AP CALCULUS BC • EXERCISE SHEET

5.3 Where a Function Increases or Decreases

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

Objective

Build the skills to answer exam questions on **intervals where a function is increasing or decreasing**.

You must be able to:

- use the sign of f' to find where f is **increasing** 递增 or **decreasing** 递减

1 Worked examples

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

■ **Increasing and decreasing**

- f is **increasing** where $f' > 0$;
- f is **decreasing** where $f' < 0$.

Test the sign of f' on the intervals between critical points.

■ **Example**

$f'(x) = 2x - 4$: $f' > 0$ for $x > 2$ (increasing) and $f' < 0$ for $x < 2$ (decreasing).

2 Practice

2.1 State where f is increasing. [1]

2.2 For $f'(x) = 2x - 4$, find where f is increasing. [2]

2.3 For the same f', state where f is decreasing. [1]

3 Exam-style questions

3.1 f is increasing where [1]

- **A** $f' < 0$
- **B** $f' > 0$
- **C** $f'' > 0$
- **D** $f = 0$

3.2 If $f'(x) = 2x - 4$, then f is decreasing for [1]

- **A** $x > 2$
- **B** $x < 2$
- **C** all x
- **D** $x = 2$

3.3 $f'(x) = 3x^2 - 3$.

(a) Solve $f' = 0$. [1]

(b) Test a point in $(-1, 1)$. [1]

(c) State where f is decreasing. [1]

4 Go further

- work through the **5.3 Determining Intervals on Which a Function Is Increasing or Decreasing** lesson on the **Learn** page;
- read the **Analytical Applications of Differentiation** section of the AP Calculus BC handout on the **Know** page.

Solutions

2.1 where $f' > 0$.

2.2 $2x - 4 > 0 \Rightarrow x > 2$.

2.3 $x < 2$.

3.1 B.

3.2 B.

3.3 (a) $x = \pm 1$. (b) $f'(0) = -3 < 0$. (c) $(-1, 1)$.