SOLVING ADDITION EQUATIONS

LESSON 3.3

Solve equations involving addition.

To solve an equation the variable must be isolated on one side of the equation. This process is sometimes referred to as "getting the variable by itself". The most important thing to remember is that the equation must always remain balanced. Whatever operation is performed on one side of the equation MUST be performed on the other side to keep both sides equal.

THE SUBTRACTION PROPERTY OF EQUALITY

For any numbers a, b and c:
If $a = b$, then $a - c = b - c$

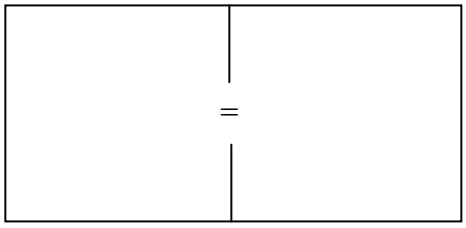
To illustrate the Subtraction Property of Equality, look at this simple equation.

$$\begin{array}{rcl} 7 & = & 7 \\ -2 & & -2 \\ \hline 5 & = & 5 \end{array}$$

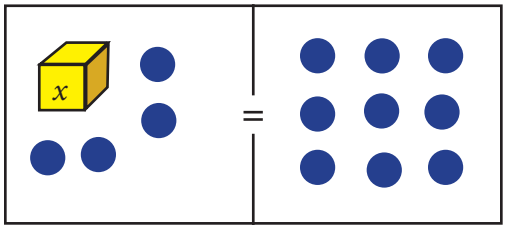
Subtract the same number from both sides of the equals sign and the equation remains true.

EXPLORE! **INTRODUCTION TO EQUATION MATS**

Step 1: If you do not have an equation mat, draw one like the one seen below on a blank sheet of paper.



Step 2: On your equation mat, place a variable cube on one side with 4 chips. On the other side of the mat place 9 chips. This represents the equation $x + 4 = 9$.



Step 3: To get the variable by itself you must remove the 4 chips that are with the variable cube. If you take chips away from one side of the mat, you must do the same on the other side of the mat (Subtraction Property of Equality). How many chips remain on the right side once 4 have been removed from each side? What does this represent?

EXPLORE! **CONTINUED**

Step 4: Clear your mat and place chips and a cube on the mat to represent the equation $x + 3 = 5$. Draw this on paper.

Step 5: What must you do to get the variable cube by itself? Remember that whatever you do on one side of the mat must be done on the other side. How many chips does the variable cube equal? Write your answer in the form $x =$ _____.

Step 6: Create an equation on the mat. Record the algebraic equation on your paper.

Step 7: Solve your equation. What does your variable equal?

Step 8: Write a few sentences to describe how to solve a one-step addition equation using the equation mat, chips and variable cubes.

You will not always have chips, variable cubes and an equation mat available to solve equations. You can solve equations using **inverse operations**. Inverse operations are operations that undo each other. The inverse operation of addition is subtraction.

If an equation has a number being added to the variable, you must subtract the number from both sides of the equation to perform the inverse operation. It is important that you show your work as problems get more complex as you get into higher-level mathematics.

EXAMPLE 1

Solve each equation. Show your work and check your solution.

a. $x + 4 = 11$ **b.** $23 + m = 39$ **c.** $9.4 = y + 5.1$

SOLUTIONS

Draw a vertical line through the equals sign to help you stay organized. Any operation done on one side of the line to cancel out a value must be done on the other side of the line.

Notice that the variable can be on either side of the equals sign.

a. $x + 4 = 11$
$-4 \quad -4$
$x = 7$

b. $23 + m = 39$
$-23 \quad -23$
$m = 16$

c. $9.4 = y + 5.1$
$-5.1 \quad -5.1$
$4.3 = y$

Check your answer by substituting your solution into the original equation for the variable.

☑ $7 + 4 \stackrel{?}{=} 11$
$11 = 11$

☑ $23 + 16 \stackrel{?}{=} 39$
$39 = 39$

☑ $9.4 \stackrel{?}{=} 4.3 + 5.1$
$9.4 = 9.4$

EXERCISES

Solve each equation using an equation mat or inverse operations. Show all work necessary to justify your answer.

1. $x + 6 = 13$

2. $y + 18 = 30$

3. $19 - p = 11$

4. $h + 3.4 = 7.6$

5. $k + 8 = 72$

6. $x + \frac{2}{3} = 1$

7. $427 + y = 533$

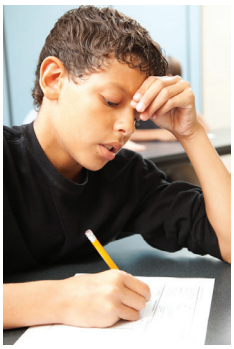
8. $4 = d + 4$

9. $f + 0.8 = 2$

10. $19 = m + 1$

11. $p + \frac{1}{4} = 2\frac{3}{4}$

12. $x + 103 = 156$



13. Kyle **did not** check his solutions for the four-problem quiz on one-step equations. Check Kyle's answers. If the answer is incorrect, find the correct answer.

a. $x + 82 = 124$
Kyle's answer: $x = 206$

b. $6 = x + 6$
Kyle's answer: $x = 1$

c. $x + 2.6 = 4.9$
Kyle's answer: $x = 2.3$

d. $x + \frac{1}{2} = 3\frac{1}{2}$
Kyle's answer: $x = 3$

14. Tonya is thinking of two numbers. The sum is 34. One of the numbers is 19. What is the other number? Write an equation and solve using inverse operations.

Write an algebraic equation for each word phrase. Solve each equation using an equation mat or inverse operations.

15. The sum of x and twelve equals twenty-six.

16. Seventeen more than x is twenty.

17. Eight plus x equals thirty-one.

18. The sum of x and one-half is five.

19. Dan rents an apartment for \$215 more than Jared pays for his rent. Dan's rent is \$800.

a. Explain how the equation $j + 215 = 800$ relates to this situation. What does the variable represent?

b. How much is Jared's rent?

20. Jillian puts a few apples in a bag and weighs the bag on a produce scale at the grocery store. The bag full of apples weighs 2.25 pounds. She adds one more apple to the bag. The new weight of the bag is 2.6 pounds. Write and solve an addition equation to find the weight of the last apple added to the bag.

21. The distance from Missoula, Montana to Mt. Rushmore is 105 miles more than the distance from St. Paul, Minnesota to Mt. Rushmore. The distance from Missoula to Mt. Rushmore is 730 miles. Write and solve an addition equation to find the distance from St. Paul, Minnesota to Mt. Rushmore.

22. Explain in words how the Subtraction Property of Equality is used to solve an addition equation like $x + 7 = 16$.

REVIEW

Use the order of operations to evaluate.

23. $4 + 5(6) \div 2$

24. $(3 + 7)^2 - 25$

25. $20 - 3 \cdot 2 + 1$

26. $5(5 - 2) + 10 \div 5$

27. $\frac{4 + 23}{6 - 3}$

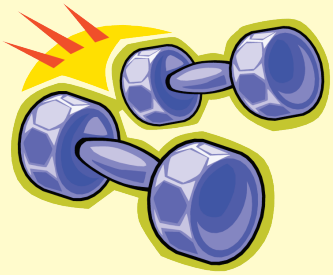
28. $\frac{5 + 5^2}{3} + 4$

Use the formula $d = rt$ to evaluate distances.

29. A snail travels at a speed of 0.03 miles per hour. How far will the snail travel in five hours?

30. Kyeron ran 7 miles per hour for half of an hour. How far did he run?

Tic-Tac-Toe ~ Design a Workout



Dee and Molly want to burn 300 calories per day by doing at least one of the exercises described below. Molly likes to do just one activity each day. Dee wants to design workouts that include at least two different activities to reach her calorie goal. Assume Dee and Molly each weigh 100 pounds.

1. Determine how many minutes Molly would need to exercise to burn 300 calories for each activity.

2. Design five different workouts for Dee that include at least two different activities. Each set of activities should help Dee burn approximately 300 calories. Specify how many minutes she will need to complete of each exercise.

Exercise	Calories Burned in One Minute for a 100 pound person
Hacky Sack	3.2
Running (9 minutes per mile)	8.7
Bicycling (12-14 miles per hour)	6.4
Weight Lifting	4.8
Walking (15 minutes per mile)	4.0
Swimming Laps	5.6
Racquetball	7.9

Source: http://www.bodybuilding.com