

2.2 Defining the Derivative and Its Notation

Name: _____ Class: _____ Date: _____ **Total: 9 marks**

KEY WORDS derivative 导数 • notations 记号 • slope 斜率 • tangent line 切线
• instantaneous 瞬时

Objective

Build the skills to answer exam questions on **defining the derivative and using derivative notation**.

You must be able to:

- write the limit definition of the **derivative** 导数
- use the notations $f'(x)$ and $\frac{dy}{dx}$

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ The derivative

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

is the instantaneous rate of change — the slope of the **tangent line** 切线. Notations:
 $f'(x)$, $\frac{dy}{dx}$, $\frac{d}{dx}[f(x)]$.

2 Practice

2.1 Write the limit definition of the derivative. [1]

2.2 State two notations for the derivative. [1]

2.3 State what $f'(x)$ measures geometrically. [2]

3 Exam-style questions

3.1 The derivative $f'(x)$ is defined as [1]

- **A** $f(x)/x$
- **B** $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$
- **C** $f(x) \cdot x$
- **D** $\frac{f(b) - f(a)}{b - a}$ only

3.2 $\frac{dy}{dx}$ is another notation for the [1]

- **A** integral
- **B** derivative
- **C** limit only
- **D** area

3.3 Answer each.

(a) $f'(a)$ is the slope of the _____ line. [1]

(b) Name the quantity $f'(x)$. [1]

(c) State what $\frac{dy}{dx}$ reads as. [1]

Solutions

2.1 $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}.$

2.2 any two of $f'(x)$, $\frac{dy}{dx}$, $\frac{d}{dx}[f(x)]$.

2.3 the slope of the tangent line to the graph of f at x .

3.1 B.

3.2 B.

3.3 (a) tangent. (b) the derivative (instantaneous rate of change). (c) the rate of change of y with respect to x .