

5-3 Dividing Polynomials

Objective: Divide Polynomials using long and synthetic division.

I. Dividing by a monomial

Ex1) $\frac{5a^2b - 15ab^3 + 10a^3b^4}{5ab}$

$$= \frac{5a^2b}{5ab} - \frac{15ab^3}{5ab} + \frac{10a^3b^4}{5ab}$$

$$= a - 3b^2 + 2a^2b^3$$

II. Long Division

**Remember: 5 | 4612

$$\begin{array}{r} 922 \frac{2}{5} \\ 5 \overline{) 4612} \\ \underline{45} \\ 10 \\ \underline{10} \\ 12 \\ \underline{10} \\ 2 \end{array}$$

EX 2. $(z^2 + 2z - 24)/(z - 4)$

$$\begin{array}{r} z+6 \\ z-4 \overline{) z^2+2z-24} \\ \underline{z-4z} \\ 6z-24 \\ \underline{6z-24} \\ 0 \end{array}$$

EX 3. $(a^2 - 5a + 3)/(a - 2)^{-1}$

$$\begin{array}{r} a-3 + \frac{-3}{a-2} \\ a-2 \overline{) a^2-5a+3} \\ \underline{a^2-2a} \\ -3a+3 \\ \underline{-3a+6} \\ -3 \end{array}$$

EX 4. $(x^3 - 2x - 15)/(x - 5)$

$$\begin{array}{r} x^2+5x+23 + \frac{100}{x-5} \\ x-5 \overline{) x^3+0x^2-2x-15} \\ \underline{x^3-5x^2} \\ 5x^2-2x \\ \underline{5x^2-25x} \\ 23x-15 \\ \underline{23x-115} \\ 100 \end{array}$$

III. Synthetic Division—is a faster way to divide polynomials. But, it can only be used when the divisor is in the form $x - c$. The coefficient in front of the divisor must be 1.

EX 5. $(x^3 - 4x^2 + 6x - 4)/(x - 2)$

$$\begin{array}{r|rrrr} 2 & 1 & -4 & 6 & -4 \\ & & 2 & -4 & 4 \\ \hline & 1 & -2 & 2 & 0 \end{array}$$

↑
Remainder

$$x^2 - 2x + 2$$

EX 6. $(5x^4 - 13x^2 + 10x - 8)/(x + 1)$

$$\begin{array}{r|rrrrr} -1 & 5 & 0 & -13 & 10 & -8 \\ & & -5 & 5 & 8 & -18 \\ \hline & 5 & -5 & -8 & 18 & -26 \end{array}$$

$$5x^3 - 5x^2 - 8x + 18 + \frac{-26}{x+1}$$