

3.1 Operations with Polynomials

Objective: student will add, subtract, and multiply polynomials

Polynomial-- term or sum of terms where each term is a product of a real number coefficient and a variable with a whole number exponent.

$$2x^3 + 5x^2 + 4x + 6$$

Standard form--

polynomial written with the exponents in decreasing order

Degree -- the greatest exponent (or sum of exponents) of the polynomial.

Constant- the term without a variable.

Add and Subtract Polynomials

Ex. 1 Given that $f(x) = (3x^4 + 9x^3 - 3x^2 + 5)$ and $g(x) = (7x^4 - 4x^3 - x^2 + 6x - 12)$. Find:

$f(x) + g(x)$	$f(x) \ominus g(x)$
$\begin{array}{r} 3x^4 + 9x^3 - 3x^2 + 5 \\ 7x^4 - 4x^3 - x^2 + 6x - 12 \\ \hline 10x^4 + 5x^3 - 4x^2 + 6x - 7 \end{array}$	$\begin{array}{r} 3x^4 + 9x^3 - 3x^2 + 5 \\ -7x^4 + 4x^3 + x^2 - 6x + 12 \\ \hline -4x^4 + 13x^3 - 2x^2 - 6x + 17 \end{array}$

Ex. 2 Given that $f(x) = (-7x^5 + 8x^3 - 2x^2 + x - 9)$ and $g(x) = (-5x^3 - 12x + 2)$. Find:

$f(x) + g(x)$	$f(x) \ominus g(x)$
$\begin{array}{r} -7x^5 + 8x^3 - 2x^2 + x - 9 \\ -5x^3 - 12x + 2 \\ \hline -7x^5 + 3x^3 - 2x^2 - 11x - 7 \end{array}$	$\begin{array}{r} -7x^5 + 8x^3 - 2x^2 + x - 9 \\ +5x^3 + 12x - 2 \\ \hline -7x^5 + 13x^3 - 2x^2 + 13x - 11 \end{array}$

Multiply Polynomials

can multiply horizontally

Ex. 3 Given that $f(x) = x^3 - 3x^2 + 5$ and $g(x) = x^2 - 12$. Find:

$$f(x) \cdot g(x) = (x^3 - 3x^2 + 5)(x^2 - 12) = x^5 - 12x^3 - 3x^4 + 36x^2 + 5x^2 - 60 = x^5 - 3x^4 - 12x^3 + 41x^2 - 60$$

Ex. 4 Given that $f(x) = 2x^3 - x^2 + 1$ and $g(x) = x^2 + 2x - 4$. Find:

or can multiply vertically

$$\begin{array}{r} 2x^3 - x^2 + 1 \\ \times x^2 + 2x - 4 \\ \hline -8x^3 + 4x^2 - 4 \\ 4x^4 - 2x^3 + 2x \\ 2x^5 - x^4 + x^2 \\ \hline 2x^5 + 3x^4 - 10x^3 + 5x^2 + 2x - 4 \end{array}$$

or multiply horizontally, if you prefer.

$$(2x^3 - x^2 + 1)(x^2 + 2x - 4) = 2x^5 + 4x^4 - 8x^3 - x^4 - 2x^3 + 4x^2 + x^2 + 2x - 4 = 2x^5 + 3x^4 - 10x^3 + 5x^2 + 2x - 4$$