

A Sum Lent Out At Simple Interest Becomes Rs4480 In 3 Years And Rs 4800 In 5years.find The Rate Of Interest

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This problem involves calculating the rate of interest for a principal amount that accrues simple interest over a period of time. By analyzing the given data—where the amount increases over different time periods—we can deduce the rate of interest per annum. Understanding how simple interest works is essential to solving this problem efficiently. In this article, we will explore the concepts of simple interest, work through the problem step-by-step, and provide tips for solving similar financial questions.

Understanding Simple Interest

Before delving into the problem, let's review the fundamentals of simple interest. Simple interest is a method of calculating interest where the interest earned is based solely on the original principal amount, without compounding. The formula for simple interest is:

$$\text{Interest (SI)} = \frac{P \times R \times T}{100}$$

where:

- P = Principal amount (initial loan or investment)
- R = Rate of interest per annum (in percentage)
- T = Time period in years

The total amount A after time T is then:

$$A = P + SI = P + \frac{P \times R \times T}{100} = P \left(1 + \frac{R \times T}{100}\right)$$

Using this formula, we can analyze how the amount changes over different periods and work backward to find the rate R .

Analyzing the Problem Data

Given:

- When time $T = 3$ years, amount $A_1 = \text{Rs}4480$
- When time $T = 5$ years, amount $A_2 = \text{Rs}4800$

Our goal: Find the rate of interest R .

Let's identify what this data tells us:

- The principal (P) remains the same since the sum is lent out once and interest is accumulated over different periods.
- The amounts are given at two different times, which allows us to determine how much interest accrues over these periods.

Step-by-Step Solution

Step 1: Express the amounts in terms of principal and interest

Using the simple interest formula:

$$\begin{aligned} A_1 &= P \left(1 + \frac{R \times 3}{100}\right) = \text{Rs}4480 \\ A_2 &= P \left(1 + \frac{R \times 5}{100}\right) = \text{Rs}4800 \end{aligned}$$

Step 2: Write equations from the data

From the first data point:

$$P \left(1 + \frac{3R}{100}\right) = 4480 \quad \text{(Equation 1)}$$

From the second data point:

$$P \left(1 + \frac{5R}{100}\right) = 4800 \quad \text{(Equation 2)}$$

Step 3: Subtract Equation 1 from Equation 2 to eliminate (P)

Subtracting:

$$P \left(1 + \frac{5R}{100}\right) - P \left(1 + \frac{3R}{100}\right) = 4800 - 4480$$

$$P \left[\left(1 + \frac{5R}{100}\right) - \left(1 + \frac{3R}{100}\right)\right] = 320$$

Simplify inside the brackets:

$$P \left(\frac{5R}{100} - \frac{3R}{100}\right) = 320$$

$$P \times \frac{2R}{100} = 320$$

$$P \times \frac{2R}{100} = 320$$

Multiply both sides by 100 to clear the denominator:

$$P \times 2R = 320 \times 100 = 32,000$$

So,

$$2RP = 32,000 \quad \text{(Equation 3)}$$

Step 4: Express (P) from Equation 1 or 2 and substitute into Equation 3

From Equation 1:

$$P = \frac{4480}{1 + \frac{3R}{100}}$$

Substitute into Equation 3:

$$2R \times \frac{4480}{1 + \frac{3R}{100}} = 32,000$$

Multiply both sides by the denominator:

$$2R \times 4480 = 32,000 \left(1 + \frac{3R}{100}\right)$$

Simplify left side:

$$8960R = 32,000 \left(1 + \frac{3R}{100}\right)$$

Express the right side:

$$8960R = 32,000 + 32,000 \times \frac{3R}{100}$$

$$8960R = 32,000 + 960R$$

Bring all terms to one side:

$$8960R - 960R = 32,000$$

$$(8960 - 960)R = 32,000$$

$$8000R = 32,000$$

Solve for (R) :

$$R = \frac{32,000}{8000} = 4$$

Therefore, the rate of interest $(R = 4\%)$ per annum.

Verification of the Result

To ensure the correctness of our solution, let's verify by calculating the

principal (P) and checking the amounts:

Using Equation 1:

$$P = \frac{4480}{1 + \frac{3 \times 4}{100}} = \frac{4480}{1 + 0.12} = \frac{4480}{1.12} = 4000$$

Now, check with Equation 2:

$$A_2 = P \left(1 + \frac{5 \times R}{100}\right) = 4000 \times \left(1 + \frac{5 \times 4}{100}\right) = 4000 \times (1 + 0.20) = 4000 \times 1.20 = \text{Rs}4800$$

The calculations match the given data, confirming our result.

Summary and Key Takeaways

- The principal amount (P) is Rs4000.
- The rate of interest (R) per annum is 4%.
- The amounts at different times can be used to derive the interest rate using simple algebraic methods.
- Verifying calculations with known formulas ensures accuracy.

Additional Tips for Solving Simple Interest Problems

- Always write down the basic simple interest formula first.
- Use the given data to set up equations that relate principal, interest, rate, and time.
- When multiple time periods are involved, subtract the equations to eliminate the principal and find the interest rate.
- Verify your answers by plugging them back into the original formulas.

Conclusion

Calculating the rate of interest in problems involving simple interest requires understanding the fundamental formula and applying algebraic techniques to relate different data points. By carefully analyzing the amounts at different times, subtracting equations, and solving for the interest rate, you can accurately determine the percentage rate per annum. Practice with similar problems enhances your ability to solve complex financial questions confidently and efficiently.

Frequently Asked Questions

What is the principal amount lent out at simple interest if it becomes Rs 4480 in 3 years and Rs 4800 in 5 years?

The principal amount is Rs 4000.

How do you calculate the rate of interest when the amount and time are given for simple interest?

Use the formula for simple interest: $SI = (P \times R \times T) / 100$, and solve for R using the given amounts and times.

What is the interest earned in 2 years based on the given data?

Interest in 2 years is Rs 400, since the amount increases from Rs 4480 in 3 years to Rs 4800 in 5 years.

How is the difference in amounts after 2 years used to find the rate of interest?

The difference (Rs 4800 - Rs 4480 = Rs 320) represents interest earned over 2 years, which helps to calculate the rate of interest.

What is the rate of interest per annum based on the given data?

The rate of interest is 8% per annum.

Can the simple interest rate be determined if the amounts for different years are known?

Yes, by analyzing the difference in amounts over different periods and using the simple interest formula, the rate can be calculated.

Additional Resources

A Sum Lent Out At Simple Interest Becomes Rs 4480 In 3 Years And Rs 4800 In 5 Years Find The Rate Of Interest is a classic problem in the realm of simple interest calculations, often encountered in mathematics exams and financial studies. This problem combines the core concepts of simple interest, principal amount, rate of interest, and time period, making it an excellent example to understand how these variables interact. Solving such problems enhances one's ability to analyze financial data, understand interest calculations, and develop problem-solving skills that are applicable in real-

world financial scenarios.

Understanding the Basics of Simple Interest

Before diving into the problem, it's essential to understand what simple interest (SI) is and how it is calculated. Simple interest is a straightforward way of calculating interest on a principal amount over a specified period at a fixed rate of interest.

Formula for Simple Interest

The basic formula for simple interest is:

$$SI = \frac{P \times R \times T}{100}$$

Where:

- SI = Simple Interest
- P = Principal amount (initial sum borrowed or lent)
- R = Rate of interest per annum (in percentage)
- T = Time period in years

The total amount (A) after interest is added is:

$$A = P + SI$$

or equivalently:

$$A = P \left(1 + \frac{R \times T}{100}\right)$$

Understanding these formulas is fundamental for solving problems related to simple interest.

Analyzing the Given Data

The problem provides two key pieces of information:

- The amount after 3 years is Rs 4480
- The amount after 5 years is Rs 4800

Our goal is to find the rate of interest (R).

This setup indicates that the principal amount remains the same, but the interest accumulated over different time periods alters the total amount. The

first step is to understand the implications of these data points.

Key Observations

- The principal (P) is the same for both time periods.
- The interest accrued over 3 years and 5 years can be computed using the simple interest formula.
- The difference in amounts over these two periods reflects the interest accrued during the 2-year interval (from Year 3 to Year 5).

This insight allows us to approach the problem systematically.

Step-by-Step Solution Approach

To find the rate of interest, we need to determine the principal and the interest accrued over the time periods.

Step 1: Express the amounts in terms of principal and interest

Let:

- P = principal amount
- R = rate of interest per annum (unknown)
- T = time in years

From the given data:

- Amount after 3 years: $A_3 = P + SI_3 = 4480$
- Amount after 5 years: $A_5 = P + SI_5 = 4800$

Using the simple interest formula:

$$SI = \frac{P \times R \times T}{100}$$

So:

$$A_3 = P + \frac{P \times R \times 3}{100}$$

$$A_5 = P + \frac{P \times R \times 5}{100}$$

Expressed explicitly:

$$4480 = P \left(1 + \frac{3R}{100}\right)$$

$$4800 = P \left(1 + \frac{5R}{100}\right)$$

Step 2: Form equations and eliminate P

From the two equations:

$$1. \quad P \left(1 + \frac{3R}{100}\right) = 4480$$

$$2. \quad P \left(1 + \frac{5R}{100}\right) = 4800$$

Dividing equation (2) by equation (1):

$$\frac{P \left(1 + \frac{5R}{100}\right)}{P \left(1 + \frac{3R}{100}\right)} = \frac{4800}{4480}$$

Simplifies to:

$$\frac{1 + \frac{5R}{100}}{1 + \frac{3R}{100}} = \frac{4800}{4480}$$

Calculate the right side:

$$\frac{4800}{4480} = \frac{4800 \div 80}{4480 \div 80} = \frac{60}{56} = \frac{15}{14}$$

Now, rewrite the left side:

$$\frac{1 + \frac{5R}{100}}{1 + \frac{3R}{100}} = \frac{\frac{100 + 5R}{100}}{\frac{100 + 3R}{100}} = \frac{100 + 5R}{100 + 3R}$$

Set equal:

$$\frac{100 + 5R}{100 + 3R} = \frac{15}{14}$$

Cross-multiplied:

$$14(100 + 5R) = 15(100 + 3R)$$

Expand:

$$14 \times 100 + 14 \times 5R = 15 \times 100 + 15 \times 3R$$

$$\begin{aligned} & 1400 + 70 R = 1500 + 45 R \\ & \end{aligned}$$

Bring like terms together:

$$\begin{aligned} & 70 R - 45 R = 1500 - 1400 \\ & \end{aligned}$$

$$\begin{aligned} & 25 R = 100 \\ & \end{aligned}$$

$$\begin{aligned} & R = \frac{100}{25} = 4 \\ & \end{aligned}$$

Therefore, the rate of interest is 4% per annum.

Calculating the Principal

Now that we know $(R = 4\%)$, we can find the principal (P) .

Using the initial equation:

$$\begin{aligned} & 4480 = P \left(1 + \frac{3 \times 4}{100}\right) = P \left(1 + 0.12\right) = \\ & P \times 1.12 \\ & \end{aligned}$$

Thus:

$$\begin{aligned} & P = \frac{4480}{1.12} = 4000 \\ & \end{aligned}$$

To verify, check with the second data point:

$$\begin{aligned} & A_5 = P \left(1 + \frac{5 R}{100}\right) = 4000 \times \left(1 + \frac{5 \times 4}{100}\right) = 4000 \times (1 + 0.20) = 4000 \times 1.20 = 4800 \\ & \end{aligned}$$

This matches the given data, confirming our solution.

Summary of Findings

- The principal amount (P) is Rs 4000.
- The rate of interest (R) is 4% per annum.
- The interest accrued over 3 years is Rs 480, and over 5 years Rs 800, consistent with simple interest calculations.

Features, Pros, and Cons of Simple Interest in Financial Calculations

Features:

- Simple interest is straightforward to calculate.
- It is based only on the original principal, not on accumulated interest.
- Suitable for short-term loans and investments.

Pros:

- Easy to understand and compute.
- Clear relationship between principal, rate, and interest.
- Useful for quick estimations and straightforward financial planning.

Cons:

- Doesn't account for compounding, which is more realistic for long-term investments.
- Less beneficial for investors seeking exponential growth.
- Can underestimate earnings in scenarios where interest is compounded.

Applications and Real-World Relevance

Understanding simple interest is fundamental in various financial contexts:

- Loan calculations for short-term borrowing.
- Savings accounts with simple interest.
- Basic financial literacy and education.
- Initial steps before understanding compound interest and more complex financial products.

Conclusion

The problem of determining the rate of interest given the amounts after specific periods exemplifies the practical application of simple interest formulas. By systematically translating word problems into algebraic equations, solving for unknowns, and verifying results, students and professionals can develop confidence in financial calculations. The clarity offered by simple interest makes it an excellent starting point for understanding more complex interest calculations, and mastering these basics is essential for effective financial decision-making.

Final Answer: The rate of interest is 4% per annum.

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