Polynomial Root Theorems

1) Fundamental Theorem of Algebra

If P(x) is a polynomial function of degree n (n > 0) with complex coefficients, then the equation P(x) = 0 has n roots assuming you count double roots as 2, triple roots as 3, etc.

2) Complex Conjugates Theorem

If P(x) is a polynomial function with real coefficients, and *a + bi* is a solution of the equation P(x) = 0, then *a - bi* is also a solution.

3) Irrational Conjugate Theorem

If P(x) is a polynomial with rational coefficients and is $a+b\sqrt{c}$ a root (where a, b, and c are rational and $\sqrt{c}$ is irrational, then $a-b\sqrt{c}$ is also a root.

4) Rational roots theorem

If P(x) is a polynomial function with integer coefficients where a_n is the leading coefficient and a_0 is the constant term, then any rational roots of the polynomial will be in the form $\frac{p}{q}$ where p is a factor of a_0 and q is a factor of a_n

5) Descarte's rule of signs

The maximum number of positive REAL roots is the number of times P(x) changes sign. If it has less than that number, it will be less by a factor of 2. The maximum number of negative REAL roots is the number of times P(-x) changes sign. If it has less than that number, it will be less by a multiple of 2.

6) Sum and product of roots.

If P(x) is a polynomial function where a_n is the leading coefficient and a_0 is the constant term, then the sum of the roots is $\frac{-a_{n-1}}{a_n}$ and the product of the roots is $\frac{a_0}{a_n}$ if n is even and $-\frac{a_0}{a_n}$ if n is odd.