ANOKA-RAMSEY COMMUNITY COLLEGE
ARCC Tutoring Services | 763-433-1260
Rapids: Math Skills Center, Room L-127
Cambridge: ASC, Room D-208

Quadratic Functions

General form:

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

Vertex form:

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

Factored form:

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

Vertex form ⟷ **General form** ⟷ **Factored form**

Complete the square / Factor

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:

$$f(x) = -3(x^2 - 2x - 8)$$
$$= -3(x-4)(x+2)$$

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

$$0 = -3(x-4)(x+2)$$
$$x - 4 = 0 \Rightarrow x = 4$$
$$x + 2 = 0 \Rightarrow x = -2$$

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

Vertex form: Complete the square

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

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

$$f(x) = -3(x^2 - 2x + (-1)^2) + 24 - (-3)(-1)^2$$

$$f(x) = -3(x-1)^2 + 27$$

Vertex: $(1, 27)$

Axis of symmetry: $x = 1$

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