

3.3 Differentiating Inverse Functions

Name: _____ Class: _____ Date: _____

Total: 9 marks

Objective

Build the skills to answer exam questions on **differentiating inverse functions**.

You must be able to:

- apply $(f^{-1})'(a) = \frac{1}{f'(f^{-1}(a))}$

1 Worked examples

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

■ Derivative of an inverse

$$(f^{-1})'(a) = \frac{1}{f'(f^{-1}(a))}.$$

The slope of the **inverse function** 反函数 is the reciprocal of the slope of f at the corresponding point.

■ Example

If $f(2) = 5$ and $f'(2) = 4$, then $(f^{-1})'(5) = \frac{1}{f'(2)} = \frac{1}{4}$.

2 Practice

2.1 State the inverse-derivative formula. [1]

2.2 If $f'(2) = 4$ and $f(2) = 5$, find $(f^{-1})'(5)$. [2]

2.3 State the relationship between the two slopes. [1]

3 Exam-style questions

3.1 $(f^{-1})'(a)$ equals [1]

- **A** $f'(a)$
 - **B** $\frac{1}{f'(f^{-1}(a))}$
 - **C** $f'(f^{-1}(a))$
 - **D** $\frac{1}{a}$
-

3.2 The slope of f^{-1} is the _____ of the slope of f . [1]

- **A** same
 - **B** reciprocal
 - **C** negative
 - **D** square
-

3.3 $f(3) = 7$, $f'(3) = 2$.

(a) Find $f^{-1}(7)$. [1]

(b) Apply the formula. [1]

(c) Find $(f^{-1})'(7)$. [1]

4 Go further

- work through the **3.3 Differentiating Inverse Functions** lesson on the **Learn** page;
- read the **Differentiation: Composite, Implicit, and Inverse Functions** section of the AP Calculus AB handout on the **Know** page.

Solutions

2.1 $(f^{-1})'(a) = \frac{1}{f'(f^{-1}(a))}.$

2.2 $f^{-1}(5) = 2$, so $(f^{-1})'(5) = \frac{1}{f'(2)} = \frac{1}{4}.$

2.3 they are reciprocals of each other.

3.1 B.

3.2 B.

3.3 (a) 3. (b) $\frac{1}{f'(3)}.$ (c) $\frac{1}{2}.$