MATHEMATICS ADVANCED YEAR 11 - MODULE 3 - LESSON 3

The Derivative as the Gradient of a Tangent

Use this worksheet after reading the lesson to practise the key ideas and prove you can meet the success criteria.

Name _____

Date _____

Class _____

1. Key Ideas

A secant line cuts through a curve at two points. A tangent line just kisses it at one. By letting those two points slide closer and closer together — using a limit — we can turn the gradient of a secant into the gradient of a tangent. That limit has a special name: the derivative .

- The definition of the derivative using first principles
- Why the limit $h \to 0$ turns a secant gradient into a tangent gradient

2. Success Criteria

By the end, you should be able to:

- The definition of the derivative using first principles
- The difference between a secant and a tangent
- How to expand and simplify $f(x+h)$ for polynomial functions

3. Key Terms

Derivative
The rate of change of a function at a point; the gradient of the tangent.

Differentiation
The process of finding the derivative of a function.

Stationary Point
A point where the derivative equals zero.

Chain Rule
A rule for differentiating composite functions: dy/dx = dy/du × du/dx.

Product Rule
A rule for differentiating products: d(uv)/dx = u(dv/dx) + v(du/dx).

Tangent
A line that touches a curve at exactly one point; its gradient equals the instantaneous rate of change.

4. Activity: Build the Lesson Map

Use the lesson to complete the table. Keep answers brief but specific.

Prompt	Your answer
Main concept	
Important example	
Common mistake to avoid	
How this links to the next lesson	

5. Short Answer Questions

1. Explain this lesson goal in your own words: "The definition of the derivative using first principles". Use one specific example from the lesson.

BAND 3 2 MARKS

2. Apply this idea to a new example: "The difference between a secant and a tangent". Show your reasoning clearly.

BAND 4 3 MARKS

3. Analyse why this idea matters for understanding The Derivative as the Gradient of a Tangent: "How to expand and simplify $f(x+h)$ for polynomial functions".

BAND 5 4 MARKS

6. Extend: Apply the Idea

BAND 5/6 5 MARKS

A student gives a memorised answer about The Derivative as the Gradient of a Tangent but does not use evidence or reasoning.

Improve the answer by writing a stronger response that uses accurate terminology, a relevant example and a clear explanation.

7. Multiple Choice

1. What is the best first step when answering a question about The Derivative as the Gradient of a Tangent?

☐ A. Identify the key concept being tested

☐ B. Write every fact from memory

☐ C. Ignore the command word

☐ D. Skip examples and evidence

2. Which answer would show stronger understanding of The Derivative as the Gradient of a Tangent?

☐ A. An answer with accurate terms and reasoning

☐ B. A copied definition only

☐ C. A single-word response

☐ D. An answer with no example

3. What should you do if a question asks you to explain?

☐ A. Link the idea to a reason or cause

☐ B. List unrelated facts

☐ C. Only draw a diagram

☐ D. Write the shortest possible answer

8. Success Criteria Proof

Finish with evidence that you can do each success criterion.

SUCCESS CRITERION 1

Prove that you can: The definition of the derivative using first principles

BAND 3 2 MARKS

SUCCESS CRITERION 2

Prove that you can: The difference between a secant and a tangent

BAND 4 3 MARKS

SUCCESS CRITERION 3

Prove that you can: How to expand and simplify $f(x+h)$ for polynomial functions

BAND 5 4 MARKS

One thing I still need help with: