

Percentage



~ Quantitative Aptitude · SSC Exams ~

← circled = key formulas!



Percentage means “per hundred” — a way of writing a fraction with denominator 100. $x\% = x / 100$ — it lets us compare fractions, ratios & growth on one common scale.

① Meaning & Conversions ↔

Four basic conversions

- Fraction → %: multiply by 100. e.g. $3/8 \times 100 = 37.5\%$
- Decimal → %: multiply by 100 (shift point 2 right). $0.045 = 4.5\%$
- % → Fraction: write $x/100$ & simplify. $35\% = 35/100 = 7/20$
- % → Decimal: divide by 100 (shift point 2 left). $62\% = 0.62$

Worked example — convert $3/8$ and 0.045 to %

Step 1 — $3/8 \times 100 = 300/8 = 37.5$.

Step 2 — $0.045 \times 100 = 4.5$.

Answer → $3/8 = 37.5\%$; $0.045 = 4.5\%$. ✓

Quick conversions — memorise the pattern

$$0.2 = 20\%$$

$$0.05 = 5\%$$

$$1.5 = 150\%$$

$$0.008 = 0.8\%$$

$$45\% = 0.45$$

$$125\% = 1.25$$



A percentage greater than 100% just means “more than the whole” — e.g. 150% of 40 = 60, which is bigger than 40. Nothing scary about it!

② The Fraction ↔ % Master Table

The single most time-saving table in this chapter. Memorise it and most “find x% of y” sums become one-line multiplications.

Fraction	%	Fraction	%
1/2	50%	1/9	11.11%
1/3	33.33%	1/10	10%
1/4	25%	1/11	9.09%
1/5	20%	1/12	8.33%
1/6	16.67%	1/15	6.67%
1/7	14.28%	1/16	6.25%
1/8	12.5%	1/20	5%

Worked example – find 37.5% of 96

Step 1 – recognise $37.5\% = 3/8$ (from the table).

Step 2 – $3/8 \times 96 = 3 \times 12$.

Answer → = **36** – no long decimal multiplication needed! 

Try these (use the table!)

12.5% of 640 = **80**

6.25% of 480 = **30**

16.67% of 720 = **120**

9.09% of 220 = **20**



Recurring decimals like 33.33%, 16.67%, 14.28% are really $100/3\%$, $50/3\%$, $100/7\%$ – always prefer the exact fraction over the rounded decimal in calculations.

③ Finding a % of a Number – and the Reverse 🔍

Three forms of the same idea

- $x\% \text{ of } N = (x/100) \times N$
- $X \text{ is what } \% \text{ of } Y? \rightarrow \% = (X/Y) \times 100$
- $x\% \text{ of } N = V, \text{ find } N \rightarrow N = V \times 100/x$

Worked – find 15% of 460

$$15\% \text{ of } 460 = 15/100 \times 460 = \mathbf{69}. \quad \checkmark$$

Worked – 45 is what percent of 360?

$$(45/360) \times 100 = (1/8) \times 100 = \mathbf{12.5\%}. \quad \checkmark$$

Worked – 20% of a number is 90; find the number

$$N = 90 \times 100/20 = \mathbf{450}. \quad \checkmark$$

Try these

$$24\% \text{ of } 350 = \mathbf{84}$$

$$63 \text{ is what } \% \text{ of } 180? \rightarrow \mathbf{35\%}$$

$$8\% \text{ of a no. is } 44 \rightarrow \text{no.} = \mathbf{550}$$

$$150\% \text{ of } 80 = \mathbf{120}$$



“of” always means $\times$ and “is” always means $=$ – translate the English sentence into an equation word-by-word and the sum solves itself.



All three formulas are really **one** equation, $x/100 \times N = V$, just solved for a different letter each time.

④ Percentage Increase & Decrease $\uparrow \downarrow$

Core formulas

- **New value** = $\text{Old} \times (1 \pm r/100)$ (+ increase, - decrease)
- **% change** = $(\text{Change} / \text{Original}) \times 100$
- Increase X by $r\%$ quickly $\rightarrow X \times (100+r)/100$; decrease $\rightarrow X \times (100-r)/100$

Worked – a number rises from 250 to 300

Step 1 – change = $300 - 250 = 50$.

Step 2 – % increase = $(50/250) \times 100$.

Answer $\rightarrow$ **20%** increase. 

Worked – price falls from ₹800 to ₹680

% decrease = $(120/800) \times 100 =$ **15%**. 

Multiplying-factor cheat sheet

+10% $\rightarrow \times$ **1.1**

-25% $\rightarrow \times$ **0.75**

+50% $\rightarrow \times$ **1.5**

-12.5% $\rightarrow \times$ **0.875**



“% change” is *always* taken on the **original** value, never on the new one – a very common SSC trap.



If a value is X and it becomes N after an $r\%$ change, then $\text{Original} = N \times 100/(100 \pm r)$ – reverse-engineer using the same factor.

⑤ Successive Percentage Change

The master formula

$$\text{Net \% change} = a + b + ab/100$$

Use + for increase, - for decrease in a and b. A positive result = net increase, negative = net decrease.

Worked – successive increase of 10% then 20%

$$\text{Net} = 10 + 20 + (10 \times 20)/100 = 30 + 2 = \mathbf{32\% \text{ increase.}} \quad \checkmark$$

Worked – the classic trap: +20% then -20%

$$\text{Net} = 20 - 20 + (20 \times -20)/100 = 0 - 4 = \mathbf{-4\%} \text{ (net decrease of 4\%, NOT zero!)} \quad \checkmark$$

Try these

$$+25\%, +10\% \rightarrow \text{net} = \mathbf{+37.5\%}$$

$$-10\%, -10\% \rightarrow \text{net} = \mathbf{-19\%}$$

$$+30\%, -10\% \rightarrow \text{net} = \mathbf{+17\%}$$

$$+50\%, -33.33\% \rightarrow \text{net} = \mathbf{0\%}$$



Equal % increase then decrease **never** cancels – net is always a decrease of $r^2/100$ %. Multiply the two factors $(1+r/100)(1-r/100)$ to see why: it equals $1-r^2/10000 \times 100$.



For 3 successive changes, apply the formula **twice**: combine a & b first, then combine that result with c.

⑥ The Swap Trick – $x\%$ of $y = y\%$ of x

Why it works

$x\%$ of $y = (x/100) \times y = (y/100) \times x = y\%$ of x – both sides equal $xy/100$.

Worked – find 8% of 25

Step 1 – swap: 8% of 25 = 25% of 8.

Step 2 – 25% = $1/4$ (easy fraction), so $1/4 \times 8$.

Answer $\rightarrow = 2$. 

Worked – find 4% of 75

Swap: 75% of 4 = $3/4 \times 4 = 3$. 

Try these

12% of 50 = 50% of 12 = **6**

60% of 15 = 15% of 60 = **9**

16% of 250 = 250% of 16 = **40**

5% of 480 = 480% of 5 = **24**



Always swap so that the “of” number becomes a clean fraction from the page-2 table (25%, 50%, 20%...) – that’s the whole point of the trick.



Works for any pair – e.g. $3\frac{1}{3}\%$ of 900 = 900% of $3\frac{1}{3}$? Too messy – here just keep $3\frac{1}{3}\% = 1/30$ and multiply directly = 30.

⑦ “A is r% more/less than B” – the Trap $\updownarrow$

Formulas – never assume symmetry!

- A is r% **more** than B $\rightarrow A = B(1+r/100)$; then B is $[r/(100+r)] \times 100$ % less than A.
- A is r% **less** than B $\rightarrow A = B(1-r/100)$; then B is $[r/(100-r)] \times 100$ % more than A.

Worked – A's income is 25% more than B's

Step 1 – less% = $r/(100+r) \times 100 = 25/125 \times 100$.

Answer $\rightarrow$ B's income is **20% less** than A's (not 25%!). 

Worked – reverse: A is 20% less than B

more% = $r/(100-r) \times 100 = 20/80 \times 100 = \mathbf{25\%}$ – B is 25% more than A. 

Quick pairs to remember

10% more $\leftrightarrow$ **9.09%** less

50% more $\leftrightarrow$ **33.33%** less

25% less $\leftrightarrow$ **33.33%** more

10% less $\leftrightarrow$ **11.11%** more



“more” and “less” % are computed on **different bases** (more% on the smaller B, less% on the larger A) – that's exactly why $25\% \neq 20\%$.

⑧ Price & Consumption (Expenditure Fixed) ₹

Since Expenditure = Price × Consumption is **constant**, this is really the page-7 more↔less trick applied to Price & Consumption.

Formulas

- Price ↑ by $r\%$ → reduce consumption by $[r/(100+r)] \times 100\%$ to keep expenditure same.
- Price ↓ by $r\%$ → increase consumption by $[r/(100-r)] \times 100\%$ to keep expenditure same.

Worked – sugar price rises 25%

Reduction needed = $25/125 \times 100 = 20\%$ less consumption. ✓

Worked – petrol price falls 20%

Increase possible = $20/80 \times 100 = 25\%$ more consumption (same budget). ✓

Try these

Price ↑10% → reduce **9.09%**

Price ↓10% → increase **11.11%**

Price ↑50% → reduce **33.33%**

Price ↓25% → increase **33.33%**



Any “inverse product constant” question – speed×time, price×quantity, workers×days – uses this exact same $r/(100 \pm r)$ formula.

⑨ Income, Expenditure & Savings

Key relation

Savings = Income – Expenditure. There is no direct shortcut formula for % change in savings — always convert to actual rupee values first.

Worked – Income ₹20,000, Expenditure ₹15,000

Step 1 — Savings = 20,000 – 15,000 = ₹5,000.

Step 2 — income ↑20% → ₹24,000; expenditure ↑10% → ₹16,500.

Step 3 — new savings = 24,000 – 16,500 = ₹7,500.

Answer → % increase in savings = $(2,500 / 5,000) \times 100 = 50\%$. 

Mini-example – Income ₹10,000, Expenditure ₹8,000

Income +10% = 11,000; Expenditure +5% = 8,400; new saving = 2,600 (old 2,000) → **30%** rise in savings.



Take Income = 100 (assume a base) when no rupee figure is given — it makes the actual-value method just as fast as any formula.



Savings as a % of income = $(\text{Savings} / \text{Income}) \times 100$ — always double-check whether the question wants % of income or plain rupee change.

⑩ Population Growth & Depreciation

The compound formula

$$P_n = P_0 (1 \pm r/100)^n \quad (+ \text{ for growth, } - \text{ for depreciation})$$

• Different rate each year: $P_0(1 \pm r_1/100)(1 \pm r_2/100) \dots$ — multiply the factors.

Worked — town of 40,000 grows at 5% p.a.

Step 1 — $P_2 = 40,000 \times (1.05)^2$.

Step 2 — $(1.05)^2 = 1.1025$.

Answer → $P_2 = 40,000 \times 1.1025 = \mathbf{44,100}$. 

Worked — machine worth ₹20,000 depreciates 10% p.a.

Value after 2 yrs = $20,000 \times (0.9)^2 = 20,000 \times 0.81 = \mathbf{₹16,200}$. 

Quick multiplying factors (2 years)

+10% p.a. → × **1.21**

−20% p.a. → × **0.64**



“Grows one year, falls the next” questions — e.g. +10% then −10% — are just the page-5 successive-change formula applied to a real population figure.

11 Percentage in Exams – Marks & Pass-Marks

Core idea

Pass marks = (Pass %) $\times$ (Max marks) / 100. The **difference** between two %'s of the same max marks equals the **difference** between the two actual-marks statements.

Worked – pass mark is 40%; got 178, failed by 22

Step 1 – passing marks = $178 + 22 = 200$.

Step 2 – 40% of $M = 200 \rightarrow M = 200 \times 100 / 40$.

Answer $\rightarrow$ Max marks = **500**. 

Worked – A scores 30% & fails by 30; B scores 40% & is 30 above pass marks

Step 1 – $(40\% - 30\%)$ of $M = 30 + 30 = 60 \rightarrow 10\%$ of $M = 60 \rightarrow M = 600$.

Answer $\rightarrow$ Max marks = **600**; pass marks = $30\% \times 600 + 30 = 210$. 

Try these

33% of 300 = **99** pass marks

Got 450 / 600 $\rightarrow$ **75%**



Always convert “failed by” / “passed by” marks into an equation before touching percentages – that’s the single biggest source of silly mistakes here.

⑫ High-Frequency Shortcuts & Golden Rules ☆

Successive discount formula

Single equivalent discount of $a\%$ & $b\%$ = $a + b - ab/100$ (note the minus — both are decreases).

Worked — successive discounts of 10% and 15%

$$10 + 15 - (10 \times 15) / 100 = 25 - 1.5 = \mathbf{23.5\%} \text{ single discount. } \checkmark$$

Worked — a number becomes 460 after a 15% rise; find it

$$\text{Original} = 460 \times 100 / 115 = \mathbf{400.} \checkmark$$

One-line recall

“of” = $\times$, “is” = =

Increase then decrease $\neq$ no change

Always base % on the **original** value

Swap $x\%$ of $y \leftrightarrow y\%$ of x for easy numbers



Almost every “hard” percentage question is one of pages 3–11 in disguise — identify which pattern it is **first**, then plug in numbers.



45% of a number exceeds 30% of it by 60 $\rightarrow 15\%$ of $N = 60 \rightarrow N = \mathbf{400}$. Differences of percentages of the **same** number are just percentages of the difference.

Solved Examples

Q1. Find 20% of 150 + 30% of 200.

$$= 30 + 60 = \mathbf{90}. \quad \checkmark$$

Q2. A number is increased by 25% then decreased by 20%. Net % change?

$$\text{Net} = 25 - 20 + (25 \times -20) / 100 = 5 - 5 = \mathbf{0\% \text{ (no change)}}. \quad \checkmark$$

Q3. 40% of a number is 30 more than 25% of it. Find the number.

$$15\% \text{ of } N = 30 \rightarrow N = 30 \times 100 / 15 = \mathbf{200}. \quad \checkmark$$

Q4. Price of an item is cut by 25%. By what % must consumption rise to keep expenditure unchanged?

$$= 25 / 75 \times 100 = \mathbf{33.33\%}. \quad \checkmark$$

Q5. A's salary is 40% less than B's. By what % is B's salary more than A's?

$$= 40 / 60 \times 100 = \mathbf{66.67\%}. \quad \checkmark$$

Q6. A container has 80 L; 15% is water, rest milk. Find milk quantity.

$$\text{Milk} = 85\% \text{ of } 80 = \mathbf{68 \text{ L}}. \quad \checkmark$$



Golden move (Q2) $\rightarrow$ +25% then -20% cancel exactly because $1.25 \times 0.8 = 1$ – the two multiplying factors are reciprocals.

Practice Set – Part 1

Attempt these on your own first — answers for both parts are on page 16.

1. Convert $5/8$ to a percentage.
2. What is 35% of 640?
3. 90 is what percent of 360?
4. A number increases from 240 to 300. Find the % increase.
5. Find the net % change for successive changes of +30% and -10%.
6. Using the swap trick, evaluate 8% of 150.
7. A's income is 20% more than B's. B's income is what % less than A's?
8. The price of oil rises by 25%. By what % should consumption fall to keep expenditure unchanged?



For Q6 & Q7, remember pages 6 & 7 — swap to the easier base, and never mix up the “more” and “less” percentages.



Time yourself — each of these should take under 40 seconds once the fraction table (page 2) is memorised.

Practice Set – Part 2

9. Income = ₹18,000, Expenditure = ₹12,000. Income rises 15%, expenditure rises 5%. Find the % rise in savings.
10. A town's population is 25,000, growing at 4% p.a. Find the population after 2 years.
11. Pass marks are 35%. A student scores 189 and fails by 21 marks. Find the maximum marks.
12. Find the single discount equivalent to successive discounts of 20% and 10%.
13. A number becomes 552 after a 15% increase. Find the original number.
14. 45% of a number exceeds 30% of the same number by 60. Find the number.
15. A car worth ₹5,00,000 depreciates 10% every year. Find its value after 2 years.
16. A vessel is 60% milk and the rest water; it holds 40 L of water. Find the total quantity.



Q9, Q10 & Q15 all use the “convert to actual values, then compare” approach – the safest method whenever rupee or population figures appear.



Check your answers against the key on the next page – then redo any you missed without looking!

Answer Key ✓

1 → 62.5% ($5/8 \times 100$) · 2 → 224 · 3 → 25% · 4 → 25% ($60/240$) · 5 → +17%
($30-10+30 \times -10/100$) · 6 → 12 (150% of 8) · 7 → 16.67% less ($20/120$) · 8 → 20% less
($25/125$) · 9 → 35% rise (saving 6,000 → 8,100) · 10 → 27,040 ($25,000 \times 1.04^2$) · 11 → 600
($210/35\%$) · 12 → 28% ($20+10-2$) · 13 → 480 ($552 \times 100/115$) · 14 → 400 ($15\%N=60$) · 15 →
₹4,05,000 ($5,00,000 \times 0.81$) · 16 → 100 L ($40 \text{ L} = 40\% \rightarrow \text{total, milk} = 60 \text{ L}$).

Quick Revision 💡

- ✓ $x\% = x/100$. Memorise the fraction ↔ % table ($1/2$ to $1/12$, $1/15$, $1/16$, $1/20$) to skip decimal maths.
- ✓ Successive change: $\text{net}\% = a+b+ab/100$. "A is $r\%$ more/less than B" and its reverse use the $r/(100 \pm r)$ formula — never assume symmetry.
- ✓ Price × Consumption, Income − Expenditure = Savings, and Population $P(1 \pm r/100)^n$ are the three real-world engines behind almost every SSC percentage word problem.

☆ Percentages — every mark starts with 100! ☆

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