IB DP MATHS AI · EXAM SPECIAL · SL & HL · MODEL WORDING FOR R1 AND A1 MARKS · ~9 MIN READ

IB Maths AI Answer Templates: Interpret, Justify, Conclude

Fill-in-the-blank model answers for the IB Maths AI questions where examiners say students lose reasoning marks: hypothesis tests, interpreting parameters, regression, comparing data, Voronoi, finance and model limitations.

Interpreting gradients & parameters | Regression & reliability | Comparing distributions | χ^2 tests | t-tests | HL tests & intervals | Voronoi justifications | Finance answers

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No tag = **SL and HL** HL ONLY HL students only FORMULA BOOKLET given in the exam

M1 A1 how marks are awarded highlight = comes up again and again HANDY worth memorising

Test yourself at the end

IN 30 SECONDS

- **AI marks reasoning in words.** Every AI subject report in 2024–25 says students lose R1 and A1 marks by writing generic or incomplete statements: "reject H_0" with no context, "a is the gradient", "it's reliable because r is high".
- **The fix is a template.** Each one below has the parts examiners look for. Swap in the context of the question and keep the structure.
- **The number of marks tells you how much to write.** A 1-mark "interpret" needs one precise sentence; a 6-mark "justify" needs calculations and a conclusion.

BY THE END YOU CAN

- Interpret gradients, intercepts and model parameters in context.
- Write complete hypothesis-test answers that earn every mark.
- Judge the reliability of predictions and the limitations of models.
- Justify Voronoi and finance answers with the evidence examiners want.

1 Interpreting models

Linear models

- **Template (gradient):** "For each extra **[1 unit of x, with units]**, **[y]** increases (or decreases) by **[gradient, with units]**."
- **Template (intercept):** "When **[x = 0, in context]**, **[y]** is **[intercept, with units]**." Add "(the fixed cost)" or similar if it has a meaning.

WORKED EXAMPLE

A model for a city's population is P = 0.362t + 30.5 (millions), t years after 2000. Interpret 0.362 and 30.5.

1. "The population increases by 0.362 **million people per year**." R1
2. **"In 2000 (t = 0) the population was 30.5 million."** R1

COMMON MISTAKE

Writing "0.362 is the rate of change" or "the population increases by 0.362". Examiners want the change in y **per unit of x**, with the units (here millions per year).

Exponential and sinusoidal models

- **Exponential $y = k \times a^x + c$:** "k + c is the value when x = 0; **a** is the growth factor each [unit], so it grows by **(a – 1) × 100%** each [unit]; **c** is the long-term value the model approaches."
- **Logistic (HL):** "L is the **carrying capacity**: the maximum [population] the model predicts in the long term."
- **Sinusoidal $y = a\sin(b(x - c)) + d$:** "|**a**| is the amplitude (half the difference between the highest and lowest values); **d** is the principal axis, the mean level; the period is **360°/b**: the time for one full cycle."

WORKED EXAMPLE

The depth of water is D = 1.8 sin(30t)° + 3.2 metres, t hours after midnight. Interpret 3.2 and the period.

1. "3.2 m is the mean depth (the principal axis)." R1
2. **period = 360/30 = 12, so "the tide repeats every 12 hours."** A1

2 Regression and correlation

- **Describe r:** "r = **0.912** shows a **strong positive linear** correlation between **[x]** and **[y]**." Use strong (|r| ≥ 0.75), moderate, weak or very weak, and always say **linear**.
- **Reliability of a prediction:** "The prediction is **reliable/unreliable** because **x = [value] is inside/outside the range of the data (interpolation/extrapolation)** and the correlation is **strong/weak**." You need **both** reasons for full marks when the question asks "is this reliable?".
- **Correlation vs causation:** "A strong correlation doesn't show that **[x]** causes **[y]**; both might depend on **[a third factor]**."

COMMON MISTAKE

Using r alone to justify reliability. The Nov 2024 and May 2025 reports both saw this. A strong r doesn't save an extrapolation.

Comparing two data sets

- **Template:** "**[Group A]** has a higher median (**[value]** vs **[value]**), so **A** typically **[context, e.g. waited longer]**. **[Group A]** has a larger IQR (**[value]** vs **[value]**), so **A**'s **[context]** are more spread out / less consistent."

COMMON MISTAKE

Comparing numbers without saying what they mean, or comparing a median with a mean. Compare **like with like**: median with median, IQR with IQR, and say which data set each number comes from.

3 Hypothesis tests

χ^2 test for independence

- **H_o:** "**[Variable A]** and **[variable B]** are **independent**." **H_1:** "**[Variable A]** and **[variable B]** are **not independent**."
- **Evidence:** "p-value = **0.0631** > 0.05 (the significance level)" or "χ^2_calc = **5.52** < 5.99 (critical value)".
- **Conclusion:** "There is **insufficient evidence** at the 5% level to reject H_o, so **[favourite subject is independent of year group]**." Or: "Reject H_o: there is evidence at the 5% level that **A** and **B** are **not independent**."

COMMON MISTAKE

Writing H_o as "there is no relationship", "A does not influence B" or "there is no association". The May 2025 SL report calls these incorrect. Use **independent**.

χ^2 goodness of fit

- **H_o:** "The data **fits** the **[uniform / binomial B(4, 0.5) / normal]** model." **H_1:** "The data does not fit the model."
- **Degrees of freedom:** number of categories − 1 (HL: subtract one more for each parameter you estimated from the data).

t-test for two means

- **H_o:** $\mu_A = \mu_B$. **H_1:** $\mu_A > \mu_B$ (one-tailed) or $\mu_A \neq \mu_B$ (two-tailed), where μ is the **population** mean **[score, time...]**.
- **Conclusion:** "p = **0.00697** < 0.05, so reject H_o: there is evidence at the 5% level that the **mean [score] of A is greater** than that of **B**."
- **Assumptions (if asked):** "both samples are random and independent, and both populations are normally distributed."

EXAM TIP

Say "insufficient evidence to reject H_o", never "accept H_o". A test can't prove the null hypothesis.

HL tests and intervals

HL ONLY

- **Binomial test of a proportion:** "X ~ B(20, 0.3) under H_o: p = 0.3, H_1: p > 0.3. P(X ≥ 10) = 0.0480 < 0.05, so reject H_o: there is evidence that more than 30% of seeds fail."
- **Confidence interval:** "**46.1 < μ < 50.3**." Interpret: "We are 95% confident that the **population mean [quantity]** lies between 46.1 and 50.3." If asked about a claimed value: "**17 °C is (not) inside the interval**, so it is (not) a plausible value for the mean."
- **Type I error (in context):** "Concluding that **[more than 30% of seeds fail]** when in fact **[30% fail]**." **Type II:** "Not concluding that **[more than 30% fail]** when in fact **[they do]**."
- **Symbols:** write hypotheses with μ, p or ρ (population parameters), not with $\bar{x}$ or r.

4 Voronoi diagrams

- **Nearest site:** "Point **P** lies in the cell of site **B**, so **B** is the nearest **[fire station]**."
- **Why a different site might respond:** "**P** is close to the edge between B and C, so the distances are almost equal; **[traffic, road layout, availability]** could make **C** quicker."
- **Coverage:** "The furthest point of the cell from **D** is the vertex **(6, 5)**, at a distance of **2.83 km < 3 km**, so the whole cell is covered." The explicit comparison is the R1 mark.
- **Toxic waste dump / new site:** "The point furthest from all sites is a **vertex of the Voronoi diagram** (or on the boundary of the region): **[coordinates]**, which is **[distance]** from its nearest sites."

5 Finance answers

- **Template:** list the TVM entries, then the answer with the right accuracy and a sentence: "N = 60, I% = 6, PV = 20 000, FV = 0, P/Y = C/Y = 12 ⇒ PMT = −386.66, so the monthly payment is **$386.66**."
- **Interest vs rate:** "Total interest = total paid − amount borrowed = **$3199.36**." A rate is a percentage; interest is money.
- **Which option is better?** Compare the same quantity (total cost, final value) and **say which** with the numbers: "Option B costs $1240 less in total, so B is better."

6 Model limitations and "comment" questions

- **Template:** "The model predicts **[impossible or unrealistic value]** for **[x]**, for example **[a negative height / endless growth]**, so it is only valid for **[domain]**."
- **Context first:** reasons must be about the situation in the question. "Fiona can't run for an infinite time, so t is limited by the length of the race" scores; "the model is just a model" doesn't.
- **"Explain why the answer is reasonable":** compare with the information you were given ("8.9 m is more than the 8.5 m in the question, which is consistent").

7 "Show that" in AI

- **Start from the question's information and finish with the given answer** as your final line. Never substitute the given value to check it.
- **Show one more significant figure:** to show r = 18.5, write r = 18.49... = 18.5.
- **Re-enter:** if you can't show it, use the given answer in the next part. Examiners note many students give up instead.

LINKING QUESTION

The tests and models here are taught in Chi-squared and t-tests, Statistics, correlation and regression and Modelling with functions. The GDC steps are in the GDC guide.

Test yourself — cover the answers first

QUICK CHECK

1. Write H_0 for a χ^2 test on eye colour and hair colour.
2. Which two reasons judge whether a prediction is reliable?
3. How do you interpret b = 2.4 in C = 3 + 2.4d (dollars, d in km)?

4. $p = 0.21$ at the 5% level. Write the decision.
5. HL Write a Type I error for H_0: $p = 0.3$ vs H_1: $p > 0.3$ (seeds failing).

Show answers

1. eye colour and hair colour are independent
2. interpolation vs extrapolation, and the strength of correlation
3. the cost increases by $2.40 per extra km
4. insufficient evidence to reject H_0
5. concluding more than 30% fail when really 30% fail

Stuck on a question?

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