Set Up The System Of Equations:The Cost Of 4 Bananas And 6 Pears Is $1.68. Nine Bananas And 2 Pears

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Understanding how to set up a system of equations is a fundamental skill in algebra that helps solve problems involving multiple variables. A classic example involves determining the individual prices of different fruits based on given total costs. In this case, we are told that the cost of 4 bananas and 6 pears totals $1.68, and that the cost of 9 bananas and 2 pears is another amount. Our goal is to formulate an appropriate system of equations that can be used to find the price of one banana and one pear. This process involves identifying variables, translating word problems into algebraic expressions, and establishing equations based on given data. Properly setting up these equations lays the foundation for solving real-world problems involving unknown quantities.

Understanding the Problem and Defining Variables

Before setting up equations, it’s essential to understand the problem thoroughly and define variables that represent the unknown quantities.

Breaking Down the Problem

- The problem provides two scenarios involving bananas and pears.
- In the first scenario, 4 bananas and 6 pears cost $1.68.
- In the second scenario, 9 bananas and 2 pears have an unknown total cost.
- The task is to determine the individual prices of a single banana and a single pear.

Defining Variables

- Let’s assign variables to the unknowns:
- b: the cost of one banana (in dollars)
- p: the cost of one pear (in dollars)

Having established these variables, we can now express the total costs in terms of b and p.

Translating Word Problems into Algebraic Equations

The next step involves converting the given problem statements into algebraic equations using the variables.

Formulating the Equations

- For the first scenario:
- 4 bananas and 6 pears cost $1.68.
- This translates to:
$4b + 6p = 1.68$

- For the second scenario:
- 9 bananas and 2 pears cost an unknown amount, say C.
- Since the problem does not specify the total cost for this scenario, but assuming it's similar or relevant, we can denote it as C for now, or if the problem states an amount, we fill that in accordingly.
- If, for example, the total cost for 9 bananas and 2 pears is known (say, for illustration, $2.94), then:
$9b + 2p = 2.94$

In absence of a specific total for the second scenario, the key is to understand how to set up the equations based on the known data.

Establishing the System of Equations

Once the problem is translated into algebraic expressions, the next step is to clearly write the system of equations that can be used to solve for b and p.

Writing the System

- The system consists of:
1. Equation 1: $4b + 6p = 1.68$
2. Equation 2: $9b + 2p =$ [Total cost for the second scenario, e.g., 2.94]

- These equations form a system that can be solved using substitution, elimination, or graphical methods.

Example with Specific Second Scenario Total

Suppose the total cost for 9 bananas and 2 pears is $2.94. Then, the system becomes:
- $4b + 6p = 1.68$
- $9b + 2p = 2.94$

This is a typical system of two equations with two variables, ready for solving.

Solving the System of Equations

After setting up the equations, the next logical step is solving for the individual prices.

Methods for Solving Systems

- Substitution Method: Solve one equation for one variable and substitute into the other.
- Elimination Method: Multiply equations to align coefficients and subtract to eliminate a variable.
- Graphical Method: Plot both equations and find the point of intersection.

Step-by-Step Solution Using Elimination

Suppose the system is:
- $4b + 6p = 1.68$
- $9b + 2p = 2.94$

Step 1: Equalize coefficients of one variable.
- Multiply the first equation by 3 to match the coefficient of p:
- $(4b + 6p) \times 3 \rightarrow 12b + 18p = 5.04$

- Multiply the second equation by 9:
- $(9b + 2p) \times 9 \rightarrow 81b + 18p = 26.46$

Step 2: Subtract the first new equation from the second:
- $(81b + 18p) - (12b + 18p) = 26.46 - 5.04$
- $69b = 21.42$

Step 3: Solve for b:
- $b = 21.42 / 69 \approx 0.31$

Step 4: Substitute b back into one original equation to find p:
- Using the first equation:
- $4(0.31) + 6p = 1.68$
- $1.24 + 6p = 1.68$
- $6p = 1.68 - 1.24 = 0.44$
- $p = 0.44 / 6 \approx 0.0733$

Result:
- Cost of one banana ≈ $0.31
- Cost of one pear ≈ $0.0733

Interpreting and Verifying the Solution

Once the prices are calculated, it’s essential to verify their accuracy and consistency with the original problem.

Verification Steps

- Plug the values of b and p back into the original equations.
- Check if the total costs match the given amounts.

For the first equation:
- $4b + 6p \approx 4(0.31) + 6(0.0733) \approx 1.24 + 0.44 \approx 1.68$ (matches)

For the second equation:
- $9b + 2p \approx 9(0.31) + 2(0.0733) \approx 2.79 + 0.1466 \approx 2.94$ (matches)

Since both calculations align with the given data, the solution is verified.

Practical Applications of Setting Up and Solving Systems of Equations

Understanding how to set up and solve systems of equations is invaluable across various real-world scenarios:

Applications in Business and Economics

- Determining pricing strategies.
- Calculating profit margins.
- Analyzing cost and revenue scenarios.

Applications in Everyday Life

- Budget planning.
- Shopping comparisons.
- Resource allocation.

Educational Benefits

- Enhances problem-solving skills.
- Promotes logical reasoning.
- Prepares students for advanced mathematics and science courses.

Tips for Effectively Setting Up Systems of Equations

To master setting up systems of equations, consider the following tips:

1. **Read the problem carefully:** Identify what is known and what needs to be found.
2. **Define variables explicitly:** Use clear, meaningful variable names.
3. **Translate words into algebra:** Convert phrases into mathematical expressions systematically.
4. **Write equations based on data:** Use the relationships given to formulate equations.
5. **Check your equations:** Ensure they correctly reflect the problem scenario.
6. **Choose an appropriate solution method:** Use substitution, elimination, or graphing based on the system's structure.
7. **Verify your solutions:** Substitute back into original equations to confirm accuracy.

Conclusion

Setting up the system of equations for problems like calculating the cost of bananas and pears is a crucial skill in algebra that bridges theoretical mathematics with practical applications. By defining variables clearly, translating word problems into algebraic form, and solving systematically, students and professionals alike can tackle complex problems involving multiple unknowns. Remember, the key steps include understanding the problem, formulating accurate equations, solving efficiently, and verifying solutions. Whether in academics, business, or everyday life, mastering these skills empowers you to analyze situations logically and arrive at accurate solutions efficiently.

Frequently Asked Questions

How can I set up a system of equations to find the cost of one banana and one pear?

Let x be the cost of one banana and y be the cost of one pear. Based on the problem, set up equations: 4x + 6y = 1.68 (for 4 bananas and 6 pears) and 9x + 2y = total cost for 9 bananas and 2

pears, which can be written as another equation once the total is known or expressed as variables.

What are the steps to solve the system of equations for the costs of bananas and pears?

First, write the equations based on the given data. Then, use substitution or elimination methods to solve for one variable, and substitute back to find the other. For example, eliminate one variable to find the value of the other, then calculate the individual costs.

If the total cost of 4 bananas and 6 pears is $1.68, how much does one banana cost if a pear costs $0.30?

Set y = 0.30 (cost of one pear). Plug into the first equation: 4x + 6(0.30) = 1.68. Simplify: 4x + 1.80 = 1.68. Subtract 1.80 from both sides: 4x = -0.12. Divide both sides by 4: x = -0.03. So, the banana would cost -3 cents, which indicates the assumption about pear cost is incorrect; the real costs need to be found by solving the system.

Can I find the cost of bananas and pears without knowing the total cost for 9 bananas and 2 pears?

No, you need at least two equations with known total costs to solve for both individual prices. If only one total cost is known, additional information or equations are necessary to find the individual prices.

What does it mean if the solution to the system of equations yields a negative price for a fruit?

A negative price indicates that the assumptions or data provided are inconsistent or incorrect, as prices cannot be negative in real-world scenarios. It suggests revisiting the problem's data or constraints.

How can I verify the solution for the costs of bananas and pears once I find them?

Substitute the found values back into the original equations to see if they satisfy both equations. If both equations hold true with the substituted values, the solution is verified.

Additional Resources

Set Up The System Of Equations: The Cost Of 4 Bananas And 6 Pears Is $1.68. Nine Bananas And 2 Pears

When it comes to solving real-world problems involving prices and quantities, understanding how to set up the system of equations is an essential skill in algebra. Whether you're a student trying to master word problems or a professional looking to model economic scenarios, translating a word problem into algebraic equations is a fundamental step. Today, we'll explore how to approach a classic problem: determining the individual costs of bananas and pears given their combined prices in

specific quantities. The problem states that the cost of 4 bananas and 6 pears is $1.68, and that nine bananas and 2 pears also relate to some total cost, prompting us to set up a system of equations to find the prices of each fruit.

Understanding the Problem

Before jumping into the mathematical formulation, it’s crucial to interpret the problem carefully:

- The main goal is to determine the unit prices of bananas and pears.
- The information provided includes:
- The total cost for a certain combination of bananas and pears.
- Different quantities involved in separate purchase scenarios.

In this case, the problem states:

- "The cost of 4 bananas and 6 pears is $1.68."
- Additionally, there's mention of "Nine bananas and 2 pears," which implies a second total cost, though the total isn't explicitly given in the prompt. For the sake of completeness, let's assume that the total cost for 9 bananas and 2 pears is also provided or needs to be determined.

Step 1: Assign Variables

The first step in setting up the system of equations is to assign variables to the unknown quantities:

- Let b = the cost of a single banana (in dollars).
- Let p = the cost of a single pear (in dollars).

Step 2: Translate Words into Equations

Once variables are assigned, convert the problem statements into algebraic expressions:

Equation from the first scenario:

- 4 bananas and 6 pears cost $1.68.

This translates to:

`4b + 6p = 1.68` ... (Equation 1)

Equation from the second scenario:

- 9 bananas and 2 pears, assuming their total cost is \(T \), gives:

`9b + 2p = T` ... (Equation 2)

Note: If the total cost for the second scenario isn't specified, the problem might be to find the prices given only the first scenario, or perhaps the total for the second scenario is known. For this guide, we'll proceed assuming the total is known or given in the problem.

Step 3: Formulate the System of Equations

Now, with the two equations:

1. `4b + 6p = 1.68`
2. `9b + 2p = T`

we have a system of linear equations. The goal is to solve this system to find the values of b and p.

Step 4: Strategies for Solving the System

There are several methods to solve the system of equations:

1. Substitution Method

- Solve one equation for one variable.
- Substitute into the other.

2. Elimination Method

- Multiply equations to align coefficients.
- Subtract or add equations to eliminate one variable.

3. Graphical Method

- Graph both equations on the coordinate plane.
- The intersection point gives the solution.

In algebraic contexts, substitution and elimination are most efficient.

Step 5: Solving Using the Elimination Method

Let's demonstrate solving the system with the elimination method.

Step 5.1: Simplify the equations

Equation 1:

`4b + 6p = 1.68`

Equation 2:

`9b + 2p = T`

Suppose the total cost for the second scenario is provided, say, $3.36 for illustration purposes. Then:

`9b + 2p = 3.36`

(Note: Adjust the total as per actual problem data.)

Step 5.2: Equalize coefficients to eliminate one variable

We want to eliminate p or b. Let's focus on eliminating p.

- Multiply Equation 1 by 1: (to keep the coefficients manageable)
- Multiply Equation 2 by 3 to match the coefficient of p in Equation 1:

Equation 1 remains:

`4b + 6p = 1.68`

Equation 2 multiplied by 3:

`27b + 6p = 10.08`

Step 5.3: Subtract equations to eliminate p

Subtract Equation 1 from the scaled Equation 2:

`(27b + 6p) - (4b + 6p) = 10.08 - 1.68`

`(27b - 4b) + (6p - 6p) = 8.40`

`23b = 8.40`

Step 5.4: Solve for b

`b = 8.40 / 23 ≈ 0.3652`

This suggests that each banana costs approximately $0.3652.

Step 5.5: Find p

Plug b back into Equation 1:

`4(0.3652) + 6p = 1.68`

`1.4608 + 6p = 1.68`

Subtract:

`6p = 1.68 - 1.4608 = 0.2192`

Solve for p:

`p = 0.2192 / 6 ≈ 0.0365`

Thus, each pear costs approximately $0.0365.

Step 6: Validating the Solution

It's always prudent to verify the solution by plugging back into the original equations:

- Check Equation 1:

`4 0.3652 + 6 0.0365 ≈ 1.4608 + 0.219 ≈ 1.6798 ≈ 1.68` (Close enough considering rounding)

- Check Equation 2:

`9 0.3652 + 2 0.0365 ≈ 3.2868 + 0.073 ≈ 3.3598 ≈ 3.36` (Again, close considering rounding)

The small discrepancies are due to rounding, but the solution is consistent.

Additional Considerations

- Units and currency: Make sure to interpret the dollar signs and units correctly.
- Multiple scenarios: If more data points are provided, the process involves setting up additional equations.
- Real-world context: Prices should be reasonable and consistent with market values.

Summary and Tips for Setting Up System of Equations

- Carefully identify what each piece of information represents.
- Assign clear variables to unknown quantities.
- Convert words into algebraic expressions step-by-step.
- Write equations that accurately reflect the relationships.
- Choose an appropriate method (substitution, elimination) for solving.
- Always verify your solutions in the original equations.

Final Thoughts

Mastering how to set up the system of equations from word problems involving costs and quantities is an invaluable skill that extends beyond textbooks into real-world applications like budgeting, economics, and business planning. By systematically translating the problem into algebraic form and applying suitable solution methods, you can unlock the answers hidden within complex scenarios. With practice, you'll find that these problems become more intuitive, empowering you to tackle a wide

array of quantitative challenges confidently.

Remember: the key to success is clarity in defining your variables, precision in transforming words into equations, and diligence in solving and verifying your solutions. Happy solving!

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