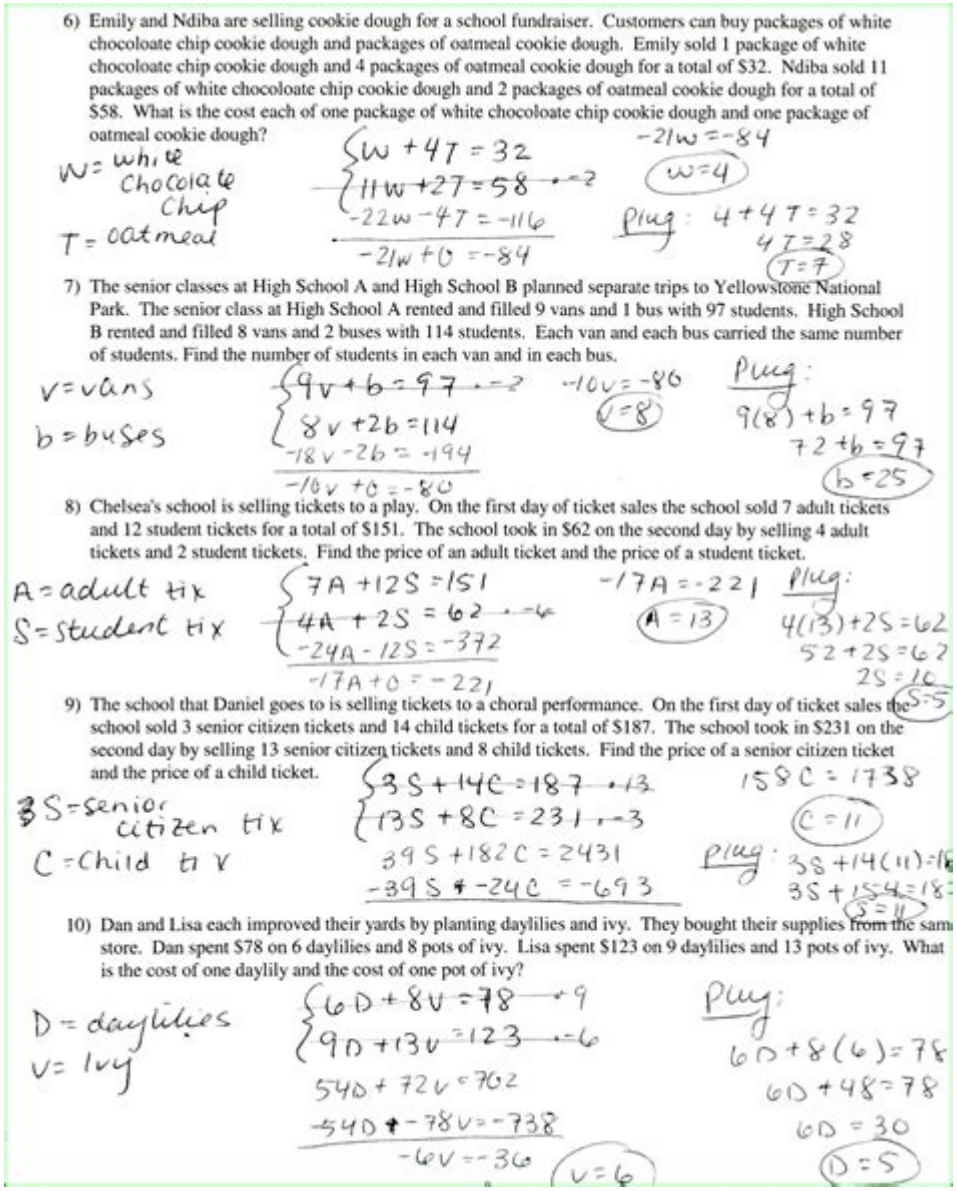
Using Algebra To Solve Word Problems Answer Key


6) Emily and Ndiba are selling cookie dough for a school fundraiser. Customers can buy packages of white chocoloate chip cookie dough and packages of oatmeal cookie dough. Emily sold 1 package of white chocoloate chip cookie dough and 4 packages of oatmeal cookie dough for a total of $32. Ndiba sold 11 packages of white chocoloate chip cookie dough and 2 packages of oatmeal cookie dough for a total of $58. What is the cost each of one package of white chocoloate chip cookie dough and one package of oatmeal cookie dough?

W = white chocolate chip
T = oatmeal

$\begin{cases} W + 4T = 32 \\ 11W + 2T = 58 \cdot -2 \end{cases}$
$-22W - 4T = -116$
$-21W + 0 = -84$
$-21W = -84$
$W = 4$

Plug: $4 + 4T = 32$
$4T = 28$
$T = 7$

7) The senior classes at High School A and High School B planned separate trips to Yellowstone National Park. The senior class at High School A rented and filled 9 vans and 1 bus with 97 students. High School B rented and filled 8 vans and 2 buses with 114 students. Each van and each bus carried the same number of students. Find the number of students in each van and in each bus.

v = vans
b = buses

$\begin{cases} 9v + b = 97 \cdot -2 \\ 8v + 2b = 114 \end{cases}$
$-18v - 2b = -194$
$-10v + 0 = -80$
$-10v = -80$
$v = 8$

Plug:
$9(8) + b = 97$
$72 + b = 97$
$b = 25$

8) Chelsea's school is selling tickets to a play. On the first day of ticket sales the school sold 7 adult tickets and 12 student tickets for a total of $151. The school took in $62 on the second day by selling 4 adult tickets and 2 student tickets. Find the price of an adult ticket and the price of a student ticket.

A = adult tix
S = student tix

$\begin{cases} 7A + 12S = 151 \\ 4A + 2S = 62 \cdot -6 \end{cases}$
$-24A - 12S = -372$
$-17A + 0 = -221$
$-17A = -221$
$A = 13$

Plug:
$4(13) + 2S = 62$
$52 + 2S = 62$
$2S = 10$
$S = 5$

9) The school that Daniel goes to is selling tickets to a choral performance. On the first day of ticket sales the school sold 3 senior citizen tickets and 14 child tickets for a total of $187. The school took in $231 on the second day by selling 13 senior citizen tickets and 8 child tickets. Find the price of a senior citizen ticket and the price of a child ticket.

S = senior citizen tix
C = child tix

$\begin{cases} 3S + 14C = 187 \cdot 13 \\ 13S + 8C = 231 \cdot -3 \end{cases}$
$39S + 182C = 2431$
$-39S + -24C = -693$
$158C = 1738$
$C = 11$

Plug: $3S + 14(11) = 187$
$3S + 154 = 187$
$S = 11$

10) Dan and Lisa each improved their yards by planting daylilies and ivy. They bought their supplies from the same store. Dan spent $78 on 6 daylilies and 8 pots of ivy. Lisa spent $123 on 9 daylilies and 13 pots of ivy. What is the cost of one daylily and the cost of one pot of ivy?

D = daylilies
V = ivy

$\begin{cases} 6D + 8V = 78 \cdot 9 \\ 9D + 13V = 123 \cdot -6 \end{cases}$
$54D + 72V = 702$
$-54D + -78V = -738$
$-6V = -36$
$V = 6$

Plug:
$6D + 8(6) = 78$
$6D + 48 = 78$
$6D = 30$
$D = 5$

Using algebra to solve word problems answer key is a critical skill that enhances problem-solving abilities in mathematics and many other fields. Word problems translate real-world situations into mathematical equations, allowing individuals to apply algebraic concepts to find solutions. This article aims to provide a comprehensive guide on how to effectively use algebra to solve word problems, including strategies, examples, and an answer key for practice problems.

Understanding Word Problems

Word problems often present a scenario that requires interpretation and analysis before mathematical operations can be applied. They typically involve:

- Identifying the variables: Determine what you need to find and assign variables to those unknowns.
- Understanding the relationships: Analyze how the variables interact or relate to one another.

- Translating words into equations: Convert the narrative of the problem into a mathematical equation or set of equations.

Types of Word Problems

Word problems can be categorized into several types, including:

1. Age Problems: Involves the current ages of individuals and their ages at different times.
2. Distance Problems: Deals with the relationship between distance, rate, and time.
3. Work Problems: Focuses on how long it takes to complete a job when multiple entities are involved.
4. Mixture Problems: Concerns combining different substances or quantities to find a desired concentration or amount.
5. Percentage Problems: Involves finding a percentage of a number or determining what number a percentage represents.

Strategies for Solving Word Problems with Algebra

To effectively solve word problems using algebra, follow these strategies:

1. Read the Problem Carefully

Start by reading the problem multiple times to ensure you understand the scenario. Pay attention to keywords and phrases that indicate mathematical operations, such as:

- Sum (addition)
- Difference (subtraction)
- Product (multiplication)
- Quotient (division)

2. Identify the Unknowns

Determine what the problem is asking you to find. Assign variables to these unknowns. For example, if you need to find the number of apples, you might let x represent the number of apples.

3. Set Up the Equation

Translate the words of the problem into a mathematical equation. Use the identified variables and relationships to formulate this equation.

4. Solve the Equation

Once the equation is established, use algebraic techniques to isolate the variable and solve for it. This may involve:

- Combining like terms
- Using the distributive property

- Factoring
- Applying inverse operations

5. Check Your Work

After finding a solution, substitute the value back into the original problem to verify that it makes sense in the context. This step ensures accuracy and helps identify any mistakes.

Examples of Word Problems and Solutions

Let's look at a few examples of word problems and how to solve them using algebra.

Example 1: Age Problem

Problem: Sarah is 4 years older than Tom. If the sum of their ages is 40, how old are Sarah and Tom?

Solution:
1. Let x = Tom's age.
2. Then Sarah's age is $x + 4$.
3. Set up the equation:
$$x + (x + 4) = 40$$
4. Combine like terms:
$$2x + 4 = 40$$
5. Subtract 4 from both sides:
$$2x = 36$$
6. Divide by 2:
$$x = 18$$ (Tom's age)
7. Sarah's age = $18 + 4 = 22$.

Answer: Tom is 18 years old, and Sarah is 22 years old.

Example 2: Distance Problem

Problem: A car travels at a speed of 60 miles per hour. How far will it travel in 3 hours?

Solution:
1. Let d = distance traveled.
2. Use the formula:
$$d = \text{speed} \times \text{time}$$
3. Substitute the values:
$$d = 60 \times 3$$
4. Calculate:
$$d = 180 \text{ miles}$$.

Answer: The car will travel 180 miles in 3 hours.

Example 3: Work Problem

Problem: If it takes 4 hours for 3 workers to complete a task, how long will it take for 6 workers to complete the same task?

Solution:
1. Determine the amount of work done. If 3 workers complete the task in 4 hours, the total work is:
$$ \text{Total work} = 3 \text{ workers} \times 4 \text{ hours} = 12 \text{ worker-hours} $$.
2. Let $ t $ = time taken by 6 workers to complete the task. Thus:
$$ 6 \text{ workers} \times t = 12 \text{ worker-hours} $$.
3. Solve for $ t $:
$$ t = \frac{12}{6} = 2 \text{ hours} $$.

Answer: It will take 6 workers 2 hours to complete the task.

Practice Problems with Answer Key

Here are some practice problems to reinforce your skills in solving word problems using algebra.

Practice Problems

1. A rectangle has a length that is twice its width. If the perimeter of the rectangle is 48 meters, what are the dimensions of the rectangle?
2. John has $50. He spends $x on a book and has $20 left. How much did he spend on the book?
3. A train travels at a speed of 80 miles per hour. How long will it take to travel 240 miles?
4. A mixture contains 30% salt. If you have 200 grams of the mixture, how much salt is present?

Answer Key

1. Let $ w $ = width. Then length $ l = 2w $.
Perimeter: $ 2(l + w) = 48 $.
$ 2(2w + w) = 48 $ → $ 6w = 48 $ → $ w = 8 $; $ l = 16 $.
Answer: Width is 8 meters, length is 16 meters.

2. $ 50 - x = 20 $ → $ x = 30 $.
Answer: John spent $30 on the book.

3. Using the formula $ \text{time} = \frac{\text{distance}}{\text{speed}} $:
$ \text{time} = \frac{240}{80} = 3 \text{ hours} $.
Answer: It will take 3 hours.

4. $ 0.30 \times 200 = 60 $ grams of salt.
Answer: There is 60 grams of salt in the mixture.

Conclusion

Using algebra to solve word problems is a powerful skill that can simplify complex situations into manageable mathematical equations. By understanding the types of word problems, employing effective strategies, and practicing regularly, anyone can improve their ability to tackle these challenges. Whether in academic settings or real-world applications, mastering this skill will undoubtedly enhance your analytical capabilities and problem-solving efficiency.

Frequently Asked Questions

What is the first step in using algebra to solve word problems?

The first step is to read the problem carefully and identify the unknowns, as well as what is being asked.

How can I translate a word problem into an algebraic equation?

Look for keywords that indicate mathematical operations, such as 'total' for addition, 'difference' for subtraction, 'product' for multiplication, and 'quotient' for division.

What role do variables play in solving word problems with algebra?

Variables represent the unknown quantities in the problem, allowing you to create equations that can be solved to find the values of these unknowns.

Can you provide an example of a word problem and its algebraic equation?

Sure! For the problem 'A number increased by 5 equals 12', the algebraic equation would be 'x + 5 = 12', where x is the unknown number.

What should I do if my algebraic solution doesn't make sense in the context of the word problem?

Double-check your translations and calculations, and ensure that your final answer is reasonable and fits the context of the problem.

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