HN Math III: Unit 3 – Day 4 Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**DIVIDING POLYNOMIALS**

**Long Division**

Just like we can use long division to divide numbers, polynomials can be divided using the same process.



First, line up your polynomial in standard form. Then,

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the first term of the divisor by the first term in the dividend. Put the result in the “answer”
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the divisor by that “answer” and put that below the dividend.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to create a new polynomial. (Don’t forget to distribute the subtraction)
4. Repeat!

**EX:** $(x^{2}+2x-7) ÷(x-2)$ **EX:**  $(2x^{2}-5x-1) ÷(x-3)$

**MISSING TERMS:**

**EX:** $(x^{6}+2x^{4}+6x-9) ÷(x^{3}+3)$

**Synthetic Division**

Synthetic division is a shorthand method of long division in the special case of dividing by a *linear factor,* and it ONLY works in this case.

1. Set the divisor equal to zero and solve for x. This number goes in the “box”
2. Line up your coefficients from the dividend next to the box (including 0 placeholders if needed). Leave some room below these numbers, then draw a line under them.
3. Bring the leading coefficient straight down and put it under the line.
4. Multiply number in the “box” by the number that you brought down, and put the result under the second coefficient.
5. Add the two numbers together and write the result under the line.
6. Repeat this process until you have run out of numbers.
7. Your answer becomes the leading coefficients a polynomial in standard form with the degree **one less** than what you started with, and the last number is the remainder.

**EX:** $(x^{3}-x^{2}-2x+8) ÷(x+2)$

**EX:** $(4x^{3}+50x^{2}+105x+56) ÷(x+10)$ **EX:** $(4x^{3}-8x+3) ÷(x+2)$

**REMAINDER THEOREM**

When you divide a polynomial $f(x)$ by a factor $(x-c)$, where $c$ is a constant, the remainder will be $f\left(c\right).$

**EX:** What is the remainder of $(2x^{2}-5x-1)÷(x-3)$?

How will you know if the binomial you are dividing by will be a **factor** of the divisor?

**EX:** Will $(x+4)$ be a factor of $(x^{3}+x^{2}-7x+20$? How do you know?