

# Section 6.3 - Dividing Polynomials (Long Division)

## 1) Dividing by a monomial <sup>single term</sup>

ex:  $\frac{5x+125}{10} = \frac{5(x+25)}{10} = \frac{x+25}{2}$

OR  $\frac{5x}{10} + \frac{125}{10} = \frac{x}{2} + \frac{25}{2}$  → only allowed to split a numerator...

NO!  $\frac{5x+125}{2 \cancel{10}}$  stop sign!

ex:  $\frac{8a^3b - 2a^2}{2a} = \frac{4a^3b - 2a^2}{1 \cdot 2a} = \frac{4a^2b - a}{2a}$

OR  $\frac{2a^2(4ab-1)}{2a} = a(4ab-1)$

## 2) Dividing by a binomial or larger (2+ terms!)

LONG DIVISION      dividend      divisor

ex:  $190 \div 3$

$$\begin{array}{r} 3 \overline{) 190} \\ \underline{-3} \phantom{0} \\ 27 \\ \underline{-27} \\ 0 \phantom{0} \\ \underline{-0} \\ 0 \end{array}$$

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

$$\begin{array}{r} 3x^2 + 4x + 13 + 25 \\ \hline x-2 \overline{) 3x^3 - 2x^2 + 5x - 1} \\ \underline{-3x^3 + 6x^2} \phantom{-1} \\ 4x^2 + 5x \phantom{-1} \\ \underline{-4x^2 + 8x} \phantom{-1} \\ 13x - 1 \\ \underline{-13x + 26} \\ 25 \end{array}$$

ex #3  $(x^3 - 1) \div (x + 4)$  → you must put placeholders in when missing terms - std form!

$$\begin{array}{r}
 \text{ex #3} \\
 \hline
 (x^3 - 1) \div (x + 4) \\
 \hline
 \text{cloud: } x^2 - 4x + 16 - 65/x + 4 \\
 \hline
 x + 4 \overline{) x^3 + 0x^2 + 0x - 1} \\
 \underline{-x^3 + 4x^2} \phantom{0x} \phantom{-1} \\
 -4x^2 + 0x \phantom{-1} \\
 \underline{+4x^2 + 16x} \phantom{-1} \\
 16x - 1 \\
 \underline{-16x + 64} \\
 -65
 \end{array}$$

ex #4  $(4y^4 - 2y^2 + 1) \div (2y^2 + 1)$  →  $4y^4 + 0y^3 - 2y^2 + 0y + 1$

$$\begin{array}{r}
 \text{ex #4} \\
 \hline
 (4y^4 - 2y^2 + 1) \div (2y^2 + 1) \\
 \hline
 \text{cloud: } 2y^2 - 2 + 3/2y^2 + 1 \\
 \hline
 2y^2 + 1 \overline{) 4y^4 + 0y^3 - 2y^2 + 0y + 1} \\
 \underline{-4y^4} \phantom{0y^3} \phantom{-2y^2} \phantom{0y} \phantom{+1} \\
 -2y^2 \phantom{0y} \phantom{+1} \\
 \underline{+4y^2} \phantom{0y} \phantom{+1} \\
 -4y^2 \phantom{0y} \phantom{+1} \\
 \underline{+4y^2} \phantom{0y} \phantom{+1} \\
 0 \phantom{0y} \phantom{+1} \\
 3
 \end{array}$$

Must use long division:

- 1) divisor is a quadratic or higher
- 2) leading coeff of divisor is  $\neq 1$ .

ex #2:  $(-y^2 + 2y^3 + 25) \div (y - 3)$

$$\begin{array}{r}
 \text{ex #2} \\
 \hline
 (-y^2 + 2y^3 + 25) \div (y - 3) \\
 \hline
 \text{cloud: } 2y^2 + 5y + 15 + \frac{70}{y-3} \\
 \hline
 y - 3 \overline{) 2y^3 - y^2 + 0y + 25} \\
 \underline{-2y^3 + 6y^2} \phantom{0y} \phantom{+25} \\
 5y^2 + 0y \phantom{+25} \\
 \underline{-5y^2 + 15y} \phantom{+25} \\
 15y + 25 \\
 \underline{-15y + 45} \\
 70
 \end{array}$$