

## General Information

### Lesson Parts & Duration

Total Duration: 1 hour

- From Word Problems to Equations: Tape Diagrams and Equations

### Subject(s)

- Operations and Algebraic Thinking: Multiply and Division, Solving Word Problems, Multiplicative Comparisons, Using Variables, Tape Diagrams (**4.OA.A.2**).

### Objective

- Students will be able to solve word problems by multiplying or dividing numbers.
- Students will be able to solve word problems using drawings and equations with a letter for the unknown variable.

### Materials

- blank paper
- pencil & crayons/colored pencils
- document camera or whiteboard
- Optional: printable “Exit Slip” (page 6)
- **Optional:** printable “Break Up Your Day” brain/movement break ideas (page 7)

### Instructional Setting

- Students should be seated with or near another student for partner work.

#### Throughout this lesson, you will find:

- ☀ **Scripted Text** indicates things that need to be said directly. Bullets starting with a “T” followed by *italicized type* indicate scripted text
- ☀ **Clarifiers** within scripted text are in **orange**
- ☀ **Teacher Directions** indicate things you should be doing
- ☀ **Side notes** provide helpful hints, ELL strategies, differentiation and information
- ☀ **Break Up Your Day** (Brain/Movement Breaks) are in green boxes (at the end)

#### Remember!

Quality over quantity. All components do not have to be accomplished; lessons may be ended at any time and resumed later.

## Instructional Plan: 45-60 minutes

### Introduction

- T** Today we will talk about comparing things, sets of things, time, measurements, money, all kinds of items that we can think of.
- T** I am sure you have compared these types of things before using an additive comparison either this year or last year.
- T** Does anyone remember what an additive comparison means?
- T** You may not remember that it is called this, but I am sure when I tell you what it means you will know exactly what I am talking about.
- T** Who would like to make a guess at what an additive comparison means? **Call on a few students. Answer: We find an unknown variable by comparing how much more or less it is than another variable. We use addition or subtraction.**
- T** As fourth graders, we will continue creating equations, but our focus will be using multiplication and division.
- T** We will also try to go backwards, as I will give you an equation or a tape diagram and you will have to write the word problem using your own creative ideas.
- T** So, let's see how that goes!
- T** Are you ready?

Pass out a piece of paper to each student.

### Setting up the Paper

- T** Write your name and date in the top right-hand corner of your paper. **See example & model so students can follow.**
- T** The title of this lesson is: "Comparisons and Word Problems with Variables"
- T** First, we are going to write "additive comparison" and what it means. It means "comparing two quantities with "more" or "less." Calculated through addition or subtraction." **See example & model so students can follow.**
- T** Then, we will write the definition for "multiplicative comparison." It is "comparing two quantities with 'x times more' or 'x times less.' Calculated through multiplication or division." **See example & model so students can follow.**
- T** Then write the title which is "Word Problems and Tape Diagrams."
- T** We will warm ourselves up with the following problem. **See example and write the word problem on the board.**
- T** "A popsicle costs \$1.50. A tub of ice cream costs 4 times as much. How much does the tub of ice cream cost?"
- T** I will give you a few minutes to copy the problem and think of how we can illustrate it using a tape diagram. **Give students a few minutes.**
- T** Please share with your partner, sitting next to or near you, how you can turn this word problem into a tape diagram.

Name & Date

#### Comparisons and Word Problems with Variables

**Additive comparison:** Comparing two quantities with "more" or "less." Calculated through addition or subtraction.

**Multiplicative comparison:** Comparing two quantities with "x times more" or "x times less." Calculated through multiplication or division.

#### Word Problems and Tape Diagrams

A popsicle costs \$1.50. A tub of ice cream costs 4 times as much. How much does a tub of ice cream cost?

\$1.50
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Popsicle = \$1.50

\$1.50	\$1.50	\$1.50	\$1.50
--------	--------	--------	--------

Tub of ice cream = x

$\$1.50 \times 4 = \$6.00$

A tub of ice cream costs \$6.00.

Provide students a few minutes to discuss their ideas and draw a tape diagram to match the word problem. Monitor and provide assistance as needed.

Name & Date

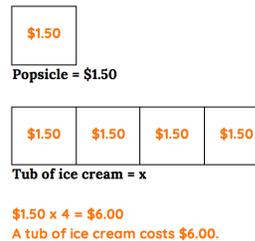
**Comparisons and Word Problems with Variables**

**Additive comparison:** Comparing two quantities with "more" or "less." Calculated through addition or subtraction.

**Multiplicative comparison:** Comparing two quantities with "x times more" or "x times less." Calculated through multiplication or division.

**Word Problems and Tape Diagrams**

A popsicle costs \$1.50. A tub of ice cream costs 4 times as much. How much does a tub of ice cream cost?

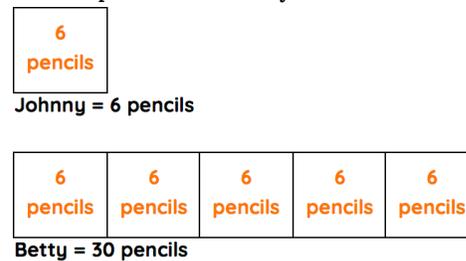


- T* Ok, let's see what you discussed with your partner. Who would like to share? Call on a few students.
- T* If we use a tape diagram, we can see the connection between the price of a popsicle and the price of a tub of ice cream and then easily compare the two.
- T* In the problem, it says that a tub of ice cream costs 4 times more than a popsicle.
- T* Therefore, we can represent a tub of ice cream with 4 squares and a popsicle with one square. See example & model so students can follow.
- T* The next step will be to multiply what we have in one square by 4.
- T* That means "\$1.50 x 4" to give us the price of a tub of ice cream. Let's write our equation.
- T* "\$1.50 x 4 = 6.00."
- T* That means that the tub of ice cream costs "\$6.00."

**Problem # 2**

- T* Great work everyone!
- T* Now we'll move on to another type of problem where we will use the multiplicative comparison to see the difference between two quantities.
- T* Remember to take notes as we go.
- T* Our second problem is: "Johnny has 6 colored pencils. Betty has 30 colored pencils. How many times more pencils did Betty have as compared to Johnny?" See example & write problem on the board so students can follow.
- T* Think about this problem for a moment and try to visualize it on your paper. Give students a few minutes.
- T* Let's see how this is going to look if we try to use a tape diagram again.
- T* First, I will draw 6 pencils in one square which will represent the number of colored pencils that Johnny has. See example & model so students can follow. Draw squares on the board.
- T* Then, I will start grouping Betty's colored pencils in squares while making sure I keep only 6 pencils in one square. Let's see how that goes. See example & model so students can follow. Draw squares on the board.
- T* Now in order to see how many times the difference is between the two amounts, I only need to count the squares.
- T* In this case, 30 pencils are grouped in 5 squares of 6 pencils each.
- T* Therefore, my answer is that Betty had 5 times more pencils than Johnny.

Johnny has 6 colored pencils. Betty has 30 colored pencils. How many times more pencils did Betty have as compared to Johnny?



$30 \div 6 = 5$  times more  
Betty had 5 times more pencils than Johnny.

- T* My equation would look like this: “ $30 \div 6 = 5$ .”  
*T* Any questions before we move on?

### Problem #3

- T* Let’s try another example, this time you will practice this type of problem on your own.  
*T* “Sheila’s dad is 40 years old. He is eight times her age. How old is Sheila?”  
*T* I would like you to use a tape diagram and think about the equation that will follow based on this word problem. **Give students a few minutes.**

**Provide a few minutes for students to complete their tape diagram and equation independently. Monitor and provide assistance as needed.**

- T* Now please exchange your papers with person next to you and check his or her work.  
*T* Ask for clarifications if something is unclear before crossing out or marking down.  
*T* Then, we will discuss the problem together.

Sheila’s dad is 40 years old. He is eight times her age.  
 How old is Sheila?



Sheila’s dad= 40 years old



Sheila =  $x$  years old

$$40 = 8x$$

$$40 \div 8 = x$$

$$x = 5$$

Sheila is 5 years old.

**Provide a few minutes for students to check their partners work. Monitor and provide assistance as needed.**

- T* Ok, let’s see if everyone set up their tape diagrams correctly.  
*T* If Sheila’s dad is 40 years old, and Sheila is  $x$  years old, how can we connect this information knowing he is eight times older.  
*T* What will the tape diagram look like? **Call on a few students. See example & draw the correct tape diagram.**  
*T* Then what would the equation look like? **Call on a few students. Answer:  $40 = 8x$ ;  $40 \div 8 = x$ ;  $x = 5$**   
*T* The equation will be: “ $40 = 8x$ ” and when we divide 40 by 8 we find that “ $x = 5$ .”  
*T* Sheila is 5-years-old.  
*T* Now that we have practiced even more using tape diagrams and converting word problems into equations, it is time for the next challenge.

**Pass out a copy of the “Exit Slip” (page 6) or a piece of blank paper and project the problems for students to copy.**

### Working Backwards

- T* Now we will try to work backwards this time.  
*T* I will give you a few equations and I would like you to create the tape diagrams and the word problem scenarios.  
*T* Then I will collect them and share them with your teacher.  
*T* Here we go! Make sure that you have chosen different scenarios, you can use dollars and cents, days of the week, or any other units of time, length and weight units, and basically anything else that can be multiplied and divided. Be creative!  
*T* Each problem should use different units to make it a bit more exciting for you!  
*T* Once you have the word problem written out, solve the equation underneath the problem.  
*T* Don’t forget to label the units that you have used.

Write the 3 equations on the board for the students to use if you did not print the “Exit Slips.”

*T* Make sure that you have used complete sentences, that you have written your name on the paper and that you have clearly shown your work.

*T* I am excited to read your ideas! When you are done raise your hand so I can collect your papers and we will have a break!

\*Leave their papers for their teacher to review. Based on the information there, the teacher can decide whether some concepts need to be re-taught either to the whole class, small group, or individual students.

Name: **ANSWER KEY** Date: \_\_\_\_\_

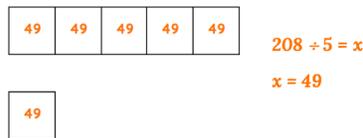
**Exit Slip:**

Backwards Multiplicative Comparisons

**Directions:** Create a word problem that uses a multiplicative comparison to match each equation. Then illustrate the word problem using a tape diagram and solve. Last write your answer in a complete sentence.

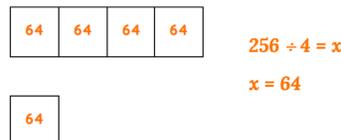
**Equation 1:**  $245 = 5x$

The word problem can be any scenario that fits this equation. The tape diagram should have 5 boxes of 49 that equal 245 and one box of 49 one next to the other.



**Equation 2:**  $4x = 256$

The word problem can be any scenario that fits this equation. The tape diagram should have 4 boxes of 64 that equal 256 and one box of 64 one next to the other.



**Equation 3:**  $51 = 3x$

The word problem can be any scenario that fits this equation. The tape diagram should have 3 boxes of 17 that equal 51 and one box of 51 one next to the other



**Make sure to “Break Up Your Day!”**

Now is a great time to take a break and get students re-energized.  
See our list of engaging movement and brain break ideas to get your students moving and ready to refocus! (see page 7)

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Exit Slip:**

**Backwards Multiplicative Comparisons**

**Directions:** Create a word problem that uses a multiplicative comparison to match each equation. Then illustrate the word problem using a tape diagram and solve. Last write your answer in a complete sentence.

**Equation 1:**       $245 = 5x$

**Equation 2:**       $4x = 256$

**Equation 3:**       $51 = 3x$

## Make sure to “Break Up Your Day!”

These can be used in the middle of a lesson or at the end of your lesson.

Here are a few engaging movement and brain break ideas to get your students moving and ready to refocus!



### Break Up Your Day: Guess My Number!



- Teacher thinks of a multiple digit number.
- The students will take turns asking yes or no questions to try and figure out the number, can use equity cards to call on students to ask questions.
- (Example: does the number have six digits, is the number in the tens place greater than 2).
- Providing paper and pencils for students to write down guesses can be helpful.)



### Break Up Your Day: Body Stretches!



**10 minutes**

**FORMATION:** Standing at desks

- Have students begin the day with a series of simple activities lasting 30 seconds or more: jumping jacks, knee lifts, flap arms like a bird, hopping, scissors (feet apart then cross in front, feet apart then cross in back)...
  - Follow each activity with a basic stretching movement:
  - Reach for the sky runner’s stretch
  - Butterfly stretch (sit with bottom of feet together)
  - Knee to chest, rotate ankles, scratch your back
- Hold stretches for 10 - 30 seconds. Repeat a different simple activity followed by a new basic stretch as many times as desired.



### Break Up Your Day: Thumbs Up!



- Student is called on (use name cards or equity cards if available) to state a rounding observation from within the classroom using numbers from 1 to 500.
- Other students signify whether they understand and agree with the observation. (Example: “There are approximately 100 pencils in the classroom because each student has 3 pencils and there are 32 students. 3 times 32 is 96 and 96 rounds to 100.)
- Tally how many students agree with the rounding statements.
- The statement with the most votes or Thumbs Up is the “Round Up Captain”!