

Section 4-4 The Rational Root Theorem

For any polynomial, $P(x)$, the factors of the lead coefficient and the final constant will contribute to possible real roots of $P(x)$.

Rational Root Theorem- Let $a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0 = 0$ represent a polynomial equation of degree n with integral coefficients. If a rational number $\frac{p}{q}$, where p and q have no common factors, is a root of the equation, then p is a factor of a_0 and q is a factor of a_n .

This theorem helps to identify the possible rational roots for $P(x)$.

$$\text{Ex. } 6x^3 + 11x^2 - 3x - 2 = 0$$

↑
q

↑
p

factors of $P \pm 2, \pm 1$

factors of $Q \pm 6, \pm 3, \pm 2, \pm 1$

The rational root possibilities include:

$$\pm \frac{1}{3}, \pm \frac{1}{6}, \pm \frac{2}{3}, \pm 1, \pm \frac{1}{2}, \pm 2$$

Using synthetic division, we can test these possible rational real roots to locate solutions for $P(x)$.

