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Chapter-8: Comparing Quantities

Exercise 8.1 (Page 119 of Grade 8 NCERT)

Q1. Find the ratio of the following.

(i) Speed of a cycle 15 km per hour to the speed of scooter 30 km per hour.
(ii) 5 m to 10 km
(iii) 50 paise to Rs 5

Difficulty Level: Easy

What is known:
Value of two quantities, which needs to be compared.

What is unknown:
Ratio

Reasoning:
A relationship between two quantities is normally expressed as the quantity of one divided by the other.

Solution (i):
Speed of a cycle = 15 km/hr
Speed of a scooter = 30 km/hr

Speed of cycle: Speed of scooter = $\frac{15}{30} = \frac{1}{2}$

Answer: 1:2

Solution (ii):
Given data: 5 m to 10 km

Quantities can be compared only when the units are same.

1 km = 1000 m
Therefore, 10 km = 10 $\times$1000 = 10000 m

5 m to 10 km = 5 m to 10000 m = $\frac{5}{10000} = \frac{1}{2000}$

Answer: 1:2000

Solution (iii):
Given data: 50 paise to Rs 5

Quantities can be compared only when the units are same.

Rs 1 = 100 paise
Rs 5 = 5$\times$100 paise
= 500 paise

50 paise to Rs 5 = 50 paise to 500 paise

$$\frac{50}{500} = \frac{1}{10}$$

Answer: 1:10

Q2. Convert the following ratios to percentages

(i) 3:4

(ii) 2:3

Difficulty Level: Easy

What is known:

Ratios

What is unknown:

Percentages of given ratios

Reasoning:

A ratio is a comparison of any two quantities by division. A percent is a special ratio that compares any quantity to 100, with 100 representing one whole.

Solution (i):

Given data: 3:4

$$\frac{3}{4} \times 100$$

$$= 3 \times 25$$

$$= 75\%$$

Answer: 75%

Solution (ii):

Given data: 2:3

Type 1: Decimal Form

$$\frac{2}{3} \times 100$$

$$= 2 \times 33.33$$

$$= 66.67\%$$

Answer: 66.67% (Decimal form)

Type 2: Fractions Form

$$\frac{2 \times 100}{3}$$

$$= \frac{200}{3}$$

$$= 66\frac{2}{3}\%$$

Answer: $66\frac{2}{3}\%$ (Mixed fraction form)

Q3. 72% of 25 students are interested in mathematics. How many are not interested in mathematics?

Difficulty Level: Medium

What is known:
Total number of students = 25
Percentage of students who are interested in Mathematics = 72%

What is unknown:
Number of students who are not interested in Mathematics

Reasoning:
Percentage is a special ratio that compares any quantity to 100, with 100 representing one whole.

Solution:
Percentage of students who are not interested in Mathematics

$$= (100 - 72)\% = 28\%$$

Therefore, number of students who are not good in Mathematics

$$= 28\% \text{ of the total number of students}$$
$$= 28\% \text{ of } 25$$
$$= \frac{28}{100} \times 25$$
$$= \frac{28}{4}$$
$$= 7$$

Answer:
The total number of students who are not interested in Mathematics are 7.

Q4. A football team won 10 matches out of the total number of matches they played. If their win percentage was 40, then how many matches did they play in all?

Difficulty Level: Medium

What is known:
Total number of matches = 10
Win percentage = 40%

What is unknown:
Total number of matches played.

Reasoning:
Assuming the total number of matches played as x, equating 40% of x is to 10, the value of x can be found.

Solution:

Let the total number of matches played = x

$$40\% \text{ of } x = 10$$

$$\frac{40}{100} \times x = 10$$

$$x = \frac{10 \times 100}{40}$$

$$= 25$$

Answer:

The total number of matches played by football team is 25.

Q5. If Chameli had Rs 600 left after spending 75% of her money, how much did she have in the beginning?

Difficulty Level: Medium

What is known:

Percentage of amount Chameli spent = 75%

Amount left with her = Rs 600

What is unknown:

Amount Chameli had in the beginning

Reasoning:

Since the whole is considered as 100%, Percentage of amount left with Chameli is

$$(100 - 75)\% = 25\%$$

Assuming the total amount in the beginning as x, and equating 25% of x to 600, the value of x can be found.

Solution:

Let the total amount Chameli had with her in the beginning = x

Percentage of amount left with Chameli = 100-75 = 25%

$$25\% \text{ of } x = 600$$

$$\frac{25}{100} \times x = 600$$

$$x = \frac{600 \times 100}{25}$$

$$= 2,400$$

Answer:

The amount that Chameli had in the beginning is Rs 2,400

Q6. If 60% people in a city like cricket, 30% like football and the remaining like other games, then what percent of the people like other games? If the total number of people is 50 lakhs, find the exact number who like each type of game.

Difficulty Level: Medium

What is known:
Percentage of people who like cricket = 60%
Percentage of people who like football = 30%
Total number of people: 50 lakhs

What is unknown:
Percentage of people like other games
Exact number of people who like the game

Reasoning:
Since the whole is considered as 100%, percentage of people who like other games is 100% – (60+30) % = 10%

Number of people who like each game can be found using percentage and total number of people.

Solution:
Percentage of people who like other games = 100% – (60+30) % = 10%
Number of people who like cricket

$$= 60\% \text{ of } 50 \text{ lakhs}$$
$$= \frac{60}{100} \times 50,00,000$$
$$= 30,00,000$$
$$= 30 \text{ lakhs}$$

Number of people who like football

$$= 30\% \text{ of } 50 \text{ lakhs}$$
$$= \frac{30}{100} \times 50,00,000$$
$$= 15,00,000$$
$$= 15 \text{ lakhs}$$

Number of people who like other games

$$= 10\% \text{ of } 50 \text{ lakhs}$$
$$= \frac{10}{100} \times 50,00,000$$
$$= 5,00,000$$
$$= 5 \text{ lakhs}$$

Answer:

Percentage of people who like other games = 10%
Number of people who like cricket = 30 lakhs
Number of people who like football = 15 lakhs
Number of people who like other games = 5 lakhs

Chapter-8: Comparing Quantities

Exercise 8.2 (Page 125 of Grade 8 NCERT)

Q1. A man got a 10% increase in his salary. If his new salary is Rs 1,54,000, find his original salary.

Difficulty Level: Medium

What is known:
Percentage of increase in salary = 10%
New Salary = Rs 1,54,000

What is unknown:
Original Salary

Reasoning:
Whole is considered as 100%. Percentage increase is 10%. So, the new salary is original salary plus 10% of original salary.

Solution:
Let the original salary be x
Percentage increase is 10%
Therefore, Original salary + Increment in salary = New Salary

$$x + 10\% \times x = 154000$$

$$x + \frac{10}{100} \times x = 154000$$

$$\frac{110}{100} \times x = 154000$$

$$x = \frac{154000 \times 100}{40}$$

$$= 140000$$

Answer:
Original salary is Rs 1,40,000

Q2. On Sunday 845 people went to the zoo. On Monday only 169 people went. What is the per cent decrease in the people visiting the zoo on Monday?

Difficulty Level: Medium

What is known:
Number of people visited zoo on Sunday = 845
Number of people visited zoo on Monday = 169

What is unknown:
Percent decrease in the people visiting zoo on Monday

Reasoning:
Finding the decrease in number of people and calculating it for 100, will get us the percentage decrease.

Solution:
Decrease in the number of people = 845-169 = 676
Percentage decrease in the number of people

$$= \frac{676}{845} \times 100$$
$$= 4 \times 20$$
$$= 80\%$$

Answer:
Percentage decrease in the people visiting zoo on Monday = 80%

Q3. A shopkeeper buys 80 articles for Rs 2,400 and sells them for a profit of 16%. Find the selling price of one article.

Difficulty Level: Medium

What is known:
Number of articles bought = 80
Cost Price = Rs 2,400
Profit Percentage = 16%

What is unknown:
Selling price of one article

Reasoning:
With Cost Price and Profit Percentage, the Selling Price of all articles can be found.
Dividing Selling Price by number of articles will result in Selling Price of one article.

Solution:
Cost Price of 80 articles = 2400
Profit Percentage = 16%

$$\text{Selling Price} = \frac{116}{100} \times 2400$$
$$= \text{Rs}\, 2784$$

OR

$$S.P. = C.P. + 16\%\ C.P.$$
$$= 2400 + \frac{16}{100} \times 2400$$
$$= 2400 + 384$$
$$= \text{Rs } 2784$$
$$S.P \text{ of one article} = \frac{2784}{80}$$
$$= \text{Rs } 34.80$$

Answer:
Selling Price of one article = Rs 34.80

Q4. The cost of an article was Rs 15,500. Rs 450 was spent on its repairs. If it is sold for a profit of 15%, find the selling price of the article.

Difficulty Level: Medium

What is known:
Cost Price of the article = Rs 15,500
Overhead charges = Rs 450
Profit (in %) = 15%

What is unknown:
Selling Price of the article

Reasoning:
New Cost Price = Cost Price + Overhead charges
Selling Price = Cost Price + Profit (Profit = 15% of C.P.)

Solution:
$$\text{New } C.P. = 15500 + 450$$
$$= 15950$$
$$S.P. = C.P. + Profit$$
$$= C.P. + 15\% \times C.P.$$
$$= C.P. + \frac{15}{100} \times C.P.$$
$$= 115\% C.P.$$
$$S.P. = \frac{115}{100} \times 15950$$
$$= 18342.50$$

Answer:
Selling Price of the article = Rs 18,342.50

Q5. A VCR and TV were bought for Rs 8,000 each. The shopkeeper made a loss of 4% on the VCR and a profit of 8% on the TV. Find the gain or loss percent on the whole transaction.

Difficulty Level: Medium

What is known:
C.P of VCR and TV each = Rs 8000
Loss (in %) on VCR = 4%
Profit (in %) on TV = 8%

What is unknown:
Gain or loss of whole transaction

Reasoning:
S.P of VCR + S.P of TV is compared with 16,000 to know gain or loss

$$\text{Gain}\% = \frac{\text{Gain}}{\text{C.P}} \times 100$$

$$\text{Loss}\% = \frac{\text{Loss}}{\text{C.P}} \times 100$$

Solution:

$$\begin{aligned} S.P.\text{ of VCR} &= C.P. - Loss\% \times 8000 \\ &= 8000 - 4\% \times 8000 \\ &= 8000 - \frac{4}{100} \times 8000 \\ &= 8000 - 320 \\ &= \text{Rs } 7680 \end{aligned}$$

$$\begin{aligned} S.P.\text{ of TV} &= C.P. + Profit\ \% \times C.P. \\ &= 8000 + \frac{8}{100} \times 8000 \\ &= 8000 + 640 \\ &= \text{Rs } 8640 \end{aligned}$$

$$\begin{aligned} S.P.\text{ of VCR} + \text{TV} &= 7680 + 8640 \\ &= \text{Rs } 16320 \end{aligned}$$

$$\begin{aligned} C.P.\text{ of VCR} + \text{TV} &= 8000 + 8000 \\ &= \text{Rs } 16000 \end{aligned}$$

$$\begin{aligned} \text{Gain} &= \text{Rs } (16320 - 16000) \\ &= \text{Rs } 320 \end{aligned}$$

$$\begin{aligned} \text{Gain}\% &= \frac{\text{Gain}}{\text{C.P}} \times 100 \\ &= \frac{320}{16000} \times 100 \\ &= 2\% \end{aligned}$$

Answer:
The shopkeeper gains 2% on the whole transaction

Q6. During a sale, a shop offers a discount of 10% on the marked price of all the items. What would a customer have to pay for a pair of jeans marked at Rs 1450 and two shirts marked at Rs 850 each?

Difficulty Level: Hard

What is known:
Discount percentage = 10%
Marked price of a pair of jeans = Rs 1450
Marked Price of a shirt = Rs 850

What is unknown:
Amount customer has to pay for a pair of jeans and two shirts after discount.

Reasoning:
(i) M.P. of a pair of jeans = C.P. of two jeans - Discount
(ii) M.P. of a shirt = C.P. of two shirts – Discount

Adding (i) and (ii) will give the amount has to pay.

Solution:
M.P of a pair of jeans = 1450

M.P of 2 shirts $= 850 \times 2 = 1700$

Total M.P. = 1450 + 1700 =3150
Discount on Total M.P $= 10\% \times 3150$

$$= \frac{10}{100} \times 3150$$
$$= 315$$

Answer:
The amount customer has to pay is 3150 - 315 = Rs 2835

Q7. A milkman sold two of his buffaloes for Rs 20,000 each. On one he made a gain of 5% and on the other a loss of 10%. Find his overall gain or loss. (**Hint:** Find CP of each).

Difficulty Level: Hard

What is known:
S.P of each buffalo is Rs 20,000
Buffalo 1 = On selling one gain% made is = 5%
Buffalo 2 = On selling one loss% made is = 10%
Number of buffaloes sold = 2

What is unknown:
Overall gain or loss

Reasoning:

(C.P of buffalo 1 + C.P of buffalo 2) is compared with S.P of Rs 40,000 to know gain or loss

$$S.P = \frac{100 + Gain\%}{100} \times C.P$$

$$S.P = \frac{100 - Loss\%}{100} \times C.P$$

Solution:

C.P. of buffalo (5% gain)

$$20000 = \frac{105}{100} \times C.P.$$

$$C.P. = \frac{100}{105} \times 20000$$

$$C.P. = \frac{20}{21} \times 20000$$

$$C.P. = Rs\,19,047.62$$

C.P. of buffalo (10% loss)

$$20000 = \frac{90}{100} \times C.P.$$

$$C.P. = \frac{100}{90} \times 20000$$

$$C.P. = \frac{10}{9} \times 20000$$

$$C.P. = Rs\ \ 22,222.22$$

Total Cost Price of two buffaloes = 19,047.62 + 22,222.22
= Rs 41,269.84

Loss = Cost Price – Selling Price
= 41,269.84 – 40000
= 1269.84

Loss = Rs 1269.84

Answer:

The milkman incurred a loss of Rs 1269.84 on the whole transaction.

Q8. The price of a TV is Rs 13,000. The sales tax charged on it is at the rate of 12%. Find the amount that Vinod will have to pay if he buys it.

Difficulty Level: Hard

What is known:

Price of the TV = Rs 13,000
Sales tax on the TV = 12%

What is unknown:
Amount Vinod will have to pay if he buys the TV

Reasoning:
Amount Vinod has to pay to buy = 13,000 + 12% of 13,000

Solution:

Sales Tax Amount = $\frac{12}{100} \times 13000$ = Rs 1560

Answer:
Amount Vinod has to pay to buy = 13,000 + 1560 = Rs 14,560

Q9. Arun bought a pair of skates at a sale where the discount given was 20%. If the amount he pays is Rs 1,600 find the marked price.

Difficulty Level: Hard

What is known:
Discount percentage = 20%
Amount paid by Arun to buy skates is Rs 1,600

What is unknown:
Marked Price of a pair of skates

Reasoning:
Assuming the marked price as x and equating marked price minus discount to 1600, value of x (Marked price) can be found.

Solution:
Let the Marked price of a pair of skates be x
Discount percentage is 20%
Therefore, M.P. of skates - Discount = 1600 (Discount = Discount % $\times$ M.P.)

$$x - 8\% \times x = 1600$$
$$x - \frac{8}{100} \times x = 1600$$
$$\frac{80}{100} \times x = 1600$$
$$x = 1600 \times \frac{100}{80}$$
$$x = 2000$$

Marked price = Rs 2000

Answer:
Therefore, the Marked Price of a pair of skates is Rs 2000.

Q10. I purchased a hairdryer for Rs 5,400 including 8% VAT. Find the price before VAT was added.

Difficulty Level: Hard

What is known:
Price of hair dryer with VAT = Rs 5400
VAT% = 8%

What is unknown:
Price of hair dryer before VAT was added

Reasoning:
Assuming initial price of hair dryer as x and equating S.P. of hair dryer plus VAT to Rs 5400, value of x can be found.

Solution:
Let the initial price of hair dryer be Rs x
Price of hair dryer with VAT is Rs 5400
VAT % = 8%
VAT = 8% of initial price of hair dryer
So, initial price of hair dryer + VAT = 5400

$$x + 8\% \times x = 5400$$

$$x + \frac{8}{100} \times x = 5400$$

$$\frac{108}{100} \times x = 5400$$

$$x = \frac{5400 \times 100}{108}$$

$$x = \text{Rs } 5000$$

Answer:
Price of hair dryer before VAT was added is Rs 5000

Q11. An article was purchased for Rs 1239 including GST of 18%. Find the price of the article before GST was added?

Difficulty Level: Medium
What is known:
Price of article including GST = Rs 1239
GST = 18%

What is unknown:
Price of the article before GST was added.

Reasoning:
GST is 18%, initial price (before GST was added) + GST is Rs 1239.

Assuming initial price as x, and using above, x can be calculated.

Solution:

Let the price of the article before GST was added be x

GST% = 18%

GST = 18% of initial price of article

Then, initial price of article + GST = 1239

$$x + 18\% \times x = 1239$$

$$x + \frac{18}{100}x = 1239$$

$$\frac{118}{100} \times x = 1239$$

$$x = \frac{1239 \times 100}{118}$$

$$x = 1050$$

Answer:

Price of the article before GST was added is Rs 1050

Chapter-8: Comparing Quantities

Exercise 8.3 (Page 133 of Grade 8 NCERT)

Q1. Calculate the amount and compound interest on

(i) Rs 10,800 for 3 years at $12\frac{1}{2}$% per annum compounded annually.

(ii) Rs 18,000 for $2\frac{1}{2}$ years at 10% per annum compounded annually.

(iii) Rs 62,500 for $1\frac{1}{2}$ years at 8% per annum compounded half yearly.

(iv) Rs 8,000 for 1 year at 9% per annum compounded half yearly.
(You could use the year by year calculation using SI formula to verify).

(v) Rs 10,000 for 1 year at 8% per annum compounded half yearly.

Difficulty Level: Hard

What is known:
Principal, Time Period and Rate of Interest

What is unknown:
Amount and Compound Interest (C.I)

Reasoning:

$A = P\left(1+\frac{r}{100}\right)^n$

P = Rs 10800

N = 3 years

$R = 12\frac{1}{2}\% = \frac{25}{2}\%$ compounded annually

Solution (i):

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$= 10800\left(1+\frac{25}{2\times 100}\right)^3$$

$$= 10800\left(\frac{225}{200}\right)^3$$

$$= 10800\times\frac{225\times 225\times 225}{200\times 200\times 200}$$

$$= 15377.34$$

$$C.I. = A - P$$

$$= 15377.34 - 10800$$

$$= 4577.34$$

Answer:

Amount = Rs 15377.34

Compound Interest = Rs 4577.34

Solution (ii):

P= Rs 18000

$n = 2\frac{1}{2}$ years

R = 10% p.a compounded annually

$$A = P\left(1+\frac{r}{100}\right)^n$$

Since 'n' is $2\frac{1}{2}$ years, amount can be calculated for 2 years and having amount as principal S.I can be calculated for $\frac{1}{2}$ year, because C.I is only annually.

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$= 18000\left(1+\frac{10}{100}\right)^2$$

$$= 18000\times\frac{11\times11}{10\times10}$$

$$= 21780$$

Amount after 2 years = Rs 21780

$$\text{S.I. for } \frac{1}{2} \text{ years} = \frac{1}{2}\times21780\times\frac{10}{100}$$

$$= 1089$$

$$\text{Amount after } 2\frac{1}{2} \text{ years} = 21780+1089$$

$$= \text{Rs } 22869$$

$$\text{Compound Interest after } 2\frac{1}{2} \text{ years} = 22869-18000$$

$$= \text{Rs } 4869$$

Solution (iii):

P = Rs 62,500

$n = 1\frac{1}{2}$ years

R = 8% p.a. compounded half yearly

$$A = P\left(1+\frac{r}{100}\right)^n$$

There are 3 half years in $1\frac{1}{2}$ years. Therefore, compounding has to be done 3 times and rate of interest will be 4%

$$A = P\left(1+\frac{r}{100}\right)^n$$
$$= 62500\left(1+\frac{4}{100}\right)^3$$
$$= 62500\times\frac{104\times104\times104}{100\times100\times100}$$
$$= 70304$$

C.I. after $1\frac{1}{2}$ years $(8\%$ p.a. interest half yearly$) = 70304 - 62500$
$= 7804$

Amount after $1\frac{1}{2}$ years $(8\%$ p.a. interest half yearly$) = 70304$

Answer:

Amount after $1\frac{1}{2}$ years = Rs 70304

Compound Interest after $1\frac{1}{2}$ years = Rs 7804

Solution (iv):

P = Rs 8000
n = 1 year
R = 9% p.a. compounded half yearly

$$A = P\left(1+\frac{r}{100}\right)^n$$

S.I. for 1st 6 months $= \frac{1}{2}\times8000\times\frac{9}{100}$
$= 40\times9$
$= 360$

Amount after 1st 6 months including Simple Interest $= 8000+360$
$=$ Rs 8360

Principal for 2nd 6 months = Rs 8360

S.I. for 2nd 6 months $= \frac{1}{2}\times8360\times\frac{9}{100}$
$= \frac{418\times9}{10}$
$= 376.20$

C.I. after 1 year $(9\%$ p.a. interest half yearly$) = 360+376.20$
$= 736.20$

Amount after 1 year $(9\%$ p.a. interest half yearly$) = 8000+736.20$
$= 8736.20$

Answer:

Amount after 1 year = Rs 8736.20
Compound Interest after 1 year = Rs 736.20

Solution (v):

P = Rs 10,000
n = 1 year
R = 8% p.a. compounded half yearly

$$A = P\left(1+\frac{r}{100}\right)^n$$

There are 2 half years in 1 years. Therefore, compounding has to be done 2 times and rate of interest will be 4%

$$A = P\left(1+\frac{r}{100}\right)^n$$
$$= 10000\left(1+\frac{4}{100}\right)^2$$
$$= 10000\times\frac{104\times104}{100\times100}$$
$$= 10816$$

$$\text{C.I. after 1 year } (8\% \text{ p.a. interest half yearly}) = 10816+10000$$
$$= 816$$
$$\text{Amount after 1 year } (8\% \text{ p.a. interest half yearly}) = 10816$$

Answer:

Amount after 1 year = Rs 10816
Compound Interest after 1 year = Rs 816

Q2. Kamala borrowed Rs 26400 from a Bank to buy a scooter at a rate of 15% p.a. compounded yearly. What amount will she pay at the end of 2 years and 4 months to clear the loan?
(**Hint:** Find A for 2 years with interest is compounded yearly and then find SI on the 2nd year amount for $\frac{4}{12}$ years.)

Difficulty Level: Medium

What is known:

Principal, Time Period and Rate of Interest

What is unknown:

Amount and Compound Interest (C.I)

Reasoning:

$$A = P\left(1+\frac{r}{100}\right)^n$$

P = Rs 26400
N = 2 years 4 months
R = 15% compounded annually

Solution:

First, we will calculate Compound Interest (C.I) for the period of 2 years

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$= 26400\left(1+\frac{15}{100}\right)^2$$

$$= 26400\left(\frac{100}{100}+\frac{15}{100}\right)^2$$

$$= 26400\times\frac{115\times115}{100\times100}$$

$$= 26400\left(\frac{23}{20}\times\frac{23}{20}\right)$$

$$= 26400\times1.3225$$

$$= 34914$$

$$\text{C.I.} = A - P$$

$$= 34914 - 26400$$

$$= 8514$$

Second, we will find Simple Interest (S.I) for the period of 4 months

Principal for 4 months after C.I. for 2 years = Rs 34,914

$$\text{S.I. for 4 months} = \frac{4}{12}\times34914\times\frac{15}{100}$$

$$= \frac{1}{3}\times34914\times\frac{3}{20}$$

$$= \frac{34914}{20}$$

$$= 1745.70$$

$$\text{Total interest for 2 years 4 months} = 8514 + 1745.70$$

$$= 10259.70$$

$$\text{Total amount for 2 years 4 months} = 26400 + 10259.70$$

$$= 36659.70$$

Answer:

The amount Kamala will have to pay after 2 years 4 months = Rs 36659.70

Q3. Fabina borrows Rs 12,500 at 12% per annum for 3 years at simple interest and Radha borrows the same amount for the same time period at 10% per annum, compounded annually. Who pays more interest and by how much?

Difficulty Level: Medium

What is known:

Principal, Time Period and Rate of Interest

What is unknown:
Simple Interest and Compound Interest (C.I)

Reasoning:
For Simple Interest:

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

P = Rs 12,500
N = 3 years
R = 12% simple interest

For Compound Interest:

$$A = P\left(1 + \frac{r}{100}\right)^n$$

P = Rs 12,500
N = 3 years
R = 10% compounded annually

Solution:
Simple Interest paid by Fabina for 3 years at the rate of 12% per annum

$$\text{S.I. for 3 years} = 3 \times 12500 \times \frac{12}{100}$$
$$= 3 \times 125 \times 12$$
$$= 4500$$

Amount paid by Radha for 3 years at the rate of 10% p.a. compounded annually

$$A = P\left(1 + \frac{r}{100}\right)^n$$
$$= 12500\left(1 + \frac{10}{100}\right)^3$$
$$= 12500\left(\frac{11}{10}\right)^3$$
$$= 12500\left(\frac{11 \times 11 \times 11}{10 \times 10 \times 10}\right)$$
$$= 12500\left(\frac{1331}{1000}\right)$$
$$= 12500 \times 1.331$$
$$= 16637.50$$

$$\text{Compound Interest} = 16637.50 - 12500$$
$$= 4137.50$$

Since 4500 > 4137.50, Fabina paid more interest than Radha

Additional Interest paid by Fabina = 4500 – 4137.50 = Rs 362.50

Q4. I borrowed Rs 12000 from Jamshed at 6% per annum simple interest for 2 years. Had I borrowed this sum at 6% per annum compound interest, what extra amount would I have to pay?

Difficulty Level: Medium

What is known:
Principal, Time Period and Rate of Interest

What is unknown:
Simple Interest and Compound Interest (C.I)

Reasoning:
For Simple Interest:

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

P = Rs 12,000
N = 2 years
R = 6% simple interest

For Compound Interest:

$$A = P\left(1 + \frac{r}{100}\right)^n$$

P = Rs 12,000
N = 2 years
R = 6% compounded annually

Solution:
Simple Interest to be paid for 2 years at the rate of 6% per annum

$$\text{S.I. for 2 years} = 2 \times 12000 \times \frac{6}{100}$$
$$= 2 \times 120 \times 6$$
$$= 1440$$

Compound Interest to be paid for 2 years at the rate of 6% per annum

$$A = P\left(1 + \frac{r}{100}\right)^n$$
$$= 12000\left(1 + \frac{6}{100}\right)^2$$
$$= 12000\left(\frac{100}{100} + \frac{6}{100}\right)^2$$
$$= 12000\left(\frac{106 \times 106}{100 \times 100}\right)$$
$$= 12000\left(\frac{11236}{10000}\right)$$
$$= 12000 \times 1.1236$$
$$= 13483.20$$

$$\text{Compound Interest} = 13483.20 - 12000$$
$$= 1483.20$$
$$\text{Compound Interest} - \text{Simple Interest} = 1483.20 - 1440$$
$$= 43.20$$

Answer:
The extra amount that would have been paid = Rs 43.20

Q5. Vasudevan invested Rs 60,000 at an interest rate of 12% per annum compounded half yearly. What amount would he get
(i) after 6 months?
(ii) after 1 year?

Difficulty Level: Medium

What is known:
Principal, Time Period and Rate of Interest

What is unknown:
Amount and Compound Interest (C.I.)

Reasoning:

$$A = P\left(1+\frac{r}{100}\right)^n$$

P = Rs 60,000
N = 6 months and 1 year
R = 12% p.a. compounded half yearly

Solution:
(i) For easy calculation of compound interest, we will put Interest Rate as 6% half yearly and 'n' as 1.

Compound Interest to be paid for 6 months

$$A = P\left(1+\frac{r}{100}\right)^n$$
$$= 60000\left(1+\frac{6}{100}\right)^1$$
$$= 60000\left(\frac{100}{100}+\frac{6}{100}\right)^1$$
$$= 60000\left(\frac{106}{100}\right)$$
$$= 60000\times 1.06$$
$$= 63600$$
$$\text{Compound Interest for 6 months} = 63600 - 60000$$
$$= 3600$$

(ii) Compound Interest to be paid for 12 months (1 year) compounded half yearly.
So, n = 2, r = 6%

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$= 60000\left(1+\frac{6}{100}\right)^2$$

$$= 60000\left(\frac{100}{100}+\frac{6}{100}\right)^2$$

$$= 60000\left(\frac{106}{100}\right)^2$$

$$= 60000\left(\frac{106\times106}{100\times100}\right)$$

$$= 60000\left(\frac{11236}{10000}\right)$$

$$= 60000\times1.1236$$

$$= 67416$$

Compound Interest for 12 months $= 67416 - 60000$

$$= 7416$$

Answer:
The amount that Vasudevan will get after 6 months = Rs 63600
The amount that Vasudevan will get after 1 year = Rs 67416

Q6. Arif took a loan of Rs 80,000 from a bank. If the rate of interest is 10% per annum, find the difference in amounts he would be paying after $1\frac{1}{2}$ years if the interest is

(i) Compounded annually
(ii) Compounded half-yearly

Difficulty Level: Medium

What is known:
Principal, Time Period and Rate of Interest

What is unknown:
Amount and Compound Interest (C.I.)

Reasoning:

$$A = P\left(1+\frac{r}{100}\right)^n$$

P = Rs 80,000

N = $1\frac{1}{2}$ years

R = 10% p.a. compounded half yearly and 10% p.a. compounded yearly

Solution:

For calculation of Compound Interest (C.I.) compounded annually:

Since 'n' is $1\frac{1}{2}$ years, amount can be calculated for 1 year and having that amount as principal, S.I can be calculated for $\frac{1}{2}$ year, because C.I is only annually.

$$A = P\left(1+\frac{r}{100}\right)^n$$
$$= 80000\left(1+\frac{10}{100}\right)^1$$
$$= 80000\times\frac{11}{10}$$
$$= 80000\times 1.1$$
$$= 88000$$

Amount after 1 years = Rs 88,000

Therefore, the principal for the $1\frac{1}{2}$ th year = Rs 88,000

$$\text{S.I. for } \frac{1}{2} \text{ years} = \frac{1}{2}\times 88000\times\frac{10}{100}$$
$$= \frac{8800}{2}$$
$$= 4400$$

$$\text{Amount after } 1\frac{1}{2} \text{ years} = 88000+4400$$
$$= \text{Rs } 92400$$

$$\text{Compound Interest after } 1\frac{1}{2} \text{ years} = 92400-80000$$
$$= \text{Rs } 12400$$

---------- { For the C.I. to be charged yealy }

For calculation of Compound Interest (C.I.) compounded half-yearly, we will consider as rate 5% p.a. and 'n' as 3

$$A = P\left(1+\frac{r}{100}\right)^n$$
$$= 80000\left(1+\frac{5}{100}\right)^3$$
$$= 80000\left(1+\frac{1}{20}\right)^3$$
$$= 80000\left(\frac{21}{20}\right)^3$$
$$= 80000\times\frac{21}{20}\times\frac{21}{20}\times\frac{21}{20}$$
$$= 80000\times\frac{9261}{8000}$$
$$= 10\times 9261$$
$$= 92610$$

Compound Interest after $1\frac{1}{2}$ years $= 92610 - 80000$ ---------- {For the C.I. to be charged half-yealy}

$= \text{Rs}\,12610$

Answer:

Difference in amounts he would be paying = Rs 92,610 − Rs 92,400 = Rs 210

Q7. Maria invested Rs 8,000 in a business. She would be paid interest at 5% per annum compounded annually. Find:

(i) The amount credited against her name at the end of the second year

(ii) The interest for the 3rd year.

Difficulty Level: Medium

What is known:

Principal, Time Period and Rate of Interest

What is unknown:

Amount and Compound Interest (C.I.)

Reasoning:

$A = P\left(1+\frac{r}{100}\right)^n$

P = Rs 8,000

N = 2 years and 3rd year

R = 5% p.a. compounded annually

Solution:

(i) For calculation of amount credited at the end of second year:

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$= 8000\left(1+\frac{5}{100}\right)^2$$

$$= 8000\left(1+\frac{1}{20}\right)^2$$

$$= 8000\left(\frac{21}{20}\right)^2$$

$$= 8000\times\frac{21}{20}\times\frac{21}{20}$$

$$= 8000\times\frac{441}{400}$$

$$= 20\times 441$$

$$= 8820$$

(ii) For calculating C.I. for the 3rd year, the principal = 8820

$$\text{S.I.} = \frac{P \times R \times T}{100}$$
$$= \left(\frac{8820 \times 5 \times 1}{100}\right)$$
$$= 441$$

Answer:

The amount credited at the end of the 2nd year = Rs 8820
The interest for the 3rd year = Rs 441

Q8. Find the amount and the compound interest on Rs 10,000 for $1\frac{1}{2}$ years at 10% per annum, compounded half yearly. Would this interest be more than the interest he would get if it was compounded annually?

Difficulty Level: Medium

What is known:

Principal, Time Period and Rate of Interest

What is unknown:

Amount and Compound Interest (C.I.)

Reasoning:

$A = P\left(1+\frac{r}{100}\right)^n$

P = Rs 10,000

N = $1\frac{1}{2}$ years

R = 10% p.a. compounded annually and half-yearly

Solution:

For calculation of C.I. compounded half yearly, we will take Interest rate as 5%

$$A = P\left(1+\frac{r}{100}\right)^n$$
$$= 10000\left(1+\frac{5}{100}\right)^3$$
$$= 10000\left(1+\frac{1}{20}\right)^3$$
$$= 10000\left(\frac{21}{20}\right)^3$$
$$= 10000 \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20}$$

$$= 10000 \times \frac{9261}{8000}$$
$$= 5 \times \frac{9261}{4}$$
$$= 11576.25$$

Interest earned at 10% p.a. compounded half-yearly = 11576.25 – 10000 = Rs 1576.25

Answer:
The amount earned at 10% p.a. compounded half-yearly = 11576.25
The C.I. earned at 10% p.a. compounded half-yearly = 1576.25

The above interest earned being compounded half-yearly would be more than the interest compounded annually since interest compounded half yearly is always more than compounded annually at the same rate of interest.

Q9. Find the amount which Ram will get on Rs 4096, if he gave it for 18 months at $12\frac{1}{2}\%$ per annum, interest being compounded half yearly.

Difficulty Level: Medium

What is known:
Principal, Time Period and Rate of Interest

What is unknown:
Amount

Reasoning:
$A = P\left(1+\frac{r}{100}\right)^n$
P = Rs 4096
N = 18 months
R = $12\frac{1}{2}\%$ p.a. compounded half-yearly

Solution:
For calculation of C.I. compounded half yearly, we will take Interest rate as $6\frac{1}{4}\% = \frac{25}{4}\%$ and 'n' as 3 $(18 \div 6 = 3)$

$$A = P\left(1+\frac{r}{100}\right)^n$$
$$= 4096\left(1+\frac{25}{100\times 4}\right)^3$$

$$= 4096\left(1+\frac{25}{400}\right)^3$$

$$= 4096\left(\frac{425}{400}\right)^3$$

$$= 4096\left(\frac{17}{16}\right)^3$$

$$= 4096\times\frac{17}{16}\times\frac{17}{16}\times\frac{17}{16}$$

$$= 4096\times\frac{4913}{4096}$$

$$= 4913$$

Answer:
The total amount that Ram will get at the end of 18 months = Rs 4913

Q10 The population of a place increased to 54,000 in 2003 at a rate of 5% per annum

(i) find the population in 2001.
(ii) what would be its population in 2005?

Difficulty Level: Medium

What is known:
Population in 2003, Time Period and Rate of population growth

What is unknown:
Population in 2005 and 2001

Reasoning:

$$A = P\left(1+\frac{r}{100}\right)^n$$

P = 54000 in the year 2003
N = 2 years
R = 5% p.a. compounded annually

Solution:
(i) Population in the year 2001

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$54000 = P\left(1+\frac{5}{100}\right)^2$$

$$54000 = P\left(1+\frac{1}{20}\right)^2$$

$$54000 = P\left(\frac{21}{20}\right)^2$$

$$54000 = P \times \frac{21}{20} \times \frac{21}{20}$$

$$P = 54000 \times \frac{400}{441}$$

$$P = 48979.6$$

The population in 2001 = 48980.

(ii) Population in the year 2005

$$A = P\left(1 + \frac{r}{100}\right)^n$$

$$= 54000\left(1 + \frac{5}{100}\right)^2$$

$$= 54000\left(1 + \frac{1}{20}\right)^2$$

$$= 54000\left(\frac{21}{20}\right)^2$$

$$= 54000 \times \frac{21}{20} \times \frac{21}{20}$$

$$= 54000 \times \frac{441}{400}$$

$$= 135 \times 441$$

$$= 59535$$

The population in 2005 = 59535.

Answer:
The population in 2001 = 48980.
The population in 2005 = 59535.

Q11 In a Laboratory, the count of bacteria in a certain experiment was increasing at the rate of 2.5% per hour. Find the bacteria at the end of 2 hours if the count was initially 5, 06,000.

Difficulty Level: Medium

What is known:
Original Count, Time Period and Rate of Increase

What is unknown:
The total count after 2 hours

Reasoning:

$$A = P\left(1+\frac{r}{100}\right)^n$$

$P = 5,06,000$

$N = 2$ hours

$R = 2.5\%$ hour $= \frac{25}{10}$ hours

Solution:

$$A = P\left(1+\frac{r}{100}\right)^n$$

$$= 506000\left(1+\frac{25}{1000}\right)^2$$

$$= 506000\left(1+\frac{1}{40}\right)^2$$

$$= 506000\left(\frac{41}{40}\right)^2$$

$$= 506000\times\frac{41}{40}\times\frac{41}{40}$$

$$= 506000\times\frac{1681}{1600}$$

$$= 506000\times 1.050625$$

$$= 531616.25$$

Answer:

The total count of bacteria after 2 hours = 531616

Q12 A scooter was bought at Rs 42,000. Its value depreciated at the rate of 8% per annum. Find its value after one year

Difficulty Level: Medium

What is known:

Original Value, Rate of Depreciation

What is unknown:

The value of scooter after 1 year

Reasoning:

Original value of the scooter = Rs 42,000

Rate of depreciation = 8%

Solution:

$$\text{The value of the scooter after 1 year} = 42000 - \left(42000 \times \frac{8}{100}\right)$$
$$= 42000 - \left(42000 \times \frac{2}{25}\right)$$
$$= 42000 - (1680 \times 2)$$
$$= 42000 - 3360$$
$$= 38640$$

Answer:

The value of the scooter after 1 year (8% depreciation rate) = Rs 38640.

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