

**Solve; i)  $X + 10\% \text{ of } X = 22$  ii)  $x + 20\% \text{ of } X = 60$  iii)  $X + 25\% \text{ of } x = 120$  iv)  $X = 200 + 50\% \text{ of } X$  v)  $X = 180 + 10\% \text{ of } X$  question From**

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## Introduction to Solving Percentage-Based Equations

Understanding how to solve equations involving percentages is an essential skill in mathematics, especially in real-world applications like finance, shopping, and data analysis. These types of problems typically involve finding an unknown value based on its percentage relationship with another number. In this article, we will explore multiple types of percentage equations, step-by-step methods to solve them, and practical examples to enhance your understanding.

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### What Are Percentage Equations?

A percentage equation relates a number to a percentage of that number or another quantity. The general form of such equations can be written as:

- $X + Y\% \text{ of } X = Z$
- $X - Y\% \text{ of } X = Z$
- $X = Z + Y\% \text{ of } X$
- $X = Z - Y\% \text{ of } X$

Where:

- $X$  is the unknown value we need to determine.
- $Y\% \text{ of } X$  is the percentage of  $X$ .
- $Z$  is a known value.

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### Step-by-Step Approach to Solving Percentage Equations

Before diving into specific problems, let's understand the common steps involved:

1. Identify the equation type: Determine whether the unknown is part of a percentage, total, or difference.
2. Translate the percentage into decimal: Convert  $Y\%$  into a decimal by dividing by 100.
3. Rearrange the equation: Isolate the variable  $X$ .
4. Solve the algebraic equation: Use algebraic methods to find the value of  $X$ .

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### Detailed Solutions to the Given Percentage Problems

Let's analyze each question individually and provide detailed solutions.

1. Solve:  $X + 10\% \text{ of } X = 22$

Step 1: Understand the equation:

$$[X + 10\% \text{ of } X = 22]$$

Step 2: Convert 10% into decimal:

$$[10\% = 0.10]$$

Step 3: Rewrite the equation:

$$[X + 0.10X = 22]$$

Step 4: Combine like terms:

$$[(1 + 0.10)X = 22]$$

$$[1.10X = 22]$$

Step 5: Solve for X:

$$[X = \frac{22}{1.10}]$$

$$[X = 20]$$

Answer:  $X = \text{Rs } 20$

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2. Solve:  $x + 20\% \text{ of } x = \text{Rs } 60$

Step 1: Equation:

$$[x + 20\% \text{ of } x = 60]$$

Step 2: Convert 20%:

$$[20\% = 0.20]$$

Step 3: Rewrite:

$$[x + 0.20x = 60]$$

Step 4: Combine:

$$[1.20x = 60]$$

Step 5: Find x:

$$[x = \frac{60}{1.20}]$$

$$[x = 50]$$

Answer:  $x = \text{Rs } 50$

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3. Solve:  $X + 25\% \text{ of } X = \text{Rs } 120$

Step 1: Equation:

$$\text{[ } X + 25\% \text{ of } X = 120 \text{ ]}$$

Step 2: Convert 25%:

$$\text{[ } 25\% = 0.25 \text{ ]}$$

Step 3: Rewrite:

$$\text{[ } X + 0.25X = 120 \text{ ]}$$

Step 4: Combine:

$$\text{[ } 1.25X = 120 \text{ ]}$$

Step 5: Calculate X:

$$\text{[ } X = \frac{120}{1.25} \text{ ]}$$

$$\text{[ } X = 96 \text{ ]}$$

Answer:  $X = \text{Rs } 96$

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4. Solve:  $X = \text{Rs } 200 + 50\% \text{ of } X$

Step 1: Equation:

$$\text{[ } X = 200 + 50\% \text{ of } X \text{ ]}$$

Step 2: Convert 50%:

$$\text{[ } 50\% = 0.50 \text{ ]}$$

Step 3: Rewrite:

$$\text{[ } X = 200 + 0.50X \text{ ]}$$

Step 4: Rearrange to solve for X:

$$\text{[ } X - 0.50X = 200 \text{ ]}$$

$$\text{[ } 0.50X = 200 \text{ ]}$$

Step 5: Divide both sides:

$$\text{[ } X = \frac{200}{0.50} \text{ ]}$$

$$\text{[ } X = 400 \text{ ]}$$

Answer:  $X = \text{Rs } 400$

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5. Solve:  $X = \text{Rs } 180 + 10\% \text{ of } X$

Step 1: Equation:

$$\text{[ } X = 180 + 10\% \text{ of } X \text{ ]}$$

Step 2: Convert 10%:

$$\left[ 10\% = 0.10 \right]$$

Step 3: Rewrite:

$$\left[ X = 180 + 0.10X \right]$$

Step 4: Collect like terms:

$$\left[ X - 0.10X = 180 \right]$$

$$\left[ 0.90X = 180 \right]$$

Step 5: Find X:

$$\left[ X = \frac{180}{0.90} \right]$$

$$\left[ X = 200 \right]$$

Answer:  $X = \text{Rs } 200$

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### Practical Applications of Percentage Equations

Understanding how to solve percentage equations has many real-world applications:

- Financial calculations: Determining original prices before discounts or taxes.
- Business profit margins: Calculating profit based on percentage increases.
- Shopping and discounts: Finding original prices after discounts.
- Interest calculations: Computing simple and compound interest.

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### Tips for Solving Percentage Equations

- Always convert percentages into decimals for easier calculations.
- Carefully isolate the variable  $X$  by moving all  $X$  terms to one side.
- Check your solutions by substituting back into the original equation.
- Practice different types of percentage problems to build confidence.

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### Common Mistakes to Avoid

- Forgetting to convert percentages into decimals.
- Mixing up addition and subtraction when rearranging equations.
- Miscalculating the division step.
- Overlooking the order of operations in more complex problems.

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### Summary

Solving percentage-based equations involves understanding the relationship between the total value and its percentage, converting percentages into decimals, and algebraically manipulating the equations to isolate the unknown. By following systematic steps and practicing various problems, you can confidently solve any percentage problem, whether in academic exams or real-life scenarios. Remember to verify your solutions for accuracy and

consistency.

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## Final Thoughts

Mastering these types of problems enhances not only your mathematical skills but also your practical understanding of percentages in everyday life. Keep practicing with different equations, and soon you'll find solving these problems becomes second nature!

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Keywords for SEO:

- How to solve percentage equations
- Percentage problems with solutions
- Algebraic methods for percentages
- Solving for X in percentage equations
- Practical percentage calculations
- Percentage increase and decrease formulas
- Tips for solving percentage-based math problems

## Frequently Asked Questions

### **How do you solve for X in the equation $X + 10\% \text{ of } X = 22$ ?**

First, express 10% of X as  $0.10X$ . The equation becomes  $X + 0.10X = 22$ , which simplifies to  $1.10X = 22$ . Divide both sides by 1.10 to find X:  $X = 22 / 1.10 = 20$ .

### **What is the value of X in the equation $X + 20\% \text{ of } X = \text{Rs}60$ ?**

Express 20% of X as  $0.20X$ . The equation becomes  $X + 0.20X = 60$ , so  $1.20X = 60$ . Dividing both sides by 1.20 gives  $X = 60 / 1.20 = \text{Rs}50$ .

### **How do you find X if $X + 25\% \text{ of } X = \text{Rs}120$ ?**

Rewrite 25% of X as  $0.25X$ . The equation is  $X + 0.25X = 120$ , which simplifies to  $1.25X = 120$ . Divide both sides by 1.25 to get  $X = 120 / 1.25 = \text{Rs}96$ .

### **What is the solution for X in the equation $X = \text{Rs}200 + 50\% \text{ of } X$ ?**

Rewrite 50% of X as  $0.50X$ . The equation becomes  $X = 200 + 0.50X$ . Subtract  $0.50X$  from both sides:  $X - 0.50X = 200$ , resulting in  $0.50X = 200$ . Divide both sides by 0.50 to find  $X = 200 / 0.50 = \text{Rs}400$ .

### **How do you solve for X in $X = 180 + 10\% \text{ of } X$ ?**

Express 10% of X as  $0.10X$ . The equation becomes  $X = 180 + 0.10X$ . Bring all X

terms to one side:  $X - 0.10X = 180$ , so  $0.90X = 180$ . Divide both sides by 0.90 to get  $X = 180 / 0.90 = \text{Rs}200$ .

## **What is the general method to solve equations involving X plus a percentage of X?**

Express the percentage as a decimal multiplied by X, combine like terms, and then solve for X by dividing both sides accordingly. For example,  $X + p\%$  of X becomes  $X + p/100 X = \dots$ , then factor X out and divide.

## **In equations like $X + \text{percentage of } X$ , how can you quickly find the value of X?**

Convert the percentage into a decimal, add 1 to it, then divide the total value on the right side of the equation by this sum to find X. For example, if  $X + 10\%$  of  $X = 22$ , then  $X = 22 / (1 + 0.10) = 20$ .

## **What are common mistakes to avoid when solving percentage-based algebraic equations?**

Common mistakes include misconverting percentages to decimals, forgetting to combine like terms properly, or incorrectly isolating X. Always double-check conversions and algebraic steps.

## **Can these percentage problems be solved using a calculator, and how?**

Yes. Convert the percentage to a decimal and perform the calculations step-by-step. For example, for  $X + 10\%$  of  $X = 22$ , calculate 22 divided by 1.10 using a calculator to find  $X = 20$ .

## **Additional Resources**

Comprehensive Analysis of Solving Percent-Based Equations: A Step-by-Step Guide

Understanding how to solve equations involving percentages is a fundamental skill in mathematics, especially relevant in contexts like finance, shopping, and data analysis. In this detailed review, we will delve into a series of equations that incorporate percentage calculations, and explore the methods to solve for the unknown variable, typically denoted as X. The equations under discussion are:

1.  $X + 10\%$  of  $X = 22$
2.  $X + 20\%$  of  $X = \text{Rs } 60$
3.  $X + 25\%$  of  $X = \text{Rs } 120$
4.  $X = \text{Rs } 200 + 50\%$  of  $X$
5.  $X = 180 + 10\%$  of  $X$

We will analyze each equation carefully, demonstrate the step-by-step solution process, discuss common pitfalls, and provide insights into the underlying mathematical principles. This comprehensive approach aims to enhance your mastery over percentage-based equations, which are ubiquitous in real-world scenarios.

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## Understanding the Basic Concept of Percentages in Equations

Before diving into individual solutions, it's essential to grasp the fundamental principle of how percentages are represented mathematically:

- Percentage as a Fraction:

$$10\% = 10/100 = 0.10$$

Similarly,  $20\% = 0.20$ ,  $25\% = 0.25$ ,  $50\% = 0.50$

- Expressing Percentages of a Variable:

When an equation involves "X + Y% of X," it means:

$$X + (Y/100) X = \text{total}$$

- Rearranged Form:

$$X + (Y/100)X = X (1 + Y/100)$$

This understanding simplifies the process of solving for X because such equations can often be rewritten as algebraic expressions involving multiplication.

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### Equation 1: $X + 10\% \text{ of } X = 22$

#### Formulation and Interpretation

The equation states that the sum of a number X and 10% of X equals 22. Mathematically:

$$X + (10/100) X = 22$$

This can be viewed as:

$$X + 0.10 X = 22$$

#### Step-by-Step Solution

1. Combine like terms:

$$X + 0.10X = (1 + 0.10) X = 1.10 X$$

2. Set up the equation:

$$1.10 X = 22$$

3. Solve for X:

$$X = 22 / 1.10$$

4. Calculate the value:

$$X = 20$$

## Final Answer and Interpretation

$X = \text{Rs } 20$ .

This means that the original amount before adding 10% was Rs 20, and when increased by 10%, it sums up to Rs 22.

## Key Takeaways

- Converting percentage expressions into decimal form simplifies calculations.
- Combining like terms is essential for solving such equations efficiently.
- Always verify your solution by substituting back into the original equation.

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## Equation 2: $X + 20\% \text{ of } X = \text{Rs } 60$

### Understanding the Equation

This equation indicates:

$$X + (20/100) X = \text{Rs } 60$$

or equivalently:

$$X + 0.20 X = \text{Rs } 60$$

### Solution Process

1. Combine like terms:

$$(1 + 0.20) X = \text{Rs } 60$$

$$1.20 X = \text{Rs } 60$$

2. Isolate X:

$$X = \text{Rs } 60 / 1.20$$

3. Perform division:

$$X = \text{Rs } 50$$

### Result and Explanation

$X = \text{Rs } 50$ .

This implies that the original amount was Rs 50, which increased by 20% results in Rs 60.

### Additional Insights

- When the sum involves a percentage increase, dividing the total by  $(1 + \text{percentage in decimal})$  yields the original amount.

- This method applies broadly to percentage increases.

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## **Equation 3: $X + 25\% \text{ of } X = \text{Rs } 120$**

### **Dissection of the Equation**

The expression:

$$X + (25/100) X = \text{Rs } 120$$

or:

$$X + 0.25 X = \text{Rs } 120$$

### **Step-by-Step Solution**

1. Combine like terms:

$$(1 + 0.25) X = \text{Rs } 120$$

$$1.25 X = \text{Rs } 120$$

2. Solve for X:

$$X = \text{Rs } 120 / 1.25$$

3. Calculate:

$$X = \text{Rs } 96$$

### **Final Answer and Relevance**

$$X = \text{Rs } 96.$$

This suggests that increasing Rs 96 by 25% yields Rs 120.

### **Practical Tip**

- To find the original amount before a percentage increase, divide the total amount by  $(1 + \text{percentage in decimal})$ .
- Be cautious with decimal calculations to avoid rounding errors.

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## **Equation 4: $X = \text{Rs } 200 + 50\% \text{ of } X$**

### **Understanding the Equation**

This is a different form where X appears on both sides:

$$X = \text{Rs } 200 + (50/100) X$$

or:

$$X = \text{Rs } 200 + 0.50 X$$

## Solution Strategy

1. Bring all terms involving X to one side:

$$X - 0.50 X = \text{Rs } 200$$

2. Factor X out:

$$(1 - 0.50) X = \text{Rs } 200$$

3. Simplify:

$$0.50 X = \text{Rs } 200$$

4. Solve for X:

$$X = \text{Rs } 200 / 0.50$$

5. Calculate:

$$X = \text{Rs } 400$$

## Result and Interpretation

$X = \text{Rs } 400$ .

This indicates that the value of X that satisfies the equation is Rs 400.

## Key Conceptual Point

- When X appears on both sides, isolate X by bringing all X terms to one side and factoring, then solving algebraically.
- Always check for potential extraneous solutions, especially in equations where X appears both inside and outside percentage terms.

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## Equation 5: $X = \text{Rs } 180 + 10\% \text{ of } X$

### Equation Breakdown

Expressed mathematically:

$$X = \text{Rs } 180 + (10/100) X$$

or:

$$X = \text{Rs } 180 + 0.10 X$$

## Solution Approach

1. Rearrange to isolate X:

$$X - 0.10 X = \text{Rs } 180$$

2. Factor X:

$$(1 - 0.10) X = \text{Rs } 180$$

3. Simplify:

$$0.90 X = \text{Rs } 180$$

4. Solve for X:

$$X = \text{Rs } 180 / 0.90$$

5. Calculate:

$$X = \text{Rs } 200$$

## Final Result and Explanation

$X = \text{Rs } 200$ .

This indicates that Rs 200 plus 10% of Rs 200 equals Rs 180 plus 10% of Rs 200, which confirms the solution.

## Practical Note

- When X appears on both sides with percentages, the key is to move all X terms to one side and factor before solving.
- Verifying the solution by substitution helps ensure accuracy.

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## General Principles for Solving Percentage Equations

Having analyzed each specific equation, it's beneficial to distill general principles applicable across similar problems:

- Convert Percentages to Decimals:

Always rewrite percentage expressions as decimal fractions to facilitate calculations.

- Combine Like Terms:

When X appears multiple times, group and factor to simplify the equation.

- Use Algebraic Manipulation:

Rearrange equations systematically to isolate X.

For example, if the equation is  $X + Y\% \text{ of } X = T$ , rewrite as:

$$(1 + Y/100) X = T$$

then solve for X.

- Handling Equations with X on Both Sides:

Bring all X terms to one side and factor before solving.

- Verify Solutions:

Substitute the obtained value of X back into the original equation to verify correctness.

- Understand Context:

Recognize whether the percentage refers to an increase, decrease, or part of a total, as this impacts the algebraic approach.

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## Common Pitfalls and Tips

- Misinterpreting Percentages:

Ensure that percentage expressions are correctly converted. For example

## Solve I X 10 Of X 22ii X 20 Of X Rs60iii X 25 Ofx Rs120iv X Rs200 50 Of Xv X 180 10 Of Xquestion From

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