

The learner will demonstrate an understanding of simple algebraic expressions.

5

Notes and textbook references

5.01 Simplify algebraic expressions and verify the results using the basic properties of rational numbers.

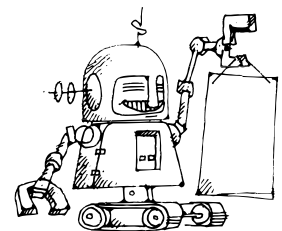
- a) Identity.***
- b) Commutative.***
- c) Associative.***
- d) Distributive.***
- e) Order of Operations.***

A. Mental Math Using Properties (Blackline Master V - 10 through V - 16) Make transparencies of each of these sheets. Tape paper on the back of the transparency to cover up the answer and property side. Use other paper to mask all but the question in play.

Divide the class into two or more teams. On a team's turn, display the top line only of one of the problems. The team's task is to give the answer using only mental math. If they need help, show the second line of the problem. A team scores two points if they answer the problem without a hint, one point if they answer it with the hint showing. If you wish, you can also add a third point if the student is able to tell you the property illustrated that allows changing the first line to the second line. Note: In addition to simplifying expressions, additional properties may be required to obtain the given answers.

B. Alien Math (Blackline Master V - 17)

Allow students to explore the addition and multiplication tables to answer the questions on the worksheet, an enrichment activity. NOTE: The math used in this example is Modulo 5 arithmetic.



C. Matching Game (Blackline Masters V - 18 though V - 21)

Materials: Each group needs a deck of cards.

Directions: The dealer shuffles the deck and distributes eight cards to each player. The remaining cards are placed face down in a draw pile. The top card is turned over and placed beside the draw pile to start a discard pile.

On a player's turn, he may choose either the top discard or draw a card. He then discards one card into the discard pile. Play moves around the table.

The game is over when a player can display two complete sets of matching cards. A matching set contains three cards, one card with a property stated and two cards with illustrations of that property.



D. Properties Vocabulary When explaining the commutative, associative, and distributive properties, give examples of other uses of the words. For example, a “commuter” goes back and forth to work. “Commuting” is moving from one place to another. Whom you “associate” with is the same as saying who is in your group. When a teacher “distributes” papers, she gives one to each member of the class. The paperboy “distributes” a paper to every house on his route.

E. Order of Operations Square Puzzle (Blackline Master V - 22) Students fit the small squares together to form the larger square. Where edges touch, a problem and its solution must match. Note: It would be best to cut out the small squares and place them in an envelope before giving the puzzle to the students, as the blackline gives the “answer”.

F. Four Fours Have the students create problems using only four 4's. They may combine them with any operation and grouping symbols. Their task is to create problems with the answers 1-20. You may wish to keep this as an ongoing activity, or challenge the students to find as many problems as they can in a fixed time period.

G. Dice Game

Materials: Dice

Procedure: Divide the students into groups. Within the groups, the students will form two teams. On a team's turn, they will toss four of the dice (or one die four times). Then the opposing team will toss the die once. The challenge is for the team in play to use the numbers rolled to create a problem with the answer of the number rolled by their opponent. An additional rule may be added that allows the opposing team to capture the point by finding a solution before the team in play does. One point is awarded for each correct solution.

H. Math Bowling (Blackline Master V - 23)

Materials: For this activity you will need a game board, markers to cover numbers on the board, three number cubes or three sets of cards numbered 1- 6, and paper and pencil. Students can play in groups of two - four. Each student tosses the cubes or draws three cards. The object of the game is to “knock down” as many pins as possible with a “ball”. The “ball” is the three number set the student has drawn or tossed.

For example if student **A** has the numbers 5, 5, 4, he/she might write the following number sentences:

$$5 + 5 = 10$$

$$5 + 4 = 9$$

$$5 + 5 - 4 = 6$$

$$5 - 4 = 1$$

$$5 - 5 + 4 = 4$$

$$4 + 5 \div 5 = 5$$

And thus the pins 1, 4, 5, 6, 9, and 10 are knocked down. Score for round one is 6.

Student **B** might start with the numbers 2, 3, 6 and write these sentences:

$$2 + 3 = 5$$

$$3 - 2 + 6 = 7$$

$$(6 - 3)^2 = 9$$

$$6 + 2 = 8$$

$$3 - 2 = 1$$

$$6 \div 3 = 2$$

$$6 \div 2 = 3$$

$$3 \times 2 = 6$$

$$6 - 2 = 4$$

and knock down all but the 10 pin for a score of 9.

When students have written their number sentences they can exchange papers to check for accuracy, record their scores and play a second round. After ten rounds the scores are totaled and the high score wins.



5.02 Use and evaluate algebraic expressions.

Notes and textbook references

A. Ordered Pairs and Patterns (Blackline Master V - 1)

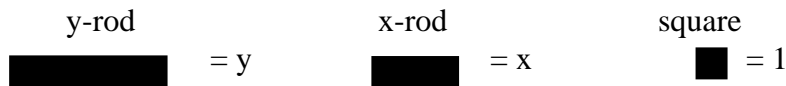
Students are presented with various problem situations in which patterns can be used to solve the problem.

B. Using Models (Blackline Masters V - 3 through V - 9)

There are multiple models that can be used to represent algebraic expressions. Many of them share some common characteristics:

- one icon represents one or more variables.
- one icon represents numbers (constants).

This section will use two models. One model is called **Rods and Squares**. In problems using this model, the following representations are used.



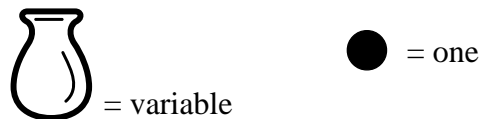
Using Rods and Squares

This arrangement represents the quantity $2x + 4$



A second model is called **Bags and Balls**. In problems using this model, the following representations are used.

bag (named with any variable name; variable stands for the number of balls in the bag)



C. Function War (Blackline Master V - 24)

Materials needed: Paper clip spinner, a die. Students work in teams of two. On a team's turn, they spin the spinner to determine a function and roll the die to find the value of x in that function. The team calculates the function value. Then the opposing team spins the spinner and uses the same die number as the first team. If the opposing team generates a higher function value, they win the point. If the team in play has the higher function value, the point goes to that team. If the two teams generate the same function value, no point is scored.

D. Star Travel (Blackline Master V - 25)

Students use space travel to examine and interpret patterns.

E. Perimeter and Area Patterns (Blackline Masters V - 26 and

V - 27) Students examine some geometric patterns to discover number patterns relating to perimeter and area. They then use these patterns to find formulas to predict perimeter and area for larger figures.

The patterns created from these figures are each linear. It is fairly easy to use the repetitive pattern to find the answers required. Students may notice (or you may point this out) that patterns which increase by 2 every time n increases by 1 will have a formula of the form " $2n + 1$ ". If the formula value increases by 4 each time n increases by 1, the formula will be of the form " $4n + ?$ ". If you study the concept of slope, remind students of this example and explain how this ties in with slope.

Students should also be reminded of the geometric meaning of the variables. For instance in the first pattern, n represents the length of figure. Each figure has a top and bottom of equal length and ends of length 1. Pointing out this pattern, and then having students imagine what the 100th figure will look like, can help them find the formula. Show how this connects with the formula $2n + 2$ for perimeter.

Some students may be able to solve the problems by the iterative pattern only, others may know and use the rule about equal increment changes, others may see the pattern geometrically. Expose students to all three ways of viewing the problem and help them understand how they connect.

F. Block Patterns (Blackline Masters V - 28 and V - 29)

Students examine geometric patterns to determine how they grow and to determine perimeter of the shapes formed. After completing a data table that shows pattern figure number and perimeter, the students should be able to find a formula to predict the perimeter of the n^{th} figure.

G. X in the Mix (Blackline Master V - 30)

Variables are used to represent the ingredients in a recipe for chocolate brownies. Students will use computation with fractions as they solve the puzzle.

H. Mini Review – Patterns (Blackline Master V - 31)

This mini review covers most of the skills from this unit. Allow students to work in pairs to share strategies and skills.

I. Four in a Row (Blackline Master V - 33)

The class is divided into two teams. To start play, the teacher puts an algebraic expression on the overhead. On a team's turn, they will give coordinates for a point they wish to capture. That point is circled. If the team can then give the correct answer for substituting the coordinates into the expression, the team captures that point, and the circle is filled in with the the color chosen for that team. If the team in play cannot provide a correct answer, the opposing team gets an opportunity to fill in the circle. Teams alternate playing until one team has captured four points in a row either horizontally, diagonally, or vertically.

If the leader wishes to direct students toward negative numbers, he/she may circle a point in the 2nd, 3rd, or 4th quadrant that may be used by either team as a free spot. Each round of the game lasts only a few minutes, thus making this game an excellent time filler. You may wish to play several rounds with your students to determine a winner.



J. X-Racing (Blackline Master V - 34)

Materials needed: Pawns for the players (two each of two colors), scissors, a paper bag, a die, calculator (for challenges). To prepare for the game, the students cut apart the numbered squares and place them in a paper bag.

Three of these numbered squares are drawn. The first square is the value for x , the second the value for y , and the third is the value for z . Each player places a pawn in the start square. Students work in teams of two to compete as they race around a track. Turns alternate between the two teams.

On a player's turn, he rolls the die and moves forward that number of spaces. When he arrives, he evaluates the expression on the space using the values of x , y , and z determined at the beginning of the game. If the player answers correctly, he remains where he is. If he answers incorrectly, the other team may challenge. If the opposing team can provide the correct answer, the challenged player moves back one, and the challenging player moves forward one. If a player challenges a player who has answered correctly, the false challenger moves back 2 spaces. Calculators may be used to resolve challenge situations.

The first team to get all pawns to the finish line wins.

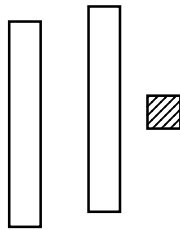
5.03 Solve simple (one- and two-step) equations or inequalities.

Notes and textbook references

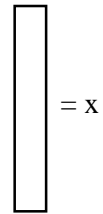
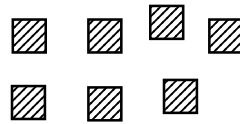
A. Using Algebra Tiles to Solve Two-Step Equations


Students may confuse the different kinds of algebra tiles and what they represent. Remind the students that the algebra tile's area is the value it represents. The length of the small square is one unit, so its area is one unit square. The x-bar is one unit wide and an unknown value for its length, so its area is x square units. The red tiles represent negative numbers and the yellow represent positive numbers. You may need to suggest students make a key so they won't forget the values. If you do not have access to algebra tiles you can draw a vertical rectangle to represent the bar and a square to represent a square. Demonstrate solving a two-step equation using algebra tiles, one is done for you below.


- **Model the equation $2x - 1 = -7$**



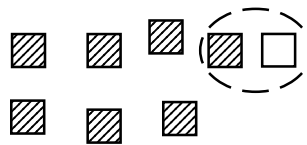
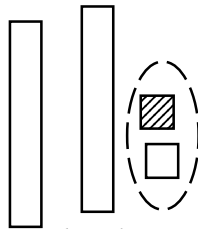
Notice that $2x - 1$ is shown as $2x + (-1)$



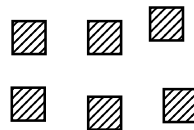
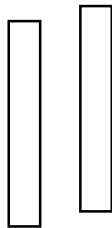
 = negative number

 = positive number

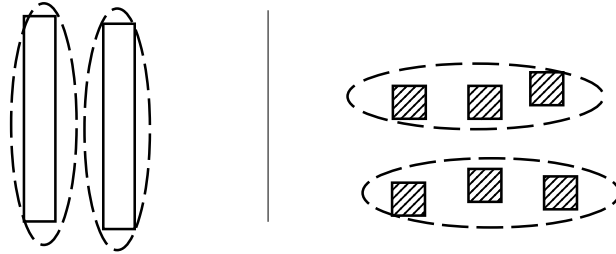
- **Make zero pairs to get the x-tiles alone on one side of the equation**



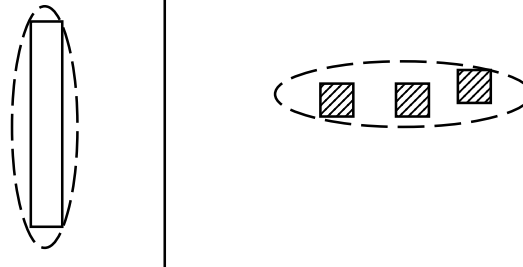
- **Simplify each side. You now have a one-step equation, $2x = -6$**



- *Divide each side of the equation into 2 equal parts*



- *Find the solution.*



The solution to $2x - 1 = -7$ is: $x = -3$.

Activity: Pair students. Have one partner solve an equation using algebra tiles while the other partner observes. The observing student should only give suggestions or feedback when prompted by their partner. Have students change roles with another set of equations.

B. Using Students to Model the Solution to One-Step

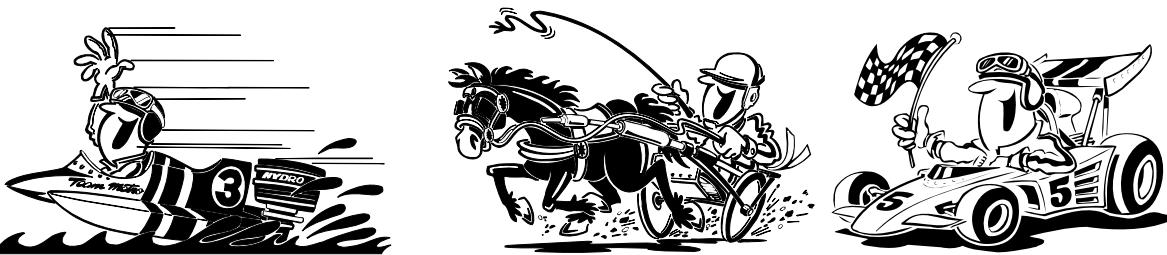
Equations Ask students to model $-8 - (-6)$. Have 8 students stand at the front of the room. Give each student a red piece of construction paper to represent a negative number. Ask 6 of the 8 students to sit down on the floor to represent the negative amount being removed from the starting negative integer. Then ask: What is $-8 - (-6)$? Students can clearly see that the answer is -2 . Model other equations using the subtraction of negative numbers.

C. Modeling equations Give students twenty paperclips, rubber bands, or other small manipulatives. Ask them how they would share them equally among four people (*Make four groups of five*). Have them write an expression that represents the activity ($4 \times 5 = 20$). Ask students how they would write the expression before they know how many items are in each pile ($4x = 20$). Discuss how you solve each solution (*By dividing*). Allow students to work in groups to solve other equations.

D. Inequality Race (Blackline Master V - 35)

Materials: Paper clip for spinners, pawns for players. Players start with their pawns in the start space. On a player's turn, he will spin both spinners to produce an inequality and a number. If the number is a solution to the inequality, the player moves forward two squares. If the number is not a solution, the player does not advance. If a player claims the number is a solution, but is challenged and found incorrect, that player will move back one space from his original position before the turn.

When encountering the situation where the equation has a negative coefficient, such as in $-x > 5$, students have an opportunity to think of that in terms of the concrete number presented as a solution. For example, when considering the statement $-x > 5$ and the number -6 , students can be encouraged to think of the statement as it can be stated in words. Is the opposite of x greater than five? Is $-(-6) > 5$? After considering several such cases, students may be ready to understand why $-x > 5$ is equivalent to $x < -5$.



5.04 *Use graphs, tables, and symbols to model and solve problems involving rates of change and ratios.*

A. Mascot Painting (Blackline Master V - 2) Students will use a grid to enlarge a picture of a Panda mascot. Once the figure is drawn on the larger grid, have the students find ratios of several corresponding measurements from the figures. For example, have the students compare the heights, widths, foot lengths, etc. They should find the same ratio for all linear measurements.

B. Pattern Problem Discussion Cards (Blackline Master V - 32) Students work in groups to discuss these problems. After the problems are solved, students should share their results with the entire class.

C. He Grew and He Grew! (Blackline Masters V - 36 and V - 37)

Materials: Graph paper, This activity could be completed in several ways. You could organize the class into groups and assign each group the complete task or you could assign each group an exercise number and allow number 6 to be homework. The exercises that follow allow students to investigate rate of change using a real-life situation.

