

## 2.2 Defining the Derivative and Reading 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]

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### 3 Exam-style questions

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

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

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**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  $x$ .