

State the vertex.



$$y=x^2-6x-1$$

Complete the following:

$$(x+7)(x+7)$$

$$x^2 + 7x + 7x + 49$$

$$(x-3)(x-3)$$

$$x^2 - 3x - 3x + 9$$

$$x^2 - 6x + 9$$

$$(x-4)(x-4)$$

$$x^2 - 4x - 4x + 16$$

$$x^2 - 8x + 16$$

What do you notice?

Complete the following:

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$$(x+7)(x+7)$$

$$x^2 + 7x + 7x + 49$$

$$x^2 + 14x + 49$$

$$(x-3)(x-3)$$

$$x^2 - 3x - 3x + 9$$

$$x^2 - 6x + 9$$

$$(x-4)(x-4)$$

$$x^2 - 4x - 4x + 16$$

$$x^2 - 8x + 16$$

What do you notice?

$$x^2 + 14x \underline{+49}$$

☺ ☺

$$x^2 - 6x \underline{+9}$$

★ ★

$$x^2 - 8x \underline{+16}$$

✿ ✿

The constant is always one half of the numerical coefficient of x and then squared.

What do you notice?

Half it and Square it!

$$x^2 + 14x \quad \underline{\hspace{1cm}}$$

😊 😊

$$x^2 - 6x \quad \underline{\hspace{1cm}}$$

★ ★

$$x^2 - 8x \quad \underline{\hspace{1cm}}$$

🌸 🌸

The constant is always one half of the numerical coefficient of x and then squared.

Half it and Square it!

Complete the square.

$$x^2 + 6x + 9 = (x + 3)(x + 3) = (x + 3)^2$$

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

$$x^2 - 8x + 16 = (x - 4)(x - 4) = (x - 4)^2$$

Many
Quadratic functions
appear in general form:

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

$$y = 2x^2 + 3x + 8$$

Although you can graph the function in general form, using a table of values, it is much easier to graph a quadratic equation in standard form.



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

To make the transition
from general to standard form
we use a procedure called
"completing the square".



Example:



$$y = x^2 - 6x + 5$$



$$y - 5 = x^2 - 6x$$

STEPS:

Separate the constant from the terms with the x by moving it to the other side of the equation.

Example:



$y - 5 = x^2 - 6x + 9$ Determine what is to be added to $(x^2 - 6x)$ to make it a perfect square trinomial.



$$\left(\frac{6}{2}\right)^2$$

$$(3)^2$$

$$9$$

Use the numerical coefficient of "x", which is 6.

Half it and Square it!

Example:



$$y-5+9=x^2-6x+9$$

Add the new number to each side of the equation.

This will balance the equation

Example:



$$y-5+9=x^2-6x+9$$

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

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

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

$$\text{Vertex: } (3, -4)$$

$$\text{SF: } 1$$

$$\text{dir: up}$$

Factor the right side of the equation and simplify the left.

Rearrange the equation for y.
(Y must be by itself!)



$$y = x^2 - 6x + 5$$

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

Vertex: $(3, -4)$

SF:

1

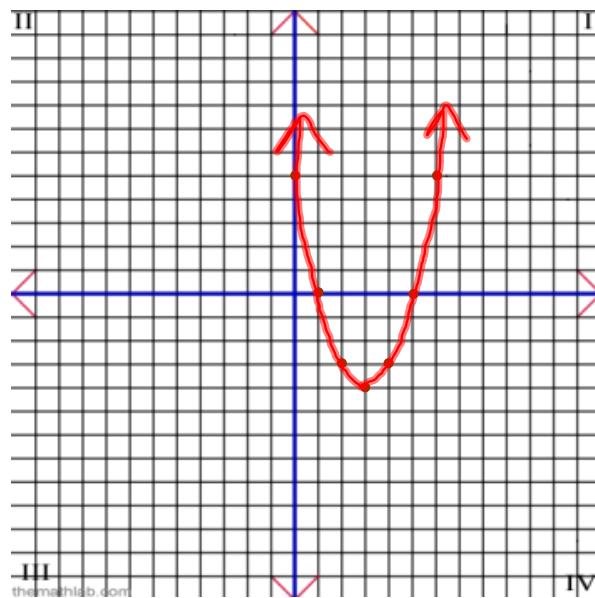
Dir:

up

Over	Up
1	1
2	4
3	9



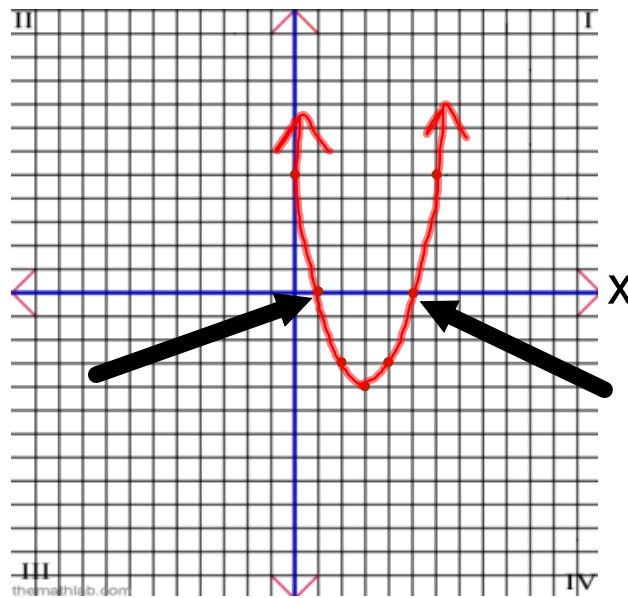
Look for the roots !!





Look for the roots !!

$x = 1$
 ε
 $x = 5$



The Roots are where the graph crosses the x-axis



1.

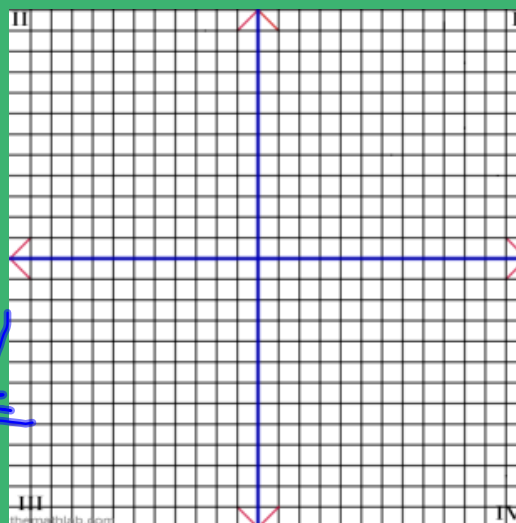
$$y = x^2 - 4x - 3$$

$$y + 3 = x^2 - 4x$$

$$y + 3 + 4 = x^2 - 4x + 4$$

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

$$y = (x - 2)^2 - 7$$



Vertex : (2, -7)

SF: 1

Dir: Up



2.

$$y = x^2 - 8x + 12$$

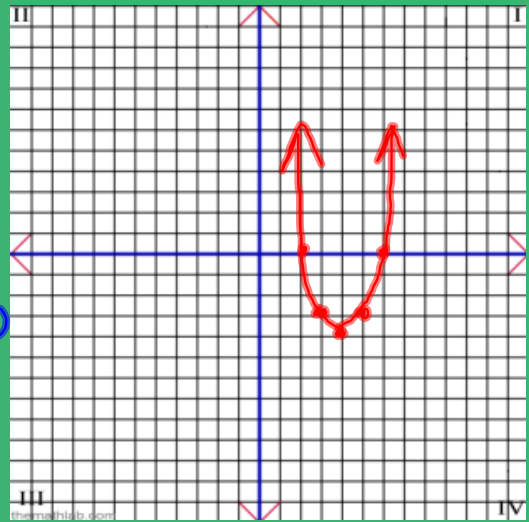
$$y - 12 = x^2 - 8x$$

$$y - 12 + 16 = x^2 - 8x + 16$$

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

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

Roots are $x = 2$ & 6



Vertex : $(4, -4)$

SF: 1

Dir: up



3.

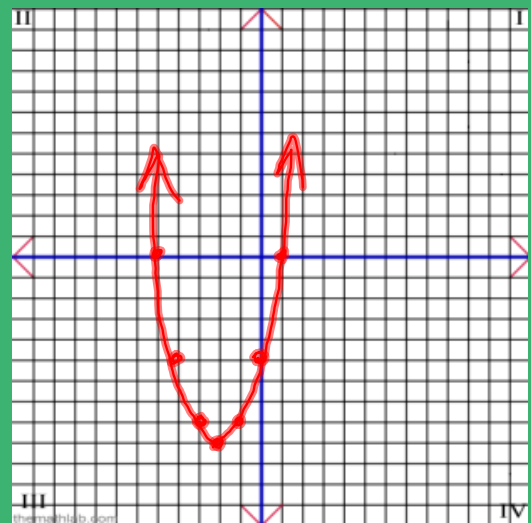
$$y = x^2 + 4x - 5$$

$$y + 5 + 4 = x^2 + 4x + 4$$

$$y + 9 = (x + 2)^2$$

$$y = (x + 2)^2 - 9$$

Roots $x = 1$ & $x = -5$



Vertex : $(-2, -9)$

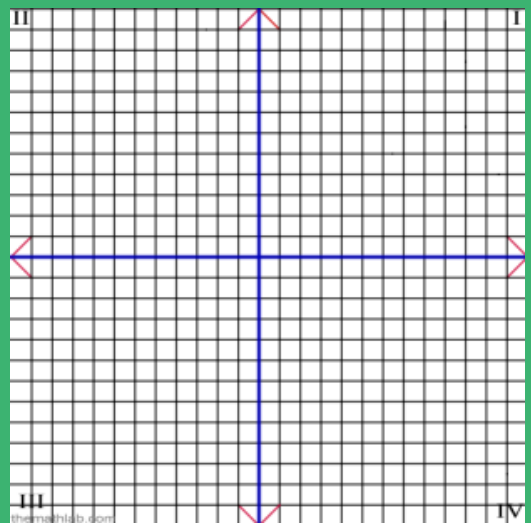
SF: 1

Dir: up



4.

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



Vertex :

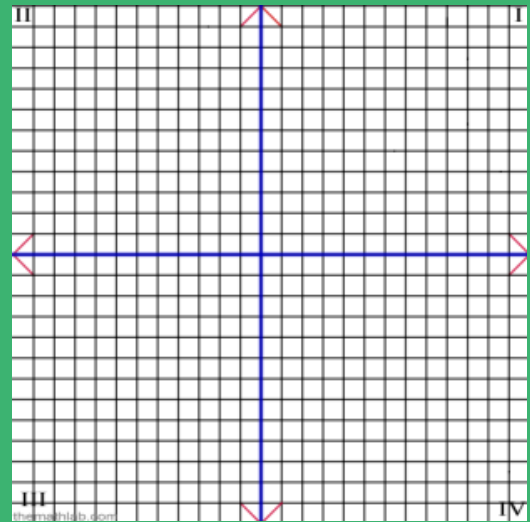
SF:

Dir:



5.

$$y = x^2 - 4x + 3$$



Vertex :

SF:

Dir:



6.

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

What do you notice?

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

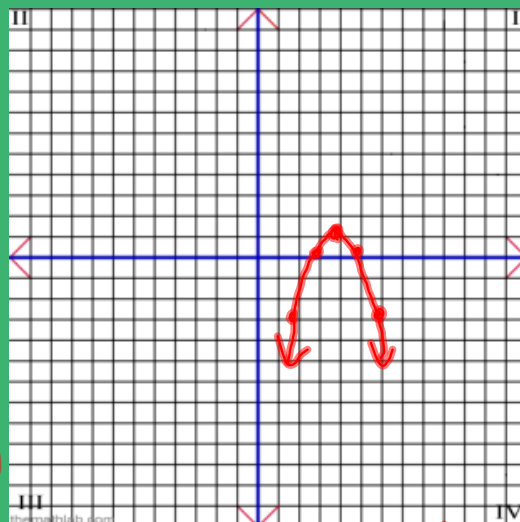
$$y + 15 = -1(x^2 - 8x)$$

$$y + 15 - 16 = -1(x^2 - 8x + 16)$$

$$y - 1 = -1(x - 4)^2$$

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

Roots $x = 3$ & $x = 5$



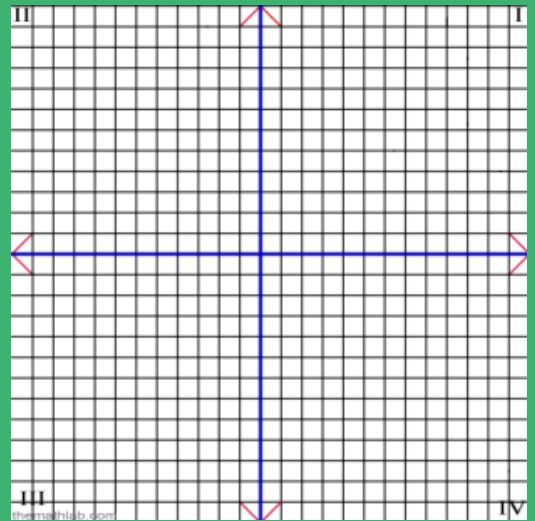
Vertex : (4, 1)

SF: 1

Dir: Down



$$y = -x^2 - 10x - 21$$



Vertex :

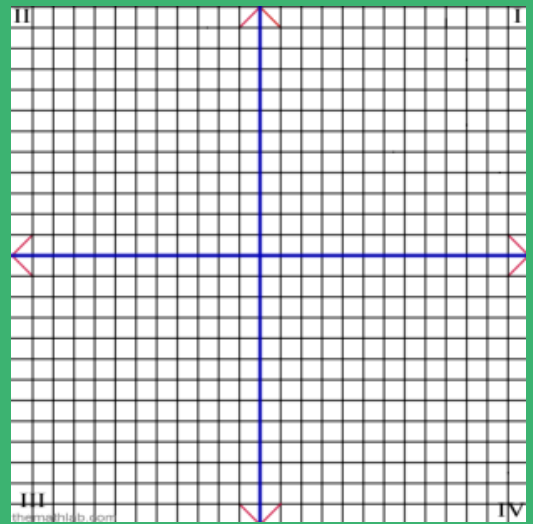
SF:

Dir:

8.



$$y = 5x^2 + 40x - 1$$



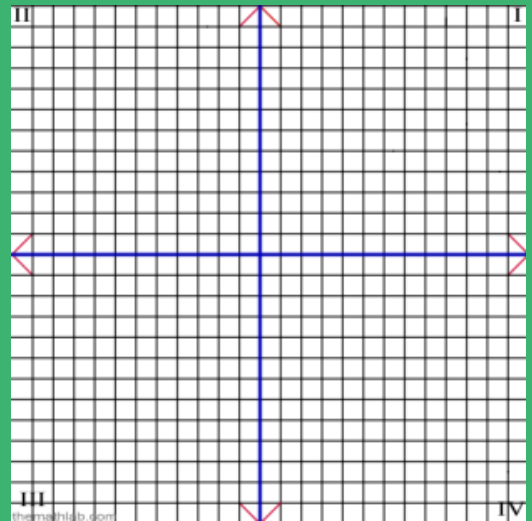
Vertex :

SF:

Dir:



$$y = -5x^2 - 20x - 5$$



Vertex :

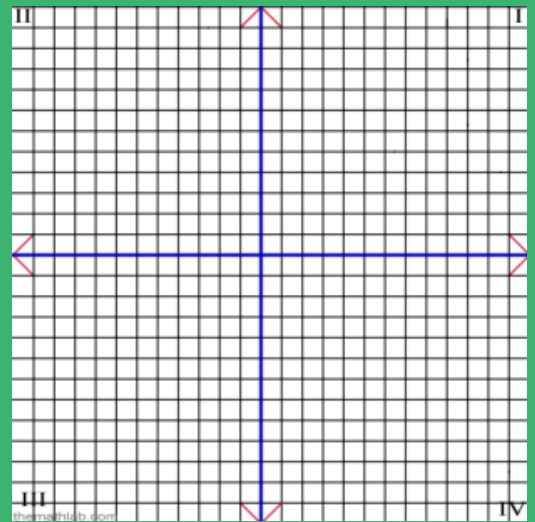
SF:

Dir:



10.

$$y = -2x^2 - 16x - 1$$



Vertex :

SF:

Dir: