UNIT 1

Introduction to Algebra Tiles

Unit Overview

Areas of squares and rectangles are key to naming and working with **Algebra Tile** pieces. Beginning with the small yellow/red squares, it is common to denote the length of each side as 1. Therefore, the area is 1. The value of a yellow square is 1, whereas the value of a red square is –1. The blue/red square customarily has sides of length x. Its area is x^2. The value of a blue square is x^2, whereas the value of a red square is $-x^2$. The dimensions of a green/red rectangle are 1 unit by x units, and its area is x. Activities in the unit first involve representing integers using the small squares, and then proceed to representing and writing algebraic expressions using the **Algebra Tiles**. The Zero Principle is introduced and used throughout this unit and future units.

Glossary of Terms

Integers: The set of numbers . . . –3, –2, –1, 0, 1, 2, 3, . . .

Opposites: Two numbers that have the same absolute value but opposite signs.

Zero Pair: Two tiles, one of each color. A zero pair sums to zero.

Variable: A symbol, usually a letter, that is used to represent one or more numbers in an algebraic expression. For example, x is a variable in the expression $4x + 3$.

Polynomial: An expression that has one or more terms of the form ax^n where a is any real number and n is a whole number.

Binomial: A polynomial that has two terms.

Trinomial: A polynomial that has three terms.

Term: A part of an expression that is separated by an addition or subtraction sign. In the expression $2x - 4$, the terms are $2x$ and -4.

Activity 1.1 Integer Pieces

Objective: To represent positive and negative integers using **Algebra Tiles.**

Prerequisites: Students need to know that the area of a square is given by $A = s^2$, where s is the length of a side.

Getting Started: Introduce the unit squares. Discuss the idea of unit length, so that the area of the square is 1. Discuss the idea of a negative integer. Note that we can use the yellow unit squares to represent positive integers and the red unit squares to represent negative integers.

Closing the Activity: Present verbal descriptions to students and have them model the result with **Algebra Tiles**.

Answers:

1. 8 yellow pieces
2. 3 red pieces
3. Answers vary
4. 2 yellow pieces
5. 10 red pieces
6. 5 red pieces
7. (a) –4 (b) 9 (c) 2
8. Possible answer: make a zero pair with one yellow piece and one red piece. Two yellow pieces remain. Answer is 2.

Activity 1.2 The Zero Principle

Objective: To represent the opposite of an integer using **Algebra Tiles**. To represent zero pairs using **Algebra Tiles**.

Prerequisites: Students must be able to represent positive and negative integers using **Algebra Tiles**.

Getting Started: Show students how two small squares of opposite colors neutralize each other, so that the net result of such a pair is zero.

Closing the Activity: Present various collections of unit squares, positive and negative, and have students use the Zero Principle to simplify the collection. Given that there are an odd number of unit squares, have students determine possible outcomes: all yellow, positive integer; all red, negative, integer; more yellow than red, positive integer; more red than yellow, negative integer.

Answers:

1. (a) 5 + (–5) = 0 (b) 3 + (–3) = 0 (c) 6 + (–6) = 0
2. Answers vary
3. (a) 4 + (–4) = 0 (b) 2 + (–2) = 0 (c) 6 + (–6) = 0

Activity 1.3 Modeling Integers

Objective: To model integers using zero pairs.

Prerequisites: Students need to be able to represent positive and negative integers using **Algebra Tiles**.

Getting Started: A positive integer can be represented by other positive integers in many ways. For example, $6 = 3 + 3 = 5 + 1 = 4 + 2$. Similarly, positive and negative integers can be represented by other positive and negative integers in many ways. Start with a positive integer such as 2. Add zero pairs and discuss the new name for 2. Continue this process several times. Repeat the activity; however, begin with a negative integer and add zero pairs.

Closing the Activity: Have students sketch more than one model for a given positive or negative integer. Give students an illustration of several positive and negative integers using **Algebra Tiles**, and have them name the integer represented in the model.

Answers:

1. (a) 2 (b) –6 (c) 4 (d) 3 (e) –4 (f) 1
2. (a)–(f) Teacher check
3. Infinite. Starting with 4 yellow tiles, as many zero pairs can be added as you wish.

Activity 1.4 Naming Algebra Tile Pieces

Objective: To name the remaining **Algebra Tile** pieces $(x,\ x^2)$.

Prerequisites: An area model is used in naming **Algebra Tile** pieces. Students must know that the area of a square is given by $A = s^2$, where s is the length of a side. Students must know that the area of a rectangle is given by $A = lw$, where l is the length and w is the width of the rectangle.

Getting Started: On an overhead projector, show the other **Algebra Tile** pieces. Show that the length of a side of the blue/red square is not an integer value. We will say that the length is x. Therefore, the area is x^2. The blue square has a value of x^2, whereas the red square has a value of $-x^2$. The green **Algebra Tile** piece has a value of x, and the red **Algebra Tile** piece has a value of $-x$. Place a collection of **Algebra Tiles** on an overhead projector and write an algebraic expression for the collection. Then write an algebraic expression and have students model it with the tiles.

Closing the Activity: The activity concludes with change in the length of a side of the small square. With a side of length y, the area now becomes y^2. The value of a yellow square is y^2, and the value of a small red square is $-y^2$. Expressions involving two variables can be written.

Answers:

1.–4. Teacher check

5. $x^2+3xy + 4y^2$
6. $2x^2 + (-2xy) + y^2$
7. $-3x^2 + 4xy + (-3y^2)$
8. 4 blue a^2 pieces, 2 red ab pieces, 2 yellow b^2 pieces

Activity 1.5 Grab Game

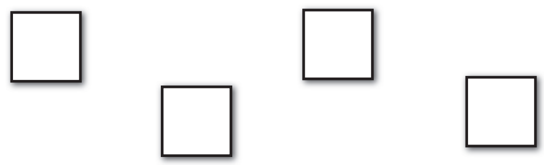
Objective: To practice writing and simplifying algebraic expressions, using the Zero Principle.

Prerequisites: Students must know how to apply the Zero Principle in order to simplify algebraic expressions.

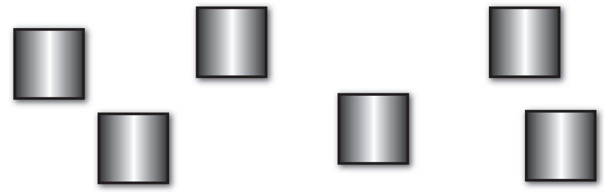
Getting Started: Using overhead **Algebra Tiles**, illustrate how to simplify an algebraic expression, using the Zero Principle where necessary.

Closing the Activity: Show illustrations of **Algebra Tile** pieces and have students write a simplified expression. Write algebraic expressions and have students write simplified expressions.

To represent integer values, use the small square tiles.



Each white piece represents +1



Each gray piece represents −1

Use the small square tiles to represent each number. Make a sketch of your model.

1. **8**

2. **−3**

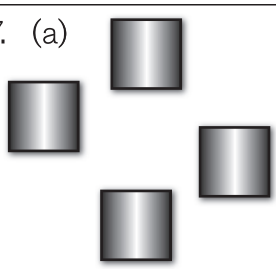
3. **A single digit odd number**

4. **An even prime number**

5. **10 feet below sea level**

6. **5 degrees below zero**

7. (a)



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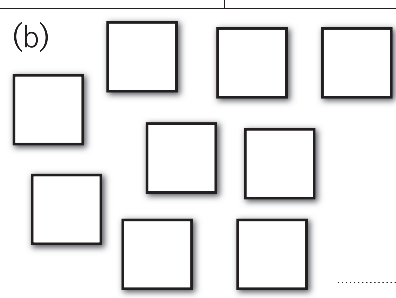
(b)



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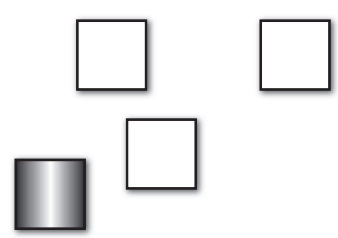
(c)



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8. Explain how you determined the value represented in 7c.

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____

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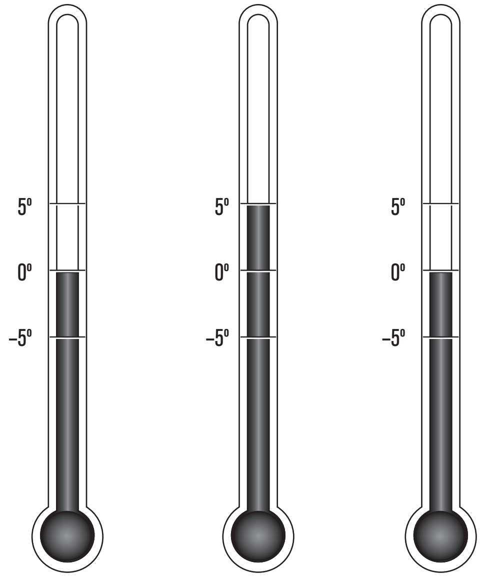
Name:



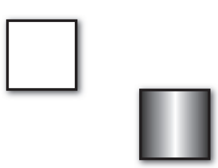
Temperature starts at 0° | Temperature rises 5° | Temperature falls 5°

In each example above, the two actions balance, or neutralize, one another.

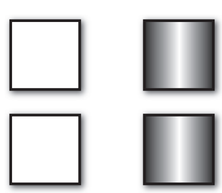
Think of additional examples where two actions neutralize one another.

- ____
  ____
- ____
  ____
- ____
  ____

A small white square tile represents 1. A small gray square tile represents −1. The numbers 1 and −1 are opposites. They sum to 0. We refer to 1 and −1 as a zero pair.



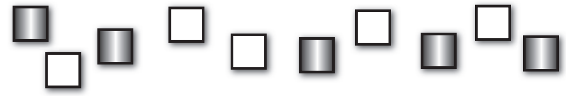
$1 + (-1) = 0$



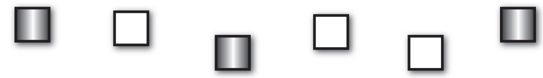
$2 + (-2) = 0$

1. Write an equation for each diagram.

(a)



(b)



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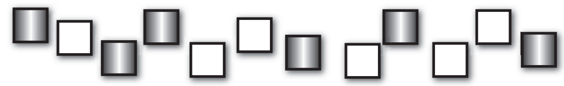
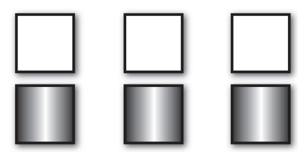


2. Draw diagrams on the mats below that each have a value of 0. Write an equation for each.

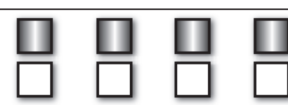
Although it is not necessary, it is easier to read the value represented on the mat when the tiles have been arranged as shown.



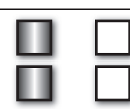
$3 + (-3) = 0$

3. Write an equation for each diagram.

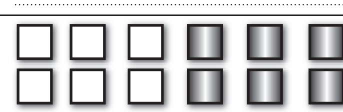
(a)



(b)



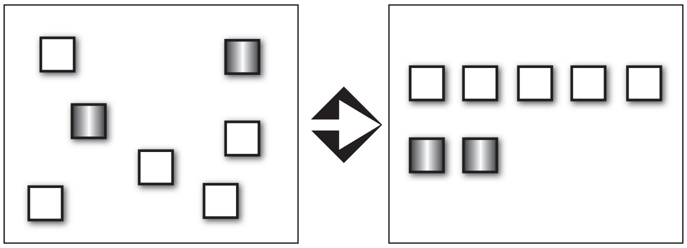
(c)



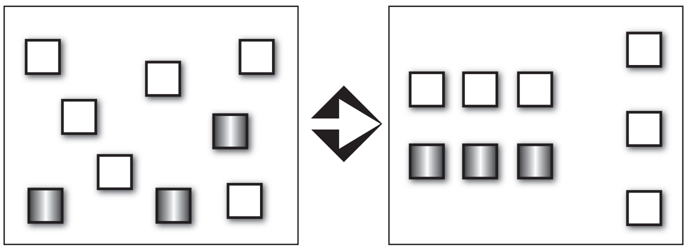
ACTIVITY 1.3 **Modeling Integers**

Name:

The integer 3 is modeled in each diagram below.

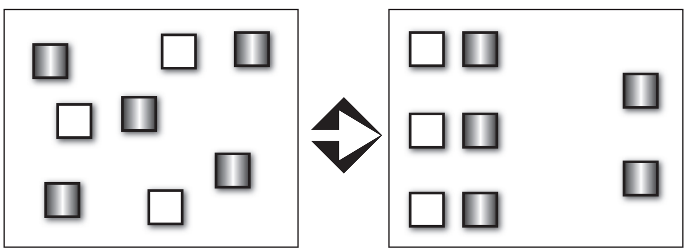


If the two zero pairs were removed, three white tiles would remain, or positive 3.



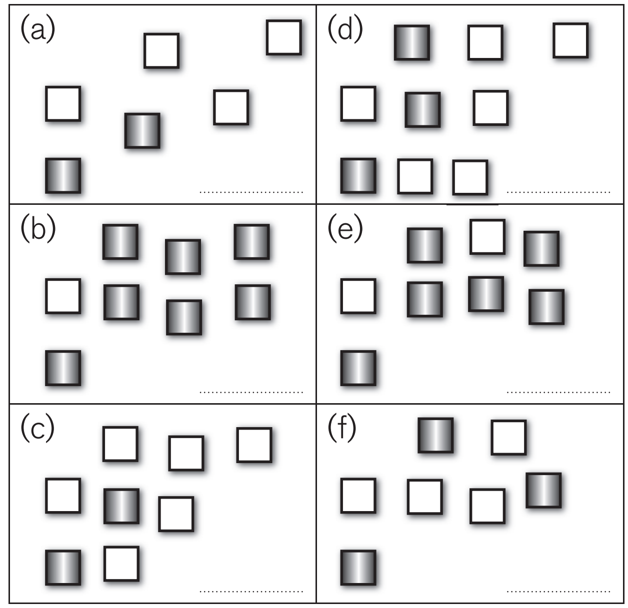
If the three zero pairs were removed, three white tiles would remain, or positive 3.

The integer −2 is modeled in the diagram below.



If the three zero pairs were removed two gray tiles would remain, or −2.

1. Name the integer modeled in each of the following.



2. Sketch a model for each integer using white and gray tiles in each diagram.

(a) **4**	(d) **5**
(b) **−3**	(e) **−6**
(c) **−1**	(f) **2**

3. How many different models are there for the integer 4? Explain.