5.3 Add, Subtract, and Multiply Polynomials

TEKS a.2, 2A.2.A; P.3.A, P.3.B

Before You evaluated and graphed polynomial functions.

Now You will add, subtract, and multiply polynomials.

Why? So you can model collegiate sports participation, as in Ex. 63.

Key Vocabulary
- **like terms,** *p. 12*

To add or subtract polynomials, add or subtract the coefficients of like terms. You can use a vertical or horizontal format.

EXAMPLE 1 Add polynomials vertically and horizontally

a. Add $2x^3 - 5x^2 + 3x - 9$ and $x^3 + 6x^2 + 11$ in a vertical format.

b. Add $3y^3 - 2y^2 - 7y$ and $-4y^2 + 2y - 5$ in a horizontal format.

REVIEW SIMPLIFYING
For help with simplifying expressions, see p. 10.

Solution

a.
$$\begin{array}{r} 2x^3 - 5x^2 + 3x - 9 \\ +\ x^3 + 6x^2 \qquad + 11 \\ \hline 3x^3 + x^2 + 3x + 2 \end{array}$$

b. $(3y^3 - 2y^2 - 7y) + (-4y^2 + 2y - 5)$
$= 3y^3 - 2y^2 - 4y^2 - 7y + 2y - 5$
$= 3y^3 - 6y^2 - 5y - 5$

EXAMPLE 2 Subtract polynomials vertically and horizontally

a. Subtract $3x^3 + 2x^2 - x + 7$ from $8x^3 - x^2 - 5x + 1$ in a vertical format.

b. Subtract $5z^2 - z + 3$ from $4z^2 + 9z - 12$ in a horizontal format.

Solution

a. Align like terms, then add the opposite of the subtracted polynomial.

$$\begin{array}{r} 8x^3 - x^2 - 5x + 1 \\ -\ (3x^3 + 2x^2 - x + 7) \\ \hline \end{array} \quad \rightarrow \quad \begin{array}{r} 8x^3 - x^2 - 5x + 1 \\ +\ -3x^3 - 2x^2 + x - 7 \\ \hline 5x^3 - 3x^2 - 4x - 6 \end{array}$$

b. Write the opposite of the subtracted polynomial, then add like terms.

$$\begin{aligned} (4z^2 + 9z - 12) - (5z^2 - z + 3) &= 4z^2 + 9z - 12 - 5z^2 + z - 3 \\ &= 4z^2 - 5z^2 + 9z + z - 12 - 3 \\ &= -z^2 + 10z - 15 \end{aligned}$$

GUIDED PRACTICE for Examples 1 and 2

Find the sum or difference.

1. $(t^2 - 6t + 2) + (5t^2 - t - 8)$

2. $(8d - 3 + 9d^3) - (d^3 - 13d^2 - 4)$