

State the vertex.



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

Complete the following:

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

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

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

What do you notice?

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

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

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



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

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

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



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

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

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



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

What do you notice?

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

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

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



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

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

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



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

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

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



The constant is always half of
the numeric value of x and
then

Half it and Square it!

What do you notice?

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



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

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



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

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



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



The factors are always one half of the middle term.

Half it and Square it!

Complete the square.

$$x^2 + 6x + \underline{9} = (x + \underline{3})(x + \underline{3})$$

$$x^2 + 2x + \underline{1} = (x + \underline{1})(x + \underline{1})$$

$$x^2 - 8x + \underline{16} = (x - \underline{4})(x - \underline{4})$$

Many
Quadratic functions
appear in general form:

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

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:



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

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:



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

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

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

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

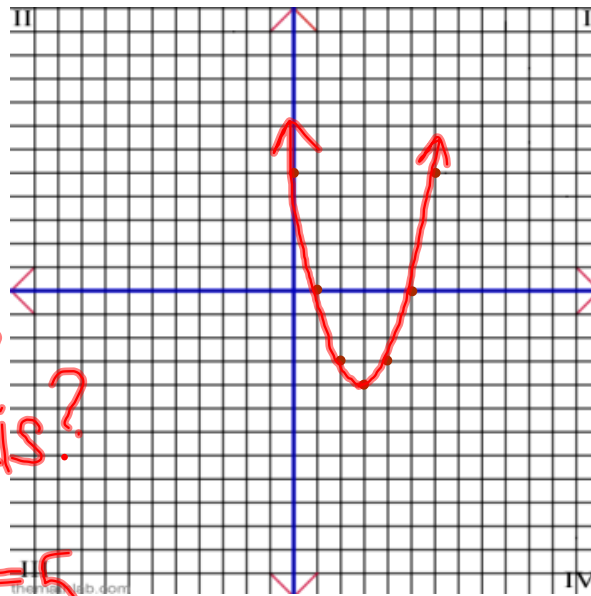
Over	Up
1	1
2	4
3	9



Look for the roots !!

Where
does the
line cross
the x-axis?

$x=1$ & $x=5$





$$1. y = x^2 - 4x + 2$$

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

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

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

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

$$V (2, -2)$$

$$SF: 1$$

dir: up



$$x = 0.7 \text{ \& } x = 3.7$$



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

$$y + 12 \stackrel{+16}{=} x^2 - 8x + 16$$

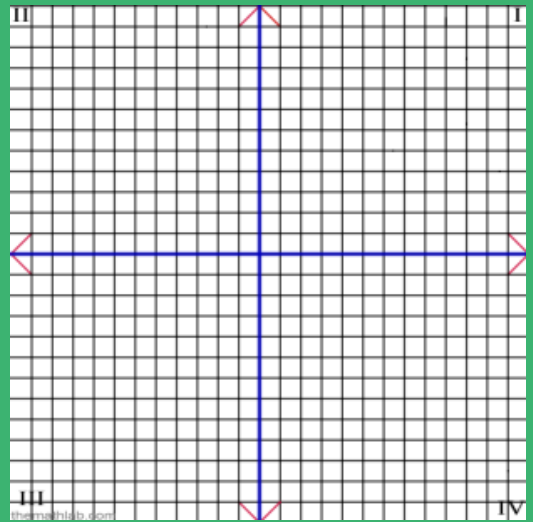
$$y + 28 = (x - 4)^2 - 28$$

$$y = (x - 4)^2 - 28$$

$$(4, -28)$$

$$SF = 1$$

dir = up





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

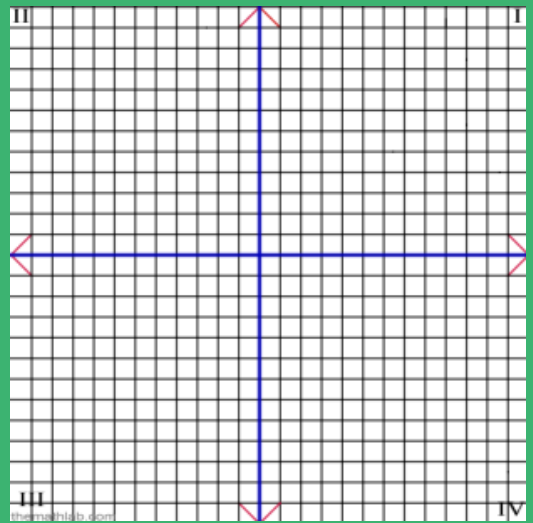
$$y + 5 = x^2 + 4x + 4$$

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

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

$$V(-2, -9)$$

$$SF = 1$$
$$dir = up$$



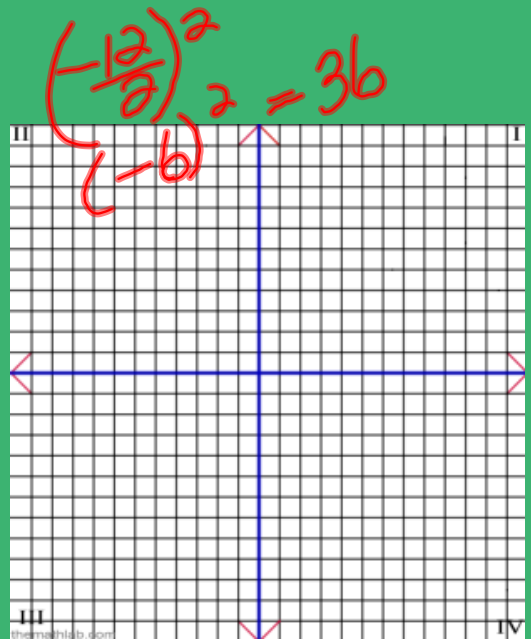


$$4. \quad y = x^2 - 12x - 28$$

$$y + 28 + 36 = x^2 - 12x + 36$$

$$y + 64 = (x - 6)^2$$

$$y = (x - 6)^2 - 64$$



$$y = -x^2 - 4x + 8$$

$$y - 8 = -x^2 - 4x$$

$$y - 8 = -1(x^2 + 4x)$$

$$y - 8 - 4 = -1(x^2 + 4x + 4)$$

$$y + 12 = -1(x + 2)^2 + 12$$

$$y = -1(x + 2)^2 + 12$$

$$\begin{aligned} & \left(\frac{4}{2}\right)^2 \\ & 2^2 \\ & = 4 \end{aligned}$$

$$y = -x^2 - 8x + 1$$

$$y - 1 = -x^2 - 8x$$

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

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

$$y - 1 - 16 = -1(x + 4)^2$$

$$y - 17 = -1(x + 4)^2$$

$$y = -1(x + 4)^2 + 17$$

$$\left(\frac{8}{2}\right)^2$$
$$4^2$$
$$-16$$