

MATHEMATICS

Chapter 8: Comparing Quantities



Comparing Quantities

Ratio and Proportion

1. Ratio is a method of comparing two quantities of same kind by division. Symbol used to write ratio is ':' and is read as 'is to'. Ratio is always expressed in its simplest form.
2. Two or more ratios are equivalent if their corresponding fractions are equivalent.
3. When two ratios are equal they are said to be in proportion. Symbol for proportion is '::' and is read as 'as to'.
4. If two ratios are equal or to be in proportion, their product of means should be equal to the product of extremes.
5. That is, if $a : b :: c : d$ then $ad = bc$.
6. The method to find out the value of one unit/item which in turn is used to find the value of required number of units/items is called unitary method.

Percentages

1. Percentages are numerators of fractions with denominator 100. The symbol '%' is used for percent and it indicates multiplication with $\frac{1}{100}$.

For example: $16\% = \frac{16}{100}$

2. To convert a fraction into a percentage, we multiply the fraction by 100.
3. To convert a decimal into a percentage, write the decimal as fraction and then multiply the fraction by 100.
4. To convert a percentage into a fraction (decimal), drop the percent sign and divide by 100 and then reduce it into simplest form of fraction (decimal).

$$1. \text{ Percentage increase/ decrease} = \frac{\text{Amount of change}}{\text{Original amount}} \times 100\%$$

Profit and Loss

1. The price at which an article is purchased is called the cost price (CP).
2. The price at which an article is sold is called the selling price (SP).
3. If $SP > CP$, then a profit is made.

$$\text{Gain} = (SP) - (CP)$$

4. If $SP < CP$, then a loss is incurred.

$$\text{Loss} = (CP) - (SP)$$

5. $\text{Gain}\% = \left\{ \frac{\text{gain} \times 100}{CP} \right\}$

$$\text{Loss}\% = \left\{ \frac{\text{loss} \times 100}{CP} \right\}$$

Simple Interest

- Whenever we borrow money from some lending sources such as banks or financial institutions etc., we have to pay some extra money for the service of lending. This extra money depends on the sum we borrow and the period of time for which we borrow. This extra money is called the interest.
- The money borrowed is called the principal or sum.
- Amount = (principal + interest).
- Interest on ₹ 100 for 1 year is called the rate per cent per annum.
- If the interest is calculated uniformly on the original principal, it is called the simple interest.
- If stand for principal, rate and time respectively, and SI stands for simple interest, then:

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

Prices related to an item

- Prices related to an item are: (i) Selling price
(ii) Cost price
- Selling price (SP) is the price at which a product is sold out.
- Cost price (CP) is the buying price of an item.
- Profit = Selling price – Cost price
- Loss = Cost price – Selling price
- If $SP > CP$, then it is profit.
- If $SP = CP$, then it is neither profit nor loss.
- If $CP > SP$, then it is loss.

Finding the profit or loss percentage

- $\text{Profit Percentage} = \frac{\text{Profit}}{\text{Cost Price}} \times 100$
- $\text{Loss Percentage} = \frac{\text{Loss}}{\text{Cost Price}} \times 100$

Percentages

Percentages are ratios expressed as a fraction of 100.

Percentages are represented by the symbol '%’.

Example: $\frac{20}{100} = 20\%$ and $\frac{50}{100} = 50\%$.

Comparing percentages when denominator is not 100

When a ratio is not expressed in fraction of 100, then convert the fraction to an equivalent fraction with denominator 100.

Example: Consider a fraction $\frac{3}{5}$. Multiply the numerator and denominator by 20.
 $\Rightarrow \frac{3 \times 20}{5 \times 20} = \frac{60}{100} = 60\%$

Converting fractions/decimals to percentages

Converting Decimals to Percentages

Given decimal: 0.44

$$0.44 = \frac{44}{100} = \frac{44}{100} \times 100\% = 44\%$$

Converting Fractions to Percentages

Given fraction: $\frac{3}{5}$ $\frac{3}{5} \times 100\% = 3 \times 20\% = 60\%$

Converting percentages to fractions/decimals

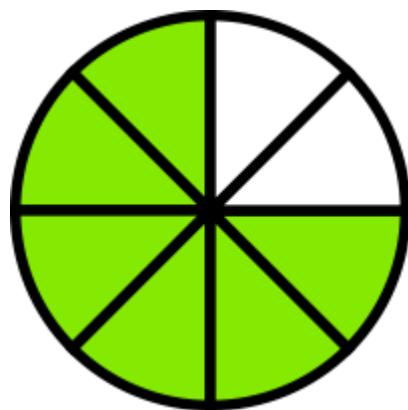
$$0.25 = \frac{25}{100} = \frac{1}{4}$$

$$0.225 = \frac{225}{1000} = \frac{9}{40}$$

Estimation using percentages

Estimation can be done using percentages.

Example: What percentage of the given circle is shaded?



Solution: The given triangle consists of 8 regions, out of which 6 regions are shaded.

So, the percentage of shaded regions will be

$$\frac{6}{8} \times 100 = \frac{3}{4} \times 100 = 75\%.$$

Interpreting percentage into usable data

- Percentages can be interpreted into useful data.
- Examples:
 - (i) 40% of Raghav's clothes are not washed.
 \Rightarrow Raghav's 40 clothes out of 100 clothes are not washed.
 - (ii) 30 % of students in class are infected by fever.
 \Rightarrow Out of 100 students in a class, 30 students are infected by fever.

Converting percentage to the form "how many"

Example: 200 chocolates were distributed among two children: Joe and Tom. Joe got 60% and Tom got 40% of the chocolates. How many chocolates will each get?

Solution: Total number of chocolates = 200

$$\begin{aligned} \text{Joe got 60\% of the chocolates} &= \frac{60}{100} \times 200 = 120 \\ \text{Tom got 40\% of the chocolates} &= \frac{40}{100} \times 200 = 80 \end{aligned}$$

\therefore Joe and Tom will get 120 and 80 chocolates, respectively.

Converting Ratios to percentages

Ratios can be expressed as percentages to understand certain situations much better.

Example: 200 chocolates were distributed among two children: James and Jacob. James got $\frac{3}{5}$ and Jacob got $\frac{2}{5}$ of the chocolates. What is the percentage of chocolate that each got?

Solution: Total number of chocolates = 200

$$\text{James got } \frac{3}{5} \text{ of the chocolates} = \frac{3}{5} \times 100 = 60\%$$

of the total chocolates.

$$\text{Jacob got } \frac{2}{5} \text{ of the chocolates} = \frac{2}{5} \times 100 = 40\% \text{ of the total chocolates.}$$

Introduction to Fractions and Ratios

Comparing Quantities: Introduction

To compare two quantities, the units must be the same.

Examples:

(i) Joe's height is 150 cm and Tom's is 100 cm.

Ratio of Joe's height to Tom's height would be Joe's height: Tom's height.

$$= 150: 100 = 3 : 2$$

(ii) Ratio of 3 km to 30 m is 3 km : 30 m.

$$= 3000 \text{ m} : 30 \text{ m}$$

$$= 300 : 1$$

Ratios

Ratio is a relation between two quantities showing the number of times one value contains or is contained within the other.

Example: If there are four girls and seven boys in a class, then the ratio of number of girls to number of boys is 4:7.

Equivalent Ratios

By multiplying numerator and denominator of a rational number by a non zero integer, we obtain another rational number equivalent to the given rational number. These are called equivalent fractions.

Example: $\frac{1}{3} = \frac{1}{3} \times \frac{2}{2} = \frac{2}{6}$
and $\frac{1}{3}$ are equivalent fractions.

Proportions

If two ratios are equal, then they are said to be in proportion.

Symbol “::” or “=” is used to equate the two ratios.

Example: (i) Ratios 2:3 and 6:9 are equal. They can be represented as 2:3 :: 6:9 or 2:3 = 6:9.

(ii) Ratios 1:2 and x:4 are in proportion.

$$\Rightarrow 12 = x4$$

$$\Rightarrow 1 \times 4 = x \times 2$$

$$\Rightarrow 2x = 4$$

$$\Rightarrow x = 2$$

Finding the percentage increase or decrease

Example: Price of a book was changed from ₹20 to ₹25 in a week. Calculate the percentage increased.

Solution: Change in price = ₹25 – ₹20 = ₹5

$$\begin{aligned} \text{Percentage Increased} &= \frac{\text{Change in Price}}{\text{Original Price}} \\ &= \frac{5}{20} \times 100 = 25\% \end{aligned}$$

Simple and Compound Interest

Sum / principal

The money which has been borrowed is called sum or principal.

This money can be used by the borrower for a particular time period before returning to the lender.

Example: Loan that you take from a bank is the principal.

Interest

Interest is the extra payment that a borrower should pay to the lender along with the principal.

Amount

A borrower should return the principal amount (he/she has borrowed) and the interest to the lender. This money is called amount.

⇒ Amount = Principal + Interest.

Simple Interest

Simple Interest (S.I) is the method of calculating the interest amount for some principal amount of money. Have you ever borrowed money from your siblings when your pocket money is exhausted? Or lent him maybe? What happens when you borrow money? You use that money for the purpose you had borrowed it in the first place. After that, you return the money whenever you get the next month's pocket money from your parents. This is how borrowing and lending work at home.

But in the real world, money is not free to borrow. You often have to borrow money from banks in the form of a loan. During payback, apart from the loan amount, you pay some more money that depends on the loan amount as well as the time for which you borrow. This is called simple interest. This term finds extensive usage in banking.

Simple interest (SI) is the interest charged on a borrowed money where the principal

amount will be fixed for a particular time period.

Simple Interest Formula

The formula for simple interest helps you find the interest amount if the principal amount, rate of interest and time periods are given.

Simple interest formula is given as:

$$SI = \frac{PTR}{100}$$

Where SI = simple interest

P = principal

R = interest rate (in percentage)

T = time duration (in years)

In order to calculate the total amount, the following formula is used:

Amount (A) = Principal (P) + Interest (I)

Where,

Amount (A) is the total money paid back at the end of the time period for which it was borrowed.

The total amount formula in case of simple interest can also be written as:

$$A = P (1 + RT)$$

Here,

A = Total amount after the given time period

P = Principal amount or the initial loan amount

R = Rate of interest (per annum)

T = Time (in years)

Simple Interest Formula For Months

The formula to calculate the simple interest on a yearly basis has been given above. Now, let us see the formula to calculate the interest for months. Suppose P be the principal amount, R be the rate of interest per annum and n be the time (in months), then the formula can be written as:

Simple Interest for n months = $(P \times n \times R) / (12 \times 100)$

The list of formulas of simple interest for when the time period is given in years, months and days are tabulated below:

Time	Simple interest Formula	Explanation
Years	$PTR/100$	T = Number of years
Months	$(P \times n \times R) / (12 \times 100)$	n = Number of months
Days	$(P \times d \times R) / (365 \times 100)$	d = Number of days (non-leap year)

Simple Interest = $\frac{P \times R \times N}{100}$ P = Principal Amount, R = Interest rate
N = Number of years

Example: Calculate the simple interest for 3 years when the principal amount is 200 and interest rate is 10% for 1 year.

Solution: Given: P = 200; R = 10%; T = 3 yrs

Simple Interest = $\frac{200 \times 10 \times 3}{100} = 60$ Amount = P + SI = Rs. (200 + 60) = Rs. 260

Difference Between Simple Interest and Compound Interest

There is another type of interest called compound interest. The major difference between simple and compound interest is that simple interest is based on the principal amount of a deposit or a loan whereas compound interest is based on the principal amount and interest that accumulates in every period of time. Let's see one simple example to understand the concept of simple interest.

Compound interest

Compound interest is the addition of interest to the principal sum of a loan or deposit, or in other words, interest on interest. It is the result of reinvesting interest, rather than paying it out, so that interest in the next period is then earned on the principal sum plus previously accumulated interest.

Formula

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

A = final amount

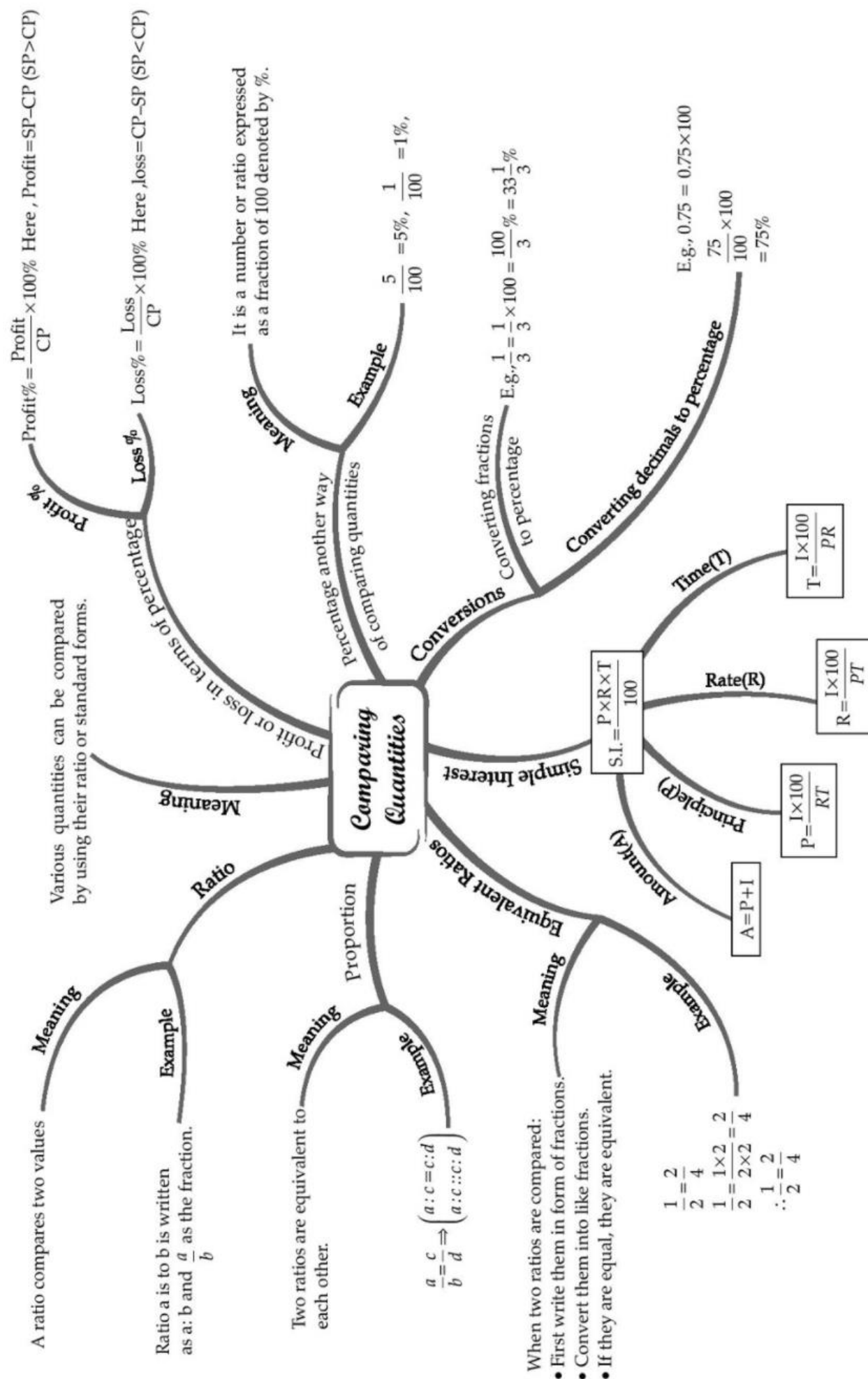
P = initial principal balance

r = interest rate

n = number of times interest applied per time period

t = number of time periods elapsed

CHAPTER - 8 COMPARING QUANTITIES



Important Questions

Multiple Choice Questions :

Question 1. Convert 0.09 into per cent.

- (a) 9%
- (b) 8%
- (c) 10%
- (d) None of these

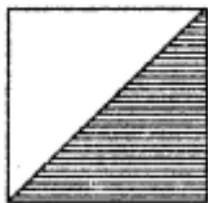
Question 2. Convert 0.2 into per cent.

- (a) 200%
- (b) 2%
- (c) 20%
- (d) None of these

Question 3. If 65% of students in a class have bicycle, what per cent of the students do not have bicycles ?

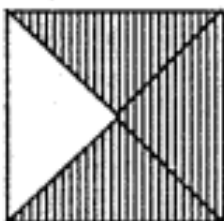
- (a) 35%
- (b) 25%
- (c) 45%
- (d) None of these

Question 4. What per cent of the adjoining figure is shaded ?



- (a) 50%
- (b) 40%
- (c) 100%
- (d) None of these

Question 5. What per cent of the given figure is shaded ?



- (a) 75%
- (b) 50%
- (c) 25%
- (d) None of these

Question 6. A survey of 40 children showed that 25% liked playing football. How many children liked playing football ?

- (a) 10
- (b) 20
- (c) 30
- (d) None of these

Question 7. Find 50% of 164.

- (a) 72
- (b) 62
- (c) 82
- (d) None of these

Question 8. Rahul has saved Rs. 20 when a discount of 25% was given. What was the price of the sweater before the discount ?

- (a) 70
- (b) 60
- (c) 80
- (d) None of these

Question 9. Convert the given fractional numbers 18 into percentage.

- (a) 12.5%
- (b) 13.5%
- (c) 14.5%
- (d) None of these

Question 10. Convert the given decimal fractions to per cent

- (a) 6.5%
- (b) 0.065%
- (c) 65%
- (d) None of these

Question 11. Find 75% of 1 kg.

- (a) 750 g

- (b) 75 g
- (c) .750 g
- (d) None of these

Question 12. Find the whole quantity if 5% of it is 600.

- (a) 1200
- (b) 120
- (c) 12000
- (d) None of these

Question 13. Gardening shares are bought for Rs. 250 and sold for Rs. 325.
What is the profit ?

- (a) Rs. 75
- (b) Rs. 50
- (c) Rs. 25
- (d) None of these

Question 14. Find loss if CP is 250 and SP is Rs. 150.

- (a) Rs. 50
- (b) Rs. 100
- (c) Rs. 15
- (d) None of these

Question 15. Find interest if Principal = Rs. 1200, rate of interest = 12% p.a. and Time 1 year.

- (a) Rs. 144
- (b) Rs. 244
- (c) Rs. 344
- (d) None of these

Very Short Questions :

1. Find the ratio of:
 - (a) 5 km to 400 m
 - (b) 2 hours to 160 minutes
2. State whether the following ratios are equivalent or not?
 - (a) 2 : 3 and 4 : 5
 - (b) 1 : 3 and 2 : 6

3. Express the following ratios in simplest form:
 - (a) $6\frac{1}{5} : 2\frac{1}{3}$
 - (b) $42 : 56$
4. Compare the following ratios:
 $3 : 4$, $5 : 6$ and $3 : 8$
5. State whether the following ratios are proportional or not:
 - (i) $20 : 45$ and $4 : 9$
 - (ii) $9 : 27$ and $33 : 11$
6. 24 , 36 , x are in continued proportion, find the value of x .
7. Find the mean proportional between 9 and 16 .
8. Find:
 - (i) 36% of 400
 - (ii) $16\frac{2}{3}\%$ of 32

Short Questions :

1. Find a number whose $6\frac{1}{4}\%$ is 12 .
2. What per cent of 40 kg is 440 g?
3. Convert each of the following into the decimal form:
 - (a) 25.2%
 - (b) 0.15%
 - (c) 25%
4. What per cent of
 - (a) 64 is 148.48 ?
 - (b) 75 is 1225 ?
5. A machine costs ₹ 7500 . Its value decreases by 5% every year due to usage. What will be its price after one year?
6. What sum of money lent out at 12 per cent p.a. simple interest would produce ₹ 9000 as interest in 2 years?

Long Questions :

1. Rashmi obtains 480 marks out of 600 . Rajan obtains 560 marks out of 700 . Whose performance is better?
2. ₹ 9000 becomes ₹ 18000 at simple interest in 8 years. Find the rate per cent per annum.

3. The cost of an object is increased by 12%. If the current cost is ₹ 896, what was its original cost?
4. Radhika borrowed ₹ 12000 from her friends. Out of which ₹ 4000 were borrowed at 18% and the remaining at 15% rate of interest per annum. What is the total interest after 3 years?
5. Bhavya earns ₹ 50,000 per month and spends 80% of it. Due to pay revision, her monthly income increases by 20% but due to price rise, she has to spend 20% more. Find her new savings.
6. The simple interest on a certain sum at 5% per annum for 3 years and 4 years differ by ₹ 82. Find the sum.
7. Rajan's monthly income is 20% more than the monthly income of Sarita. What per cent of Sarita's income is less than Rajan's monthly income?
8. If 10 apples are bought for ₹ 11 and sold at the rate of 11 apples for ₹ 10. Find the overall gain or loss per cent in these transactions.
9. If 25 men can do a work in 36 hours, find the number of men required to do the same work in 108 hours.
10. A machine is sold by A to B at a profit of 10% and then B sold it to C at a profit of 20%. If C paid ₹ 1200 for the machine, what amount was paid by A to purchase the machine?

Assertion Reason Questions:

1) Assertion (A) –The ratio of 50 paise to Rs. 1 is 1 : 2.

Reasons (R) –A ratio can be defined as the relationship or comparison between two numbers of the same unit to check how bigger is one number than the other one

- a) Both A and R are true and R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

2) Assertion (A) –A shopkeeper purchased 2 refrigerators for Rs 9800 and Rs 8200 respectively. He sold them for Rs 16920. Loss% = 6%

Reasons (R) –Loss percentage refers to the amount of loss incurred which is expressed or calculated in percentage

- a) Both A and R are true and R is the correct explanation of A
- b) Both A and R are true but R is not the correct explanation of A
- c) A is true but R is false
- d) A is false but R is true

ANSWER KEY -

Multiple Choice questions :

1. (a) 9%
2. (c) 20%
3. (a) 35%
4. (a) 50%
5. (a) 75%
6. (a) 10
7. (c) 82
8. (c) 80
9. (a) 12.5%
10. (c) 65%
11. (a) 750 g
12. (c) 12000
13. (a) Rs. 75
14. (b) Rs. 100
15. (a) Rs. 144

Very Short Answer :

1. (a) $5 \text{ km} = 5 \times 1000 = 5000 \text{ m}$
 Ratio of 5 km to 400 m
 $= 5000 \text{ m} : 400 \text{ m}$
 $= 25 : 2$
 Required ratio = 25 : 2
 (b) $2 \text{ hours} = 2 \times 60 = 120 \text{ minutes}$
 Ratio of 2 hours to 160 minutes
 $= 120 : 160$
 $= 3 : 4$
 Required ratio = 3 : 4
2. (a) Given ratios = 2 : 3 and 4 : 5

or $\frac{2}{3}$ and $\frac{4}{5}$

LCM of 3 and 5 = 15

$$\therefore \frac{2}{3} = \frac{2 \times 5}{3 \times 5} = \frac{10}{15}$$

$$\text{and } \frac{4}{5} = \frac{4 \times 3}{5 \times 3} = \frac{12}{15}$$

Here, $\frac{10}{15} < \frac{12}{15}$

Hence 2 : 3 and 4 : 5 are not equivalent ratios.

(b) Given ratios = 1 : 3 and 2 : 6

LCM of 3 and 6 = 6

or $\frac{1}{3}$ and $\frac{2}{6}$

LCM of 3 and 6 = 6

$$\therefore \frac{1}{3} = \frac{1 \times 2}{3 \times 2} = \frac{2}{6}$$

$$\text{and } \frac{2}{6} = \frac{2 \times 1}{6 \times 1} = \frac{2}{6}$$

Here, $\frac{2}{6} = \frac{2}{6}$

Hence, 1 : 3 and 2 : 6 are equivalent ratios.

3.

(a) $6\frac{1}{5} : 2\frac{1}{3}$

$$\Rightarrow \frac{31}{5} : \frac{7}{3} \Rightarrow \frac{31}{5} \div \frac{7}{3}$$

$$\Rightarrow \frac{31}{5} \times \frac{3}{7} = \frac{63}{35} \text{ or } 63 : 35$$

Hence, the required form of the ratio = 63 : 35.

(b) 42 : 56

$$\Rightarrow \frac{42}{56} = \frac{42 \div 14}{56 \div 14} = \frac{3}{4} \text{ or } 3 : 4$$

[HCF of 42 and 56 = 14]

Hence, the required form of ratio = 3 : 4.

4. Given: 3 : 4, 5 : 6 and 3 : 8

or $\frac{3}{4}$, $\frac{5}{6}$ and $\frac{3}{8}$

LCM of 4, 6 and 8 = 24

$$\therefore \frac{3 \times 6}{4 \times 6} = \frac{18}{24}, \frac{5 \times 4}{6 \times 4} = \frac{20}{24}$$

$$\text{and } \frac{3 \times 3}{8 \times 3} = \frac{9}{24}$$

Here $9 < 18 < 20$

$$\text{or } \frac{9}{24} < \frac{18}{24} < \frac{20}{24}$$

$$\text{or } \frac{3}{8} < \frac{3}{4} < \frac{5}{6}$$

Hence, $3 : 8 < 3 : 4 < 5 : 6$

5. (i) $20 : 45$ and $4 : 9$

Product of extremes = $20 \times 9 = 180$

Product of means = $45 \times 4 = 180$

Here, the product of extremes = Product of means

Hence, the given ratios are in proportion.

- (ii) $9 : 27$ and $33 : 11$

Product of extremes = $9 \times 11 = 99$

Product of means = $27 \times 33 = 891$

Here, the product of extremes \neq Product of means

Hence, the given ratios are not in proportion.

6. Since, 24, 36, x are in continued proportion.

$$24 : 36 :: 36 : x$$

$$\Rightarrow 24 \times x = 36 \times 36$$

$$\Rightarrow x = 54$$

Hence, the value of $x = 54$.

7. Let x be the mean proportional between 9 and 16.

$$9 : x :: x : 16$$

$$\Rightarrow x \times x = 9 \times 16$$

$$\Rightarrow x^2 = 144$$

$$\Rightarrow x = \sqrt{144} = 12$$

Hence, the required mean proportional = 12.

- 8.

$$(i) 36\% \text{ of } 400 = \frac{36}{100} \times 400 = 36 \times 4 = 144$$

$$(ii) 16\frac{2}{3}\% \text{ of } 32 = \frac{50}{3}\% \text{ of } 32 = \frac{50}{3} \times \frac{1}{100} \times 32 \\ = \frac{16}{3} = 5\frac{1}{3}$$

Short Answer :

1. Let the required number be x.

$$6\frac{1}{4}\% \text{ of } x = 12$$

$$\frac{25}{4}\% \text{ of } x = 12$$

$$\Rightarrow \frac{25}{4 \times 100} \times x = 12$$

$$\Rightarrow x = \frac{12 \times 4 \times 100}{25} = 192$$

Hence, the required number = 192.

2. Let x% of 40 kg = 440 g

$$\Rightarrow \frac{x}{100} \times 40 \times 1000 = 440$$

$$\Rightarrow 400x = 440$$

$$\therefore x = \frac{440}{400} = 1.1\%$$

Hence, the required Percentage = 1.1%

- 3.

$$(a) 25.2\% = \frac{25.2}{100} = 0.252$$

$$(b) 0.15\% = \frac{0.15}{100} = 0.0015$$

$$(c) 25\% = \frac{25}{100} = 0.25$$

- 4.

(a) Let $x\%$ of 64 = 148.48

$$\therefore \frac{x}{100} \times 64 = 148.48$$

$$\therefore x = \frac{148.48 \times 100}{64} = 232\%$$

Hence, the required Percentage = 232%

(b) Let $x\%$ of 75 = 1225

$$\frac{x}{100} \times 75 = 1225$$

$$\Rightarrow x = \frac{1225 \times 100}{75} = 1633.3\%$$

Hence, the required Percentage = 1633.3%

5. The cost price of the machine = ₹ 7500

Decrease in price = 5%

Decreased price after one year

$$= 7500 \left(1 - \frac{5}{100} \right) = 7500 \times \frac{95}{100}$$

$$= 75 \times 95$$

$$= ₹ 7125$$

Hence, the required price = ₹ 7125.

6. Here, Interest = ₹ 9000

Rate = 12% p.a.

Time = 2 years

Principal = ?

$$\begin{aligned} \text{Principal} &= \frac{100 \times I}{R \times T} \\ &= \frac{100 \times 9000}{12 \times 2} = ₹ 37500 \end{aligned}$$

Hence, the required principal amount = ₹ 37500.

Long Answer :

1. Rashmi obtains 480 marks out of 600

$$\text{Marks Percentage} = \frac{480}{600} \times 100 = 80\%$$

Rajan obtains 560 marks out of 700

$$\text{Marks Percentage} = \frac{560}{700} \times 100 = 80\%$$

Since, both of them obtained the same per cent of marks i.e. 80%.

So, their performance cannot be compared.

2. Here, Principal = ₹ 9000

Amount = ₹ 18000

Interest = Amount – Principal = ₹ 18000 – ₹ 9000 = ₹ 9000

$$R = \frac{100 \times I}{P \times T} = \frac{100 \times 9000}{9000 \times 8}$$

$$= \frac{25}{2}\% \text{ or } 12\frac{1}{2}\%$$

Hence, the required rate of interest = $12\frac{1}{2}\%$.

3. Here, rate of increase in cost = 12%

Increased Cost = ₹ 896

Original Cost = ?

Let the Original Cost be ₹ x

$$\therefore \text{Increase in cost} = 12\% \text{ of } x = \frac{12}{100}x$$

$$\text{Increased cost of the object} = x + \frac{12}{100}x$$

$$= \frac{112}{100}x$$

$$\therefore \frac{112}{100}x = 896$$

$$\Rightarrow x = \frac{896 \times 100}{112} = ₹ 800$$

Hence, the required cost = ₹ 800.

4. Total amount borrowed by Radhika = ₹ 12,000

The amount borrowed by her at 18% p.a. = ₹ 4000

$$\therefore \text{Interest} = \frac{P \times R \times T}{100} = \frac{4,000 \times 18 \times 3}{100}$$

$$= ₹ 2160$$

Remaining amount

$$= ₹ 12,000 - ₹ 4,000 = ₹ 8,000$$

$$\text{Interest on ₹ 8000} = \frac{P \times R \times T}{100} = \frac{8,000 \times 15 \times 3}{100}$$

$$= ₹ 3600$$

Total interest = ₹ 2160 + ₹ 3600 = ₹ 5760

Hence, the total interest = ₹ 5760.

5. Monthly income of Bhavya = ₹ 50,000

Money spent by her = 80% of ₹ 50,000

$$= \frac{80}{100} \times 50,000 = ₹ 40,000$$

Due to pay revision, income is increased by 20%

$$\text{i.e. } 50,000 \left(1 + \frac{20}{100} \right) = 50,000 \times \frac{120}{100} = ₹ 60,000$$

Money spent due to price rise

$$\begin{aligned} &= ₹ 40,000 \left(1 + \frac{20}{100} \right) = ₹ 40,000 \times \frac{120}{100} \\ &= ₹ 48,000 \end{aligned}$$

So, the new savings = ₹ 60,000 – ₹ 48,000 = ₹ 12,000

6. Let the required sum be ₹ P.

Simple interest for 3 years

$$= \frac{P \times R \times T}{100} = \frac{P \times 5 \times 3}{100} = ₹ \frac{3P}{20}$$

$$\text{Simple interest for 4 years} = \frac{P \times R \times T}{100}$$

$$= \frac{P \times 5 \times 4}{100} = ₹ \frac{4P}{20}$$

As per the question, we have

$$\frac{4P}{20} - \frac{3P}{20} = 82 \Rightarrow \frac{P}{20} = 82$$

$$\Rightarrow P = 20 \times 82 = ₹ 1640$$

Hence, the required sum = ₹ 1640

Alternate Method

Simple Interest gained from 3rd to 4th year = ₹ 82

Time (4th year – 3rd year) = 1 year

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

$$P = \frac{82 \times 100}{5 \times 1} = 1640$$

Required sum = ₹ 1640

7. Let the monthly income of Sarita be ₹ 100.

Rajan's monthly income

$$= ₹ \left[100 \left(1 + \frac{20}{100} \right) \right] = ₹ \frac{100 \times 120}{100} = ₹ 120$$

Now, Sarita's monthly income is less than the monthly income of Rajan by = ₹

$$120 - ₹ 100 = ₹ 20$$

Per cent of less in Rajan's monthly income

$$= \frac{20 \times 100}{120} = \frac{50}{3}\% = 16\frac{2}{3}\%$$

Hence, the required per cent = $16\frac{2}{3}\%$

8. CP of 10 apples = ₹ 11

$$\text{CP of 1 apple} = ₹ \frac{11}{10}$$

$$\text{SP of 11 apples} = ₹ 10$$

$$\text{SP of 1 apple} = ₹ \frac{10}{11}$$

$$\text{Clearly CP} > \text{SP} \left(\because \frac{11}{10} > \frac{10}{11} \right)$$

$$\begin{aligned} \therefore \text{Loss} &= ₹ \left(\frac{11}{10} - \frac{10}{11} \right) \\ &= ₹ \left(\frac{121 - 100}{110} \right) = ₹ \frac{21}{110} \end{aligned}$$

$$\text{On ₹ } \frac{11}{10}, \text{ the loss} = ₹ \frac{21}{110}$$

$$\text{On ₹ 1, the loss} = ₹ \frac{21}{110} \times \frac{10}{11}$$

$$\text{On ₹ 100, the loss} = ₹ \frac{21}{110} \times \frac{10}{11} \times 100$$

$$= \frac{2100}{121}\% = 17\frac{43}{121}\%$$

$$\text{Hence, the overall loss} = 17\frac{43}{121}\%.$$

9. Let the number of men required to be x.

Men : Hours :: Men : Hours

$$25 : 36 :: x : 108$$

$$\text{Product of extremes} = 25 \times 108$$

$$\text{Product of means} = 36 \times x$$

$$\text{Product of means} = \text{Product of extremes}$$

$$36 \times x = 25 \times 108$$

$$\Rightarrow x = 25 \times 3 = 75$$

Hence, the required number of men = 75.

10. Cost price of machine for C = Selling price of the machine for B = ₹ 1200

$$\therefore SP = CP \left(1 + \frac{P}{100} \right)$$

$$1200 = CP \left(1 + \frac{20}{100} \right)$$

$$\Rightarrow 1200 = CP \times \frac{120}{100}$$

$$\therefore CP = \frac{1200 \times 100}{120} = ₹ 1000$$

CP of machine for B = SP of machine for A
= ₹ 1000

$$SP = CP \left(1 + \frac{P}{100} \right)$$

$$1000 = CP \left(1 + \frac{10}{100} \right)$$

$$\Rightarrow 1000 = CP \times \frac{110}{100}$$

$$\therefore CP = \frac{1000 \times 100}{110} = ₹ \frac{10000}{11}$$

$$= ₹ 909 \frac{10}{11}$$

Hence, the required cost price = ₹ 909 $\frac{10}{11}$ or ₹ 909.09 (approx)

Assertion Reason answers:

- 1) a) Both A and R are true and R is the correct explanation of A
- 2) a) Both A and R are true and R is the correct explanation of A