Name: _____ Date: _____

Lesson 1-1: What Do All the Blocks Mean?

Algeblocks can help you learn algebra. But first you need to get to know the blocks and what each block stands for.

Name each block by its dimensions and the area of its *largest surface*. Notice how the dimensions of the blocks are related to each other.

---

1. Green Square

Length _____ Area _____

Width _____

---

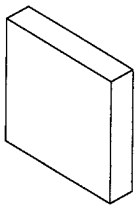
2. Yellow Rectangle

Length _____ Area _____

Width _____

---

3. Yellow Square



Length _____ Area _____

Width _____

---

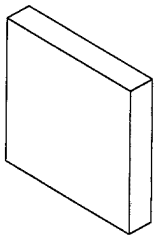
4. Orange Rectangle

Length _____ Area _____

Width _____

---

5. Orange Square

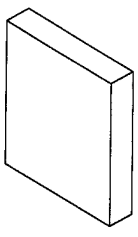


Length _____ Area _____

Width _____

---

6. Light Orange Rectangle



Length _____ Area _____

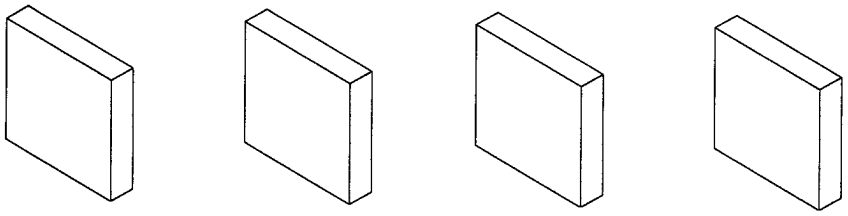
Width _____

Name: _____ Date: _____

Lesson 1-2: Reading the Blocks

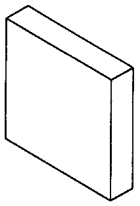
Like blocks can be grouped to represent greater numbers or expressions.

Example:



Step 1.

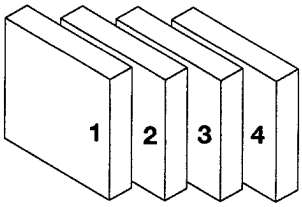
Identify the area of each block.



$= x^2$

Step 2.

Count the number of blocks.



Step 3.

Read the number or expression.

4 of x^2

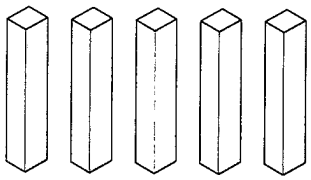
Step 4.

Record.

$4 \cdot x^2$

$4x^2$

Try It



1. You have 5 orange rectangles. What name will you use to name <u>each</u> rectangle?

_____

2. Write the expression represented by all 5 of these Algeblocks. Think about the process used in the example. Describe how you named the expression.

_____

_____

Practice

Use Algeblocks to make your own expressions. Take a handful of like blocks and write the expression represented. Be sure all the blocks in a handful are the same.

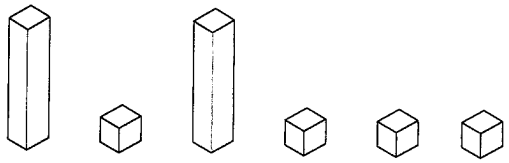
	Green Square	Yellow Rectangle	Yellow Square	Orange Rectangle	Orange Square	Light Orange Rectangle	Expression
3.							
4.							
5.							
6.							

Name: _____ Date: _____

Lesson 1-3: Writing Expressions for Groups of Blocks

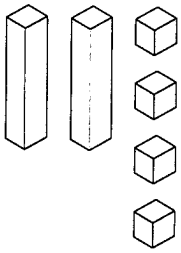
Unlike blocks can be grouped to represent greater numbers or expressions.

Example:



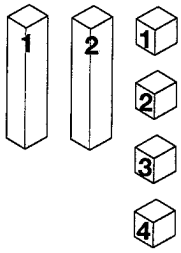
Step 1.

Sort the blocks into groups.



Step 2.

Count the number in each group.



Step 3.

Read the number.

$2 \times x = 2x$

$4 \times 1 = (4 \times 1) = 4$

Step 4.

Record.

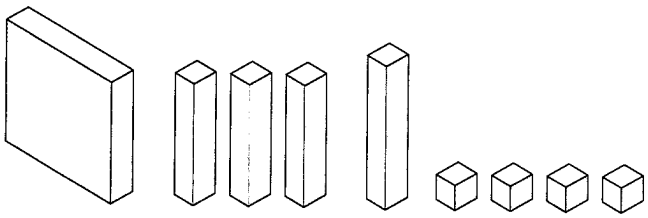
$2x$ and 4

$2x + 4$

Try It

1. Suppose that one orange square was included in the group of blocks in the example. What expression would then be represented?

2. Write the expression represented by the following Algeblocks. Think about the process you learned in the example. Describe how you determined the expression represented by the Algeblocks.



Practice

Use Algeblocks to make your own expressions. Take a random handful of blocks and write the expression represented.

	Green Square	Yellow Rectangle	Yellow Square	Orange Rectangle	Orange Square	Light Orange Rectangle	Expression
3.							
4.							
5.							
6.							

Name: _____ Date: _____

Lesson 1-4: Using Blocks to Model Expressions

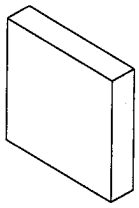
Algeblocks can be used to model numerical and variable algebraic expressions.

Example: Model the expression $3x^2 + 4xy + 1$

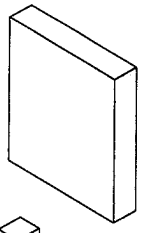
Step 1.

Identify the correct block for each part of the expression.

x^2 =



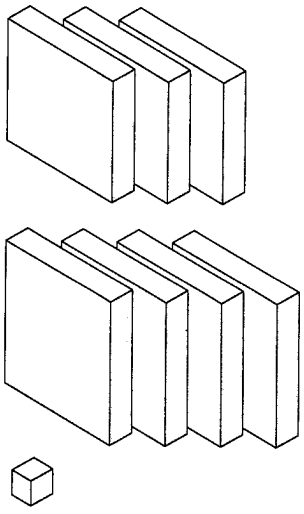
xy =



1 =

Step 2.

Model the expression.



Step 3.

Read the expression.

$3x^2$ and $4xy$ and 1

Step 4.

Record.

$3x^2 + 4xy + 1$

Try it

1. Which block would you use to model the expression $8y^2$? How many blocks would you use?

_____

2. Model the expression $3x + 4y + 3xy + 5$. Remember how the example was modeled. Describe how you decided which Algeblocks to use.

_____

_____

Practice

Model each expression. Sketch each mat when you have completed each model.

3. $2 + 3x + y^2$

4. $5y^2 + 3 + 2xy$

5. $3x + 5y + 7$

continued on next page

continued from previous page

Lesson 1-4: Using Blocks to Model Expressions

6. $4x^2 + 2xy + 3x$

7. $5 + xy + 3y^2$

8. $5y + 4 + 3xy$

9. $3y^2 + 6 + 2xy + 3y$

10. $5y + 3y^2 + 2 + 2xy$

11. $3x^2 + 5xy + 2y^2$

12. $2 + 2x^2 + 4xy + 2y^2 + 4x + 2y$

13. $4y^2 + xy + y + 3x^2 + 7 + 3x$

Name: _____ Date: _____

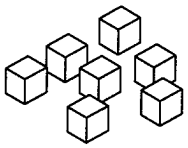
Lesson 2-1: Modeling Integers on the Basic Mat

You can use Algeblocks and the Basic Mat to help you model integers. You will need this skill for solving any problem with Algeblocks.

Example: Model the integer -7 on the basic mat.

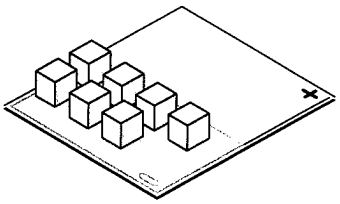
Step 1.

Count out 7 unit blocks.



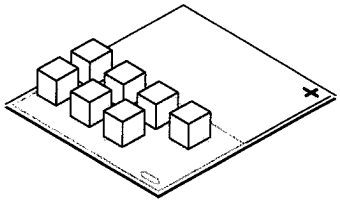
Step 2.

Place the unit blocks on the mat. Since the integer is negative, place the blocks on the negative side of the mat.



Step 3.

Read the mat. (Remember to note the sign on the part of the mat with the blocks.) -7



Step 4.

Record.

-7

Try It

1. Which side of the mat would you use to model the integer 5?

_____

2. How many blocks would you need to model the integer -9?

_____

Practice

Model each integer.

3. 5
4. -3
5. -8
6. 10

Take a random handful of unit blocks. Drop them on the mat. Record an integer for the blocks that land on each side of the mat.

	Positive	Negative
7.		
8.		
9.		
10.		
11.		

	Positive	Negative
12.		
13.		
14.		
15.		
16.		

Name: _____ Date: _____

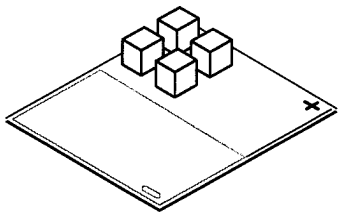
Lesson 2-3: Finding the Opposite of an Integer

Recognizing the opposite of an integer is the first step in learning to solve algebraic problems using Algeblocks.

Example: What is the opposite of 4?

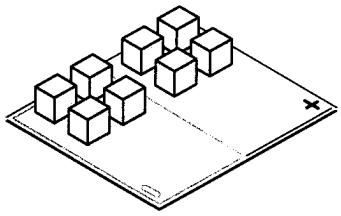
Step 1.

Model the integer using Algeblocks.



Step 2.

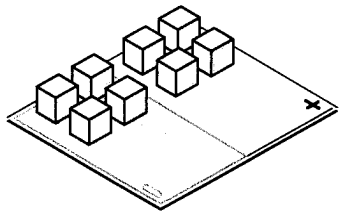
Place the same number of blocks on the other side of the mat.



Step 3.

Read the integers you have modeled.

4 and -4



Step 4.

Record the integer and its opposite.

4

-4

Try It

1. How do you know how many blocks to use to model the opposite of an integer?

_____

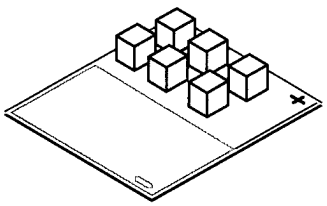
2. If the given integer is negative, what sign would its opposite have? _____

_____

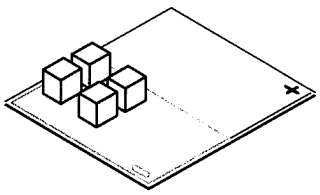
Practice

Show the opposite of each given integer.

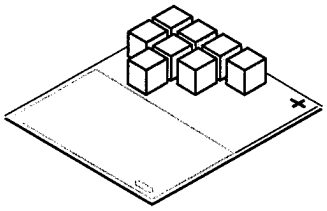
3.



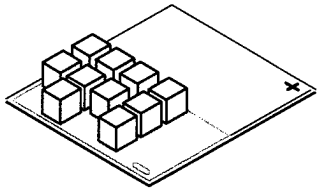
4.



5.



6.



Complete each sentence.

7. The opposite of -7 is _____.

8. The opposite of 3 is _____.

9. The opposite of 0 is _____.

10. The opposite of -12 is _____.

Name: _____ Date: _____

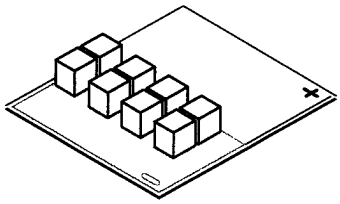
Lesson 2-2: Adding Positive and Negative Integers

Use Algeblocks and the Basic Mat to model addition.

Example: Add: $^{-}8 + (^{-}3)$

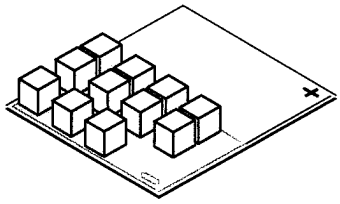
Step 1.

Model the first integer on the mat. Remember this integer is negative.



Step 2.

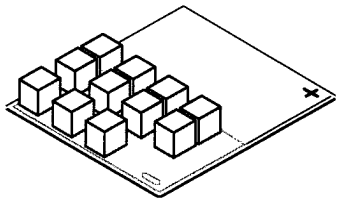
Model the second integer on the mat.



Step 3.

Read the mat.

$^{-}11$



Step 4.

Record.

$^{-}8 + (^{-}3) = ^{-}11$

Try It

1. What would change in the example if the numbers being added were positive?

_____

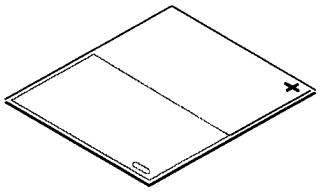
2. Explain how to find the sum of $^{-}4 + (^{-}6)$. _____

_____

Practice

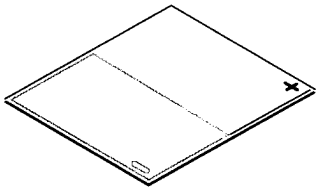
Draw blocks to show the addition. Write the sum.

3.



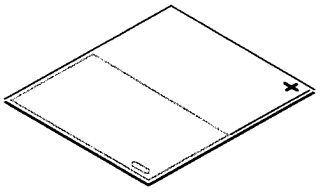
$7 + 2 =$ _____

4.



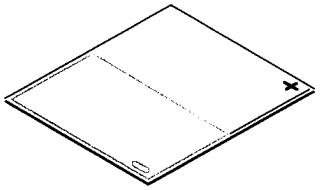
$^{-}5 + (^{-}3) =$ _____

5.



$^{-}2 + (^{-}4) =$ _____

6.



$5 + 9 =$ _____

Find each sum.

7. $^{-}5 + (^{-}6) =$ _____

8. $3 + 2 =$ _____

9. $^{-}3 + (^{-}8) =$ _____

10. $5 + 4 =$ _____

11. $^{-}5 + (^{-}2) =$ _____

12. $7 + 4 =$ _____

13. $^{-}2 + (^{-}9) =$ _____

14. $6 + 7 =$ _____

Name: _____ Date: _____

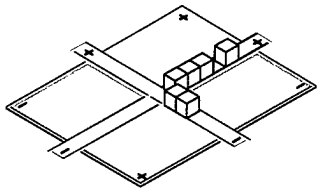
Lesson 4-5: Modeling the Distributive Property of Multiplication

The Distributive Property relates a product to a sum.

Example: Show that the product $-2 \times (3 + 1)$ equals a sum.

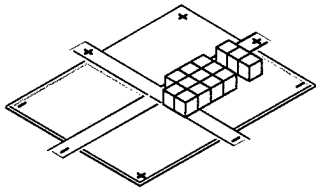
Step 1.

Model the factors. The second factor is a sum.



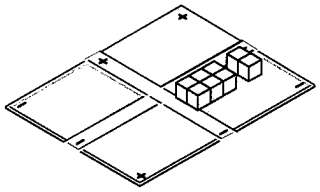
Step 2.

Build the two product rectangles. Remove the Factor Track.



Step 3.

Read the mat. Notice that two products are shown. Products: 6 and 2



Step 4.

Record.

$-2 \times (3 + 1)$
$= (-2 \times 3) + (-2 \times 1)$

Try It

1. How is the sum 3 + 1 shown on the Factor Track? _____

2. Do you think it would be good to remove the Factor Track after Step 2? Why or why not? _____

3. Model the product $-2 \times (3 + 1)$ in a different way. Start by showing -2 on the left side of the Factor Track. Then put the factor 3 + 1 on the top part of the track.

Practice

Model the factors. Then complete the sums.

4. $2 \times (6 + 1) = (2 \times \_\_\_) + (2 \times \_\_\_)$

5. $-4 \times (3 + 2) = (-4 \times \_\_\_) + (-4 \times \_\_\_)$

6. $-3 \times (1 + 3) = (-3 \times \_\_\_) + (-3 \times \_\_\_)$

7. $1 \times (5 + 2) = (1 \times \_\_\_) + (1 \times \_\_\_)$

8. $6 \times (2 + 4) = (6 \times \_\_\_) + (6 \times \_\_\_)$

9. $-2 \times (3 + 4) = (-2 \times \_\_\_) + (-2 \times \_\_\_)$

10. $3 \times (4 + 2) =$ _____ + _____

11. $-1 \times (5 + 3) =$ _____ + _____

12. $-5 \times (1 + 3) =$ _____ + _____

13. $3 \times (2 + 6) =$ _____ + _____

14. $2 \times (4 + 1) =$ _____ + _____

15. $-3 \times (3 + 2) =$ _____ + _____

Critical Thinking

16. Use a model to show that the Distributive Property holds for $-3 \times (-2 + 4)$.

_____

Name: _____ Date: _____

Lesson 5-1: Modeling Polynomials on the Basic Mat

The terms of a polynomial are separated by plus or minus signs. Using the Basic Mat allows you to model expressions with negative terms.

Example: Model the polynomial $2x^2 - 3x + 1$

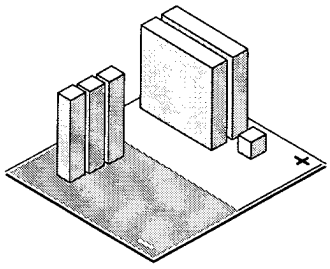
Step 1.

Rewrite the polynomial as a sum.

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

Step 2.

Show each term on the Basic Mat. The first and last terms are positive. They go on the top section. The middle term is negative. It goes on the bottom section.



Try It

1. Move the green unit block to the bottom of the Basic Mat.

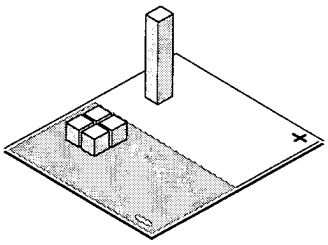
   What new polynomial have you modeled? _____

2. Model the polynomial $2y^2 - 3y + 1$.

Practice

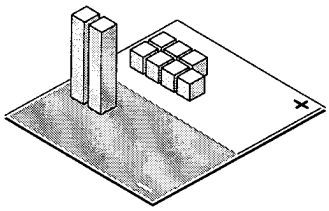
Model each polynomial on the Basic Mat using unit blocks, x blocks, and x^2 blocks. Write each polynomial.

3.



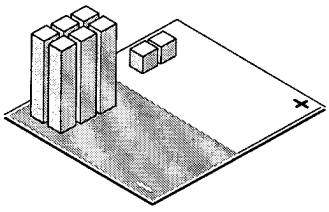
_____

4.



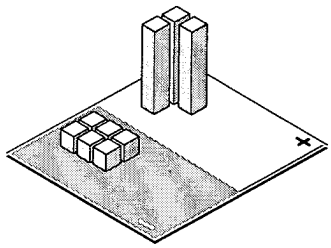
_____

5.



_____

6.



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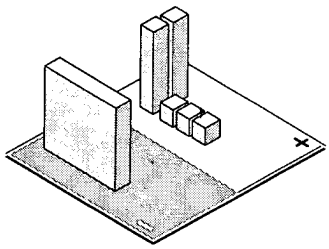

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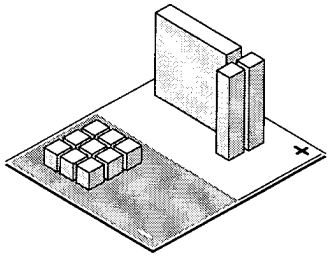

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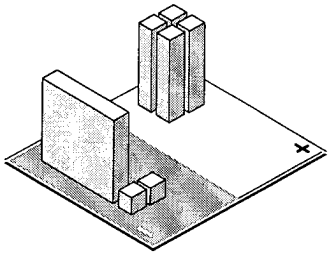

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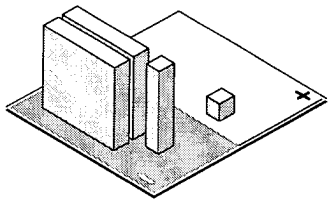

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Lesson 5-1: Modeling Polynomials on the Basic Mat

Model each polynomial on the Basic Mat. Record by sketching.

11. $4 - 3x$

12. $x^2 - 2x$

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

14. $-x - 2y + 3$

15. $-2y - 1$

16. $2y^2 - 5$

17. $y^2 + 3y - 2$

18. $y^2 + 1 - x^2$

Name: _____ Date: _____

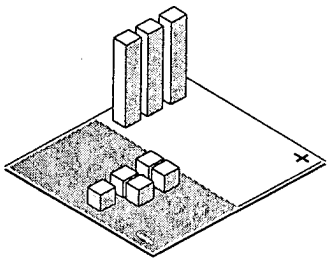
Lesson 5-2: Adding Polynomials

Adding polynomials can be done on the Basic Mat.

Example: Find the sum $(3x - 5) + (2 - x)$.

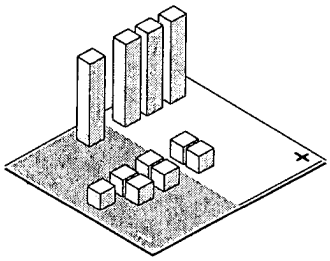
Step 1.

Model the first addend.



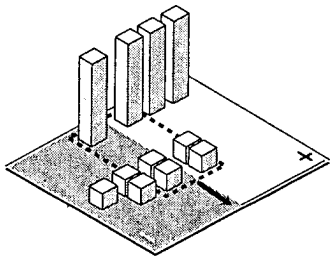
Step 2.

Model the second addend.



Step 3.

Remove zero pairs to simplify the sum. Read the mat.



Step 4.

Record.

$(3x - 5) + (2 - x) = 2x - 3$

Try It

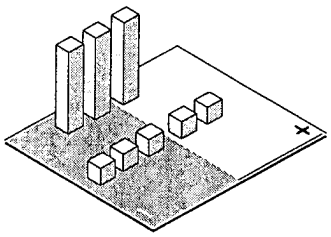
1. Adding polynomials involves combining like terms. What are the like terms in $(3x - 5) + (2 - x)$?
_____ and _____

2. What are the zero pairs shown in Step 3? _____

Practice

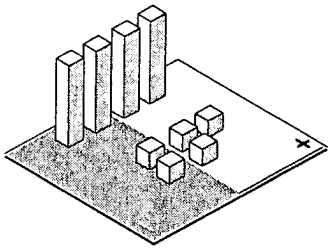
Set up the Basic Mat like the drawing. Remove zero pairs and write the sum.

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



_____

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



_____

Use Algeblocks to find each sum.

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

_____

6. $(2x + 3) + (-4) =$

_____

7. $(-5 + x) + (-3x) =$

_____

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

_____

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

_____

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

_____

Critical Thinking

11. A student claims that $3x^3 + (-2x^2)$ equals x. Use Algeblocks to find out if this is true.

Name: _____ Date: _____

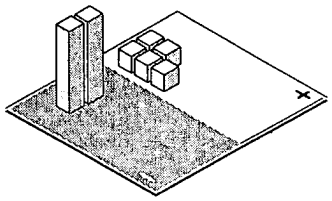
Lesson 5-3: Finding the Opposite

The opposite of a polynomial is the opposite of each of its terms.

Example: Find the opposite of $-2x + 5$.

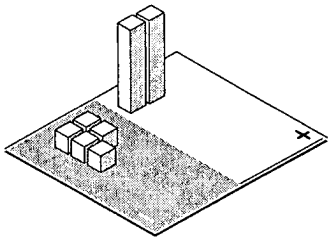
Step 1.

Model the polynomial.



Step 2.

Move each block to the opposite section of the mat.



Step 3.

Read the mat.

$2x - 5$

Step 4.

Record.

The opposite of $-2x + 5$ is $2x - 5$.

Another way to record this is $-(-2x + 5) = 2x - 5$.

Try It

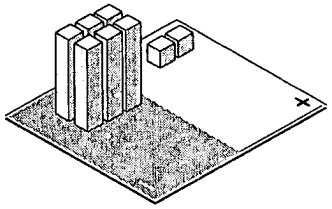
1. What is the opposite of a negative number? _____
2. What is the sum of a quantity and its opposite? _____
3. How does a zero pair show the idea of opposites? _____

_____

Practice

Find the opposite of each polynomial using unit blocks and x blocks.

4.



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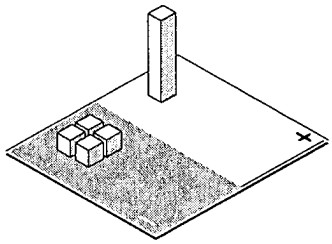
5.



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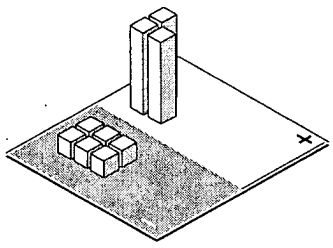

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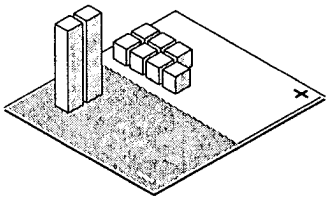


_____

Find the opposite of each polynomial.

8. $3x - 4$ _____

9. $-x - 1$ _____

10. $6 - 2x$ _____

11. $3x + 3$ _____

12. $x^2 - 2x$ _____

13. $-2x^2 + 1$ _____

14. $3y - 2x$ _____

15. $-x + y - 2$ _____

Name: _____ Date: _____

Lesson 5-4: Subtracting Polynomials

To subtract two polynomials, add the opposite of the polynomial being subtracted.

Example: Find the difference $(2x - 1) - (3x - 4)$.

Step 1.

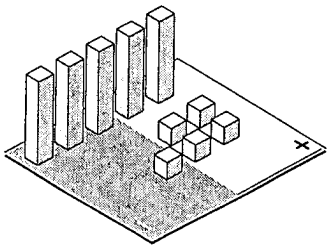
Write the opposite of the second polynomial.

$(2x - 1) - (3x - 4)$
$(2x - 1) + (-3x + 4)$

Step 2.

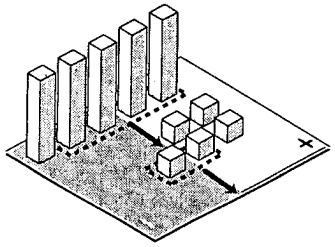
Add the two expressions.

$(2x - 1) + (-3x + 4)$



Step 3.

Remove zero pairs to simplify the sum. Read the mat.



Step 4.

Record.

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

Try It

1. Describe how to use Algeblocks to find the opposite of $(3x - 4)$. _____

2. Which Algeblocks show the first addend in Step 2? _____

3. Which Algeblocks show the second addend in Step 2? _____

Practice

Use Algeblocks to find each difference.

4. $(-3x + 2) - (2x) =$ _____

5. $(-3x) - (-x + 1) =$ _____

6. $(4x - 2) - (5x) =$ _____

7. $(3 - x) - (2x + 4) =$ _____

8. $(3x - 1) - (-x - 2) =$ _____

9. $(-2x - 1) - (2x + 2) =$ _____

Mixed Practice

Use the Algeblocks to find each sum or difference.

10. $(-2x) + (3 - x) =$ _____

11. $(1 + x) + (2x - 3) =$ _____

12. $(4 - 3x) + (-2x - 1)$ _____

13. $(-3x + 1) - (-3) =$ _____

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

15. $(3 + 3x) - (-1 + x) =$ _____

Name: _____ Date: _____

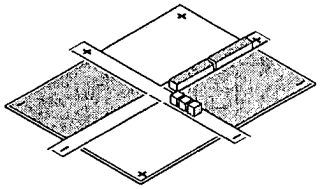
Lesson 5-5: Multiplying Monomials

A monomial is an algebraic expression with just one term. To multiply monomials, use the Quadrant Mat and the Factor Track.

Example: Find the product $(-3)(2x)$.

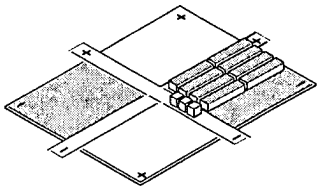
Step 1.

Model the factors on the factor track. The plus signs and minus signs show you where to put the factors.



Step 2.

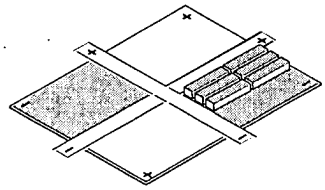
Solve. Build the product rectangle on the mat. Remove the factor track when you are finished.



Step 3.

Read the mat. Notice the minus sign in this part of the mat. This means the product is negative.

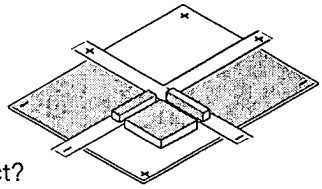
Product: $-6x$



Step 4.

Record.

$(-3)(2x) = -6x$



Try It

1. The illustration shows the product $(-x)(-x)$. Which Algeblocks are used in this product?

_____

2. How do you know that the product of $-x$ and $-x$ is a positive quantity? _____

_____

3. Find the products of (x) (x) and $(x)(-x)$ using Algeblocks. $(x)(x)$ = _____ $(x)(-x)$ = _____

Practice

Use Algeblocks to find each product.

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

5. $(x)(-4)$ = _____

6. $(3)(2x)$ = _____

7. $(-1)(2x)$ = _____

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

9. $(3)(-3x)$ = _____

Find each product. Use unit blocks, x blocks, and x^2 blocks.

10. $(2x)(x)$ = _____

11. $(x)(-2x)$ = _____

12. $(-2x)(-3x)$ = _____

13. $(3x)(-x)$ = _____

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

15. $(-x)(-4x)$ = _____

Challenge

16. Identify the Algeblocks that show the product xy. Model the product $(3x)(-2y)$ _____

Name: _____ Date: _____

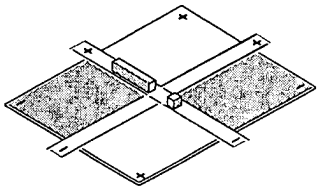
Lesson 5-6: Multiplying Binomials

A binomial is an algebraic expression that has two terms. Multiplying two binomials results in four product rectangles. You will sometimes need to remove a zero or combine like terms.

Example: Find the product $(x - 1)(x + 1)$.

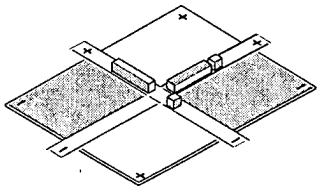
Step 1a.

Use the Factor Track. Model the first factor vertically.



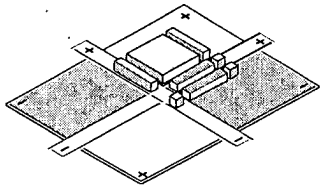
Step 1b.

Model the second factor.



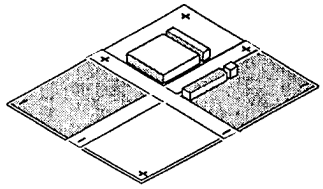
Step 2a.

Build the product rectangles on the mat.



Step 2b.

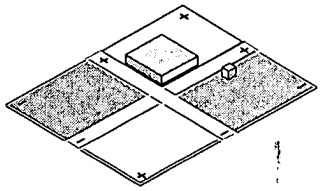
Remove the Factor Track.



Step 3.

Remove zero pairs. Read the mat to find the product.

Product: $x^2 - 1$



Step 4.

Record.

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

Try It

1 Look at the model in Step 2b. What zero pair is shown? _____

2. The problem $(2x)(1 + x)$ has two factors. One factor is a binomial. How many product rectangles will this problem have? _____ Model the factors and product to check your prediction.

   Number of product rectangles: _____ $(2x)(1 + x) =$ _____

Practice

Find each product using Algeblocks.

3. $(3)(x + 1) =$ _____
4. $(x - 1)(^-2) =$ _____
5. $(x)(x + 2) =$ _____
6. $(x - 3)(^-x) =$ _____
7. $(^-2x)(x - 1) =$ _____
8. $(2x + 1)(3x) =$ _____
9. $(x + 1)(x + 1) =$ _____
10. $(x - 1)(x - 1) =$ _____
11. $(x + 1)(2x + 1) =$ _____
12. $(2x - 1)(2x + 1) =$ _____

Name: _____ Date: _____

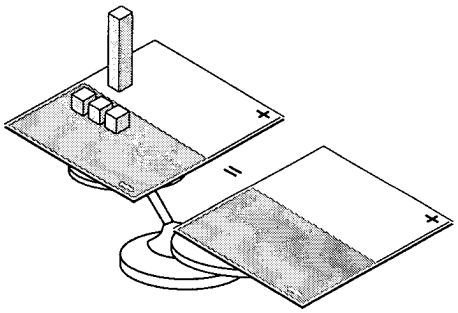
Lesson 6-1: Modeling Equations on the Sentences Mat

An equation is a little like a balance scale. The two sides of an equation must equal the same number. The scale on the Sentences Mat shows this equality.

Example: Model the equation $x - 3 = -2 + 7$ on the Sentences Mat.

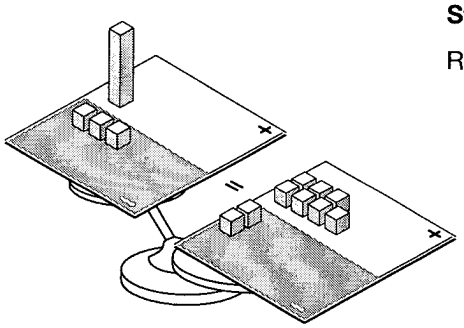
Step 1.

Model the left side of the equation on the left side of the Sentences Mat.



Step 2.

Model the right side of the equation on the right side of the mat.



Step 3.

Read the mat.

$x - 3 = -2 + 7$

Step 4.

Record your model.

Try It

1. What Algeblocks are used in Step 1? _____
2. What do the two sections of the Sentences Mat show? _____
3. The drawing in Step 2 can be simplified by removing some zero pairs.

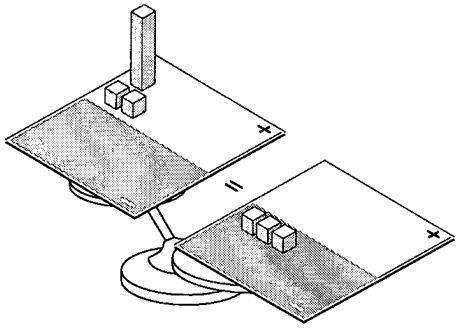
   Explain how to simplify the equation. _____

   _____

Practice

Use Algeblocks to make each model. Then write the equation shown.

4.



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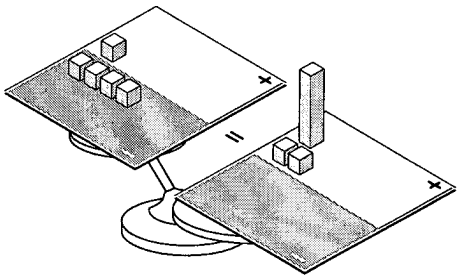
5.



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Lesson 6-1: Modeling Equations on the Sentences Mat

Use Algeblocks and the Sentences Mat to model each equation. Record by sketching.

6. $x + 4 = -1$

7. $6 = x - 3$

8. $-1 + x = 3 - 2$

9. $2 - x = -8 + 1$

10. $-3 + 2 = 4 + x$

11. $x - 7 = 1 - 6$

Name: _____ Date: _____

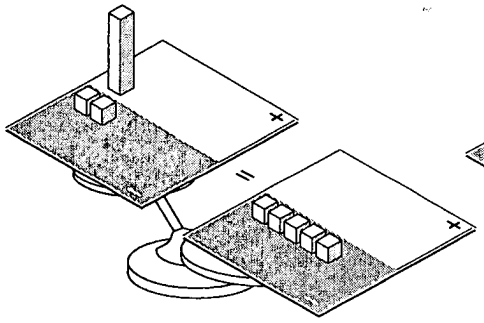
Lesson 6-2: Using Addition to Solve Equations

Your Algeblocks and the Sentences Mat can help you solve equations. The goal is to get the block for the variable all by itself on one side of the mat.

Example: Solve $y - 2 = -5$

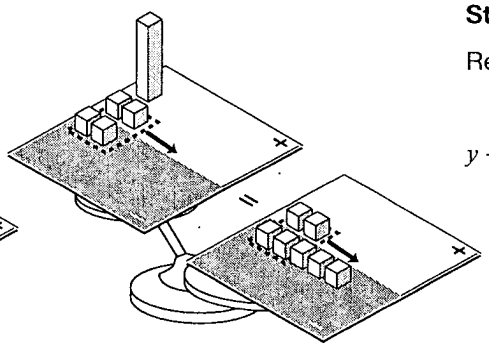
Step 1.

Model the equation. Use the left side of the mat for $y - 2$. Use the right side of the mat for -5.



Step 2.

Solve. Add 2 unit blocks to both sides of the mat. Then take all zero pairs off the mat.



Step 3.

Read the mat.

$y = -3$

Step 4.

Record.

$$y - 2 = -5$$
$$y - 2 + 2 = -5 + 2$$
$$y = -3$$

Try It

1. In Step 2, how do you know how many zero pairs to take off the mat? _____

_____

2. Model and solve the equation $5 = x - 3$. Before you begin, think about your goal. What will the right side of the Sentences Mat look like when you are done? _____

_____

Practice

Solve each equation. Record your steps to complete the chart.

	Equation	Number Added to Each Side	Number of Zero Pairs Removed	Solution
3.	$y - 3 = 6$			$y =$ _____
4.	$2 = -1 + x$			$x =$ _____
5.	$-5 = y - 4$			$y =$ _____
6.	$x - 4 = 4$			$x =$ _____
7.	$4 = y - 1$			$y =$ _____

Critical Thinking

8. Create a method to solve $-y = -3$ using Algeblocks.

Name: _____ Date: _____

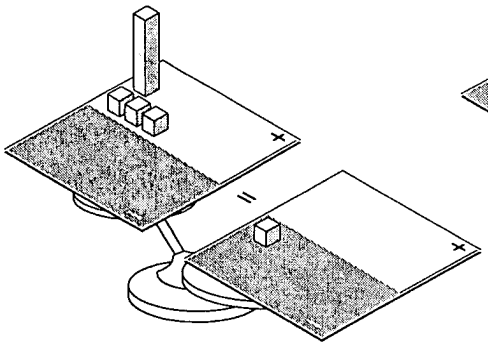
Lesson 6-3: Using Subtraction to Solve Equations

Sometimes you need to subtract from both sides of an equation to get the variable alone.

Example: Solve $x + 3 = -1$

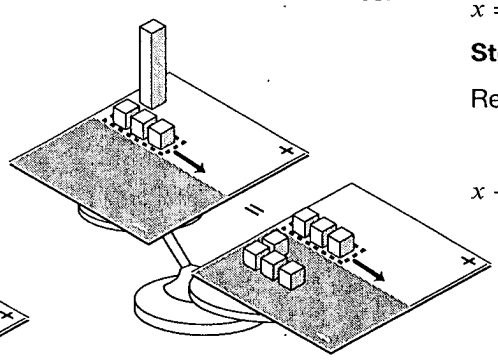
Step 1.

Model the equation. You need to subtract 3 from both sides. Add 3 zero pairs to the right side so you can do this.



Step 2.

Solve. Add 3 zero pairs to the right side. Subtract 3 from both sides.



Step 3.

Read the mat.

$x = -4$

Step 4.

Record.

$$x + 3 = -1$$
$$x + 3 - 3 = -1 - 3$$
$$x = -4$$

Try It

1. Why do you have to add zero pairs before subtracting? _____

_____

2. Where do you put the unit blocks when you add the zero pairs to the mat? _____

_____

3. Model and solve the equation $y + 1 = 5$. Explain why you do not need to add zero pairs before you subtract.

_____

Practice

Use Algeblocks and the Sentences Mat to solve each equation.

4. $y + 2 = 6$ $y =$ _____

5. $7 = 1 + x$ $x =$ _____

6. $3 + y = 5$ $y =$ _____

Solve each equation. You will need to add zero pairs before you can subtract.

7. $x + 4 = 1$ $x =$ _____

8. $3 + y = -2$ $y =$ _____

9. $-3 = 1 + x$ $x =$ _____

Mixed Practice

Solve each equation. Add or subtract the same number from both sides of the mat.

10. $x - 2 = -3$ $x =$ _____

11. $-2 = 4 + y$ $y =$ _____

12. $1 = y - 6$ $y =$ _____

13. $-4 = 5 + x$ $x =$ _____

14. $2 + y = 8$ $y =$ _____

15. $x - 5 = -2$ $x =$ _____

Name: _____ Date: _____

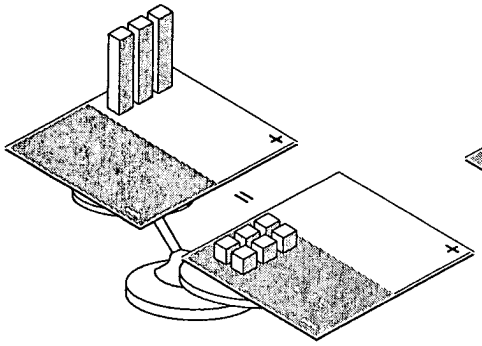
Lesson 6-4: Using Division to Solve Equations

In a term such as $3x$, the number 3 is called a coefficient. In these equations, you will divide both sides by the coefficient of the variable term.

Example: Solve $3x = -6$

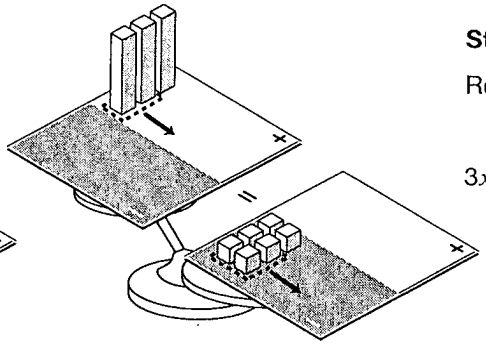
Step 1.

Model the equation. The coefficient of the x-term is 3. So, make 3 equal groups on the right side of the mat.



Step 2.

Solve. Each x equals -2. Remove equal quantities from both sides of the mat to show the solution.



Step 3.

Read the mat.

$x = -2$

Step 4.

Record.

$3x = -6$

$3x \div 3 = -6 \div 3$

$x = -2$

Try It

1. How is solving $3x = -6$ different from solving $3 + x = -6$? _____

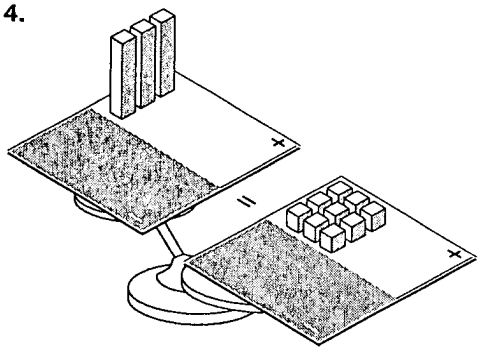
2. Change the example equation to $2x = -6$. How many equal groups do you make? _____

3. What Algeblocks would you use to show the equation $3y = -3$? _____

Practice

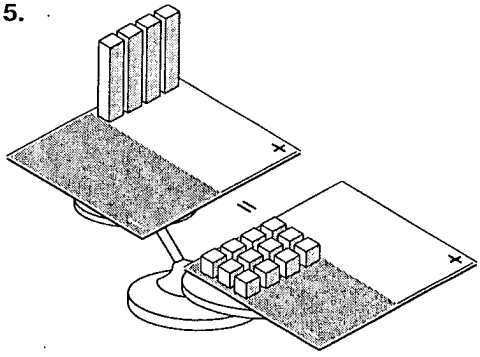
Write the equation shown by each model. Then use Algeblocks to find the solution.

4.



_____ $y =$ _____

5.



_____ $x =$ _____

Solve each equation. Make equal groups to divide.

6. $2x = 10$ $x =$ _____

7. $-4 = 2y$ $y =$ _____

8. $3y = -9$ $y =$ _____

9. $-3 = 3x$ $x =$ _____

10. $10 = 5x$ $x =$ _____

11. $4y = -8$ $y =$ _____

Name: _____ Date: _____

Lesson 6-5: Solving Two-Step Equations

When two steps are needed to solve an equation, add or subtract first.

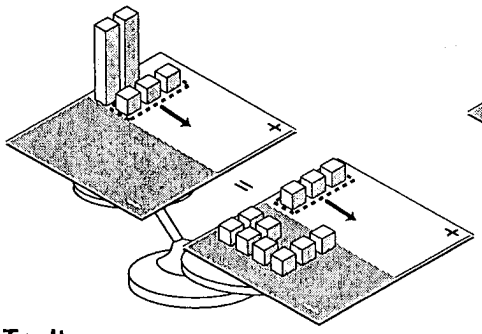
Example: Solve $2x + 3 = -5$

Step 1.

Model the equation.

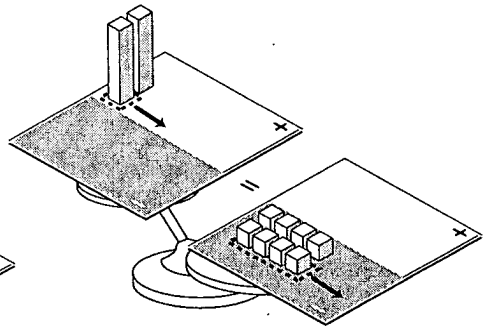
Step 2a.

Add 3 zero pairs to the right side. Then subtract 3 from both sides.



Step 2b.

The equation is now $2x = -8$. Divide both side by 2. Make 2 equal groups on the right side. Then remove equal quantities.



Step 3.

Read the mat.

$x = -4$

Step 4.

Record.

$$2x + 3 = -5$$
$$2x + 3 - 3 = -5 - 3$$
$$2x = -8$$
$$2x \div 2 = -8 \div 2$$
$$x = -4$$

Try It

1. The first step is to get the variable term $2x$ alone. How do you do this?

_____

2. How do you know whether to add or to subtract in Step 2a?

_____

Practice

Use Algeblocks to solve each equation. The first step in the solution is described.

3. $3y - 1 = 8$ Add 1 to both sides to get _____ Solution: $y =$ _____

4. $2 + 5x = 12$ Subtract 2 from both sides to get _____ Solution: $x =$ _____

5. $2x - 3 = 5$ Add 3 to both sides to get _____ Solution: $x =$ _____

6. $-7 = 2y + 1$ Subtract 1 from both sides to get _____ Solution: $y =$ _____

7. $11 = 4x - 5$ Add 5 to both sides to get _____ Solution: $x =$ _____

Solve each equation.

8. $6x + 8 = 14$ $x =$ _____

9. $16 = 6 + 2y$ $y =$ _____

10. $5x - 6 = 9$ $x =$ _____

11. $16 = 3y - 5$ $y =$ _____

12. $2x + 3 = -9$ $x =$ _____

13. $-8 = 3y - 2$ $y =$ _____

Name: _____ Date: _____

Lesson 6-6: Variables on Both Sides

You can add or subtract x and y terms from both sides of the Sentences Mat.

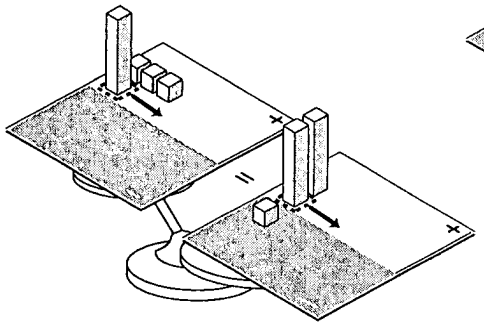
Example: Solve $3 + y = 2y - 1$

Step 1.

Model the equation.

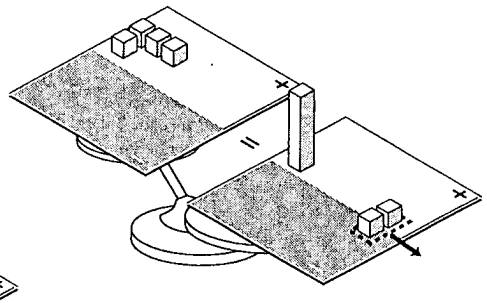
Step 2a.

Eliminate the variable term from one side. Subtract y from both sides.



Step 2b.

The equation is now $3 = y - 1$. To isolate the variable, add 1 to both sides. Remove the zero pair.



Step 3.

Read the mat.

$4 = y$

Step 4.

Record.

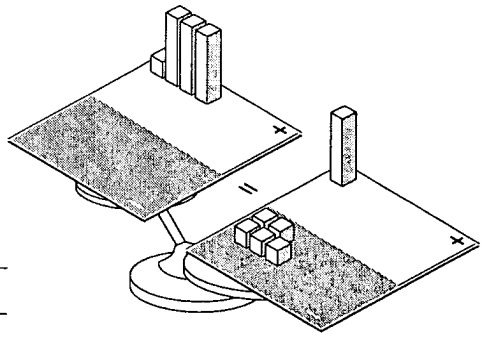
$3 + y = 2y - 1$

$3 + y - y = 2y - y - 1$

$3 = y - 1$

$3 + 1 = y - 1 + 1$

$4 = y$



Try It

1. What equation is shown at the right? _____

_____

2. Model the equation with Algeblocks. How can you eliminate the x term from the right side? _____

_____

3. Describe a plan for finishing the solution. Then carry out your plan. _____

_____

Practice

Use Algeblocks to solve each equation. The first step in the solution is described.

4. $x - 3 = -x + 5$ Add x to both sides to get _____ Solution: $x =$ _____

5. $3y - 2 = 4y$ Subtract $3y$ from both sides to get _____ Solution: $y =$ _____

6. $x - 2 = 1 - 2x$ Add $2x$ to both sides to get _____ Solution: $x =$ _____

7. $2y + 5 = 4 + y$ Subtract y from both sides to get _____ Solution: $y =$ _____

Solve each equation.

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

9. $4x = x - 9$ $x =$ _____

10. $-5 - x = 5 - 3x$ $x =$ _____

Name: _____ Date: _____

Lesson 6-7: Problem-Solving Applications: Linear Equations

To use Algeblocks to solve a word problem, first write an equation for the problem.

Example: Charles collects old teddy bears. He sold 2 bears and has 7 left. How many bears did he have originally?

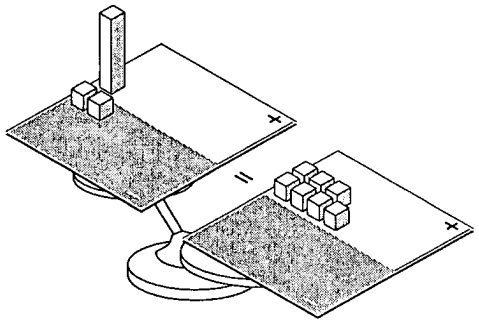
Step 1.

Write an equation for the problem. Let y stand for the number of bears he had originally.

$y - 2 = 7$

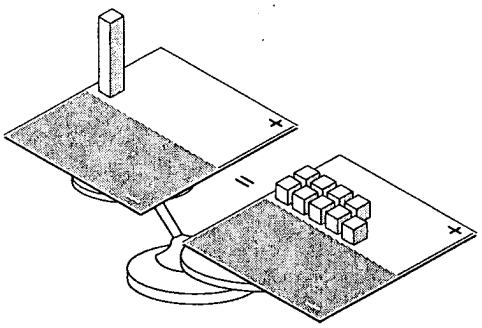
Step 2a.

Model the equation.



Step 2b.

Use Algeblocks to solve the equation.



Step 3.

Read the mat.

$y = 9$

Step 4.

Record. Remember to label the answer.

$y - 2 = 7$

$y - 2 + 2 = 7 + 2$

$y = 9$

Answer: 9 teddy bears

Try It

1. Sketch the modeling you do in Step 2b. Use a Mini Sentences Mat for the sketches.

2. There is often more than one equation for a word problem. Explain how the equation $2 + 7 = y$ can be used to solve the example problem. _____

Practice

Solve each problem. Record the equation you use. Label each answer.

3. Paula has 3 times as many antique toy boats as Bart. If Paula has 21 toy boats, how many does Bart have?

   equation: _____

   answer: _____

4. A company made a set of 8 different toy clowns. Gil has collected 5 of them. How many more does he need to have the entire set?

   equation: _____

   answer: _____

5. Sue has 6 old board games. This is 3 fewer than the number of games her cousin has. How many board games does her cousin have?

   equation: _____

   answer: _____

6. Sid works part-time at an antique store. He earns $6 per hour. How many hours must he work to earn $18?

   equation: _____

   answer: _____

Name: _____ Date: _____

Lesson 7-1: Dividing Monomials

Remember, division is the inverse operation of multiplication. Thinking about fact families can help you divide.

Example: Find the quotient: $6x^2 \div -2x$

Step 1.

Place the divisor on the horizontal axis.

Step 2.

Model the dividend in the correct quadrant. Form a rectangle with one dimension equal to the divisor.

Step 3.

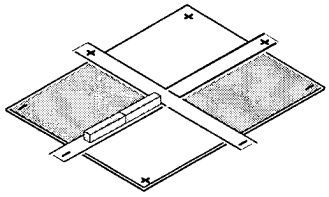
Model the quotient by building the other dimension of the rectangle. Read the mat.

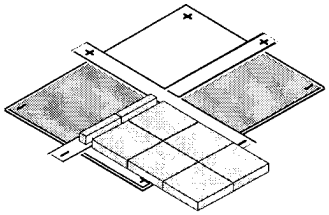
$-3x$

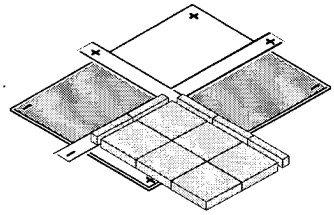
Step 4.

Record.

$6x^2 \div -2x = -3x$







Try It

1. Explain how you knew where to place the divisor and the dividend. _____

_____

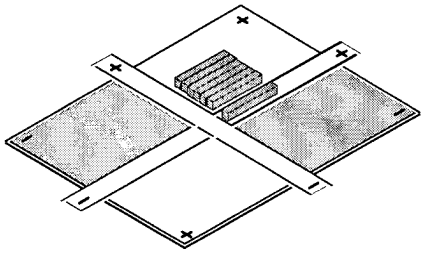
2. Where would you place the divisor, dividend, and quotient if the equation were $-6x^2 \div 2x$? _____

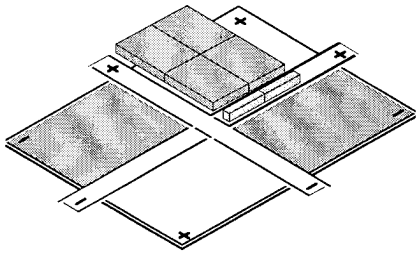
_____

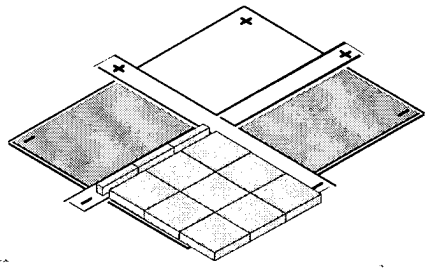
_____

Practice

Find the quotient for each division problem shown by the mats. Write the completed problem.







3. _____ 4. _____ 5. _____

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Lesson 7-1: Dividing Monomials

Use Algeblocks and the Quadrant Mat to find each quotient. Sketch your work and record the answer.

6. $5x \div 5$

7. $8x^2 \div {}^-2x$

8. $3x^2 \div {}^-x$

9. $3x^2 \div 3x$

10. ${}^-4x^2 \div {}^-x$

11. $6xy \div 3y$

12. ${}^-6x^2 \div 6x$

13. ${}^-3y^2 \div {}^-3y$

14. $6xy \div 2x$

Name: _____ Date: _____

Lesson 7-2: Dividing Binomials

Algeblocks can also be used to solve more complex division problems that involve binomials.

Example: Find the quotient: $(3xy - 6x) \div 3x$

Step 1.

Place the divisor on the horizontal axis.

Step 2.

Model a rectangle for each term of the polynomial. Be sure the width of the rectangles is equal to the divisor.

Step 3.

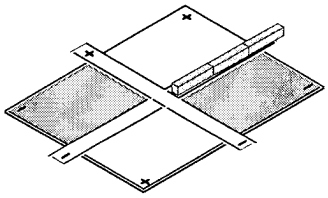
Place blocks along the vertical axis to show the quotient. Read the mat.

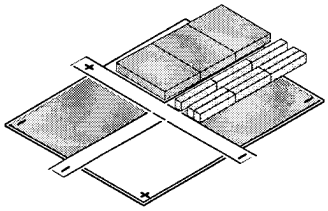
$y - 2$

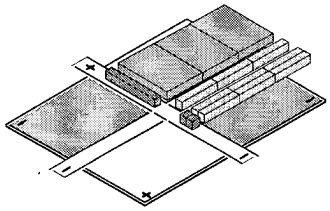
Step 4.

Record.

$(3xy - 6x) \div 3x = (y - 2)$







Try It

1. How did you decide where to make the rectangles for the terms of the polynomial? _____

_____

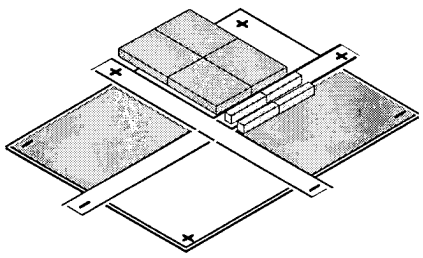
2. How would the model of the dividend change if it was $(3xy + 6x) \div 3x$? _____

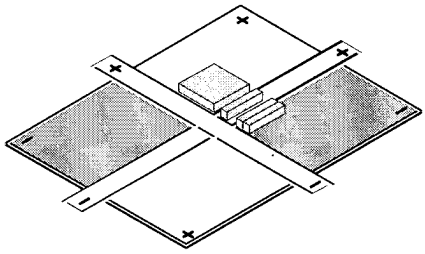
_____

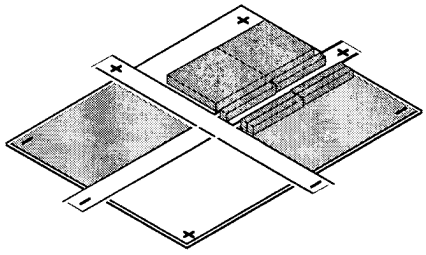
_____

Practice

Find the quotient for each division problem shown by the mats. Write the completed problem.







3. _____ 4. _____ 5. _____

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Lesson 7-2: Dividing Binomials

Use Algeblocks and the Quadrant Mat to find each quotient. Sketch your work and record the answer.

6. $(6x^2 + 6x) \div 3x$

7. $(2xy + 6x) \div 2x$

8. $(3xy - 3y) \div {-3y}$

9. $({-4x^2} - 6x) \div {-2x}$

10. $(4y - 6y^2) \div {-2y}$

11. $(9x^2 + 6x) \div {-3x}$

Name: _____ Date: _____

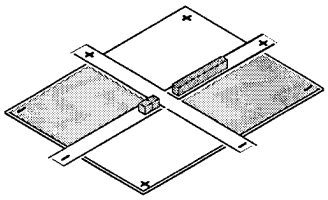
Lesson 7-3: Extending Division

You used Algeblocks to model multiplication of polynomials. Remember that process and you'll have no trouble modeling division of polynomials.

Example: Find the quotient: $(2xy - 4x) \div (y - 2)$

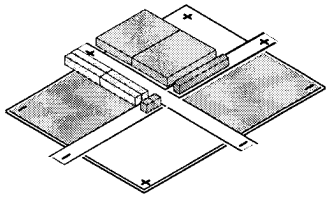
Step 1:

Model the divisor on the horizontal axis.



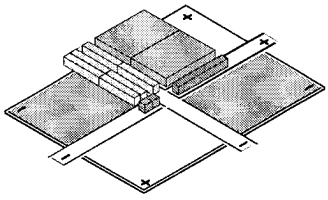
Step 2:

Form rectangles in the correct quadrants.



Step 3:

Find the quotient. Read the mat.



Step 4:

Record.

$(2xy - 4x) \div (y - 2) = 2x$

Try It

1. How would you model the division problem $(3xy + 6x) \div (y + 2)$? _____

_____

2. Sketch the problem and find the quotient: $(3xy + 6x) \div (y + 2) =$ _____

Practice

Use Algeblocks and the Quadrant Mat to find each quotient. Sketch your work and record the answer.

3. $(4y - 6y^2) \div (2 - 3y)$

4. $(9x^2 + 6x) \div (3x + 2)$

5. $(4x^2 + 4x) \div (x + 1)$

continued from previous page

Lesson 7-3: Extending Division

6. $(6xy + 9y) \div (2x + 3)$

7. $(2x^2 - x) \div (-2x + 1)$

8. $(5x^2 - 3x) \div (-3 + 5x)$

9. $(4x^2 - 2x) \div (-2x + 1)$

10. $(3xy + 9x) \div (y + 3)$

11. $(4x^2 - 12x) \div (-2x + 6)$

Name: _____ Date: _____

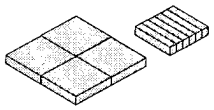
Lesson 7-4: Greatest Common Factor with Variables

Remember how you found the greatest common factor of integers? Use that same strategy to find the greatest common factor of variable expressions.

Example: Find the greatest common factor of $4x^2$ and $6x$.

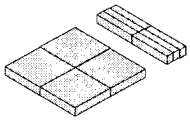
Step 1.

Make rectangles using blocks that model the expression.



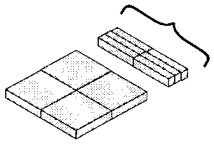
Step 2.

Find the greatest common dimension of the rectangles.



Step 3.

Read the blocks. The greatest common dimension is $2x$.



Step 4.

Record.

The GCF of $4x^2$ and $6x$ is $2x$.

Try It

1. This method of finding the GCF is trial and error, because you have to keep trying to find rectangles that have a similar dimension. What patterns do you look for to help you find the GCF?

   _____

   _____

2. Construct two different rectangles that have a GCF of $(x + 3)$. What are the two expressions represented by the rectangles? _____

   _____

Practice

Find the greatest common factor of each set of expressions. List the dimensions of each rectangle.

3. $6xy$ and $12x^2$

   $6xy$ = _____ by _____ GCF = _____

   $12x^2$ = _____ by _____

4. $3x^2$ and $5x^2$

   $3x^2$ = _____ by _____ GCF = _____

   $5x^2$ = _____ by _____

5. $9x^2$ and $3xy$

   $9x^2$ = _____ by _____ GCF = _____

   $3xy$ = _____ by _____

6. $6xy$, $8x^2$, and $6x$

   $6xy$ = _____ by _____ GCF = _____

   $8x^2$ = _____ by _____

   $6x$ = _____ by _____

Name: _____ Date: _____

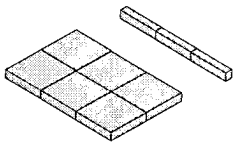
Lesson 7-5: Factoring Binomials

Factoring means writing an expression as the product of its factors. You might think of it as "un-multiplying."

Example: Factor $(6x^2 - 3x)$.

Step 1.

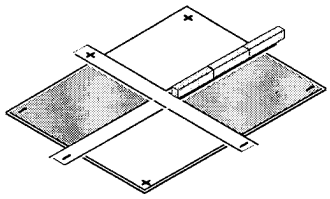
Find the GCF of the two terms.



GCF = $3x$

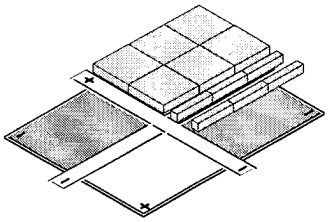
Step 2a.

Model the GCF on the horizontal axis.



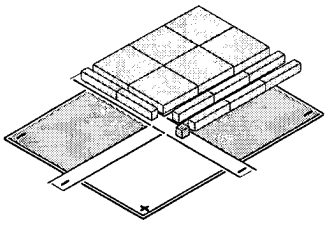
Step 2b.

Make rectangles in the correct quadrants. Use the GCF as a boundary for both rectangles.



Step 3a.

Use blocks to find the other boundary of the rectangles.



Step 3b.

Read the mat. The two boundaries are the factors.

Horizontal boundary: $3x$
Vertical boundary: $2x$ and -1

Step 4.

Record.

$(6x^2 - 3x) = 3x(2x - 1)$

Try It

1. How did you know where to model the rectangles? _____

_____

2. How do you know what boundaries to make in **Step 3a**? _____

_____

Practice

Use Algeblocks to factor these algebraic expressions. Sketch your work and record the factors.

3. $2x^2 - 4x =$ _____

4. $4y^2 - 2xy =$ _____

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Lesson 7-5: Factoring Binomials

5. $6xy + 3y =$ _____

6. $-3x^2 - 2x =$ _____

7. $6x^2 - 4xy =$ _____

8. $2xy - x =$ _____

9. $6y^2 - 9y =$ _____

10. $6xy - 2y^2 =$ _____

Name: _____ Date: _____

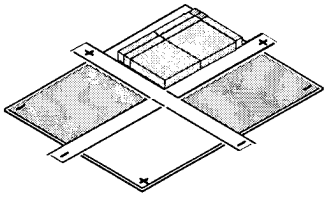
Lesson 7-6: Factoring Trinomials

Using what you have learned, you can factor trinomials.

Example: Factor $2x^2 + 5x + 2$

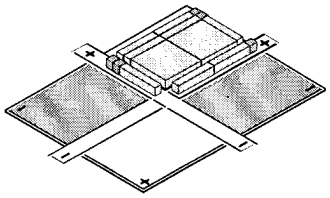
Step 1.

Use the blocks shown by the trinomial to form a rectangle.



Step 2.

Place blocks on the axes to show the factors.



Step 3.

Read the mat. $2x + 1$ and $x + 2$

Check by multiplying.

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

Step 4.

Record.

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

Try It

1. Why is the rectangle modeled in Quadrant 1? _____

_____

Practice

Use Algeblocks and the Quadrant Mat to factor the trinomials. Sketch your work and record the factors.

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

3. $2x^2 + 3x + 1 =$ _____

4. $2x^2 + 8x + 6 =$ _____

5. $x^2 + 2x + 1 =$ _____

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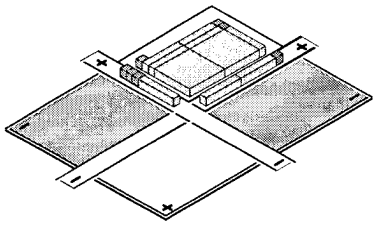
Lesson 7-6: Factoring Trinomials

6. $3x^2 + 10x + 3 =$ _____

7. $4x^2 + 6x + 2 =$ _____

8. $6x^2 + 7x + 2 =$ _____

9. What is wrong with this factoring of the trinomial $2x^2 + 5x + 3$? How can you fix it?



_____

_____

_____

_____

Factor these trinomials completely. (Hint: Factor the GCF first, then factor the trinomial.)

10. $9x^2 + 21x + 6 =$ _____

11. $20x^2 + 40x + 15 =$ _____