

Multiplying Polynomials

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Multiplying polynomials

Let's start with multiplying two monomials together.

$$\begin{aligned}
 & (3x^2)(4x), && \text{multiply like factors} \\
 = & 12x^2x, && \text{multiply powers using power rules} \\
 = & 12x^3
 \end{aligned}$$

Let's multiply a monomial and a binomial.

$$\begin{aligned}
 & (3x^3)(2x^2 + 4), && \text{multiply monomial into the binomial} \\
 = & (3x^3)(2x^2) + (3x^3)(4), && \text{multiply monomials} \\
 = & 6x^3x^2 + 12x^3 \\
 = & 6x^5 + 12x^3
 \end{aligned}$$

Let's multiply two binomials together.

$$\begin{aligned}
 & (2x^2 + 3)(-3x^3 + x), && \text{multiply to obtain monomial} \times \text{binomial} \\
 = & (2x^2)(-3x^3 + x) + (3)(-3x^3 + x), && \text{multiply to get monomial} \times \text{monomial} \\
 = & (2x^2)(-3x^3) + (2x^2)(x) + (3)(-3x^3) + (3)(x) \\
 = & -6x^2x^3 + 2x^2x - 9x^3 + 3x \\
 = & -6x^4 + 2x^3 - 9x^3 + 3x \\
 = & -6x^4 - 7x^3 + 3x
 \end{aligned}$$

Let's multiply two polynomials together now.

$$\begin{aligned}
 & (x + 3x^2 - 4)(x^2 + 2x^3) \\
 = & x(x^2 + 2x^3) + 3x^2(x^2 + 2x^3) - 4(x^2 + 2x^3) \\
 = & xx^2 + 2xx^3 + 3x^2x^2 + 6x^2x^3 - 4x^2 - 8x^3 \\
 = & x^3 + 2x^4 + 3x^4 + 6x^5 - 4x^2 - 8x^3 \\
 = & -7x^3 + 5x^4 + 6x^5 - 4x^2
 \end{aligned}$$

Notice that in each case we try and reduce it to the previous case until we have the product of a whole bunch of monomials added and subtracted together, then we group like terms.

Exercises

Multiply the following polynomials.

(a) $(2x^2)(-3x^3)$

(b) $(-4y^3)(y^2)$

(c) $(a^2 + a)(3a^3)$

(d) $(4a^2 + a + 2)(-2a)$

(e) $(3a + a^2)(4a^2 - a)$

(f) $(x^2 + x + 1)(x - 1)$

(g) $(3x - 2)(4 + 2x - 5x^2)$

(h) $(y^3 + y^2 + y + 1)(y + 2y^2 + 2)$

(i) $(x + x^2 + x^3)(x^4 - x^3 - x^2 - x - 1)$

(j) $5(z^6 - z^2 + 1)$