Sections 6 and 7 - Graphing Quadratic Functions

Quadratic functions graph as parabolas, opening either upward or downward. How do we know ahead of time how the parabola opens?

To graph a line, you need a minimum of two points. To graph a parabola, you need a minimum of three points. These three points are usually the two x-intercepts and the vertex. Because the y-intercept is so easy to find, we'll find this point even if we don't need it. We will find all points algebraically and check our answers against the graph.

Graph each of the following. Give the domain and range of each.

Example 1: \( f(x) = 3 - 2x - x^2 \)

Example 2: \( g(x) = 4x^2 - 20x + 25 \)
**Example 3:** \( f(x) = -x^2 - 3x + 2 \)

- \( a = -1 \)
- \( b = -3 \)
- \( c = 2 \)

1. **x-intercepts**
   \[ x = \frac{-(3) \pm \sqrt{(3)^2 - 4(-1)(2)}}{2(-1)} \]
   \[ x = \frac{3 \pm \sqrt{9 + 8}}{2} \]
   \[ x = \frac{3 \pm \sqrt{17}}{2} \]
   \[ x = \frac{3 + \sqrt{17}}{2}, \frac{3 - \sqrt{17}}{2} \]

2. **Vertex**
   \[ x = \frac{-(-3)}{2(-1)} = -1.5 \]
   \[ y = f(-1.5) = (-1.5)^2 - 3(-1.5) + 2 = 4 \]

3. **y-intercept**
   \[ y = 2 \]

4. **Domain**
   \( (-\infty, \infty) \)

**Example 4:** \( g(x) = 2x^2 - 5x + 4 \)