Algebra 2B Notes Name: _____

5-4 Dividing Polynomials

Date: _____ Hr: _____

Objectives:

- To divide polynomials using long division.
- To divide polynomials using synthetic division.

Common Core Content Standard:

A.APR.2 Know and apply the remainder theorem.

Also A.APR.1, A.APR.6

_____ is an algorithm for dividing a polynomial by another polynomial of the same or lower degree. It is similar to the long-division steps that you use to divide whole numbers.

Example 1: Using Polynomial Long Division

Use polynomial long division to divide $5x^2 + 2x + 3$ by $x + 1$. What are the quotient and the nainder?

Take Note

Key Concept The Division Algorithm for Polynomials

You can divide polynomial $P(x)$ by polynomial $D(x)$ to get polynomial quotient $Q(x)$ and polynomial remainder $R(x)$. The result is $P(x) = D(x)Q(x) + R(x)$.

$$D(x)\overline{)P(x)}$$
$$Q(x)$$
$$\vdots$$
$$\overline{R(x)}$$

If $R(x) = 0$, then $P(x) = D(x)Q(x)$ and $D(x)$ and $Q(x)$ are factors of $P(x)$.

To use long division, $P(x)$ and $D(x)$ should be in standard form with zero coefficients where appropriate. The process stops when the degree of the remainder, $R(x)$, is less than the degree of the divisor, $D(x)$.

Example 2: **Checking Factors**

Is $x^2 - 2$ a factor of $P(x) = x^4 - x^2 - 2$? If it is, write $P(x)$ as a product of two factors.

_____ is a simplified version of polynomial long division that only works when dividing by a linear factor.

Example 3: **Using Synthetic Division**

Use synthetic division to divide $4x^3 - 3x^2 + 2x - 3$ by $x - 1$. What are the quotient and the remainder?

Example 4: **Using Synthetic Division to Solve a Problem**

The polynomial $x^3 + 9x^2 + 23x + 15$ expresses the volume, in cubic inches, of a box, and the length is $(x + 5)$ inches. What are the other two dimensions of the box?

The _____ provides a quick way to find the remainder of a polynomial long-division problem.

Take note

Theorem The Remainder Theorem

If you divide a polynomial $P(x)$ of degree $n \geq 1$ by $x - a$, then the remainder is $P(a)$.

Example 5: **Evaluating a Polynomial**

Given that $P(x) = x^4 + 6x^3 + 9x^2 + 3x - 3$, what is $P(4)$?