Long Division and Synthetic Division
Section 2.3 (Part 1)

Warm-up

1. Given $f(x) = x^4 - 10^2 - 2x + 4$, find ***f(-3).***

2. Given $f(x) = 3x^3 + 8x^2 + 5x - 7$, find ***f(-2).***

Long Division of Polynomials

Example 1

a) Given $f(x) = 6x^3 - 19x^2 + 16x - 4$ and $f(2) = 0$. Factor *f(x)* completely.

b) Given $f(x) = x^3 - 2x^2 - 9$ and $f(3) = 0$. Factor *f(x)* completely.

Practice Problem 1

Given $f(x) = 2x^2 + 10x + 12$ and $f(-3) = 0$. Factor *f(x)* completely.

Example 2 (Remainders)

Divide $x^2 + 3x + 5$ by $x + 1$

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Example 3 (Missing Terms)

Divide $8x^3 - 1$ by $2x - 1$.

Practice Problem 2

Divide $7x^3 + 3$ by $x + 2$

Practice Problem 3 (Division by Higher Degree Polynomials)

Divide $-2 + 3x - 5x^2 + 4x^3 + 2x^4$ by $x^2 + 2x - 3$

Synthetic Division

Example 4

Divide $x^4 - 10x^2 - 2x + 4$ by $x + 3$

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Practice Problem 4

Divide $(3x^3 - 17x^2 + 15x - 25) \div (x - 5)$

Remainder Theorem

Synthetic division can be used to evaluate a polynomial function. To find ***f(k),*** divide ***f(x)*** by ***x – k***: _____

Example 5
Given $f(x) = 3x^3 + 8x^2 + 5x - 7$ find ***f(-2).***

Practice Problem 5
Given $f(x) = 4x^3 + 10x^2 - 3x - 8$ find ***f(-1).***

Using Synthetic Division to Factor a Polynomial

Example 6
Given $f(x) = 2x^4 + 7x^3 - 4x^2 - 27x - 18$ and $f(2) = 0$ and $f(-3) = 0$
Factor ***f(x)*** completely.

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Practice Problem 6

Given $f(x) = x^4 - 4x^3 - 15x^2 + 58x - 40$ and $f(5) = 0$ and $f(-4) = 0$ factor ***f(x)*** completely.

Summary

In summary, the remainder r, obtained in the synthetic division of *f(x)* by $x - k$, provides the following information:

1. _____

2. _____

3. _____