

MORE WORK WITH PARABOLAS COMMON CORE ALGEBRA I



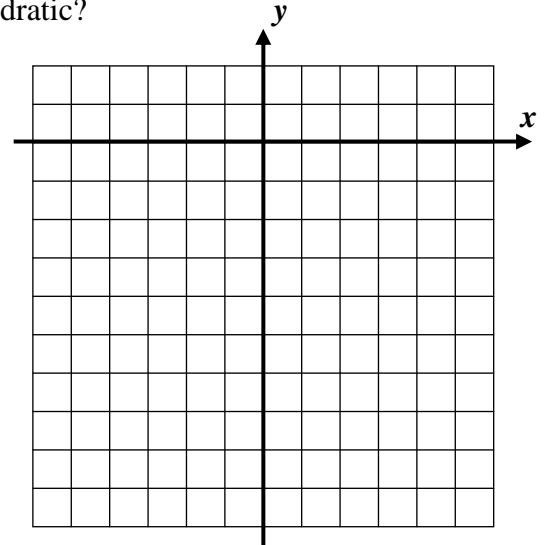
The graphs of quadratic functions are more complex than linear and exponential because they include a **turning point** that is either the location of a **maximum** or a **minimum**. Today we will explore these functions more by using our calculator technology. But first, we need to examine one additional quadratic function by hand.

Exercise #1: Consider the simple quadratic function $y = -x^2$.

(a) Write this parabola in the form $y = ax^2$, where a is the leading coefficient. Then, fill out the table below.

x	$y = -x^2$	(x, y)
-3		
-2		
-1		
0		
1		
2		
3		

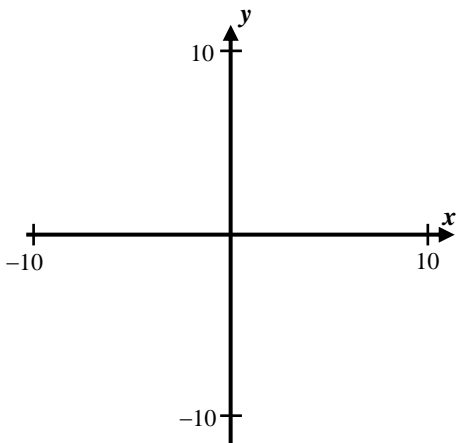
(b) Graph the parabola given in this table on the grid provided. What is the range of this quadratic?



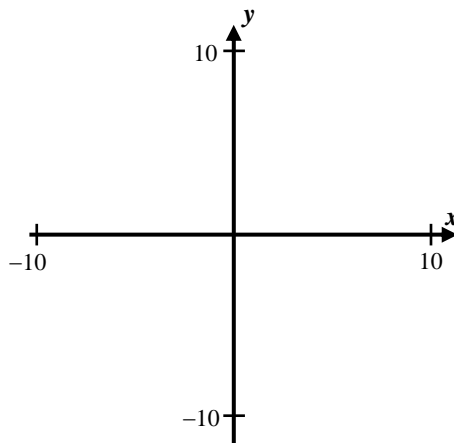
Range:

Some parabolas are concave up (open upward) and some are concave down (open downward). Let's see if we can find a pattern that tells us what controls this behavior.

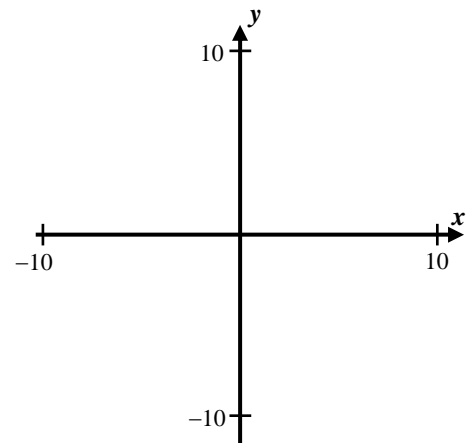
Exercise #2: Use your graphing calculator with a **STANDARD WINDOW** to sketch each of the following.



$$y = 3x^2 + 6x - 4$$



$$y = -x^2 + 6x + 1$$

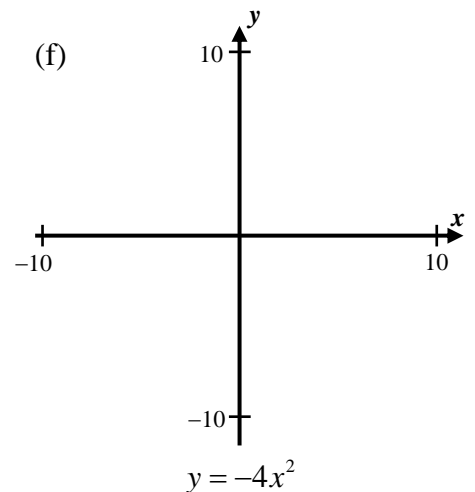
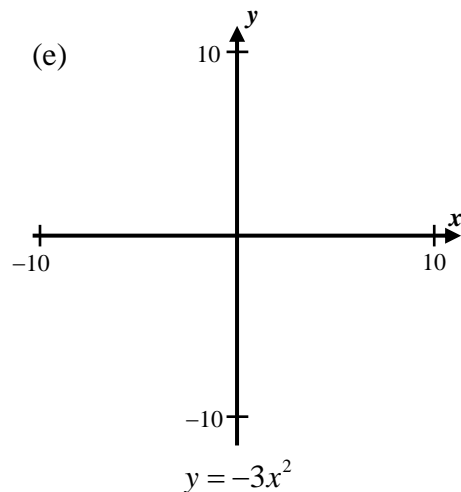
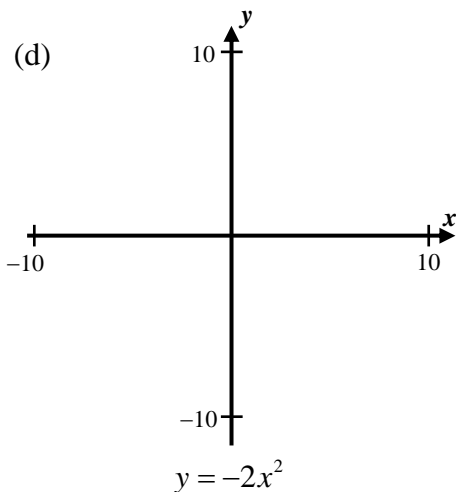
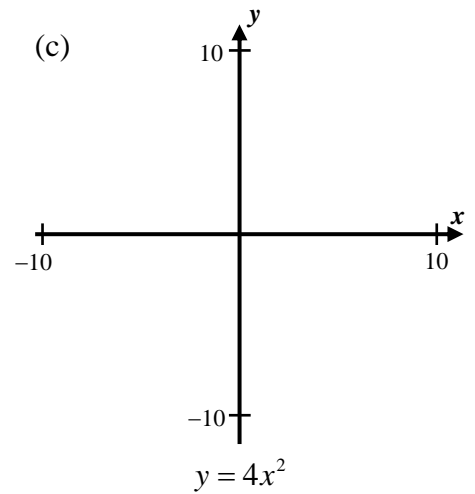
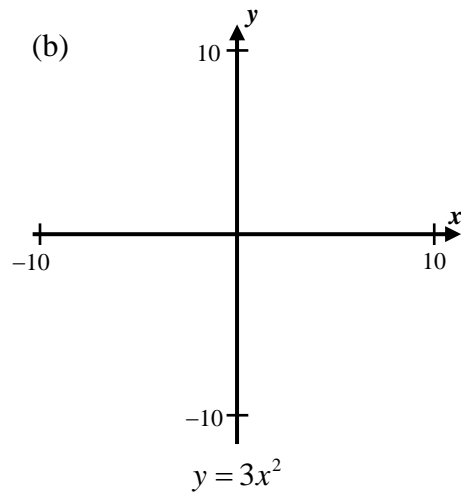
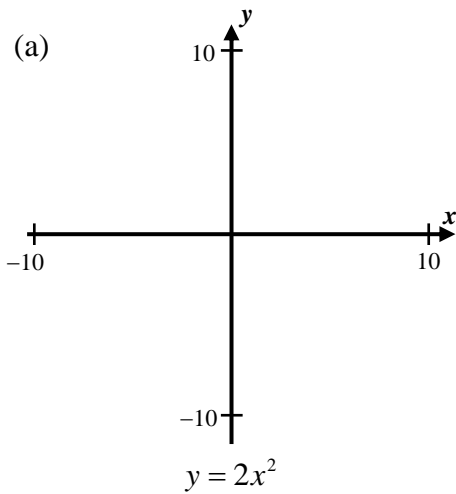


$$y = -2x^2 - 8x - 4$$



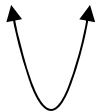
We will explore the reason for this pattern more in the next exercise with much simpler quadratic functions.

Exercise #3: Use your calculator to sketch a graph of each of the following quadratics using the indicated window.

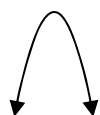


So, it appears that we can now determine what controls the direction a parabola opens.

Exercise #4: For the quadratic $y = ax^2 + bx + c$ fill in the blanks:

(1) The parabola will **open upwards**, in other words look like  if _____.

This type of quadratic function will have a **minimum y-value**.

(2) The parabola will **open downwards**, in other words look like  if _____.

This type of quadratic function will have a **maximum y-value**.



MORE WORK WITH PARABOLAS
COMMON CORE ALGEBRA I HOMEWORK

FLUENCY

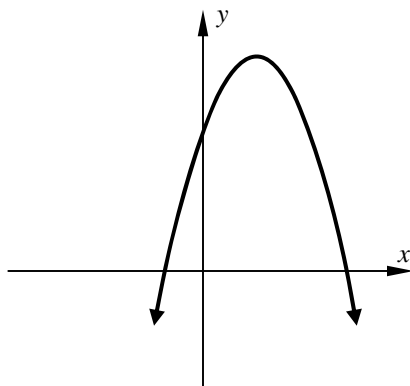
1. Which of the following could be the equation of the quadratic shown below? Explain your reasoning.

(1) $y = -3x^2 + 8x - 5$

(2) $y = 4x^2 - 6x + 7$

(3) $y = -2x^2 + 12x + 11$

(4) $y = x^2 - 8x - 2$



Reasoning:

2. Based on the quadratic function shown in the table below, which of the following is the range of this function?

(1) $y \geq -7$

(3) $y \leq 4$

(2) $y \geq 3$

(4) $y \leq 11$

x	-1	0	1	2	3	4
y	3	9	11	9	3	-7

For Problems 3 – 5, use tables on your calculator to help you investigate these functions.

3. Which of the following quadratics will have a maximum value at $x = 3$?

(1) $y = x^2 - 6x + 19$

(3) $y = -2x^2 + 20x - 49$

(2) $y = -4x^2 + 24x - 21$

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

4. Which of the following quadratics will have a minimum value of -5 at $x = 7$?

(1) $y = x^2 - 14x + 39$

(3) $y = x^2 - 14x + 44$

(2) $y = -x^2 + 14x - 54$

(4) $y = -x^2 - 10x - 18$

5. The parabola $y = -x^2 + 12x - 11$ has an **axis of symmetry** of $x = 6$. Which of the following represents its range?

(1) $y \geq -11$

(3) $y \leq 6$

(2) $y \leq 25$

(4) $y \geq 10$

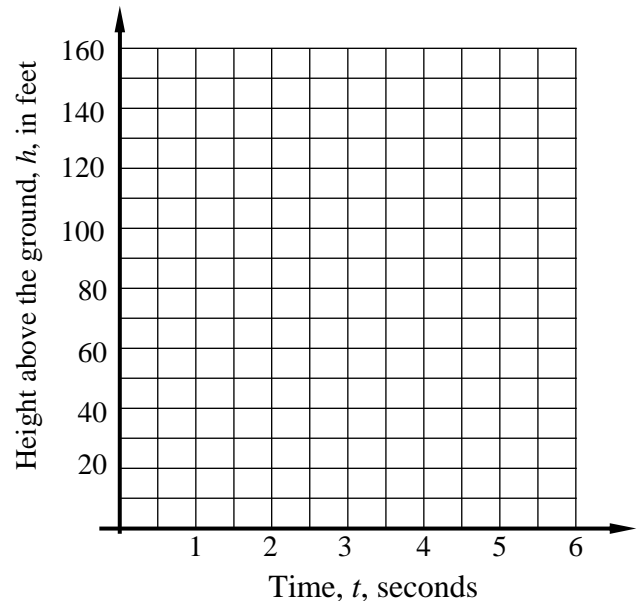


APPLICATIONS

6. The height of an object that is traveling through the air can be well modeled by a quadratic function that opens downward. An object is fired upward and its height in feet above the ground is given by:

$$h(t) = -16t^2 + 64t + 80 \quad \text{where the input, } t, \text{ is the time, in seconds, the object has been in the air}$$

- (a) Using your calculator, sketch a graph of the object's height for all times where it is at or above the ground.
- (b) What is its maximum height in feet?
- (c) At what time does it hit the ground?
- (d) Over what time interval is its height increasing?



7. The cost per computer produced at a factory depends on how many computers the factory produces in a day. The cost function is modeled by $C(n) = \frac{1}{500}n^2 - n + 200$, where n is the number of computers produced in a day and $C(n)$ is the unit cost, in dollars per computer.
- (a) Calculate $C(50)$ and give an interpretation of your answer in terms of the scenario described.
- (b) Does the cost have a minimum or maximum value? Explain. Use your calculator to find it.
- (c) Based on (b), can this function have any real zeroes? Explain your thought process.

