

Quadratic Functions Video Lecture

Section 3.3

Course Learning Objectives:

- 1) Demonstrate an understanding of functional attributes such as domain and range. Determine these attributes for a function given its graph and/or its rule.**
- 2) Graph polynomial functions and use such graphs to solve applied problems and to understand the significance of attributes of the graph to such applied problems.**
- 3) Solve appropriate applications of determining the maximum or minimum of a quadratic function.**
- 4) Identify and articulate the significance of graphical components in a mathematical model/application.**

Weekly Learning Objectives:

- 1) Graph a quadratic equation in vertex or general form.**
- 2) Identify the transformations of a quadratic function.**
- 3) Identify the vertex, axis of symmetry, intercepts, domain and range of a quadratic function.**
- 4) Graph a quadratic function using its vertex, axis, and intercepts.**

Quadratic Functions

Quadratic Functions can come in two forms:

Vertex Form: $f(x) = a(x-h)^2 + k$

Vertex: (h, k) minimum if $a > 0$, maximum if $a < 0$

Axis of Symmetry: $x = h$

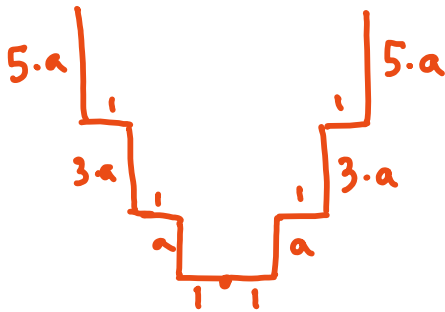
or:

General Form: $f(x) = ax^2 + bx + c$

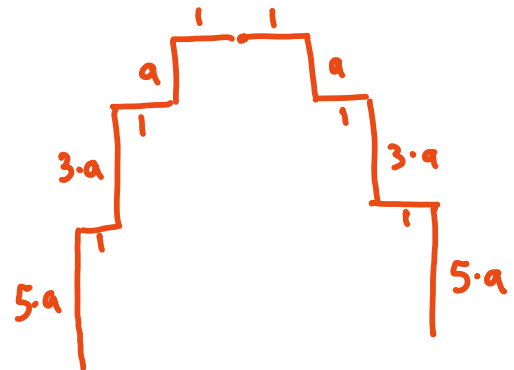
Vertex: $\left(-\frac{b}{2a}, f\left(-\frac{b}{2a}\right)\right)$ minimum if $a > 0$, maximum if $a < 0$

The pattern for graphing either form is the following:

If $a > 0$, parabola points up
(minimum at vertex)



If $a < 0$, parabola points down
(maximum at vertex)



x-intercepts can be found by setting $f(x) = 0$ and solving for x .

y-intercept can be found by setting $x = 0$ and solving for y .

Domain: $(-\infty, \infty)$

Range: If $a > 0$, points up
 $[k, \infty)$

If $a < 0$, points down
 $(-\infty, k]$

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

Find the following:

a) Express in vertex form:

b) List the transformations to $f(x) = x^2$

c) Find the vertex:

d) Find the x-intercept:

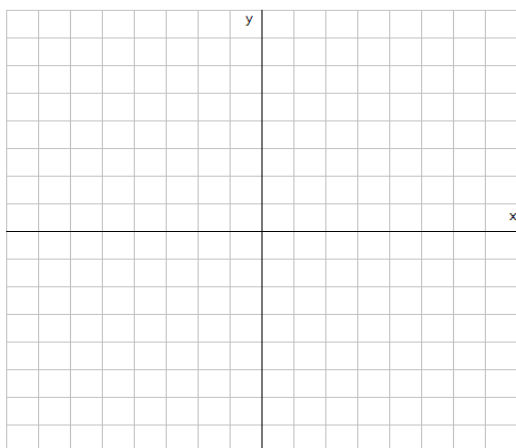
e) Find the y-intercept:

f) Find the Domain:

g) Find the Range:

h) Find the Max or Min value:

i) Graph:



Let $f(x) = 6x^2 + 12x - 5$

Find the following:

a) Express in vertex form:

b) List the transformations to $f(x) = x^2$

c) Find the vertex:

d) Find the x-intercept:

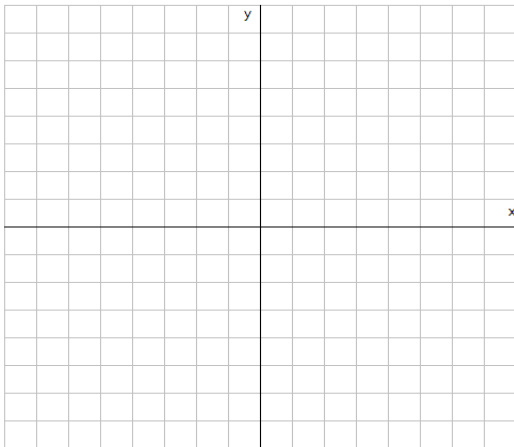
e) Find the y-intercept:

f) Find the Domain:

g) Find the Range:

h) Find the Max or Min value:

i) Graph:



Let $f(x) = -3x^2 + 6x + 1$

Does it have a maximum or minimum? Find the max or min value.

Where does $f(x)$ increase and decrease?

Find the axis of symmetry of $f(x)$.

A soft-drink vendor at a popular beach analyzes his sales records, and finds that if he sells x cans of soda pop in one day, his profit (in dollars) is given by

$$P(x) = -0.001x^2 + 3x - 1800$$

What is his maximum profit per day, and how many cans must he sell for maximum profit?

A farmer has 2000 yards of fence to enclose a rectangular field. What are the dimensions of the rectangle that encloses the most area?

A projectile is fired from a cliff 500 feet above the water with a velocity of 400 feet per second. The height h of the projectile above the water is given by the function:

$$h(x) = -.0002x^2 + x + 500$$

where x is the time in the air, measured in seconds.

a) Find the maximum height of the projectile.

b) When will the projectile hit the water?