

Name: _____

Date: _____

Learning Goal 5.3

I can multiply and divide polynomials.

Recall the area model for multiplying and dividing polynomials by a monomial.

$$\begin{aligned} & -3x(2 - 3x) \\ &= -6x + 9x^2 \end{aligned}$$

$$\begin{aligned} & \frac{6x^2 - 9x}{-3x} \\ &= \frac{6x^2}{-3x} - \frac{9x}{-3x} \\ &= -2x^1 + 3x^0 \rightarrow 1 \\ &= -2x + 3 \end{aligned}$$

The same rules apply if that constant is replaced with a binomial (a 2-term polynomial).

Example Expand and simplify, if possible.

$$\begin{aligned} \text{a. } & (x - 4)(x + 1) \\ &= (x \cdot x) + (1 \cdot x) - (4 \cdot x) - (4 \cdot 1) \\ &= x^2 + x - 4x - 4 \\ &= x^2 - 3x - 4 \end{aligned}$$

$$\begin{aligned} \text{b. } & (2 - x)(x - 3) \\ &= (2 \cdot x) - (2 \cdot 3) - (x \cdot x) + (x \cdot 3) \\ &= 2x - 6 - x^2 + 3x \\ &= 5x - 6 - x^2 \end{aligned}$$

$$\begin{aligned} \text{c. } & (x + 2)(4x - 3) \\ &= (x \cdot 4x) - (x \cdot 3) + (2 \cdot 4x) - (2 \cdot 3) \\ &= 4x^2 - 3x + 8x - 6 \end{aligned}$$

just like long division!

Example Simplify where possible.

a. $\frac{x^2 + 7x + 6}{x + 1}$
 $= x + 6$

$$\begin{array}{r} x+6 \\ x+1 \overline{) x^2+7x+6} \\ \underline{-(x^2+x)} \\ 0+6x+6 \\ \underline{-(6x+6)} \\ 0+0 \end{array}$$

* only worry about the leading terms - make them match
 $x(x+1) = x^2 + x$
 $6(x+1) = 6x + 6$

b. $\frac{x^2 + 5x + 6}{x + 2}$
 $= x + 3$

$$\begin{array}{r} x+3 \\ x+2 \overline{) x^2+5x+6} \\ \underline{-(x^2+2x)} \\ 0+3x+6 \\ \underline{-(3x+6)} \\ 0 \end{array}$$

$x(x+2) = x^2 + 2x$
 $3(x+2) = 3x + 6$

c. $\frac{x^2 + 7x + 10}{x + 3}$

\Rightarrow Not a factor
 \Rightarrow no solution

$$\begin{array}{r} x+4 \\ x+3 \overline{) x^2+7x+10} \\ \underline{-(x^2+3x)} \\ 0+4x+10 \\ \underline{-(4x+12)} \\ -2 \end{array}$$

-2 ← does not divide evenly

A harder (or extending) problem would be

Find the greatest common factor of the following expression, then factor the expression.

$$x^2 + 14x + 49$$