

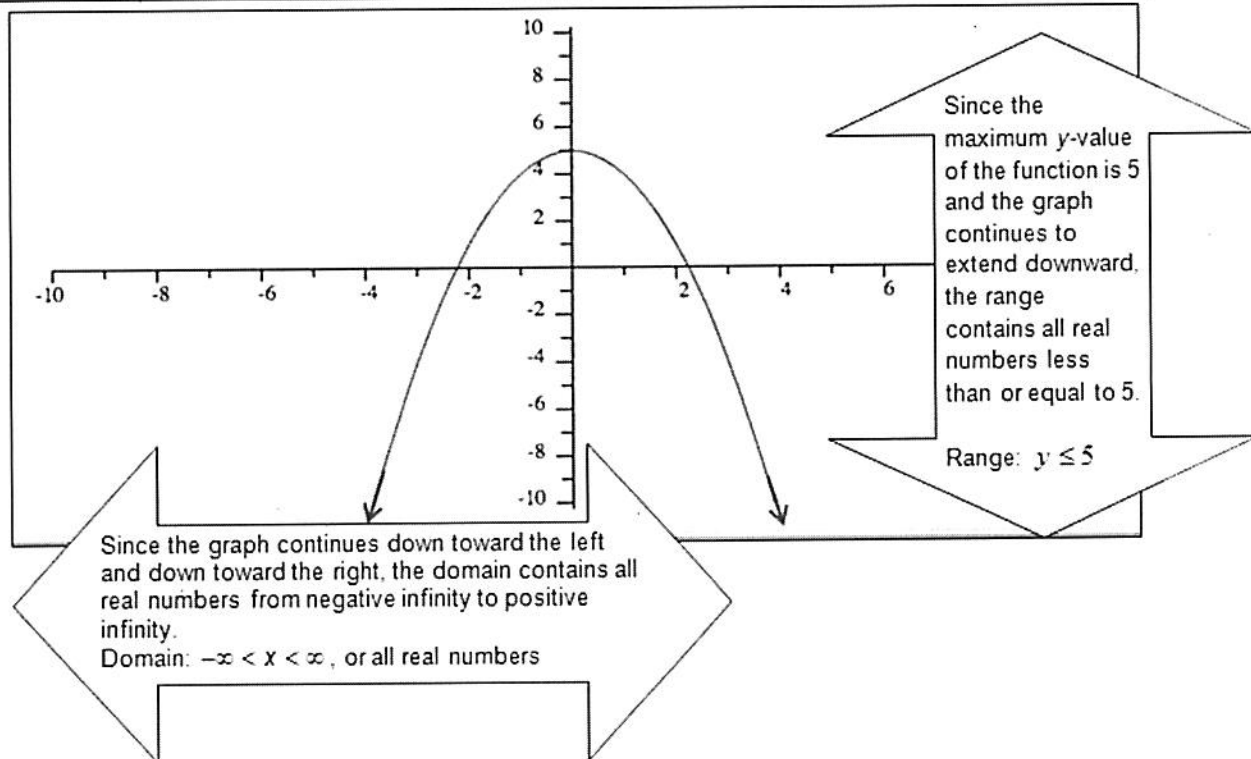
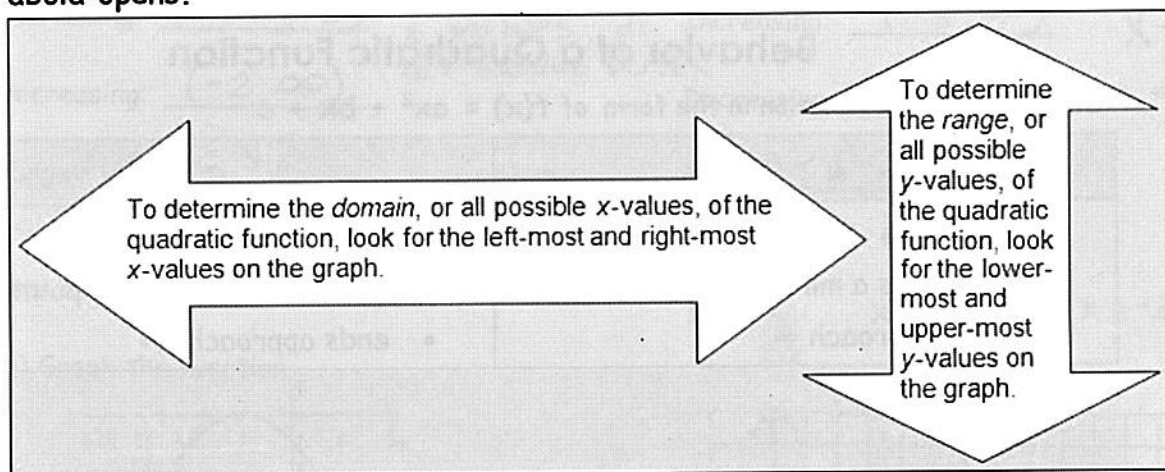
Essential Questions: How do we determine the domain and range of a quadratic function? How do we determine when the function is increasing? How do we determine when the function is decreasing?

Do Now: Complete the table with the correct terminology.

Domain	input	x-values
Range	output	y-values

Domain and Range of Quadratic Functions

Substituting any real value of x into a quadratic equation results in a real number. Therefore, in general, the domain of any quadratic function is all real numbers. The range of a quadratic function depends on its vertex and the direction that the parabola opens.



1) Graph the quadratic function $y = -x^2 + 4x - 6$

State the:

$$x = \frac{-b}{2a}$$

$$x = \frac{-4}{2(-1)}$$

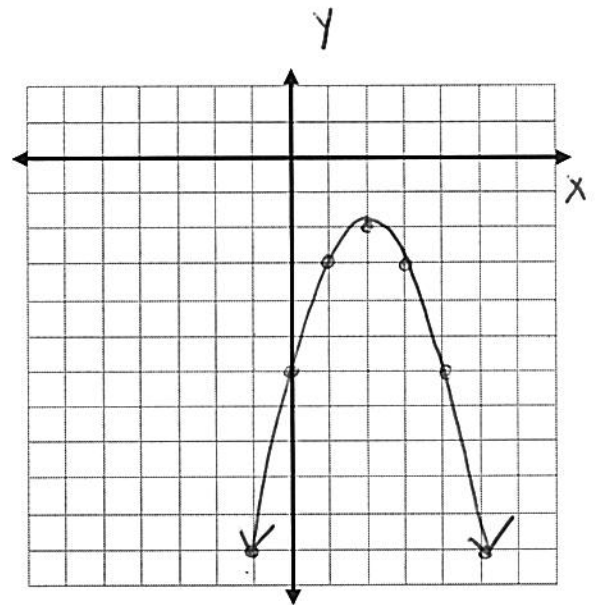
$$x = 2$$

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

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

$$y = -2$$

- Vertex: (2, -2)
- Maximum or minimum maximum
- x-intercepts: no real roots
- Zeros (roots): none
- Domain: $(-\infty, \infty)$
- Range: $(-\infty, -2]$

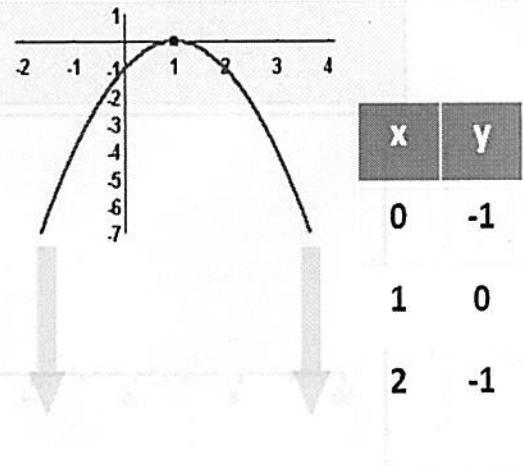
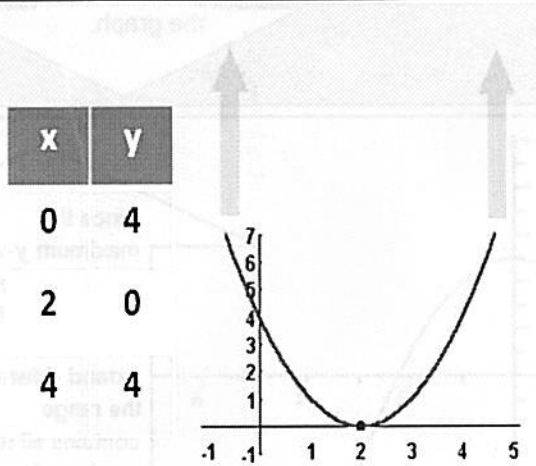


x	y
-1	-11
0	-6
1	-3
2	-2
3	-3
4	-6
5	-11

Behavior of a Quadratic Function

Given a quadratic function in the form of $f(x) = ax^2 + bx + c$

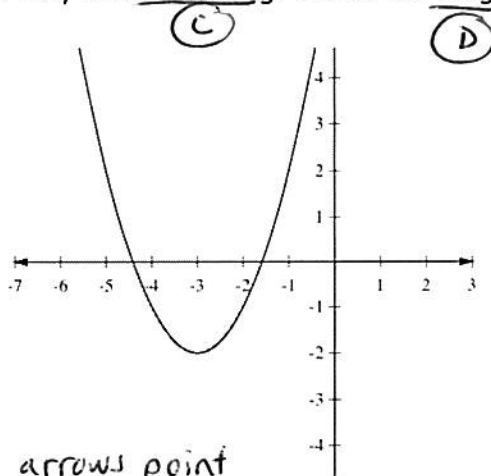
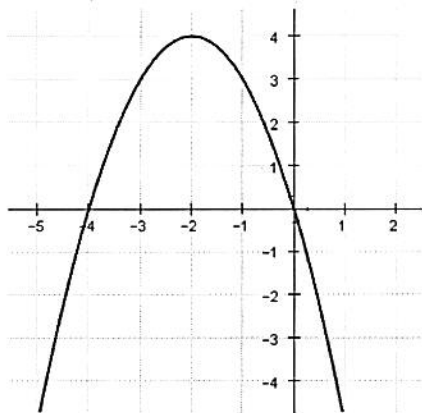
$a > 0$	$a < 0$
<ul style="list-style-type: none"> • Opens up • Vertex is a minimum point • ends approach ∞ 	<ul style="list-style-type: none"> • Opens down • Vertex is a maximum point • ends approach $-\infty$



- The function is **decreasing** for all values in which $x < 2$
- The function is **increasing** for all values in which $x > 2$
- The ends of the graph approach $+\infty$

- The function is **increasing** for all values in which $x < 1$
- The function is **decreasing** for all values in which $x > 1$
- The ends of the graph approach $-\infty$

- 2) Describe the end behavior of the following graphs. Describe the intervals for which the functions are increasing and the intervals for which they are decreasing. State the range of each function.



End behavior: (down) approaches $-\infty$

End behavior: approaches ∞ (up)

$x < -2$ Increasing: $(-\infty, -2)$ x values, do not include vertex

Increasing: $(-3, \infty)$ $x > -3$

$x > -2$ Decreasing: $(-2, \infty)$

Decreasing: $(-\infty, -3)$ $x < -3$

Range: $(-\infty, 4]$ y values
or $y \leq 4$

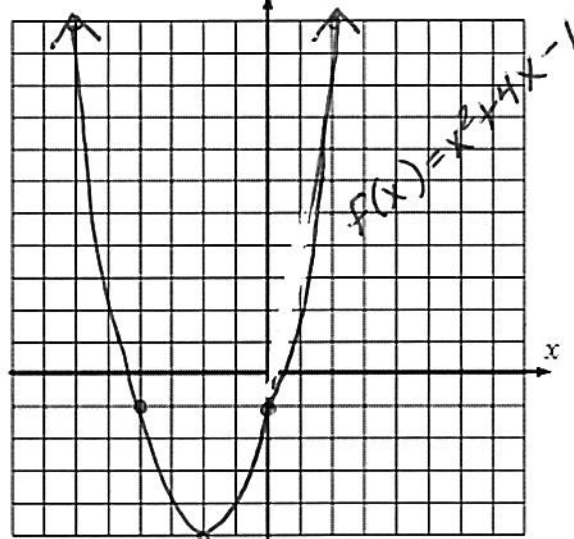
Range: $[-2, \infty)$
 $y \geq -2$

- 3) Consider the quadratic function $f(x) = x^2 + 4x - 1$

(a) Graph the function.

x	y
-6	11
-4	-1
-2	-5
0	-1
2	11

$x = \frac{-b}{2a}$ $x = \frac{-4}{2(1)}$ $x = -2$



(b) State the range of the function.

$y \geq -5$

(c) State the interval over which $f(x)$ is increasing.

x values

$x > -2$ or $(-2, \infty)$