

# Quadratic Functions

## Maximum and Minimum

Week 2 Part 2



# Objectives

- Determine the maximum or minimum of a quadratic function.

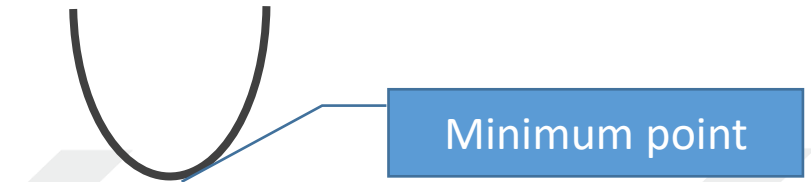


# Maximum or minimum value

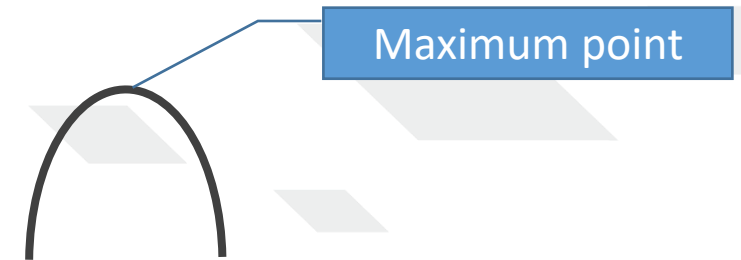
The **maximum** or **minimum** value of a quadratic function

$$f(x) = ax^2 + bx + c \text{ occurs at } x = \frac{-b}{2a}$$

If  $a > 0$  then the **minimum value** is  $f\left(\frac{-b}{2a}\right)$



If  $a < 0$  then the **maximum value** is  $f\left(\frac{-b}{2a}\right)$



# Example

Find the maximum or minimum value of each quadratic functions.

a)  $f(x) = x^2 + 4x$

**Solution:** a)  $a = 1, b = 4, c = 0$

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

$$f(-2) = (-2)^2 + 4(-2) = -4$$

Since  $a = 1 > 0$  the function has the minimum value

The minimum value is -4 .

By Substituting  
 $x = -2$   
in  
 $f(x) = x^2 + 4x$



# Example

b)  $f(x) = -2x^2 + 4x - 5$

**Solution:**  $a = -2, \quad b = 4, \quad c = -5$

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

$$f(1) = -2(1)^2 + 4(1) - 5 = -3$$

Since  $a = -2 < 0$ , the function has the maximum value.  
Maximum value is -3

By Substituting  
 $x = 1$   
in  
 $f(x) = -2x^2 + 4x - 5$



# Exercise:

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Find the maximum or minimum value of the quadratic equations:

1)  $f(x) = x^2 + 14x - 14$

2)  $f(x) = x^2 - 6x + 17$

3)  $f(x) = -x^2 + 7x + 11$



# Reference

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- <https://vdocuments.site/route404.html>. (Full reference unavailable, due to removal of original web source).