

Math 1314 – College Algebra
Section 5.4 Dividing Polynomials (including some of Section 5.5)

- Polynomial equation: $P(x) = 0$ where $P(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \dots + a_2 x^2 + a_1 x + a_0$.
 n is a natural number and gives the degree of the polynomial.
- Zero of a polynomial $P(x)$: is any number r for which

Ex: Use long division to simplify $\frac{9x^4 + 8x^2 - 3x + 4}{3x^2 - x + 1}$.

- $P(x) =$

Ex: Use long division to simplify $\frac{3x^3 - 12x^2 - 9x + 1}{x - 5}$.

- Factor Theorem: If $P(x)$ is a polynomial and r is a zero of $P(x)$ (i.e. $P(r) = 0$) then $x - r$ is a factor of $P(x)$. Also, if $x - r$ is a factor of $P(x)$, then $P(r) = 0$ (r is a zero of $P(x)$).
- Remainder Theorem: If $P(x)$ is divided by $x - r$, the remainder is $P(r)$.

Real Zeros of Polynomials: If P is a polynomial and c is a real number, then the following are equivalent:

1. c is a zero of P .
2. $x = c$ is a zero of $P(x)$.
3. $x - c$ is a factor of $P(x)$.
4. $(c, 0)$ is a point on the graph of $P(x)$.

Ex: Find $P(5)$ for $P(x) = 3x^3 - 12x^2 - 9x + 1$.

Ex: Let $P(x) = 2x^3 + 7x^2 + 6x - 5$.

Show that $x - \frac{1}{2}$ is a factor of $P(x)$.

Show that $2x - 1$ is a factor of $P(x)$.