Important CAT 2024 Quant Formulas: Mensuration

Mensuration questions frequently appear in the CAT exam, so it's essential to know and memorize the following formulas:

Triangle:

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

Area = $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$

Square:

Area = a^2

Perimeter = $4a$

Rectangle:

Area = $l \times b$

Perimeter = $2(l+b)$

Cube:

Volume = a^3

Lateral Surface Area = $4a^2$

Surface Area = $6a^2$

Diagonal = $\sqrt{3} \times a$

Cuboid:

Volume = $l \times b \times h$

Total Surface Area = $2(lb+bh+hl)$

Diagonal = $\sqrt{l^2+b^2+h^2}$

Circle:

Area = πr^2 or $\frac{\pi d^2}{4}$

Circumference = $2\pi r$ or πd

Area of a Sector = $\frac{\theta \pi r^2}{360}$

Important CAT 2024 Quant Formulas: Trigonometry

For Trigonometry in CAT, understand and memorize these formulas:

Trigonometric Identities:

Sine = $\frac{\text{Opposite}}{\text{Hypotenuse}}$

Secant = $\frac{\text{Hypotenuse}}{\text{Adjacent}}$

Cosine = $\frac{\text{Adjacent}}{\text{Hypotenuse}}$

Tangent = $\frac{\text{Opposite}}{\text{Adjacent}}$

Co-secant = $\frac{\text{Hypotenuse}}{\text{Opposite}}$

Co-tangent = $\frac{\text{Adjacent}}{\text{Opposite}}$

Reciprocal Identities:

$$\csc\theta = \frac{1}{\sin\theta}$$

$$\sec\theta = \frac{1}{\cos\theta}$$

$$\cot\theta = \frac{1}{\tan\theta}$$

$$\sin\theta = \frac{1}{\csc\theta}$$

$$\cos\theta = \frac{1}{\sec\theta}$$

$$\tan\theta = \frac{1}{\cot\theta}$$

Important CAT 2024 Quant Formulas: Coordinate Geometry

For Coordinate Geometry, these are the key formulas:

Distance Between Two Points $A(x_1, y_1)$ and $B(x_2, y_2)$:

- $AB^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$

Midpoint of a Line Segment:

- Midpoint = $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

Equation of a Line:

For a line with gradient m passing through (x_1, y_1): $y - y_1 = m(x - x_1)$

Important CAT 2024 Quant Formulas: Number Systems

Essential Number Systems formulas for CAT 2024:

Sum of the first n natural numbers: $\frac{n(n+1)}{2}$

Sum of squares of the first n natural numbers: $\frac{n(n+1)(2n+1)}{6}$

Sum of cubes of the first n natural numbers: $\left(\frac{n(n+1)}{2}\right)^2$

Sum of the first n odd numbers: n^2

Sum of the first n even numbers: $n(n+1)$

Mathematical Formulas:

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

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

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

$(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab+bc+ca)$

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

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

$a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2+b^2+c^2-ab-bc-ac)$

If $a+b+c=0$, then $a^3+b^3+c^3 = 3abc$

$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + b^n$

Important CAT 2024 Quant Formulas: Profit, Loss, and Discount

Key formulas for Profit, Loss, and Discount:

Profit = SP - CP

Profit Percentage = $\frac{\text{Profit}}{\text{CP}} \times 100$

SP = $\frac{100+\text{Gain }\%}{100} \times \text{CP}$

CP = $\frac{100}{100+\text{Gain }\%} \times \text{SP}$

Loss = CP - SP

Loss Percentage = $\frac{\text{Loss}}{\text{CP}} \times 100$

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

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

Important CAT 2024 Quant Formulas: LCM and HCF

Formulas for LCM and HCF:

$$\text{LCM} \times \text{HCF} = \text{Product of the Numbers}$$

LCM of co-prime numbers = Product of the Numbers

Important CAT 2024 Quant Formulas: Speed, Time, and Distance

Formulas for Speed, Time, and Distance:

Distance = Speed × Time

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

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

Important CAT 2024 Quant Formulas: Percentages

Formulas for Percentages:

To find what percentage of x is y: $\frac{y}{x} \times 100$

Increase N by $S\%$: $N\left(1+\frac{S}{100}\right)$

Decrease N by $S\%$: $N\left(1-\frac{S}{100}\right)$

Important CAT 2024 Quant Formulas: Time and Work

Formulas for Time and Work:

If X can complete a task in n days, then X's 1 day's work = $\frac{1}{n}$

If X's 1 day's work = $\frac{1}{n}$, then X can complete the work in n days.

Important CAT 2024 Quant Formulas: Averages

Formula for Averages:

- Average = $\frac{\text{Sum of Observations}}{\text{Number of Observations}}$

Important CAT 2024 Quant Formulas: Simple and Compound Interest

Formulas for Simple and Compound Interest:

Interest Compounded Annually:

- Amount = $P\left(1+\frac{R}{100}\right)^n$

Interest Compounded Half-Yearly:

- Amount = $P\left(1+\frac{R}{2\times 100}\right)^{2n}$

Interest Compounded Quarterly:

- Amount = $P\left(1+\frac{R}{4\times 100}\right)^{4n}$

Interest Compounded Annually with Fractional Time:

- Amount = $P\left(1+\frac{R}{100}\right)^{\frac{3}{P}} \times P\left(1+\frac{R}{2\times 100}\right)^{4n}$

Different Rates for Different Years:

- Amount = $P\left(1+\frac{R_1}{100}\right) \times P\left(1+\frac{R_2}{100}\right) \times P\left(1+\frac{R_3}{100}\right)$

Important CAT 2024 Quant Formulas: Probability

For solving CAT questions on Probability, remember the following:

- **Sample Space:** The set S of all possible outcomes of an experiment.
- **Event:** Any subset of a sample space.

The probability of occurrence of an event E is given by:

$P(E) = \frac{n(E)}{n(S)}$

Important CAT 2024 Quant Formulas: Logarithm

To tackle Logarithm questions in the CAT exam, memorize these formulas:

To tackle Logarithm questions in the CAT exam, memorize these formulas:

- $\log_a(xy) = \log_a(x) + \log_a(y)$
- $\log_a\left(\frac{x}{y}\right) = \log_a(x) - \log_a(y)$
- $\log_x(x) = 1$
- $\log_a(1) = 0$
- $\log_a(x^n) = n\log_a(x)$
- $\log_a(x) = \frac{1}{\log_x(a)}$
- $\log_a(x) = \frac{\log_b(x)}{\log_b(a)} = \frac{\log(x)}{\log(a)}$

Important CAT 2024 Quant Formulas: Set Theory and Function

Key formulas for Set Theory and Function:

- De Morgan's Laws:
  - $(A \cap B)' = A' \cup B'$
  - $(A \cup B)' = A' \cap B'$
- Relations:
  - **Reflexive Relation:** If aRa for all $a \in A$.
  - **Symmetric Relation:** If aRb then bRa for all $a, b \in A$.
  - **Transitive Relation:** If aRb and bRc then aRc for all $a, b, c \in A$.

If a relation R is reflexive, symmetric, and transitive in a set A, it is called an equivalence relation.

- **Permutation Formula:** The arrangement of r things from a set of n things where order matters.

$$nP_r = \frac{n!}{(n-r)!}$$

- **Combination Formula:** The selection of r things from a set of n things where order does not matter.

$$nC_r = \frac{n!}{(n-r)!r!} = \frac{nPr}{r!}$$

Important CAT 2024 Quant Formulas: Mixtures and Alligations

To solve Mixtures and Alligations problems, use the following rule:

$$\frac{\text{Quantity of Cheaper}}{\text{Quantity of Dearer}} = \frac{\text{C.P. of Dearer - Mean Price}}{\text{Mean Price - C.P. of Cheaper}}$$

Important CAT 2024 Quant Formulas: Surds and Indices

Key laws of indices and surds:

- Indices:
  - $a^m \times a^n = a^{m+n}$
  - $\frac{a^m}{a^n} = a^{m-n}$
  - $(a^m)^n = a^{mn}$
  - $(ab)^n = a^n b^n$
  - $\frac{a^n}{b^n} = \left(\frac{a}{b}\right)^n$
  - $a^0 = 1$
  - $a^{-m} = \frac{1}{a^m}$
- Surds:
  - Let a be a rational number and n be a positive integer such that $\sqrt[n]{a}$.

$a^{\frac{1}{n}} = \sqrt[n]{a}$

Here, $\sqrt[n]{a}$ is called a surd of order n.

- $\sqrt[n]{a} = a^{\frac{1}{n}}$
- $\sqrt[n]{ab} = \sqrt[n]{a} \times \sqrt[n]{b}$
- $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$
- $(\sqrt[n]{a})^n = a$
- $\sqrt[m]{\sqrt[n]{a}} = \sqrt[mn]{a}$
- $(\sqrt[n]{a})^m = \sqrt[n]{a^m}$