Dividing Polynomials: Long Division

Example 1

Divide $2x^2+5x-8$ by $x+3$.

A restriction must be placed on x in order to avoid division by 0. Here $x\neq-3$.
The process required to carry out the division of a polynomial by another polynomial is similar to the procedure used for numerical long division.

*** Recall the process of numerical long division and review the terminology by dividing 1724 by 13 .
Show Work:

Conclusion: 1724 = 132 x 13 + 8

Dividend = Divisor × Quotient + Remainder

Back to Example 1:

Divide $2x^2+5x-8$ by $x+3$.

Solution

To begin, set up the division question and ensure the terms of the dividend and divisor are in descending order of degree.

In Conclusion:
$P(x) = d(x)\,q(x) + r(x)$ [Dividend = Divisor × Quotient + Remainder]

OR , in our example:

$$2x^2+5x-8 = (x+3)(2x-1)-5$$

Example 2

Determine the quotient and remainder for $(4x^3 - 11x - 9) \div (2x - 3), \quad x \neq 3/2$

Solution

Notice the dividend has no x^2 term. When terms are missing in the dividend or divisor, placeholders are used to keep the terms properly aligned.

$$2x-3 \enclose{longdiv}{4x^3 + \underset{\substack{\uparrow \\ \text{placeholder}}}{0x^2} - 11x - 9}$$

Example 3

Determine $3x^4 + 12x^2 - 2x^3 - 5 \div x^2 - 1, \; x \neq \pm 1$.

Solution

When setting up the division, ensure the terms of the dividend and divisor are in descending order, and use placeholders for missing terms.

$$x^2 \underset{\substack{\uparrow \\ \text{placeholder}}}{+0x} - 1 \enclose{longdiv}{3x^4 - 2x^3 + 12x^2 + \underset{\substack{\uparrow \\ \text{placeholder}}}{0x} - 5}$$