10.2: graphing quadratics in standard form

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

a tells us: (leading coefficient)
- wide or narrow
  - wide → $0 < a < 1$
  - narrow → $a > 1$
- flip? (opens up or down)
  - up → a is positive
  - down → a is negative

c tells us:
- shift?
  - c is positive → ↑
  - c is negative → ↓
- y-intercept $(0, c)$

b tells us:
- x-coordinate of the vertex & line of symmetry

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

Finding the axis of symmetry & vertex:

Step 1: $\boxed{x = \frac{-b}{2a}}$

* this is the equation of your axis of symm. & the x-coordinate of your vertex

Step 2: plug in x-value to the original equation to solve for the y-coordinate of your vertex

EX: Find the vertex & axis of symmetry of the following:

① $y = x^2 - 6x + 11$ $\quad a=1 \quad b=-6 \quad c=11$

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

$x = \frac{-(-6)}{2(1)} = \frac{6}{2} = 3$

$y = x^2 - 6x + 11$

$y = (3)^2 - 6(3) + 11$

$y = 9 - 18 + 11$

Vertex:

② $y = -x^2 - 10x + 0$ $\quad a=-1 \quad b=-10 \quad c=0$

$x = \frac{-b}{2a} = \frac{-(-10)}{2(-1)} = \frac{10}{-2} = -5$

$y = -x^2 - 10x$

$y = -(-5)^2 - 10(-5)$

$y = -(25) + 50$

$y = 25$

③ $y = \frac{1}{2}x^2 + 8x - 9$ $\quad a=\frac{1}{2} \quad b=8 \quad c=-9$

$x = \frac{-b}{2a} = \frac{-8}{2(\frac{1}{2})} = \frac{-8}{1} = -8$

$y = \frac{1}{2}(-8)^2 + 8(-8) - 9$

$y = \frac{1}{2}(64) - 64 - 9$

$y = 9 - 18 + 11$

$y = 2$

Vertex: (3, 2)
A. of S.: $x = 3$

$y = 25$

Vertex: (−5, 25)
A. of S.: $x = -5$

$y = \frac{1}{2}(64) - 64 - 9$
$y = 32 - 64 - 9$
$y = -41$

Vertex: (−8, −41)
A. of S.: $x = -8$

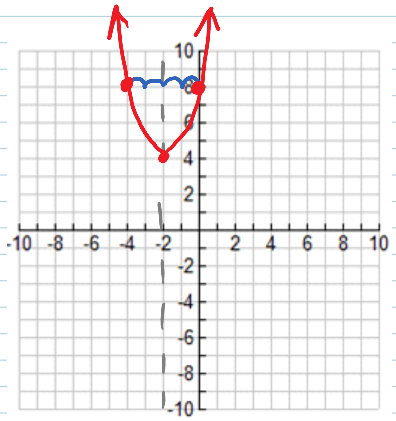
Practice Graphing!

graph the following quadratic equations:

① $y = x^2 + 4x + 8$

$a = 1 \quad b = 4 \quad c = 8$

(0, 8)



$x = \frac{-b}{2a} = \frac{-4}{2(1)} = -2$

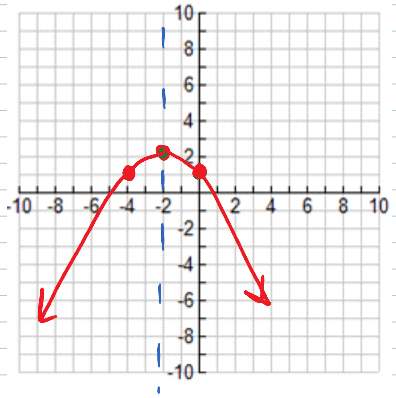
$y = x^2 + 4x + 8$
$y = (-2)^2 + 4(-2) + 8$
$y = 4 - 8 + 8$
$y = 4$

vertex: (−2, 4)
a. of s. $x = -2$

② $y = -\frac{1}{4}x^2 - x + 1$

$a = -\frac{1}{4} \quad b = -1 \quad c = 1$

(0, 1)



Vertex: (−2, 2)

$x = \frac{-b}{2a} = \frac{-(-1)}{2(-\frac{1}{4})} = \frac{1}{-\frac{1}{2}}$

$1 \div -\frac{1}{2}$

$1 \cdot -\frac{2}{1} = -2$

$y = -\frac{1}{4}(-2)^2 - (-2) + 1$
$y = -\frac{1}{4}(4) + 2 + 1$
$y = -1 + 2 + 1$
$y = 2$