Collegedunia NCERT Notes

NCERT Class 8 Maths Notes Chapter 1 Fractions in Disguise (Part 2, 2026-27 Syllabus)

Chapter 1: Fractions in Disguise

These NCERT Class 8 Maths Notes Chapter 1 Fractions in Disguise unpack the whole of *Ganita Prakash* Part 2, Chapter 1. Percentages are fractions wearing a costume: every per cent is simply a fraction whose denominator is 100. The notes move from that one idea to mental maths shortcuts, ratios, profit and loss, discounts, taxes, compounding and depreciation.

Also see for this chapter: NCERT Solutions | Formula Sheet | Exemplar Solutions

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1 Percentages: Fractions in Disguise

Every shop board that shouts "50% off" is really talking about a fraction. The symbol % is read as *per cent*, from the Latin *per centum*, meaning "by the hundred". So a percentage is a fraction whose denominator has been fixed at 100. Once you accept that single sentence, the rest of the chapter is just practice. This section builds the idea, shows both directions of conversion, and explains why the number 100 was chosen in the first place.

1.1 What Per Cent Really Means

Saying 25% means 25 out of every 100. It could be 25 people out of 100 people, 25 rupees out of 100 rupees, or 25 marks out of 100 marks. The unit changes, the proportion does not.

The Core Definition

For any number x,

$$x\% = \frac{x}{100}.$$

So x% of a quantity s is

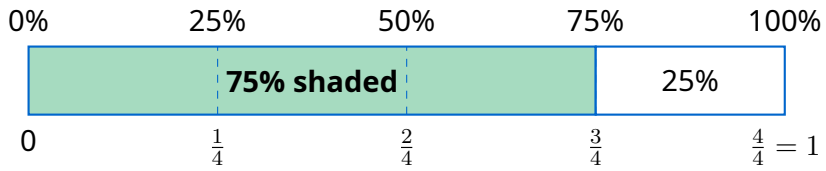
$$x\% \text{ of } s = \frac{x}{100} \times s.$$

Try it with 50% of s:

$$50\% \text{ of } s = 50 \times \frac{1}{100} \times s = \frac{50}{100} \times s = \frac{1}{2}s.$$

Percentages simplify like any other fraction:

- $20\% = \frac{20}{100} = \frac{2}{10} = \frac{1}{5}$
- $33\% = \frac{33}{100}$ (already in lowest terms)
- $75\% = \frac{75}{100} = \frac{3}{4}$



One bar, two labels. The fraction scale and the percentage scale mark exactly the same points.

Memory Aid: Cent Means Hundred

Century is 100 years. A centimetre is $\frac{1}{100}$ of a metre. A centipede was named for its "hundred" legs. So **cent** always points to 100, and **per cent** means "out of 100".

1.2 Turning a Fraction into a Percentage

Surya mixes red and yellow paint for a sunset colour. Red makes up $\frac{3}{4}$ of the mixture. What per cent of the colour is red?

$\frac{3}{4}$ means 3 out of every 4. Scale the fraction up until the denominator reads 100:

$$\frac{3}{4} = \frac{6}{8} = \frac{30}{40} = \frac{75}{100} = 75\%.$$

There are two clean written methods.

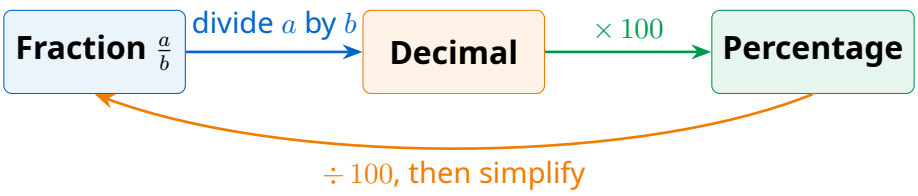
Method 1: equivalent fraction	Method 2: solve for the numerator
$\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 75\%$	$\frac{3}{4} = \frac{x}{100}$, so $x = \frac{3}{4} \times 100 = 75$

Both routes land on the same shortcut.

Fraction to Percentage

$$\frac{a}{b} \longrightarrow \left(\frac{a}{b} \times 100\right)\%$$

A fraction is a share of one unit. A percentage is a share of 100 units. So multiply by 100.



The conversion loop. Any one of the three forms can be reached from any other.

Two more worked conversions:

1. $\frac{2}{5} = \frac{2 \times 20}{5 \times 20} = \frac{40}{100} = 40\%$.
2. $\frac{7}{14} = \frac{1}{2} = \frac{50}{100} = 50\%$. Simplify first, and the arithmetic almost disappears.

Reduce the fraction to lowest terms before multiplying. The fraction $\frac{72}{150}$ looks awkward, but $\frac{72}{150} = \frac{12}{25}$, and $\frac{12}{25} \times 100 = 48\%$ falls out in one step.

1.3 Turning a Percentage Back into a Fraction

This direction needs no new rule at all. Write the per cent number over 100, then simplify.

$$24\% = \frac{24}{100} = \frac{12}{50} = \frac{6}{25}.$$

Every fraction equivalent to $\frac{24}{100}$ describes the same share, including $\frac{48}{200}$.

The General Statement

A percentage $z\%$ can be written as *any* fraction equivalent to $\frac{z}{100}$. The simplest form is usually the most useful one for calculation.

Some conversions worth knowing by heart:

Per cent	10%	20%	25%	$33\frac{1}{3}\%$	50%	75%	100%
Fraction	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{3}{4}$	1
Decimal	0.1	0.2	0.25	$0.\overline{3}$	0.5	0.75	1.0

1.4 Why 100 and Not 10 or 1000

If any denominator would do, why did the world settle on 100? Compare two biscuit varieties. Sugar makes up $\frac{9}{34}$ of Variety 1 and $\frac{13}{45}$ of Variety 2. Which is sweeter? Nothing is obvious. Restate it as 26.47% and 28.88% and the answer jumps out.

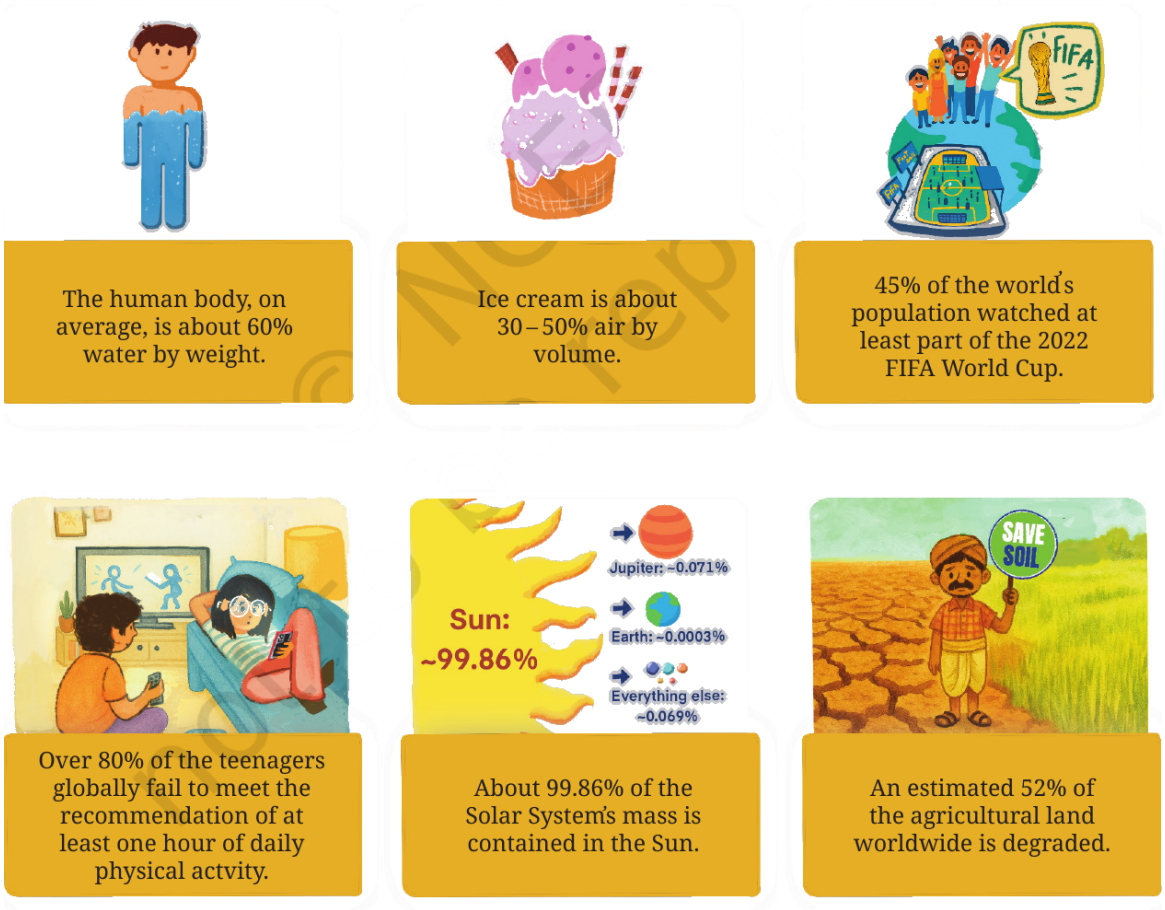
A common denominator makes comparison instant. The number 100 is the sweet spot:

- Our number system is base 10, so 100 slots neatly beside decimals: $31\% = \frac{31}{100} = 0.31$.

- Per 10 is too coarse. A share of $\frac{9}{34}$ becomes 2.647 per ten, which needs decimals anyway.
- Per 1000 is finer than daily life needs. It survives only in phrases such as "per thousand" or "per lakh" used by statisticians.

Percentages Around Us

Percentages describe the world at every scale, from your own body to the Solar System.



Six real findings stated as percentages, from body water to degraded farmland. Source: NCERT Ganita Prakash, Class 8 Part 2, Chapter 1, page 5.

The idea is old. Kautilya's *Arthaśhāstra* (4th century BCE) records interest quoted "per month per cent". Roman traders used taxes of $\frac{1}{20}$ and $\frac{1}{100}$. Italian manuscripts of the 15th century write "xx p cento" for what we would call 20%.

A Percentage on Its Own Is Not a Quantity

"Madhav's biscuits had 35% sugar" does not by itself mean Madhav ate more sugar than Madhu. Until you know how many grams each of them ate, 35% and 25% cannot be compared as amounts. A percentage always needs a base.

2 Finding a Percentage of a Quantity

Section 1.2 of the textbook moves from "what is a percentage" to "how much is it worth". The tools here are proportional reasoning, fraction multiplication and decimal multiplication, and all three give the same answer. This section also builds the mental maths that lets you compute 15% of a bill without touching a pen.

2.1 The Basic Calculation

Madhu ate 120 g of biscuits containing 25% sugar. How much sugar was that? Set up the proportion:

$$25 : 100 :: s : 120 \quad \Longrightarrow \quad \frac{25}{100} = \frac{s}{120} \quad \Longrightarrow \quad s = \frac{25}{100} \times 120 = 30 \text{ g}.$$

Madhav ate 95 g of biscuits containing 35% sugar:

$$s = \frac{35}{100} \times 95 = 33.25 \text{ g}.$$

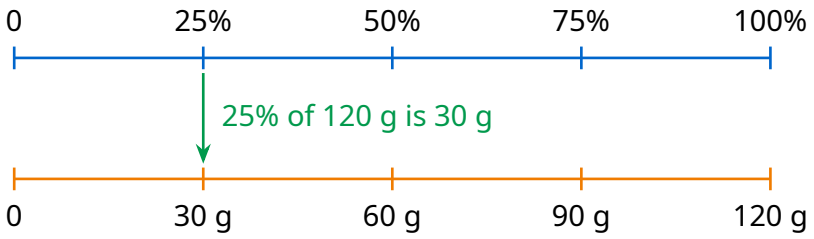
So Madhav ate more sugar, even though he ate fewer biscuits.

Percentage of a Quantity

$$y\% \text{ of } z \;=\; \frac{y}{100} \times z$$

Read it as: "per 100 units there are y units, so per z units there are $\frac{y}{100} \times z$".

A double number line makes the proportion visible.



A double number line. The per cent scale on top, the gram scale below, one stretch factor between them.

2.2 Free-Hand Computation and Mental Shortcuts

Since $25\% = \frac{1}{4}$, finding 25% of 40 is the same as finding a quarter of 40, which is 10. Recognising the friendly fractions turns most percentage questions into one-step arithmetic.

	100	**200**	**50**	**80**	**10**	**35**	**287**
25%	25	50	12.5	20	2.5	8.75	71.75
10%	10	20	5	8	1	3.5	28.7
20%	20	40	10	16	2	7	57.4
5%	5	10	2.5	4	0.5	1.75	14.35

Two patterns fall straight out of the table:

- 20% of a value is double 10% of it, because 20 parts out of 100 is twice 10 parts out of 100.
- $(20\%$ of $y) + (5\%$ of $y) = 25\%$ of y, since $\frac{20}{100}y + \frac{5}{100}y = \frac{25}{100}y$.

That second pattern is the whole trick. Break any awkward percentage into friendly pieces.

10% of y	$+$	5% of y	$=$	15% of y
move the decimal		half of the 10%		add the two

The build-a-percentage method. 15% of 240 is $24 + 12 = 36$, done in your head.

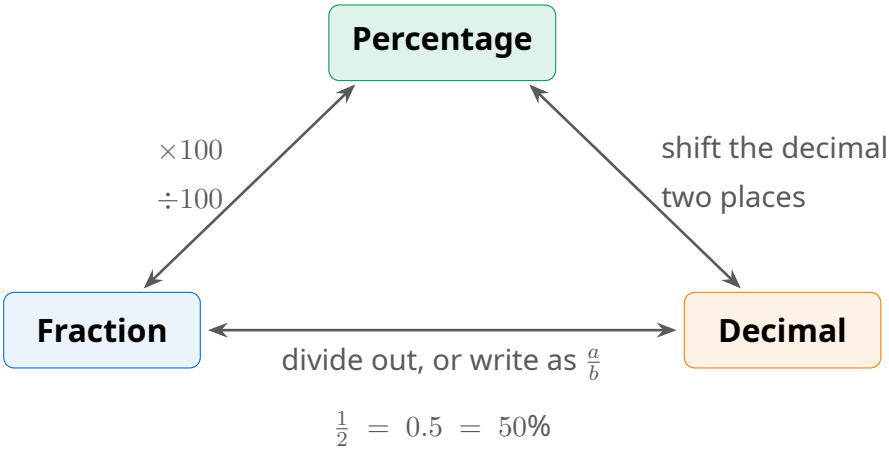
Build Percentages from 10% and 1%

Find 10% by shifting the decimal one place left, and 1% by shifting it two places. Then assemble:

- $90\% = 100\% - 10\%$
- $70\% = 7 \times 10\%$
- $55\% = 50\% + 5\%$
- $18\% = 10\% + 5\% + 3 \times 1\%$

2.3 The FDP Trio: Fractions, Decimals and Percentages

The same share can be written three ways, and each way suits a different job. Since $50\% = \frac{50}{100} = \frac{1}{2} = 0.5$, multiplying by 0.5 must give the same answer as halving. Check it: 50% of $24 = 12$, and $0.5 \times 24 = 12$.



The FDP triangle. Fractions are best for exact work, decimals for calculators, percentages for comparing.

Complete the standard row of conversions:

Per cent	50%	100%	25%	75%	10%	1%	5%	43%
Fraction	$\frac{1}{2}$	1	$\frac{1}{4}$	$\frac{3}{4}$	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{20}$	$\frac{43}{100}$
Decimal	0.5	1.0	0.25	0.75	0.1	0.01	0.05	0.43

Worked example. A test is out of 75 marks and an A grade needs 80%. What is the least score that earns an A?

Fraction route	Decimal route	Proportion route
$\frac{80}{100} \times 75 = \frac{4}{5} \times 75 = 60$	$0.8 \times 75 = 60$	$\frac{80}{100} = \frac{m}{75}$, so $m = 60$

Zubin needs at least 60 marks.

2.4 From Ratios to Percentages

Millet kanji mixes millet and water in the ratio $2 : 7$. What percentage of the mixture is millet?

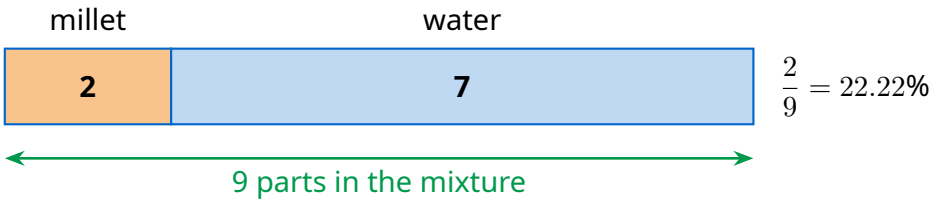
The ratio $2 : 7$ compares millet to water. The mixture has $2 + 7 = 9$ parts in all, so millet to mixture is $2 : 9$. Now convert:

$$\frac{2}{9} \times 100 = 22.22\%, \qquad \text{water} = 100 - 22.22 = 77.78\%.$$

For 500 ml of mixture, millet $= 5 \times 22.22 = 111.1$ ml.

Ratio, Fraction, Percentage

A ratio $a : b$ becomes the fraction $\frac{a}{a+b}$ of the whole, and that fraction becomes a percentage on multiplying by 100. The trap is using $\frac{a}{b}$ instead of $\frac{a}{a+b}$.



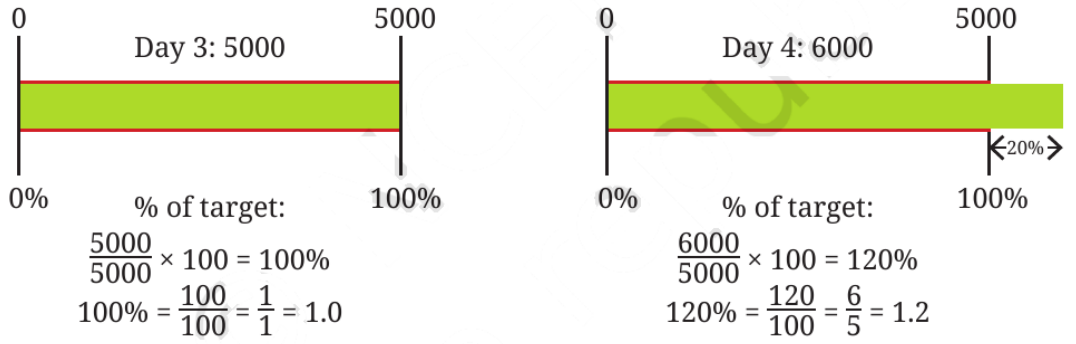
Bar model for the ratio 2:7. Count the total parts before writing the fraction.

Estimate before you compute. Half of 9 is 4.5, so $\frac{2}{9}$ sits well below 50%. A quarter of 9 is 2.25, so $\frac{2}{9}$ sits a little below 25%. Expecting an answer near 22% is what catches a slipped decimal point later.

2.5 Percentages Greater Than 100

Kishanlal targets daily sales of ₹5000. On four days he sells ₹2000, ₹3500, ₹5000 and ₹6000. As a share of target:

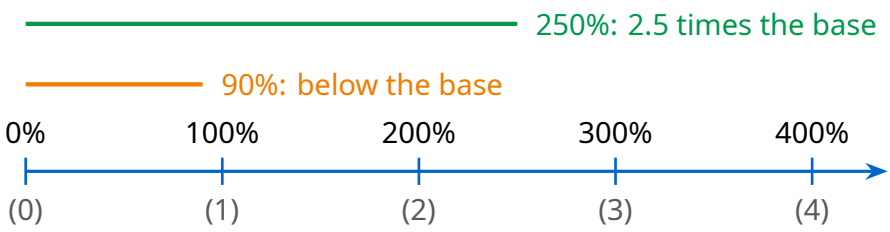
$$\frac{2000}{5000} \times 100 = 40\%, \quad \frac{3500}{5000} \times 100 = 70\%, \quad \frac{5000}{5000} \times 100 = 100\%, \quad \frac{6000}{5000} \times 100 = 120\%.$$



Bar models for Day 3 and Day 4. The Day 4 bar runs past the 100% mark by 20%. Source: NCERT Ganita Prakash, Class 8 Part 2, Chapter 1, page 11.

A percentage above 100 simply means the value is larger than the base.

- $120\% = \frac{120}{100} = \frac{6}{5} = 1.2$, so the value is 1.2 times the base.
- $250\% = 2.5$ times the base. A harvest that rises from 260 kg to 650 kg is $\frac{650}{260} \times 100 = 250\%$ of last year's.
- 100% of the base is the base itself. Nothing has changed.



One scale, two readings. 100% is the base, and everything to its right is growth beyond the base.

120% Is Not "120% More"

Achieving 120% of a target means beating it by 20%, not by 120%. The extra part is

$120\% - 100\% = 20\%$. Read the words carefully: "120% of" and "120% more than" describe very different numbers.

3 Using Percentages to Compare and to Measure Change

Section 1.3 puts percentages to work. Two jobs dominate: comparing shares that have different totals, and measuring how much a quantity has grown or shrunk. Both jobs reduce to the same habit, which is choosing the right base and dividing by it.

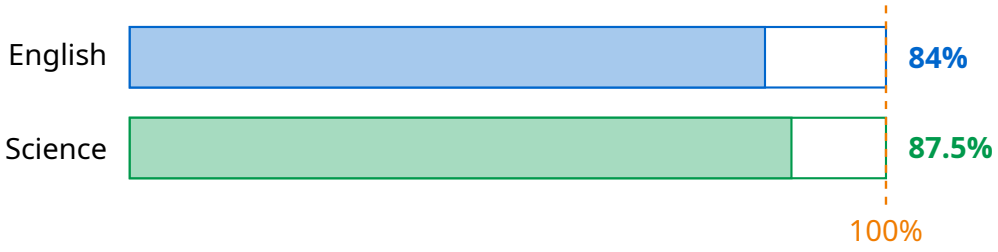
3.1 Comparing Proportions with Different Totals

Eesha scored 42 out of 50 in English and 70 out of 80 in Science. She lost 8 marks in English and 10 in Science, so she thinks English was her better subject. Her friend Reema points at the larger Science score. Vishu says the two cannot be compared at all.

Convert both to a common base of 100:

$$\text{English} = \frac{42}{50} \times 100 = 84\%, \qquad \text{Science} = \frac{70}{80} \times 100 = 87.5\%.$$

Science is the stronger performance. Marks lost is a misleading measure because the two tests were out of different totals.



Rescaling both tests to 100 makes the comparison honest.

The same idea reads food labels. Two badam drink mixes list different pack weights, so raw gram figures cannot be compared. Convert each ingredient to a share of the total weight:

$$\text{sugar in DEF} = \frac{99}{150} \times 100 = 66\%.$$

A mix that is 66% sugar is closer to a sugar drink than a badam drink.

Know Your Contents

Food labels print ingredients by weight. Turning each into a percentage of the pack tells you what you are really buying, and the percentages of a full label should add up to 100.

3.2 Percentage Increase and Percentage Decrease

Tomatoes cost ₹30 three years ago and ₹42 now. The rise is ₹12. A cinema had an average footfall of 160 before a shutdown and 100 after, a fall of 60.

Change as a Percentage

$$\text{Percentage increase} = \frac{\text{amount of increase}}{\text{original amount}} \times 100$$

$$\text{Percentage decrease} = \frac{\text{amount of decrease}}{\text{original amount}} \times 100$$

The denominator is always the **original** value, never the new one.

Applying the formulas:

$$\text{tomatoes: } \frac{12}{30} \times 100 = 40\% \text{ increase}, \qquad \text{footfall: } \frac{60}{160} \times 100 = 37.5\% \text{ decrease}.$$

original (100%) now (140%)

The extra block is 12 out of the original 30, which is 40% of the base.

Two sentences can say the same thing in different clothes.

Statement A	Statement B
Population in 1991 is 165% of that in 1961. $q = \frac{165}{100} \times p = 1.65p$	Population increased by 65% from 1961 to 1991. $q = p + 0.65p = 1.65p$

Both give $q = 1.65p$, so both mean the same thing.

The Base Decides the Answer

A price falls from 100 to 80, then rises from 80 back to 100. The fall is $\frac{20}{100} = 20\%$ but the rise is $\frac{20}{80} = 25\%$. Same rupee change, different percentages, because the base changed between the two steps.

Multiplier Shortcut

An increase of $r\%$ multiplies the value by $\left(1 + \frac{r}{100}\right)$; a decrease of $r\%$ multiplies it by $\left(1 - \frac{r}{100}\right)$. A 15% rise is $\times 1.15$; a 15% fall is $\times 0.85$. One multiplication replaces two steps.

4 Profit, Loss, Discount and Tax

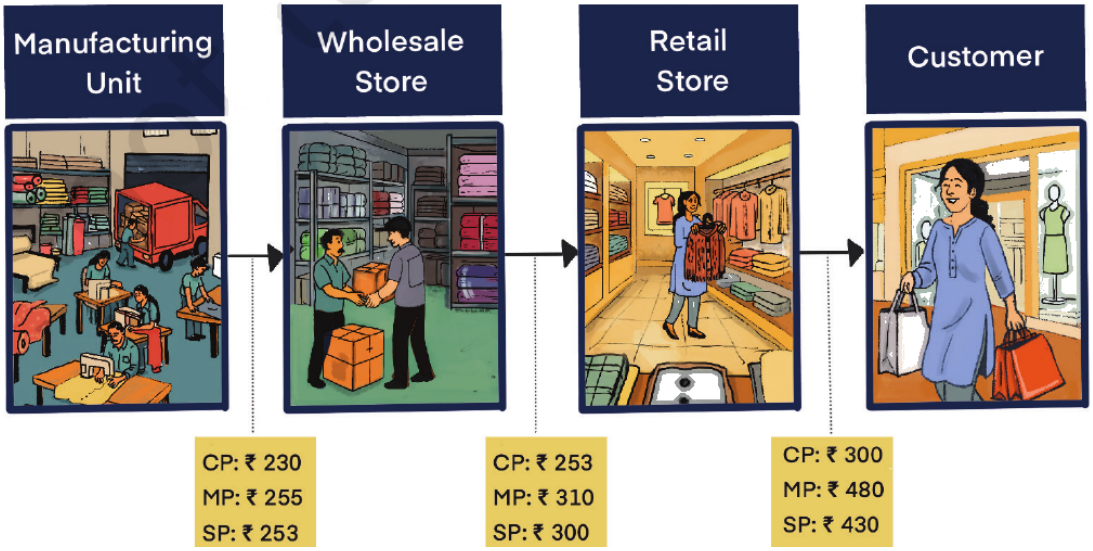
Every purchase carries three prices, and the chapter names all of them. Cost price is what the seller paid, marked price is what the seller asks, and selling price is what the buyer actually pays. Profit, loss, discount and tax are all percentages built on top of these three numbers.

4.1 Cost Price, Marked Price and Selling Price

Kishanlal buys a sweater from a wholesaler for ₹300. He marks it at ₹480 and, after bargaining, sells it for ₹430. Then:

- Cost price (CP) $=$ ₹300
- Marked price (MP) $=$ ₹480
- Selling price (SP) $=$ ₹430
- Profit $=$ SP $-$ CP $=$ ₹130

The same sweater carries different labels at each stage of its journey. One person's selling price becomes the next person's cost price.



The journey of a sweater from the manufacturing unit to the customer, with CP, MP and SP at every stage. Source: NCERT Ganita Prakash, Class 8 Part 2, Chapter 1, page 16.

The Labels Are Relative

CP, MP and SP describe a *position in a transaction*, not a fixed property of the item. The wholesaler's SP of ₹253 is the retailer's CP of ₹253.

4.2 Profit Percentage and Loss Percentage

Profit is judged against what was invested, so the cost price is the base and counts as 100%.

Profit and Loss

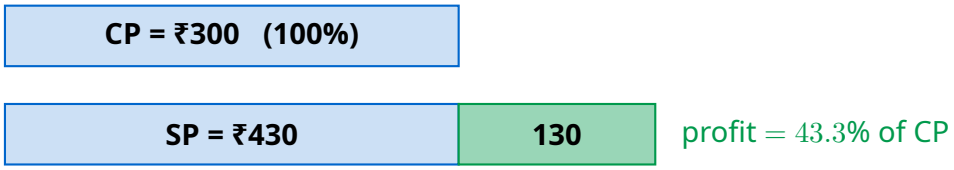
$$\text{Profit} = SP - CP, \qquad \text{Loss} = CP - SP$$

$$\text{Profit\%} = \frac{SP - CP}{CP} \times 100, \qquad \text{Loss\%} = \frac{CP - SP}{CP} \times 100$$

$$SP = CP\left(1 + \frac{\text{Profit\%}}{100}\right), \qquad SP = CP\left(1 - \frac{\text{Loss\%}}{100}\right)$$

Kishanlal's sweater: profit % $= \frac{130}{300} \times 100 = 43.3\%$.

Raghu buys 10 kg rice at ₹35 per kg, so CP $=$ ₹350, and clears the stock at ₹300. Loss $=$ ₹50 and loss % $= \frac{50}{350} \times 100 = 14.28\%$.



Stack SP against CP. The overhang is the profit, measured as a share of the CP bar.

Two quick reverse problems from the textbook:

1. Shambhavi buys notebooks at ₹36 and wants a 20% margin. $SP = 36 \times 1.20 =$ ₹43.20.
2. She sells crayon boxes at ₹50 with a 25% margin. $CP = \frac{50}{1.25} =$ ₹40.

Never Divide by the Selling Price

Profit percentage in this chapter is always measured against the cost price. Manisha buys a fertiliser bag at ₹500 and sells at ₹750. Her profit is $\frac{250}{500} \times 100 = 50\%$, not $\frac{250}{750} \times 100 = 33.33\%$. The second figure answers a different question, about margin on revenue.

4.3 Discount

A discount is a percentage cut on the marked price, so MP is the base here.

Discount

$$\text{Discount} = MP - SP$$

$$\text{Discount\%} = \frac{MP - SP}{MP} \times 100$$

$$SP = MP\left(1 - \frac{\text{Discount\%}}{100}\right)$$

A cooker has MP ₹1800 and a 35% discount. Then $SP = 1800 \times 0.65 =$ ₹1170. If the shop's CP was ₹900, the profit is ₹270 and the profit percentage is $\frac{270}{900} \times 100 = 30\%$.

Shyamala's damaged vase cost ₹2650 and is sold at an 18% loss. Two routes, one answer:

Multiplier route	Subtract route
SP is $100\% - 18\% = 82\%$ of CP, so $SP = 0.82 \times 2650 =$ ₹2173	Loss $= \frac{18}{100} \times 2650 =$ ₹477, so $SP = 2650 - 477 =$ ₹2173

Two Different Bases in One Sum

Discount always sits on the marked price. Profit always sits on the cost price. When a question mixes both, write MP, CP and SP in a column before you start, and label which one each percentage belongs to.

4.4 Taxes, Gross Profit and Net Profit

GST and income tax are quoted as percentages too. GST is added on top of the price, so the customer pays more than the listed amount.

For a phone priced ₹8250 with 18% GST:

$$\text{Final price} = 8250 + \frac{18}{100} \times 8250 = 8250 \times 1.18 = ₹9735.$$

The chapter also separates two kinds of profit.

Term	Meaning
Gross profit	Sales minus the cost of the goods sold. For sales of ₹80,000 and goods costing ₹48,000, gross profit is ₹32,000.
Net profit	Gross profit minus all other expenses (transport, salary, electricity). With ₹8,000 of expenses, net profit is ₹24,000.

Net profit can also be measured against revenue. On sales of ₹1,50,000 with a net profit of ₹45,000:

$$\frac{45000}{150000} \times 100 = 30\%.$$

Reading a Restaurant Bill

Look at any GST bill at home. The item total comes first, then a tax line at a

stated per cent, then the payable amount. Recomputing that tax line yourself is a two-second check that the bill is honest.

5 Growth, Compounding and Decline

Money in a bank, a growing population and a bacterial culture all change by a fixed percentage each period. Whether that percentage is applied to the starting value every time, or to the latest value, decides everything. This section builds both patterns and their formulas, then turns them around for values that fall.

5.1 Interest Without Compounding

A bank offering 10% per annum (p.a.) on a fixed deposit pays ₹600 a year on a deposit of ₹6000. The deposit is called the principal, and 10% is the rate.

If the interest is paid out each year, the principal never changes, so each year earns the same ₹600. Over 3 years the depositor receives $3 \times 600 =$ ₹1800 in interest plus the ₹6000 principal, a total of ₹7800.

Growth Without Compounding

For principal p, rate r (as a decimal) and t terms:

$$\text{Interest} = p\,r\,t, \qquad \text{Total amount} = p + prt = p(1 + rt).$$

The graph of this amount against time is a straight line, so this is linear growth.

5.2 Interest With Compounding

If the interest is added back to the deposit instead of paid out, the principal grows every year, so each year earns more than the last. This is compounding.

		Interest added back (10% p.a.)	Amount in the FD
Year 1	Beginning	× 0.10	₹6000
	Ending	₹600 added back	₹6600
Year 2	Beginning	× 0.10	₹6600
	Ending	₹660 added back	₹7260
Year 3	Beginning	× 0.10	₹7260
	Ending	₹726	₹7986
		₹7986 is returned	
Total amount received		₹7986	

× 1.10 × 1.10 × 1.10

Year by year compounding at 10% p.a. on ₹6000. Each year multiplies the balance by 1.10. Source: NCERT Ganita Prakash, Class 8 Part 2, Chapter 1, page 22.

Tracing the three years: $6000 \to 6600 \to 7260 \to 7986$. Each step multiplies by 1.10, so

$$6000 \times 1.1 \times 1.1 \times 1.1 = 6000 \times 1.331 = 7986.$$

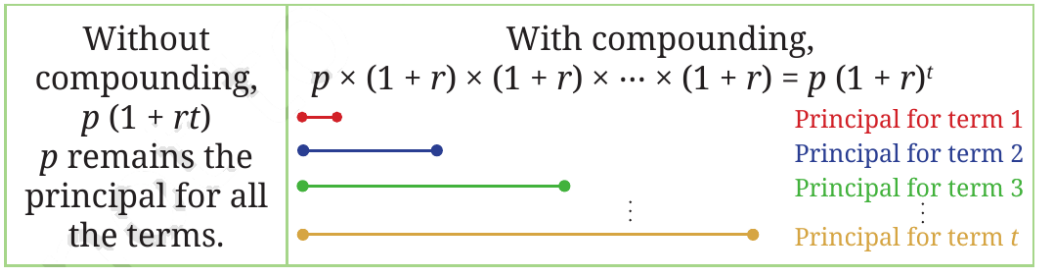
Comparing the two options on the same deposit:

Without compounding	**With compounding**
Total $=$ ₹7800	Total $=$ ₹7986
$\frac{7800}{6000} \times 100 = 130\%$	$\frac{7986}{6000} \times 100 = 133.1\%$
$6000 \times (1 + 0.1 + 0.1 + 0.1)$	$6000 \times 1.1 \times 1.1 \times 1.1$
Gain over 3 years: 30%	Gain over 3 years: 33.1%

Growth With Compounding

$$\text{Total amount after } t \text{ terms} = p\,(1 + r)^t$$

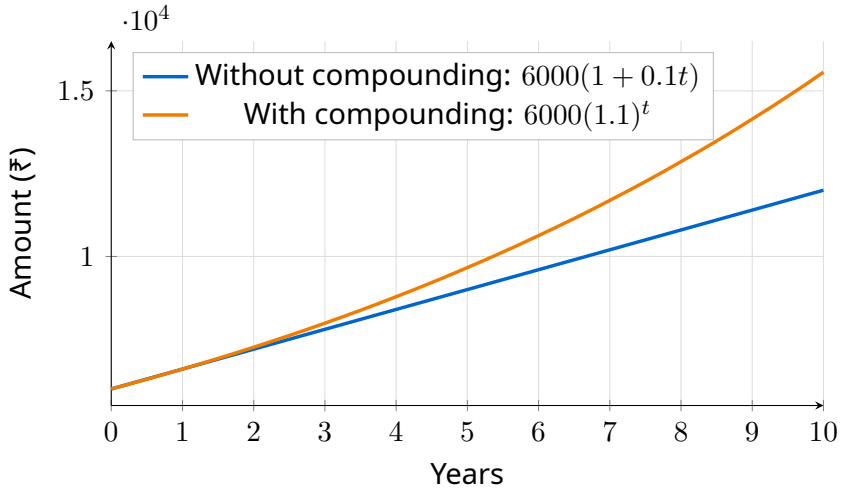
Each factor of $(1 + r)$ is one term's growth applied to the balance at the start of that term.



The chapter summary contrasts $p(1 + rt)$ with $p(1 + r)^t$, showing how the principal for each term keeps growing.

Source: NCERT Ganita Prakash, Class 8 Part 2, Chapter 1, page 31.

The two patterns pull apart as the years pass.



A straight line against a curve. Compounding is slow at first and then pulls clearly ahead.

Linear Growth Against Exponential Growth

Without compounding, the same amount is added each term, so the graph is a straight line. With compounding, the same *ratio* is applied each term, so the graph curves upward. Doubling money at 10% p.a. takes 10 years without compounding, but under 8 years with it.

Rate as a Decimal, Not as a Per Cent Number

In $p(1 + r)^t$ the letter r is the decimal rate, not the per cent number. For 6% p.a. use $r = 0.06$, so 4 years without compounding gives $p + (p \times 0.06 \times 4)$. Writing $p \times 6 \times 4$ inflates the answer a hundredfold.

5.3 Decline and Depreciation

Vehicles, phones and machines lose value with age and use. That fall is called depreciation, and it is compounding with a negative sign.

A television bought for ₹21,000 depreciates 5% in a year:

$$\text{Value} = 21000 - 0.05 \times 21000 = 0.95 \times 21000 = ₹19{,}950.$$

A village population falls about 10% per decade from 1250:

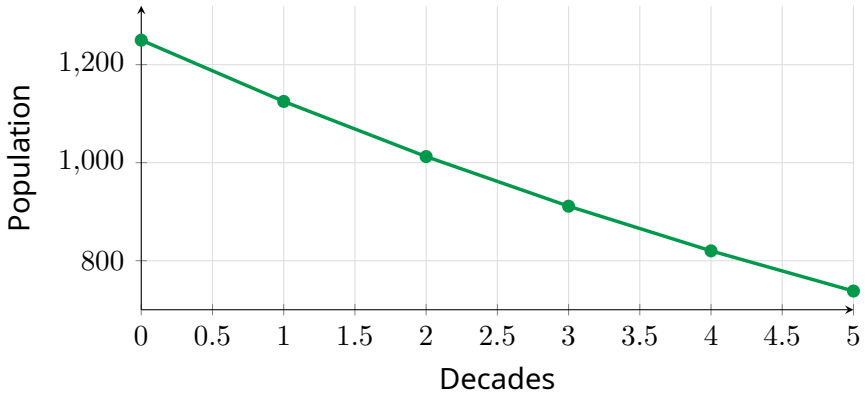
$$1250 \times 0.9 \times 0.9 \times 0.9 = 911.25 \approx 910 \text{ after 3 decades.}$$

Repeated Decrease

For a fall of r (as a decimal) per period,

$$\text{Value after } t \text{ periods} = p\,(1 - r)^t.$$

A 10% fall means multiplying by 0.9 each time, never subtracting 10% of the original each time.



Repeated 10% decline. Each drop is smaller than the last because the base keeps shrinking.

Memory Aid: Up Adds, Down Subtracts, Both Multiply

Growth of r: multiply by $(1 + r)$. Decline of r: multiply by $(1 - r)$. Repeat the multiplier once per period. Three sentences cover every compounding question in this chapter.

Where Compounding Shows Up

Fixed deposits and recurring deposits, loan interest, inflation in food prices, population projections, bacterial counts in a laboratory, and the resale value of a bike all follow the same $p(1 \pm r)^t$ pattern.

6 Tricky Percentages and Common Traps

The last part of the chapter is a set of traps. Every one of them comes from the same source, which is forgetting that a percentage means nothing without its base. Working through these carefully is the fastest way to secure full marks on the chapter.

6.1 Comparing Percentages, Not Amounts

A contest offers two prizes. Option A: deposit ₹100 and get back ₹300. Option B: deposit ₹1000 and get back ₹1500.

$$\text{A: gain} = \frac{200}{100} \times 100 = 200\%, \qquad \text{B: gain} = \frac{500}{1000} \times 100 = 50\%.$$

Option A gives the better percentage gain, yet Option B puts more rupees in your pocket. Which is "better" depends on the question asked.

Proportion Against Absolute Value

Percentage compares proportions. Rupees compare amounts. A shop offering "20% off or ₹50 off" on a bill above ₹150 is asking you to compare the two:

- Bill ₹180: 20% off saves ₹36, so the flat ₹50 wins.
- Bill ₹225: 20% off saves ₹45, so the flat ₹50 still wins.
- Bill ₹300: 20% off saves ₹60, so the percentage wins.

The break-even bill is ₹250.

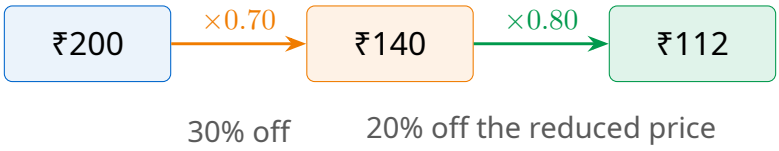
6.2 Successive Percentages Do Not Add

A bakery advertises "30% + 20% off". Another offers a flat 50%. They are not the same offer.

On a cake priced ₹200:

- First shop: $200 \to 200 - 60 = 140$, then $140 - 28 =$ ₹112.
- Second shop: $200 \times 0.5 =$ ₹100.

The second discount lands on the already reduced price, so it is worth less.



Net multiplier $= 0.70 \times 0.80 = 0.56$, so the true discount is 44%, not 50%.

Successive discounts multiply. Chain the multipliers instead of adding the percentages.

Chaining Percentage Changes

Two successive changes of a% and b% give a net multiplier

$$\left(1 \pm \frac{a}{100}\right)\left(1 \pm \frac{b}{100}\right).$$

Bus fares rising 3% then 4% give $1.03 \times 1.04 = 1.0712$, an overall rise of 7.12%, not 7%.

Adding the Percentages

Mice change by $+5$%, -2% and -3% over three months. The population is $p \times 1.05 \times 0.98 \times 0.97 = 0.9981p$, slightly *below* p. Adding $+5 - 2 - 3 = 0$ wrongly suggests no change at all.

6.3 The Margin and Discount Mishap

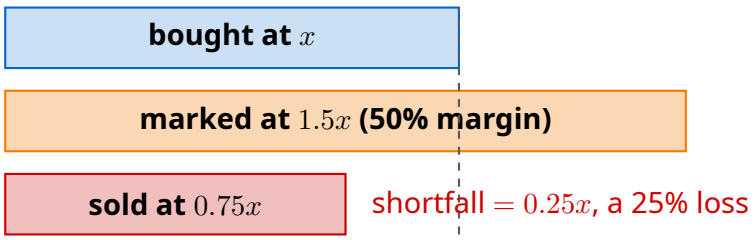
Surbhi adds a 50% profit margin, then offers a 50% discount, expecting to break even. Let x be what she paid.

1. Marked price $= 1.5x$.

2. After a 50% discount, selling price $= 0.5 \times 1.5x = 0.75x$.
3. She sells at $\frac{3}{4}$ of her cost, which is a 25% loss.

If the discounted goods fetched ₹12,000, then $0.75x = 12000$, so $x =$ ₹16,000 and the loss is ₹4,000.

To break even she needed $1.5x - d \times 1.5x = x$, giving $d = \frac{1}{3} = 33.33\%$.



The margin is measured on the cost, the discount on the marked price. Different bases, so they do not cancel.

6.4 Symmetry, Reversals and Careful Reading

Three short results save a lot of time.

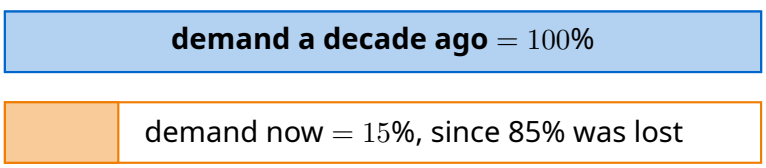
1. x% of y equals y% of x.

$$x\% \text{ of } y = \frac{x}{100} \times y = \frac{xy}{100} = \frac{y}{100} \times x = y\% \text{ of } x.$$

So 5% of 40 and 40% of 5 are both 2. Use it to swap an awkward calculation for an easy one: 12% of 25 is the same as 25% of 12, which is 3.

2. Percentages do not reverse. If Ariba has 120% of Arun's marbles, Arun does not have 80% of Ariba's. Let Arun have 100, so Ariba has 120. Then Arun has $\frac{100}{120} \times 100 = 83.33\%$ of Ariba's.

3. Falling by 85% means 15% remains. "Demand fell by 85%" means demand now is 15% of what it was, not 85% of it.



A fall of 85% leaves 15% standing. Draw the bar before choosing the number.

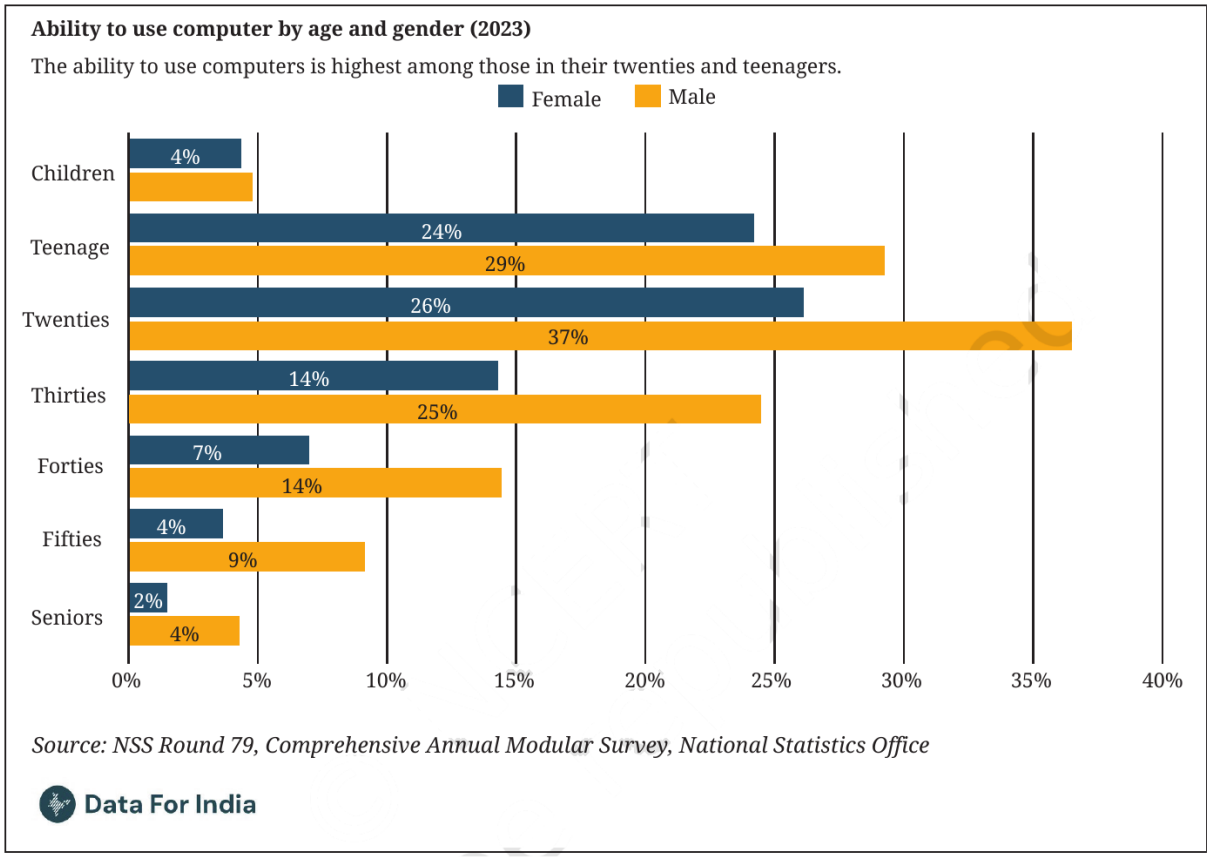
Assume 100 When No Number Is Given

For any question phrased only in percentages, set the unknown base to 100. The left-handed puzzle then solves itself. In a room of 100 people, 99 are left-handed and 1 is right-handed. For the left-handers to fall to 98%, the single right-hander must become 2% of the room, so the room must hold 50 people in all. That means 49 left-handers stay and 50 leave.

A four-word routine covers all three results: base first, amount of change next, share it as a fraction, express it per hundred. Naming the base before you divide prevents most errors in this chapter.

6.5 Reading Percentage Graphs

Exam questions often hang on a chart rather than a calculation. The graph below plots the share of each age group that can use a computer, split by gender.



Ability to use a computer by age and gender, 2023. Each bar is a percentage of that age group, not of the whole population. Source: NCERT Ganita Prakash, Class 8 Part 2, Chapter 1, page 30.

Read the statements carefully against the bars:

- "People in their twenties are the most computer literate." Valid, since both bars peak there.
- "Women lag behind across age groups." Valid, since every female bar is shorter than the male bar beside it.
- "There are more people in their twenties than teenagers." Not valid. The chart shows shares within each group, not group sizes.
- "More than a quarter of people in their thirties can use computers." Not valid from these bars alone, since 14% and 25% are each below 25% of that whole group.

Percentage of What?

A bar chart of percentages hides the base. Two bars can show 40% each while standing for very different head counts. Before comparing them, always ask which total each percentage was taken from.

7 Quick Reference Summary

Everything in the chapter reduces to a short list of formulas and a few habits. Use this section for last-minute revision, and use the practice checklist to test yourself before the exam.

7.1 Formula Sheet

Conversions

$$x\% = \frac{x}{100}, \qquad \frac{a}{b} = \left(\frac{a}{b} \times 100\right)\%, \qquad y\% \text{ of } z = \frac{y}{100} \times z$$

$$\text{ratio } a : b \longrightarrow \frac{a}{a+b} \times 100\ \%$$

Change, Trade and Growth

$$\text{Increase\%} = \frac{\text{increase}}{\text{original}} \times 100, \qquad \text{Decrease\%} = \frac{\text{decrease}}{\text{original}} \times 100$$

$$\text{Profit\%} = \frac{SP - CP}{CP} \times 100, \qquad \text{Loss\%} = \frac{CP - SP}{CP} \times 100$$

$$\text{Discount\%} = \frac{MP - SP}{MP} \times 100$$

$$A = p(1 + rt) \quad \text{(no compounding)}$$

$$A = p(1 + r)^t \quad \text{(compounding)}$$

$$A = p(1 - r)^t \quad \text{(decline)}$$

7.2 Conversion Table to Memorise

Per cent	1%	5%	10%	20%	25%	40%	50%	75%	125%
Fraction	$\frac{1}{100}$	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{5}{4}$
Decimal	0.01	0.05	0.1	0.2	0.25	0.4	0.5	0.75	1.25
Multiplier for a rise	1.01	1.05	1.1	1.2	1.25	1.4	1.5	1.75	2.25
Multiplier for a fall	0.99	0.95	0.9	0.8	0.75	0.6	0.5	0.25	n/a

7.3 Question Types and Where They Appear

Percentage questions in Class 8 tests repeat a small set of shapes. The table shows how the marks usually fall.

Question type	Usual marks	What to write
Convert between fraction, decimal and per cent	1	One line each way, simplified
Find y% of a quantity	1 to 2	Formula, substitution, answer with unit
Ratio to percentage share	2	Total parts first, then the fraction
Percentage increase or decrease	2	Name the base before dividing
Profit, loss or discount	2 to 3	Table of CP, MP, SP, then the formula
GST or tax added on	2	Multiplier method, $\times(1+r)$
Simple against compound growth	3	Both totals, then the difference
Successive percentage change	3	Chain of multipliers, never a sum
Reading a percentage chart	2 to 3	Quote the bar, then judge the claim

7.4 Common Mistakes and How to Avoid Them

Mistake	Fix
Using the new value as the base for percentage change	The base is always the original value
Adding successive percentages	Multiply the multipliers instead
Using $\frac{a}{b}$ for a ratio $a:b$ of a whole	Use $\frac{a}{a+b}$
Computing profit % on the selling price	Profit % is always on the cost price
Treating "120% of" as "120% more than"	Subtract 100% to get the excess
Putting the per cent number into $p(1+r)^t$	Convert to a decimal first, $r = \frac{\text{rate}}{100}$
Assuming a 85% fall leaves 85%	It leaves $100 - 85 = 15$%

The Three-Line Habit

Write these three lines before touching the arithmetic: what the base is, what the change is, and which formula matches. Most lost marks in this chapter come from

starting the calculation too early.

7.5 Self-Check Before the Exam

Tick each item only when you can do it without notes.

1. Convert $\frac{5}{11}$, $\frac{9}{20}$ and $\frac{72}{150}$ to percentages.
2. Find 62% of 360 and 140% of 40 by two different methods.
3. Express the ratio $3 : 5$ as the percentage share of each part.
4. A price moves from ₹38 to ₹42. State the percentage increase.
5. A shopkeeper buys at ₹75 and sells at ₹110. State the profit percentage.
6. A shirt marked ₹300 carries a 25% discount. State the amount payable.
7. Compare ₹20,000 at 10% p.a. for 2 years with and without compounding.
8. A population of 1.5 crore grows 3% a year. State it after 3 years.
9. Fares rise 3% then 4%. State the overall rise.
10. A number increased by 20% becomes 90. Find the number.

Memory Aid: PDF for Word Problems

Picture it with a bar model, **D**ecide the base, **F**ormula last. Drawing the rough diagram first is the single habit the chapter keeps recommending.

Sale boards, a mobile recharge with GST, marks on a test out of 40 or 80, the battery reading on a phone, and the interest line on a bank passbook all use the same idea. Each one is a fraction over 100 in disguise, which is exactly what the chapter title promises.

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