Section 5.5A – Polynomial Division and the Remainder Theorem

Recall:

Long Division - standard division ______________ suitable for dividing one number by another

Divisor – the number you divide by

Dividend – the number that is divided

Quotient – the answer of division

Example 1.) $\frac{30}{7}$

$$\begin{array}{r} 4 \\ 7\overline{)30} \\ -28 \\ \hline 2 \end{array} \qquad 4\frac{2}{7}$$

Example 2.) $\frac{1633}{5}$

$$\begin{array}{r} 326 \\ 5\overline{)1633} \\ -15 \\ \hline 13 \\ -10 \\ \hline 33 \\ -30 \\ \hline 3 \end{array} \qquad 326\frac{3}{5}$$

Polynomial Long Division – one way to divide polynomials

Example 3.) Divide $f(x) = 3x^4 - 5x^3 + 4x - 6$ by $x^2 - 3x + 5$

Note – include a 0 as the coefficient of x^2 in the dividend

Note – at each stage, divide the term with the highest power in what is left of the dividend by the first term of the divisor

$$\begin{array}{r} 3x^2 + 4x - 3 \\ x^2-3x+5\overline{)3x^4 - 5x^3 + 0x^2 + 4x - 6} \\ -(3x^4 - 9x^3 + 15x^2) \\ \hline 4x^3 - 15x^2 + 4x \\ -(4x^3 - 12x^2 + 20x) \\ \hline -3x^2 - 16x - 6 \\ -(-3x^2 + 9x - 15) \\ \hline -25x + 9 \end{array}$$

$$\boxed{3x^2 + 4x - 3 + \frac{-25x+9}{x^2-3x+5}}$$

Note – you can check the result of a division problem by multiplying the quotient by the divisor and adding the remainder. The result should be the dividend.

Example 4.) Divide $f(x) = x^3 + 5x^2 - 7x + 2$ by $x - 2$

$$\begin{array}{r} x^2 + 7x + 7 \\ x-2\overline{)x^3 + 5x^2 - 7x + 2} \\ -(x^3 - 2x^2) \\ \hline 7x^2 - 7x \\ -(7x^2 - 14x) \\ \hline 7x + 2 \\ -(7x - 14) \\ \hline 16 \end{array}$$

$$\boxed{x^2 + 7x + 7 + \frac{16}{x-2}}$$