Topic 7: Solving One-Step Equations

The relationships between addition and subtraction or multiplication and division are called **inverse operations.** This concept of inverse operations and undoing an operation is needed to solve algebraic equations.

	Arithmetic	Algebra
Addition	$7 + 3 - 3 = 7$	$a + 3 - 3 = a$
Subtraction	$12 - 7 + 7 = 12$	$s - 7 + 7 = s$
Multiplication	$5 \times 4 \div 4 = 5$	$m \times 4 \div 4 = m$
Division	$16 \div 2 \times 2 = 16$	$d \div 2 \times 2 = d$

Problem 7.1

A. Sue knows that her plant grows 2 inches each week.

   1. If g represents last week's height of the plant in inches, write an expression for the height of the plant this week.

   2. Today the plant measures 16 inches in height. Set your expression equal to 16.

   3. How does subtracting 2 find the height of the plant last week?

   4. How tall was the plant last week?

   5. What would the expression $2g$ mean?

B. Patrick just bought a book for $9. He forgot how much money he had when he entered the bookstore.

   1. If m represents the amount of money he had before he bought the book, write an expression for the amount of money he has now.

   2. He counts his money and finds that he has $25 left after he bought the book. Set your expression equal to 25.

   3. Patrick wants to find the value of m. He does not know whether he should add or subtract 9. Determine which operation is correct and explain your decision.

   4. How much money did Patrick have before he bought the book?

C. Each student pays $4 to enter the school dance.

    1. If *s* represents a student, write an expression for the amount of money collected for the dance.

    2. The money collected totals $168. Set your expression equal to 168. Which operation do you need to solve for *s*?

    3. How many students came to the dance?

D. Christopher is given sheets of paper to distribute to the class for a project. He gives each student 5 sheets. He wants to know how many sheets of paper he started with.

    1. Determine whether this is a multiplication or a division situation.

    2. If *p* represents the total number of sheets of paper, write an expression for the number of students in the class.

    3. There are 32 students in the class. Set your expression equal to 32.

    4. How many sheets of paper did Christopher start with?

Exercises

For each Exercise 1–8, decide which operation is needed to isolate the variable. Solve the equation.

1. $a + 6 = 14$ **2.** $b - 3 = 9$

3. $4d = 12$ **4.** $7 + t = 15$

5. $\dfrac{x}{2} = 5$ **6.** $\dfrac{n}{9} = 6$

7. $y - 13 = 29$ **8.** $11h = 132$

9. Greg counted 11 people who get on the bus at the last stop. Now every seat is filled. How many people were on the bus before the stop if the bus has seats for 42 people?

10. There are four dozen daisies in a vase. If every person receives three daisies until the daisies are gone, how many people will get daisies?

11. The bulletin board has 18 square feet of space. An announcement is posted that takes up 2 square feet. How many of these announcements could be placed on this bulletin board?

12. Becky wants to solve the equation $3x = 18$. Becky says that $18 - 3 = 15$, so $x = 15$. Explain to Becky why her answer is incorrect.

Topic 7: Solving One-Step Equations

Mathematical Goals

• Use inverse operations to solve one-step equations.

Guided Instruction

Introduce this topic by defining and supplying several examples of inverse operations. Ask:

- *What do you get when you subtract 4 from 4?* (0)
- *What is the result of $5 - 5$?* (0)
- *What would you subtract from 7 to get to 0?* (7)
- *What do you get when you divide 3 by 3?* (1)
- *Simplify $\frac{12}{12}$.* (1)

Once you are satisfied that the students understand the relationships associated with identities and their inverses, begin to include variables into the discussion. Use questions like:

- *What is the result of* b $+ 5 - 5$? (*b*)
- *What is the result of 3*x $\div$ *3?* (*x*)
- *When you are trying to change an expression from* b $- 6$ *to* b, *what should you do?* (Add 6.)
- *When you are trying to change an expression from 7*b *to* b, *what should you do?* (Divide by 7.)

The last developmental step to the topic is to place the expressions into an equation. Use questions like these to introduce the problem.

- *What does it mean when you see an equal sign between two expressions?* (Both expressions have the same value.)
- *What happens when you add 3 to one of the expressions?* (The expressions are no longer equal.)
- *What do you need to do to keep the expressions equal?* (Add 3 to the other side as well.)
- *Why would you choose to add 3 to both sides of an equation?* (To get the variable by itself.)
- *Give an example of an equation that could be solved by adding 3 to both sides.* (Answers may vary. Sample: $t - 3 = 10$.)

You will find additional work on solving equations in the grade 7 unit *Variables and Patterns*.

Vocabulary
- inverse operations

ACE Assignment Guide for Topic 7

Core 1–12

Answers to Topic 7

Problem 7.1

A. 1. $g + 2$

2. $g + 2 = 16$

3. Answers may vary. Sample: If you know that the plant is 16 inches tall this week, and that it grew 2 inches in the past week, then subtracting 2 will allow you to work back to the height last week.

4. 14 inches

5. Answers may vary. Sample: The expression $2g$ would mean twice the height from last week.

B. 1. $m - 9$

2. $m - 9 = 25$

3. Patrick needs to add in order to leave the m by itself and solve for the value of m.

4. $34

C. 1. $4s$

2. division

3. 42 students

D. 1. Division; the whole was distributed 5 at a time. We are trying to find the whole, or total number of sheets.

2. $\frac{P}{5}$

3. $\frac{P}{5} = 32$

4. 160 sheets

Exercises

1. subtraction, $a = 8$

2. addition, $b = 12$

3. division, $d = 3$

4. subtraction, $t = 8$

5. multiplication, $x = 10$

6. multiplication, $n = 54$

7. addition, $y = 42$

8. division, $h = 12$

9. 31 people

10. 16 people

11. 9 announcements

12. Becky is trying to undo multiplication with subtraction. To solve $3x = 18$, she must divide both sides by 3. The correct solution is $x = 6$. She can check her work by substituting 6 into the original equation. $3 \times 6 = 18$.