If a polynomial doesn't have rational roots what kind of roots could it have?

- 1. Irrational Roots
- 2. Imaginary Roots

Where do irrational roots come from? Taking square roots.

This happens when.....

- 1. Using the Quadratic Formula
- 2. Finding zeros of factors such as $(x^2 7)$

What are irrational roots?

Roots that have square roots of non-perfect squares. Example:

$$x = \sqrt{3}$$

Irrational roots always come in PAIRS.

Numbers of the form $11 - \sqrt{5}$ and $11 + \sqrt{5}$ are called CONJUGATES.

Theorem

Irrational Root Theorem

Let a and b be rational numbers and let \sqrt{b} be an irrational number. If $a + \sqrt{b}$ is a root of a polynomial equation with rational coefficients, then the conjugate $a - \sqrt{b}$ also is a root.

Since Imaginary Roots also occur when you are taking a square root, they also come in PAIRS!

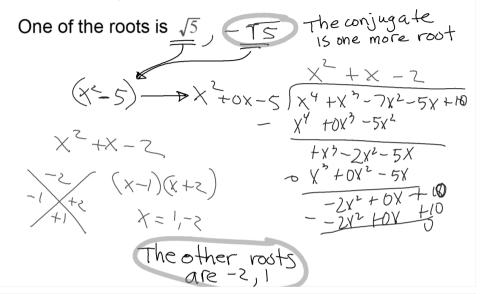
These pairs of imaginary roots are called Complex Conjugates.

In other words, if 3 - 5i is a root, so is

3 + 5i.

Use the given root to find the remaining 3 roots of this polynomial:

$$f(x) = x^4 + x^3 - 7x^2 - 5x + 10$$



Theorem

Imaginary Root Theorem

If the imaginary number a+bi is a root of a polynomial equation with real coefficients, then the conjugate a-bi also is a root.

Use the given roots to find the remaining roots of this polynomial:

$$f(x) = x^5 + 4x^4 + 2x^3 + 76x^2 - 8x + 240$$

Three of the roots are -6, 2i, 1 + 3i

The other two roots are: -20 /-30 factors

Use the given root to find the remaining 2 roots of this polynomial: $y = x^3 - 5x^2 + 11x - 15$

one root is 1-2i

The other two roots are: 1+2i 3

possible rational roots are $\pm 1 \pm 3 \pm 5 \pm 15$ f(i)=-8 f(-i)=-32

Use the given root to find the remaining 3 roots of this polynomial: $f(x) = x^4 - 3x^3 + 5x^2 - 27x - 36$

State the other root of the cubic that has the given roots.

Two of the roots are $\sqrt{5}$ and -7 $-\sqrt{5}$ is also a zero

State the equation of this cubic Standard Form.

State the other root of the cubic that has the given roots.

two of the roots are -1 and $2 + \sqrt{6}$ \longrightarrow $2 - \sqrt{6}$ is also a root. $(x - (2 + \sqrt{6}))(x - (2 - \sqrt{6})) = (x - 2 - \sqrt{6})(x - 2 + \sqrt{6})$ State the equation of this cubic Standard Form. $x - 2 - \sqrt{6}$ $x - 2 - \sqrt{$

You can now finish Hwk #33.

Practice Sheet Sec 6-5