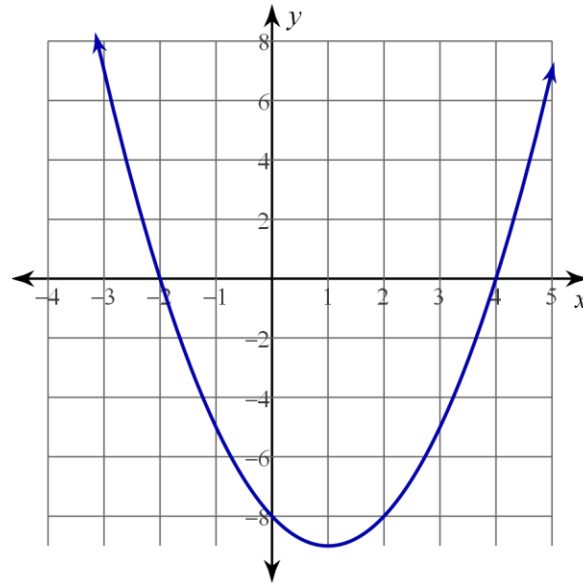


SM3-A Lesson 2-5 (Intercept Form Quadratic Equation)



Factor the following quadratic expressions:

$$x^2 + 11x + 30 \rightarrow (x + 5)(x + 6)$$

$$x^2 - 10x - 24 \rightarrow (x - 12)(x + 2)$$

$$x^2 - 8x + 15 \rightarrow (x - 5)(x - 3)$$

Standard Form Quadratic Equation

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

$$y = x^2 + 11x + 30$$

$$y = (x + 5)(x + 6)$$

$$y = x^2 - 10x - 24$$

$$y = (x - 12)(x + 2)$$

$$y = x^2 - 8x + 15$$

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

Intercept Form Quadratic Equation

$$y = a(x - p)(x - q)$$

Vocabulary

X-intercept: the x-y pair where the graph crosses the x-axis.

The y-value of an x-intercept always equals Zero

The Zero Product Property: Zero multiplied by any number equals zero.

The Zero Product Property: If two numbers are multiplied together and the product equals zero, then one or both of the factors must equal zero.

$A * B = 0$ → either $A = 0$ or $B = 0$ or both A and B equal zero.

Intercept form Quadratic Equation

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

The y-value of an x-intercept always equals Zero

$$0 = (x + 4)(x - 2)$$

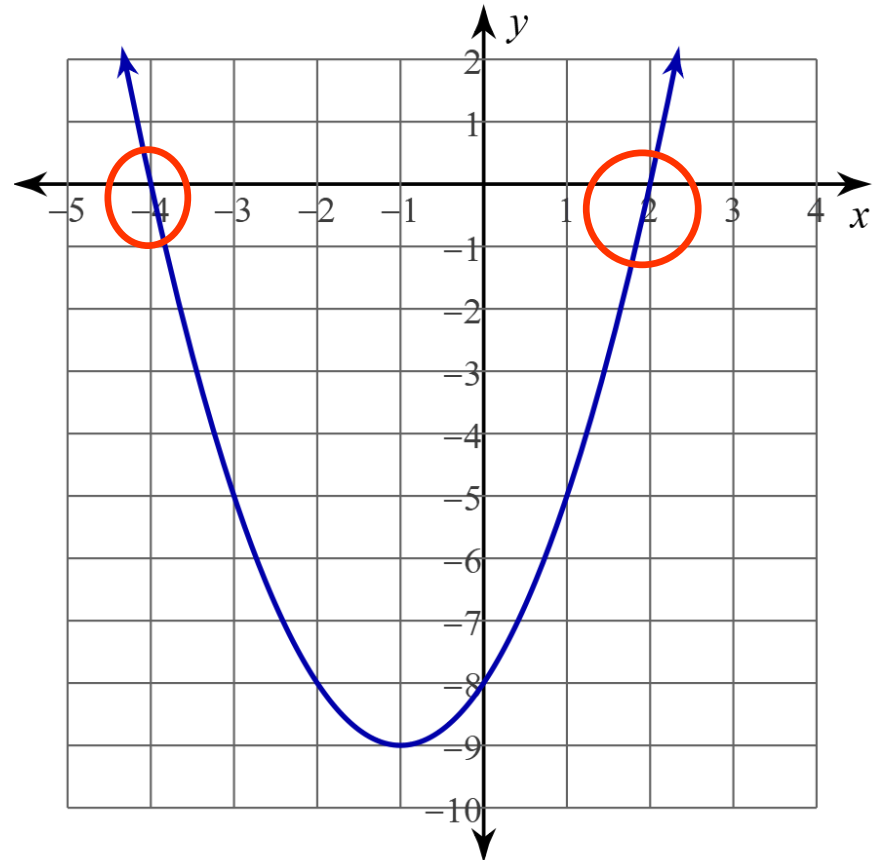
$$0 = A * B$$

Zero Product Property: either

$$(x + 4) = 0 \text{ or } (x - 2) = 0$$

$$x + 4 = 0 \quad x - 2 = 0$$

$$x = -4 \quad x = +2$$



Intercept form Quadratic Equation

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

The y-value of an x-intercept always equals Zero

$$0 = (x - 1)(x - 3)$$

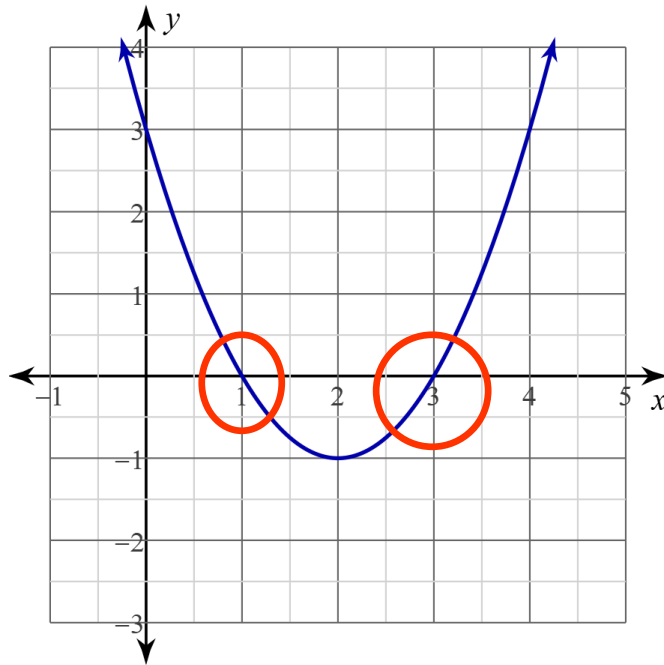
$$0 = A * B$$

Zero Product Property: either

$$(x - 1) = 0 \text{ or } (x - 3) = 0$$

$$x - 1 = 0 \qquad x - 3 = 0$$

$$x = 1 \qquad x = 3$$



Standard Form Quadratic Equation is converted to an Intercept Form Quadratic Equation by factoring.

$$y = x^2 + 10x + 21 \rightarrow y = (x + 7)(x + 3)$$
$$x = -7 \quad x = -3$$

$$y = x^2 - 6x - 16 \rightarrow y = (x - 8)(x + 2)$$
$$x = 8 \quad x = -2$$

$$y = x^2 - 9x + 18 \rightarrow y = (x - 6)(x - 3)$$
$$x = 6 \quad x = 3$$

What are the x-intercepts for each of these equations?

Convert the following Standard Form Quadratic Equations to Intercept Form (by factoring)

$$y = x^2 + 3x - 10 \rightarrow y = (x + 5)(x - 2)$$

$$x = -5 \quad x = 2$$

$$y = x^2 - 8x - 20 \rightarrow y = (x - 10)(x + 2)$$

$$x = 10 \quad x = -2$$

$$y = x^2 - 10x + 24 \rightarrow y = (x - 6)(x - 4)$$

$$x = 6 \quad x = 4$$

What are the x-intercepts for each of these equations?

Intercept Form Quadratic Equation:

Vertical
Stretch
Factor!

'x-intercepts are 'p' and 'q'

$$y = (-1)a(x - p)(x - q)$$

If negative: reflected
across x-axis.

'x-intercepts are:
'1' and '3'

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

Opens
down

'x-intercepts are:
'-2' and '-4'

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

Each set of parentheses is
called a "factor". Why?

Convert to Intercept Form

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

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

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

Always factor out the common factor first.

Now factor the trinomial.

What are the x-intercepts?

'x-intercepts are:
'-2' and '-1'

Which way (up/down) does the parabola open?

Up (not reflected across x-axis)

What is the vertical stretch factor?

VSF = 2

Convert to Intercept Form

$$y = 3x^2 - 15x - 18$$

$$y = 3(x^2 - 5x - 6)$$

$$y = 3(x - 6)(x + 1)$$

Always factor out the common factor first.

Now factor the trinomial.

What are the x-intercepts?

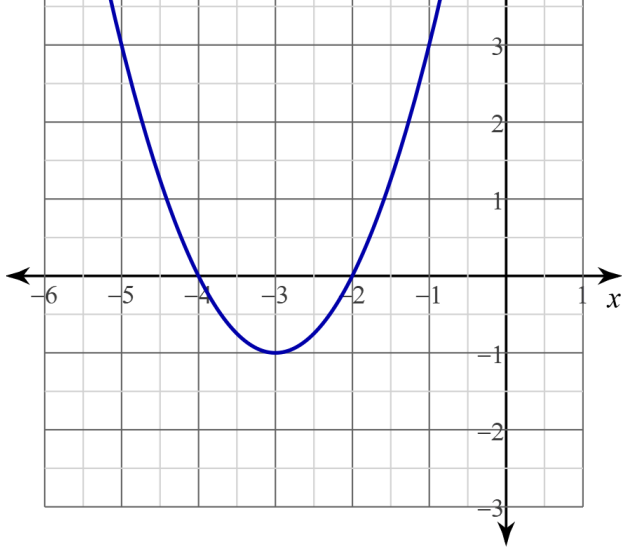
'x-intercepts are:
'6' and '-1'

Which way (up/down) does the parabola open?

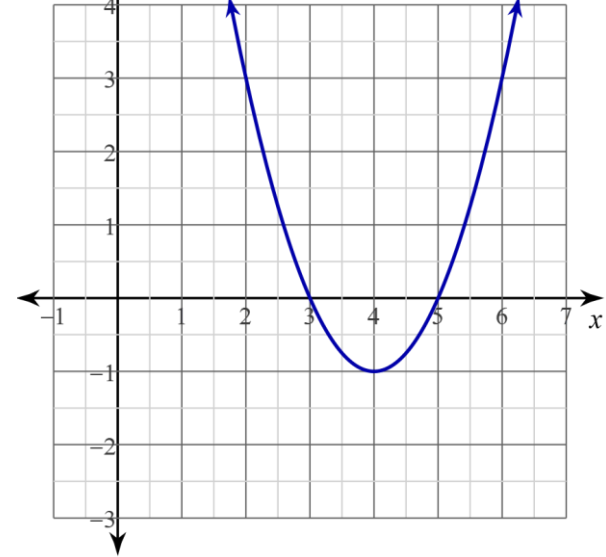
Up (not reflected across x-axis)

What is the vertical stretch factor?

VSF = 3



x-intercepts? '4' and '2'



x-intercepts? '3' and '5'

How can you use the x-intercepts to determine the x-coordinate of the vertex?

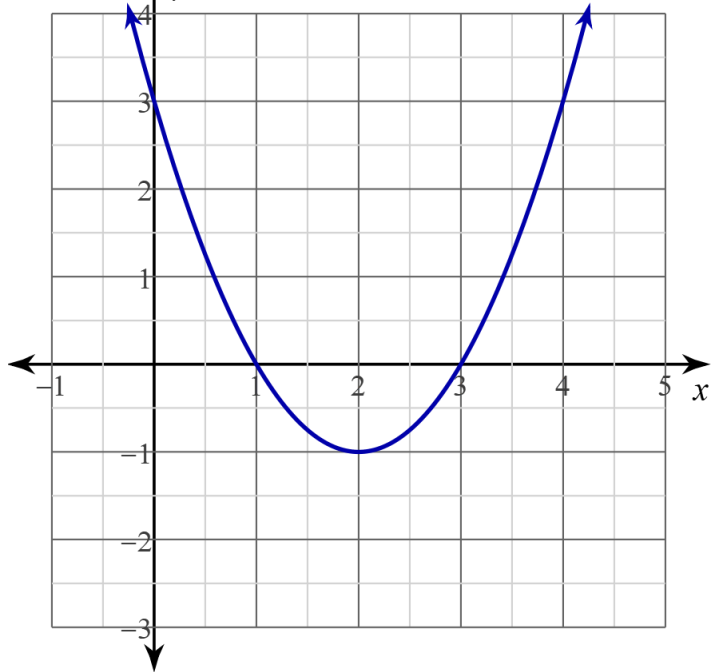
The x-coordinate of the vertex is halfway between the x-intercepts.

x-coordinate of the vertex?

(-3, ___)

x-coordinate of the vertex?

(4, ___)



x-intercepts?

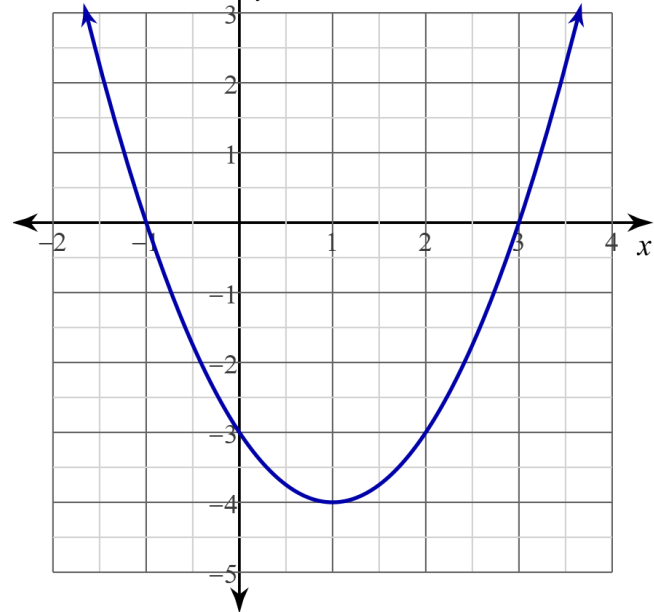
'x-intercepts are '1' and '3'

axis of symmetry?

$$x = 2$$

x-coordinate of the vertex?

(2, ___)



x-intercepts?

'x-intercepts are '-1' and '3'

axis of symmetry?

$$x = 1$$

x-coordinate of the vertex?

(1, ___)

How can you use the x-intercepts to determine the x-coordinate of the vertex?

Half-way between two numbers is the average of the two numbers. The axis of symmetry is exactly half-way between the two x-intercepts.

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

$$x = -5 \quad x = 1$$

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

What is the x-coordinate of the vertex?

$$(-2, \underline{\quad})$$

$$y = (x - 6)(x - 4)$$

$$x = 6 \quad x = 4$$

$$x = \frac{6 + 4}{2} = \frac{10}{2} = 5$$

What is the x-coordinate of the vertex?

$$(5, \underline{\quad})$$

Half-way between two numbers is the average of the two numbers. The axis of symmetry is exactly half-way between the two x-intercepts.

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

$$x = -5 \quad x = 1$$

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

What is the x-coordinate of the vertex?

$$(-2, \underline{\quad})$$

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

What is the y-coordinate of the vertex?

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

$$y = -9$$

What is the vertex?

$$(-2, -9)$$

What is the vertex?

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

$$x = -2 \quad x = 4$$

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

$$(1, \underline{\quad})$$

$$y = (1 + 2)(1 - 4)$$

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

$$y = -9$$

$$(1, -9)$$

$$y = (x - 6)(x - 4)$$

$$x = 6 \quad x = 4$$

$$x = \frac{6 + 4}{2} = \frac{10}{2} = 5$$

$$(5, \underline{\quad})$$

$$y = (5 - 6)(5 - 4)$$

$$y = (-1)(1)$$

$$y = -1$$

$$(5, -1)$$

Putting it all together!

What are the x-intercepts?

What is the vertex?

What is the graph?

$$y = -3x^2 + 6x + 72$$

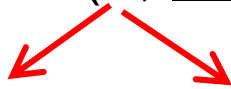
$$y = -3(x^2 - 2x - 24)$$

$$y = -3(x - 6)(x + 4)$$

$$x = \frac{6 - 4}{2} = \frac{2}{2} = 1$$

$$x = 6 \quad x = -4$$

$$(1, \text{---})$$



$$y = -3(1 - 6)(1 + 4)$$

$$y = -3(-5)(5)$$

$$y = 75$$

$$(1, 75)$$