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LOGICAL REASONING CHEAT SHEET

Essential Rules, Formulas, and Quick-Reference Shortcuts

1. Propositional Logic Rules

Logical Operators

Operation	Symbol	Condition for True
Conjunction	$P \wedge Q$	Both P and Q are T
Disjunction	$P \vee Q$	At least one is T
Implication	$P \implies Q$	False ONLY if $P=T, Q=F$
Biconditional	$P \iff Q$	Both have same truth value
Exclusive OR	$P \oplus Q$	Exactly one is T

Equivalent Statements

Given conditional statement: $**P \implies Q**$

- **Converse:** $Q \implies P$
- **Inverse:** $\neg P \implies \neg Q$
- **Contrapositive:** $\neg Q \implies \neg P$ (Logically Equivalent to original)

Important Laws

- **De Morgan's Laws:**

$$\neg(P \wedge Q) \equiv \neg P \vee \neg Q$$

$$\neg(P \vee Q) \equiv \neg P \wedge \neg Q$$

- **Material Implication:** $P \implies Q \equiv \neg P \vee Q$
- **Double Negation:** $\neg(\neg P) \equiv P$

2. Categorical Syllogisms

Standard Quantifier Types

Code	Statement	Type	Venn Diagram
A	All S are P	Universal Aff.	$S \subseteq P$
E	No S is P	Universal Neg.	$S \cap P = \emptyset$
I	Some S are P	Particular Aff.	$S \cap P \neq \emptyset$
O	Some S are not P	Particular Neg.	$S \setminus P \neq \emptyset$

Immediate Inferences (Conversion/Obversion)

- **Conversion (Swap S and P):**
 - *No S is P* $\implies$ *No P is S* (Valid)
 - *Some S are P* $\implies$ *Some P are S* (Valid)
 - *All S are P* $\implies$ *All P are S* (Invalid)
- **Rules for Valid Syllogisms:**
 1. Middle term must be distributed at least once.
 2. 2 negative premises $\implies$ No valid conclusion.
 3. 1 negative premise $\implies$ Negative conclusion.
 4. 2 particular premises $\implies$ No valid conclusion.

3. Clocks and Calendar Formulas

Clock Reasoning

- **Speed of Hands:**
 - Minute hand: 6° per minute ($360^\circ/60$ min)
 - Hour hand: 0.5° per minute ($30^\circ/60$ min)
 - Relative speed: 5.5° per minute
- **Angle (θ) between hands at H hours, M minutes:**

$$\theta = |30H - \frac{11}{2}M|$$

- Hands coincide (0°): Every $65\frac{5}{11}$ minutes.

Calendar Calculations

- **Leap Year Check:** Year divisible by 4. Century years must be divisible by 400.
- **Odd Days Count:**
 - Ordinary year (365 days) = 1 odd day.
 - Leap year (366 days) = 2 odd days.
 - 100 years = 5 odd days.
 - 200 years = 3 odd days.
 - 300 years = 1 odd day.
 - 400 years = 0 odd days.

4. Seating Arrangement & Positions

Linear Rank Formulas

For a single line of individuals:

- **Total People (T):** $T = R_{left} + R_{right} - 1$
- **Rank from opposite end:** $R_{right} = T - R_{left} + 1$
- **Overlap Case (between A and B):**

$$\text{Persons in between} = (R_A + R_B) - T - 2$$

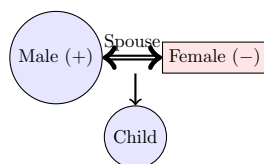
- **Non-Overlap Case:**

$$\text{Persons in between} = T - (R_A + R_B)$$

Circular Polygonal Setup Tips

- **Facing Center:** Left = Clockwise, Right = Counter-clockwise.
- **Facing Outside:** Left = Counter-clockwise, Right = Clockwise.

5. Blood Relations Matrix



- **Generation Gap Diagramming:**
 - +2: Grandparents
 - +1: Parents / Uncles / Aunts
 - 0: Self / Siblings / Cousins / Spouse
 - -1: Children / Nephews / Nieces

6. Coding-Decoding Shortcuts

Alphabet Position Mapping

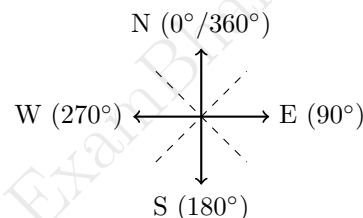
Use ****EJOTY**** (5 step jump) for rapid recall:

E	J	O	T	Y
5	10	15	20	25

Reverse Pairs (Sum = 27)

Pair	Word	Pos.	Pair	Word	Pos.
A – Z	AZ-ure	1/26	G – T	GT-Road	7/20
B – Y	BY-e	2/25	H – S	High-School	8/19
C – X	CruX	3/24	I – R	Indian-Railway	9/18
D – W	Dew	4/23	J – Q	Jack-Queen	10/17
E – V	EV-ening	5/22	K – P	KP-park	11/16
F – U	FU-ll	6/21	L – O	LO-ve	12/15

7. Direction Sense & Vectors



- **Shortest Distance (Pythagoras):**

$$d = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$

- **Shadow Rules at Sunrise/Sunset:**

- *Sunrise:* Shadows face ****West****.
- *Sunset:* Shadows face ****East****.
- *Noon (12 PM):* No shadow (Sun overhead).

8. Input-Output & Series Quick-Check

- **Number Series Patterns to Test:**

1. Prime numbers / Prime gaps.
2. Squares/Cubes ($n^2 \pm k$, $n^3 \pm k$).

3. Alternate operations ($+a, -b, +a, -b$).
4. Triplication/Halving patterns.

- **Input-Output Step Shifts:**

- Check if words arrange alphabetically ($A \rightarrow Z$) and numbers by magnitude ($1 \rightarrow 99$).
- Identify if elements shift from Left-to-Right or simultaneously from both ends.