

# Warmup:

Divide without using a calculator:

$$1048 \div 5 = 209.6$$

$10 \div 5 = 2$   
 $5 \times 2 = 10$

$$\begin{array}{r} 209.6 \\ 5 \overline{) 1048.0} \\ \underline{-(10)} \phantom{0} \\ 04 \phantom{0} \\ \underline{-0} \phantom{0} \\ 48 \phantom{0} \\ \underline{-45} \phantom{0} \\ 30 \phantom{0} \\ \underline{-30} \\ \hline \end{array}$$

$$\begin{array}{l} \star \\ 209 \text{ R } 3 \\ \hline \star \\ 209 \frac{3}{5} \end{array}$$

$$736 \div 6 = 122 \text{ R } 4$$

$$\begin{array}{r} 122 \\ 6 \overline{) 736} \\ \underline{-6} \phantom{0} \\ 13 \phantom{0} \\ \underline{-12} \phantom{0} \\ 16 \\ \underline{-12} \\ 4 \end{array}$$

or  
 $122 \frac{4}{6}$   
 $122 \frac{2}{3}$

# Polynomial Long Division

So far, we have added,  
subtracted, multiplied, and  
expanded polynomials.

Today, we will divide polynomials!!

$$\overset{\text{dividend}}{(x^2 - 9x - 10)} \div \overset{\text{divisor}}{(x + 1)}$$

check:

$$\begin{array}{r}
 \boxed{x+1} \overline{) x^2 - 9x - 10} \\
 \underline{-(x^2 + 1x)} \phantom{-10} \\
 -10x - 10 \\
 \underline{-(-10x - 10)} \\
 0
 \end{array}$$

$$(x^2 - 9x - 10) \div (x + 1) = \boxed{x - 10}$$

$$\begin{aligned}
 (x+1)(x-10) &= (x^2 - 9x - 10) \\
 x^2 - 10x + x - 10 &\checkmark
 \end{aligned}$$

$$-10(x+1)$$

$$\underline{\underline{x(x+1)}}$$

$$\frac{x^2}{x} = \boxed{x}$$

$$\frac{-10x}{x} = -10$$

$$(x^2 + 3x - 10) \div (x-2) = (x+5)$$

check:

$$\begin{array}{r}
 x + 5 \\
 \hline
 x - 2 \overline{) x^2 + 3x - 10} \\
 \underline{-x^2 + 2x} \phantom{-10} \\
 5x - 10 \\
 \underline{-5x + 10} \\
 0
 \end{array}$$

$$\frac{5x}{x} = 5$$

$$5(x-2)$$

$$\frac{x^2}{x} = \boxed{x}$$

$$\begin{array}{r}
 x(x-2) \\
 \underline{x^2 - 2x}
 \end{array}$$

check:  $(x-2)(x+5) \stackrel{?}{=} x^2 + 3x - 10$

$$\begin{array}{r}
 x^2 + 5x - 2x - 10 \\
 \hline
 x^2 + 3x - 10
 \end{array}$$

$$(2x^2 - 5x - 3) \div (x - 3) = (2x + 1)$$

$$\frac{2x^2}{x} = 2x$$

$$2x(x - 3)$$

$$\frac{x}{x} = 1$$

$$1(x - 3)$$

$$\begin{array}{r}
 2x + 1 \\
 \hline
 x - 3 \overline{) 2x^2 - 5x - 3} \\
 \underline{- 2x^2 + 6x} \phantom{- 3} \\
 11x - 3 \\
 \underline{- 11x + 33} \\
 -36
 \end{array}$$

$$(2x^2 - 5x - 3) \div (x - 2) = (2x - 1) \text{ R } -5$$

$$(2x - 1) + \frac{-5}{x - 2}$$

$$\begin{array}{r}
 \phantom{x-2} \overline{2x - 1} \\
 x - 2 \overline{) 2x^2 - 5x - 3} \\
 \underline{-2x^2 + 4x} \phantom{-3} \quad \downarrow \\
 \phantom{x-2} \overline{-1x - 3} \\
 \underline{+x + 2} \\
 \phantom{x-2} \phantom{) } -5
 \end{array}$$

$$2x(x - 2)$$

$$\frac{-1x}{x} = -1$$

$$-1(x - 2) = -x + 2$$

$$\frac{-5}{x}$$

$$(3x^2 + 14x + 8) \div (x + 4) = (3x + 2)$$

$$\begin{array}{r}
 \phantom{x+4} \overline{3x + 2} \\
 x+4 \overline{) 3x^2 + 14x + 8} \\
 \underline{-3x^2 + 12x} \phantom{+ 8} \\
 2x + 8 \\
 \underline{-2x + 8} \\
 0
 \end{array}$$

$$(3x^2 + 14x + 8) \div (3x + 2)$$



$$(125y^3 - 8) \div (5y - 2) = (25y^2 + 10y + 4)$$

$$\begin{array}{r}
 25y^2 + 10y + 4 \\
 \hline
 5y - 2 \overline{) 125y^3 - 8} \\
 \underline{-125y^3 + 50y^2} \phantom{- 8} \\
 \phantom{125y^3 -} 50y^2 - 8
 \end{array}$$

$$\begin{array}{r}
 50y^2 - 8 \\
 \underline{-50y^2 + 20y} \\
 20y - 8
 \end{array}$$

$$\begin{array}{r}
 20y - 8 \\
 \underline{-20y + 8} \\
 0
 \end{array}$$

$$\frac{125y^3}{5y^1} = 25y^2$$

$$25y^2(5y - 2)$$

$$\frac{50y^2}{5y} = 10y$$

$$10y(5y - 2)$$

$$\frac{20y}{5y} = 4$$

$$4(5y - 2)$$

$$(9y^4 + 14y^2 - 8) \div (y + 2)$$

$$y+2 \overline{) \begin{array}{r} 9y^4 + 0y^3 + 14y^2 + 0y - 8 \\ 9y^3 - 18y^2 + 50y - 100 + \frac{192}{y+2} \end{array}}$$

$$\begin{array}{r} 9y^4 \\ y \\ \hline -18y^3 \\ y \\ \hline 50y^2 \\ y \\ \hline \end{array}$$

$$\begin{array}{r} -18y^3 + 14y^2 \\ + 18y^3 + 36y^2 \\ \hline \end{array}$$

$$\begin{array}{r} 50y^2 + 0y \\ -50y^2 + 100y \\ \hline -100y - 8 \\ +100y + 200 \\ \hline \end{array}$$

$$\frac{-100y}{y}$$

$$(9y^4 + 14y^2 - 8) \div (3y + 2)$$

$$1) (3m^3 + 5m^2 - 4) \div (3m + 5)$$

$$2) (4k^3 - 14k^2 - 10k + 5) \div (4k - 2)$$

$$3) (3x^3 + 11x^2 - 5x - 6) \div (x + 4)$$

$$4) (2v^3 + 8v^2 - 20v + 5) \div (2v - 2)$$

# HW #5: Polynomial Long Division