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STUDENT ABILITY DIAGNOSTIC REPORT

Ability
Diagnostic Report

MATHEMATICS

Ability estimate θ · Actual vs Projected · Dimension profile · Cognitive diagnosis · Score stability · Personalised growth

YANZ Assessment Institute · 2026 Senior-3 Joint Mock Examination #2 · 2026-05-08

STUDENT DETAILS · HOW TO READ

This report is about you

This report is built from your **item-by-item responses** in this joint mathematics examination. It uses Item Response Theory (IRT) to estimate your ability and Cognitive Diagnosis (DINA) to reconstruct your mastery across knowledge and ability dimensions. It does more than tell you **how many marks you scored** — it answers **where your true level is, and where to push next**.

School	**YANZ Demonstration High School**
Name	**CHEN Yiming**
Class	**Senior 3 · Class 2**
Exam No.	**0228**
Assessment	**2026 Senior-3 Joint Mock Examination #2 · Mathematics**
Date	**2026-05-08**

Total Mark	**118 / 150**
School Percentile	**top 18%**
Ability θ	**+0.92**
Overall Level	**4 / 5**
School Mean	**96.5 / 150**

How to read this report

- **Actual vs Projected**: the *projected* result is the probability that a student at your current ability θ would answer correctly. green = actual **above** projection (over-performance); red = actual **below** projection (the most worthwhile to revisit).
- **Levels 1–5**: 1 = needs work, 3 = competent, 5 = excellent — set by your score rate against the whole-cohort distribution.
- **Difficulty E/M/H**: Easy / Medium / Hard, auto-calibrated from the cohort's success rate. **Norm** = the cohort's score rate on that item.
- **Stability coefficient**: how much your mathematics result swings across repeated tests — the smaller, the more stable.

> Methods: IRT 2PL/3PL ability estimation · Classical Test Theory difficulty & discrimination · DINA cognitive diagnosis · weighted dimension synthesis. The algorithms are validated on ~20 million real item-level responses.

OVERALL

01 Your overall performance at a glance

On this mathematics assessment your total mark is **118 / 150** (score rate **79%**), placing you in roughly the **top 18%** of your school, at overall level **4 / 5**. The chart below shows your ability level by dimension — the dashed line marks the maximum level.

118/150	79%	top 18%	+0.92
Total	Score rate	School percentile	Ability θ

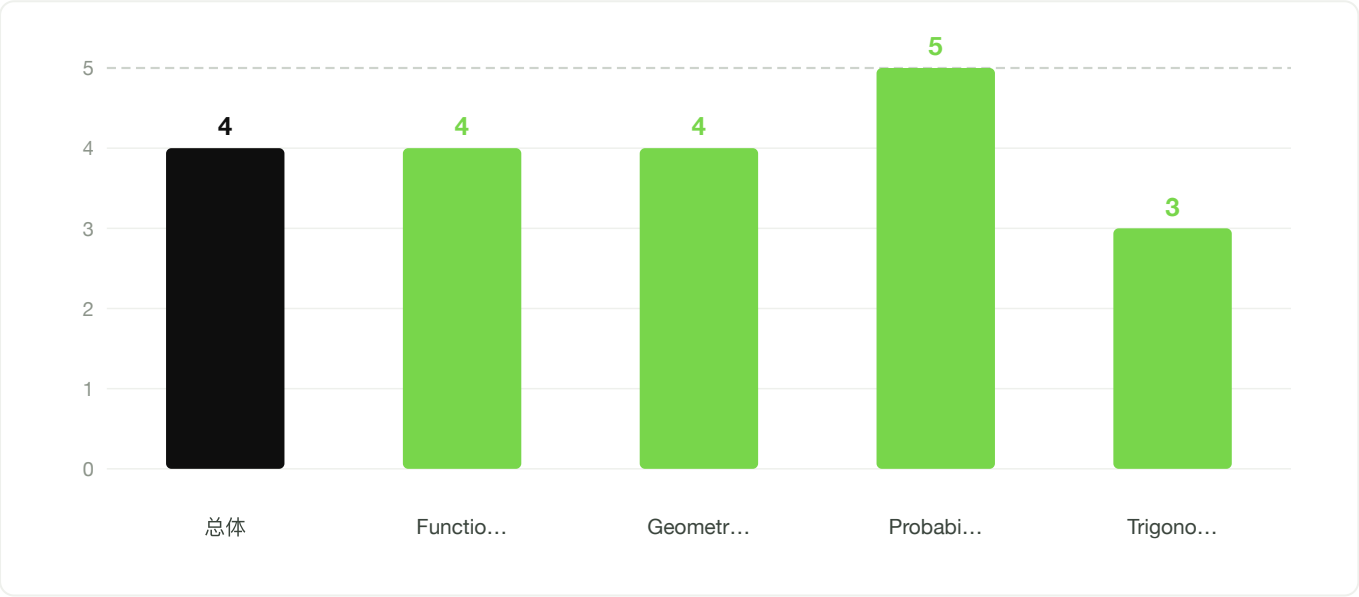


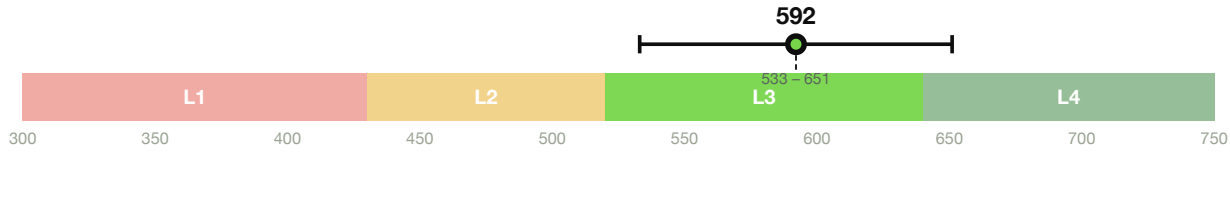
Fig 1 · Ability level by dimension (1–5). Dark = overall, green = content dimensions; dashed = level 5. **How to read：** Taller bar = higher level on that dimension; the dashed line is the maximum (level 5).

In one line: you are a **“strong but inconsistent”** student — overall among the top of your school. **Probability & Statistics** and **Functions & Calculus** are your strengths, often exceeding expectation on hard items; but **Trigonometry & Sequences** clearly lags, and your scores swing notably between tests. Fixing **stability** and **Trigonometry & Sequences** are your two fastest routes to a higher score.

ABILITY SCALE · LEVELS · PRECISION

Your ability scale score & achievement level

Item Response Theory (IRT) converts each of your responses into a single **ability scale score** (mean 500, SD 100) — more stable than a raw mark and comparable across different papers. Every test carries error, so we also report the **standard error of measurement (SEM)** and a **95% confidence interval**: there is a 95% chance your true ability lies within that band.



How to read: The coloured bands are the four achievement levels; the dot is your scale score and the whiskers are the 95% confidence interval — the narrower it is, the more precise this measurement.

Achievement level

L1 Emerging	Foundational knowledge and skills are not yet secure; needs systematic strengthening before progressing.
L2 Approaching	Has grasped some core knowledge and can complete basic tasks; still unsteady on integrated, complex problems.
L3 Proficient	Has a fluent command of the core curriculum standards, completes medium-difficulty tasks reliably, and already solves some integrated / harder problems.
L4 Advanced	Excels across most dimensions, transfers knowledge flexibly, and reliably cracks higher-order and novel-context problems.

Precision: your SEM this time is about 30 points (high precision); the confidence interval sits mainly in L3 with its upper edge reaching L4 — so the “Proficient” classification is **robust**, and you are right on the threshold of “Advanced”.

DIMENSION PROFILE

02 Performance by content dimension

The radar compares your **score rate**, the **school mean** and your **ability projection** across four content dimensions. Where “your performance” beats “your projection”, you over-performed; where it falls short, you have a **high-yield place to improve**.

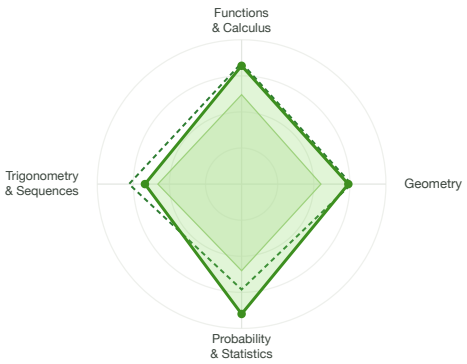


Fig 2 · Content-dimension radar: solid = your score rate, dotted = ability projection, pale = school mean.

Dimension	Score / Max	Score %	School %	Projected %	Level
Functions & Calculus	45/55	82%	62%	84%	4
Geometry (Solid & Analytic)	28/38	74%	55%	76%	4
Probability & Statistics	27/30	90%	60%	73%	5
Trigonometry & Sequences	18/27	67%	58%	78%	3

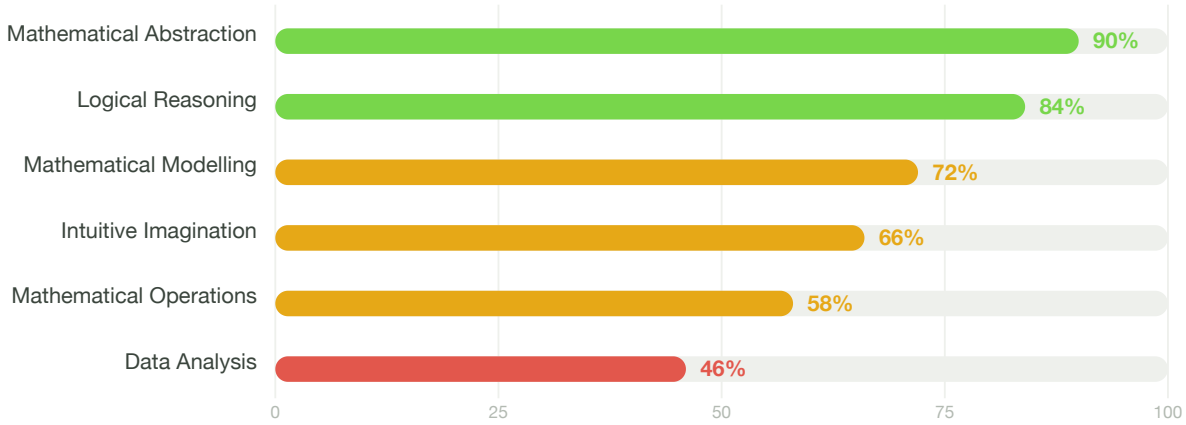
How to read： The further the solid line reaches out, the stronger you are; crossing the dotted line (your projection) means over-performance.

Probability & Statistics sits well above your ability projection (+17 points) — your signature strength. **Trigonometry & Sequences**, by contrast, runs 11 points below projection: the same ability should have earned more marks.

CORE COMPETENCIES

03 Mathematics core-competency profile

Beyond the score, this report uses cognitive diagnosis (DINA) to estimate your mastery across the **subject's curriculum-standard core competencies** — explaining the *why*: marks are won or lost through the strength of a competency, not a single knowledge point.



Mastery of each subject core competency (0–100%). Green = attained (≥75%), amber = developing (50–75%), red = needs work (<50%).
How to read： Longer bar = stronger mastery of that ability; colour shows the mastery band.

> Most of your core competencies are attained; the weaker ones are the priority to develop — competencies transfer to new item types far better than single questions.

ACTUAL VS PROJECTED

04 Item-by-item: actual vs projected

The tables compare your **actual marks** with your **ability projection** item by item. Green = over-performance (above projection), red = under-performance (below). The red items are the ones you "could do but didn't get" — **revisiting them has the highest payoff**.

Selected-response (incl. multi-select, partial credit)

Q	Diff.	Max	Actual	Proj.
1 MC	Easy	5	5	5
2 MC	Easy	5	5	5
3 MC	Medium	5	5	5
4 MC	Medium	5	5	5
5 MC	Medium	5	0	5
6 MC	Medium	5	5	5
7 MC	Hard	5	5	3
8 MC	Hard	5	5	4
9 Multi	Medium	6	6	4
10 Multi	Hard	6	4	4
11 Multi	Hard	6	3	5

Fill-in & free-response

Q	Diff.	Max	Actual	Proj.
12 Fill	Easy	5	5	5
13 Fill	Medium	5	5	5
14 Fill	Hard	5	0	4
15 Fill	Hard	5	5	2
16 Free	Medium	12	11	10
17 Free	Medium	12	8	11
18 Free	Medium	14	11	11
19 Free	Hard	17	14	11
20 Free	Hard	17	11	9

You over-performed on **5** items and under-performed on **4**. The shortfalls cluster on **Q5 & Q17 (Trigonometry & Sequences)** and **Q11 & Q14** — Q5 was an avoidable misread, and Q17 used the wrong direction of estimation.

BY DIFFICULTY

05 Performance across difficulty levels

Sorting items by difficulty (Easy / Medium / Hard) shows your strength at each level. ★ marks your current ability position — it sits **between Medium and Hard**: medium items should be fully secured, and you already break into hard items reliably.

Stronger (met or above projection)	Diff.	Weaker (below projection)
Q7, Q8, Q10, Q15, Q19, Q20	Hard	Q11, Q14
Q3, Q4, Q6, Q9, Q13, Q16, Q18	Medium ★ Your ability level	Q5, Q17
Q1, Q2, Q12	Easy	—

> Your ability already presses into the “Hard” band. **The priority is not harder problems, but plugging the leaks at the Medium level** — each medium item secured lifts your score more reliably than grinding the final problem.

SCORE STABILITY

06 Score stability analysis

Stability reflects how much your mathematics result swings across repeated tests: **the smaller the stability coefficient, the steadier you are**. Below, the x-axis is the stability coefficient and the y-axis is the total mathematics mark, split into four zones by "high vs low score × stable vs not". ★ is your current position (from 5 tests this term: 109, 124, 103, 121, 118).

Fig 4 · Score-stability quadrant. Each dot is a candidate; ★ is you. X = stability coefficient (0–1), Y = mathematics total (0–150). **How to read:** Further left = steadier, higher up = higher score; the goal is to move toward Zone A (top-left).

Zone A · High & Stable

Zone B · High but Unstable

Zone C · Low but Stable

Zone D · Low & Unstable

You are in **Zone B (high but unstable)**: your marks are already among the school's best, but they swing (103–124 this term). The swing comes mainly from **occasional slips on medium items** (like Q5 this time). **Stability is your most certain source of extra marks** — moving from Zone B to Zone A usually just means eliminating the "knew it, got it wrong".

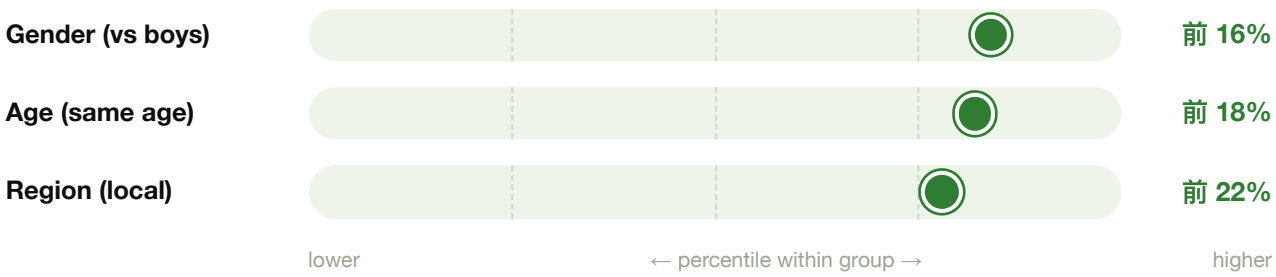
Three ways to shrink the swing

- Keep an **error-attribution log**: for every wrong item ask one question — "didn't know" or "knew it, got it wrong"? The latter is your stability leak.
- **Timed sectional drills**: 40 minutes on selected-response + fill-in, turning medium-item fluency into muscle memory.
- **Pacing discipline**: lock in the medium items (Q1–15) before attacking the final problem, so hard questions don't eat your checking time.

PEER GROUPS

07 Where you stand across groups

The same score can sit differently across reference groups. Below is your position within three groups — **gender / age / region** (the further right the dot, the higher you rank).

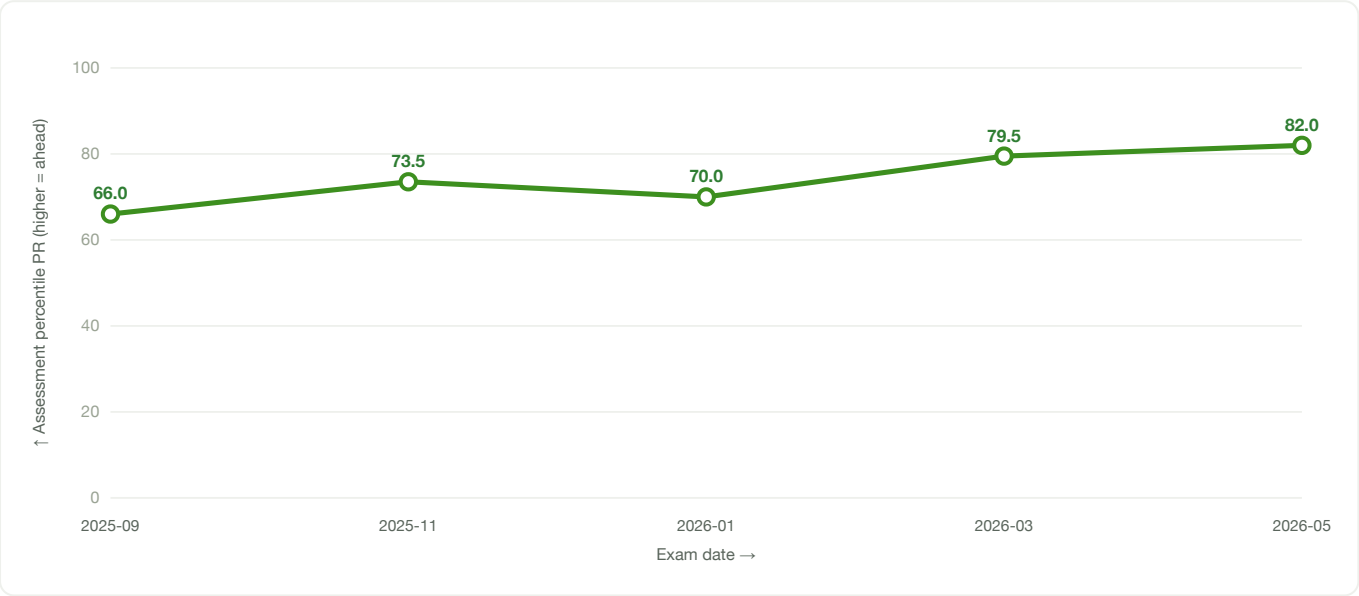


Within your **gender** and **same-age** groups you are already near the top; your **region** is more competitive — room to keep climbing.

TREND

08 Assessment-percentile trend over time

The chart shows how your **assessment percentile** changes over successive exams. Because cohort sizes differ each time, absolute rank is not comparable, so we use a **percentile rank PR (0–100, higher = ahead)** — a ratio score; **the higher the line, the higher your standing**, and a steady rise means steady progress.



X = exam date, Y = assessment percentile PR (a ratio score, independent of cohort size); higher on the curve is better. **How to read：** Line up = standing improved; down = slipped. Note the exam at each turning point and review what happened.

> Your assessment percentile is on a **steady upward trend** (PR 66 → 82); keep the pace and push for a higher percentile.

DETAILED DATA

09 Exam history

Your exam-by-exam detail. **Click any row** to jump to the full diagnostic report for that exam.

Date	Score	Percentile (PR)	Level	Report
2025-09	101 / 150	66.0	Lv3 Competent	View →
2025-11	108 / 150	73.5	Lv3 Competent	View →
2026-01	104 / 150	70.0	Lv3 Competent	View →
2026-03	112 / 150	79.5	Lv4 Good	View →
2026-05	118 / 150	82.0	Lv4 Good	View →

Note: “Percentile (PR)” is a ratio score (0–100, higher = ahead, independent of cohort size); “Level” matches the 1–5 levels used earlier. Click any row to open that exam's full report (in this sample the links point to the demo report).

PRIORITIES

10 Priority improvement list

These are the items where you had the **ability but didn't score** (actual clearly below projection), ranked by payoff. Clearing them one by one is the **most efficient** revision you can do right now.

Q	Diff.	Yours	Focus point	Diagnosis & advice
Q5 MC	Medium	0/5	Sine rule & triangle solving	Overlooked the angle range, giving the wrong value — an avoidable error.
Q17 Free	Medium	8/12	Sequences with inequalities	Wrong direction of estimation in the sequence-inequality proof; lost the latter half.
Q11 Multi	Hard	3/6	Monotonicity & extrema	Incomplete case analysis of monotonicity with a parameter.
Q14 Fill	Hard	0/5	Volumes in solid geometry	Failed to set up the decomposition for the volume — no marks.
Q20 Free	Hard	11/17	Calculus proof with parameters	Secured key marks on the hardest calculus proof, partial parameter analysis.
Q10 Multi	Hard	4/6	Properties of conic sections	Partial credit on conics; missed one correct option.

ITEM FOCUS

11 Per-item focus & feedback (Assessment Focus)

The full per-item list: difficulty, cohort success rate (Norm), your mark, the assessment focus and personalised feedback. This is your navigation map when you revisit the paper.

Q	Diff.	Norm	Yours	Focus point	Feedback
Q1	Easy	90%	5/5	Trigonometric identities	Simplifies trigonometric identities fluently.
Q2	Easy	86%	5/5	Domain & range of functions	Determines the domain of composite functions accurately.
Q3	Medium	66%	5/5	Lines & planes in space	Identifies parallelism and perpendicularity of lines and planes.
Q4	Medium	71%	5/5	Classical probability model	Enumerates the sample space and computes classical probability.
Q5	Medium	58%	0/5	Sine rule & triangle solving	Overlooked the angle range, giving the wrong value — an avoidable error.
Q6	Medium	62%	5/5	Exponential & logarithmic operations	Converts and computes with exponentials and logarithms accurately.
Q7	Hard	38%	5/5	Vectors & dihedral angles	Uses vector methods for dihedral angles, exceeding the projected level.
Q8	Hard	30%	5/5	Geometric meaning of derivatives	Finds tangents via derivatives, scoring on a hard item.
Q9	Medium	55%	6/6	Statistical charts & measures	All options correct; solid grasp of statistical measures.
Q10	Hard	34%	4/6	Properties of conic sections	Partial credit on conics; missed one correct option.
Q11	Hard	28%	3/6	Monotonicity & extrema	Incomplete case analysis of monotonicity with a parameter.
Q12	Easy	77%	5/5	Sequence terms & summation	Finds the general term and sum of a sequence accurately.
Q13	Medium	60%	5/5	Graphs & zeros of functions	Did not fully resolve the number of zeros via graphing.
Q14	Hard	36%	0/5	Volumes in solid geometry	Failed to set up the decomposition for the volume — no marks.
Q15	Hard	24%	5/5	Conditional & total probability	Excelled on conditional probability — full marks on a hard item.
Q16	Medium	58%	11/12	Derivatives & optimisation	Optimisation worked through cleanly, one minor slip.
Q17	Medium	52%	8/12	Sequences with inequalities	Wrong direction of estimation in the sequence-inequality proof; lost the latter half.
Q18	Medium	50%	11/14	Distributions & expectation	Distribution table and expectation computed correctly.
Q19	Hard	30%	14/17	Lines & conics (analytic)	Strong handling of the conic system and Vieta's formulae — above projection.
Q20	Hard	15%	11/17	Calculus proof with parameters	Secured key marks on the hardest calculus proof, partial parameter analysis.

LEARNING PATH

12 A growth path built for you

Turning the diagnosis into action. The recommended order is **steady first, stretch second**: 4 weeks on stability and Trigonometry & Sequences, then 4 weeks reaching for modelling and the final problem.

1 Weeks 1–4 · Steady the base, close the gaps

1. Build an error-attribution log and clear the “knew it, got it wrong” losses at the medium level (target: MC + fill-in ≥ 70/78).
2. Two Trigonometry / Sequences items daily — sine & cosine rules, summation and estimation — fixing the weak points exposed by Q5 and Q17.
3. One 40-minute timed mini-paper each week to train pacing.

2 Weeks 5–8 · Build modelling, take the final problem

1. Modelling theme: use probability/statistics and applied-calculus problems to practise the “situation → model” translation.
2. Step-wise calculus-proof training: parameter cases, auxiliary functions, estimation proofs — aim for the first two parts of the final problem.
3. Analytic-geometry synthesis: lock the system → Vieta → chord-length / area workflow into a reusable template.

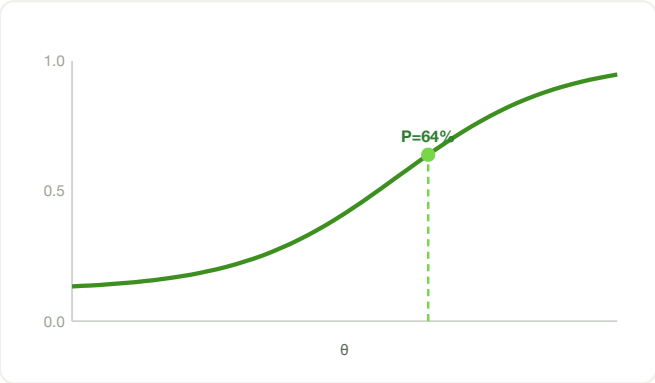
Stage goal Holding your strengths, lift Trigonometry & Sequences from 67% to 80% and halve your score swing — your total should settle from 118 to **128+**, moving your quadrant position from Zone B into **Zone A (high & stable)**.

METHOD & HOW TO READ

How this report is computed

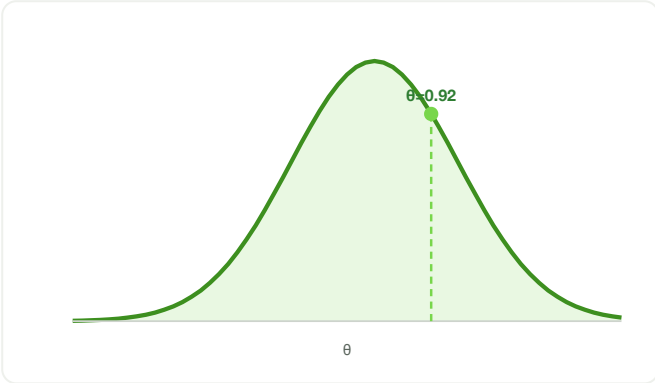
This report uses the international mainstream **Item Response Theory (IRT 2PL/3PL)** and **cognitive diagnosis (DINA)**. The three charts below explain, in turn: how an item's difficulty maps to your ability (the item characteristic curve), how precisely this paper measures someone at your level (the test information function), and where you stand relative to all candidates and to the item difficulties (the ability–difficulty map).

① Item Characteristic Curve (ICC)



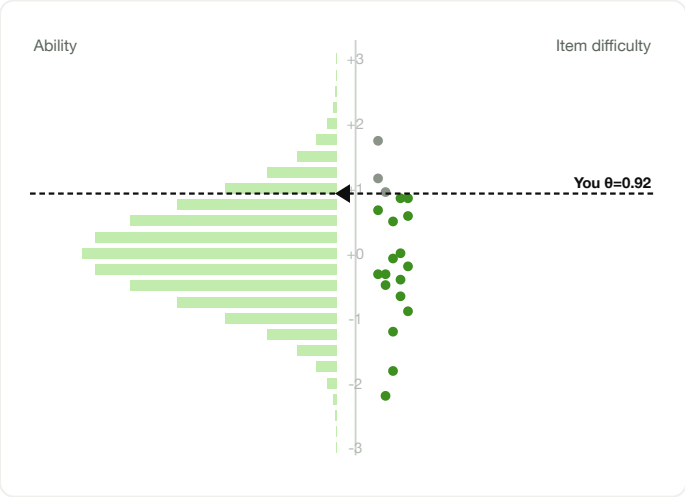
How to read: The x-axis is ability θ, the y-axis is the probability of answering the item correctly; a curve further right = a harder item. The vertical line is your θ, and its intersection with the curve = your probability of getting that item right.

② Test Information Function (TIF)



How to read: A higher curve = more precise measurement at that ability (smaller SEM). This paper's information peaks at upper-medium ability; your θ sits in the high-information zone, so the paper measures you quite precisely.

③ Ability–Difficulty Map (Wright Map)



How to read: On one shared “logit ruler”: the left is the ability distribution of all candidates; each dot on the right is one item's difficulty. Items **below** your ability line you are more than 50% likely to get right; those **above** are your challenge zone.

Glossary

Ability θ (theta)

The latent ability estimated by IRT; 0 is the cohort average, positive is above average.

Scale score

A linear transform of θ (mean 500, SD 100), enabling comparison across papers.

SEM

The uncertainty of a single estimate; smaller = more precise, used to build the confidence interval.

Difficulty b / Discrimination a

b = the ability needed for a 50% chance of success; a = how sharply the item separates high vs low ability.

Projected

The success probability predicted from your current θ; comparing with actual reveals over/under-performance.

DINA cognitive diagnosis

Infers the mastery probability (0–1) of each cognitive ability from your responses.

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METHOD & NOTICE

Every conclusion comes from your real responses

Every metric in this report — ability θ, actual vs projected, dimension levels, cognitive mastery, stability — is computed from your item-level responses through statistical models: auditable and explainable. It is not a label; it is a **map for moving upward**.

20 of 20	IRT 2PL/3PL	DINA	~20 million
Items scored	Ability model	Cognitive model	Validation set

Note: this is a **sample demonstration**; the student details and data are illustrative. Metric definitions and algorithms are documented in the *YANZ Algorithm & Data Manual*. For instructional use by students and teachers only — please do not distribute.