Name: _____ **Precalculus Unit 1, Lesson 8**

Aim: What is the Rational Root Theorem?

I. Do Now:

1. If two of the roots of the equation $x^4 - 2x^3 - 9x^2 + 2x + 8 = 0$ are -1 and 1, find all roots.

The Factor Theorem:

A polynomial $f(x)$ has a factor $(x-k)$ if and only if $f(k) = 0$.

2. If the roots of an equation in the form $ax^3 + bx^2 + cx + d = 0$ are -1, 2, and 5, find the value of d.

II. Development:

Rational Root Theorem
(also called *Rational Zeros Theorem* or *Rational Root Test or Rational Zero Test*)

If a polynomial equation has integer coefficients, then all of its rational roots (zeros) have the form $\frac{p}{q}$, where $p =$ _____ and $q =$ _____ .

Examples

3. List all possible rational zeros of each polynomial equation:
   (a) $3x^2 + 2x - 5 = 0$ (b) $2x^3 - 6x^2 + 10x + 6 = 0$

4. Given $2x^3 + 5x^2 - 4x - 3 = 0$:
   (a) list all possible rational roots
   (b) find all real solutions

To Find Rational Roots of a Polynomial:

1. *List Possible Zeros* (using the Rational Root Theorem)
2. *Divide* each possible zero *r* using synthetic division until you obtain a remainder of zero. [Note that this means that $(x - r)$ is a factor.]
3. *Repeat* steps 1 and 2 for the quotient. Stop when you reach a quotient that is quadratic or factors easily, and use the quadratic formula or factor to find the remaining zeros.

III. Applications:

5. Solve for x:
   $x^4 + 3x^3 - 13x^2 - 9x + 30 = 0$ (hint: 2 is a root)

6. Solve for x: $x^3 - 3x^2 - 10x + 24 = 0$

HW8

Factor completely: (a) $(x-5)^2 - 9$

(b) $(x+2)^3 + 1$

p. 124-125: 11, 15, 30, 32, 44, 49, 57, 58