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Study Guide and Intervention

Factoring Using the Distributive Property

Factor by Using the Distributive Property 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 $12mn + 80m^2$.**

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

$12mn = 2 \cdot 2 \cdot 3 \cdot m \cdot n$

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

GCF $= 2 \cdot 2 \cdot m$ or $4m$

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

$$\begin{aligned} 12mn + 80m^2 &= 4m(3 \cdot n) + 4m(2 \cdot 2 \cdot 5 \cdot m) \\ &= 4m(3n) + 4m(20m) \\ &= 4m(3n + 20m) \end{aligned}$$

Thus $12mn + 80m^2 = 4m(3n + 20m)$.

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

$$\begin{aligned} &6ax + 3ay + 2bx + by \\ &= (6ax + 3ay) + (2bx + by) \\ &= 3a(2x + y) + b(2x + y) \\ &= (3a + b)(2x + y) \end{aligned}$$

Check using the FOIL method.

$$\begin{aligned} &(3a + b)(2x + y) \\ &= 3a(2x) + (3a)(y) + (b)(2x) + (b)(y) \\ &= 6ax + 3ay + 2bx + by \checkmark \end{aligned}$$

Exercises

Factor each polynomial.

1. $24x + 48y$
2. $30mn^2 + m^2n - 6n$
3. $q^4 - 18q^3 + 22q$
4. $9x^2 - 3x$
5. $4m + 6n - 8mn$
6. $45s^3 - 15s^2$
7. $14c^3 - 42c^5 - 49c^4$
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. $4m^2 + 4mn + 3mn + 3n^2$
16. $12ax + 3xz + 4ay + yz$
17. $12a^2 + 3a - 8a - 2$
18. $xa + ya + x + y$

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Study Guide and Intervention *(continued)*

Factoring 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
$x = 0$ $\quad x = -\frac{1}{9}$	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.

$9x^2 + x = 0$ $\qquad$ $9x^2 + x = 0$

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

$0 = 0$ ✓ $\qquad$ $\frac{1}{9} + \left(-\frac{1}{9}\right) = 0$

$0 = 0$ ✓

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. $5s^2 = 25s$
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. $(12a + 4)(3a - 1) = 0$

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Assignment _____

SHOW YOUR WORK IN THE SPACES PROVIDED *(one problem per space and number the problems)*

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