

Name: _____ Class: _____ Date: _____

Lesson 5: Using Expressions and Equations to solve real world and mathematics problems**OBJECTIVES: SWBA to**

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. Specifically,

Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p , q , and r are specific rational numbers; solve equations of these forms fluently; compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width? **(7. EE.4a)**

INTRODUCTION:

We use expressions and equations frequently in our lives. We observe and look for patterns in nature, school, work patterns and making generalizations to explain certain behaviors. For instance,

1. In Chemistry--when combining elements and find prices (of the mixture) or percentages (of, say, acid or salt).
2. In manufacturing when involving two or more people or things working together to complete a task, and finding how long they took
3. Pharmacists use equations an expressions to determine how of one medication the have left.
4. In computer programming to write computer codes
5. Entertainment and social events—to determine how of a product you can buy with certain amount of money
6. Forensic scientists use expressions to estimate length of bones, time of death, etc.

MINI-LESSON + Vocabulary (I DO):

We tackle algebraic word problems by setting up a **strategy** and following it. Here are some recommended steps:

1. **Read the problem carefully and figure out what it is asking you to find. Usually, but not always, you can find this information at the end of the problem.**
3. **Assign a variable to the quantity you are trying to find. Write down what the variable represents.**

Most people choose to use x , but feel free to use any variable you like, unless otherwise specified. For example, if you are being asked to find a number, some students like to use the variable n . It is your choice.

At the time you decide what the variable will represent, you may think there is no need to write that down in words. However, by the time you read the problem several more times and solve the equation, it is easy to forget where you started.

4. **Re-read the problem and write an equation for the quantities given in the problem.**

This is where most students feel they have the most trouble. The only way to truly master this step is through lots of practice. Be prepared to do a lot of problems.

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5. Solve the equation.**6. Answer the question in the problem.**

Just because you found an answer to your equation does not necessarily mean you are finished with the problem. Many times you will need to take the answer you get from the equation and use it in some other way to answer the question originally given in the problem.

7. Check your solution.

Your answer should not only make sense logically, but it should also make the equation true. If you are asked for a time value and end up with a negative number, this should indicate that you've made an error somewhere. If you are asked how fast a person is running and give an answer of 700 miles per hour, again you should be worried that there is an error. If you substitute these unreasonable answers into the equation you used in step 4 and it makes the equation true, then you should re-think the validity of your equation.

Modeling (I do continues)**Problem 1:**

When 6 is added to four times a number, the result is 50. Find the number.

Step 1: What are we trying to find?

A number

Step 2: Assign a **variable** for the number, and write down what it stands for.Let's call it n . n for number.**Step 3:** Write down what the **variable** represents.Let $n =$ a number**Step 4:** Write an equation.

I am told that 6 is added to 4 times a number. Since n represents the number, four times the number would be $4n$. If 6 is added to that, I get $6 + 4n$. I am also told that the answer is 50, so now I have an **equation**

$$6 + 4n = 50.$$

Step 5: Solve the equation.

$$\begin{array}{r} 6 + 4n = 50 \quad \rightarrow \text{the equation} \\ -6 \quad -6 \quad \rightarrow \text{Use inverse operations to isolate the variable. I subtract 6 from sides of the equation} \end{array}$$

$$4n = 44 \quad \rightarrow \text{The variable is now isolated. So, again, I used inverse operations to solve for the variable.}$$

$$\frac{4n}{4} = \frac{44}{4} \quad \rightarrow \text{Divide both sides of the equation by 4.}$$

$$n = 11 \rightarrow \text{the value of the number}$$

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Step 6: Answer the question in the problem

The problem asks me to find a number. I decided that n would be the number, so I have $n = 11$. The number I am looking for is 11.

Step 7: Check the answer.

The answer makes sense and checks in my equation from Step 4.

$$6 + 4(11) = 6 + 44 = 50$$

Summarize what the class has learned up to this point**Guided Practice: (We Do):**

At the end of the day, a pharmacist counted and found she has $\frac{4}{3}$ as many prescriptions for antibiotics as she did for tranquilizers. She had 84 prescriptions for the two types of drugs. How many prescriptions did she have for tranquilizers?

Step 1: What are we trying to find?

The number of prescriptions for tranquilizers

Step 2: Assign a **variable** for the number of tranquilizer prescriptions.Let's call it t .Let t = number of tranquilizer prescriptions**Step 3:** Write an equation.

We have to be careful here. The pharmacist had $\frac{4}{3}$ as many prescriptions for antibiotics as she did for tranquilizers. Let's think about this in terms of numbers first. Suppose there were 3 tranquilizer prescriptions,

$\frac{4}{3}$ as many would mean there were 4 prescriptions for antibiotics. How do we know this? Well, $\frac{4}{3}$ is

equivalent to $1\frac{1}{3}$ or 1 whole + $\frac{1}{3}$ of the whole. So, if there are 3 tranquilizer prescriptions, then $1\frac{1}{3}$ of 3 is $3 + 1$ (

the whole of 3 is 3 and $\frac{1}{3}$ of 3 is 1. Get it?) Or if there were 30 tranquilizer prescriptions, then $\frac{4}{3}$ as many for

antibiotics, would mean there were 40 antibiotic prescriptions. In each case, we are taking the number of tranquilizers and multiplying by $\frac{4}{3}$ to get the number of antibiotic prescriptions. So if t is the number of

tranquilizer prescriptions, then $\frac{4}{3}t$ is the number of antibiotic prescriptions. We are told that together the two

types of prescriptions add up to 84. So we end up with the equation:

$$t + \frac{4}{3}t = 84.$$

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Step 5: Solve the equation.

This time, let us use the what-why table we used last week to help solve the equation and keep track of what we are doing and why.

Step	What	why
1	$t + \frac{4}{3}t = 84$	Original equation. The one we created
2	$t + \frac{4}{3}t = 84$ $t + t + \frac{1}{3}t = 84$ $2t + \frac{1}{3}t = 84$ $2\frac{1}{3}t = 84$ $\frac{7}{3}t = 84$	Combine like terms: t and $\frac{4}{3}t$ are like terms. Therefore, they can be combined. Notice that $\frac{4}{3}t = t + \frac{1}{3}t$.
3	$\left(\frac{3}{7}\right)\left(\frac{7}{3}x\right) = 84\left(\frac{3}{7}\right)$ $x = \frac{84}{1}\left(\frac{3}{7}\right) = \frac{84 \times 3}{7} = \frac{252}{7} = 36$	To solve for t , in this case, multiply both sides of the equation by the multiplicative inverse or reciprocal of $\frac{7}{3}$ which is $\frac{3}{7}$.
4	$X = 36$	Solution

Step 6: Answer the question in the problem

The problem asks us to find the number of prescriptions for tranquilizers. We decided that t would be the number of prescriptions for tranquilizers, so we have $t = 36$. There were 36 prescriptions for tranquilizers.

Step 7: Check the answer.

The answer makes sense and checks in our equation from Step 4.

$$(36) + \frac{4}{3}(36) = 36 + 48 = 84$$

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Independent Practice (You do):**Problem 1:**

In a given amount of time, Jamie drove twice as far as Rhonda. Altogether they drove 90 miles. Find the number of miles driven by each.

Complete each of the following steps:

Step 1: What are we trying to find?

Step 2: Assign a variable and describe what it stands for.

Step 3: Write down what the variable represents.

Step 4: Write an equation.

Step 5: Solve the equation.

<i>Step</i>	<i>What</i>	<i>why</i>
1		
2		
3		
4		

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Step 6: Answer the question in the problem

Step 7: Check the answer.

Problem 2:

The length of a rectangular map is 15 inches and the perimeter is 50 inches. Find the width.

Complete each of the following steps:

Step 1: What are we trying to find?

Step 2: Assign a variable and describe what it stands for.

Step 3: Write down what the variable represents.

Step 4: Write an equation.

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Step 5: Solve the equation.

<i>Step</i>	<i>What</i>	<i>why</i>
1		
2		
3		
4		

Step 6: Answer the question in the problem**Step 7:** Check the answer.

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Problem 3:

The circumference of a circular clock face is 13.12 centimeters more than three times the radius. Find the radius of the face.

Show your work.

Problem 4:

On an algebra test, the highest grade was 42 points higher than the lowest grade. The sum of the two grades was 138. Find the lowest grade.

Show your work.

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Problem 5:

The sum of a number and 9 is multiplied by -2 and the answer is -8. Find the number.

Show your work.

Problem 6: Challenge!

Karen works for \$6 an hour. A total of 25% of her salary is deducted for taxes and insurance. She is trying to save \$450 for a new car stereo and speakers. How many hours must she work to take home \$450 if she saves all of her earnings?

Show your work.

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Final Summary

In a U-Shape:

1. Re-state the objective to assess if students learn it
2. Elicit from students what they have learned and what they want to learn more about.
3. Tie what they learn to the lesson, and upcoming lessons (