**5.4 Dividing Polynomials**

Objectives: To Divide Polynomials Using Long Division.

To Divide Polynomials Using Synthetic Division.

**Quick Review on Long Division:**

We use a very similar method to divide polynomials.

**Dividing Polynomials**;

Given polynomials f(x) and divisor d(x): , where q(x) = quotient polynomial and r(x) = remainder polynomial

Or in other words: f(x)=q(x)d(x)+r(x)

\*As you can see, if there is NO remainder then d(x) is a factor of f(x)

**Steps to using Polynomial Long Division:**

* Write polynomial in standard form
* Put 0’s in for missing parts

Example 1: Divide Using Long Division.

Example 2: Divide Using Long Division.

2x4 + 3x3 + 5x – 1 by x2 – 2x + 2

Example 3: Is f(x) a factor of g(x)? Justify your answer.

Example 4: Is f(x) a factor of g(x)? If it is write g(x) as the product of two factors.

**Synthetic Division**: simplifies long-division by dividing by a linear expression .

When dividing a polynomial by an expression of the form **x – a**, you can use synthetic substitution as a form of synthetic division.

* The final constants equal the coefficients of the quotient
* Exponents for the quotient = exponent from original – 1

(For each column)

**Steps to using Polynomial Synthetic Division:**

* Write the equation in standard form

(put 0’s in for exponents not represented)

* Multiply leading coefficient by the value of the variable
* Sum the next coefficient with the answer from Step 2
* Multiply the answer from Step 3 by the value of the variable
* Sum the next coefficient with the answer from Step 4
* Continue until each coefficient has been used

Example 5: Divide Using Synthetic Division.

f(x) = 2x4 – 8x2 + 5x – 7 divided by

2x4 + 0x3 – 8x2 + 5x – 7

2 0 -8 5 -7

3 6 18 30 105

2 6 10 35 98

2x4 – 8x2 + 5x – 7=**(2x3 +6x2 + 10x +35)(x-3) +98**

Example 6: Divide Using Synthetic Division.

x6 + 3x + 4 by x-2

Example 7: If x+5 is a factor of x3 +7x2 -38x – 240

What are the other factors?

**Remainder Theorem**;

If a polynomial f(x) is divided by x – k, then the remainder is r = f(k)

Example:

Given that f(x)= 2x4 – 8x2 + 5x – 7, what is f(x)

By the Remainder Theorem, f(3) is the remainder when you divide f(x) = 2x4 – 8x2 + 5x – 7 by x-3

2x4 + 0x3 – 8x2 + 5x – 7

2 0 -8 5 -7

3 6 18 30 105

2 6 10 35 **98**

So, f(3)=98

HMWK: page 308 #1-7, 11-25 (odd), 29, 33-37 (odd), 41

(Extra Practice #44-62)