

Weekly Focus: expressions
Weekly Skill: write and evaluate

LESSON 18: Algebra Expressions and Variables

Lesson Summary: For the Warm Up, students will solve a problem about movie tickets sold. In Activity 1, they will learn some basic algebra vocabulary. In Activity 2, students will write expressions. In Activity 3, students will do word problems in the workbook. In Activity 4, they will evaluate expressions. For the Application Activity, there are two options from which to choose depending on the time you have left and/or student needs. There is a Group Exit Ticket to end the class. Estimated time for the lesson is 2 hours.

Materials Needed for Lesson 18:

- Video (length 8:50) on variables and expressions. The video is required for teachers and recommended for students.
- 2 worksheets (18.1, 18.2) with answers (embedded links)
- *Mathematical Reasoning Test Preparation for the 2014 GED Test Student Book (pages 50-51)*
- *Mathematical Reasoning Test Preparation for the 2014 GED Test Workbook (pages 58-61)*
- Tell students about this website for algebra practice, notes, and videos: www.algebra2go.com

Objectives: Students will be able to:

- Understand vocabulary related to algebraic expressions
- Translate verbal phrases into algebraic expressions
- Evaluate expressions for different values of the variables

ACES Skills Addressed: N, CT, ALS

CCRS Mathematical Practices Addressed: Model with Math, Reason Abstractly and Quantitatively

Levels of Knowing Math Addressed: Intuitive, Concrete, Abstract, and Application

Notes:

You can add more examples if you feel students need them before they work. Any ideas that concretely relates to their lives make good examples.

For more practice as a class, feel free to choose some of the easier problems from the worksheets to do together. The “easier” problems are not necessarily at the beginning of each worksheet. Also, you may decide to have students complete only part of the worksheets in class and assign the rest as homework or extra practice.

The GED Math test is 115 minutes long and includes approximately 46 questions. The questions have a focus on quantitative problem solving (45%) and algebraic problem solving (55%).

Students must be able to understand math concepts and apply them to new situations, use logical reasoning to explain their answers, evaluate and further the reasoning of others, represent real world problems algebraically and visually, and manipulate and solve algebraic expressions.

This computer-based test includes questions that may be multiple-choice, fill-in-the-blank, choose from a drop-down menu, or drag-and-drop the response from one place to another.

The purpose of the GED test is to provide students with the skills necessary to either further their education or be ready for the demands of today's careers.

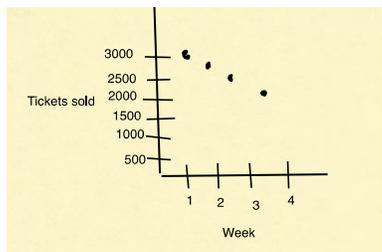
Lesson 18 Warm-up: Solve the movie ticket problem

Time: 10 Minutes

Write on the board: A movie theatre owner wants to know if there is a relationship between the number of tickets sold and how long the movie has been playing. Here is how many tickets have been sold so far: 3,000 tickets sold Week 1; 2,750 tickets sold Week 2; 2,500 tickets sold Week 3; and 2,250 tickets sold Week 4.

Basic Questions:

- Make a graph with the above information.
 - Give students time to make their graphs. They may make a line graph or a bar graph. The line graph should look like the example below. You can connect the dots to make a line of best fit or you can leave it as a scatter plot. Either way there is a negative correlation.



- What can the owner predict might happen on Week 5? (Attendance will be lower, there will be 2,000 tickets sold)

Extension Questions:

- What is the average (mean) attendance for the first 4 weeks? (Total of 10,500 divided by 4 = 2,625 tickets sold per week)
- Is the correlation positive or negative? (It is negative because the more time goes by, the lower the ticket sales. Some students may say the slope is negative, which is true. Slope will be taught in a later lesson.)

Lesson 18 Activity 1: Vocabulary

Time: 10 Minutes

- 1) This activity can be projected on the board and done as a whole class. Have students volunteer to fill in the blank after everyone has a chance to do the activity.
- 2) Explain *variable* as a letter that takes the place of a number until we figure out what that number is.
- 3) The first example for 3 and 4 is *numeric* because there are no variables.
- 4) The second example for 3 and for 4 is *algebraic* because there is a variable.

5) Solicit more examples of each from students.

Answers:

1. A variable is a letter or symbol used to write a value (number) that can change.
2. A constant is a value that does not change.
3. An equation is a math statement that shows the two sides are equal or balanced.
4. An expression is a combination of numbers and operations.

constant	expression	variable	equation
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1. A _____ is a letter or symbol used to write a value (a number) that can change. Some examples are x , y , a , c .
2. A _____ is a value that does not change. Some examples are 56 , 47 , $\frac{1}{2}$, 2 .
3. An _____ is a math statement that shows the two sides are equal. Some example are $4 + 5 = 9$ and $4 + x = 9$
4. An _____ is a combination of numbers and operations. Some examples are $4 + 5$ and $4 + x$.

Lesson 18 Activity 2: Write Expressions

Time: 25-30 Minutes

1) Write on the board:

$$a + 4$$

$$17 - b$$

$$5 \cdot x$$

$$y \div 16$$

- 2) Ask students how they would read aloud each of the expressions.
 - a. For the first one, they may say: a plus 4, 4 added to a, the sum of 4 and a, 4 more than a, etc.
 - b. For the second one, they may say 17 minus b, b subtracted from 17, the difference of 17 and b, b less than 17. (Note: This last one is tricky for students so add more examples if necessary. This example can be you have \$17 and I have less money and it's b fewer dollars).
 - c. For the third one, they may say 5 times x, the product of 5 and x, etc. This expression can also be written as $5x$, which is the case in algebra. Make sure to point this out.
 - d. For the fourth one, they may say y divided by 16, the quotient of y and 16.
- 3) Do [Worksheet 18.1](#). Do the first few together on the board. Circulate to help. Have volunteers write answers on the board.
- 4) Do **pages 50-51 in the student book** together. Page 50 has more examples of the above and on page 51 students also choose which expression best matches the problem.

Lesson 18 Activity 3: Word Problems

Time: 35-40 Minutes

- 1) After you have done the problems in the student book together, students can work independently in the **workbook pages 58-61**.
- 2) You may need to review operations with integers from a previous lesson because there are some negative numbers in some of the problems.
- 3) Circulate to help. Discuss and explain the questions that students found challenging. Validate correct reasoning and redirect/explain if reasoning is not correct.

Lesson 18 Activity 4: Evaluate Expressions

Time: 20 Minutes

- 1) Tell the students: You have just done many problems in which you had to match an expression to a word problem. Now we will learn to evaluate expressions for different variables. That means we will find the answer for different values.
- 2) Example A: You work h hours per week and make \$15 an hour.
 - a. Write an expression to represent how much you get paid. ($15h$ or $15 \times h$)
 - b. Evaluate the expression for 10 hours in one week ($15 \times 10 = \$150$)
 - c. Evaluate the expression for 25 hours in one week ($15 \times 25 = \$375$)

- 3) Example B: In the warm up activity about the movie ticket sales, the owner wants to know how much money she will make if the tickets are sold at \$11.25 each.
- Write an expression with t for tickets. ($\$11.25t$)
 - Evaluate the expression for the first week when 3,000 tickets were sold. ($3,000 \times \$11.25 = \$33,750$)
 - Evaluate the expression for the second week when 2,750 tickets were sold. ($2,750 \times \$11.25 = \$30,937.50$)
- 4) Practice evaluating expressions with [Worksheet 18.2](#). Do the first few together.

Application Option A: Make Algebra Concrete

Time: 15 Minutes

This activity may be useful to make algebraic more concrete for students. Use the following as a guideline. **I wasn't able to change the words (document is a pdf) so choose items in the classroom and ignore the reference to child.** Also, you can make the activity more interesting by saying a few examples yourself and then having students work in pairs to create an expression and dictate it to the rest of the class.

Set Up Shop with Algebra

One way to make variables and expressions more concrete for middle school students is to use real-world examples. Using items around your house, create a “store” and set up expressions to represent the cost of the items. It takes just a few minutes to set up, but this activity will have lasting effects. Those once abstract and confusing variables and expressions will now represent real-world thinking – and real-world shopping!

What You Need:

- Sticky notes
- Black marker
- Household items, such as books, playing cards, paper clips, cucumbers, apples
- Paper and pencil
- Clipboards (optional)



What You Do:

(b) book = \$10.00

(n) napkin = \$.25

(y) playing cards = \$1.00

(a) apple = \$.90

(p) paper clips = \$.10

1. Set out several household items (1 of each) and label each with a variable and a price (on sticky notes). For example:
2. Begin the activity by explaining to your child that every time you are shopping, especially at the grocery store, you write expressions “in your head”. It’s really simple if you think of writing expressions as just writing out what you are thinking as you shop.
3. Explain how you would set up a simple expression to represent the cost of one item.
4. Say: “I want to buy 3 apples.
5. First, I set up an expression to represent the cost of the apples: $3a$
6. Next, I calculate the cost of the apples by filling in the price of each apple: $3(.90) = \$2.70$

Image credit: www.education.com

Application Option B: Write Expressions from a Menu

Time: 10 Minutes

(See printable handout on the next page.)

Use the menu from this restaurant to write an algebraic expression for each question. The variable is the first letter of the menu item. Once you write the variable, evaluate the expression.

<i>French Fries</i>	\$2	<i>Pizza Slice</i>	\$3
<i>Hotdog</i>	\$3	<i>Ice Cream Sundae</i>	\$3
<i>Shake</i>	\$2	<i>Taco</i>	\$2
<i>Coke</i>	\$1	<i>Milk</i>	\$1

1. Mike ordered 3 hotdogs for his family. How much was the meal?
2. Stanley wants to eat an ice cream sundae after he finishes his meal of coke and a slice of pizza. How much was his bill?
3. There are four people in the Cullwell family. Two people order French fries and two people order tacos. Each one of them orders milk with their meal. How much do the drinks cost for the Cullwell family?
4. If the whole class decided to eat lunch, and the teacher bought everyone a taco and a shake, how much would the teacher have to pay?

Answers:

1. $3h, 3(\$3) = \9
2. $c + p + i, \$1 + \$3 + \$3 = \7
3. $2f + 2t + 4m, 2(\$2) + 2(\$2) + 4(\$1) = \12
4. Answer will vary

Writing Expressions from a Menu

Use the menu from this restaurant to write an algebraic expression for each question. The variable is the first letter of the menu item. Once you write the variable, evaluate the expression.

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Lesson 18: Group Exit Ticket

Time: 5 Minutes

Do expression dictation. For example, say "15 less than n ". Have students write the answer on a piece of paper ($n - 15$). You may continue with more dictations yourself or students can take turns saying the dictation problems for the whole class to write down. As each problem is said, students should write down the expression individually.