Misconception Taxonomy (v1)

What this is: a structured “error database” we use to grade diagnostics and fix the *root causes* behind lost marks in Calculus and Physics.

How to use this document

When you submit your Diagnostic Test, we don’t only mark answers right or wrong. We tag the reason a mistake happened using short codes (for example **C-A1** or **P-N1**). Those tags make your tutoring plan precise: the right drills, the right visualizations, and the right problem types—in the right order.

How to read the codes

C- = Calculus, **P-** = Physics. The middle letter groups the skill area (e.g., **D** for derivatives, **N** for Newton’s Laws). Each code maps to: (1) what it looks like, (2) the fast fix we apply, and (3) a mastery check we use next session.

What you’ll see in your results

• Your **top 2–3 error patterns** (highest mark loss).
• A targeted practice plan aligned to those patterns.
• A weekly update showing which patterns are shrinking and what’s next.

Note: This is the public-facing summary (v1). Your personal report will reference only the patterns that show up in *your* work.

Calculus Error Patterns (C- codes)

These are the most common high-impact patterns we see in Calculus diagnostics and exams.

Code	Pattern	What it looks like	Fast fix (what we train)
C-F1	Algebra collapses under pressure	Correct idea; wrong simplification or sign flip.	Slow-algebra lane + micro-drills; verify by back-substitution.
C-F2	Domain/range blind spot	Loses restrictions (logs, radicals, denominators).	Domain checklist: denominator $\neq 0$, radicand ≥ 0, log argument >0.
C-L1	Cancels before factoring	Cancels $(x-a)$ without factoring first; misses indeterminate form.	Factor-first rule; rewrite, then cancel; quick plug-in check.
C-L2	“Limit = plug in” overgeneralized	Treats every limit as direct substitution.	3-case classifier: substitution works / removable / infinite or jump.
C-L3	Infinity misconceptions	Thinks ∞ is a number; mishandles dominant terms.	Dominant-term routine; divide by highest power; sanity with growth rates.
C-D1	Derivative is a procedure, not meaning	Computes $f'(x)$ but can’t use slope/tangent/units.	Local linearization: $f(a)+f'(a)(x-a)$; interpret slope on graph.
C-D2	Chain rule blindness	Misses inner derivative; especially radicals, exponentials.	Inside-out annotation; circle inner function; write $d(\text{inner})/dx$ explicitly.
C-D3	Product/quotient rule mix-up	Uses wrong rule or expands unnecessarily.	Rule cards + minimal form; check with quick derivative sanity test.
C-A1	Modeling/setup breakdown (optimization)	Can differentiate, but objective/constraint are wrong.	Setup Protocol: variables $\rightarrow$ constraint $\rightarrow$ objective $\rightarrow$ reduce to 1 variable.
C-A2	Related rates translation failure	Writes unrelated equations or wrong time derivatives.	Diagram + variable dictionary; differentiate once; substitute at the end.
C-I1	Integral as “anti-derivative only”	Struggles with area/accumulation/FTC meaning.	Units + accumulation story; connect area under curve to net change.
C-I2	Substitution chosen randomly	Picks u without matching du; gets stuck.	Match-du method: choose inner; compute du; look for constant multiple.
C-I3	Definite integral sign confusion	Area vs net area mixed; negative results surprise.	Net-change framing; split at zeros; interpret sign via graph.
C-S1	Series decision tree missing	Applies tests incorrectly; ignores conditions.	Archetype set (p, geometric, alternating, comparison); decision tree.

Physics Error Patterns (P- codes)

These are the most common high-impact patterns we see in Physics diagnostics and exams.

Code	Pattern	What it looks like	Fast fix (what we train)
P-V1	Vector-direction confusion	Signs wrong; swaps components; wrong angle reference.	Axis discipline + component triangle; sketch before equations.
P-V2	Units/scale negligence	No unit checks; answers off by 10× or 100×.	Unit ledger + prefix practice; end-of-line unit check every time.
P-K1	Kinematics as memorized formulas	Chooses wrong equation; ignores initial conditions.	Derive once from a = dv/dt; use function-based approach x(t), v(t).
P-K2	Graph interpretation errors	Confuses slope vs area; misreads sign regions.	Slope/area rules + quick shaded-area practice; verbalize meaning.
P-N1	Free-body diagram missing forces	Leaves out normal, tension, friction, or components.	Contact checklist: gravity, normal, friction, tension, applied; label axes.
P-N2	Action-reaction pair confusion	Pairs forces on same object; violates Newton's 3rd.	Rule: same interaction, different objects; identify the pair explicitly.
P-N3	Friction direction guessed	Friction pointed wrong; uses μN blindly.	Friction opposes relative motion; decide impending motion first; then apply.
P-E1	Energy sign/reference confusion	Wrong zero level; mixes PE/KE changes.	Energy ledger + define reference; write ΔE terms consistently.
P-E2	Conservation conditions ignored	Uses conservation with external work present (friction, thrust).	Checklist: isolated system? nonconservative work? then choose method.
P-M1	Momentum before collision modeling	Skips system definition; mixes 1D/2D vectors.	Define system + direction; conserve components; diagram with before/after.
P-C1	Centripetal as extra force	Adds "Fc" as a new force instead of net inward.	Centripetal is a requirement: ΣF_radial = mv^2/r; identify real forces.
P-C2	Constraint reasoning missing	String/track/normal constraints not used; wrong equations.	Constraint statements: no slack, contact, geometric relation; write before solving.
P-EM1	Field vs force confusion	Treats E as force; forgets test charge dependence.	Definitions: E = F/q; separate source vs test; direction conventions.
P-EM2	Circuits: series/parallel mix-up	Wrong equivalent R; mixes current/voltage rules.	Rule cards + two-node method; practice quick reductions.

Next step: Pair this taxonomy with your Diagnostic score + subscores to create a focused 1–2 week plan. Fastest improvement usually comes from fixing the highest-frequency pattern first (often setup/modeling and diagram discipline).