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COMMUNITY COLLEGE

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Quadratic Functions

General form:

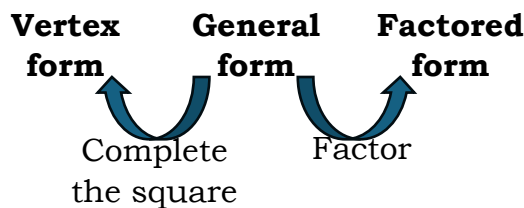
$$f(x) = ax^2 + bx + c$$

Vertex form:

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

Factored form:

$$f(x) = a(x - x_1)(x - x_2)$$



Graph: Parabola



opens up if $a > 0$



opens down if $a < 0$

Vertex:

(h, k) where $h = -\frac{b}{2a}$ and $k = f(h)$

Zeros/ x -intercepts:

$$x_1, x_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Quadratic Functions Example

$$f(x) = -3x^2 + 6x + 24$$

Parabola opens down since $-3 < 0$

y-intercept: (0,24)

$$f(0) = -3(0)^2 + 6(0) + 24 = 24$$

Factored form:

$$\begin{aligned} f(x) &= -3(x^2 - 2x - 8) \\ &= -3(x - 4)(x + 2) \end{aligned}$$

x-intercepts: (4,0) and (-2,0)

$$\begin{aligned} 0 &= -3(x - 4)(x + 2) \\ x - 4 &= 0 \Rightarrow x = 4 \\ x + 2 &= 0 \Rightarrow x = -2 \end{aligned}$$

$$\begin{aligned} x &= \frac{-6 \pm \sqrt{6^2 - 4(-3)(24)}}{2(-3)} = \frac{-6 \pm 18}{-6} \\ &= -2 \text{ or } 4 \end{aligned}$$

Vertex form: Complete the square

$$\begin{aligned} f(x) &= -3(x^2 - 2x) + 24 \\ &\quad \swarrow \quad \searrow \\ &\quad \frac{-2}{2} = -1 \\ f(x) &= -3(x^2 - 2x + (-1)^2) + 24 - (-3)(-1)^2 \\ f(x) &= -3(x - 1)^2 + 27 \end{aligned}$$

Vertex: (1,27)

Axis of symmetry: $x = 1$

$$x = -\frac{b}{2a} = -\frac{6}{2(-3)} = 1$$