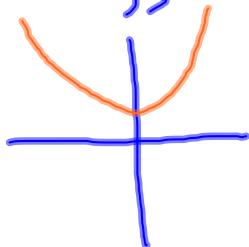


Section 2.2: Complex Roots

An n^{th} polynomial has exactly n Roots

- Multiplicity (k) multiple roots only show up once
- Non-real; complex; imaginary roots

$$f(x) = x^2 + 1$$



non real roots don't show up on a graph

I) Quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

discriminant: $b^2 - 4ac < 0$

$$f(x) = x^2 + 1 \quad x = \frac{-0 \pm \sqrt{0^2 - 4(1)(1)}}{2(1)} = \frac{\pm \sqrt{-4}}{2} = \pm \frac{2i}{2}$$

$$a = 1$$

$$b = 0$$

$$c = 1$$

$$x^2 - 4x + 5 = 0$$

$$a = 1$$

$$b = -4$$

$$c = 5$$

$$x = \frac{4 \pm \sqrt{16 - 20}}{2}$$

$$x = \frac{4 \pm \sqrt{-4}}{2} = \frac{4 \pm 2i}{2} = 2 \pm i$$

$$0 + i$$

$$0 - i$$

complex conjugates

$$2 + i$$

The quadratic formula always produces roots that are complex conjugates.

2) Sum of 2 Square Pattern

↓ Difference of 2 Squares pattern: $x^2 - 25$

$$x^2 + 25$$

$$(x+5i)(x-5i)$$

$$x^2 - 25 = x^2 - 5ix + 5ix - 25i^2$$

$$x^2 + 25 - 25(-1)$$

$$x^2 + 9 = (x+3i)(x-3i)$$

$$f(x) = x^4 + 21x^2 - 100$$

$$(x^2 + 25)(x^2 - 4)$$

$$(x+5i)(x-5i) (x+2)(x-2)$$

$$\underline{x = \pm 5i}$$

$$\text{won't}$$

$$\underline{x = \pm 2}$$

$$x \cdot \text{ints}$$

$$x^4 + 13x^2 + 36 = 0$$

$$(x^2 + 9)(x^2 + 4) = 0$$

$$(x+3i)(x-3i) (x+2i)(x-2i)$$

$$x = \pm 3i \quad x = \pm 2i$$

The sum of 2 Squares pattern also produces complex conjugate roots

Hence: Complex zeros always come in conjugate pairs.