Lesson 18

Understand Solutions to Equations

Name: _____

Prerequisite: How can you use the properties of operations to write equivalent expressions?

Study the example problem showing how to write equivalent expressions. Then solve problems 1–8.

Example

Gail plants 3 pots of roses and 2 pots of tulips. The number of flowers in each pot is the same. Write an expression for the total number of flowers. Simplify the expression to create an equivalent expression.

You can use math tiles to represent the problem.

Roses	*f*	*f*	*f*
Tulips	*f*	*f*	

Add to find the total number of flowers. An expression for the total number of flowers is $3f + 2f$. Then simplify.

$3f + 2f = f(3 + 2) = 5f$

B 1 Look at the example. What does *f* represent?

the unknown number of flowers in each pot

B 2 Tell what each expression below represents.

a. $3f$ the total number of roses

b. $2f$ the total number of tulips

c. $3f + 2f$ the combined number of roses and tulips

B 3 How was the distributive property used to create an expression that is equivalent to $3f + 2f$?

The common factor, *f*, was factored out of $3f + 2f$.

Vocabulary

like terms terms in an expression that have the same variable raised to the same power. Constants are like terms.

x and $-4x$

1 and 1.5

x^2 and $8x^2$

Solve.

M 4 David says that he can apply the commutative and distributive properties to $7s + 8 + 5s$ to get $12s + 8$. Is he correct? Explain.

Yes; Possible explanation: He can apply the commutative property to $7s + 8 + 5s$ to get $7s + 5s + 8$. Then he can apply the distributive property to $7s + 5s + 8$ to get $(7 + 5)s + 8$. Last, he can simplify to $12s + 8$.

M 5 Use three of the terms below to fill in the two expressions. Each term may be used only once. Both of your expressions must be equivalent to $0.5x + 1.5$.

0.5	2	*x*	0.25*x*	3	0.75

0.5 (*x* + 3)

2 (0.25*x* + 0.75)

C 6 Write a story that you could represent with the expression $8b + 4b - 2$. Then write an expression that is equivalent to $8b + 4b - 2$.

Possible story: Jill bought 8 bottles of water for a hiking trip. Samuel bought 4 bottles of water for the trip. Kathy had a $2 coupon for the bottles of water. The price of each bottle of water was the same. How much did the water cost?; $12b - 2$

M 7 Is $d(10 + 20)$ equivalent to $d \times 10 + 20 \times d$? Use a property, or properties, to explain.

Yes; Possible explanation: When you apply the distributive property to $d(10 + 20)$, you get $10d + 20d$. You can then use the commutative property to write $d \times 10 + 20 \times d$.

M 8 Use the distributive property to write an expression that is equivalent to $45 + 30x$.

Possible answer: $15(3 + 2x)$

Key

B Basic **M** Medium **C** Challenge

Name: _____

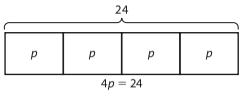
Writing and Solving Equations

Study the example problem showing how to write and solve equations. Then solve problems 1–9.

Example

Larry mows 4 lawns and earns $24. He is paid the same amount of money for each lawn. Write and solve an equation to find how much Larry is paid to mow one lawn.

You can draw a bar model to help you write and solve an equation that represents the problem. The equation $4p = 24$ represents the problem.



The equation is asking: What number could you multiply by 4 to get 24?

$4 \times 6 = 24$

Larry is paid $6 to mow one lawn.

B 1 What does p represent in the example?

the amount of money that Larry is paid to mow 1 lawn

B 2 What does the expression $4p$ represent?

the amount of money that Larry is paid to mow 4 lawns

B 3 What is the solution to the equation $4p = 24$?

$p =$ 6

M 4 Bev went to the grocery store with $45. She spent d dollars and came home with $21. Write and solve an equation to find how much Bev spent at the store.

Show your work.

Possible student work:

$45 - d = 21$

$d = 24$

Solution: Bev spent $24 at the grocery store.

Solve.

Use this situation for problems 5–9.

Yaro buys a baseball cap for $9.50. He also buys a new baseball. Yaro spends $13.50 altogether.

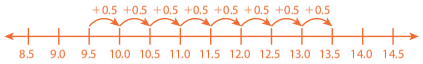
M 5 Write an equation to represent how much Yaro pays for the baseball.

Possible answer: $9.50 + b = 13.50$

M 6 Do you expect the solution to your equation to be less than or greater than $13.50? Explain.

less than; Possible explanation: The total amount that Yaro spends is $13.50, so the amount he pays for the baseball must be less than $13.50.

M 7 What is the solution to the equation you wrote in problem 5? Draw a number line. What increments did you use to label your number line? How can you use it to help you find the solution?



4.00; Possible explanation: I labeled the number line in increments of 0.5. I start at 9.5 on the number line and count forward until I reach 13.5. I count 8 times 5 tenths, which equals 4.

M 8 How much does Yaro pay for the baseball? $4.00

C 9 Write an equation using a different operation to represent how much Yaro pays for the baseball. Explain why you can use equations with different operations to represent the same problem.

Possible answer: $13.50 - b = 9.50$; Possible explanation: Addition and subtraction are inverse operations, so you can use an addition or a subtraction equation to represent the same problem.

Name: _____

Reason and Write

Study the example. Underline two parts that you think make it a particularly good answer and a helpful example.

Answers will vary. Note whether students incorporate the features they chose in their answer on the next page.

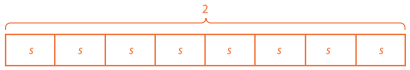
Example

Ling says that the solution to $8s = 2$ is that s must be greater than 1. Does Ling's solution make sense? Explain how you know whether or not Ling's solution makes sense without solving the equation. Then draw a model of the problem and solve the equation.

Show your work. Use numbers, words, and models to explain your answer.

Ling's solution does not make sense. The expression $8s$ means to multiply 8 by s. If I multiply 8 by 1, I get 8, which is greater than 2. So the solution must be less than 1.

I can draw a bar model to help me solve the problem.



The bar model shows that 8 times s gives me 2, so I can ask myself what number I could multiply by 8 to get 2. I know that the number is less than 1, so it must be a fraction.

The model shows that 8 bars represent 2, so 4 bars must represent 1. Therefore, each bar represents $\frac{1}{4}$.

The solution to $8s = 2$ is $s = \frac{1}{4}$.

Where does the example . . .
- use numbers to explain?
- use words to explain?
- use models to explain?
- give details?

Solve the problem. Use what you learned from the model.

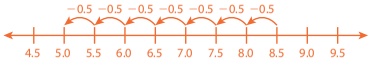
Jake says that the solution to $8.5 - a = 5$ is that a equals 13.5 because addition and subtraction are inverse operations and $8.5 + 5 = 13.5$. Does Jake's solution make sense? Explain how you know whether or not Jake's solution makes sense without solving the equation. Then draw a model of the problem and solve the equation.

Show your work. Use numbers, words, and models to explain your answer.

Possible answer: Jake's solution does not make sense. Although it is true that addition and subtraction are inverse operations, the equation you could write using addition that is equivalent to the given one is $5 + a = 8.5$, not $8.5 + 5 = a$.

Also, the expression $8.5 - a$ means to subtract a from 8.5. Because the difference equals 5, the solution must be less than 8.5, but 13.5 is greater than 8.5.

I can draw a number line to help me solve the problem.



The number line shows that I can start at 8.5 and count back by 0.5 until I reach 5. I count back 7 times, so the difference is 7(0.5), which is 3.5.

The solution to $8.5 - a = 5$ is $a = 3.5$.

Did you . . .
- use numbers to explain?
- use words to explain?
- use models to explain?
- give details?