Topic 3.4: Dividing Polynomials

Essential Question:

How can you divide polynomials?

Concept

Remainder Theorem and Factor Theorem

Q: How do the Remainder Theorem and Factor Theorem Compare?

CONCEPT Summary

Q: What are two methods used to divide polynomials? When should each method be used?

Concept Summary Assess

CONCEPT SUMMARY Dividing Polynomials

Example: Divide $x^3 - 8x^2 - 5x - 30$ by $x - 9$.

LONG DIVISION

Can be used for any polynomial division.

$$
\begin{array}{r}
x^2 + x + 4 \\
x - 9 \overline{\big)\, x^3 - 8x^2 - 5x - 30} \\
\underline{-(x^3 - 9x^2)} \\
x^2 - 5x - 30 \\
\underline{-(x^2 - 9x)} \\
4x - 30 \\
\underline{-(4x - 36)} \\
6
\end{array}
$$

SYNTHETIC DIVISION

Most readily used when the divisor is linear and its leading coefficient is 1.

$$
\begin{array}{r|rrrr}
9 & 1 & -8 & -5 & -30 \\
 & & 9 & 9 & 36 \\
\hline
 & 1 & 1 & 4 & 6
\end{array}
$$

Either method shows that $x^3 - 8x^2 - 5x - 30 = (x^2 + x + 4)(x - 9) + 6$

Notes:

Examples & Questions

Examples 1

Part A:

Q: How do you determine the terms in the quotient when dividing two polynomials?

Part B:

Q: Why do you need to have terms with 0 as coefficients in the dividend?

Examples 2

Q: When would you use synthetic division and why is it useful?

Q: Why do you reverse the sign of the constant term in the divisor?

Examples 3

Q: Explain how $P(x) = x^3 + 10x^2 + 29x + 24$ how was rewritten as

$P(x) = (x^2 + 5x = 4)(x + 5) + 4$

Q: Why would you evaluate $P(-5)$ using the function in the form

$P(x) = (x^2 + 5x = 4)(x + 5) + 4$?

Examples 4

Q: How do you determine what for what value of *a* to find *P(a)*?

Q: How is understanding the Remainder Theorem helpful in solving this problem?

Examples 5

Q: How does understanding the Factor Theorem help to determine whether *(x-a)* is a factor of a given polynomial?

Q:

Practice and Problem Solving

Complete MathXL for School: Additional Practice (online)

Complete MathXL for School: Enrichment (online)

Challenge: #11, 32, 33, 37 – key will be posted in Power School Learning.

Lesson Quiz 3.4