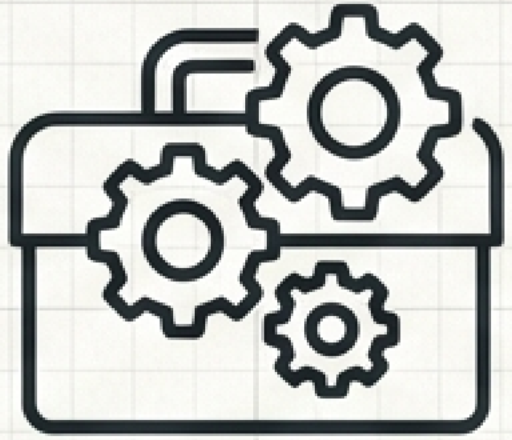


The Section A Toolkit: A Strategic Blueprint for C-CAT Quantitative & Reasoning

A rapid revision guide designed for clarity, retention, and exam success.

Your Revision Blueprint

This guide is organised into four distinct modules, taking you from core principles to advanced applications. Each module equips you with the specific concepts and formulas needed to excel.

Module 1: Foundations
Mastering Number Theory

Module 2: Applications
Commercial & Applied Arithmetic

Module 3: Dynamics
Time, Work & Motion

Module 4: Logic
Decoding Patterns & Puzzles

Module 1: Foundations

Mastering Number Theory

The Building Blocks: Classifying Numbers

A solid understanding of number types is the foundation for all quantitative reasoning.

The Number Spectrum

- **Real Numbers:** All numbers on the number line, from negative infinity to positive infinity.
- **Imaginary Numbers:** Numbers in the form of i (iota).
- **Natural Numbers:** All positive integers starting from 1 (1, 2, 3...). Note: 0 is not included.
- **Rational Numbers:** Any number that can be expressed as a p/q fraction (e.g., 2/3, 5/1).
- **Irrational Numbers:** Non-terminating, non-repeating numbers that cannot be expressed as a simple fraction (e.g., π).

Key Integer Properties

- **Prime Numbers:** Have exactly two factors: 1 and themselves (e.g., 2, 3, 7).
- **Composite Numbers:** Have more than two factors (e.g., 4 has factors 1, 2, 4; 16 has factors 1, 2, 4, 8, 16).
- **Co-prime Numbers:** Two numbers with no common factors other than 1. The numbers themselves do not have to be prime (e.g., 2 and 3; 8 and 9).

Essential Number Theory Techniques

How to Check if a Number is Prime

Concept: A quick method to verify primality.

Method:

1. Find the approximate square root of the number (n). Let's call it 'x'. You should round down to the nearest integer.
2. Test for divisibility only by the prime numbers less than 'x'.
3. If the number is not divisible by any of these primes, it is a prime number.

Example: Is 17 prime?
The square root of 17 is approx. 4.12. We take the integer 4.
Prime numbers less than 4 are 2 and 3.
17 is not divisible by 2 or 3.
Therefore, 17 is a prime number.

The HCF & LCM Product Rule

**Concept·: A fundamental relationship between two numbers and their Highest Common Factor (HCF) and Lowest Common Multiple (LCM).

Product of two numbers = Their HCF × Their LCM

$$n1 \times n2 = HCF(n1, n2) \times LCM(n1, n2)$$

NotebookLM

Solving Digit & Remainder Puzzles

Finding the Unit Digit of Large Powers

Concept: The unit digits of powers of a number often repeat in a cycle. For the number 3, the cycle of unit digits (3^1, 3^2, 3^3, 3^4...) is 3, 9, 7, 1. This cycle has a length of 4.

$$3 \to 9 \to 7 \to 1$$

Method:

1. Identify the cycle length of the base number's unit digit.
2. Divide the power by the cycle length.
3. The remainder determines the position in the cycle. If the remainder is 0, it corresponds to the last digit in the cycle.

Example: Find the unit digit of 3^{12}
The cycle length for 3 is 4.
Divide the power by the cycle length: $12 \div 4 = 3$ with a remainder of 0.
A remainder of 0 means the unit digit is the 4th element in the cycle (3, 9, 7, 1).
The unit digit is 1.

Remainder Rules for n-Digit Numbers

Concept: A common question type asks for the largest or smallest n-digit number that leaves a specific remainder when divided by another number.

Rule for the 'Largest' Number:
Subtract the remainder from the n-digit number.

Rule for the 'Smallest' Number:
Add the remainder to the n-digit number.

Module 2: Applications

Commercial & Applied Arithmetic

The Core Formulas of Commercial Mathematics

Profit & Loss

Profit / Loss: Selling Price (SP) – Cost Price (CP)

Profit Percentage: (Profit / Cost Price) × 100

Key Principle: Profit or loss percentage is always calculated on the Cost Price.

Calculating Selling Price (SP):
SP = ((100 ± Profit/Loss %) / 100) × CP

*(Use + for profit, - for loss)

Simple & Compound Interest

Simple Interest (SI): (P × R × T) / 100

P = Principal Amount
R = Annual Interest Rate
T = Time in Years

Compound Interest (CI):
Aggregate Amount (A) – Principal (P)

Aggregate Amount (A):
$P \times (1 + R/100)^n$

n = Number of Years

Using Ratios to Solve Partnership & Mixture Problems

Partnerships

Concept:
Profit shares in a partnership are distributed in the ratio of each partner's (Investment × Time).

Example:
A invests 10,000 for 6 months.
B invests 6,000 for 12 months.

Ratio of (Investment × Time):

A: 10,000 × 6 = 60,000

B: 6,000 × 12 = 72,000

The profit-sharing ratio is 60,000 : 72,000, which simplifies to **5 : 6**.

Mixture & Alligation

Concept:
A method to find the ratio in which two ingredients of different prices must be mixed to produce a mixture of a desired price.

Example:
A cheaper sugar (£10/kg) is mixed with a dearer sugar (£15/kg) to create a mixture worth £12/kg. In what ratio should they be mixed?

Cheaper: £10 | Dearer: £15

Mean: £12

(15 - 12) = **3** | (12 - 10) = **2**

The sugars must be mixed in a **3 : 2** ratio.

Module 3: Dynamics

Time, Work & Motion

Calculating Rates of Work and Travel

Time & Work / Pipes & Cisterns

Concept: These problems are solved by calculating the rate of work done per unit of time (e.g., work per day, or tank filled per hour). The core logic is identical for both problem types.

Example (Time & Work): A can complete a task in 12 days (Rate = 1/12 of the task per day).
B can complete the same task in 6 days (Rate = 1/6 of the task per day).
Together, their combined rate is `1/12 + 1/6 = 3/12 = 1/4` of the task per day.
Therefore, they will complete the task together in 4 days.

Speed, Distance & Time

The Core Formula: Speed = Distance / Time

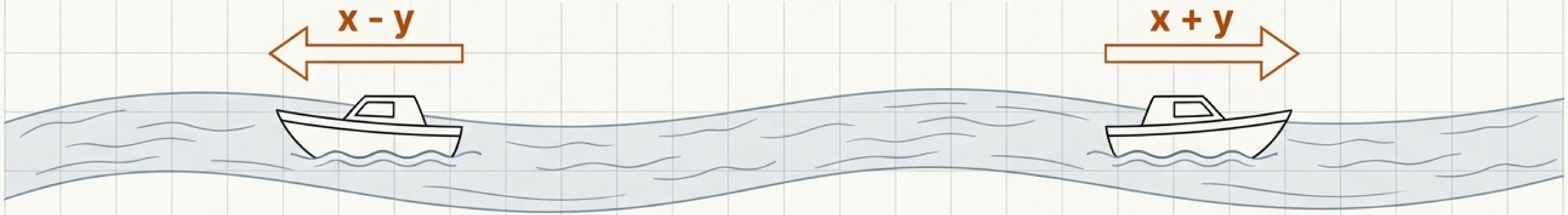
Critical Concept: Average Speed
Average Speed is **NOT** the average of the speeds.
The correct formula is: `Average Speed = Total Distance Travelled / Total Time Taken`

$$\text{Average Speed} = \frac{(d1 + d2)}{(t1 + t2)}$$

Advanced Motion: Boats & Streams

The speed of a moving object in a fluid (like a river) is affected by the speed of the fluid's current.

Let Speed of Boat in still water = **x**
Let Speed of Stream/Current = **y**



Upstream (Against the Current)

The boat is travelling in the **opposite direction** to the stream's flow.

The stream's speed reduces the boat's effective speed.

Upstream Speed = $x - y$

Downstream (With the Current)

The boat is travelling in the **same direction** as the stream's flow.

The stream's speed increases the boat's effective speed.

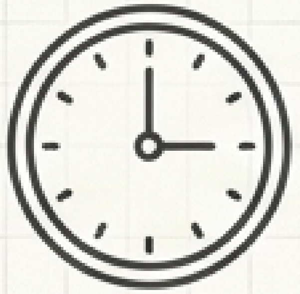
Downstream Speed = $x + y$

Module 4: Logic

Decoding Patterns & Puzzles

A Toolkit for Logical Reasoning

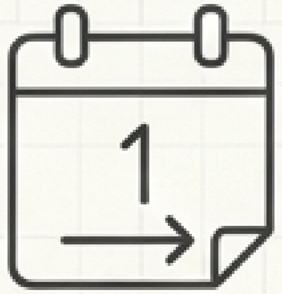
Clocks



Core Facts:
A clock face is a full circle of 360°.
The angle between each minute marking is 6° (360/60).
The angle between each hour marking is 30° (360/12).

Common Questions:
Involve finding the angle between hands at a specific time, or determining how many times the hands are at a right angle (90°) or parallel (0° or 180°) in a given period.

Calendars

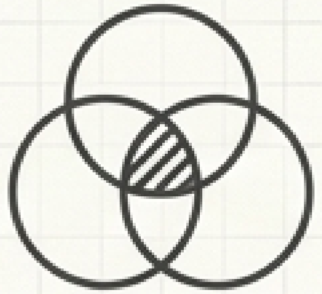


The 'Odd Day' Concept:
An 'odd day' is any day of the week remaining after the full weeks in a given period are counted.

Key Values:
A normal year (365 days) has 1 odd day.
A leap year (366 days) has 2 odd days.

Day Mapping:
0 Odd Days = Sunday
1 = Monday
2 = Tuesday
3 = Wednesday
4 = Thursday
5 = Friday
6 = Saturday

Syllogisms



Core Principle:
Base your conclusions *only* on the given statements. Do not use your own real-world knowledge or logic. The statement 'All tables are chairs' must be accepted as fact.

Method:
Use Venn diagrams to visually represent the relationships described in the statements.

Example Statements:
1. All Tables are Chairs.
2. Some Fans are not Tables.

Your Task:
Evaluate given conclusions (e.g., 'All chairs are tables,' 'No chair is a fan') against the world created by your Venn diagram.