

# Day 06 Writing Equations of Quadratic Functions Notes/HW

Master G

## How to Write a Quadratic Equation in Vertex Form when given the vertex and a point on the parabola:

1. Substitute the given vertex  $(h, k)$  into the vertex form  $y = a(x - h)^2 + k$ .
2. Substitute the coordinates of the given point  $(x, y)$  into the same equation and solve for the only remaining variable,  $a$ .
3. Write the equation by substituting  $h, k,$  and  $a$  into the vertex form  $y = a(x - h)^2 + k$ .

**Example:** Write the quadratic equation in *vertex form* of the parabola with vertex  $(2, -2)$  and which passes through the point  $(0, 2)$ .

1. The vertex is  $(2, -2) = (h, k)$        $y = a(x - 2)^2 - 2$
2. The given point is  $(0, 2) = (x, y)$        $2 = a(0 - 2)^2 - 2$   
Solve for  $a$ :       $2 = a(-2)^2 - 2$        $2 = 4a - 2 \rightarrow 4 = 4a \rightarrow a = 1$
3. Substitute  $h, k$  and  $a$ :       $y = 1(x - 2)^2 - 2$        $\rightarrow$        $y = (x - 2)^2 - 2$

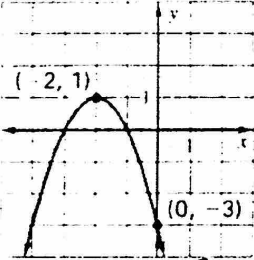
## How to Write a Quadratic Equation in Factored Form given the x-intercepts and a point on the parabola:

1. Substitute the given x-intercepts,  $p$  and  $q$ , into the intercept form  $y = a(x - p)(x - q)$ .
2. Substitute coordinates of the given point  $(x, y)$  into the same equation and solve for the only remaining variable,  $a$ .
3. Write the equation by substituting  $p, q,$  and  $a$  into the intercept form  $y = a(x - p)(x - q)$ .

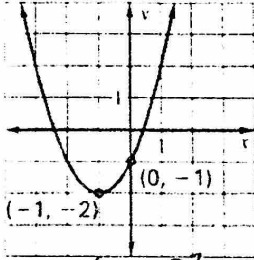
**Example:** Write the quadratic equation in *intercept form* whose graph has x-intercepts at  $-5$  and  $0$  and passes through the point  $(-3, 18)$ .

1. The x-intercepts are  $-5$  and  $0$  ( $p$  and  $q$ )       $y = a(x + 5)(x - 0)$
2. The given point is  $(-3, 18) = (x, y)$        $18 = a(-3 + 5)(-3 - 0)$   
 $18 = a(2)(-3) \rightarrow 18 = -6a \rightarrow a = -3$
3. Substitute  $p, q$  and  $a$ :       $y = -3(x + 5)(x - 0) \rightarrow y = -3x(x + 5)$

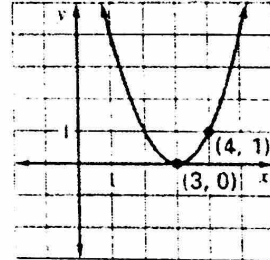
### 1-3: Write a quadratic equation in vertex form of the parabola given.

1. 

$y = a(x + 2)^2 + 1$   
 $-3 = a(0 + 2)^2 + 1$   
 $-3 = 4a + 1$   
 $-4 = 4a$   
 $-1 = a$   
 $y = -(x + 2)^2 + 1$

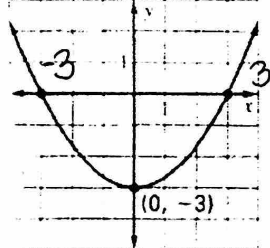
2. 

$y = a(x + 1)^2 - 2$   
 $-1 = a(0 + 1)^2 - 2$   
 $-1 = a - 2$   
 $1 = a$   
 $y = (x + 1)^2 - 2$

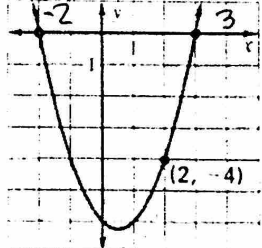
3. 

$y = a(x - 3)^2$   
 $1 = a(4 - 3)^2$   
 $1 = a$   
 $y = (x - 3)^2$

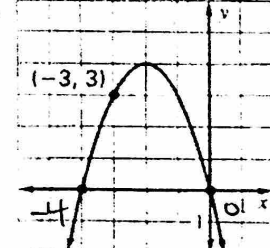
### 4-6: Write a quadratic equation in intercept form of the parabola given.

4. 

$y = a(x + 3)(x - 3)$   
 $-3 = a(0 + 3)(0 - 3)$   
 $-3 = a(3)(-3)$   
 $-3 = -9a \Rightarrow a = \frac{1}{3}$   
 $y = \frac{1}{3}(x + 3)(x - 3)$

5. 

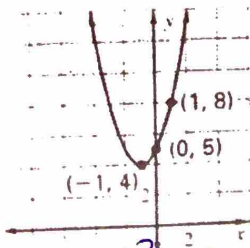
$y = a(x + 2)(x - 3)$   
 $-4 = a(2 + 2)(2 - 3)$   
 $-4 = a(4)(-1)$   
 $-4 = -4a$   
 $1 = a$   
 $y = (x + 2)(x - 3)$

6. 

$y = a(x + 4)(x)$   
 $3 = a(-3 + 4)(-3)$   
 $3 = a(1)(-3)$   
 $3 = -3a$   
 $-1 = a$   
 $y = -(x + 4)(x)$

7-12: Write a quadratic equation in standard form of the parabola given. Remember, you must write it in either vertex or factored form first!

7.



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

$$5 = a(0+1)^2 + 4$$

$$5 = a + 4$$

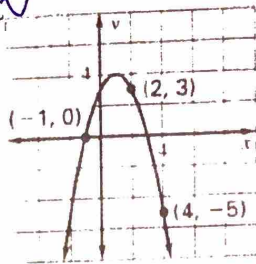
$$1 = a$$

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

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

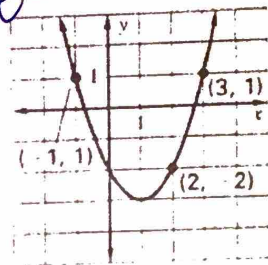
$$y = x^2 + 2x + 5$$

Don't



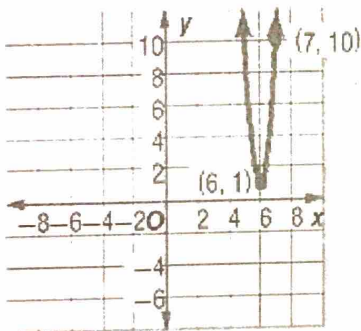
$$y = a$$

Don't



$$y = a$$

10.



$$y = a(x-6)^2 + 1$$

$$10 = a(7-6)^2 + 1$$

$$10 = a + 1$$

$$9 = a$$

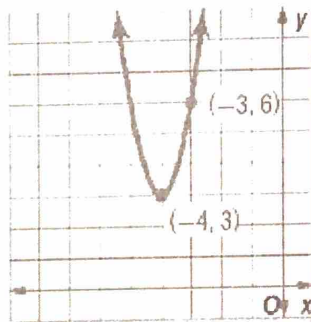
$$y = 9(x-6)^2 + 1$$

$$= 9(x^2 - 12x + 36) + 1$$

$$= 9x^2 - 108x + 324 + 1$$

$$y = 9x^2 - 108x + 325$$

11.



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

$$6 = a(-3+4)^2 + 3$$

$$6 = a + 3$$

$$3 = a$$

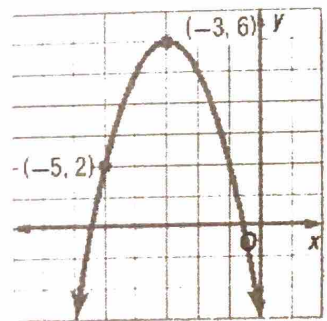
$$y = 3(x+4)^2 + 3$$

$$= 3(x^2 + 8x + 16) + 3$$

$$= 3x^2 + 24x + 48 + 3$$

$$y = 3x^2 + 24x + 51$$

12.



$$y = a(x+3)^2 + 6$$

$$2 = a(-5+3)^2 + 6$$

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

$$2 = 4a + 6$$

$$-4 = 4a$$

$$-1 = a$$

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

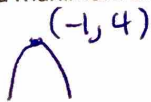
$$= -(x^2 + 6x + 9) + 6$$

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

$$y = -x^2 - 6x - 3$$

13-14: Write a quadratic equation in standard form of the quadratic function described. Hint: Think of all 3 forms!

13. I have a maximum of (-1, 4) and a vertical stretch of 2.



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

$$y = 2x^2 + 4x + 6$$

14. I have zeros at -1 and 3 and also include the point (-2, -5).

$$y = a(x+1)(x-3)$$

$$-5 = a(-2+1)(-2-3)$$

$$-5 = a(-1)(-5)$$

$$-5 = 5a$$

$$-1 = a$$

$$y = -(x+1)(x-3)$$

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

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