Section: 7.6

Objective: Notes for Writing Quadratic Functions using the vertex or roots

Writing Quadratic Functions Given Key Features
If you know the vertex and another point on the parabola, or the roots and another point on the parabola, you can figure out the equation of the parabola.

Writing a Quadratic Equation when You Know the Vertex and <u>Another</u> Point

1. Use Vertex Form: $y = a(x - h)^2 + k$

2. Substitute in the vertex for h and k.

3. Substitute in the other point for x and y (or f(x))

4. Simplify and solve for a. (Don't forget to use order of operations.)

5. Write your final answer **by substituting in a, h and k into the vertex form.**

Examples: Write an equation for each parabola described below.

a) Vertex: $(-1, -2)$, passes through $(0, -1)$

$$y = a(x-h)^2 + k$$
$$y = a(x--1)^2 + -2$$
$$-1 = a(0-1)^2 + -2$$
$$-1 = a(1) + -2$$
$$-2 \quad -2$$
$$1 = a$$
$$y = 1(x--1)^2 + -2$$
$$y = 1(x+1)^2 - 2$$

b) Vertex: $(1, -3)$, passes through $(3, 5)$

$$y = a(x-h)^2 + k$$
$$y = a(x-1)^2 + -3$$
$$5 = a(3-1)^2 + -3$$
$$5 = a(4) + -3$$
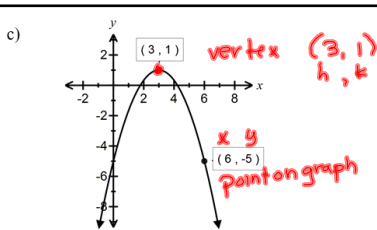$$+3 \qquad +3$$
$$\frac{8}{4} = \frac{4a}{4}$$
$$2 = a$$
$$\boxed{y = 2(x-1)^2 + -3}$$

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c)

vertex (3, 1)
h, k

(3, 1)

(6, -5)
point on graph

$$y = a(x-h)^2 + k$$
$$y = a(x-3)^2 + 1$$
$$-5 = a(6-3)^2 + 1$$
$$-5 = a(9) + 1$$
$$-1 \qquad -1$$
$$\frac{-6}{9} = \frac{9a}{9}$$
$$-\frac{2}{3} = a$$
$$\boxed{y = -\frac{2}{3}(x-3)^2 + 1}$$

Writing a Quadratic Equation when You Know the Roots and <u>Another</u> Point

1. Use factored form: $y = a(x - p)(x - q)$

2. Substitute in the roots for p and q.

3. Substitute in the other point for x and y (or f(x)).

4. Simplify and solve for a. (Don't forget to use order of operations.)

5. Write your final answer by substituting in a, p, and q back into the factored form.

Examples: Write an equation for each parabola described below.

a) Roots: $(-1, 0)$ and $(3, 0)$, passes through $(2, 9)$

$$y = a(x - p)(x - q)$$
$$y = a(x - -1)(x - 3)$$
$$9 = a(2 - -1)(2 - 3)$$
$$9 = a(-3)$$
$$9 = -3a$$
$$\frac{9}{-3} = \frac{-3a}{-3}$$
$$-3 = a$$

$$\boxed{y = -3(x - -1)(x - 3)}$$
$$y = -3(x + 1)(x - 3)$$

b) Zeros: 4 & 8, passes through $(0, 16)$

$$y = a(x - p)(x - q)$$
$$* \quad y = a(x - 4)(x - 8)$$
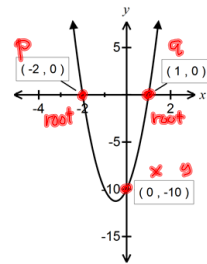$$16 = a(0 - 4)(0 - 8)$$
$$16 = a(32)$$
$$\frac{16}{32} = \frac{32a}{32}$$
$$\frac{1}{2} = a$$
$$.5 = a$$

$$\boxed{y = .5(x - 4)(x - 8)}$$

c)

roots are x-intercepts

$$y = a(x - p)(x - q)$$
$$y = a(x - -2)(x - 1)$$
$$-10 = a(0 - -2)(0 - 1)$$
$$-10 = a(-2)$$
$$\frac{-10}{-2} = \frac{-2a}{-2}$$
$$5 = a$$

$$\boxed{y = 5(x - -2)(x - 1)}$$

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