

CAT QUANTITATIVE ABILITY

FORMULA SHEET

CAT 2026

HANDWRITTEN NOTES STYLE

ARITHMETIC

ALGEBRA

GEOMETRY

NUMBER SYSTEM

MODERN MATH

TRIGONOMETRY

Quick revision formulas, shortcuts, common mistakes and active-recall prompts for CAT Quantitative Aptitude.

Prepared by Collegedunia for CAT aspirants

Revise • Recall • Practise • Analyse

How to Use This Formula Sheet

Quick recall first • application next

This sheet is for active recall. Learn the concept first, then use the formula, then solve a timed question. Add your own shortcuts and mock-test mistakes.

1

Read the formula without looking at your notes.

2

Say the condition where the formula applies.

3

Solve 3-5 representative questions.

4

Record recurring mistakes in your own formula book.

CAT formula sheets work best as a revision tool. Do not use memorisation as a substitute for understanding how a formula is applied.

Arithmetic Core

$$\text{Percentage} = (\text{Part} / \text{Whole}) \times 100$$

$$\% \text{ change} = [(\text{New} - \text{Old}) / \text{Old}] \times 100$$

$$\text{Profit} = \text{SP} - \text{CP} \quad | \quad \text{Loss} = \text{CP} - \text{SP}$$

$$\text{Profit \%} = \text{Profit} / \text{CP} \times 100$$

$$\text{Loss \%} = \text{Loss} / \text{CP} \times 100$$

$$\text{Discount} = \text{MP} - \text{SP} \quad | \quad \text{Discount \%} = \text{Discount} / \text{MP} \times 100$$

$$\text{Average} = \text{Sum of observations} / \text{Number of observations}$$

$$\text{Weighted average} = \Sigma(wx) / \Sigma w$$

Shortcut: keep the base value clear. Percentage changes are always measured against the original/base quantity.

Ratio, Proportion & Variation

$$a:b = c:d \rightarrow ad = bc$$

If $a:b = m:n$, let $a=mk$ and $b=nk$

Direct proportion: $x/y = \text{constant}$

Inverse proportion: $xy = \text{constant}$

Share in ratio $a:b:c = \text{total} \times a/(a+b+c)$

Mean proportional between $a, b = \sqrt{ab}$

CAT cue: convert a ratio into a common multiplier before building equations.

Simple & Compound Interest

$$SI = PRT / 100$$

$$\text{Amount (SI)} = P + SI$$

$$A = P(1 + R/100)^T$$

$$CI = A - P$$

Half-yearly: rate/2, periods $\times 2$

Quarterly: rate/4, periods $\times 4$

Mistake check: never mix an annual rate with the wrong number of compounding periods.

Time, Speed & Distance

Four core ideas CAT repeatedly combines

SPEED PROBLEMS

BASIC $D=S \times T$

AVERAGE SPEED

RELATIVE SPEED

TRAINS

$$\text{Distance} = \text{Speed} \times \text{Time}$$

- $\text{Speed} = \text{Distance} / \text{Time} \mid \text{Time} = \text{Distance} / \text{Speed}$
- $\text{km/hr} \square \text{m/s}: \times 5/18 \mid \text{m/s} \square \text{km/hr}: \times 18/5$

$$\text{Equal distance: Average speed} = 2xy/(x+y)$$

$$\text{Toward each other: Relative speed} = u + v$$

$$\text{Same direction: Relative speed} = |u - v|$$

$$\text{Train} \times \text{point: Time} = L / \text{speed}$$

$$\text{Train} \times \text{platform/train: Time} = (L_1 + L_2) / \text{relative speed}$$

TSD questions often chain two or more ideas. Convert units first and decide direction before applying relative speed.

Time & Work

If A finishes in x days $\rightarrow$ A's rate = $1/x$

Combined rate = sum of individual rates

Time = $1 / \text{combined rate}$

Work = Rate $\times$ Time

Efficiency ratio A:B = rates A:B

More efficient worker $\rightarrow$ less time

Fast method: choose total work as the LCM of individual completion times when convenient.

Mixtures & Alligation

Mean = Total value / Total quantity

Mixture mean = $(q_1c_1 + q_2c_2)/(q_1+q_2)$

Alligation: (Higher-Mean):(Mean-Lower) = Lower:Higher

Replacement: track quantity removed and replaced each cycle

Draw the higher value, mean and lower value before using alligation.

Algebraic Identities

$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$a^2 - b^2 = (a-b)(a+b)$$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

$$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

Identity recall is useful only when you can recognise where the identity shortens the solution.

Equations & Quadratics

$$ax^2 + bx + c = 0$$

$$x = [-b \pm \sqrt{b^2 - 4ac}] / 2a$$

$$\text{Discriminant } D = b^2 - 4ac$$

$$\text{Sum of roots} = -b/a$$

$$\text{Product of roots} = c/a$$

$$D > 0: \text{ distinct roots} \quad | \quad D = 0: \text{ equal roots}$$

CAT cue: many questions can be solved faster from root relationships than by finding both roots.

Sequences & Logarithms

$$\text{AP: } a_n = a + (n-1)d$$

$$\text{AP: } S_n = n/2 [2a + (n-1)d]$$

$$\text{GP: } a_n = ar^{n-1}$$

$$\text{GP: } S_n = a(r^n - 1)/(r - 1), r \neq 1$$

$$\log(ab) = \log a + \log b$$

$$\log(a/b) = \log a - \log b$$

$$\log(a^n) = n \log a$$

$$\log_a b = \log_c b / \log_c a$$

Keep the sequence formula and the condition together when revising.

Geometry Essentials

Triangle area = $\frac{1}{2} \times \text{base} \times \text{height}$

Pythagoras: $a^2 + b^2 = c^2$

Heron: $\sqrt{s(s-a)(s-b)(s-c)}$

Rectangle: Area = lb ; Perimeter = $2(l+b)$

Square: Area = a^2 ; Diagonal = $a\sqrt{2}$

Parallelogram: Area = $\text{base} \times \text{height}$

Trapezium: Area = $\frac{1}{2}(a+b)h$

Draw the figure first. Label the known sides and angles before selecting a formula.

Circles & Mensuration

Circle: $C=2\pi r$; Area= πr^2

Sector: Area= $(\theta/360)\pi r^2$

Arc length= $(\theta/360)2\pi r$

Cuboid: $V=lbh$; TSA= $2(lb+bh+hl)$

Cube: $V=a^3$; TSA= $6a^2$; diagonal= $a\sqrt{3}$

Cylinder: $V=\pi r^2 h$; CSA= $2\pi r h$

Cone: $V=1/3\pi r^2 h$; $l=\sqrt{r^2+h^2}$

Sphere: $V=4/3\pi r^3$; SA= $4\pi r^2$

Check whether the question asks for area, curved surface area, total surface area or volume.

Coordinate Geometry

$$\text{Distance} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\text{Midpoint} = ((x_1 + x_2)/2, (y_1 + y_2)/2)$$

$$\text{Slope } m = (y_2 - y_1)/(x_2 - x_1)$$

$$\text{Line: } y = mx + c$$

Parallel lines $\rightarrow$ equal slopes

$$\text{Perpendicular lines} \rightarrow m_1 m_2 = -1$$

Coordinate questions become faster when you translate the diagram into coordinates before calculating.

Number System

$$\Sigma \text{ first } n \text{ natural numbers} = n(n+1)/2$$

$$\Sigma \text{ first } n \text{ squares} = n(n+1)(2n+1)/6$$

$$\Sigma \text{ first } n \text{ cubes} = [n(n+1)/2]^2$$

$$n = p^a q^b r^c \rightarrow \text{factors} = (a+1)(b+1)(c+1)$$

$$\text{HCF} \times \text{LCM} = \text{product of two positive integers}$$

Divisibility by 3/9 $\rightarrow$ digit sum test

Divisibility by 4 $\rightarrow$ last two digits

Divisibility by 8 $\rightarrow$ last three digits

Divisibility by 11 $\rightarrow$ alternating digit-sum difference

For number-system questions, identify the requested property first: divisibility, remainder, factors, HCF/LCM or cyclicity.

Permutation, Combination & Probability

$$n! = n(n-1)(n-2)\dots 1$$

$${}^nPr = n!/(n-r)!$$

$${}^nC_r = n!/[r!(n-r)!]$$

$${}^nC_r = {}^nC_{(n-r)}$$

$$P(E) = \text{favourable outcomes} / \text{total outcomes}$$

$$P(\text{not } E) = 1 - P(E)$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$\text{Independent: } P(A \cap B) = P(A)P(B)$$

Counting first, probability second: define the sample space clearly before applying a formula.

Trigonometry & Modern Math

$$\sin\theta = \text{Opposite/Hypotenuse}$$

$$\cos\theta = \text{Adjacent/Hypotenuse}$$

$$\tan\theta = \text{Opposite/Adjacent}$$

$$\sin^2\theta + \cos^2\theta = 1$$

$$1 + \tan^2\theta = \sec^2\theta$$

$$1 + \cot^2\theta = \operatorname{cosec}^2\theta$$

$${}^nC_r = {}^nC_{(n-r)}$$

Focus on recognition and application. Use identities when they shorten the route to the answer.

Common Mistakes

Read this before every mock

1

Mixing km/hr and m/s without conversion

2

Using $(x+y)/2$ for equal-distance average speed

3

Adding speeds when two bodies move in the same direction

4

Forgetting platform/train length

5

Using a formula without checking its condition

6

Memorising identities without application practice

Revision Checklist

Active recall before every mock

- 1 Cover the formula and reproduce it from the topic name.
- 2 State the condition where the formula applies.
- 3 Convert units before writing the first equation.
- 4 Decide whether the question is direct, inverse, combined or comparative.
- 5 After a mock, add recurring mistakes to your personal formula book.

The best formula sheet is the one you actively use. Keep adding shortcuts, special cases and mistakes from your own mock analysis.

FAQ + Quick Recall

A compact final revision page

Q. Is memorising formulas enough? Use formulas for recall after understanding the concept and solving questions.

Q. What should I add to my personal sheet? Shortcuts, special cases, recurring mistakes and formulas you repeatedly forget.

Q. What should I do before a mock? Quickly reproduce key formulas and check the conditions where they apply.

QUICK RECALL

$$D = S \times T$$

Units first: $\times 5/18$ or $\times 18/5$

Equal-distance average speed = $2xy/(x+y)$

Toward $\square$ add | Same direction $\square$ subtract

Train $\times$ point $\square$ own length | Platform/train $\square$ combined length

Formula Sheet • One Page

Keep this page handy for last-mile revision

Arithmetic

$$\% \text{ change} = (\text{New} - \text{Old}) / \text{Old} \times 100 \quad | \quad \text{Avg} = \text{Sum} / n \quad | \quad \text{SI} = \text{PRT} / 100$$

TSD

$$D = ST \quad | \quad \text{km/hr to m/s} \times 5/18 \quad | \quad \text{Equal-distance avg} = 2xy / (x+y)$$

Relative speed

$$\text{Toward: } u+v \quad | \quad \text{Same direction: } |u-v|$$

Work

$$\text{Rate} = 1/\text{time} \quad | \quad \text{Combined rate} = \text{sum rates}$$

Algebra

$$(a \pm b)^2 = a^2 \pm 2ab + b^2 \quad | \quad a^2 - b^2 = (a-b)(a+b)$$

Quadratic

$$x = [-b \pm \sqrt{b^2 - 4ac}] / 2a \quad | \quad \text{Sum roots} = -b/a$$

AP/GP

$$a_n = a + (n-1)d \quad | \quad S_n = n/2 [2a + (n-1)d] \quad | \quad a_n = ar^{n-1}$$

Geometry

$$\text{Triangle} = 1/2bh \quad | \quad \text{Circle} = \pi r^2 \quad | \quad C = 2\pi r \quad | \quad \text{Cuboid} = lbh$$

Number System

$$n = n(n+1)/2 \quad | \quad \text{factors of } p \times q = (a+1)(b+1)$$

P&C

$${}^nP_r = n! / (n-r)! \quad | \quad {}^nC_r = n! / [r!(n-r)!]$$

Probability

$$P(E) = \text{favourable} / \text{total} \quad | \quad P(\text{not } E) = 1 - P(E)$$

Trigonometry

$$\sin^2 \theta + \cos^2 \theta = 1 \quad | \quad 1 + \tan^2 \theta = \sec^2 \theta$$

Revise the formula, recall the condition, then solve. Keep this page for quick revision—not as a substitute for concept practice.