Name: ______________________________ Date: ________________

Introduction to Quadratic Functions
Homework

TAKE EM OUTTT! ⟶

1. Which of the following is a quadratic function?

(1) $y = 3x - 2$ (3) $y = x^2 - 4$

(2) $y = x^3 + 2x^2 - 1$ (4) $y = 6(2)^x$

2. The quadratic function $y = 9 - x^2 + 4x$ written in standard form would be

(1) $y = -x^2 + 4x + 9$ (3) $y = x^2 - 4x + 9$

(2) $y = x^2 - 9x + 4$ (4) $y = -x^2 - 4x + 9$

3. Which of the following would be the leading coefficient of $f(x) = 6 - x + 7x^2$?

(1) -1 (3) 7

(2) 6 (4) -7

4. Which of the following points lies on the graph of $y = x^2 - 5$?

$-2 = (3)^2 - 5$
$-2 = 9 - 5$
$-2 = 4$ ✗

(1) $(3, -2)$ ✗ (3) $(5, 0)$

(2) $(-2, -1)$ ✓ (4) $(-1, -6)$

5. A quadratic function is partially given in the table below. Which of the following are the coordinates of its turning point?

(1) $(0, 6)$ (3) $(3, 15)$

(2) $(10, 2)$ (4) $(7, -1)$

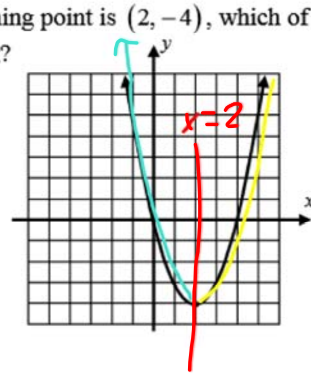
x	-2	-1	0	1	2	3
y	10	7	6	7	10	15

6. Given the quadratic function shown below whose turning point is $(2, -4)$, which of the following gives the domain interval over which this function is decreasing?

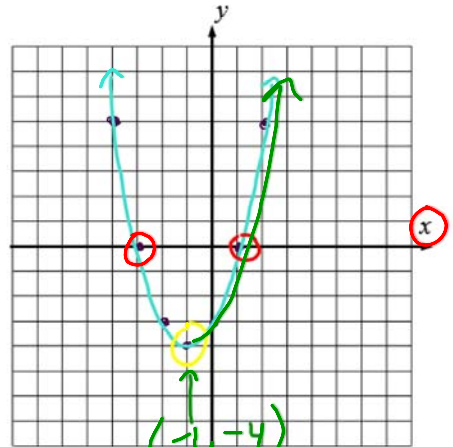
(1) $x > -4$ (3) ~~$x > 2$~~

(2) $x < -4$ (4) $x < 2$

$(-\infty, 2)$



7. Consider the function $f(x) = x^2 + 2x - 3$. ↗ y



(a) Using your calculator, create an accurate graph of $f(x)$ on the grid provided.

(b) State the coordinates of the turning point of $f(x)$. Is this point a maximum or minimum?

(−1, −4)

(c) State the range of this quadratic function.

[−4, ∞)

(−1, −4)

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X	Y_1
-4	5
-3	0
-2	-3
-1	-4
0	-3
1	0
2	5
3	12
4	21
5	32
6	45

X=-4

(d) State the **zeroes** of this function (the x-intercepts).

x = −3 and x = 1

(−3, 0) (1, 0)

(e) Over what interval is this function **increasing**?

$\boxed{x > -1}$ $\boxed{(-1, \infty)}$ going up

(f) Determine the average rate of change of this function over the interval $-2 \le x \le 4$.

SLOPE $\frac{\Delta y}{\Delta x} = \frac{-3-21}{-2-4} = \frac{-24}{-6} = \boxed{4}$

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MORE WORK WITH PARABOLAS…!
COMMON CORE ALGEBRA I

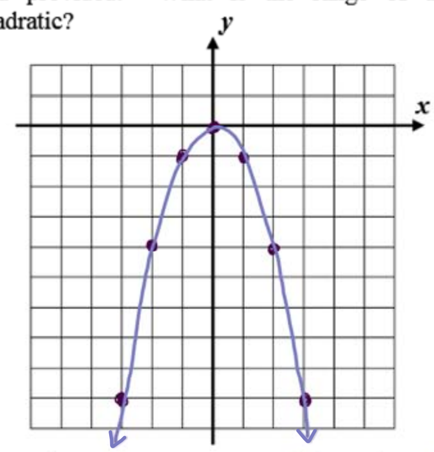
The graphs of quadratic functions are more complex than linear and exponential because they include a **turning point** that is either the location of a **maximum** or a **minimum**. Today we will explore these functions more by using our calculator technology. But first, we need to examine one additional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

Do Now: Consider the quadratic function $\boxed{y=-x^2}$. ← CALCULATOR $(-2)^2 = 4$ $-(2)^2$

(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	$y=-(-3)^2=-9$	$(-3,-9)$
-2	$y=-(-2)^2=-4$	$(-2,-4)$
-1		$(-1,-1)$
0		$(0,0)$
1		$(1,-1)$
2	$y=-(2)^2=-4$	$(2,-4)$
3		$(3,-9)$

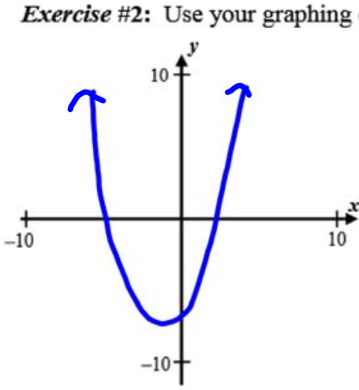
(b) Graph the parabola given in this table on the grid provided. What is the range of this quadratic?



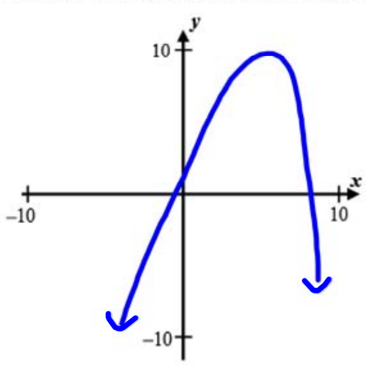
y-values Range: $(-\infty, 0]$ OR $y \le 0$

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.

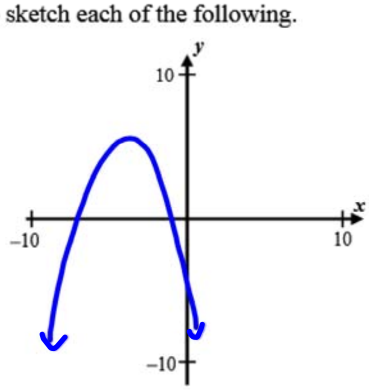
***Exercise* #2:** Use your graphing calculator with a STANDARD WINDOW to sketch each of the following.



1 $y=3x^2+6x-4$



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

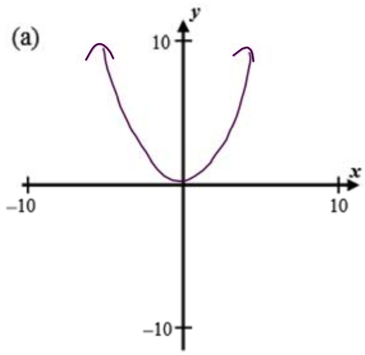


$y=-2x^2-8x-4$

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

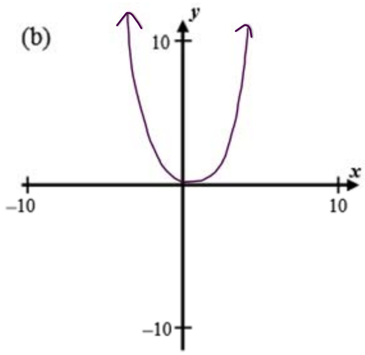
***Exercise* #3. You try:** Use your calculator to sketch a graph of each of the following quadratics using the indicated window.

(a)



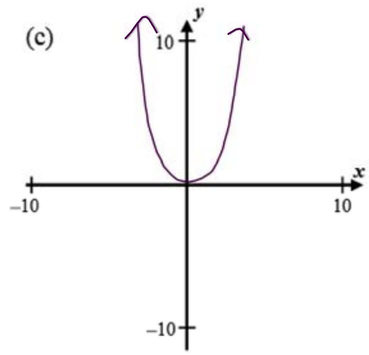
$y = 2x^2$

(b)



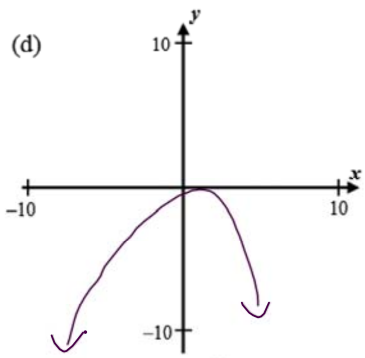
$y = 3x^2$

(c)



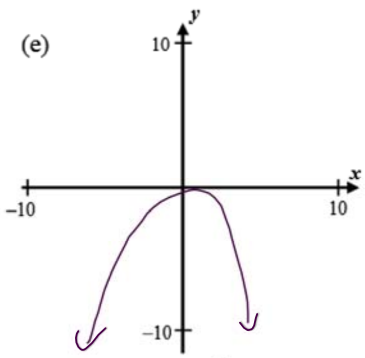
$y = 4x^2$

(d)



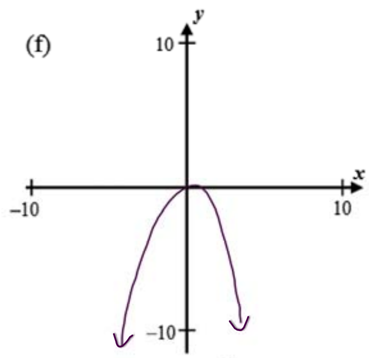
$y = -2x^2$

(e)



$y = -3x^2$

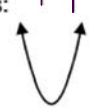
(f)



$y = -4x^2$

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 a>0 OR a is positive.

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

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

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

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More Work with Parabolas
Homework!

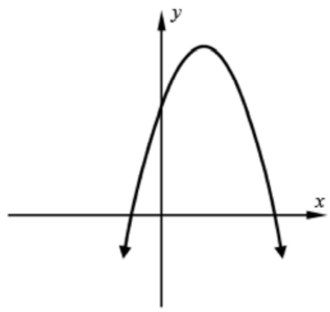
1. Which of the following could be the equation of the quadratic shown below? Explain your reasoning.

(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?

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

(1) $y \ge -7$ (3) $y \le 4$

(2) $y \ge 3$ (4) $y \le 11$

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) $y \ge -11$ (3) $y \le 6$

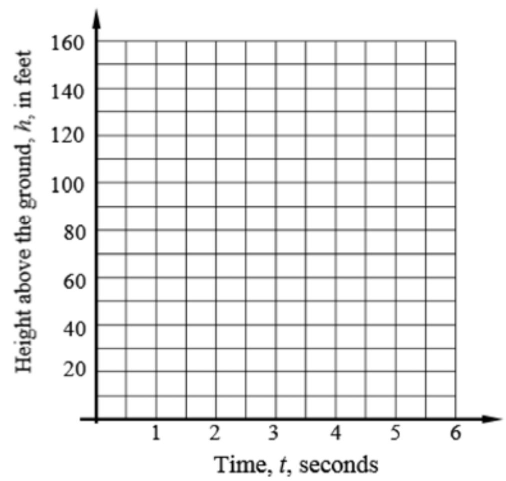
(2) $y \le 25$ (4) $y \ge 10$

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:

$h(t) = -16t^2 + 64t + 80$ where the input, t, 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?