Section 2.1 Quadratics

- Standard form: \( f(x) = ax^2 + bx + c \)
  - Opens upward, \( a > 0 \)
  - Axis of symmetry
  - Vertex: point where the graph intersects the axis of symmetry.
  - Opens downward, \( a < 0 \)

Vertex form of a quadratic:

\[ f(x) = a(x-h)^2 + k \]

(h,k) vertex

**Standard to vertex form**

**Complete the square**

**Example:**

\[ f(x) = x^2 - 8x + 7 \]

\[ x^2 - 8x + 16 - 16 + 7 \]

\[ \frac{x}{2} = -4 \Rightarrow (4, -1)^2 = 16 \]

\[ f(x) = (x-4)^2 - 9 \]

**Graph it**

- Vertex: \((4, -9)\)
- \(a = 1\) opens up
- Axis of symmetry is \(x = -4\)

**x-intercept**

\[ y = 0 \]

\[ 0 = (x-4)^2 - 9 \]

\[ (x-4)^2 = 9 \Rightarrow x-4 = \pm 3 \Rightarrow x = 7, 1 \]

**y-intercept**

\[ x = 0 \]

\[ y = (0-4)^2 - 9 \]

\[ y = 16 - 9 \]

\[ y = 7 \]
Standard to vertex form: \( a(x-h)^2 + k \)

\[
F(x) = 2x^2 + 12x - 7
\]

\[
= 2(x^2 + 6x) - 7
\]

\[
= 2(x^2 + 6x + 9) - 7 - 18 \to 2(x + 3)^2 - 25
\]

\[
\frac{-6}{2} = 3 \to 3^2 = 9
\]

vertex: \((-3, 25)\)

\[
a = 2
\]

axis of symmetry \( x = -3 \)

- **X value** of vertex when/where the min or max occurs
- **Y value** of the vertex gives the min or max value.

Formula for vertex: \( h = \frac{-b}{2a} \) \( k = f(h) \)

\[
F(x) = 2x^2 + 12x - 7
\]

\[
h = \frac{-12}{2(2)} = \frac{-12}{4} = -3
\]

\[
k = 2(-3)^2 + 12(-3) - 7 = -25
\]

vertex: \((-3, -25)\)