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Understanding the relationship between different tools and their prices in a hardware store is essential, especially for those interested in mathematics, shopping smarter, or managing budgets effectively. In this article, we will explore how to represent the given relationship between the price of a rake and a shovel using algebraic equations. We will analyze the problem step by step, providing clarity on how to formulate the correct equation that models this scenario.

Introduction to the Problem

Suppose you are shopping at a hardware store and need to purchase a rake and a shovel. You are told that:

- The price of a rake is R.
- The price of a shovel is S.
- The price of a rake R is one third the price of a shovel S.

The question posed is: Which equation represents the relationship between R and S?

To answer this, we need to translate the verbal statement into an algebraic expression. This process involves understanding the key phrase "R is one third the price of S" and how to express that relationship mathematically.

Breaking Down the Verbal Relationship

The statement "R is one third the price of S" can be interpreted as:

- R is equal to one third of S.
- Or, R is S divided by 3.

Mathematically, this is expressed as:

\[R = \frac{1}{3} S \]

This equation states that the price of the rake R is equal to one third of the price of the shovel S.

Formulating the Equation

Based on the understanding, the primary algebraic equation representing the relationship is:

Equation 1:

$$R = \frac{1}{3} S$$

This is the most straightforward and correct way to express the given relationship.

Alternative Forms

Depending on the context or the way the problem is presented, you might see this relationship manipulated into different forms:

- Multiplying both sides by 3:

$$3 R = S$$

- Expressing S in terms of R:

$$S = 3 R$$

These forms are equivalent and can be useful depending on what you are trying to find or solve.

Applying the Equation in Real-World Contexts

Understanding the relationship between R and S allows consumers and store managers to:

- Calculate the expected price of one tool if the other is known.
- Create price comparisons or discounts.
- Formulate word problems for educational purposes.

Let's look at some example scenarios:

Example 1: Calculating the Price of a Rake

If the shovel costs $15, what is the price of a rake?

Using the equation:

$$R = \frac{1}{3} S$$

Substitute S = 15:

$$R = \frac{1}{3} \times 15 = 5$$

So, the rake costs $5.

Example 2: Calculating the Price of a Shovel

If the rake costs $8, what is the price of the shovel?

Using the equivalent form:

$$ S = 3 R $$

Substitute R = 8:

$$ S = 3 \times 8 = 24 $$

Thus, the shovel costs $24.

Understanding the Significance of the Equation

Formulating the correct algebraic equation from a word problem is a fundamental skill in mathematics. It allows for:

- Clear representation of relationships.
- Simplification of complex problems.
- Accurate calculations and predictions.

In this scenario, the key is recognizing the phrase "one third the price," which indicates a fractional relationship.

Common Mistakes and How to Avoid Them

When translating verbal statements into equations, students often make errors. Here are some common pitfalls:

- **Confusing "is" with "equals":** Always interpret "is" as the equals sign (=).
- **Misinterpreting "one third":** Remember that "one third" indicates division by 3, not multiplication.
- **Reversing the relationship:** Ensure that R is expressed in terms of S, or vice versa, according to the statement.

By carefully parsing the language and translating each part into algebraic expressions, you can avoid these mistakes.

Expanding the Concept to Other Word Problems

This type of problem is common in algebra and helps develop skills such as:

- Writing equations from word problems.
- Interpreting fractional relationships.
- Solving for unknown variables.

Sample problem:
The price of a lawnmower is twice the price of a trimmer. If the trimmer costs $50, what is the lawnmower's price?
Solution:
Let T be the trimmer's price, and L be the lawnmower's price.
Given: $L = 2 T$
Substitute T = 50:
$$L = 2 \times 50 = 100$$
The lawnmower costs $100.

Summary and Key Takeaways

- The phrase "R is one third the price of S" translates to the algebraic equation:

$$R = \frac{1}{3} S$$

- Alternative equivalent forms include:

$$3 R = S \quad \text{or} \quad S = 3 R$$

- Understanding how to convert verbal relationships into equations is essential in solving real-world mathematical problems.

- Always carefully analyze the language, especially fractions and comparative phrases, to determine the correct algebraic representation.

Conclusion

Mathematics provides a powerful language to model real-world relationships, such as pricing in a hardware store. Recognizing and correctly translating phrases like "one third" into algebraic equations enables accurate problem-solving and logical reasoning. Whether you're a student honing your algebra skills or a shopper making informed choices, understanding these relationships enhances your mathematical literacy and decision-making abilities.

By mastering the translation of verbal descriptions into equations, you build a strong foundation for tackling more complex problems involving proportions, ratios, and linear relationships. Remember, the key to solving such problems lies in carefully interpreting the language and applying fundamental algebraic principles.

Frequently Asked Questions

In a hardware store, if the price of a rake is R and the price of a shovel is S, and R is one third the price of the shovel, what equation relates R and S?

$R = (1/3)S$

If the cost of a rake is one third the price of a shovel in a hardware store, how can we express the relationship between R and S mathematically?

$R = (1/3)S$

Given that R is one third the price of S, what is the algebraic equation that represents their relationship?

R = rac{1}{3}S

What is the correct equation to model the relationship where the rake's price is one third of the shovel's price?

$R = (1/3)S$

If a hardware store states that the price of a rake R is one third of the price of a shovel S, which equation correctly expresses this?

R = rac{1}{3}S

Additional Resources

Understanding Pricing Relationships in Hardware Store Tools: Analyzing the Equation for Rake and Shovel Prices

When shopping at a hardware store, especially for gardening or yard maintenance tools, understanding the relationships between prices can help consumers make smarter purchasing decisions and allow for clearer communication with sales staff. One common scenario involves analyzing the prices of tools such as rakes and shovels, which often have interrelated costs based on their utility, manufacturing cost, or promotional pricing. In this detailed review, we will explore the mathematical representation of the relationship between the price of a rake and a shovel, focusing on the specific case where the price of a rake (R) is one third the price of a shovel (S).

Setting the Context: The Importance of Price Relationships in Hardware Stores

Before diving into the specifics of the equation, it’s essential to understand why such relationships matter:

- Consumer Decision-Making: Recognizing price relationships allows consumers to compare tools effectively, especially when discounts or bundled deals are involved.
- Pricing Strategies: Retailers often set prices based on production costs, perceived value, or strategic markups, which can be expressed mathematically.
- Educational Value: For students and learners, understanding these relationships builds foundational skills in algebra and problem-solving.
- Inventory Planning: Store managers use such relationships to plan inventory levels and promotional strategies.

Defining the Variables: R and S

In our scenario:

- R = Price of a rake
- S = Price of a shovel

The problem states that the price of a rake (R) is one third of the price of a shovel (S). Mathematically, this relationship can be expressed as:

$$ R = \frac{1}{3} S $$

This simple linear relationship forms the basis for constructing an algebraic equation that accurately models the pricing scenario.

Deriving the Equation: Step-by-Step Analysis

Let's analyze how to derive the key equation representing this relationship:

1. Start with the given relationship:

$$R = \frac{1}{3} S$$

2. To express this relationship in a standard form, especially if aiming to compare or combine this with other prices, multiply both sides by 3:

$$3R = S$$

This form is often useful because it relates the total of three rakes to one shovel.

3. Alternatively, if the problem involves total pricing or combined costs, consider the sum:

$$R + S$$

Substituting $R = \frac{1}{3} S$, we get:

$$\frac{1}{3} S + S = \text{Total cost}$$

which simplifies to:

$$\frac{1}{3} S + \frac{3}{3} S = \frac{4}{3} S$$

This can be useful if, for example, the total cost of a rake and shovel is known.

4. General form of the equation:

The core equation, based on the problem statement, is:

$$R = \frac{1}{3} S$$

which succinctly shows the proportional relationship between the two tools.

Understanding the Equation in Practical Contexts

This algebraic relationship has several practical implications:

- If you know the price of the shovel (S), you can easily compute the price of the rake (R). For example, if S = $15, then:

$$R = \frac{1}{3} \times 15 = \$5$$

- Conversely, if the price of the rake is known, the shovel's price can be determined:

$$S = 3R$$

- This proportional relationship simplifies budgeting and comparisons, especially during sales or discounts.

Examples and Applications of the Equation

To understand how this equation functions in real-world shopping or store management, let's examine some practical examples:

Example 1: Calculating the price of a rake given the shovel’s price

Suppose a customer finds a shovel priced at $18. Using the equation:

$$ R = \frac{1}{3} S $$

we get:

$$ R = \frac{1}{3} \times 18 = \$6 $$

This allows the customer to swiftly assess the value of the rake relative to the shovel.

Example 2: Determining the shovel’s price based on the rake

If a store is selling rakes at $4 each, the corresponding shovel price would be:

$$ S = 3 \times R = 3 \times 4 = \$12 $$

which helps the store set pricing tiers or analyze profit margins.

Example 3: Total cost comparison

If a customer wants to buy both tools and the combined price is $21, then:

$$ R + S = 21 $$

Substituting $R = \frac{1}{3} S$:

$$ \frac{1}{3} S + S = 21 $$

$$ \frac{4}{3} S = 21 $$

$$ S = \frac{21 \times 3}{4} = \frac{63}{4} = \$15.75 $$

and

$$ R = \frac{1}{3} \times 15.75 = \$5.25 $$

This demonstrates how the equation helps in solving for unknown prices given total costs.

Interpreting Variations and Extending the Model

While the basic relationship is straightforward, real-world scenarios often involve more complex situations:

1. Discounts and Promotions

Suppose the store offers a 20% discount on shovels. The discounted price becomes:

$$ S_{discounted} = S \times (1 - 0.20) = 0.80 S $$

The rake’s price remains proportional:

$$ R_{discounted} = \frac{1}{3} S_{discounted} = \frac{1}{3} \times 0.80 S = 0.80 \times \frac{1}{3} S $$

which maintains the proportional relationship, just at a discounted rate.

2. Bulk Pricing

If a customer buys multiple rakes and shovels, the total cost can be modeled as:

$$ \text{Total} = n R + m S $$

where n and m are the number of each tool. Substituting $R = \frac{1}{3} S$:

$$ \text{Total} = n \times \frac{1}{3} S + m S = \left(\frac{n}{3} + m \right) S $$

This allows for flexible calculations of total costs based on quantities and the known price of the shovel.

3. Price Variability

In some cases, the relationship might not be fixed at exactly one-third but vary due to manufacturer pricing, store policies, or market demand. The general form can then be expressed as:

$$ R = k S $$

where k is a proportionality constant, such as 1/3 in our case. This generalization allows for modeling different scenarios.

Implications for Store Management and Marketing

Understanding and utilizing the algebraic relationship between tool prices have several strategic benefits:

- Pricing Strategies: Stores can optimize pricing by understanding the proportional relationships, ensuring competitive yet profitable pricing.
- Promotional Bundles: Offering discounts on one tool while maintaining proportional prices on related items can be attractive to consumers.
- Inventory Decisions: Knowing the price relationships helps in forecasting sales, especially when certain tools are bundled or sold as sets.
- Customer Education: Explaining pricing relationships can help consumers feel more confident in their purchasing decisions, leading to increased satisfaction.

Common Mistakes and Clarifications

While working with such equations, some common pitfalls include:

- Misinterpreting the Relationship: Remember that $R = \frac{1}{3} S$ indicates R is one third of S, not the other way around.
- Ignoring Units: Always ensure that prices are in the same monetary units (e.g., dollars, euros).
- Assuming Fixed Prices: Prices may fluctuate due to sales, discounts, or store policies, so the relationship is a model, not an absolute.

Clarifying these points ensures accurate application of the equation in real-world contexts.

Conclusion: The Significance of the Equation in Practical and Educational Settings

The algebraic equation $R = \frac{1}{3} S$ captures an essential pricing relationship that extends beyond the confines of a hardware store. It exemplifies fundamental principles of proportionality, linear relationships, and algebraic problem-solving.

Whether you're a consumer comparing tool prices, a store manager strategizing promotional offers, or a student learning to translate word problems into mathematical models, understanding this equation provides valuable insights into pricing dynamics and mathematical reasoning.

In summary:

- The equation $R = \frac{1}{3} S$ precisely models the relationship between the price of a rake and a shovel when the rake's price is one-third of the shovel's.
- It allows for quick calculations, comparisons, and strategic decisions.
- Its simplicity makes it accessible for educational purposes, yet it also forms the basis for more complex pricing and inventory models.

By mastering such relationships, individuals can become more proficient in both practical shopping and mathematical problem-solving — skills that are invaluable in everyday life and professional settings.

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