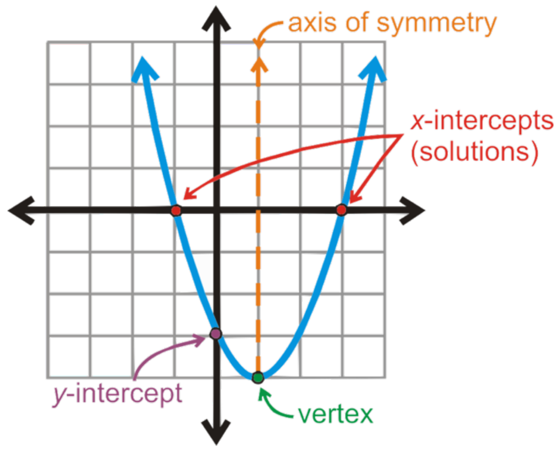
Chapter 3: Quadratic Functions

§ 3.1: Properties of Quadratic Functions

Parts of a Parabola



The graphs of quadratic functions have no ____________ restrictions. Quadratic functions can be

represented by ________________________, by ________________________, or by __________.

Quadratic Functions can be expressed in three different algebraic Forms:

Factored Form	Vertex Form	Standard Form

How can we determine whether a function is quadratic? ______________________________

Example 1: Linear or Quadratic?

a)

x	y	FD	SD
-2	15		
-1	11		
0	7		
1	3		
2	-1		

b)

x	y	FD	SD
-2	7		
-1	4		
0	3		
1	4		
2	7		

In Class Assignment: p. 145 #1bc, 2, 3; Homework: p. 146 #4, 5, 7, 8

§ 3.2: Determining Maximum and Minimum Values of Quadratic Functions

The maximum or minimum value of a quadratic function is the ________________ of the vertex.

If a $>$ 0 in standard form, factored form, or vertex form, then the parabola opens _________.

The quadratic has a __________________ value.

If a $<$ 0 in standard form, factored form, or vertex form, then the parabola opens _________.

The quadratic has a __________________ value.

The vertex can be found from the standard form $f(x) = ax^2 + bx + c$ algebraically:

- by ________________ __________ _____________ to put the quadratic in vertex form
- by expressing the quadratic in ____________ __________, if possible, and averaging the zeros at r and s to locate the ____________ ________ _______________
- by _____________ ____________ the common factor from $ax^2 + bx$ to determine two points on the parabola that are symmetrically opposite each other, and averaging the x-coordinates to determine the x-coordinate of the vertex.
- by using a graphing calculator.

Completing the Square:

$h(t) = 5t^2 + 40t + 100$

In Class Assignment: p. 153 #1, 2, 3; Homework: p. 153 #4, 5, 7, 9

§ 3.3: Inverse of a Quadratic Function

The inverse of a quadratic function undoes what the original function has done. It is a

_______________ relation that opens either to the ______ or to the _______.

If the original quadratic opens up ($a > 0$), the inverse opens to the _______.

If the original quadratic opens down ($a < 0$), the inverse opens to the _______.

The equation of the inverse of a quadratic function can be found by ________________ x and y

in the vertex form and solving for y.

In the equation of the inverse of a quadratic function, the _____________ square root function

represents the __________ ____________ of the parabola, while the __________ square root

represents the __________ ____________.

The inverse of a quadratic function can be a function if the __________ of the original function is

_____________.

<u>Example: Determine the equation of the inverse</u>

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

In Class Assignment: p. 160 #1, 2, 3 ; Homework: p. 161 #4, 5, 6, 7

§ 3.4: Operations With Radicals

Entire radicals can sometimes be simplified by expressing them as the ______________ of two radicals, one of which contains a ______________ ______________. This results in a mixed radical.

- $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$ for $a \geq 0, b \geq 0$
- $c\sqrt{a} \times d\sqrt{b} = cd\sqrt{ab}$ for $a \geq 0, b \geq 0$

The only radicals that can be added or subtracted into a single term are _________ radicals.

An answer containing a radical is an __________ answer. An answer containing a decimal is an ___________________ answer. A ____________ radical is in simplest form when the smallest possible number is written under the radical sign.

<u>**Example 1: Simplifying radicals involving perfect-square factors**</u>

a) $\sqrt{72}$

b) $5\sqrt{27}$

<u>**Example 2: Changing mixed radicals to entire radicals**</u>

a) $4\sqrt{3}$

b) $-6\sqrt{5}$

<u>**Example 3: Multiplying Radicals**</u>

a) $\sqrt{3}\sqrt{11}$

b) $-2\sqrt{6} \times 5\sqrt{6}$

c) $(3 - \sqrt{3})(3 + \sqrt{6})$

In Class Assignment: p. 167 #1, 2, 3; Homework: p. 168 #4, 5, 6, 7, 13, 15

§ 3.5: Exploring Graphs of Rational Functions

All quadratic equations can be expressed in the form $ax^2 + bx + c = 0$ by algebraic techniques.

Quadratic equations can be solved by _______________ the corresponding functions

$f(x) = ax^2 + bx + c$ and locating the _____________, or ________, either by hand or by

technology. These zeros are the ____________ or ____________ of the equation $ax^2 + bx + c = 0$.

Quadratic equations can also be solved by _____________ with the quadratic formula:

Depending on the problem and the degree of accuracy required, the solutions of a quadratic

equation may be expressed exactly by using ____________ or ____________ numbers, or

approximately with _____________.

Example 1: Determine roots of equation by factoring

a) $x^2 + 5x + 4 = 0$

b) $2x^2 - 7x - 4 = 0$

Example 2: Use the quadratic formula to determine roots

b) $3x^2 + 2x - 8 = 0$

b) $-2x^2 + 3x - 6 = 0$

In Class Assignment: p. 177 #1bc, 2ad, 4; Homework: p. 178 #5, 6, 8, 17

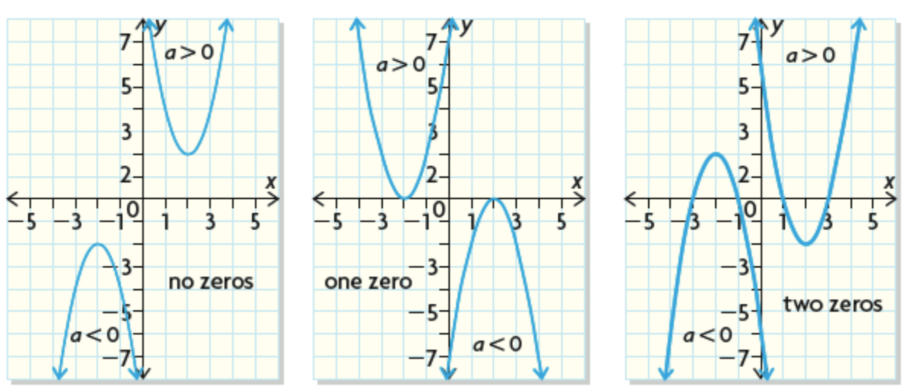
§ 3.6 – The Zeros of a Quadratic Function

A quadratic function can have _____, ______, or ______ zeros. You can determine the number of zeros either by ____________ or by _____________ the function. The number of zeros of a quadratic function can be determined by __________________, ______________________________ and ____. For a quadratic equation $ax^2 + bx + c = 0$ and its corresponding function $f(x) = ax^2 + bx + c$, use this table:

Value of the Discriminant	Number of Zeros / Solutions
$b^2 - 4ac > 0$	2
$b^2 - 4ac = 0$	1
$b^2 - 4ac < 0$	0

The number of zeros can be determined by the location of the vertex relative to the x-axis, and the direction of opening:

- If a > 0, and the vertex is above the x-axis, there are ___________ zeros.
- If a > 0, and the vertex is below the x-axis, there are ___________ zeros.
- If a < 0, and the vertex is above the x-axis, there are ___________ zeros.
- If a < 0, and the vertex is below the x-axis, there are ___________ zeros.
- If the vertex is on the x-axis, there is ____________ zero.



Example 1: State the number of zeros

a) $f(x) = 3x^2 - 5$

b) $f(x) = 3(x+2)^2$

c) $f(x) = -4(x+3)^2 - 5$

Example 2: Calculate the value of $b^2 - 4ac$ to determine the number of zeros

a) $f(x) = 2x^2 - 6x - 7$

b) $f(x) = 9x^2 - 14.4x + 5.76$

In Class Assignment: p. 185 # 1bcf, 3bc; Homework: p. 186 #5, 6, 7, 8, 17

§ 3.7 – Families of a Quadratic Functions

If the value of *a* is varied in a quadratic function expressed in a certain way, a family of parabolas similar to it will be created.

The algebraic model of a quadratic function can be determined algebraically.

- If the zeros are known, write in factored form with *a* unknown, substitute another known point, and solve for *a*.
- If the vertex is known, write in vertex form with *a* unknown, substitute a known point, and solve for *a.*

Example 1: Determine the equation of parabola with x-intercepts

-4 and 3, and that passes through (2,7)

Example 2: Determine the equation of the parabola with vertex

(-2, 5) and that passes through (4,-8)

In Class Assignment: p. 192 #1, 2, 3; Homework: p. 193 #4bcd, 5bcd, 6, 7