6.2 Writing Equations from Key Features

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

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

$$y = mx + b$$

slope   y-int

$$y = 2x + b$$
$$-7 = 2(-3) + b$$
$$-7 = -6 + b$$
$$+6 \quad +6$$

$$b = -1$$

$$\boxed{y = 2x - 1}$$

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

$$y = mx + b$$
$$y = mx + 4$$
$$3 = m(5) + 4$$
$$3 = 5m + 4$$
$$-4 \qquad -4$$
$$\frac{-1}{5} = \frac{5m}{5} \qquad m = -\frac{1}{5}$$

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

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
$y = ax^2 + bx + c$	$y = a(x-p)(x-q)$	$y = a(x-h)^2 + k$
a-value · y-intercept	a-value · x-intercepts	a-value · Vertex

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)

$$y = a(x-p)(x-q) \qquad P \qquad q \quad *\text{switch signs when putting in parentheses}$$

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

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

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

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

$$-1 = a$$

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

$$\boxed{y = -(x-2)(x+2)}$$

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

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

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

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

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

$$-5 = a(-2+4)^2 - 8$$

$$+8 \qquad\qquad +8$$

$$3 = a(2)^2$$

$$\frac{3}{4} = \frac{4a}{4}$$

$$\frac{3}{4} = a$$

$$\boxed{y = \frac{3}{4}(x+4)^2 - 8}$$

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
2) Plug in key feature (vertex or x-int)
3) Plug in other point for x & y
4) Solve for a, plug back in

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)

6.3 Writing Equations from Word Problems