

# 5.4 The First Derivative Test

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_ Total: 9 marks

**KEY WORDS** local minimum 极小值 • local maximum 极大值 • local extremum 局部极值  
• critical point 临界点

## Objective

Build the skills to answer exam questions on the **First Derivative Test**.

**You must be able to:**

- use the sign change of  $f'$  to classify a **local extremum** 局部极值

## 1 Worked examples

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

### ■ First Derivative Test

At a critical point, look at how  $f'$  changes:

- + to – → local **maximum**;
- – to + → local **minimum**;
- no sign change → neither.

### ■ Example

$f'(x) = 2x - 4$  at  $x = 2$ :  $f'$  goes – (for  $x < 2$ ) to + (for  $x > 2$ ), so  $x = 2$  is a local minimum.

## 2 Practice

**2.1** State the sign change for a local maximum. [1]

**2.2** State the sign change for a local minimum. [1]

**2.3** For  $f'(x) = 2x - 4$ , classify  $x = 2$ . [2]

## 3 Exam-style questions

**3.1** A local maximum occurs where  $f'$  changes [1]

- **A** – to +
- **B** + to –
- **C** stays +
- **D** stays –

**3.2** A local minimum occurs where  $f'$  changes [1]

- **A** + to –
- **B** – to +
- **C** stays 0
- **D** never

**3.3**  $f'(x) = 2x - 4$ , critical at  $x = 2$ .

(a) State the sign of  $f'$  for  $x < 2$ . [1]

(b) State the sign for  $x > 2$ . [1]

(c) Classify  $x = 2$ . [1]

## Solutions

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**2.1**  $f'$  changes from  $+$  to  $-$ .

**2.2**  $f'$  changes from  $-$  to  $+$ .

**2.3**  $f'$  goes  $-$  to  $+$ , so  $x = 2$  is a local minimum.

**3.1** B.

**3.2** B.

**3.3** (a) negative. (b) positive. (c) local minimum.