Properties of Exponents

GUIDED SKILL SUPPORT

Overview

In general, to rewrite an expression that contains exponents means eliminating parentheses and negative exponents, if possible. The basic properties of exponents are listed.

Property of Exponents	Algebraic Rule	Examples
Product	$x^a \cdot x^b = x^{a+b}$	$x^3 \cdot x^4 = x^7$ $2^7 \cdot 2^4 = 2^{11}$
Quotient	$\frac{x^a}{x^b} = x^{a-b}$	$\frac{x^{10}}{x^4} = x^6$ $\frac{2^4}{2^7} = 2^{-3}$
Power of a Power	$(x^a)^b = x^{ab}$	$(x^4)^3 = x^{12}$ $(2x^3)^5 = 2^5 \cdot x^{15} = 32x^{15}$
Zero Exponent	$x^0 = 1$	$2^0 = 1$ $(-3)^0 = 1$ $\left(\frac{1}{4}\right)^0 = 1$
Negative Exponent	$x^{-n} = \frac{1}{x^n}$	$x^{-3} = \frac{1}{x^3}$ $y^{-4} = \frac{1}{y^4}$ $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$
	$\frac{1}{x^{-n}} = x^n$	$\frac{1}{x^{-5}} = x^5$ $\frac{1}{x^{-2}} = x^2$ $\frac{1}{3^{-2}} = 3^2 = 9$
Fractional Exponent	$x^{\frac{m}{n}} = \sqrt[n]{x^m}$	$x^{\frac{2}{3}} = \sqrt[3]{x^2}$ $y^{\frac{1}{2}} = \sqrt{y}$

In any expression with fractions, assume the denominator does not equal zero.

Additional information about properties of exponents can be found in the Lesson 3.1.2 Methods & Meanings box. For additional examples and practice, refer to Checkpoint 5A.

Examples

For examples 1 through 6, rewrite each expression with as few exponents as possible. The final expressions should contain no parentheses or negative exponents. Assume the variables are not equal to 0.

1. $(2xy^3)(5x^2y^4)$

$(2xy^3)(5x^2y^4)$	
$= 2 \cdot 5 \cdot x \cdot x^2 \cdot y^3 \cdot y^4$	Reorder the factors.
$= 10x^3y^7$	Use the Product Property.

2. $\frac{14x^2y^{12}}{7x^5y^7}$

$\frac{14x^2y^{12}}{7x^5y^7}$	
$= \left(\frac{14}{7}\right)\left(\frac{x^2}{x^5}\right)\left(\frac{y^{12}}{y^7}\right)$	Rewrite and separate coefficients and variables.
$= 2x^{-3}y^5$	Use the Quotient Property.
$= \frac{2y^5}{x^3}$	Use the Negative Exponents Property.

3. $(3x^2y^4)^3$

$(3x^2y^4)^3$	
$= 3^3 \cdot (x^2)^3 \cdot (y^4)^3$	Rewrite and separate coefficients and variables.
$= 27x^6y^{12}$	Use the Power of a Power Property.

4. $(2x^3)^{-2}$

$(2x^3)^{-2}$	
$= \frac{1}{(2x^3)^2}$	Use the Negative Exponents Property.
$= \frac{1}{2^2 \cdot (x^3)^2}$	Rewrite and separate coefficients and variables.
$= \frac{1}{4x^6}$	Use the Power of a Power Property.

5. $\frac{10x^7y^3}{15x^{-2}y^3}$

$\frac{10x^7y^3}{15x^{-2}y^3}$

$= \left(\frac{10}{15}\right) \cdot \left(\frac{x^7}{x^{-2}}\right) \cdot \left(\frac{y^3}{y^3}\right)$ Rewrite and separate coefficients and variables.

$= \frac{2}{3}x^9y^0$ Use the Quotient Property.

$= \frac{2}{3}x^9 \cdot 1$ Use the Zero Exponent Property.

$= \frac{2}{3}x^9$ or $\frac{2x^9}{3}$

6. $25^{\frac{2}{3}}$

$25^{\frac{2}{3}}$

$= \sqrt[3]{25^2}$ Rewrite using the Fractional Exponent Property.

Practice

Rewrite each expression using the properties of exponents. The final expressions should contain no parentheses or negative exponents.

1. $y^5 \cdot y^7$

2. $b^4 \cdot b^3 \cdot b^2$

3. $8^6 \cdot 8^{-2}$

4. $(y^5)^2$

5. $(3a)^4$

6. $\frac{m^8}{m^3}$

7. $\frac{12m^8}{6m^{-3}}$

8. $(x^3y^2)^3$

9. $\frac{(y^4)^2}{(y^3)^2}$

10. $\frac{15x^2y^5}{3x^4y^5}$

11. $(4c^4)(ac^3)(3a^5c)$

12. $(7x^3y^5)^2$

13. $(4xy^2)(2y)^3$

14. $\left(\frac{4}{x^2}\right)^3$

15. $\frac{(2a^7)(3a^2)}{6m^3}$

16. $\left(\frac{5m^3n}{m^5}\right)^3$

17. $(3a^2x^3)^2(2ax^4)^3$

18. $\left(\frac{x^3y}{y^4}\right)^4$

19. $\left(\frac{6x^8y^2}{12x^3y^7}\right)^2$

20. $\frac{(2x^5y^3)^3(4xy^4)^2}{8x^7y^{12}}$

21. x^{-3}

22. $2x^{-3}$

23. $(2x)^{-3}$

24. $(2x^3)^0$

25. $5^{\frac{1}{2}}$

26. $\left(\frac{2x}{3}\right)^{-2}$

27. $m^{\frac{4}{3}}$

Answers

1.	y^{12}	**2.**	b^9	**3.**	8^4
4.	y^{10}	**5.**	$81a^4$	**6.**	m^5
7.	$2m^{11}$	**8.**	x^9y^6	**9.**	y^2
10.	$\frac{5}{x^2}$	**11.**	$12a^6c^8$	**12.**	$49x^6y^{10}$
13.	$32xy^5$	**14.**	$\frac{64}{x^6}$	**15.**	a^6
16.	$\frac{125n^3}{m^6}$	**17.**	$72a^7x^{18}$	**18.**	$\frac{x^{12}}{y^{12}}$
19.	$\frac{x^{10}}{4y^{10}}$	**20.**	$16x^{10}y^5$	**21.**	$\frac{1}{x^3}$
22.	$\frac{2}{x^3}$	**23.**	$\frac{1}{8x^3}$	**24.**	1
25.	$\sqrt{5}$	**26.**	$\frac{9}{4x^2}$	**27.**	$\sqrt[3]{m^4}$

Equations ↔ Algebra Tiles

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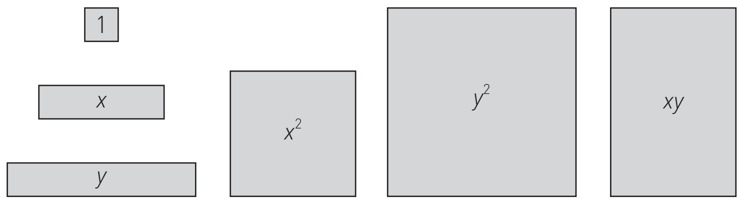
Overview

Algebra tiles, such as those shown, can be used to make sense of algebraic expressions. Algebra tiles are named by their area.



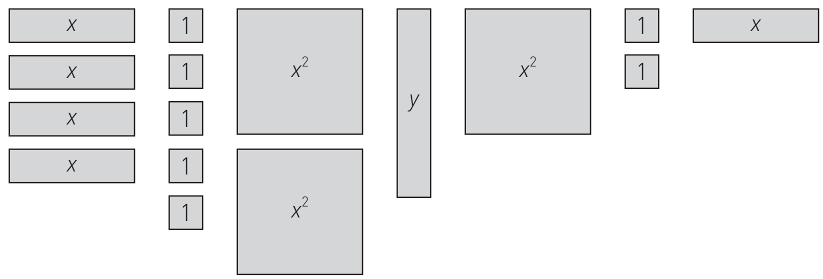
An Equation Mat can be used with algebra tiles to represent the process of solving an equation. Tile moves represent algebraic moves such as combining like terms or using Properties of Equality, such as adding the same value to both expressions of an equation.

Additional information about solving equations can be found in the Lesson 3.2.2 Methods & Meanings box. For additional examples and practice solving one-variable equations, refer to Checkpoint 1.

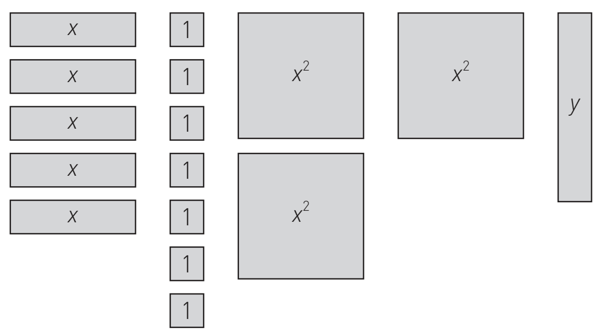
Examples

1. Add using algebra tiles. $4x + 5 + 2x^2 + y + x^2 + 2 + x$

Gather algebra tiles that represent each term.

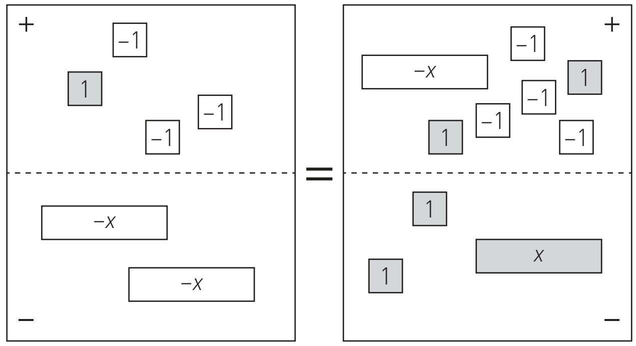


Because all the terms are being added, they can be sorted by name. Sort the tiles by name, then rewrite the expression.

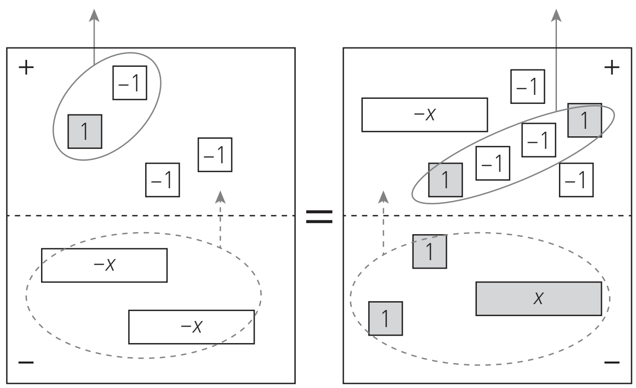


$5x + 7 + 3x^2 + y$

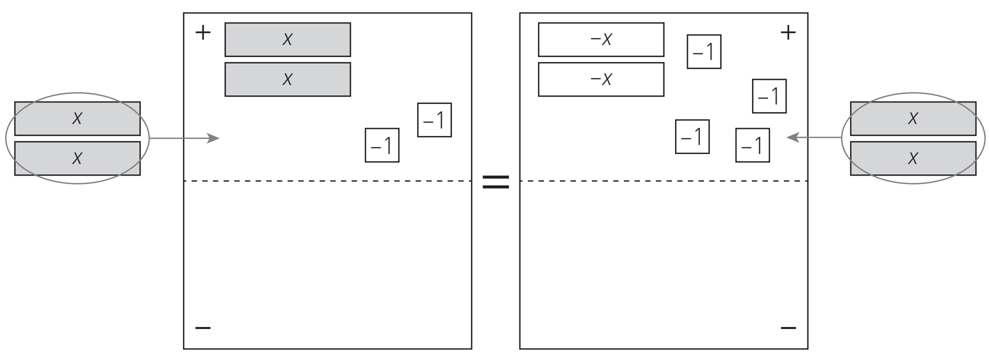
2. Solve the equation represented by the Equation Mat.



Remove zero pairs from the left and right sides of the equal sign. Flip tiles from the negative region to the positive region.



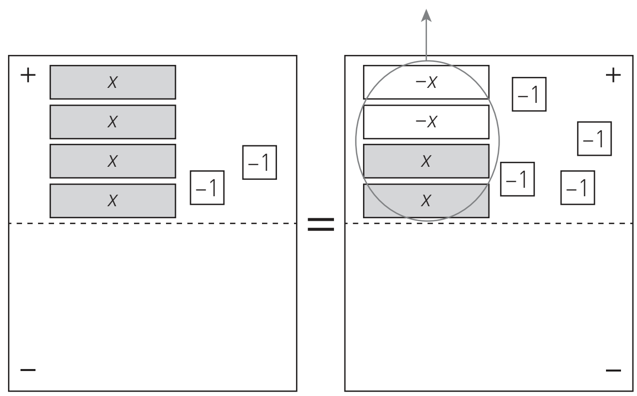
Add 2 x-tiles to the left and right positive regions.



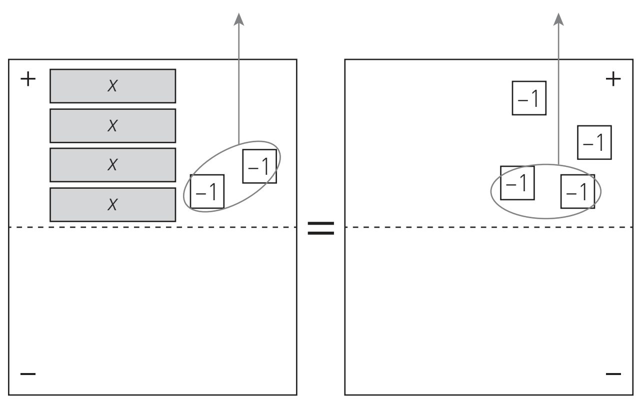
Example continues on next page.

2. Example continued from previous page.

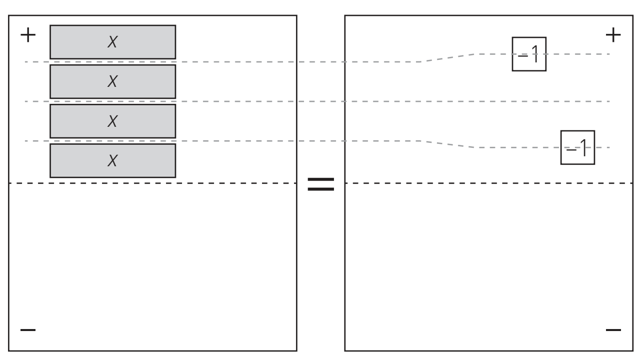
Remove zero pairs.



Remove 2 negative unit tiles from the left and right sides of the equal sign.

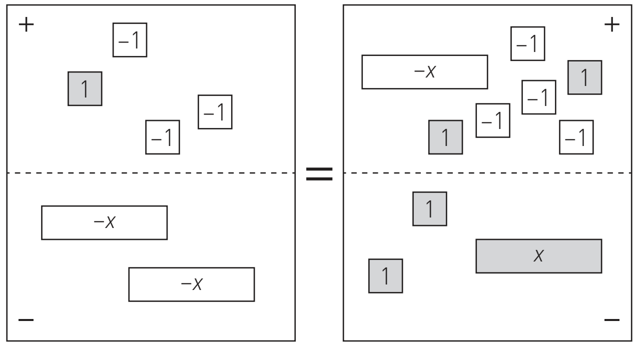


Divide the remaining tiles into 4 equal groups.



$x = -0.5$

3. Write an equation represented by the tiles on the Equation Mat.



Starting with the positive region on the left side of the mat, identify common tiles. There are positive and negative unit tiles that can be represented by the integers 1 and –3. Now, focus on the negative region of the left side and identify common tiles. The $-x$-tiles can be represented by the expression $-2x$. The left side of the Equation Mat can be represented by the expression $1 + (-3) - (-2x)$.

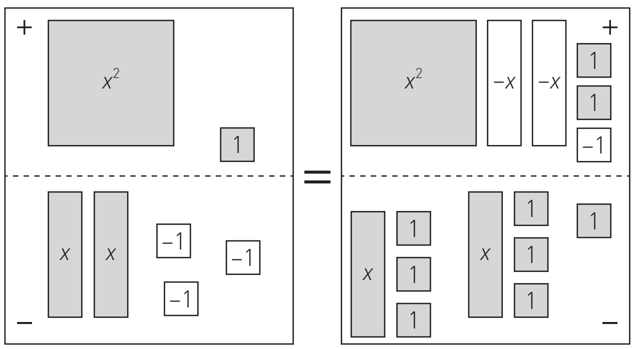
Repeat the process for the right side of the Equation Mat. Identify the tiles in the positive region. The tiles can be represented by the expression $-x + 2 + (-4)$. Identify the tiles in the negative region. The tiles can be represented by the expression $x + 2$. The right side of the Equation Mat can be represented by the expression $-x + 2 + (-4) - (x + 2)$.

One equation represented by the tiles on the Equation Mat is $1 + (-3) - (-2x) = -x + 2 + (-4) - (x + 2)$.

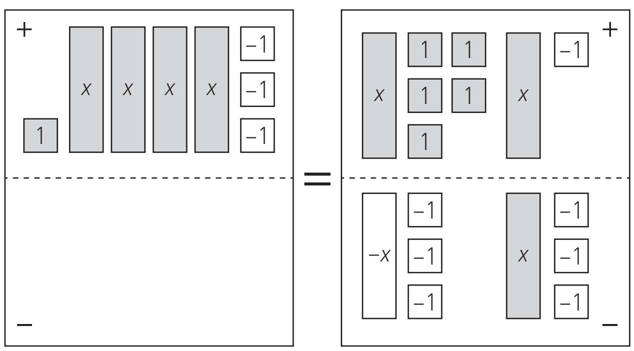
Practice

Write an equation represented by each Equation Mat.

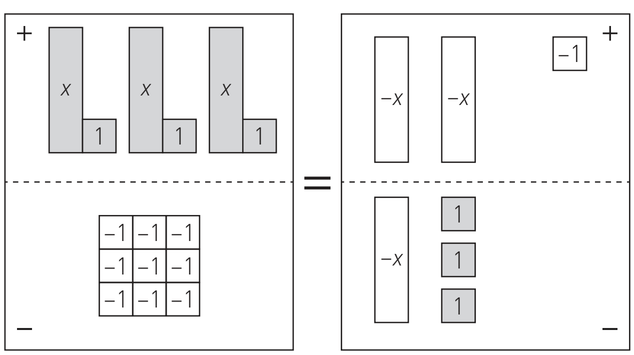
1.



2.



3.



Build each equation on an Equation Mat, then determine the value of the variable. Identify the tile moves and write the corresponding algebraic steps you use to solve the equation.

4. $x^2 + 2 - 2x = -x + (-2) - (-x^2) - (-1)$

5. $4y - 12 = 8 - y$

6. $8 - 2\,(4 + (-3y)) = 6 - 3(5 + y)$

7. $6x + 2 + x = 4x + 8 + 3x + x$

8. $-2x + 3 + (-4) - 4 - (-1) = -2x + (-2) - 4$

9. $3y + 5 + (-5) - (-2) = -2y + 3 - 1 - (-y)$

Answers

1. Responses may vary. One possible equation is $x^2 + 1 - (2x + (-3)) = x^2 + (-2x) + 2 + (-1) - 2(x + 3) - 1$.

2. Responses may vary. One possible equation is $4x + (-3) + 1 = x + 5 + (-x) + (-1) - (-x + (-3)) - (x + (-3))$.

3. Responses may vary. One possible equation is $3(x + 1) - (-9) = -2x + (-1) - (-x) - 3$.

4. Responses may vary. One possible process is shown.

Tile Move	Result
Flip tiles from subtraction to addition.	$x^2 + 2 + (-2x) = -x + (-2) + x^2 + 1$
Remove zero pairs.	$x^2 + 2 + (-2x) = -x + (-1) + x^2$
Remove x^2-tile from both sides.	$2 + (-2x) = -x + (-1)$
Add 2 x-tiles to both sides and remove zero pairs.	$2 = x + (-1)$
Add 1 unit tile to both sides and remove zero pairs.	$3 = x$

5. One possible process is shown.

Tile Move	Result
Flip tiles from subtraction to addition.	$4y + (-12) = 8 + (-y)$
Add 1 y-tile to both sides and remove zero pairs.	$5y + (-12) = 8$
Add 12 unit tiles to both sides and remove zero pairs.	$5y = 20$
Divide the tiles on both sides into 5 equal groups.	$y = 4$

6. One possible process is shown.

Tile Move	Result
Flip tiles from subtraction to addition.	$8 + (-8) + 6y = 6 + (-15) + (-3y)$
Remove zero pairs.	$6y = -9 + (-3y)$
Add 3 y-tiles to both sides and remove zero pairs.	$9y = -9$
Divide the tiles on both sides into 9 equal groups.	$y = -1$

7. One possible process is shown.

Tile Move	Result
Remove 7 x-tiles from both sides.	$2 = 8 + x$
Remove 2 unit tiles from both sides.	$0 = 6 + x$
Add 6 negative unit tiles to both sides and remove zero pairs.	$-6 = x$

8. One possible process is shown.

Tile Move	Result
Flip tiles from subtraction to addition.	$-2x + 3 + (-4) + (-4) + 1 = -2x + (-2) + (-4)$
Remove zero pairs.	$-2x + (-4) = -2x + (-2) + (-4)$
Remove $-2x$ and -4 from both sides.	$0 = -2$ false no solutions

9. One possible process is shown.

Tile Move	Result
Flip tiles from subtraction to addition.	$3y + 5 + (-5) + 2 = -2y + 3 + (-1) + y$
Remove zero pairs from the left side.	$3y + 2 = -2y + 3 + (-1) + y$
Remove 2 unit tiles from both sides.	$3y = -2y + 1 + (-1) + y$
Remove zero pairs from the right side.	$3y = -y$
Add 1 y-tile to both sides and remove zero pairs.	$4y = 0$
Divide by sides into equal groups of four.	$y = 0$

Multiplying Binomials

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Overview

Two ways to determine the area of a rectangle are:

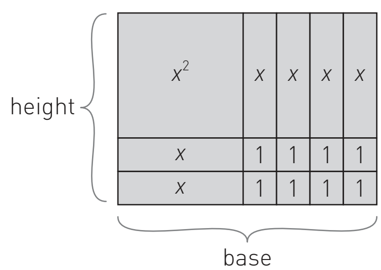
- as a product of the height and base: (height) · (base); or
- as the sum of the areas of individual pieces of the rectangle: $\text{area}_1 + \text{area}_2 + \ldots\text{area}_n$.

For all rectangles, the **area as a product is equal to the area as a sum**. Algebra tiles and generic rectangles can represent area models used to visually represent multiplying expressions.

Additional information about multiplying expressions with algebra tiles and expression vocabulary can be found in the Lessons 3.2.4 and 3.2.5 Methods & Meanings boxes. For additional examples and practice, refer to Checkpoint 6B.

Examples

1. Write an equation showing the area of the rectangle as a product and as a sum.



AREA AS A PRODUCT

Determine the base and height of the rectangle by combining algebra tiles. The height is $x + 2$ and the base is $x + 4$. Multiply the base and height to represent the area of the algebra tiles, $(x + 4)(x + 2)$.

AREA AS A SUM

Add the areas of the algebra tiles, $x^2 + x + x + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + x + x + x + x$. Rewrite the expression by combining like terms, $x^2 + 6x + 8$.

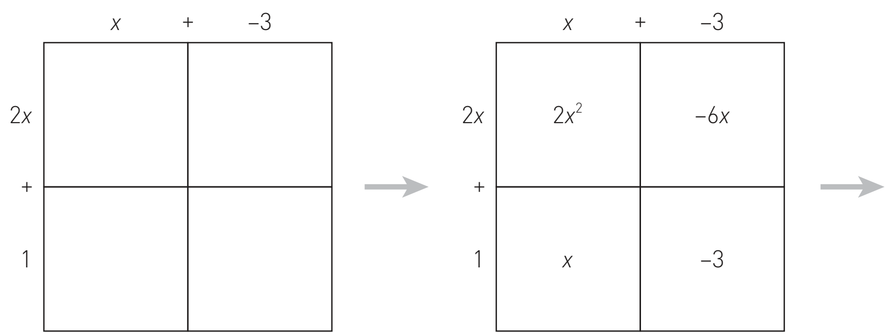
Write an equation showing that both representations of the area are equal.

$$\underbrace{(x + 4)}_{\text{base}}\underbrace{(x + 2)}_{\text{height}} = \underbrace{x^2 + 6x + 8}_{\text{area}}$$

2. Use a generic rectangle to determine the product. Express your answer as an equation showing the area of the rectangle as a product and as a sum.

$$(2x + 1)(x - 3)$$

A generic rectangle can be used instead of individual algebra tiles. Draw the generic rectangle and label the sides. Then, determine the areas of the interior rectangles. Write the area as a sum, $-6x + (-3) + 2x^2 + x$. Then, rewrite the expression, $2x^2 + (-5x) - 3$. Write an equation showing that both representations of the area are equal.

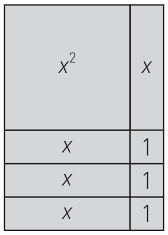


$$\underbrace{(2x + 1)(x - 3)}_{\text{area as a product}} = \underbrace{2x^2 - 5x - 3}_{\text{area as a sum}}$$

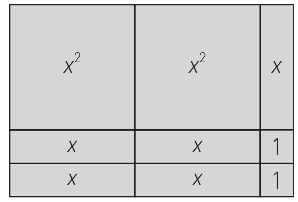
Practice

Consider the following set of algebra tiles or generic rectangles. Write an equation for each showing the area as a product and as a sum.

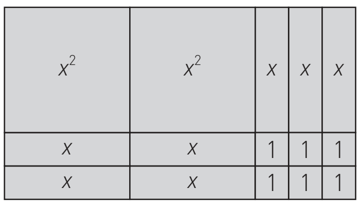
1.



2.



3.



4.

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

5.

	$3y$	$+ -2x$
6	$18y$	$-12x$

6.

	x	$+ 4$
$3y$	$3xy$	$12y$
$+ -2$	$-2x$	-8

Multiply each expression. Use algebra tiles or a generic rectangle to support your answer.

7. $(3x + 2)(2x + 7)$

8. $(2x - 1)(3x + 1)$

9. $(2x)(x - 1)$

10. $(2y - 1)(4y + 7)$

11. $(y - 4)(y + 4)$

12. $(y)(x - 1)$

13. $(3x - 1)(x + 2)$

14. $(2y - 5)(y + 4)$

15. $(3y)(x - y)$

16. $(3x - 5)(3x + 5)$

17. $(4x + 1)^2$

18. $(x + y)(x + 2)$

19. $(2y - 3)^2$

20. $(x - 1)(x + y + 1)$

21. $(x + 2)(x + y - 2)$

Answers

1. $(x + 3)(x + 1) = x^2 + 4x + 3$

2. $(x + 2)(2x + 1) = 2x^2 + 5x + 2$

3. $(x + 2)(2x + 3) = 2x^2 + 7x + 6$

4. $(x - 5)(x + 3) = x^2 - 2x - 15$

5. $6(3y - 2x) = 18y - 12x$

6. $(3y - 2)(x + 4) = 3xy - 2x + 12y - 8$

7. $6x^2 + 25x + 14$

8. $6x^2 - x - 1$

9. $2x^2 - 2x$

10. $8y^2 + 10y - 7$

11. $y^2 - 16$

12. $xy - y$

13. $3x^2 + 5x - 2$

14. $2y^2 + 3y -20$

15. $3xy - 3y^2$

16. $9x^2 - 25$

17. $16x^2 + 8x + 1$

18. $x^2 + 2x + xy + 2y$

19. $4y^2 - 12y + 9$

20. $x^2 + xy - y - 1$

21. $x^2 + xy + 2y - 4$

Solving Equations With Multiplication or Absolute Value

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Overview

To **solve an equation with multiplication**, first use the Distributive Property or a generic rectangle to rewrite the equation without parentheses, then solve.

To **solve an equation with absolute value**, first break the problem into two cases since the quantity inside the absolute value can be positive or negative. Then solve each equation to determine all possible solutions. Check your work to confirm that you determined the correct number of solutions. These equations might have no solutions, one solution, or two solutions.

Additional information about the Distributive Property can be found in the Lesson 3.3.1 Methods & Meanings box. For additional examples and practice, refer to Checkpoint 6B.

Examples

1. Solve $6(x + 2) = 3(5x + 1)$ for x.

$6(x + 2) = 3(5x + 1)$	
$6x + 12 = 15x + 3$	Use the Distributive Property.
$12 = 9x + 3$	Subtract $6x$ from both sides.
$9 = 9x$	Subtract 3 from both sides.
$1 = x$	Divide both sides by 9.

Check that the solution makes the original equation true.

$$x = 1$$

$$6(x + 2) = 3(5x + 1)$$
$$6((1) + 2) = 3(5(1) + 1)$$
$$6(3) = 3(6)$$
$$18 = 18$$

true

2. Solve $x(2x-4)=(2x+1)(x+5)$ for x.

Rewrite the equation using the Distributive Property. A generic rectangle can be used to multiply on the right side. Then, use algebra to solve the equation for x.

$2x^2 - 4x =$

	x	$+$	5
$2x$	$2x^2$		$10x$
$+$			
1	x		5

$x(2x-4)=(2x+1)(x+5)$	
$2x^2-4x=2x^2+11x+5$	Rewrite the equation.
$-4x=11x+5$	Subtract $2x^2$ from both sides.
$-15x=5$	Subtract $11x$ from both sides.
$x=\frac{5}{-15}$	Divide both sides by -15.
$x=-\frac{1}{3}$	

Check the solution in the original equation.

$$x=-\frac{1}{3}$$

$$x(2x-4)=(2x+1)(x+5)$$

$$\left(-\tfrac{1}{3}\right)\left(2\left(-\tfrac{1}{3}\right)-4\right)=\left(2\left(-\tfrac{1}{3}\right)+1\right)\left(\left(-\tfrac{1}{3}\right)+5\right)$$

$$\left(-\tfrac{1}{3}\right)\left(-\tfrac{2}{3}-4\right)=\left(-\tfrac{2}{3}+1\right)\left(4\tfrac{2}{3}\right)$$

$$\left(-\tfrac{1}{3}\right)\left(-4\tfrac{2}{3}\right)=\left(\tfrac{1}{3}\right)\left(4\tfrac{2}{3}\right)$$

$$\frac{14}{9}=\frac{14}{9}$$

true

3. Solve $|2x - 3| = 7$ for x.

Identify the quantity inside the absolute value symbol and rewrite the equation into two cases that include the positive and negative quantities, $(2x - 3)$ and $-(2x - 3)$.

$$|2x - 3| = 7$$

Separate into two cases.

$2x - 3 = 7$	Solve using the positive quantity.
$2x = 10$	Add 3 to both sides.
$x = 5$	Divide both sides by 2.

$-(2x - 3) = 7$	Solve using the negative quantity.
$-2x + 3 = 7$	Use the Distributive Property.
$-2x = 4$	Subtract 3 from both sides.
$x = -2$	Divide both sides by -2.

Check the solution in the original equation.

$x = 5$

$$\begin{aligned}|2x - 3| &= 7\\ |2(5) - 3| &= 7\\ |10 - 3| &= 7\\ |7| &= 7\\ 7 &= 7\end{aligned}$$

true

$x = -2$

$$\begin{aligned}|2x - 3| &= 7\\ |2(-2) - 3| &= 7\\ |-4 - 3| &= 7\\ |-7| &= 7\\ 7 &= 7\end{aligned}$$

true

Practice

Solve each equation.

1. $3(c + 4) = 5c + 14$

2. $x - 4 = 5(x + 2)$

3. $7(x + 7) = 49 - x$

4. $8(x - 2) = 2(2 - x)$

5. $5x - 4(x - 3) = 8$

6. $4y - 2(6 - y) = 6$

7. $2x + 2(2x - 4) = 244$

8. $x(2x - 4) = (2x + 1)(x - 2)$

9. $(x - 1)(x + 7) = (x + 1)(x - 3)$

10. $(x + 3)(x + 4) = (x + 1)(x + 2)$

11. $2x - 5(x + 4) = -2(x + 3)$

12. $(x + 2)(x + 3) = x^2 + 5x + 6$

13. $(x - 3)(x + 5) = x^2 - 7x - 15$

14. $(x + 2)(x - 2) = (x + 3)(x - 3)$

15. $\frac{1}{2}x(x + 2) = \frac{1}{2}x + 2(x - 3)$

16. $|3x + 2| = 11$

17. $|5 - x| = 9$

18. $|3 - 2x| = 7$

19. $|2x + 3| = -7$

20. $|4x + 1| = 10$

Answers

1. $c = -1$

2. $x = -\frac{7}{2}$ or -3.5

3. $x = 0$

4. $x = 2$

5. $x = -4$

6. $y = 3$

7. $x = 42$

8. $x = 2$

9. $x = \frac{1}{2}$ or 0.5

10. $x = -\frac{5}{2}$ or -2.5

11. $x = -14$

12. all numbers

13. $x = 0$

14. no solution

15. $x = -12$

16. $x = 3$ or $x = -\frac{13}{3}$

17. $x = -4$ or $x = 14$

18. $x = -2$ or $x = 5$

19. no solution

20. $x = \frac{9}{4}$ or $x = -\frac{11}{4}$

Rewriting Multivariable Equations

GUIDED SKILL SUPPORT

Overview

Some equations have more than one variable. These equations can be solved for any of the given variables. Rewriting equations with more than one variable uses the same process as solving an equation with one variable. The end result is often not a single number, but rather an algebraic expression that contains numbers and variables.

Additional information about the steps used to solve equations can be found in the Lesson 3.2.2 Methods & Meanings box. For additional examples and practice, refer to Checkpoint 6A.

Examples

1. Solve $3x - 2y = 6$ for y.

$3x - 2y = 6$	Subtract $3x$ from both sides of the equal sign.
$-2y = -3x + 6$	Divide by -2 on both sides of the equal sign.
$y = \frac{-3x+6}{-2}$	Rewrite.
$y = \frac{3}{2}x - 3$	

2. Solve $7 + 2(x + y) = 11$ for y.

$7 + 2(x + y) = 11$	Subtract 7 from both sides of the equal sign.
$2(x + y) = 4$	Multiply by 2 using the Distributive Property.
$2x + 2y = 4$	Subtract $2x$ from both sides of the equal sign.
$2y = -2x + 4$	Divide by 2 on both sides of the equal sign.
$y = \frac{-2x+4}{2}$	Rewrite.
$y = -x + 2$	

3. Solve $y = 3x - 4$ for x.

$y = 3x - 4$	Add 4 to both sides of the equal sign.
$y + 4 = 3x$	Divide by 3 on both sides of the equal sign.
$\frac{y+4}{3} = x$	

4. Solve $I = prt$ for t.

$I = prt$	Divide by pr on both sides of the equal sign.
$\frac{I}{pr} = t$	

Practice

Solve each equation for the specified variable.

1. Solve for y: $5x + 3y = 15$

2. Solve for x: $5x + 3y = 15$

3. Solve for w: $2l + 2w = P$

4. Solve for m: $4n = 3m - 1$

5. Solve for a: $2a + b = c$

6. Solve for a: $b - 2a = c$

7. Solve for p: $6 - 2(q - 3p) = 4p$

8. Solve for x: $y = \frac{1}{4}x + 1$

9. Solve for r: $4(r - 3s) = r - 5s$

Answers

Note: Other equivalent forms are possible.

1. $y = -\frac{5}{3}x + 5$

2. $x = -\frac{3}{5}y + 3$

3. $w = -l + \frac{p}{2}$

4. $m = \frac{4n+1}{3}$

5. $a = \frac{c-b}{2}$

6. $a = \frac{c-b}{-2}$ or $\frac{b-c}{2}$

7. $p = q - 3$

8. $x = 4y - 4$

9. $r = \frac{7s}{3}$

