5.3 Add, Subtract, and Multiply Polynomials

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.

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

EXAMPLE 1 **Add polynomials vertically and horizontally**

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

$(3y^3 - 2y^2 - 7y) + (-4y^2 + 2y - 5)$

$3y^3 - 6y^2 - 5y - 5$

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.

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

EXAMPLE 2 **Subtract polynomials vertically and horizontally**

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

$(4z^2+9z-12)-(5z^2-z+3)$

$4z^2+9z-12-5z^2+z-3$

$-z^2+10z-15$

EXAMPLE 3 **Multiply polynomials vertically and horizontally**

a. Multiply $-2y^2 + 3y - 6$ and $y - 2$ in a vertical format.

$$-2y^2+3y-6$$
$$\times \quad y-2$$
$$4y^2-6y+12$$
$$-2y^3+3y^2-6y$$
$$\boxed{-2y^3+7y^2-12y+12}$$

EXAMPLE 3 **Multiply polynomials vertically and horizontally**

b. Multiply $x + 3$ and $3x^2 - 2x + 4$ in a horizontal format.

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

$3x^3 - 2x^2 + 4x + 9x^2 - 6x + 12$

$3x^3 + 7x^2 - 2x + 12$

EXAMPLE 4 **Multiply three binomials**

Multiply $x - 5$, $x + 1$, and $x + 3$ in a horizontal format.

$(x-5)(x+1)(x+3)$

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

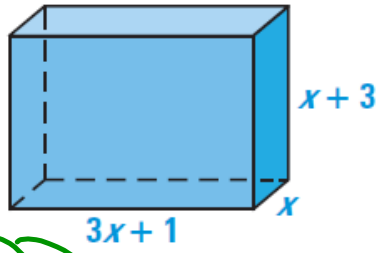
$(x^2-4x-5)(x+3)$

$x^3+3x^2-4x^2-12x-5x-15$

$x^3-x^2-17x-15$

GEOMETRY Write the figure's volume as a polynomial in standard form.

48. $V = \ell wh$



$V = (3x+1)(x)(x+3)$

$= (3x+1)(x^2+3x)$

$= 3x^3+9x^2+x^2+3x$

$V = 3x^3+10x^2+3x$