Preliminaries and Objectives

**Preliminaries**
- Polynomials
- Graph of \( y = x^2 \)
- Graph Transformations

**Objectives**
- Find the axis of symmetry of a Parabola
- Find the vertex of a Parabola
- Graph a Parabola

**Definitions**

A **quadratic function** is a polynomial of degree 2. It has the general form

\[
f(x) = ax^2 + bx + c
\]

### General Parabola

\[
y = ax^2 + bx + c
\]

\[
y = \left( x^2 + \frac{b}{a}x \right)
\]

\[
y = x \left( x + \frac{b}{a} \right)
\]

- Shift vertically by \( c \)
- Stretch by a factor of \( a \)
- Find the axis of symmetry

### Axis of Symmetry and Vertex

**For the parabola defined by the equation** \( y = ax^2 + bx + c \)

- The axis of symmetry is \( x = -\frac{b}{2a} \).
- The vertex has an \( x \)-coordinate of \(-\frac{b}{2a}\).
- The \( y \)-coordinate of the vertex can be found by plugging the \( x \)-value \(-\frac{b}{2a}\) into the original equation.

### Example

Graph the parabola \( y = 3x^2 - 12x + 7 \)

Axis of symmetry: \( x = -\frac{-12}{2(3)} = 2 \)

Vertex: \((2, -5)\)

### Recap

- Axis of symmetry: \( x = -\frac{b}{2a} \)
- Vertex: \(-\frac{b}{2a}, f \left( -\frac{b}{2a} \right) \)
- Stretch factor = \( a \)