

2.12 Logarithmic Function Manipulation

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

KEY WORDS laws of logarithms 对数律 • change-of-base 换底 • logarithm 对数 • base 底数
• logarithmic function 对数函数

Objective

Build the skills to answer exam questions on **logarithmic function manipulation**.

You must be able to:

- apply the **laws of logarithms** 对数律 (product, quotient, power)
- use the **change-of-base** 换底 formula

1 Worked examples

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

■ **Laws of logarithms**

$\log_b(xy) = \log_b x + \log_b y, \quad \log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y, \quad \log_b(x^n) = n \log_b x.$

■ **Change of base**

$$\log_b(x) = \frac{\ln x}{\ln b}.$$

■ **Example**

$\log_2(8x) = \log_2 8 + \log_2 x = 3 + \log_2 x.$

2 Practice

2.1 Expand $\log(xy)$. [1]

2.2 Write $\log(x^3)$ using the power rule. [1]

2.3 Combine $\log 6 + \log 2$ into a single logarithm. [2]

3 Exam-style questions

3.1 $\log_b(xy)$ equals [1]

- A

B

C

D
- A $\log_b x \cdot \log_b y$
B $\log_b x + \log_b y$
C $\log_b x - \log_b y$
D $\log_b(x + y)$

3.2 $\log_b(x^n)$ equals [1]

- A

B

C

D
- A $n + \log_b x$
B $n \log_b x$
C $(\log_b x)^n$
D $\log_b(nx)$

3.3 Expand $\log_2(8x)$.

- (a) Apply the product rule. [1]
- (b) Evaluate $\log_2 8$. [1]
- (c) Write the final expression. [1]