Name: _____ **Precalculus Unit 1, Lesson 9**

Aim: How do we find all real roots of a polynomial equation?

I. Do Now:

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

2. (a) Given the equation $x^2 - 2 = 0$, list all possible rational zeros and then solve the equation.
   (b) Explain why the results you obtained do not violate the Rational Root Theorem.

To Find Real 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.

3. (a) List all possible rational roots of the equation $10x^4 - 3x^3 - 29x^2 + 5x + 12 = 0$.
   (b) Use your graphing calculator to sketch the graph of the equation $y = 10x^4 - 3x^3 - 29x^2 + 5x + 12$.
   (c) Use synthetic division to find all rational roots. How does the graph help you to choose which of the possible rational roots may be *actual* roots of the equation?

II. Practice: Find all real roots of each polynomial equation.

4. $x^4 + 3x^3 - 13x^2 - 9x + 30 = 0$

5. $x^3 - 3x^2 - 10x + 24 = 0$

6. $5x^3 + 4x^2 - 20x - 16 = 0$

7. $x^3 + x^2 - 5x + 3 = 0$

8. $x^4 - 5x^3 - 5x^2 + 23x + 10 = 0$

9. $5x^3 + 29x^2 + 19x - 5 = 0$