

Exercise walk-through

Calculating Higher-Order Derivatives ■ 3.6

eXercise

You must be able to

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

Method — Higher-order derivatives

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

Method — Example

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

Practice 2.1 ■ 1 mark

State what the second derivative is.

Solution 2.1

Method: Higher-order derivatives

Worked steps

the derivative of the first derivative **B1**.

Practice 2.2 ■ 2 marks

For $f(x) = x^3$, find f' .

Solution 2.2

Worked steps

$$f' = 3x^2, \text{ so } f'' = 6x \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 1 mark

State the notation for the second derivative.

Solution 2.3

Method: Higher-order derivatives

Worked steps

$$f'(x) \text{ or } \frac{d^2 y}{dx^2} \text{ (B1).}$$

Exam-style 3.1 ■ 1 mark

The second derivative is the derivative of

A f

B f'

C the integral

D a constant

Solution 3.1

Method: Higher-order derivatives

A f

B f'



C the integral

D a constant

Worked steps

B.

Exam-style 3.2 ■ 1 mark

$\frac{d^2y}{dx^2}$ denotes the

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

Solution 3.2

A first derivative

B second derivative 

C integral

D slope only

Worked steps

B.

Exam-style 3.3 ■ 1 mark

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

(a) Find f' .

(b) Find f'' .

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

Solution 3.3

Worked steps

(a) $4x^3$ **B1**. (b) $12x^2$ **B1**. (c) 12 **B1**.