

13.2 – Synthetic Division

To divide a polynomial by a linear factor, you can use synthetic division.

Steps:

- Write the problem as a division problem. Make sure everything is in standard form.
- Write the problem in synthetic division form. Reverse the sign of the constant term in the linear factor.
- Bring down the first coefficient.
- Multiply the first coefficient by the constant term. Write the result under the next coefficient. Add these together.
- Repeat the steps of multiplying and adding until you have used all coefficients.
- Write the answer using the last number as the remainder.

Example 1: Use synthetic division to divide $3x^3 - 4x^2 + 2x - 1$ by $x + 1$.

$$x+1 \overline{) 3x^3 - 4x^2 + 2x - 1}$$

$$\begin{array}{r} -1 \ 3 \ -4 \ 2 \ -1 \\ \underline{-3 \ 7 \ -9} \\ 3 \ -7 \ 9 \ \boxed{-10} \end{array}$$

$$3x^2 - 7x + 9 \ R-10$$

Example 2: Use synthetic division to divide $x^3 - 13x + 12$ by $x + 4$.

$$x+4 \overline{) x^3 + 0x^2 - 13x + 12}$$

$$\begin{array}{r} -4 \ 1 \ 0 \ -13 \ 12 \\ \underline{-4 \ 16 \ -12} \\ 1 \ -4 \ 3 \ \boxed{0} \end{array}$$

$$x^2 - 4x + 3$$