Section 4.1 Guided Notebook

Section 4.1 Quadratic Functions

☐   Work through Section 4.1 TTK #1
☐   Work through Section 4.1 TTK #2
☐   Work through Section 4.1 TTK #3
☐   Work through Section 4.1 TTK #5
☐   Work through Objective 1
☐   Work through Objective 2
☐   Work through Objective 3
☐   Work through Objective 4
☐   Work through Objective 5

Section 4.1 Quadratic Functions

<u>4.1 Things To Know</u>

1. Solving Quadratic Equations by Factoring and the Zero Product Property

Can you solve the equation $5x^2 + 14x - 3 = 0$ by factoring? You should get an answer of

$x = -3$ or $x = \dfrac{1}{5}$. Try working through a "You Try It" problem, refer to section 1.4 or watch

the video.

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2. Solving Quadratic Equations by Completing the Square
Do you remember how to complete the square? What number must be added to the binomial $x^2 + \frac{5}{6}x$ in order to complete the square? You should get an answer of $\frac{25}{144}$. Try working through a "You Try It" problem, refer to section 1.4 or watch the video.

3. Solving Quadratic Equations Using the Quadratic Formula
Can you solve the equation $2x^2 - 2x + 3 = 0$ using the quadratic formula? You should get an answer of $x = \frac{1 + i\sqrt{5}}{2}$ or $x = \frac{1 - i\sqrt{5}}{2}$. Try working through a "You Try It" problem or refer to section 1.4.

5. Using Combinations of Transformations to Graph Functions

Work through the animation and explain how to sketch the graph of $f(x) = -2(x+3)^2 - 1$.

Section 4.1 Objective 1 Understanding the Definition of a Quadratic Function and its Graph

Watch the video that accompanies Objective 1 and take notes here:

Write down the definition of a **quadratic function**:

Sketch two different quadratic functions. Sketch one quadratic function that "opens up" and sketch another quadratic function that "opens down".

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What determines whether or not the graph of a quadratic function of the form
$f(x) = ax^2 + bx + c$ opens up or down?

Work through Example 1 and take notes here: Without graphing, determine whether the
graph of the quadratic function $f(x) = -3x^2 + 6x + 1$ opens up or down.

It is crucial that you understand the five basic characteristics of a parabola. Carefully work
through the <u>animation</u> and describe the following five characteristics of a parabola in your
own words.

1. Vertex

2. Axis of Symmetry

3. *y*-intercept

4. *x*-intercept(s) or real zeros

5. Domain and range
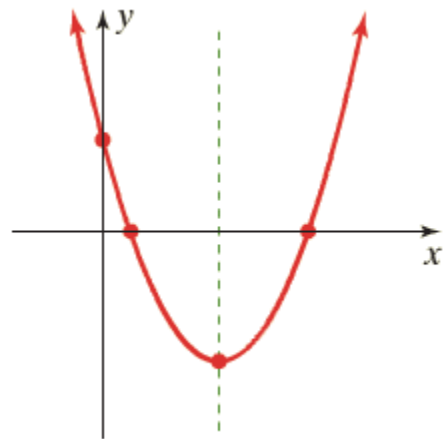
Section 4.1 Objective 2 Graphing Quadratic Functions Written in Vertex form

Work through the animation and explain how to sketch the graph of $f(x) = -2(x+3)^2 - 1$.

Vertex Form of a Quadratic Function (Fill in the Blanks)

A quadratic function is in **vertex form** if it is written as

$f(x) =$ _____. The graph is a parabola with vertex _____.

The parabola "opens up" if _____. The parabola "opens down" if _____.

Work through the video that accompanies Example 2 and answer each of the following questions:

Given that the quadratic function $f(x) = -(x-2)^2 - 4$ is in vertex form, address the following:
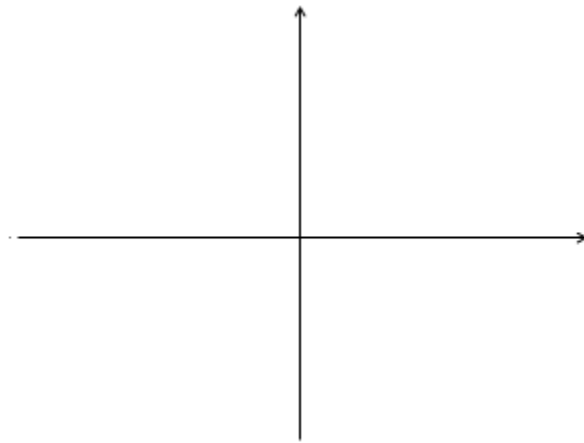
a. What are the coordinates of the vertex?

b. Does the graph "open up" or "open down"?

c. What is the equation of the axis of symmetry?

d. Find any *x*-intercepts.

e. Find the *y*-intercept.

f. Sketch the graph.

g. State the domain and range in interval notation.

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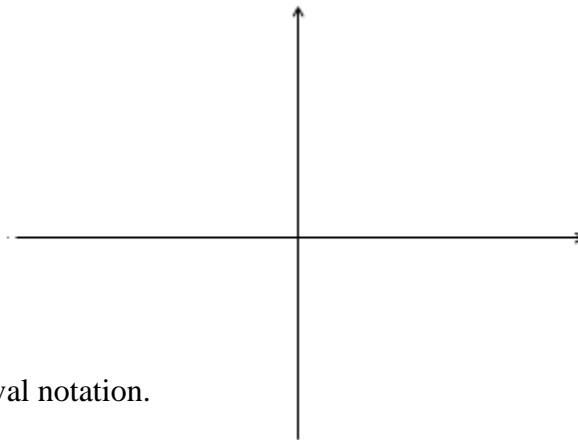Section 4.1 Objective 3 Graphing Quadratic Functions by Completing the Square
Work through the video that accompanies Example 3:
Rewrite the quadratic function $f(x) = 2x^2 - 4x - 3$ in vertex form, and then answer the
questions below.

a. What are the coordinates of the vertex?

b. Does the graph "open up" or "open down"?

c. What is the equation of the axis of symmetry?

d. Find any x-intercepts.

e. Find the y-intercept.

f. Sketch the graph.

g. State the domain and range in interval notation.

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Section 4.1 Objective 4 Graphing Quadratic Functions Using the Vertex Formula
Watch the video that accompanies Objective 4 and write your notes here:

Formula for the Vertex of a Parabola (Fill in the blanks)
Given a quadratic function of the form $f(x) = ax^2 + bx + c$, $a \neq 0$, the vertex of the parabola is

_____ .

Work through Example 4:

Given the quadratic function $f(x) = -2x^2 - 4x + 5$, address the following:

a. What are the coordinates of the vertex?

b. Does the graph "open up" or "open down"?

c. What is the equation of the axis of symmetry?

d. Find any x-intercepts.

e. Find the y-intercept.

f. Sketch the graph.

g. State the domain and range in interval notation.

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Section 4.1 Objective 5 Determining the Equation of a Quadratic Function Given Its Graph
Work through the video that accompanies Example 5: Analyze the graph to address the
following about the quadratic function it represents.

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

b. What is the value of h? What is the value of k?
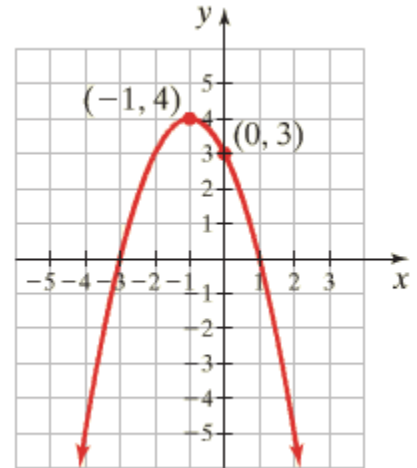
c. What is the value of the leading coefficient, a?

d. Write the equation of the function in vertex form
$$f(x) = a(x-h)^2 + k.$$

e. Write the equation of the function in the form
$$f(x) = ax^2 + bx + c.$$