

Nathan Buys 9 Items That Cost B Dollars Each. She Gives The Cashier \$100 Dollars. Writean Expression

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Introduction

In everyday life, understanding how to formulate algebraic expressions from real-world scenarios is an essential skill, especially for students and individuals interested in mathematics or financial literacy. One common scenario involves calculating the total cost of multiple items and determining the amount of change received after a purchase. This article explores the problem where Nathan purchases nine items, each costing B dollars, and pays with a \$100 bill. We will analyze and construct the correct algebraic expression to represent this situation, providing a comprehensive guide for learners to understand how to translate such word problems into mathematical expressions.

Understanding the Problem Context

Before delving into the algebraic formulation, it is crucial to understand the details and components of the problem:

- Number of items purchased: 9 items
- Cost per item: B dollars (where B is a variable representing the price of each item)
- Total amount paid: \$100
- Objective: Write an algebraic expression that represents the total cost of the items and the amount of change Nathan receives from the cashier

This scenario is typical in shopping contexts, where consumers buy multiple items at a uniform price and pay with cash. The key is to model the total cost and the change mathematically.

Breaking Down the Problem

To accurately formulate an expression, break the problem into parts:

1. Total Cost of Items

- Since each item costs B dollars and there are 9 items, the total cost is the product of the number of items and the cost per item.
- Expression: $9 \times B$

2. Total Payment

- Nathan pays with a \$100 bill.
- Expression: 100

3. Calculating the Change

- The change Nathan receives is the difference between the amount paid and the total cost of the items.
- Expression: $100 - (\text{total cost of items})$

Constructing the Algebraic Expression

Based on the breakdown, here's how to develop the expression step by step:

Step 1: Express the total cost

$$\text{Total cost} = 9B$$

Step 2: Express the amount paid

$$\text{Amount paid} = 100$$

Step 3: Write the expression for the change

$$\text{Change} = \text{Amount paid} - \text{Total cost}$$

$$\text{Change} = 100 - 9B$$

Thus, the algebraic expression that represents the change Nathan receives after purchasing 9 items at B dollars each and paying with a \$100 bill is:

$$\boxed{100 - 9B}$$

Explanation of the Expression

The expression $100 - 9B$ is a simple algebraic formula that calculates the change Nathan receives based on the price per item, B. Here's what each component signifies:

- 100: The total amount of money Nathan pays.
- $9B$: The total cost of the nine items (each costing B dollars).

By subtracting the total cost from the amount paid, we determine how much money Nathan gets back as change.

Real-World Application: Calculating Change

Let's consider some practical examples to illustrate how the expression works:

Example 1: When $B = \$8$

$$\text{Change} = 100 - 9 \times 8 = 100 - 72 = \$28$$

Nathan receives \$28 in change after buying nine items costing \$8 each.

Example 2: When $B = \$10$

$$\text{Change} = 100 - 9 \times 10 = 100 - 90 = \$10$$

Nathan receives \$10 in change.

Example 3: When $B = \$12$

$$\text{Change} = 100 - 9 \times 12 = 100 - 108 = -\$8$$

This indicates that the total cost exceeds the amount paid, meaning Nathan does not have enough money to buy all nine items at \$12 each.

Optimal Pricing and Budget Constraints

Understanding the relationship between B and the total cost is essential for budget planning. For instance:

- To break even (i.e., receive no change), the total cost should equal \$100:

$$100 - 9B = 0$$

$$9B = 100$$

$$B = \frac{100}{9} \approx 11.11$$

- For Nathan to afford all nine items, the price per item must be at most approximately \$11.11.

Visual Representation and Graphing

Graphing the expression $(100 - 9B)$ against B provides a visual understanding of how the change varies with the price per item:

Features of the Graph:

- X-axis: Price per item (B)
- Y-axis: Change in dollars

Key points:

- When $(B = 0)$, change is \$100.
- When $(B = \frac{100}{9} \approx 11.11)$, change is 0.
- When $(B > 11.11)$, the change becomes negative, indicating insufficient funds.

This graph can help students visualize the relationship between item cost and change received.

Extending the Scenario

The basic structure of this problem can be extended to more complex situations:

1. Variable Number of Items

If Nathan buys (n) items:

$$\begin{aligned} & \text{Change} = 100 - nB \end{aligned}$$

2. Different Payment Amounts

If Nathan pays with an amount (P) :

$$\begin{aligned} & \text{Change} = P - nB \end{aligned}$$

3. Discounted Prices

If each item has a discounted price (D) :

$$\begin{aligned} & \text{Change} = P - nD \end{aligned}$$

These variations demonstrate the flexibility of algebraic expressions in modeling real-world transactions.

Practical Tips for Students

- Always identify the key components of the word problem: quantities, prices, total amounts.
- Translate phrases into mathematical symbols carefully.
- Remember to use the correct operations: multiplication for total cost, subtraction for change.
- Verify your expression with specific numbers to ensure accuracy.
- Use visual aids like graphs to better understand relationships.

Conclusion

Formulating algebraic expressions from real-world shopping scenarios, such as Nathan buying nine items at a price B dollars each and paying with \$100, is a fundamental skill in mathematics. The expression $(100 - 9B)$ succinctly captures the amount of change Nathan receives, linking the concepts of multiplication, subtraction, and variables. Mastery of such translation skills enhances mathematical literacy and prepares learners for more complex problem-solving tasks. Whether you're budgeting, shopping, or analyzing financial data, understanding how to create and interpret algebraic expressions is invaluable.

Additional Resources

- Algebra Practice Problems
- Understanding Variables and Expressions
- Graphing Linear Equations
- Financial Literacy and Budgeting Basics
- Word Problem Strategies

By practicing these concepts and applying them to everyday scenarios, learners can develop strong mathematical reasoning skills that are applicable beyond the classroom.

Keywords: algebraic expression, real-world problem, shopping scenario, total cost, change calculation, variables, mathematical modeling, financial literacy, word problems, graphing equations

Frequently Asked Questions

How can I express the total cost of Nathan buying 9 items costing B dollars each?

The total cost can be expressed as 9 times B , or $9B$.

If Nathan pays with \$100 after buying 9 items at B dollars

each, how can I write an expression for her change?

Her change is \$100 minus the total cost: $100 - 9B$.

What is the algebraic expression for the total amount Nathan spends on 9 items costing B dollars each?

The expression is $9B$.

If B is the price per item, how do I write an expression for the amount Nathan spends if she buys 9 items?

She spends 9 multiplied by B, so the expression is $9B$.

How can I determine if Nathan has enough money to buy 9 items costing B dollars each with \$100?

Compare $9B$ to 100: if $9B \leq 100$, she has enough money; otherwise, she doesn't.

What expression represents the amount Nathan needs to pay for 9 items at B dollars each?

The amount needed is $9B$.

If Nathan pays with \$100 and the total cost is $9B$, how can I write an expression for her remaining money?

Her remaining money is $100 - 9B$.

How do I write an algebraic expression for the total cost if each item costs B dollars and she buys 9 items?

The total cost is $9B$.

What is the expression for the amount Nathan spends when buying 9 items at B dollars each, given she pays with a \$100 bill?

The amount spent is $9B$, and her change is $100 - 9B$.

Additional Resources

Nathan Buys 9 Items That Cost B Dollars Each. She Gives The Cashier \$100 Dollars. Write an Expression

In everyday transactions, understanding the underlying mathematical expressions can often illuminate the process of how costs and payments relate. Take, for example, Nathan, who is shopping for nine items, each priced at B dollars. After selecting her items, she approaches the cashier and hands over a \$100 bill. The question that naturally arises is: how can we express the total cost of her purchase mathematically? What is the expression that captures this transaction? In this article, we will delve into the formulation of this problem, explore the concepts involved, and present a clear, reader-friendly explanation of the mathematical expression that models Nathan's shopping scenario.

Understanding the Scenario: The Basics of Cost and Payment

Before we craft the expression, it's essential to understand the fundamental components involved in this transaction.

Key elements:

- Number of items purchased: 9
- Cost per item: B dollars
- Total cost of all items: ?
- Amount paid by Nathan: \$100

The goal is to develop an algebraic expression that accurately represents the total cost of Nathan's purchase and, subsequently, her change or remaining balance after payment.

Step 1: Calculating the Total Cost of the Items

The first step involves determining the total expense Nathan incurs for her shopping. Since she buys 9 items, each costing B dollars, the total cost can be expressed as a multiplication problem:

$$\text{Total cost} = \text{Number of items} \times \text{Cost per item}$$

Mathematically, this becomes:

$$\text{Total cost} = 9 \times B$$

This algebraic expression succinctly captures the total amount Nathan must pay for her items before considering any payment she makes.

Step 2: Comparing Total Cost to the Amount Paid

Nathan hands over \$100 to the cashier. To understand the transaction fully, we need to compare her payment to the total cost of the items.

- If the total cost is less than \$100, Nathan overpays and receives change.
- If the total cost equals \$100, she pays exactly.
- If the total cost exceeds \$100, she has insufficient funds or needs to pay more.

The primary focus here is on the total cost, which is represented by the expression $(9 \times B)$.

Step 3: Formulating the Expression for the Transaction

The core expression we derive from this scenario is:

$$\boxed{9B}$$

This expression is read as: "Nine times B," representing the total cost of the nine items.

Additional considerations:

- Change calculation: If needed, the change Nathan receives can be expressed as:

$$\text{Change} = 100 - 9B$$

- Conditions:

- When $(9B \leq 100)$, Nathan receives some change.
- When $(9B = 100)$, she pays exactly.
- When $(9B > 100)$, she needs additional funds.

Practical Application: Using the Expression

Suppose Nathan's items are each priced at a specific amount, say $B = \$10$. Then:

$$9 \times 10 = \$90$$

Since she pays \$100, her change is:

$$100 - 90 = \$10$$

Alternatively, if each item costs $B = \$12$:

$$9 \times 12 = \$108$$

In this case, Nathan has paid only \$100, which is insufficient. She needs an additional \$8 to complete her purchase.

Broader Mathematical Context: Variables and Expressions

The scenario illustrates a common situation in algebra involving variables, multiplication, and expressions. Here, B is a variable representing the unit price, which could be any value depending on the context.

Key points:

- The use of variables allows for flexible modeling of real-world situations.
- Expressions like $9B$ symbolize the total cost for a given unit price.
- Understanding how to manipulate these expressions is fundamental in algebra.

Extending the Model: Solving for B or Total Cost

Suppose you are told that Nathan paid \$100 for her items, and the total cost was less than or equal to \$100. How can you find the maximum price per item B?

Set the total cost equal to \$100:

$$9B = 100$$

Solving for B:

$$B = \frac{100}{9} \approx 11.11$$

This indicates that if each item costs approximately \$11.11, Nathan's total will exactly match her \$100 payment.

Alternatively, if she paid more than \$100, the total cost exceeds the amount she paid, and she would need additional funds.

Real-World Implications and Applications

Expressions like $9B$ are not just academic exercises—they have tangible applications in everyday life and various fields:

- Shopping and budgeting: Estimating total costs based on unit prices.
- Business and inventory management: Calculating total expenses for bulk purchases.
- Financial planning: Understanding how unit prices influence total expenditure.
- Economics: Modeling consumer behavior and price elasticity.

Understanding how to formulate and interpret such expressions helps consumers make informed decisions, helps businesses set prices, and aids students in grasping the fundamental concepts of algebra.

Conclusion: The Power of Simple Expressions

In summary, the transaction involving Nathan buying nine items at B dollars each and paying \$100 can be succinctly represented by the algebraic expression:

$$\boxed{9B}$$

This expression encapsulates the total cost of her shopping. It serves as a foundation for further

calculations, such as determining her change, analyzing different pricing scenarios, or solving for the unit price B given the total payment.

Mastering how to craft and interpret such expressions is a vital skill in mathematics, bridging practical scenarios with abstract concepts. Whether for shopping, budgeting, or more complex financial calculations, understanding the relationship between quantities through expressions empowers individuals to make smarter decisions and develop a deeper appreciation for the elegance and utility of algebra.

In essence: The simple expression $(9B)$ is a powerful tool that captures the core of Nathan's shopping scenario, demonstrating how basic algebra can clarify and solve everyday problems.

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