NAME ____________________ DATE __________ PERIOD __________

8-5 Study Guide and Intervention

#1

Using the Distributive Property

Use the Distributive Property to Factor The Distributive Property has been used to multiply a polynomial by a monomial. It can also be used to express a polynomial in factored form. Compare the two columns in the table below.

Multiplying	Factoring
$3(a + b) = 3a + 3b$	$3a + 3b = 3(a + b)$
$x(y - z) = xy - xz$	$xy - xz = x(y - z)$
$6y(2x + 1) = 6y(2x) + 6y(1)$ $= 12xy + 6y$	$12xy + 6y = 6y(2x) + 6y(1)$ $= 6y(2x + 1)$

Example 1 **Use the Distributive Property to factor $12mp + 80m^2$.**

Find the GCF of $12mp$ and $80m^2$.

$12mp = 2 \cdot 2 \cdot 3 \cdot m \cdot p$

$80m^2 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot m \cdot m$

$\text{GCF} = 2 \cdot 2 \cdot m$ or $4m$

Write each term as the product of the GCF and its remaining factors.

$12mp + 80m^2 = 4m(3 \cdot p) + 4m(2 \cdot 2 \cdot 5 \cdot m)$

$= 4m(3p) + 4m(20m)$

$= 4m(3p + 20m)$

Thus $12mp + 80m^2 = 4m(3p + 20m)$.

Example 2 **Factor $6ax + 3ay + 2bx + by$ by grouping.**

$6ax + 3ay + 2bx + by$

$= (6ax + 3ay) + (2bx + by)$

$= 3a(2x + y) + b(2x + y)$

$= (3a + b)(2x + y)$

Check using the FOIL method.

$(3a + b)(2x + y)$

$= 3a(2x) + (3a)(y) + (b)(2x) + (b)(y)$

$= 6ax + 3ay + 2bx + by$ ✓

Exercises

Factor each polynomial.

1. $24x + 48y$

2. $30mp^2 + m^2p - 6p$

3. $q^4 - 18q^3 + 22q$

4. $9x^2 - 3x$

5. $4m + 6p - 8mp$

6. $45r^3 - 15r^2$

7. $14t^3 - 42t^5 - 49t^4$

8. $55p^2 - 11p^4 + 44p^5$

9. $14y^3 - 28y^2 + y$

10. $4x + 12x^2 + 16x^3$

11. $4a^2b + 28ab^2 + 7ab$

12. $6y + 12x - 8z$

13. $x^2 + 2x + x + 2$

14. $6y^2 - 4y + 3y - 2$

15. $4m^2 + 4mp + 3mp + 3p^2$

16. $12ax + 3xz + 4ay + yz$

17. $12a^2 + 3a - 8a - 2$

18. $xa + ya + x + y$

Lesson 8-5

8-5 Study Guide and Intervention *(continued)*

#2

Using the Distributive Property

Solve Equations by Factoring The following property, along with factoring, can be used to solve certain equations.

Zero Product Property	For any real numbers a and b, if $ab = 0$, then either $a = 0$, $b = 0$, or both a and b equal 0.

Example **Solve $9x^2 + x = 0$. Then check the solutions.**

Write the equation so that it is of the form $ab = 0$.

$9x^2 + x = 0$ Original equation

$x(9x + 1) = 0$ Factor the GCF of $9x^2 + x$, which is x.

$x = 0$ or $9x + 1 = 0$ Zero Product Property

$x = 0 \qquad x = -\frac{1}{9}$ Solve each equation.

The solution set is $\left\{0, -\frac{1}{9}\right\}$.

Check Substitute 0 and $-\frac{1}{9}$ for x in the original equation.

$9x^2 + x = 0$

$9(0)^2 + 0 \stackrel{?}{=} 0$

$0 = 0$ ✓

$9x^2 + x = 0$

$9\left(-\frac{1}{9}\right)^2 + \left(-\frac{1}{9}\right) \stackrel{?}{=} 0$

$\frac{1}{9} + \left(-\frac{1}{9}\right) \stackrel{?}{=} 0$

$0 = 0$ ✓

Exercises

Solve each equation. Check your solutions.

1. $x(x + 3) = 0$

2. $3m(m - 4) = 0$

3. $(r - 3)(r + 2) = 0$

4. $3x(2x - 1) = 0$

5. $(4m + 8)(m - 3) = 0$

6. $5t^2 = 25t$

7. $(4c + 2)(2c - 7) = 0$

8. $5p - 15p^2 = 0$

9. $4y^2 = 28y$

10. $12x^2 = -6x$

11. $(4a + 3)(8a + 7) = 0$

12. $8y = 12y^2$

13. $x^2 = -2x$

14. $(6y - 4)(y + 3) = 0$

15. $4m^2 = 4m$

16. $12x = 3x^2$

17. $12a^2 = -3a$

18. $(12a + 4)(3a - 1) = 0$

8-6 Study Guide and Intervention *(continued)*

Solving $x^2 + bx + c = 0$

Solve Equations by Factoring Factoring and the Zero Product Property can be used to solve many equations of the form $x^2 + bx + c = 0$.

Example 1 **Solve $x^2 + 6x = 7$. Check your solutions.**

$x^2 + 6x = 7$	Original equation
$x^2 + 6x - 7 = 0$	Rewrite equation so that one side equals 0.
$(x - 1)(x + 7) = 0$	Factor.
$x - 1 = 0$ or $x + 7 = 0$	Zero Product Property
$x = 1$ $\quad x = -7$	Solve each equation.

The solution set is $\{1, -7\}$. Since $1^2 + 6(1) = 7$ and $(-7)^2 + 6(-7) = 7$, the solutions check.

Example 2 **ROCKET LAUNCH The formula $h = vt - 16t^2$ gives the height h of a rocket after t seconds when the initial velocity v is given in feet per second. If a rocket is fired with initial velocity 2288 feet per second, how many seconds will it take for the rocket to reach a height of 6720 feet?**

$h = vt - 16t^2$	Formula
$6720 = 2288t - 16t^2$	Substitute.
$0 = -16t^2 + 2288t - 6720$	Rewrite equation so that one side equals 0.
$0 = -16(t - 143t + 420)$	Factor out GCF.
$0 = -16(t - 3)(t - 140)$	Factor
$t - 3 = 0$ or $t - 140 = 0$	Zero Product Property
$t = 3$ $\quad t = 140$	Solve each equation.

The rocket reaches 6720 feet in 3 seconds and again in 140 seconds, or 2 minutes 20 seconds after launch.

Exercises

Solve each equation. Check the solutions.

1. $x^2 - 4x + 3 = 0$

2. $y^2 - 5y + 4 = 0$

3. $m^2 + 10m + 9 = 0$

4. $x^2 = x + 2$

5. $x^2 - 4x = 5$

6. $x^2 - 12x + 36 = 0$

7. $t^2 - 8 = -7t$

8. $p^2 = 9p - 14$

9. $-9 - 8x + x^2 = 0$

10. $x^2 + 6 = 5x$

11. $a^2 = 11a - 18$

12. $y^2 - 8y + 15 = 0$

13. $x^2 = 24 - 10x$

14. $a^2 - 18a = -72$

15. $b^2 = 10b - 16$

Use the formula $h = vt - 16t^2$ to solve each problem.

16. FOOTBALL A punter can kick a football with an initial velocity of 48 feet per second. How many seconds will it take for the ball to first reach a height of 32 feet?

17. ROCKET LAUNCH If a rocket is launched with an initial velocity of 1600 feet per second, when will the rocket be 14,400 feet high?