AP CALCULUS BC • EXERCISE SHEET

3.6 Calculating Higher-Order Derivatives

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

Objective

Build the skills to answer exam questions on **higher-order derivatives**.

You must be able to:

- find the **second derivative** 二阶导数 f''
- use the notation $\dfrac{d^2y}{dx^2}$

1 Worked examples

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

■ **Higher-order derivatives**

The second derivative $f'' = (f')'$ is the derivative of the first derivative. Notation: $f''(x)$, $\dfrac{d^2y}{dx^2}$.

■ **Example**

$f(x) = x^3 \Rightarrow f'(x) = 3x^2 \Rightarrow f''(x) = 6x$.

2 Practice

2.1 State what the second derivative is. [1]

2.2 For $f(x) = x^3$, find f''. [2]

2.3 State the notation for the second derivative. [1]

3 Exam-style questions

3.1 The second derivative is the derivative of [1]

- **A** f
- **B** f'
- **C** the integral
- **D** a constant

3.2 $\dfrac{d^2y}{dx^2}$ denotes the [1]

- **A** first derivative
- **B** second derivative
- **C** integral
- **D** slope only

3.3 $f(x) = x^4$.

(a) Find f'. [1]

(b) Find f''. [1]

(c) State $f''(1)$. [1]

4 Go further

- work through the **3.6 Calculating Higher-Order Derivatives** lesson on the **Learn** page;
- read the **Differentiation: Composite, Implicit, and Inverse Functions** section of the AP Calculus BC handout on the **Know** page.

Solutions

2.1 the derivative of the first derivative.

2.2 $f' = 3x^2$, so $f'' = 6x$.

2.3 $f''(x)$ or $\dfrac{d^2y}{dx^2}$.

3.1 B.

3.2 B.

3.3 (a) $4x^3$. (b) $12x^2$. (c) 12.