

2.3 Estimating a Derivative at a Point

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

KEY WORDS table 表格 • difference quotient 差商 • derivative 导数 • slope 斜率

Objective

Build the skills to answer exam questions on **estimating derivatives at a point**.

You must be able to:

- estimate $f'(a)$ from a **table** 表格 of values using a small- h difference quotient

1 Worked examples

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

■ Estimating a derivative

Estimate $f'(a)$ with a small- h difference quotient from table values:

$$f'(a) \approx \frac{f(a+h) - f(a)}{h} \quad \text{or} \quad \frac{f(a+h) - f(a-h)}{2h} \quad (\text{symmetric}).$$

■ Example

$$f(2) = 5, f(2.1) = 5.4: f'(2) \approx \frac{5.4 - 5}{0.1} = 4.$$

2 Practice

2.1 State a formula to estimate $f'(a)$ from a table. [1]

2.2 If $f(2) = 5$ and $f(2.1) = 5.4$, estimate $f'(2)$. [2]

2.3 State why a smaller h generally gives a better estimate. [1]

3 Exam-style questions

3.1 A derivative at a point can be estimated from a table using a [1]

- | | |
|---|---|
| A | B |
| C | D |
- A single value
B difference quotient with small h
C maximum
D mean

3.2 The symmetric difference quotient is [1]

- | | |
|---|---|
| A | B |
| C | D |
- A $\frac{f(a+h) - f(a)}{h}$
B $\frac{f(a+h) - f(a-h)}{2h}$
C $\frac{f(a)}{h}$
D $f(a+h) \cdot f(a-h)$

3.3 $f(3) = 10, f(3.2) = 10.6$.

- (a) Find Δf . [1]
(b) Find Δx . [1]
(c) Estimate $f'(3)$. [1]