2.3 The Remainder and Factor Theorems

Objectives:

- Divide polynomials using long division and synthetic division
- Use the remainder and factor theorems

Dividing Polynomials

Method 1 - Long Division

Factor completely using the given factor and long division:

ex. 1 $x^3 + 7x^2 + 4x - 12; x + 6$

ex. 2 $6x^3 - 2x^2 - 16x - 8; 2x - 4$

Polynomial Division: Let $f(x)$ and $d(x)$ be polynomials such that the degree of $d(x)$ is less than or equal to the degree of $f(x)$ and $d(x) \neq 0$. The there exist unique polynomials $q(x)$ and $r(x)$ such that:

$$\frac{f(x)}{d(x)} = q(x) + \frac{r(x)}{d(x)} \quad \text{OR} \quad f(x) = d(x) \cdot q(x) + r(x)$$

Where $r(x) = 0$ or the degree of $r(x)$ is less than the degree of $d(x)$. If $r(x) = 0$, then $d(x)$ divides evenly into $f(x)$.

Divide using long division:

ex. 1 $(8x^3 - 18x^2 + 21x - 20) \div (2x - 3)$

ex. 2 $(-3x^3 + x^2 + 4x - 66) \div (x - 5)$

ex. 3 $(2x^3 + 5x^2 - 7x + 6) \div (x^2 + 3x - 4)$

ex. 4 $(6x^5 - x^4 + 12x^2 + 15x) \div (3x^3 - 2x^2 + x)$

Assignment:

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