

## Higher Degree Equations – Rational Root Theorem

Procedure:

1. Write all the factors of the leading coefficient
2. Write all the factors of the constant
3. Place all the factors of the constant over all the factors of the leading coefficient, positive & negative
4. Use synthetic substitution by substituting those possible solutions in step 3 to find the zeros

Example Solve  $2x^3 - 11x^2 + 12x + 9 = 0$

1.  $\pm\{1, 2\}$
2.  $\pm\{1, 3, 9\}$
3.  $\pm\{1, 3, 9, \frac{1}{2}, \frac{3}{2}, \frac{9}{2}\}$

4.

*Using mental math to do the sums mentally, we can arrange our work more conveniently.*

x				R
	2	-11	12	9
1	2	-9	3	12
3	2	-5	-3	0

Therefore  $x = 3$  is a solution with a depressed equation of  $2x^2 - 5x - 3 = 0$  which can be solved by the Quadratic Formula.

Find the rational roots, if any, of the following equations.

1.  $x^3 - 4x^2 + x + 2 = 0$

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

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

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

5.  $x^3 + 2x^2 + x + 18 = 0$

6.  $x^4 - 5x^3 + 9x^2 - 7x + 2 = 0$

7.  $2x^3 + 3x^2 - 8x + 3 = 0$

8.  $6x^3 - 11x^2 - 24x + 9 = 0$

9.  $4x^3 + 5x^2 + 2x - 6 = 0$

10.  $2x^4 - x^3 - 6x + 3 = 0$

**Hint – fill in a placeholder, zero, for the quadratic term**