To add or subtract polynomials, simply add or subtract their like terms. To do this, you need add or subtract the coefficients of like terms. When adding two or more polynomials, you need write the terms of the polynomials in a vertical or in a horizontal line, and then combine the like terms. When subtracting first polynomial from the second polynomial, you must change the sign of the first polynomial.

Practice 15. Add the polynomials.

(a) $(3x^4 - 12x^3 - 7x^2 + 11x - 21) + (-x^4 - 2x^3 + 9x^2 - 14x - 33)$

(b) $(2x^3y^2 - 2x^2y^3 - 3xy^4 + x - 2y) + (-5x^3y^2 + 6x^2y^3 + xy^4 - 3x - y)$

Solution.
(a) $(3x^4 - 12x^3 - 7x^2 + 11x - 21) + (-x^4 - 2x^3 + 9x^2 - 14x - 33)$

$= 3x^4 - 12x^3 - 7x^2 + 11x - 21 - x^4 - 2x^3 + 9x^2 - 14x - 33$

$= 2x^4 - 14x^3 + 2x^2 - 3x - 54$

(b) $(2x^3y^2 - 2x^2y^3 - 3xy^4 + x - 2y) + (-5x^3y^2 + 6x^2y^3 + xy^4 - 3x - y)$

$= 2x^3y^2 - 2x^2y^3 - 3xy^4 + x - 2y - 5x^3y^2 + 6x^2y^3 + xy^4 - 3x - y$

$= -3x^3y^2 + 4x^2y^3 - 2xy^4 - 2x - 3y$

Practice 16. Subtract the polynomials.

(a) $(4m^5 - 3m^3 + 11m^2 - mn) - (-m^5 + m^3 - 4m^2 + 2mn)$

(b) $(4a^3b - 2a^3b^2 + 11a^3b^3 - 8ab) - (-a^3b + a^3b^2 - 3a^3b^3 - 4ab)$

Solution.
(a) $(4m^5 - 3m^3 + 11m^2 - mn) - (-m^5 + m^3 - 4m^2 + 2mn)$

$= 4m^5 - 3m^3 + 11m^2 - mn + m^5 - m^3 + 4m^2 - 2mn$

$= 5m^5 - 4m^3 + 15m^2 - 3mn$

(b) $(4a^3b - 2a^3b^2 + 11a^3b^3 - 8ab) - (-a^3b + a^3b^2 - 3a^3b^3 - 4ab)$

$= 4a^3b - 2a^3b^2 + 11a^3b^3 - 8ab + a^3b - a^3b^2 + 3a^3b^3 + 4ab$

$= 5a^3b - 3a^3b^2 + 14a^3b^3 - 4ab$

Practice 17. Perform the indicated operations.

(a) $(4x^4 - 3x^3 - 7x) + (-3x^4 + 4x^3 - 7x^2) - (8x^3 + 2x^2 - 5x)$

(b) $(-4m^5 - n^3 - m - n) + (-3m^5 + 4n^3 - 3m + 7n) - (8x^3 + 2x^2 - 5x)$

Solution.
(a) $(4x^4 - 3x^3 - 7x) + (-3x^4 + 4x^3 - 7x^2) - (8x^3 + 2x^2 - 5x)$

$= 4x^4 - 3x^3 - 7x - 3x^4 + 4x^3 - 7x^2 - 8x^3 - 2x^2 + 5x$

$= x^4 - 7x^3 - 9x^2 - 2x$

(b) $(-4m^5 - n^3 - m - n) + (-3m^5 + 4n^3 - 3m + 7n) - (8x^3 + 2x^2 - 5x)$

$= -4m^5 - n^3 - m - n - 3m^5 + 4n^3 - 3m + 7n - 8x^3 - 2x^2 + 5x$

$= -7m^5 + 3n^3 - 4m + 6n - 8x^3 - 2x^2 + 5x$

Real Life Application. The total revenue of computer company is modeled by the expression below.

$$(-0.06x^2 + 114.8x)$$

In this expression, x is the number of computers produced per week and the expression is in dollars.

The total cost of producing x computers is modeled by the expression below.

$$(0.00007x^3 - 0.03x^2 + 1200x + 14600)$$

Find a model that represents the profit of the producer.

Solution. To find the profit, simply subtract the cost model from the model of revenue.

$(-0.06x^2 + 114.8x) - (0.00007x^3 - 0.03x^2 + 1200x + 14600) =$

$= -0.06x^2 + 114.8x - 0.00007x^3 + 0.03x^2 - 1200x - 14600$

$= -0.00007x^3 - 0.03x^2 - 1085.2x - 14600$

Real Life Application 2. In Figure 6.5, the colored region is the side walk around a pool. The dimensions are in feet. Find the area of this region.

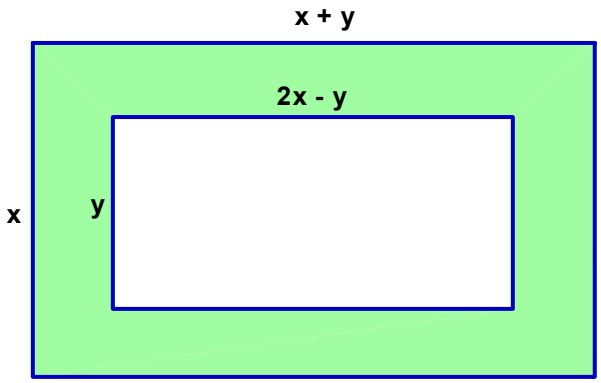

Figure 6.5

Solution. To find the area of the side walk, we must subtract the area of the inner rectangle from the area of the outer rectangle.

Area of Outer Rectangle = $x\,(x + y)$

$= x(x) + x(y)$

$= x^2 + xy$

Area of Inner Rectangle = $y(2x - y)$

$= y(2x) - y(y)$

$= 2xy - y^2$

Area of Side walk = $(x^2 + xy) - (2xy - y^2)$

$= x^2 + xy - 2xy + y^2$

$= (x^2 - xy + y^2)\ \text{ft}^2$

Practical Exercise 5. Add or subtract.

(a) $(x^7 + x^6 - x^5 + 2x^4 - x^3) - (5x^6 + x^5 + x^4 - 5x^3 + 10x^2)$

(b) $(-m^5 - n^3 - 3m - 2n) + (-m^5 + n^3 - m + n)$

Answer.
(a) $x^7 - 4x^6 - 2x^5 + x^4 + 4x^3 - 10x^2$
(b) $-2m^5 - 4m - n$