Explain: Application of Synthetic and Long Divison **Name:**____________________________

Factor Theorem

Let a polynomial f(x) be divided by x – a. If the remainder is 0, then x – a is a factor of f(x).

Ex 1. Let $f(x) = 3x^3 – 4x^2 – 28x – 16$. Is (x+2) a factor?

Ex 2: Synthetic division can also be used to help us factor and solve polynomials.

Given that (x + 3) is a factor of $f(x)= 2x^3 + 9x^2 + 10x + 3$.

Step 1: Divide out the factor.

Step 2: Factor the Quadratic expression left.

Step 3: List all three factors.

Step 4: Determine the zeros, or roots.

Ex 3: Factor $f(x) = x^3 – 18x^2 + 95x – 126$ given that $(x – 9)$ is a factor.

Ex 4: Factor $f(x) = 2x^3 + 3x^2 – 39x – 20$ given that -5 is a zero of f(x).

Ex 5: Show that (3x-2) is a factor of $3x^3-8x^2+16x-8$. Can you use Synthetic?

Remainder Theorem

$$\begin{array}{r} q(x) \\ x-a\overline{\big)\, f(x)} \\ \underline{WORK} \\ f(a) \end{array}$$

If a polynomial f(x) is divided by x – a, the remainder is the constant f(a).

So to find f(a) you can do synthetic division of the polynomial with the “a” value.

And,

f(x) = q(x) • (x – a) + f(a) where q(x) is a polynomial with degree one less that the degree of f(x).

To find the y-value for f(a), divide f(x) by (x-a) and your reminder is the answer.

Ex 6: Let $f(x) = 2x^4 – x^3 + 4$. Show that f(-1) is the remainder when f(x) is divided by (x + 1).

Ex 7: Let $f(x) = x^3 + 5x^2 – 7x + 2$. Find f(2).