The University of New South Wales
School of Mathematics and Statistics

Mathematics Drop–in Centre

POLYNOMIAL DIVISION

You need to be able to divide one polynomial by another, giving a quotient and remainder, and to write the result of your calculation as an equation. The working can be set out using long division, as in the following example.

Problem. Divide $2x^3 + 3x^2 - 4x - 9$ by $x^2 - x - 3$.

Solution. The line numbers in the following are just for explanation and you do not need to write them in your working.

$$
\begin{array}{rrl}
 & 2x + 5 & (1) \\
x^2 - x - 3 \,\big) & 2x^3 + 3x^2 - 4x - 9 & (2) \\
 & 2x^3 - 2x^2 - 6x & (3) \\
\hline
 & 5x^2 + 2x - 9 & (4) \\
 & 5x^2 - 5x - 15 & (5) \\
\hline
 & 7x + 6 & (6)
\end{array}
$$

This shows that if $2x^3 + 3x^2 - 4x - 9$ is divided by $x^2 - x - 3$, the quotient is $2x + 5$ and the remainder is $7x + 6$. This can be written as the equation

$$2x^3 + 3x^2 - 4x - 9 = (x^2 - x - 3)(2x + 5) + (7x + 6) \ ,$$

and you can check your working by multiplying out the right hand side.

Explanation of the method.

- Write the given polynomials as in line (2).
- Look at the first term of each, that is, $2x^3$ and x^2