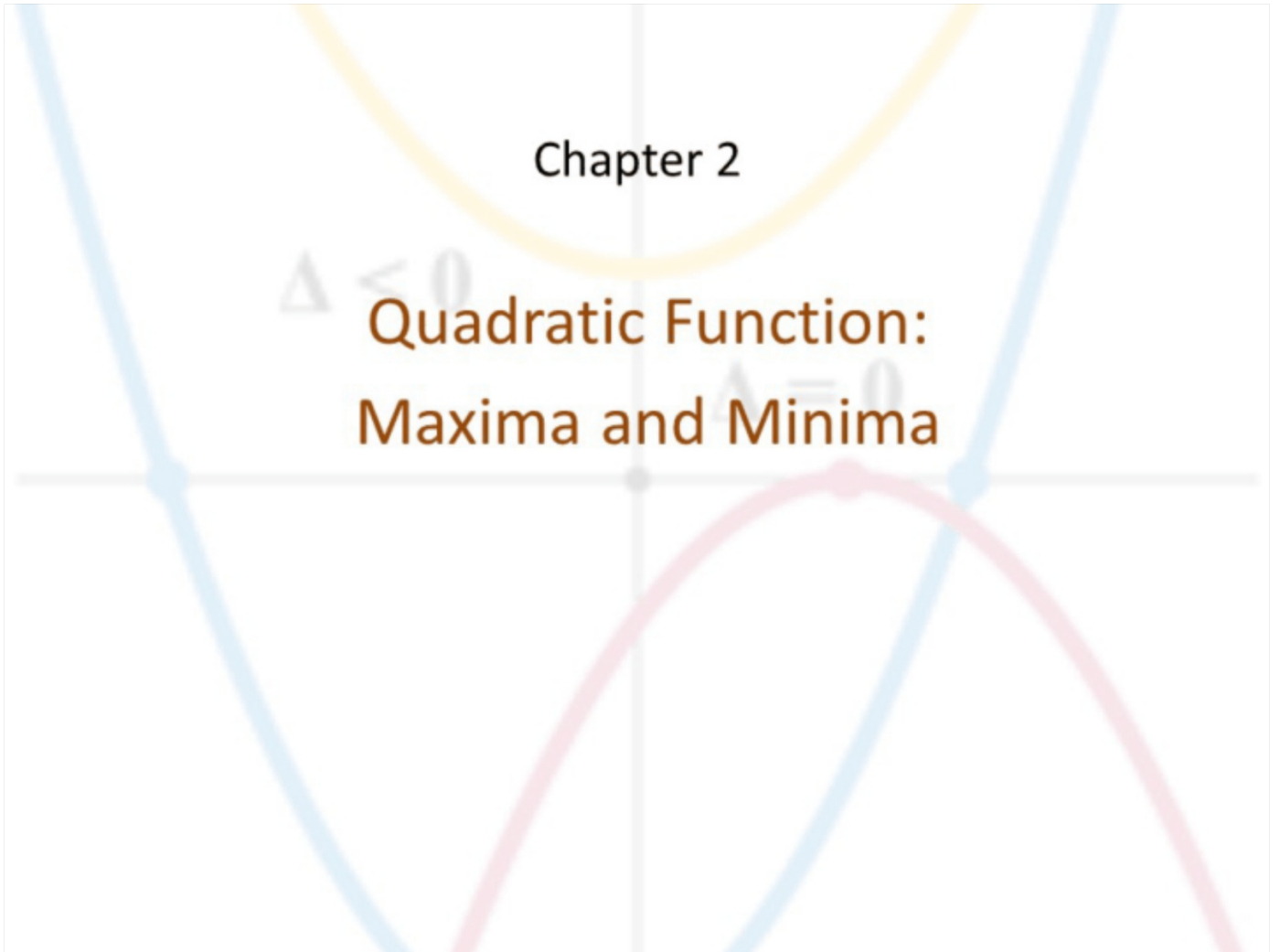


## Chapter 2

$\Delta < 0$

Quadratic Function:  
Maxima and Minima

$\Delta = 0$



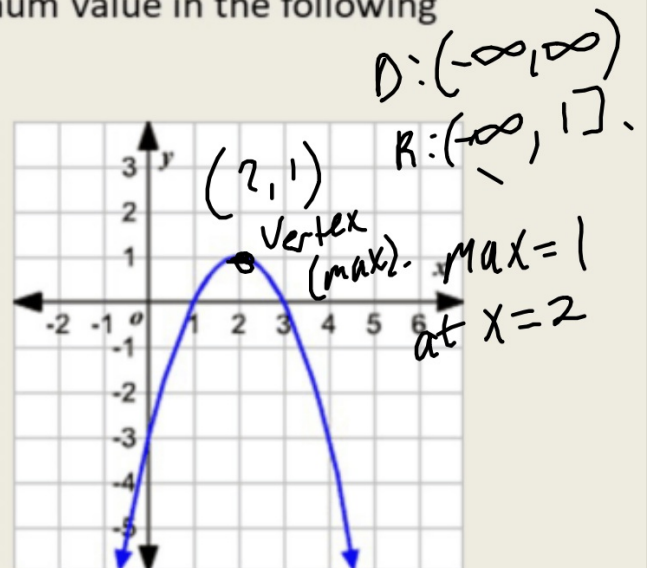
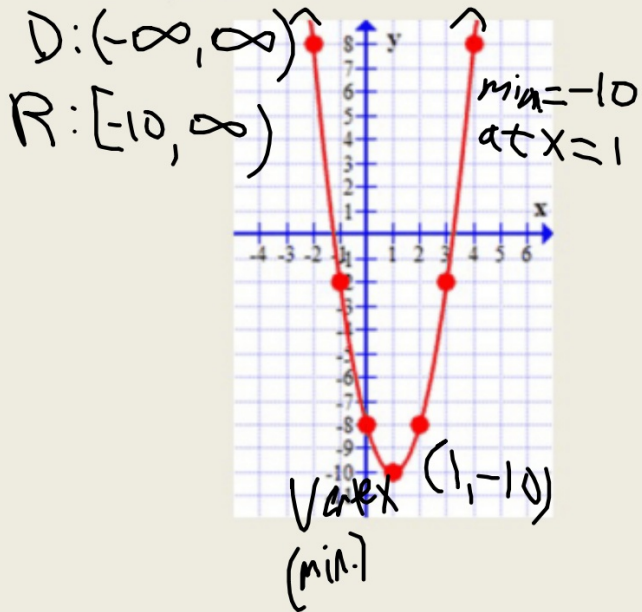
## Objective

Students will...

- Be able to identify the vertex of a parabola as the maximum or the minimum value of the function.
- Be able to model and solve applicable word problems using quadratic functions.

Consider the following...

Do you see a maximum or minimum value in the following parabolas?



For  $V: (h, k)$  **Maxima and Minima** the min/max value is  $k$ , and  $h$  is the location.

Visually it's clear that the vertex of a parabola is naturally the maximum or a minimum, depending upon the orientation of the parabola. If the parabola opens down, the vertex is the maximum (at the highest point), while if graph opens up its vertex is the minimum (at the lowest point).

Ex.

Identify whether the function will have a minimum or a maximum.

$\cup$  Ex.  $f(x) = x^2 - 6x + 8$  min

$\cap$  Ex.  $f(x) = -2x^2 - 3x + 9$  max

## Examples

Find the maximum or minimum value of each quadratic function, and state its domain and range.

1.  $f(x) = x^2 - 2x - 3$

$$V: (h, k) = (1, -4)$$

$$h = \frac{2}{2(1)} = 1$$

$$k = f(1) = 1 - 2 - 3 = -4$$

$$D: (-\infty, \infty)$$
$$R: [-4, \infty)$$

min = -4  
at  $x = 1$

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

$$V: (h, k) = (2, 1)$$

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

$$k = f(2) = -(2)^2 + 4(2) - 3 = -4 + 8 - 3 = 1$$

max = 1, at  $x = 2$

$$D: (-\infty, \infty)$$
$$R: (-\infty, 1]$$

## Examples

Find the maximum or minimum value of each quadratic function, and state its domain and range.

3.  $f(x) = x^2 + 4x$

4.  $g(x) = -2x^2 + 4x - 5$

If a ball is thrown directly upward with a velocity of 50 ft/s, its height (in feet) after  $t$  seconds is given by

$$y = 50t - 5t^2$$

$$y = -5t^2 + 50t$$

What is the maximum height attained by the ball?

$$V: (h, k) = (5, 125)$$

$$h = \frac{-50}{2(-5)} = 5$$

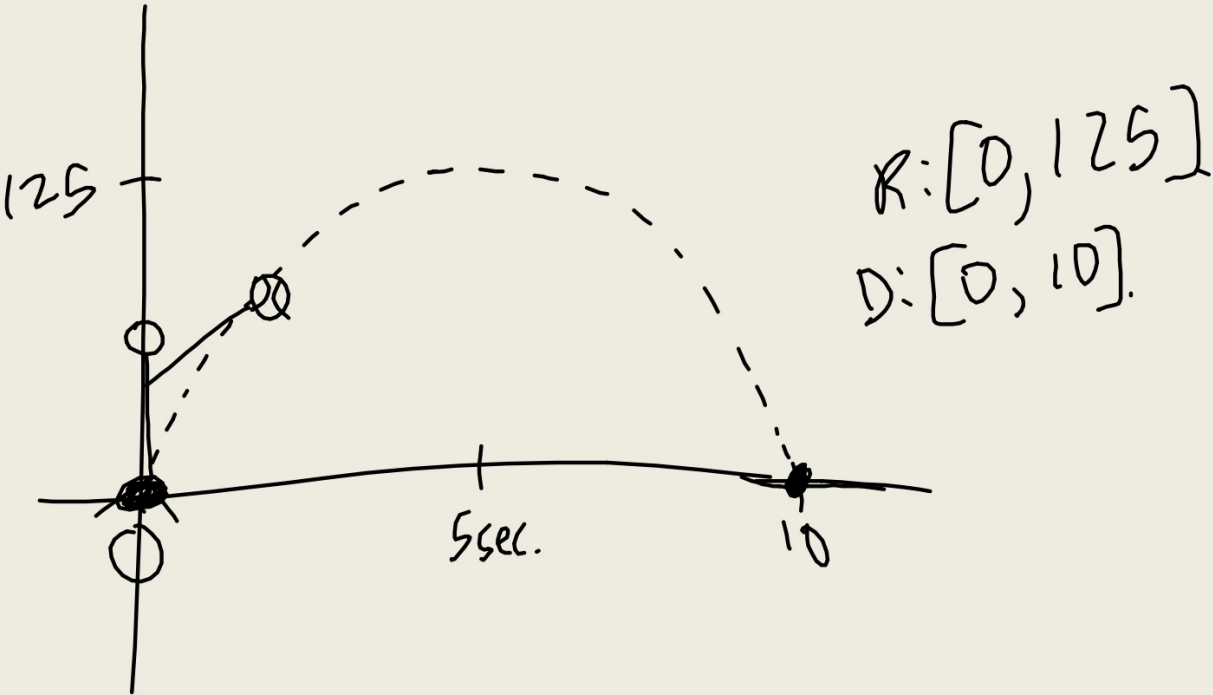
$$k = 50(5) - 5(5)^2 \\ = 250 - 125 = 125$$

125 feet

After how many seconds did the ball reach its maximum height?

5 seconds

After how many seconds did the ball hit the ground again?





Homework Due 9/11

**Applications with Parabolic  
Functions WKSHT**