

# 6.5 Part 1 DIVIDING POLYNOMIALS

## Synthetic Division

Synthetic Division is a quick method for dividing polynomials.

BUT it can only be used when the divisor is in the form  $x - c$

In synthetic division, we only write the coefficients *linear* for the division process.

### Example 1

Divide  $f(x) = x^3 - x^2 + 4x - 10$  by  $(x - 2)$ .

$$\begin{array}{r|rrrr} 2 & 1 & -1 & 4 & -10 \\ & \downarrow & 2 & 2 & 12 \\ \hline & 1 & 1 & 6 & 2 \end{array} \leftarrow \text{remainder}$$

$$\begin{array}{l} x - 2 = 0 \\ +2 \quad +2 \\ \hline x = 2 \end{array} \leftarrow \text{put in the box}$$

$$\boxed{1x^2 + 1x + 6 + \frac{2}{x-2}}$$

### Example 2

Divide  $f(x) = 2x^4 - 3x^3 - 24x^2 + 13x + 12$  by  $(x - 1)$ .

$$\begin{array}{r|rrrrr} 1 & 2 & -3 & -24 & 13 & 12 \\ & \downarrow & 2 & -1 & -25 & -12 \\ \hline & 2 & -1 & -25 & -12 & 0 \end{array} \leftarrow \text{remainder}$$

$$\begin{array}{l} x - 1 = 0 \\ +1 \quad +1 \\ \hline x = 1 \end{array} \rightarrow \text{box}$$

$$\boxed{2x^3 - 1x^2 - 25x - 12}$$

Example 3  $2x^3 + x^2 + 0x + 8$

Divide  $f(x) = 2x^3 + x^2 + 8$  by  $(x + 2)$ .

$$\begin{array}{r} x+2=0 \\ -2 \quad -2 \\ \hline x = -2 \leftarrow \text{box} \end{array}$$

$$\begin{array}{r} \underline{-2} \mid \quad 2 \quad -1 \quad 0 \quad 8 \\ \quad \downarrow \quad -4 \quad 10 \quad -20 \\ \hline \quad 2 \quad -5 \quad 10 \quad -12 \leftarrow \text{remainder} \end{array}$$

$$\boxed{2x^2 - 5x + 10 - \frac{12}{x+2}}$$

Example 4

Divide  $f(x) = 3x^4 - 5x^3 + 4x - 6$  by  $(x - 2)$ .

$$\begin{array}{r} x-2=0 \\ +2 \quad +2 \\ \hline x = 2 \leftarrow \text{box} \end{array}$$

$$\begin{array}{r} \underline{2} \mid \quad 3 \quad -5 \quad 0 \quad 4 \quad -6 \\ \quad \downarrow \quad 6 \quad 2 \quad 4 \quad 16 \\ \hline \quad 3 \quad 1 \quad 2 \quad 8 \quad 10 \leftarrow \text{remainder} \end{array}$$

$$\boxed{3x^3 + 1x^2 + 2x + 8 + \frac{10}{x-2}}$$

Example 5  $x^3 + 0x^2 + 0x + 64$   $x+4=0$   
 $\frac{-4}{-4}$   
 $x=-4 \leftarrow \text{box}$

Divide  $f(x) = x^3 + 64$  by  $(x+4)$ .

$$\begin{array}{r|rrrr} -4 & 1 & 0 & 0 & 64 \\ & \downarrow & -4 & 16 & -64 \\ \hline & 1 & -4 & 16 & 0 \leftarrow \text{remainder} \end{array}$$

$$\boxed{1x^2 - 4x + 16}$$

Example 6

Divide  $f(x) = 3x^4 + 16x^3 - 33x^2 + 14x$  by  $(x+7)$ .

$$\begin{array}{r} x+7=0 \\ \frac{-7}{-7} \\ x=-7 \leftarrow \text{box} \end{array}$$

$$\begin{array}{r|rrrrrr} -7 & 3 & 16 & -33 & 14 & 0 \\ & \downarrow & -21 & 35 & -14 & 0 \\ \hline & 3 & -5 & 2 & 0 & 0 \end{array}$$

$$\boxed{3x^3 - 5x^2 + 2x}$$

Example 7Divide  $f(x) = 2x^4 - 19x^2 + 9$  by  $(x - 3)$ .

$$\begin{array}{r} x-3=0 \\ +3 \quad +3 \\ \hline x=3 \leftarrow \text{box} \end{array}$$

$$\begin{array}{r} \underline{3} \mid \quad 2 \quad 0 \quad -19 \quad 0 \quad 9 \\ \quad \downarrow \quad 6 \quad 18 \quad -3 \quad -9 \\ \hline \quad 2 \quad 6 \quad -1 \quad -3 \quad 0 \leftarrow \text{remainder} \end{array}$$

$$\boxed{2x^3 + 6x^2 - 1x - 3}$$

Example 8Divide  $f(x) = 6x^3 + 7x^2 - 19x + 7$  by  $(2x - 1)$ .