NAME ________________________ DATE ____________

Module 11 Simplifying Algebraic Expressions with Polynomials
Lesson 4 Multiplying Monomials and Binomials

independent practice

Find the product.

1. $4h \cdot 2h$

2. $(-2t^3)(-5t^2)$

3. $\frac{2}{3}w \cdot (-9w^3)$

4. $3x^2y \cdot 2xy^3$

5. $(4m^2n^3)(-5m^3)$

6. $5b(b^3 - 6b)$

7. $-4g^3h^2(4gh^2 - g^2h^3)$

8. $(x + 4)(x + 6)$

9. $(w - 8)(w + 3)$

10. $(r - 11)(r + 11)$

11. $(g + 7)^2$

12. $(b - 6)^2$

Journal

1. A friend missed class today and wants to know how to multiply two monomials. Explain in words how to find the product $(-4x^2)(-6x^4)$.
2. What is the product $(x + a)^2$? Write a rule for finding the square of a binomial that contains an addition symbol and use the rule to find the product $(x + 3)^2$.
3. What is the product $(x - a)^2$? Write a rule for finding the square of a binomial that contains a subtraction symbol and use the rule to find the product $(x - 6)^2$.
4. A student claimed the simplified product of any two binomials is a trinomial. Is the student correct? Give an example to support this answer.
5. Find the product $(x + 5)(x + 4)$, showing each step. How are the constants 5 and 4 in the binomial factors related to the coefficient of the middle term in the product? How are the constants 5 and 4 in the binomial factors related to the last term in the product? If $(x + a)(x + b) = x^2 + cx + d$, how are a, b, and c related? How are a, b, and d related?

Cumulative Review

Simplify.

1. $3x^2 - 5x^2$
2. $4 - 9b + 3$
3. $5m + 2m^2 - m$
4. $3(x - 4) + 1$
5. $2(x + 3) - 5x$
6. $w^3 \cdot w^5 \cdot w$
7. $6x - 4(x + 3)$
8. $3(b + 1) + 4(2 - b)$
9. $3h - 4h^2 + h^3 - 7h + 5h^2$
10. $8x^2y - 3xy + 2x^2y - 4xy^2 - 2xy$

Manipulatives

Use algebra tiles to represent the product $(2x - 3)(x + 1)$.

1. Represent the factor $2x - 3$ to the left of the vertical gridline and represent the factor $x + 1$ above the horizontal gridline. See Figure 1. Solid figures represent negatives and hollow figures represent positives. A small square represents the number one, a rectangle represents x, and a large square represents x^2.
2. The factor $2x - 3$ is represented by two x-rectangles and three small negative one-squares. The factor $x + 1$ is represented by one x-rectangle and one small one-square.
3. The product is represented below and to the right of the gridlines. An x-rectangle times an x-rectangle is a large x^2-square. An x-rectangle times a small negative one-square equals a $-x$-rectangle. A small one-square times an x-rectangle equals an x-rectangle. A small one-square times a small negative one-square equals a small negative one-square. See Figure 2.
4. Combine small squares with small squares, rectangles with rectangles, and large squares with large squares (combine like terms). There are two x^2-squares: $x^2 + x^2 = 2x^2$. There are two x-rectangles and three $-x$-rectangles. Pair a positive rectangle with a negative rectangle (this is called a zero pair because their sum is zero) and remove that pair of tiles. Then, remove another positive rectangle and negative rectangle (another zero pair). The only remaining rectangle is one $-x$-rectangle: $2x - 3x = -x$. There are three small negative one-squares: $-1 - 1 - 1 = -3$. After combining all like terms, you have the simplified product: $2x^2 - x - 3$. See Figure 3.

Figure 1

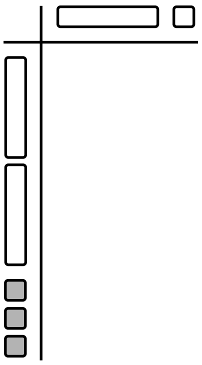


Figure 2

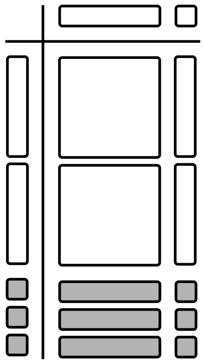
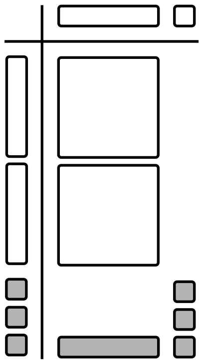


Figure 3



Use algebra tiles to find the following products.

1. $3x(x + 3)$ ____________________

2. $(x + 2)(x - 2)$ ____________________

3. $(x + 1)(x + 4)$ ____________________

4. $5(2x^2 + 3x)$ ____________________