

Dividing Using Synthetic Division

Use synthetic division.

Example 1

1 Check for and put in zero placeholders.

$$\begin{array}{r} 2x^3 + 9x^2 + x - 12 \\ x + 4 \end{array} \rightarrow \begin{array}{r|rrrr} -4 & 2 & 9 & 1 & -12 \\ & \downarrow & -8 & -4 & 12 \\ \hline & 2 & 1 & -3 & 0 \end{array}$$

$2x^2 + x - 3$

zero placeholder for x^2 term.

2 Copy the coefficients.

use the opposite sign for the number in the divisor.

$$\begin{array}{r} x^4 - 2x^3 + 13x - 5 \\ x + 2 \end{array} \rightarrow \begin{array}{r|rrrrr} -2 & 1 & -2 & 0 & 13 & -5 \\ & \downarrow & -2 & 8 & -16 & +6 \\ \hline & 1 & -4 & 8 & -3 & 1 \end{array}$$

$x^3 - 4x^2 + 8x - 3 + \frac{1}{x+2}$

3 Follow the pattern.

4 The variables increase in degree from R to L, Write $\frac{\text{Remainder}}{\text{divisor}}$

$$\begin{array}{r} 6x^3 + 7x^2 + x + 1 \\ 2x + 3 \end{array} \rightarrow \begin{array}{r} 6x^3 + 7x^2 + x + 1 \\ 2(x + \frac{3}{2}) \end{array}$$

We have to force factor the divisor

Use synthetic division on the inside of (), at the end we need to mult. by $\frac{1}{2}$.

$$\frac{1}{2} \left(\begin{array}{r} 6x^3 + 7x^2 + x + 1 \\ x + \frac{3}{2} \end{array} \right) \rightarrow \begin{array}{r|rrrr} -\frac{3}{2} & 6 & 7 & 1 & 1 \\ & \downarrow & -9 & 3 & -6 \\ \hline & 6 & -2 & 4 & -5 \end{array}$$

$$\frac{1}{2} \left(\begin{array}{r} 6x^2 - 2x + 4 + \frac{-5}{x + \frac{3}{2}} \\ \frac{6x^2 - 2x + 4}{2} + \frac{-5}{2(x + \frac{3}{2})} \end{array} \right)$$

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