B. Quadratic Like Equations
   Example 2. Solve \( x^2 - 6x + 9 = 0 \)

C. Solving Quadratics by Factoring
   Example 3. Solve \( x^2 - 3x + 2 = 0 \)

Definition of Complex Numbers

Where do complex numbers live?

Example 5. Graph \( 3 + 2i \) and \( 1 + 6i \)
E. Solving Polynomials Using the Calculator and Calculus

Example 5: Solve: \(2x^3 - 3x^2 + 1 = 0\).

Let \(f(x) = 2x^3 - 3x^2 + 1\).

Then \(f(1) = -2\) and \(f(-1) = 6\).

Therefore, \(x = 1\) and \(x = -1\) are solutions.
\[ f(x) = x^2 - 5x \]
\[ \lim_{h \to 0} \frac{(x+h)^2 - 5(x+h) - (x^2 - 5x)}{h} \]
\[ = \lim_{h \to 0} \frac{x^2 + 2xh + h^2 - 5x - 5h - x^2 + 5x}{h} \]
\[ = \lim_{h \to 0} \frac{2xh + h^2 - 5h}{h} \]
\[ = \lim_{h \to 0} (2x + h - 5) \]
\[ = 2x - 5 \]

\[
W = \begin{cases} 
12 - 2x & x \leq 4 \\
\frac{x^2}{x+1} & x > 4 
\end{cases}
\]

\[
\lim_{x \to 2} \frac{x^2 - 6x + 8}{x - 2} = \frac{(x-4)(x-2)}{x-2} = 2 - 4 = -2
\]

\[
g(x) = x^2 + 3x - 4x^2 + 1000 \\
g'(x) = 2x + 3 \\
g''(x) = 6x + 18 \\
0 = 3x^2 + 18x - 4x \\
0 = 3(x^2 + 6x - 12) \\
x^2 + 6x - 12 = 0 \\
x^2 - 6x = 0 \\
x = 12 \quad x = 0
\]

\[
x^4 - 63x^2 + 108 = 0 \\
x^2 - 63x^2 + 108 = 0 \\
x^2 = 10.55 \quad x = 2.0467 \\
x = 13.24 \quad x = 1.143
\]
Definitions: Even and odd multiplicity.

- If $x = r$ is a zero of even multiplicity of $f(x)$, then $f(x)$ has a factor of $(x - r)^2$.
- If $x = r$ is a zero of odd multiplicity of $f(x)$, then $f(x)$ has a factor of $(x - r)$ and $n$ is odd.

Recall example 3. The solutions to $x^2 - 7x - 16 = 0$ are $x = 8, -2$.

The graph of $f(x)$ is given below.

If $x = a$ is a zero of even multiplicity, then what does the graph do at $x = a$?

If $x = a$ is a zero of odd multiplicity, then what does the graph do at $x = a$?