

### 6.3 Writing Quadratic Equations

Warmup: Write the equation of each line using the given information.

a. Line with slope of 2 through the point (-3, -7)

$$y = mx + b$$

$$y = 2x + b$$

$$-7 = 2(-3) + b$$

$$-7 = -6 + b$$

$$-1 = b$$

$y = 2x - 1$

Plug in point for x & y

b. Line with y-intercept of (0,4) through the point (5,3)

$$y = mx + b$$

$$y = mx + 4$$

$$3 = m(5) + 4$$

$$3 = 5m + 4$$

$$-1 = 5m$$

$$-\frac{1}{5} = m$$

$$M = -\frac{1}{5}$$

$y = -\frac{1}{5}x + 4$

The equations you wrote above are linear models. Today we will be focusing on quadratic models. For each form, identify what information is given by each feature in the equation.

Standard Form	Intercept Form	Vertex Form
$y = ax^2 + bx + c$	$y = a(x - p)(x - q)$ <small>opposite</small>	$y = a(x - h)^2 + k$ <small>opposite</small>
<div style="border: 1px solid black; padding: 2px; display: inline-block; margin: 5px;">a-value (growth rate)</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin: 5px; margin-left: 50px;">y-intercept</div>	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin: 5px;">a-value</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin: 5px; margin-left: 50px;">x-intercepts</div>	<div style="border: 1px solid black; padding: 2px; display: inline-block; margin: 5px;">a-value</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; margin: 5px; margin-left: 50px;">Vertex</div>

Knowing this, try the following problems:

1) Write an equation that models the given information.

a. A quadratic with x-intercepts at (2,0) and (-2,0) that goes through the point (0,4)

Write in intercept form  $y = a(x-p)(x-q)$  since you are given x-intercepts

PEMDAS

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

$$4 = a(0-2)(0+2)$$

$$4 = a(-2)(2)$$

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

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

b. A quadratic with x-intercepts at (-2,0) and (4,0) that passes through the point (2,4)

$$y = a(x-p)(x-q)$$

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

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

$$4 = a(4)(-2)$$

$$\frac{4}{-8} = \frac{-4a}{-8}$$

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

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

Vertex form

- c. A quadratic with a vertex of  $(1, 6)$  that passes through the point  $(2, 4)$

$$y = a(x-h)^2 + k$$

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

$$4 = a(2-1)^2 + 6$$

$$4 = a(1)^2 + 6$$

Multiply

$$4 = 1a + 6$$

$$-6 \quad -6$$

$$-2 = a$$

PEMDAS

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

- d. A quadratic with vertex  $(-4, -8)$  that passes through the point  $(-2, -5)$

Write yourself a list of steps to describe how to write a quadratic equation from key features.

Writing Quadratic Models

- 1) Decide which form to use based on what you are given (x-ints or vertex)
- 2) Plug in key feature (x-ints or vertex)
- 3) Plug in  $(x, y)$  for  $x$  &  $y$
- 4) Solve for  $a$

Tip

- 2) Write the equation that models the given information:

- a. A quadratic with vertex at  $(3, 12)$  that goes through the point  $(-1, 53)$

- b. A quadratic with x-intercepts at  $(6, 0)$  and  $(10, 0)$  that goes through the point  $(2, -14)$