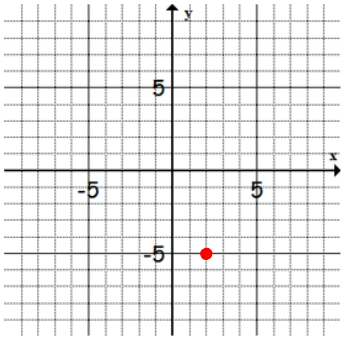
NOTES 1a-3 graphing a parabola by finding the vertex

When a quadratic equation is written in **VERTEX FORM**, $y = a(x-h)^2 + k$ finding the vertex is easy because the coordinates are in the equation. It is (h,k).

EXAMPLE: $y = 1(x-2)^2 - 5$ (a = 1, h = 2, k = −5) The vertex point is (2,-5)

To graph follow the "1,3,5 pattern" for parabolas.

Remember, parabolas are symmetrical.



When a quadratic equation is written in **STANDARD FORM**, $y = ax^2+bx+c$

we will use the **Vertex Formula** $x = \frac{-b}{2a}$ to find the x-value of the vertex.

EXAMPLE: $y = 2x^2 - 12x + 13$ $a=2$ $b=-12$ $c=13$

$x = \frac{-b}{2a}$

$x = \frac{-(-12)}{2(2)} = \frac{12}{4} = 3$

The vertex is at (3, y).

Then use substitution to find the y-value.

Order of operations! left to right

$y = 2(3)^2 - 12(3) + 13$

$y = 2(9) - 36 + 13$

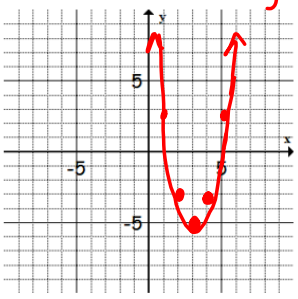
$y = 18 - 36 + 13$

$y = -5$

The vertex point is (3,-5)

To graph follow the "1,3,5 pattern" for parabolas.

BUT, a=2 so we need to double the pattern to a "2, 6, 10 pattern".



When a quadratic equation is written in **FACTORED FORM**, $y = a(x - r_1)(x - r_2)$

The vertex is on the line of symmetry through the midpoint of the x-intercepts.

EXAMPLE: $y = 1(x-1)(x-9)$

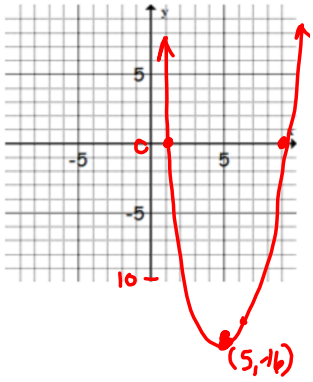
Step 1: Find the x-intercepts:

Let $y = 0$ $\quad 0 = (x-1)(x-9)$

$x - 1 = 0 \quad x = 1$ $\qquad x - 9 = 0 \quad x = 9$

The x-intercepts are: $(1,0), (9,0)$

roots, zeroes



Step 2: Average the x-intercepts:

$x = \frac{1+9}{2}$

$x = \frac{10}{2} = 5$

The vertex is at (5 , y)

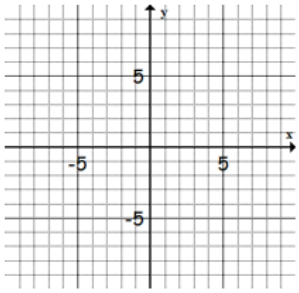
Step 3: Use substitution to find the y-value.

$y = (5-1)(5-9)$

$= (4)(-4)$

$y = -16$

The vertex point is $(5, -16)$



OR, if you love the vertex formula, you can rewrite it in standard form, then use the vertex formula.