

MATHEMATICS | SESSION SUMMARY

Lesson Report for Kevin

Derivatives, antiderivatives, and definite integrals

1 hour session

IB Mathematics

Next focus: increasing rigor

Pietro's Summary. Kevin worked with good discipline and stayed engaged throughout the session. The strongest part of today's lesson was his improving intuition about what derivatives and integrals represent geometrically. The main improvement area is rigor: he should slow down when applying rules, especially when signs, powers, and constants are involved.

Focus

**Excellent**

Kevin stayed attentive throughout the full session.

Understanding

**Strong**

He understands the ideas well when the setup is clear.

Execution

**Developing Well**

Good progress, but algebra and notation still need care.

Strengths Observed

- Kevin asks targeted questions instead of guessing blindly.
- He connects derivative rules to curve behavior more naturally than before.
- He is starting to interpret integrals as accumulated change rather than just a formula.

Immediate Priorities

- Start each exercise by listing givens and target quantity.
- Slow down when simplifying powers and coefficients.
- Check whether the task asks for derivative, antiderivative, or definite integral.

For Kevin

Tonight's goal is short and specific: review the core derivative rules once, then solve the first four exercises without notes. The target is not speed. The target is a clean method: identify the rule, apply it carefully, and simplify only at the end.

For the Parents

Kevin is progressing well when the work is structured. At this stage, he does not need much more theory; he needs repetition with a reliable written method. A brief 10–15 minute review over the weekend would be enough to reinforce today's gains.

Study Materials for Kevin

A concise review sheet to support independent work

Lesson Materials

Digital Whiteboard Notes

Use the board after the lesson, not during the exercise set. Scan the QR code or open the link to review the worked examples on derivatives, tangent slope, and area under the curve. The board should be used as a correction tool after an independent attempt.



Direct link: <https://example.com/kevin-lesson-board>

Core Formulas and Meaning

$$\frac{d}{dx}(x^n) = nx^{n-1} \quad \int x^n dx = \frac{x^{n+1}}{n+1} + C \quad \int_a^b f(x) dx$$

How to choose the formula. Use the derivative rule when the task asks for rate of change or tangent slope. Use the antiderivative rule when you are finding a primitive function. Use the definite integral when you are finding signed area or total accumulation between two bounds.

Most common mistake from today. Kevin sometimes applies the right idea too quickly and loses accuracy in the algebra. Today the main issue was not the concept itself, but the precision of execution.

Study Guidance

- Write the symbol and unit together from the start: for example, $v_0 = 3 \text{ m/s}$.
- When differentiating, rewrite radicals and fractions as powers if it makes the rule easier to apply.
- Before accepting an integral, quickly differentiate your answer mentally to see if it makes sense.
- In definite integrals, always check the interval and whether the area should be positive or signed.

Exercise Sheet

Progression from warm-up to challenge

Practice Exercises**Warm-up**

1. ●○○
Differentiate $f(x) = 3x^4 - 2x^2 + 5$.
2. ●○○
Differentiate $g(x) = \frac{5}{x^2} + 7x$.
3. ●○○
Find $\int(6x^2 - 4x + 1) dx$.

Core practice

4. ●●○
Differentiate $h(x) = \sqrt{x} + \frac{3}{x}$.
5. ●●○
Find the equation of the tangent to $y = x^3 - 2x$ at $x = 2$.
6. ●●○
Find $\int_0^2(3x^2 + 1) dx$.
7. ●●○
Find an antiderivative of $f(x) = 2x - \frac{4}{x^3}$.
8. ●●○
Differentiate $p(x) = (2x^2 - 1)(x^3 + 4)$.

Challenge

9. ●●●
A function is given by $f(x) = x^3 - 6x^2 + 9x + 1$. Find the stationary points.
10. ●●●
Evaluate $\int_1^3(x^2 - 4x + 5) dx$ and interpret whether the signed area is positive.
11. ●●●
If $f'(x) = 6x - 4$ and $f(1) = 3$, find $f(x)$.
12. ●●●
A particle moves with velocity $v(t) = 3t^2 - 4t + 2$. Find the displacement from $t = 0$ to $t = 3$.
13. ●●●
For $f(x) = x^4 - 4x^3$, determine where the function is increasing and decreasing.

 **Final Answers**

Numeric solutions only, aligned with the practice sheet

 **Solutions****Warm-up**

1. $f'(x) = 12x^3 - 4x$
2. $g'(x) = -10x^{-3} + 7$
3. $2x^3 - 2x^2 + x + C$

Core practice

4. $h'(x) = \frac{1}{2\sqrt{x}} - \frac{3}{x^2}$
5. $y = 10x - 12$
6. 10
7. $x^2 + \frac{2}{x^2} + C$
8. $p'(x) = 4x(x^3 + 4) + 3x^2(2x^2 - 1)$

Challenge

9. $x = 1$ and $x = 3$
10. $\frac{8}{3}$, positive
11. $f(x) = 3x^2 - 4x + 4$
12. 6
13. Increasing for $x < 0$ and $x > 3$; decreasing for $0 < x < 3$