**5.5 Theorems About Roots of Polynomial Equations**

Objectives: To Solve Equations using the Rational Root Theorems

To use the Conjugate Root Theorem

**The Rational Zero Theorem;**

If f(x) = anxn + an-1xn-1 + … + a1x + a0 has integer coefficients, then every rational zero of f has the following form:



*Examples*: *List all the possible rational zeros of f using the rational zero theorem.*

f(x) = x3 + 2x2 – 11x – 12

f(x) = 2x3 + 7x2 – 7x + 30

f(x) = 5x4 + 12x3 – 16x2 + 10

**Solving for Rational Zeros**:

1. List all possible rational zeros by combining the factors into all possible solutions using the Rational Zero Theorem 
2. Test each of the possible rational zeros, using synthetic division or direct substitution, until you find a zero, k

(Solutions will be the rational numbers that yield r = 0, or f(k) = 0)

* Graphing Calculator will help find possible zeros

1. Factor f(x); f(x) = (x – k)(q(x))
2. Solve for zeros

*Examples*:

Find all the real zeros of f(x) = x3 – 3x2 – 6x + 8

Find all the real zeros of 15x3 – 32x2 +3x + 2=0

Find all the real zeros of f(x) = 2x3 – 4x2 + 2x + 5

Find all the real zeros of f(x) = x3 + 4x2 – x – 4

Find all the real zeros of f(x) = x3 + 5x2 – x – 5

**Conjugate Root Theorem:** The irrational roots of P(x) come in conjugate pairs. That is if is a solution then also has to be a solution.

The complex zeros of a polynomial function with real coefficients always occur in complex conjugate pairs also. That is if is a solution then also has to be a solution.

Example:

What are the other roots?

4, 4, 2 + i 2, -6i

HMWK: pg 315 #1-6, 8, 11-25 (odd), 39