

# Quadratics

Vertex Form Equations

$$y = a(x - h)^2 + k$$

Standard Form Equations

$$y = ax^2 + bx + c$$

Factored Form Equations

$$y = a(x - r)(x - s)$$

## Vertex Form Equations

$$y = a(x - h)^2 + k$$

**a** - controls how fast the parabola goes up or down

- if 'a' is negative, curve is upside down

- step pattern: regular (1, 3, 5, 7)

**h** - horizontal shift (x-value of vertex)

**k** - vertical shift (y-value of vertex)

**vertex:** (     ,     )

**max/min:**

**axis of symmetry:**

**step pattern:**

$$y = 2(x - \boxed{3})^2 - \boxed{4}$$

$h$ 
 $k$

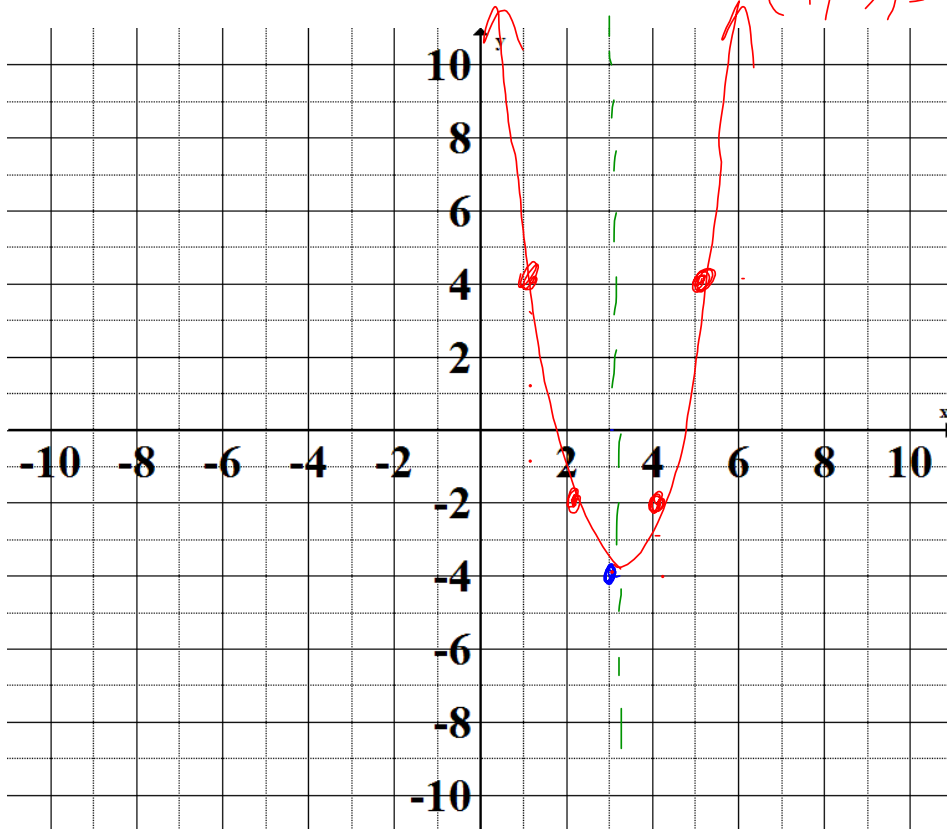
vertex: (3, -4)

max/min:  $y = -4$

axis of symmetry:  $x = 3$

step pattern:

2, 6, 10, 14  
(1, 3, 5, 7)



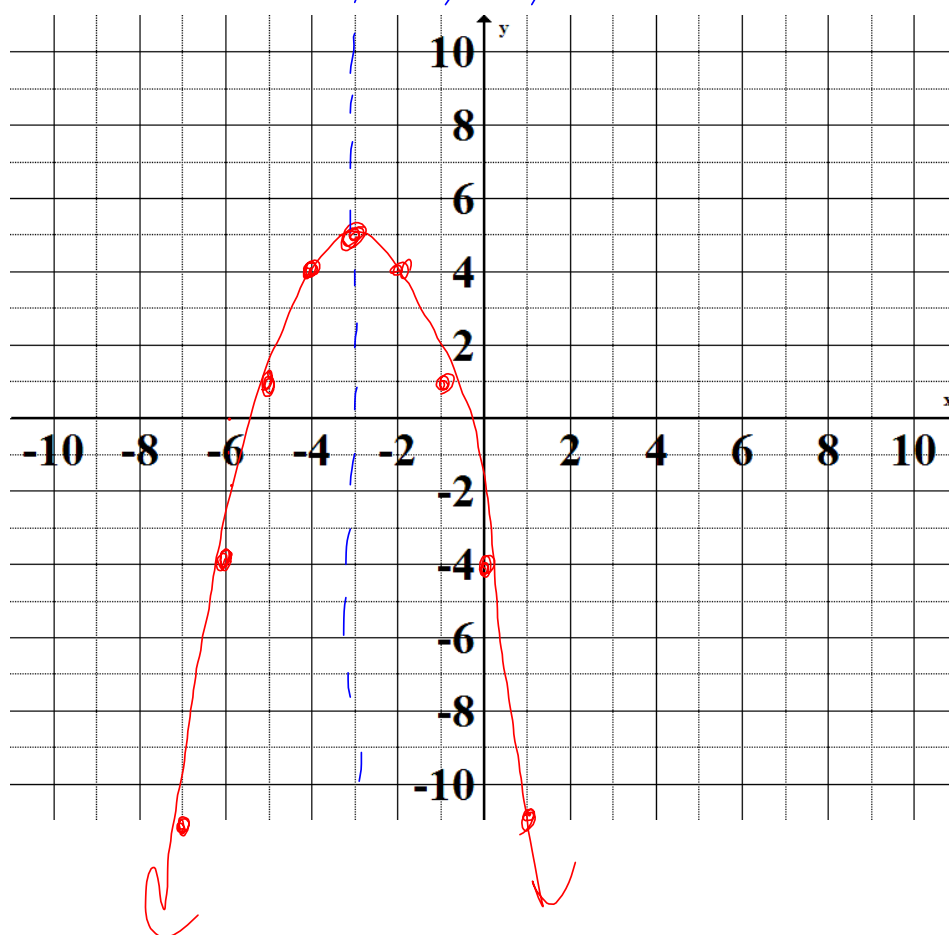
$$a = -1 \quad y = -(x + 3)^2 + 5$$

vertex:  $(-3, 5)$

max/min:  $y = 5$

axis of symmetry:  $x = -3$

step pattern:  $-1, -3, -5, -7$



## Standard Form Equations

$$y = ax^2 + bx + c$$

**a** - controls how fast the parabola goes up or down

- if 'a' is negative, curve is upside down

**b** - need to know nothin!

**c** - The y-intercept

## Factored Form Equations

$$y = a(x - r)(x - s)$$

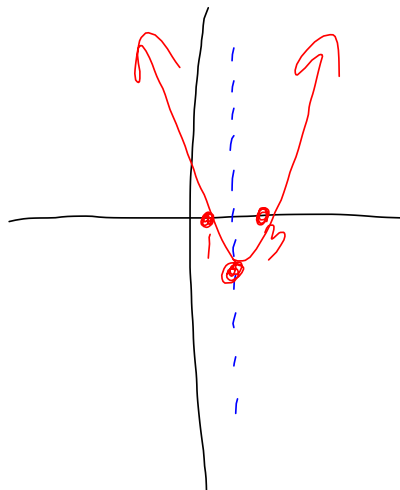
- a** - controls how fast the parabola goes up or down
- if 'a' is negative, curve is upside down

**r** - } x-intercepts, also known  
**s** - } as the zeros! :)

## Factored Form Equations

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

zeros:   +3   ,   +1  



x-value of vertex = 2

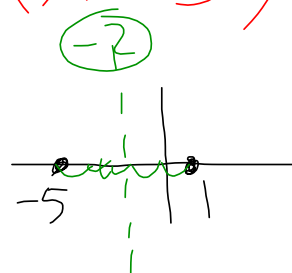
y-value of vertex

$$\begin{aligned} y &= 2(2-3)(2-1) \\ &= 2(-1)(1) \\ &= -2 \end{aligned}$$

## Factored Form Equations

$$y = -2(x-1)(x+5)$$

zeros: 1, -5



vertex: x-value is between the zeros

$$\frac{+1-5}{2} = \frac{-4}{2} = -2$$

y-value  $\Rightarrow$  plug in x-value and solve

$$y = -2(-2-1)(-2+5)$$

$$y = -2(-3)(3)$$

$$y = 18 \quad \text{vertex} = (-2, 18)$$



# Converting to Standard Form

Write the equation in standard form

$$y = 2(x + 4)(x + 3)$$

FOIL  
The GRID

First FOIL the brackets!

$$y = 2(x + 4)(x + 3)$$

$$y = 2(x^2 + 7x + 12)$$

$$y = 2x^2 + 14x + 24$$

y-intercept

## Converting to Standard Form

Write the equation in standard form

$$y = 2(x + 4)(x + 3)$$

$$y = 2(x^2 + 4x + 3x + 12)$$

Collect your like terms in the brackets

## Converting to Standard Form

Write the equation in standard form

$$y = 2(x + 4)(x + 3)$$

$$y = 2(x^2 + 4x + 3x + 12)$$

$$y = 2(x^2 + 7x + 12)$$

Multiply your 'a' value through the brackets

## Converting to Standard Form

Write the equation in standard form

$$y = 2(x + 4)(x + 3)$$

$$y = 2(x^2 + 4x + 3x + 12)$$

$$y = 2(x^2 + 7x + 12)$$

$$y = 2x^2 + 14x + 24$$

## Converting to Standard Form

Write the equation in standard form

$$y = 3(x - 2)(x + 5)$$

# Factoring

We factor so that we can figure out the zeros (x-intercepts) of a parabola.

Factor

$$y = \frac{2x^2}{2} + \frac{14x}{2} + \frac{24}{2}$$

$$y = 2(x^2 + 7x + 12)$$

Find two numbers that multiply to **12**  
and add to **7**.

3 and 4

$$y = 2(\underline{x+3})(\underline{x+4})$$

## Factoring $ax^2 + bx + c$

Factor and state the zeros

$$2x^2 + 10x + 12$$

Divide every term by the value of a.  
If a is 1, skip this step!



Factoring  $ax^2 + bx + c$

Factor and state the zeros

$$\begin{aligned} & 2x^2 + 10x + 12 \\ & = 2(x^2 + 5x + 6) \end{aligned}$$

Find two numbers that multiply to  $b$  and add to  $c$ .

Factoring  $ax^2 + bx + c$

Factor and state the zeros

$$\begin{aligned} & 2x^2 + 10x + 12 \\ &= 2(x^2 + 5x + 6) \\ &= 2(x + 2)(x + 3) \end{aligned}$$

$$Y = \frac{-2x^2}{-2} - \frac{14x}{-2} - \frac{20}{-2}$$

$$Y = -2(x^2 + 7x + 10)$$

$$Y = -2(x+2)(x+5)$$