NCERT Solutions For Class 8 Maths

Chapter 8 - Fractions in Disguise (Part 2, Chapter 1)

1.1 Fractions As Percentages

Figure It Out (Pages 3-4)

Question 1.
Express the following fractions as percentages?
(i) 3/5
(ii) 7/14
(iii) 9/20
(iv) 72/150
(v) 1/3
(vi) 5/11

Solution:
To convert a fraction into a percentage, multiply it by 100%.
(i) 3/5 × 100%
= 60%
(ii) 7/14 × 100%
= 1/2 × 100%
= 50%
(iii) 9/20 × 100%
= 45%
(iv) 72/150 × 100%
= 48%
(v) 1/3 × 100%
= 100/3%
= 33⅓%
(vi) 5/11 × 100%
= 500/11%
= 45 5/11%
≈ 45.45%

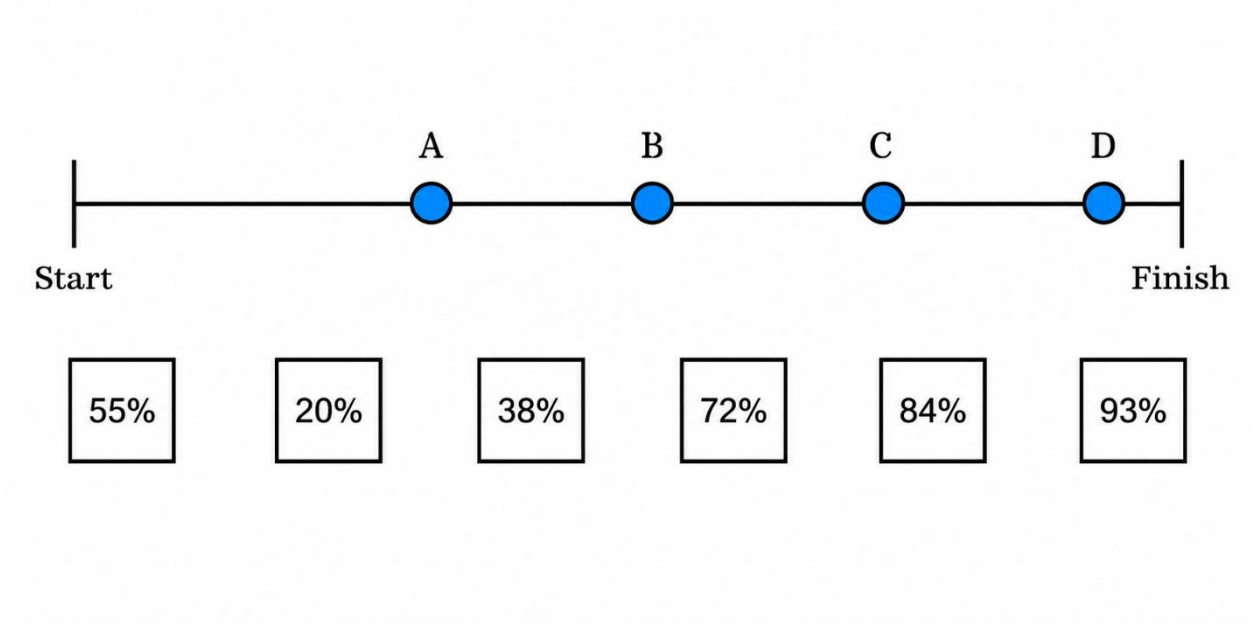
Question 2.
Nandini has 25 marbles, of which 15 are white. What percentage of her marbles are white?
(i) 10%
(ii) 15%
(iii) 25%
(iv) 60%
(v) 40%
(vi) None of these

Solution:
(iv) 60%
Number of white marbles = 15
Total number of marbles = 25
Percentage of white marbles
= 15/25 × 100%
= 3/5 × 100%
= 60%
Therefore, 60% of Nandini's marbles are white.

Question 3.
In a school, 15 of the 80 students come to school by walking. What percentage of the students come by walking?

Solution:
Number of students who walk to school = 15
Total number of students = 80
Required percentage
= 15/80 × 100%
= 3/16 × 100%
= 18.75%
Therefore, 18.75% of the students come to school by walking.

Question 4.
A group of friends is participating in a long-distance run. The positions of each of them after 15 minutes are shown in the following picture. Match (among the given options) what percentage of the race each of them has approximately completed.



Solution:
By observing the positions of the runners in the given picture, the approximate percentages completed are:
A = 20%
B = 38%
C = 72%
D = 93%

Question 5.
A pair of quantities is shown below. Identify and write appropriate symbols '>', '<', '=' in the blanks. Try to do it without calculations.
(i) 50% ____ 5%
(ii) 5/10 ____ 50%
(iii) 3/11 ____ 61%
(iv) 30% ____ 1/3

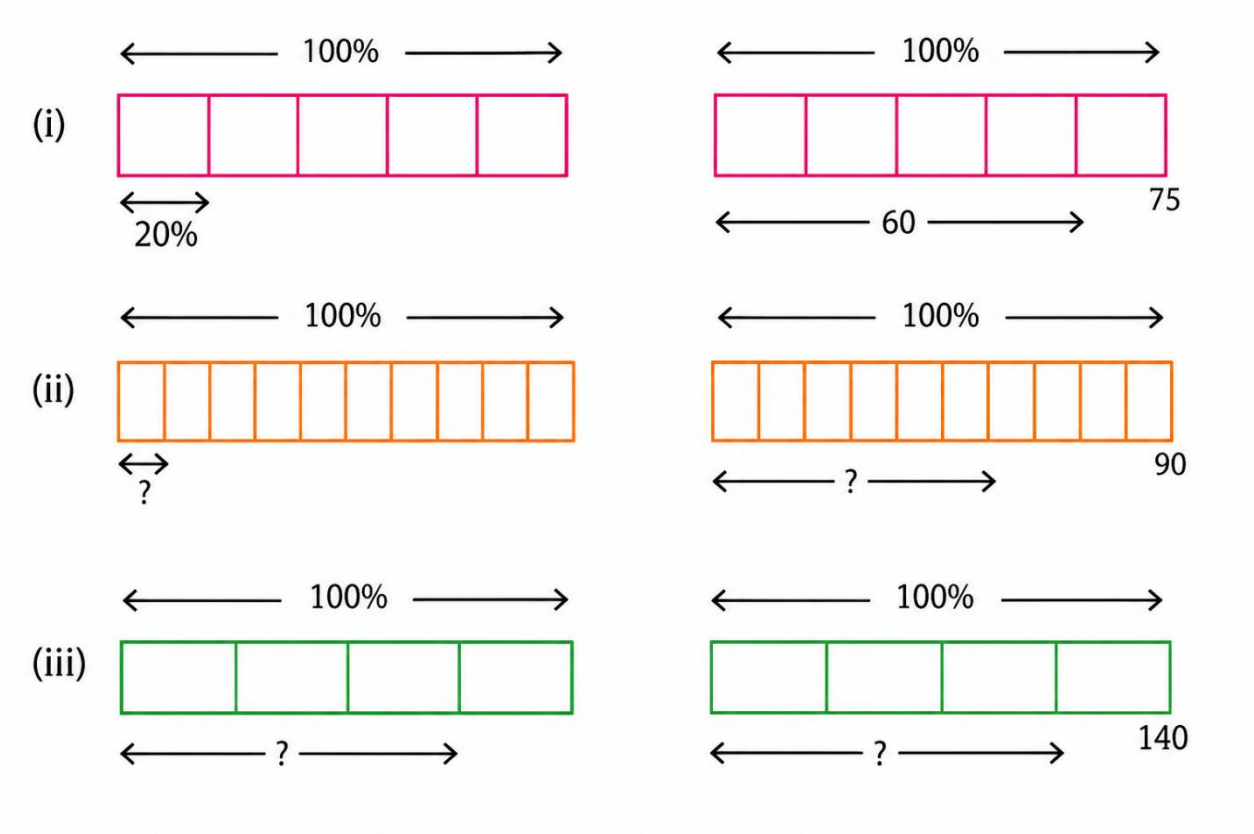
Solution:
(i) 50% > 5%

(ii) 5/10 = 1/2 = 50%
Therefore, 5/10 = 50%.
(iii) 3/11 is approximately 27.27%.
Therefore, 3/11 < 61%.
(iv) 1/3 is approximately 33.33%.
Therefore, 30% < 1/3.
Hence:
(i) 50% > 5%
(ii) 5/10 = 50%
(iii) 3/11 < 61%
(iv) 30% < 1/3

1.2 Percentage of Some Quantity

Figure It Out (Pages 12-14)
Estimate first before making any computations to solve the following questions. Try different methods, including mental computations.

Question 1.
Find the missing numbers. The first problem has been worked out.



Solution:

From the given percentage models, the missing numbers are:

(i) 20%; 60

(ii) 10%; 54

(iii) 25%; 105

Question 2.

Find the value of the following and also draw their bar models.

(i) 25% of 160

(ii) 16% of 250

(iii) 62% of 360

(iv) 140% of 40

(v) 1% of 1 hour

(vi) 7% of 10 kg

Solution:

(i) 25% of 160

= 25/100 × 160

= 1/4 × 160

= 40

Therefore, 25% of 160 is 40.

Bar model: Divide a bar representing 160 into four equal parts. One part represents 25%, which is 40.

(ii) 16% of 250

= 16/100 × 250

= 40

Therefore, 16% of 250 is 40.

Bar model: A bar representing 250 can be divided into 100 equal percentage parts. Sixteen such parts represent 40.

(iii) 62% of 360

= 62/100 × 360

= 223.2

Therefore, 62% of 360 is 223.2.

(iv) 140% of 40

= 140/100 × 40

= 1.4 × 40

= 56

Therefore, 140% of 40 is 56.

Here, 100% represents 40 and the additional 40% represents 16. Thus, 140% represents 56.

(v) 1% of 1 hour

1 hour = 60 minutes = 3600 seconds

1% of 3600 seconds

= 1/100 × 3600

= 36 seconds

Therefore, 1% of 1 hour is 36 seconds.

(vi) 7% of 10 kg

= 7/100 × 10 kg

= 0.7 kg

Therefore, 7% of 10 kg is 0.7 kg or 700 g.

Question 3.
Surya made 60 ml of deep orange paint. How much red paint did he use if red paint made up 3/4 of the deep orange paint?

Solution:
Total quantity of deep orange paint = 60 ml
Quantity of red paint
= 3/4 × 60 ml
= 45 ml
Therefore, Surya used 45 ml of red paint.

Question 4.
Pairs of quantities are shown below. Identify and write appropriate symbols '>', '<', '=' in the boxes. Visualising or estimating can help. Compute only if necessary or for verification.
(i) 50% of 510 ____ 50% of 515
(ii) 37% of 148 ____ 73% of 148
(iii) 29% of 43 ____ 92% of 110
(iv) 30% of 40 ____ 40% of 50
(v) 45% of 200 ____ 10% of 490
(vi) 30% of 80 ____ 24% of 64

Solution:
(i) 50% of 510 < 50% of 515
The same percentage is being taken of both numbers. Since 510 < 515, its 50% will also be smaller.
(ii) 37% of 148 < 73% of 148
Both percentages are of the same number. Since 37% < 73%, the first quantity is smaller.
(iii) 29% of 43 < 92% of 110
29% of 43
= 29/100 × 43
= 12.47
92% of 110
= 92/100 × 110
= 101.2
Therefore, 29% of 43 < 92% of 110.

(iv) 30% of 40 < 40% of 50
30% of 40
= 12
40% of 50
= 20
Therefore, 30% of 40 < 40% of 50.
(v) 45% of 200 > 10% of 490
45% of 200
= 90
10% of 490
= 49
Therefore, 45% of 200 > 10% of 490.
(vi) 30% of 80 > 24% of 64
30% of 80
= 24
24% of 64
= 15.36
Therefore, 30% of 80 > 24% of 64.

Question 5.
Fill in the blanks appropriately:
(i) 30% of k is 70, 60% of k is ____, 90% of k is ____, 120% of k is ____
(ii) 100% of m is 215, 10% of m is ____, 1% of m is ____, 6% of m is ____
(iii) 90% of n is 270, 9% of n is ____, 18% of n is ____, 100% of n is ____
(iv) Make 2 more such questions and challenge your peers.

Solution:
(i) 30% of k = 70
60% is twice 30%.
Therefore, 60% of k
= 70 × 2
= 140
90% is three times 30%.
Therefore, 90% of k
= 70 × 3
= 210

120% is four times 30%.
Therefore, 120% of k
= 70 × 4
= 280
Answers: 140, 210 and 280.
(ii) 100% of m = 215
10% of m
= 215 ÷ 10
= 21.5
1% of m
= 215 ÷ 100
= 2.15
6% of m
= 2.15 × 6
= 12.9
Answers: 21.5, 2.15 and 12.9.
(iii) 90% of n = 270
9% of n
= 270 ÷ 10
= 27
18% of n
= 27 × 2
= 54
To find 100%:
10% of n
= 270 ÷ 9
= 30
100% of n
= 30 × 10
= 300
Answers: 27, 54 and 300.
(iv) Two similar questions:
(a) 20% of p is 50. Find 40%, 60% and 100% of p.
Answer:
40% = 100

60% = 150
100% = 250
(b) 50% of q is 120. Find 10%, 25% and 100% of q.
Answer:
10% = 24
25% = 60
100% = 240

Question 6.
Fill in the blanks:
(i) 3 is ____ % of 300.
(ii) ____ is 40% of 4.
(iii) 40 is 80% of ____

Solution:
(i) Required percentage
= 3/300 × 100%
= 1%
Therefore, 3 is 1% of 300.
(ii) 40% of 4
= 40/100 × 4
= 1.6
Therefore, 1.6 is 40% of 4.
(iii) Let the required number be x.
80% of x = 40
80/100 × x = 40
x = 40 × 100/80
= 50
Therefore, 40 is 80% of 50.

Question 7.
Is 10% of a day longer than 1% of a week? Create such questions and challenge your peers.

Solution:
10% of one day:
One day = 24 hours
10% of 24 hours
= 10/100 × 24
= 2.4 hours
1% of one week:
One week = 7 × 24 hours
= 168 hours
1% of 168 hours
= 1/100 × 168
= 1.68 hours
Since 2.4 hours > 1.68 hours, 10% of a day is longer than 1% of a week.
Similar questions:

1. Is 10% of a 30-day month less than 50% of a week?

10% of 30 days = 3 days
50% of 7 days = 3.5 days
Yes, 3 days < 3.5 days.

2. Is 50% of a dozen greater than 10% of a score?

50% of 12 = 6
10% of 20 = 2
Yes, 6 > 2.

3. Is 80% of a century less than 45% of a double century?

80% of 100 = 80
45% of 200 = 90
Yes, 80 < 90.

Question 8.
Mariam's farm has a peculiar bull. One day, she gave the bull 2 units of fodder, and the bull ate 1 unit. The next day, she gave the bull 3-units of fodder, and the bull ate 2 units. The day after, she gave the bull 4 units, and the bull ate 3 units. This continued, and on the 99th day, she gave the bull 100 units, and the bull ate 99 units. Represent these quantities as percentages. This task can be distributed among the class. What do you observe?

Solution:
On the first day, the bull ate:
1/2 × 100% = 50%
On the second day:
2/3 × 100% = 66⅔%
On the third day:
3/4 × 100% = 75%
On the fourth day:
4/5 × 100% = 80%
Similarly:
On the 98th day:
98/99 × 100%
≈ 98.99%
On the 99th day:
99/100 × 100%
= 99%
The fractions follow the pattern:
n/(n + 1)
where n is the day number.
Observation:
As the number of days increases, the percentage of fodder eaten gets closer and closer to 100%. However, it remains less than 100% because the bull always leaves one unit of fodder uneaten.

Question 9.
Workers in a coffee plantation take 18 days to pick coffee berries in 20% of the plantation. How many days will they take to complete the picking work for the entire plantation, assuming the rate of work stays the same? Why is this assumption necessary?

Solution:
Time taken to complete 20% of the plantation = 18 days
100% is five times 20%.
Therefore, time required for 100%
= 18 × 5
= 90 days

The workers will take 90 days to complete the work, provided their rate of work remains constant.
This assumption is necessary because the actual rate may change due to:
• Changes in weather conditions
• Workers becoming tired over time
• Workers taking leave or breaks
• Different parts of the plantation requiring different levels of effort
• Changes in the number of workers
• Availability and ripeness of coffee berries

Question 10.
The badminton coach has planned the training sessions such that the ratio of warm-up: play: cool down is 10% : 80% : 10%. If he wants to conduct a training of 90 minutes. How long should each activity last?



Solution:
Total training time = 90 minutes
Warm-up time
= 10% of 90 minutes
= 10/100 × 90
= 9 minutes

Play time
= 80% of 90 minutes
= 80/100 × 90
= 72 minutes
Cool-down time
= 10% of 90 minutes
= 9 minutes
Therefore:
Warm-up = 9 minutes
Play = 72 minutes
Cool-down = 9 minutes
Check:
9 + 72 + 9 = 90 minutes

Question 11.
An estimated 90% of the world's population lives in the Northern Hemisphere. Find the (approximate) number of people living in the Northern Hemisphere based on this year's worldwide population.

Solution:
Using the estimated worldwide population of 8.3 billion given for the question:
Population living in the Northern Hemisphere
= 90% of 8.3 billion
= 90/100 × 8.3 billion
= 7.47 billion
Therefore, approximately 7.47 billion people live in the Northern Hemisphere.

Question 12.
A recipe for the dish, halwa, for 4 people has the following ingredients in the given proportions — Rava: 40%, Sugar: 40%, and Ghee: 20%.

(i) If you want to make halwa for 8 people, what is the proportion of each of the above ingredients?
(ii) If the total weight of the ingredients is 2 kg, how much rava, sugar, and ghee are present?

Solution:
(i) Increasing the number of people changes the total quantity of ingredients but not their percentage proportions.
Therefore, for 8 people:
Rava = 40%
Sugar = 40%
Ghee = 20%
(ii) Total weight of ingredients = 2 kg
Quantity of rava
= 40% of 2 kg
= 40/100 × 2
= 0.8 kg
Quantity of sugar
= 40% of 2 kg
= 0.8 kg
Quantity of ghee
= 20% of 2 kg
= 20/100 × 2
= 0.4 kg
Therefore:
Rava = 0.8 kg
Sugar = 0.8 kg
Ghee = 0.4 kg
Check:
0.8 + 0.8 + 0.4 = 2 kg
1.3 Using Percentages

Figure It Out (Pages 19-20)

Question 1.
If a shopkeeper buys a geometry box for ₹75 and sells it for ₹110, what is his profit margin with respect to the cost?

Solution:
Cost price = ₹75
Selling price = ₹110

Profit
= Selling price − Cost price
= ₹110 − ₹75
= ₹35
Profit percentage with respect to cost
= Profit/Cost price × 100%
= 35/75 × 100%
= 46.67% approximately
Therefore, the shopkeeper's profit percentage with respect to the cost is approximately 46.67%.

Question 2.
I am a carpenter, and I make chairs. The cost of materials for a chair is ₹475, and I want to have a profit margin of 50%. At what price should I sell a chair?

Solution:
Cost of materials = ₹475
Required profit
= 50% of ₹475
= 50/100 × 475
= ₹237.50
Selling price
= Cost price + Profit
= ₹475 + ₹237.50
= ₹712.50
Therefore, the carpenter should sell the chair for ₹712.50.

Question 3.
The total sales of a company (also called revenue) were ₹2.5 crore last year. They had a healthy profit margin of 25%. What was the total expenditure (costs) of the company last year?

Solution:
Taking the stated 25% profit with respect to cost:
Let the total cost be ₹x crore.

Profit
= 25% of x
= 0.25x
Revenue
= Cost + Profit
Therefore:
x + 0.25x = 2.5
1.25x = 2.5
x = 2.5/1.25
= 2
Therefore, the company's total expenditure was ₹2 crore.
Check:
25% of ₹2 crore = ₹0.5 crore
₹2 crore + ₹0.5 crore = ₹2.5 crore

Question 4.
A clothing shop offers a 25% discount on all shirts. If the original price of a shirt is ₹300, how much will Anwar have to pay to buy this shirt?

Solution:
Original price of the shirt = ₹300
Discount
= 25% of ₹300
= 25/100 × 300
= ₹75
Amount to be paid
= Original price − Discount
= ₹300 − ₹75
= ₹225
Therefore, Anwar will have to pay ₹225.

Question 5.
The petrol price in 2015 was ₹60 and ₹100 in 2025. What is the percentage increase in the price of petrol?

(i) 50%
(ii) 40%
(iii) 60%
(iv) 66.66%
(v) 140%
(vi) 160.66%

Solution:
Original price = ₹60
New price = ₹100
Increase in price
= ₹100 − ₹60
= ₹40
Percentage increase
= Increase/Original price × 100%
= 40/60 × 100%
= 2/3 × 100%
= 66⅔%
≈ 66.67%
Therefore, the correct option is:
(iv) 66.66% approximately.

Question 6.
Samson bought a car for ₹4,40,000 after getting a 15% discount from the car dealer. What was the original price of the car? (NCERT Q. No. 3)

Solution:
Let the original price of the car be ₹x.
Discount = 15%
Therefore, Samson paid:
100% − 15% = 85% of the original price.
85% of x = ₹4,40,000
85/100 × x = 4,40,000
x = 4,40,000 × 100/85
x = ₹5,17,647.06 approximately
Therefore, the original price of the car was approximately ₹5,17,647.

Question 7.
1600 people voted in an election, and the winner got 500 votes. What percent of the total votes did the winner get? Can you guess the minimum number of candidates who stood for the election? (NCERT Q. No. 4)

Solution:
Total number of votes = 1600
Votes received by the winner = 500
Percentage of votes received
$= 500/1600 \times 100\%$
$= 31.25\%$
Therefore, the winner received 31.25% of the total votes.
To find the minimum number of candidates:
The remaining votes
$= 1600 - 500$
$= 1100$
Since 500 votes were enough to win, no other candidate could have received more than 500 votes.
If there were only three candidates, the other two candidates would have to share 1100 votes. At least one of them would receive 550 or more votes and would defeat the stated winner.
With four candidates, the remaining 1100 votes can be distributed among three candidates so that each receives fewer than 500 votes.
Therefore, at least four candidates stood in the election.

Question 8.
The price of 1 kg of rice was ₹38 in 2024. It is ₹42 in 2025. What is the rate of inflation? (Inflation is the percentage increase in prices.) (NCERT Q. No. 5)

Solution:
Original price of rice = ₹38 per kg
New price of rice = ₹42 per kg
Increase in price
= ₹42 − ₹38
= ₹4

Rate of inflation
= Increase/Original price × 100%
= 4/38 × 100%
= 10.526...%
Therefore, the rate of inflation is approximately 10.53%.

Question 9.
A number increased by 20% becomes 90. What is the number? (NCERT Q. No. 6)

Solution:
Let the original number be x.
After an increase of 20%, the new number becomes 120% of x.
120% of x = 90
120/100 × x = 90
x = 90 × 100/120
x = 75
Therefore, the original number was 75.
Verification:
20% of 75
= 20/100 × 75
= 15
75 + 15 = 90

Question 10.
A milkman sold two buffaloes for ₹ 80,000 each. On one of them, he made a profit of 5% and on the other a loss of 10%. Find his overall profit or loss. (NCERT Q. No. 7)

Solution:
Selling price of the first buffalo = ₹80,000
Profit = 5%
Therefore, ₹80,000 represents 105% of its cost price.
Cost price of the first buffalo
= 80,000 × 100/105
= ₹76,190.48 approximately

Selling price of the second buffalo = ₹80,000
Loss = 10%
Therefore, ₹80,000 represents 90% of its cost price.
Cost price of the second buffalo
= 80,000 × 100/90
= ₹88,888.89 approximately
Total cost price
= ₹76,190.48 + ₹88,888.89
= ₹1,65,079.37
Total selling price
= ₹80,000 + ₹80,000
= ₹1,60,000
Overall loss
= Total cost price − Total selling price
= ₹1,65,079.37 − ₹1,60,000
= ₹5,079.37 approximately
Loss percentage
= Loss/Total cost price × 100%
= 5,079.37/1,65,079.37 × 100%
≈ 3.08%
Therefore, the milkman incurred an overall loss of approximately ₹5,079.37, or 3.08%.

Question 11.
The population of elephants in a national park increased by 5% in the last decade. If the population of the elephants over the last decade is p, the population now is (NCERT Q. No. 8)
(i) p × 0.5
(ii) p × 0.05
(iii) p × 1.5
(iv) p × 1.05
(v) p + 1.50

Solution:
Population ten years ago = p
Increase in population
= 5% of p

= 5/100 × p
= 0.05p
Current population
= Original population + Increase
= p + 0.05p
= 1.05p
Therefore, the correct option is:
(iv) p × 1.05

Question 12.
Which of the following statements means the same as — "The demand for cameras has fallen by 85% in the last decade"? (NCERT Q. No. 9)
(i) The demand now is 85% of the demand a decade ago.
(ii) The demand a decade ago was 85% of the demand now.
(iii) The demand now is 15% of the demand a decade ago.
(iv) The demand a decade ago was 15% of the demand now.
(v) The demand a decade ago was 185% of the demand now.
(vi) The demand now is 185% of the demand a decade ago.

Solution:
Suppose the demand for cameras a decade ago was 100 units.
Fall in demand = 85% of 100
= 85 units
Present demand
= 100 − 85
= 15 units
Therefore, the demand now is 15% of the demand a decade ago.
Hence, the correct option is:
(iii) The demand now is 15% of the demand a decade ago.

1.4 Growth and Compounding

Figure It Out (Pages 22-24)

Question 1.
The Bank of Yahapur offers an interest rate of 10% p.a. Compare the amount one

earns by depositing ₹20,000 for a period of 2 years with and without compounding annually.

Solution:

Principal = ₹20,000
Rate of interest = 10% per annum
Time = 2 years
Without compounding
Simple interest
= Principal × Rate × Time/100
= 20,000 × 10 × 2/100
= ₹4,000
Total amount
= Principal + Interest
= ₹20,000 + ₹4,000
= ₹24,000
With annual compounding
Amount
= Principal × $(1 + \text{Rate}/100)^2$
= 20,000 × $(1 + 10/100)^2$
= 20,000 × $(1.1)^2$
= 20,000 × 1.21
= ₹24,200
Compound interest
= ₹24,200 − ₹20,000
= ₹4,200
Comparison:
Amount without compounding = ₹24,000
Amount with compounding = ₹24,200
Difference
= ₹24,200 − ₹24,000
= ₹200
Therefore, the depositor receives ₹200 more when the interest is compounded annually.

Question 2.
The Bank of Wahapur offers an interest rate of 5% p.a. Compare the amount one earns by depositing ₹20,000 for a period of 4 years with and without compounding annually.

Solution:
Principal = ₹20,000
Rate = 5% per annum
Time = 4 years
Without compounding
Simple interest
$= 20,000 \times 5 \times 4/100$
= ₹4,000
Total amount
= ₹20,000 + ₹4,000
= ₹24,000
With annual compounding
Amount
$= 20,000 \times (1 + 5/100)^4$
$= 20,000 \times (1.05)^4$
$= 20,000 \times 1.21550625$
= ₹24,310.13 approximately
Compound interest
= ₹24,310.13 − ₹20,000
= ₹4,310.13
Comparison:
Amount without compounding = ₹24,000
Amount with compounding = ₹24,310.13
Difference
= ₹24,310.13 − ₹24,000
= ₹310.13
Therefore, annual compounding gives approximately ₹310.13 more.

Question 3.
Do you observe anything interesting in the solutions of the two questions above? Share and discuss.

Solution:
In both questions, the total simple interest rate is 20%.
In Question 1:
10% per year for 2 years
= 20% without compounding
In Question 2:
5% per year for 4 years
= 20% without compounding
Therefore, the final amount without compounding is ₹24,000 in both cases.
However, the compound amounts are different:
• At 10% for 2 years, the amount is ₹24,200.
• At 5% for 4 years, the amount is approximately ₹24,310.13.
This happens because, under compound interest, interest is added to the principal after each year. In the following year, interest is earned on both the original principal and the earlier interest.
Thus, compounding for more periods can produce a higher amount even when the total simple-interest percentage is the same.

Question 4.
Jasmine invests an amount 'p' for 4 years at an interest of 6% p.a. Which of the following expression(s) describe the total amount she will get after 4 years when compounding is not done?
(i) p × 6 × 4
(ii) p × 0.6 × 4
(iii) p × 0.6/100 × 4
(iv) p × 0.06/100 × 4
(v) p × 1.6 × 4
(vi) p × 1.06 × 4
(vii) p + (p × 0.06 × 4)

Solution:
Principal = p
Rate = 6% per annum
Time = 4 years
Without compounding, the interest is:
Interest
= p × 6 × 4/100
= p × 0.06 × 4
= 0.24p
Total amount
= Principal + Interest
= p + 0.24p
= 1.24p
The expression that correctly represents this amount is:
(vii) p + (p × 0.06 × 4)
Option (vi) is not correct because:
p × 1.06 × 4 = 4.24p, not 1.24p.
Therefore, only option (vii) is correct.

Question 5.
The post office offers an interest of 7% p.a. How much interest would one get if one invests ₹ 50,000 for 3 years without compounding? How much more would one get if it were compounded?

Solution:
Principal = ₹50,000
Rate = 7% per annum
Time = 3 years
Without compounding
Simple interest
= 50,000 × 7 × 3/100
= ₹10,500
Amount without compounding
= ₹50,000 + ₹10,500
= ₹60,500
With annual compounding

Amount
$= 50,000 \times (1 + 7/100)^3$
$= 50,000 \times (1.07)^3$
$= 50,000 \times 1.225043$
$= ₹61,252.15$
Compound interest
$= ₹61,252.15 - ₹50,000$
$= ₹11,252.15$
Additional interest received because of compounding
$= ₹11,252.15 - ₹10,500$
$= ₹752.15$
Therefore:
Interest without compounding = ₹10,500
Interest with compounding = ₹11,252.15
The investor receives ₹752.15 more with annual compounding.

Question 6.
Giridhar borrows a loan of ₹ 12,500 at 12% per annum for 3 years without compounding, and Raghava borrows the same amount for the same time period at 10% per annum, compounded annually. Who pays more interest and by how much?

Solution:
For Giridhar
Principal = ₹12,500
Rate = 12% per annum
Time = 3 years
Simple interest
$= 12,500 \times 12 \times 3/100$
$= ₹4,500$
For Raghava
Principal = ₹12,500
Rate = 10% per annum
Time = 3 years
Amount
$= 12,500 \times (1 + 10/100)^3$

$= 12,500 \times (1.1)^3$
$= 12,500 \times 1.331$
$= ₹16,637.50$
Compound interest
$= ₹16,637.50 - ₹12,500$
$= ₹4,137.50$
Difference in interest
$= ₹4,500 - ₹4,137.50$
$= ₹362.50$
Therefore, Giridhar pays ₹362.50 more interest than Raghava.

Question 7.
Consider an amount of ₹ 1000. If this grows at 10% p.a., how long will it take to double when compounding is done vs. when compounding is not done? Is compounding an example of exponential growth and not-compounding an example of linear growth?

Solution:
Initial amount = ₹1,000
Required amount = ₹2,000
Without compounding
Required interest
$= ₹2,000 - ₹1,000$
$= ₹1,000$
Using simple interest:
$1,000 = 1,000 \times 10 \times t/100$
$1,000 = 100t$
$t = 10$ years
Therefore, without compounding, the amount doubles in 10 years.
With annual compounding
Amount after n years:
$1,000 \times (1.1)^n = 2,000$
Therefore:
$(1.1)^n = 2$
Successive values are:
After 7 years:

$1,000 \times (1.1)^7$
= ₹1,948.72 approximately
After 8 years:
$1,000 \times (1.1)^8$
= ₹2,143.59 approximately
Therefore, the amount crosses ₹2,000 during the eighth year. Its theoretical doubling time is approximately 7.27 years, but with interest added only at the end of each complete year, it takes 8 years to reach or exceed ₹2,000.
Yes, compound growth is exponential because each year's increase is calculated on the continuously growing amount.
Growth without compounding is linear because the same amount of interest, ₹100, is added every year.

Question 8.
The population of a city is rising by about 3% every year. If the current population is 1.5 crore, what is the expected population after 3 years?

Solution:
Current population = 1.5 crore
Annual growth rate = 3%
Population after 3 years
$= 1.5 \times (1 + 3/100)^3$
$= 1.5 \times (1.03)^3$
$= 1.5 \times 1.092727$
= 1.6390905 crore
Therefore, the expected population after three years is approximately 1.639 crore, or about 1.64 crore.

Question 9.
In a laboratory, the number of bacteria in a certain experiment increases at the rate of 2.5% per hour. Find the number of bacteria at the end of 2 hours if the initial count is 5,06,000.

Solution:
Initial number of bacteria = 5,06,000
Growth rate = 2.5% per hour
Time = 2 hours
Number after 2 hours
= 5,06,000 × $(1 + 2.5/100)^2$
= 5,06,000 × $(1.025)^2$
= 5,06,000 × 1.050625
= 5,31,616.25
Since the number of bacteria must be a whole number, the approximate count is 5,31,616 bacteria.

1.5 Decline

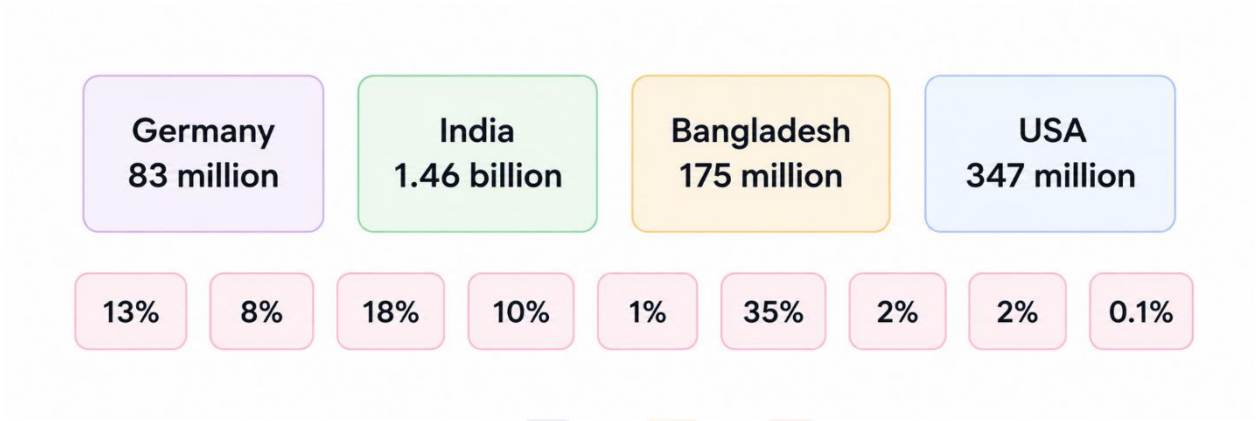
Figure It Out (Pages 28-30)

Question 1.
The population of Bengaluru in 2025 is about 250% of its population in 2000. If the population in 2000 was 50 lakhs, what is the population in 2025?

Solution:
Population in 2000 = 50 lakh
Population in 2025
= 250% of 50 lakh
= 250/100 × 50 lakh
= 2.5 × 50 lakh
= 125 lakh
125 lakh = 1 crore 25 lakh
Therefore, the population of Bengaluru in 2025 is approximately 1 crore 25 lakh.

Question 2.
The population of the world in 2025 is about 8.2 billion. The populations of some countries in 2025 are given. Match them with their approximate percentage share of the worldwide population.

Hint: Writing these numbers in the standard form and estimating can help.



Solution:

Worldwide population = 8.2 billion or 8,200 million

Germany

Population = 83 million

Percentage share

= 83/8,200 × 100%

≈ 1.01%

≈ 1%

India

Population = 1.46 billion

Percentage share

= 1.46/8.2 × 100%

≈ 17.8%

≈ 18%

Bangladesh

Population = 175 million

Percentage share

= 175/8,200 × 100%

≈ 2.13%

≈ 2%

USA

Population = 347 million

Percentage share

= 347/8,200 × 100%

≈ 4.23%
≈ 4%
Therefore:
Germany → approximately 1%
India → approximately 18%
Bangladesh → approximately 2%
USA → approximately 4%

Question 3.
The price of a mobile phone is ₹ 8,250. A GST of 18% is added to the price. Which of the following gives the final price of the phone, including the GST?
(i) 8250 + 18
(ii) 8250 + 1800
(iii) 8250 + 18/100
(iv) 8250 × 18
(v) 8250 × 1.18
(vi) 8250 + 8250 × 0.18
(vii) 1.8 × 8250

Solution:
Original price = ₹8,250
GST
= 18% of ₹8,250
= 8,250 × 0.18
Final price
= 8,250 + 8,250 × 0.18
This can also be written as:
Final price
= 8,250 × (1 + 0.18)
= 8,250 × 1.18
Therefore, the correct options are:
(v) 8250 × 1.18
and
(vi) 8250 + 8250 × 0.18
The final price is:
₹8,250 × 1.18 = ₹9,735

Question 4.
The monthly percentage change in population (compared to the previous month) of mice in a lab is given:
Month 1 change was + 5%, Month 2 change was -2%, and Month 3 change was -3%.

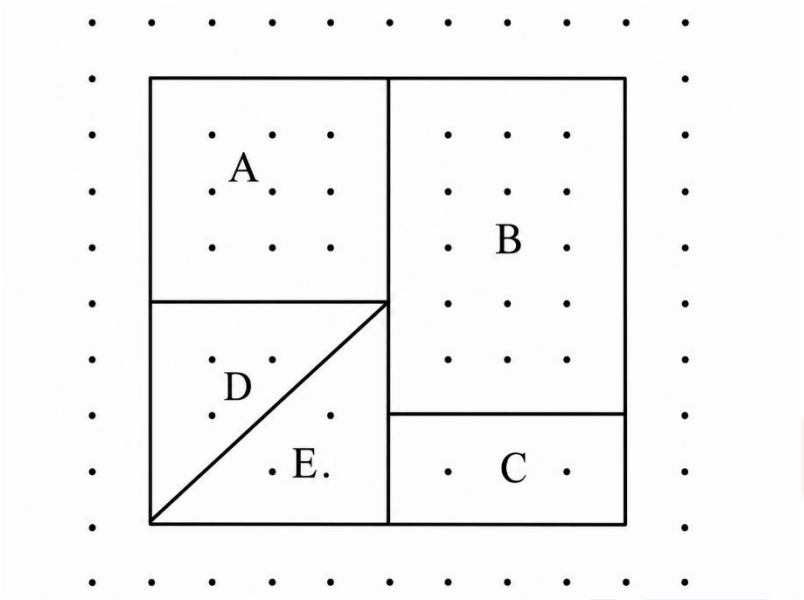
Which of the following statements are true? The initial population is p.
(i) The population after three months was p × 0.05 × 0.02 × 0.03.
(ii) The population after three months was p × 1.05 × 0.98 × 0.97.
(iii) The population after three months was p + 0.05 – 0.02 – 0.03.
(iv) The population after three months was p.
(v) The population after three months was more than p.
(vi) The population after three months was less than p.

Solution:
After Month 1:
Population
= p × 1.05
After Month 2:
Population
= p × 1.05 × 0.98
After Month 3:
Population
= p × 1.05 × 0.98 × 0.97
= 0.99813p
Since 0.99813p < p, the final population is slightly less than the initial population.
Therefore, the correct statements are:
(ii) The population after three months was p × 1.05 × 0.98 × 0.97.
(vi) The population after three months was less than p.

Question 5.
A shopkeeper initially set the price of a product with a 35% profit margin. Due to poor sales, he decided to offer a 30% discount on the selling price. Will he make a profit or a loss? Give reasons for your answer.

Solution:
Let the cost price of the product be ₹100.
Profit added = 35% of ₹100
= ₹35
Initial selling price
= ₹100 + ₹35
= ₹135
Discount
= 30% of ₹135
= 30/100 × 135
= ₹40.50
Final selling price
= ₹135 − ₹40.50
= ₹94.50
Since the cost price was ₹100 and the final selling price is ₹94.50, the shopkeeper makes a loss.
Loss
= ₹100 − ₹94.50
= ₹5.50
Loss percentage
= 5.50/100 × 100%
= 5.5%
Therefore, the shopkeeper makes a loss of 5.5%.
The 35% increase and 30% decrease do not cancel each other because the discount is calculated on ₹135, not on the original cost price of ₹100.

Question 6. What percentage of the area is occupied by the region marked 'E' in the figure?



Solution:
Total area of the figure
= 8 × 8
= 64 square units
Area occupied by region E
= 8 square units
Required percentage
= 8/64 × 100%
= 1/8 × 100%
= 12.5%
Therefore, region E occupies 12.5% of the total area.

Question 7.
What is 5% of 40? What is 40% of 5? What is 25% of 12? What is 12% of 25? What is 15% of 60? What is 60% of 15? What do you notice? Can you make a general statement and justify it using algebra, comparing x% of y and y% of x?

Solution:
5% of 40
= 5/100 × 40
= 2

40% of 5
= 40/100 × 5
= 2
25% of 12
= 25/100 × 12
= 3
12% of 25
= 12/100 × 25
= 3
15% of 60
= 15/100 × 60
= 9
60% of 15
= 60/100 × 15
= 9
Observation:
5% of 40 = 40% of 5
25% of 12 = 12% of 25
15% of 60 = 60% of 15
General statement:
x% of y = y% of x
Algebraic justification:
x% of y
= x/100 × y
= xy/100
y% of x
= y/100 × x
= xy/100
Therefore:
x% of y = y% of x

Question 8.
A school is organising an excursion for its students. 40% of them are Grade 8 students, and the rest are Grade 9 students. Among these Grade 8 students, 60% are girls.

Hint: Drawing a rough diagram can help.
(i) What percentage of the students going to the excursion are Grade 8 girls?
(ii) If the total number of students going to the excursion is 160, how many of them are Grade 8 girls?

Solution:
(i) Grade 8 students form 40% of the total group.
Girls form 60% of the Grade 8 students.
Percentage of all students who are Grade 8 girls
= 60% of 40%
= 60/100 × 40%
= 24%
Therefore, Grade 8 girls form 24% of all the students going on the excursion.
(ii) Number of Grade 8 girls
= 24% of 160
= 24/100 × 160
= 38.4
However, the number of students must be a whole number. Therefore, the percentages and total of 160 are not exactly compatible with a whole-number count.
Mathematically, the given data produce 38.4 students. Hence, either the total number or one of the percentages would need adjustment for an exact whole-number answer.

Question 9.
A shopkeeper sells pencils at a price such that the selling price of 3 pencils is equal to the cost of 5 pencils. Does he make a profit or a loss? What is his profit or loss percentage?

Solution:
Selling price of 3 pencils = Cost price of 5 pencils
Let the cost price of one pencil be ₹3.
Then, cost price of 5 pencils
= 5 × ₹3
= ₹15
Therefore, selling price of 3 pencils = ₹15.

Selling price of one pencil
= ₹15 ÷ 3
= ₹5
Cost price of one pencil = ₹3
Selling price of one pencil = ₹5
Profit per pencil
= ₹5 − ₹3
= ₹2
Profit percentage
= Profit/Cost price × 100%
= 2/3 × 100%
= 66⅔%
Therefore, the shopkeeper makes a profit of 66⅔%.

Question 10.
The bus fares were increased by 3% last year and by 4% this year. What is the overall percentage price increase in the last 2 years?

Solution:
Let the original bus fare be ₹100.
After a 3% increase in the first year:
Fare
= ₹100 × 1.03
= ₹103
After a 4% increase in the second year:
New fare
= ₹103 × 1.04
= ₹107.12
Overall increase
= ₹107.12 − ₹100
= ₹7.12
Overall percentage increase
= 7.12/100 × 100%
= 7.12%
Therefore, the overall increase in bus fare over the two years is 7.12%.

Question 11.
If the length of a rectangle is increased by 10% and the area is unchanged, by what percentage (exactly) does the breadth decrease by?

Solution:
Let the original length be L and the original breadth be B.
Original area
$= L \times B$
The new length is 10% more:
New length
= 110% of L
$= 1.1L$
$= 11L/10$
Let the new breadth be B_1.
Since the area remains unchanged:
$11L/10 \times B_1 = L \times B$
$B_1 = 10B/11$
Decrease in breadth
$= B - 10B/11$
$= B/11$
Percentage decrease
$= (B/11)/B \times 100\%$
$= 1/11 \times 100\%$
$= 100/11\%$
$= 9\ 1/11\%$
Therefore, the breadth decreases by exactly 9 1/11%, or approximately 9.09%.

Question 12.
The percentage of ingredients in a 65 g chips packet is shown in the picture. Find out the weight each ingredient makes up in this packet.



Solution:

Total weight of the packet = 65 g

Potato = 70%

Weight of potato

= 70/100 × 65

= 45.5 g

Vegetable oil = 24%

Weight of vegetable oil

= 24/100 × 65

= 15.6 g

Salt = 3%

Weight of salt

= 3/100 × 65

= 1.95 g

Spices = 3%

Weight of spices

= 3/100 × 65

= 1.95 g

Therefore:

Potato = 45.5 g
Vegetable oil = 15.6 g
Salt = 1.95 g
Spices = 1.95 g
Verification:
45.5 + 15.6 + 1.95 + 1.95
= 65 g

Question 13.
Three shops sell the same items at the same price. The shops offer deals as follows:
Shop A: "Buy 1 and get 1 free."
Shop B: "Buy 2 and get 1 free."
Shop C: "Buy 3 and get 1 free".

Answer the following:
(i) If the price of one item is ₹ 100, what is the effective price per item in each shop? Arrange the shops from cheapest to costliest.
(ii) For each shop, calculate the percentage discount on the items.
[Hint: Compare the free items to the total items you receive.]
(iii) Suppose you need 4 items. Which shop would you choose? Why?

Solution:
(i) Effective price per item
Shop A: Buy 1 and get 1 free
Amount paid = ₹100
Total items received = 2
Effective price per item
= ₹100 ÷ 2
= ₹50
Shop B: Buy 2 and get 1 free
Amount paid = ₹200
Total items received = 3
Effective price per item
= ₹200 ÷ 3
= ₹66⅔ approximately
Shop C: Buy 3 and get 1 free

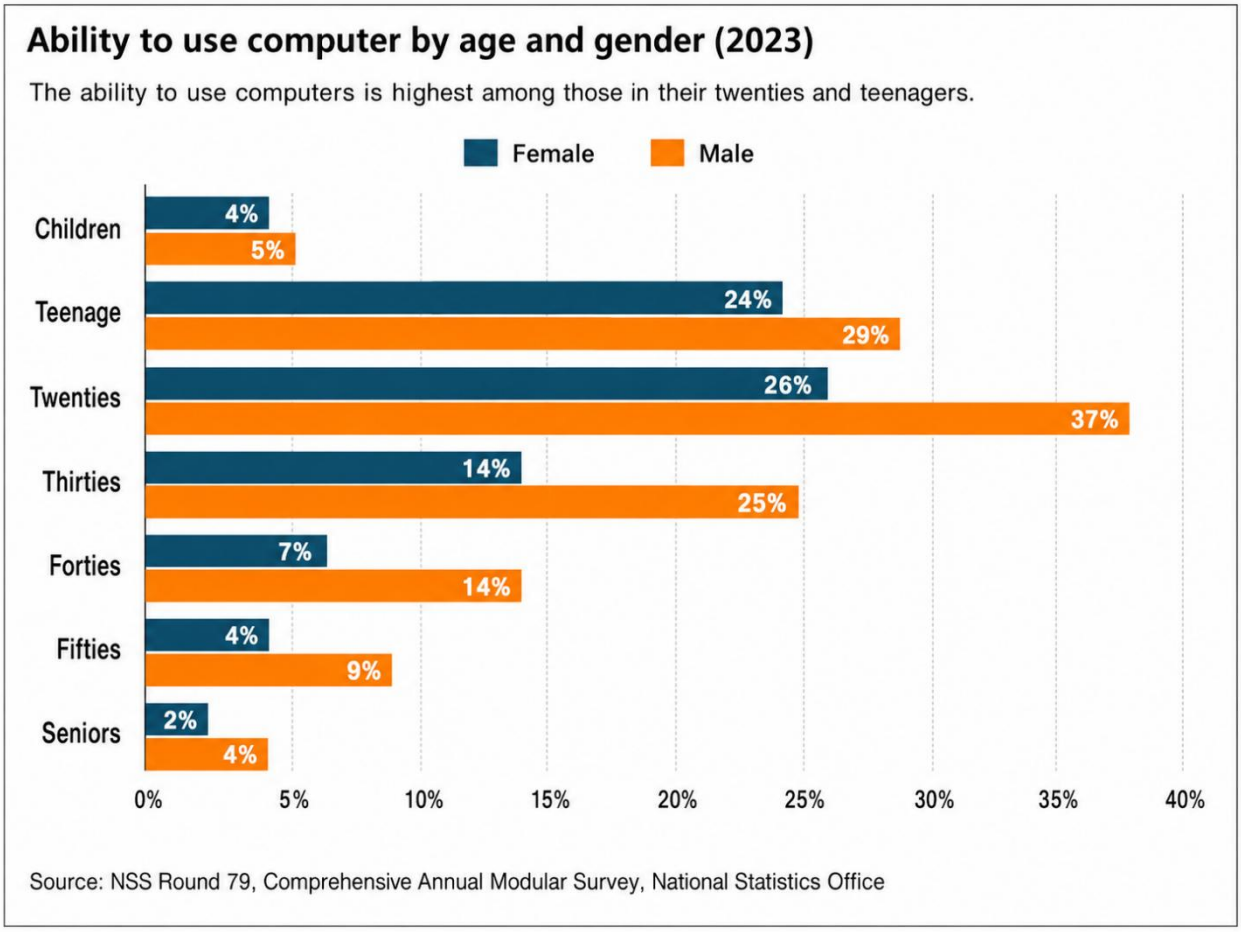
Amount paid = ₹300
Total items received = 4
Effective price per item
= ₹300 ÷ 4
= ₹75
Cheapest to costliest:
Shop A → Shop B → Shop C
(ii) Percentage discount
Shop A:
One item is free out of two items.
Discount
= 1/2 × 100%
= 50%
Shop B:
One item is free out of three items.
Discount
= 1/3 × 100%
= 33⅓%
Shop C:
One item is free out of four items.
Discount
= 1/4 × 100%
= 25%
Therefore:
Shop A discount = 50%
Shop B discount = 33⅓%
Shop C discount = 25%
(iii) If four items are required:
At Shop A:
Buy two items and receive two items free.
Total cost = ₹200
At Shop B:
The customer pays ₹200 for three items and ₹100 for the fourth item.
Total cost = ₹300
At Shop C:
The customer pays ₹300 and receives four items.

Total cost = ₹300
Therefore, Shop A should be chosen because four items can be purchased for only ₹200.

Question 14.
In a room of 100 people, 99% are left-handed. How many left-handed people have to leave the room to bring that percentage down to 98%?

Solution:
Total number of people = 100
Number of left-handed people = 99
Number of right-handed people = 1
Let x left-handed people leave the room.
Remaining left-handed people = 99 − x
Remaining total people = 100 − x
The new percentage of left-handed people is 98%.
Therefore:
$(99 - x)/(100 - x) = 98/100$
$100(99 - x) = 98(100 - x)$
$9{,}900 - 100x = 9{,}800 - 98x$
$100 = 2x$
$x = 50$
Therefore, 50 left-handed people must leave the room.
Verification:
Remaining left-handed people = 99 − 50 = 49
Remaining total people = 100 − 50 = 50
Percentage of left-handed people
$= 49/50 \times 100\%$
$= 98\%$

Question 15.
Look at the following graph.



Based on the graph, which of the following statements are valid?
(i) People in their twenties are the most computer-literate among all age groups.
(ii) Women lag in the ability to use computers across age groups.
(iii) There are more people in their twenties than teenagers.
(iv) More than a quarter of people in their thirties can use computers.
(v) Less than 1 in 10 aged 60 and above can use computers.
(vi) Half of the people in their twenties can use computers.

Solution:
Based on the percentages shown in the graph:
(i) True
The computer-literacy percentage is highest for people in their twenties.

(ii) True
The graph shows a lower computer-literacy percentage for women than for men across the displayed age groups.
(iii) False
The graph shows percentages of computer literacy, not the total number of people in each age group. Therefore, the population of people in their twenties and teenagers cannot be compared using this graph.
(iv) False
The graph does not show more than 25% computer literacy for people in their thirties.
(v) True
The percentage for people aged 60 and above is below 10%, which is less than 1 in 10.
(vi) False
The graph does not show that exactly 50% of people in their twenties can use computers.
Therefore, the valid statements are:
(i), (ii), and (v).