Chapter 7: Quadratics

Lesson 7.3 Writing an Equation

Example #1: Write the equation for the following parabola

\[ y = a (x-p)^2 + q \]
\[ y = a (x-4)^2 + 2 \]
Pick a point (ex. (0, -6))
\[-6 = a (0-4)^2 + 2 \]
Solve for \(a\)
\[-8 = 16a \]
\[ -\frac{1}{2} = a \]
\[ y = -\frac{1}{2} (x-4)^2 + 2 \]

Example #2: A parabola has a y-intercept of -4 and a vertex at (3, -7). Write the equation for this quadratic

\[ y = a (x-p)^2 + q \]
\[ y = a (x-3)^2 - 7 \]
\[ -4 = a (0-3)^2 - 7 \]
\[ 3 = 9a \]
\[ \frac{1}{3} = a \]
\[ y = \frac{1}{3} (x-3)^2 - 7 \]

Example #3: A parabola has x-intercepts of -3 and 5 and goes through the point (2, 15). Write the equation for this quadratic

\[ y = -(x-1)^2 + 16 \]
Assignment: Write the equation for each of the following parabola graphs

1)

\[ y = a(x-p)^2 + q \]
\[ y = a(x-2)^2 + 0 \]
\[ -4 = a(4-2)^2 + 0 \]
\[ -4 = a(4) \]
\[ -1 = a \]
\[ y = -(x-2)^2 \]

2)

\[ y = a(x-p)^2 + q \]
\[ y = a(x-1)^2 - 2 \]
\[ 0 = a(0-1)^2 - 2 \]
\[ 0 = a(1) - 2 \]
\[ 2 = a \]
\[ y = 2(x-1)^2 - 2 \]

3)

\[ y = a(x-p)^2 + q \]
\[ y = a(x-1)^2 - 4 \]
\[ -1 = a(0-1)^2 - 4 \]
\[ -1 = a(1) \]
\[ 3 = a \]
\[ y = 3(x-1)^2 - 4 \]
4) \[ y = a (x-h)^2 + k \]
\[ y = a (x-0)^2 + 6 \]
\[ 0 = a (2-0)^2 + 6 \]
\[ -6 = a (4) \]
\[ -3 = a \]
\[ y = -\frac{3}{2} (x)^2 + 6 \]

5) \[ y = a (x-h)^2 + k \]
\[ y = a (x+2)^2 + 1 \]
\[ 3 = a (0+2)^2 + 1 \]
\[ 4a = 3 \]
\[ \frac{4a}{2} = a \]
\[ y = \frac{1}{2} (x+2)^2 + 1 \]

6) \[ y = a (x-h)^2 + k \]
\[ y = a (x-2)^2 - 2 \]
\[ 6 = a (3-2)^2 - 2 \]
\[ 2 = a (1)^2 \]
\[ 2 = a \]
\[ y = 2 (x-2)^2 - 2 \]
7) A parabola has a vertex at (2,1) and goes through the origin
\[ y = a(x-2)^2 + 1 \]
\[ 0 = a(0-2)^2 + 1 \]
\[ -1 = 4a \]
\[ -\frac{1}{4} = a \]

8) A parabola has a vertex at (-2,-5) and a y-intercept of 3
\[ y = a(x+2)^2 - 5 \]
\[ 3 = a(0+2)^2 - 5 \]
\[ 8 = a(4) \]
\[ 2 = a \]
\[ y = 2(x+2)^2 - 5 \]

9) A parabola has a vertex at (-1,6) and an x-intercept of -4
\[ y = a(x+1)^2 + 6 \]
\[ 0 = a(-4+1)^2 + 6 \]
\[ -6 = a(4) \]
\[ -\frac{3}{2} = a \]
\[ y = -\frac{3}{2}(x+1)^2 + 6 \]

10) A parabola has a vertex at (-4,0) and goes through the point (-2,12)
\[ y = a(x+4)^2 + 0 \]
\[ 12 = a(-2+4)^2 \]
\[ 12 = 4a \]
\[ 3 = a \]
\[ y = 3(x+4)^2 \]

11) A parabola has an axis of symmetry at x=1, a y-intercept of 2, and only one x-intercept
\[ y = a(x-1)^2 + 0 \]
\[ 2 = a(1-1)^2 \]
\[ 2 = a \]
\[ y = 2(x-1)^2 \]
Answer Key

1) \[ y = -(x - 2)^2 \]
2) \[ y = 2(x - 1)^2 - 2 \]
3) \[ y = 3(x - 1)^2 - 4 \]
4) \[ y = -\frac{3}{2}x^2 + 6 \]
5) \[ y = \frac{1}{2}(x + 2)^2 + 1 \]
6) \[ y = 2(x - 2)^2 - 2 \]
7) \[ y = -\frac{1}{4}(x - 2)^2 + 1 \]
8) \[ y = 2(x + 2)^2 - 5 \]
9) \[ y = -\frac{2}{3}(x + 1)^2 + 6 \]
10) \[ y = 3(x + 4)^2 \]
11) \[ y = 2(x - 1)^2 \]