1)^2$ n of $y = ax^2 + bx + c$, the value of $a + b + c$ is _______________.

FOM 11

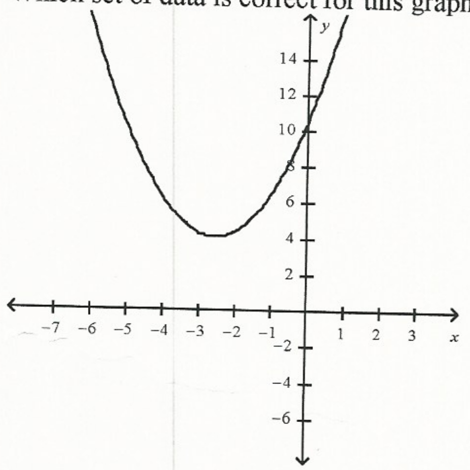
Summary Assignment

Ch.7 Quadratic Functions and Equations

Name: ____________
Date: ____________
Block: ______

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. Which set of data is correct for this graph?



	Axis of Symmetry	Vertex	Domain	Range
A.	$x = 4.25$	$(4.25, -2.5)$	$-8 \le x \le 4.25$	$2.5 \le y$
B.	$x = 2.5$	$(2.5, 4)$	$x \in R$	$y \in R$
C.	$x = 4$	$(4, 2.5)$	$-6 \le x \le 2$	$0 \le y$
D.	$x = -2.5$	$(-2.5, 4)$	$x \in R$	$4 \le y$

a. Set D.
b. Set A.
c. Set B.
d. Set C.

____ 2. What are the x- and y-intercepts for the function $f(x) = x^2 + 5x + 6$?

a. $x = -4, x = -2, y = 6$
b. no x-intercepts, $y = 6$
c. $x = -2.5, y = 6$
d. $x = -3, x = -2, y = 6$

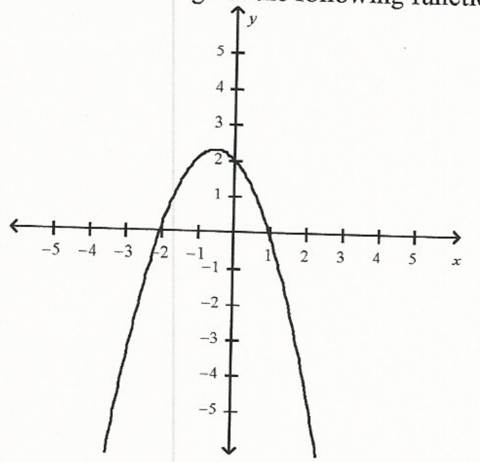
____ 3. The points $(-2, 4)$ and $(1, 4)$ are located on the same parabola. What is the equation for the axis of symmetry for this parabola?

a. $x = -0.5$
b. $x = -1$
c. $x = 0.5$
d. $x = -1.5$

____ 4. Solve $2x^2 - 12x - 14 = 0$ by graphing the corresponding function and determining the zeros.

a. $x = 1, x = -7$
b. $x = 14, x = -2$
c. $x = 2, x = -14$
d. $x = 7, x = -1$

____ 5. What is the Range of the following function?



a. $-2 \le y \le 1$
b. $[-2, 1]$
c. $(-\infty, 2.25]$
d. $y \ge 2.25$

____ 6. Which set of data is correct for the quadratic relation $f(x) = -3x^2 + 3x + 18$?

	x-intercepts	*y*-intercept	Axis of Symmetry	Vertex
A.	(2, 0), (3, 0)	$y = -18$	$x = 2.5$	(2.5, 6.75)
B.	(–2, 0), (3, 0)	$y = -18$	$x = -0.5$	(–0.5, 15.75)
C.	(2, 0), (–3, 0)	$y = 18$	$x = -0.5$	(–0.5, 15.75)
D.	(–2, 0), (3, 0)	$y = 18$	$x = 0.5$	(0.5, 18.75)

a. Set A.
b. Set B.
c. Set C.
d. Set D.

____ 7. Which relation is the factored form of $f(x) = x^2 + 2x - 8$?

a. $f(x) = (x - 2)(x + 4)$
b. $f(x) = (x + 2)(x - 4)$
c. $f(x) = (x - 1)(x + 8)$
d. $f(x) = 2(x + 2)(x - 2)$

____ 8. Solve $6x^2 + 13x - 5 = 0$ by graphing. (Find the zeroes)

a. $x = -2, x = 3$
b. $x = 2, x = -3$
c. $x = \frac{5}{2}, x = -\frac{1}{4}$
d. $x = -\frac{5}{2}, x = \frac{1}{3}$

____ 9. Solve $4x^2 + 15x = -9$ using the quadratic formula.

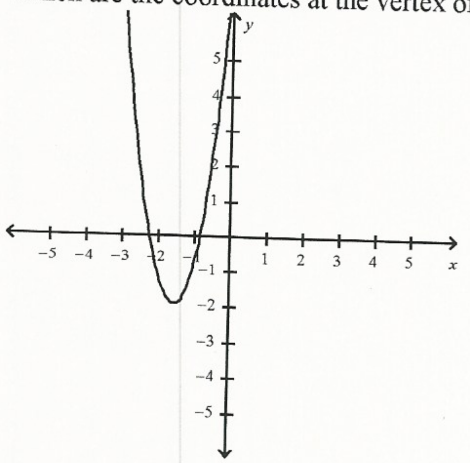
a. $x = -\frac{3}{4}, x = 3$
b. $x = -\frac{3}{4}, x = -3$
c. $x = -4, x = 3$
d. $x = 4, x = 3$

____ 10. Which set of data is correct for the quadratic relation $f(x) = 5(x - 27)^2 - 9$?

	Direction parabola opens	Vertex	Axis of Symmetry
A.	upward	(27, –9)	$x = 27$
B.	downward	(–27, 9)	$x = -27$
C.	upward	(–27, –9)	$x = -9$
D.	downward	(27, 9)	$x = 9$

a. Set C.
b. Set D.
c. Set B.
d. Set A.

____ 11. Which are the coordinates at the vertex of this parabola?



a. (1.5 , –2)
b. (–1.5 , 2)
c. (–1.5 , –2)
d. (1.5 , 2)