

## 2.1 QUADRATIC EQUATIONS

Key

Given the following information, determine the missing pieces ↓

<p><b>Quadratic Equation:</b> <math>y = x^2 + 4x + 9</math>  <b>Equation in Standard Form:</b> <math>y = (x+2)^2 + 5</math>  <b>Point on the Graph:</b> (0, 9)  <b>Vertex:</b> (-2, 5)  <b>X-Intercepts:</b> None  <b>Graph:</b></p> <p> <math>9 = a(0 - (-2))^2 + 5</math>  <math>9 = a(4) + 5</math>  <math>4 = 4a</math>  <math>a = 1</math>  <math>y = (x+2)(x+2) + 5</math>  <math>x^2 + 4x + 4 + 5</math>  <math>y = x^2 + 4x + 9</math>  <math>\frac{-4 \pm \sqrt{16 - 4(1)(9)}}{2} = \frac{-4 \pm \sqrt{-20}}{2}</math>                      No X-INT                 </p>	<p><b>Quadratic Equation:</b> <math>f(x) = x^2 - 8x + 16</math>  <b>Equation in Standard Form:</b> <math>y = (x-4)^2</math>  <b>Point on the Graph:</b> (0, 16)  <b>Vertex:</b> (4, 0)  <b>X-Intercepts:</b> (4, 0) → only 1  <b>Graph:</b></p> <p> <math>y = x^2 - 8x + 16</math>  <math>y - 16 = x^2 - 8x</math>  <math>y - 16 + 16 = x^2 - 8x + 16</math>  <math>y = (x-4)^2</math>  <math>0 = (x-4)^2</math>  <math>0 = x-4</math>  <math>x = 4</math>                      (4, 0)                 </p>
<p><b>Quadratic Equation:</b> <math>f(x) = 2x^2 - x + 1</math>  <b>Equation in Standard Form:</b> <math>y = 2(x - \frac{1}{4})^2 + \frac{7}{8}</math>  <b>Point on the Graph:</b> (0, 1)  <b>Vertex:</b> (<math>\frac{1}{4}, \frac{7}{8}</math>)  <b>X-Intercepts:</b> None  <b>Graph:</b></p> <p> <math>y - 1 = 2(x^2 - \frac{1}{2})</math>  <math>y - 1 + \frac{1}{8} = 2(x^2 - \frac{1}{2} + \frac{1}{16})</math>  <math>y - \frac{7}{8} = 2(x - \frac{1}{4})^2</math>  <math>y = 2(x - \frac{1}{4})^2 + \frac{7}{8}</math>  <math>\frac{1 \pm \sqrt{1 - 4(2)(1)}}{2(2)}</math> </p>	<p><b>Quadratic Equation:</b> <math>y = x^2 - 2x - 3</math>  <b>Equation in Standard Form:</b> <math>y = (x-1)^2 - 4</math>  <b>Point on the Graph:</b> (0, -3)  <b>Vertex:</b> (1, -4)  <b>X-Intercepts:</b> (-1, 0), (3, 0)  <b>Graph:</b></p> <p> <math>(x+1)(x-3)</math>  <math>x^2 - 3x + x - 3</math>  <math>y = x^2 - 2x - 3</math>  <math>y + 3 = x^2 - 2x</math>  <math>y + 3 + 1 = x^2 - 2x + 1</math>  <math>y + 4 = (x-1)^2</math>  <math>y = (x-1)^2 - 4</math>                      *Answers may vary, as many functions can have these x-intercepts                 </p>

**Quadratic Equation:**  $y = -x^2 - \frac{1}{2}x - \frac{17}{16}$   
**Equation in Standard Form:**  $y = -1(x + \frac{1}{4})^2 - 1$   
**Point on the Graph:**  $(0, -17/16)$   
**Vertex:**  $(-1/4, -1)$   
**X-Intercepts:** NONE  
**Graph:**

$$0 = -1(x + \frac{1}{4})^2 - 1$$

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

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

$$-\frac{17}{16} = a(0 - \frac{1}{4})^2 - 1$$

$$-\frac{17}{16} = a(\frac{1}{16}) - 1$$

$$-\frac{1}{16} = \frac{1}{16}a$$

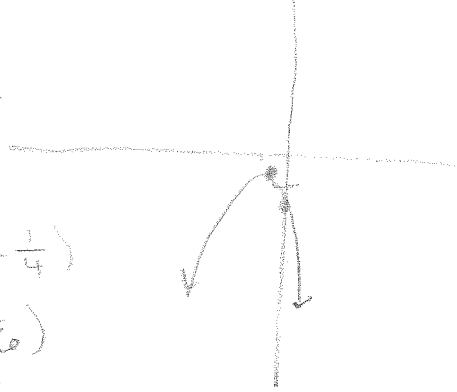
$$a = -1$$

$$(x + \frac{1}{4})(x + \frac{1}{4})$$

$$-(x^2 - \frac{1}{2}x + \frac{1}{16})$$

$$-x^2 - \frac{1}{2}x - \frac{1}{16} - 1$$

$$-x^2 - \frac{1}{2}x - \frac{17}{16}$$



**Quadratic Equation:**  $y = -\frac{5}{4}x^2 - 5x - 1$   
**Equation in Standard Form:**  $y = -\frac{5}{4}(x+2)^2 + 4$   
**Point on the Graph:**  $(-4, -1)$   
**Vertex:**  $(-2, 4)$   
**X-Intercepts:**  $(\frac{16}{5} - 2, 0)$  and  $(\frac{16}{5} - 2, 0)$   
**Graph:**

$$-1 = a(-4+2)^2 + 4$$

$$-1 = a(4) + 4$$

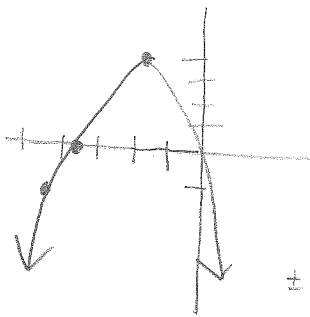
$$-5 = 4a$$

$$a = -\frac{5}{4}$$

$$-\frac{5}{4}(x^2 + 4x + 4) + 4$$

$$-\frac{5}{4}x^2 - 5x - 5 + 4$$

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



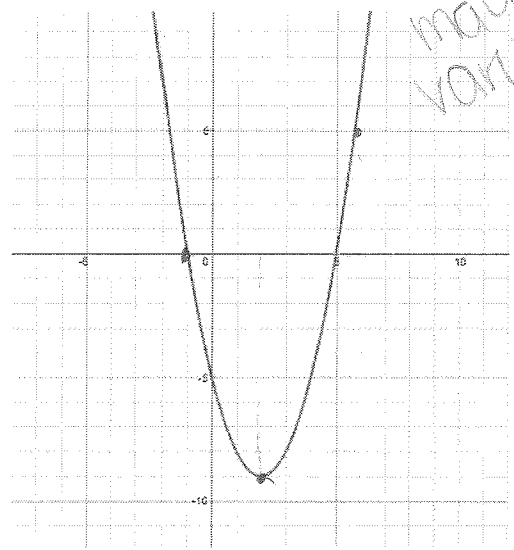
$$0 = -\frac{5}{4}(x+2)^2 + 4$$

$$-4 = -\frac{5}{4}(x+2)^2$$

$$\frac{16}{5} = (x+2)^2$$

$$\pm \sqrt{\frac{16}{5}} = x+2$$

**Quadratic Equation:**  $y = x^2 - 4x - 5$   
**Equation in Standard Form:**  $y = (x-2)^2 - 9$   
**Point on the Graph:**  $(6, 5)$   
**Vertex:**  $(2, -9)$   
**X-Intercepts:**  $(-1, 0)$  and  $(5, 0)$   
**Graph:**



# answers may vary

$$0 = a(-1-2)^2 - 9$$

$$0 = a(9) - 9$$

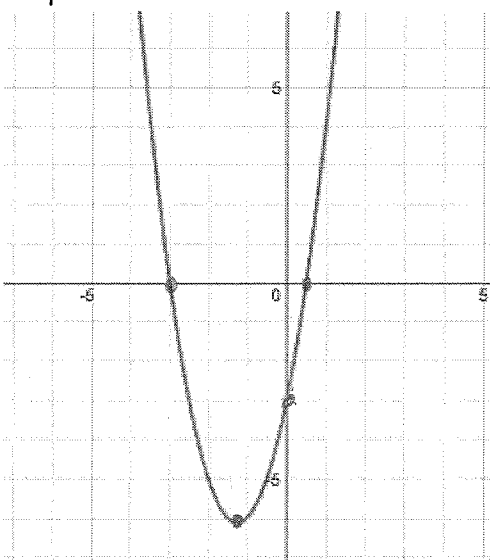
$$9 = 9a \quad a = 1$$

$$(x-2)(x-2) - 9$$

$$x^2 - 4x + 4 - 9$$

$$x^2 - 4x - 5$$

**Quadratic Equation:**  $y = \frac{3}{2}x^2 + 3x - \frac{9}{2}$   
**Equation in Standard Form:**  $y = \frac{3}{2}(x+1)^2 - 6$   
**Point on the Graph:**  $(0, -3)$   
**Vertex:**  $(-1, -6)$   
**X-Intercepts:**  $(-3, 0)$  and  $(\frac{1}{2}, 0)$   
**Graph:**



# answers may vary

$$0 = a(-3+1)^2 - 6$$

$$0 = a(-2)^2 - 6$$

$$0 = 4a - 6$$

$$6 = 4a$$

$$a = \frac{3}{2}$$

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

$$\frac{3}{2}x^2 + 3x + \frac{3}{2} - 6$$

$$\frac{3}{2}x^2 + 3x - \frac{9}{2}$$