

Long Division and Synthetic Division

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) Divide $(6x^3 - 19x^2 + 16x - 4)$ by $(x - 2)$.

b) Divide $(x^3 - 2x^2 - 9)$ by $(x - 3)$.

Practice Problem 1

Divide $(2x^2 + 10x + 12)$ by $(x + 3)$.

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 $f(-1)$.

How can you tell if a binomial is a factor of another polynomial?

Factor	Zero
$x+5$	
$x - 3$	
$x + 2$	
	4
	-6
	-1

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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.

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. _____