

Exercise walk-through

Logarithmic Function Manipulation ■ 2.12

eXercise

You must be able to

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

Method — Laws of logarithms

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

Method — Change of base

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

Method — Example

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

Practice 2.1 ■ 1 mark

Expand $\log(xy)$.

Solution 2.1

Worked steps

$$\log x + \log y \quad \text{B1}.$$

Practice 2.2 ■ 1 mark

Write $\log(x^3)$ using the power rule.

Solution 2.2

Worked steps

$$3 \log x \quad \text{B1}.$$

Practice 2.3 ■ 2 marks

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

Solution 2.3

Worked steps

$$\log(6 \cdot 2) = \log 12 \quad \text{M1} \quad \text{A1}.$$

Exam-style 3.1 ■ 1 mark

$\log_b(xy)$ equals

A $\log_b x \cdot \log_b y$

B $\log_b x + \log_b y$

C $\log_b x - \log_b y$

D $\log_b(x + y)$

Solution 3.1

A $\log_b x \cdot \log_b y$

B $\log_b x + \log_b y$ 

C $\log_b x - \log_b y$

D $\log_b(x + y)$

Worked steps

B.

Exam-style 3.2 ■ 1 mark

$\log_b(x^n)$ equals

A $n + \log_b x$

B $n \log_b x$

C $(\log_b x)^n$

D $\log_b(nx)$

Solution 3.2

A $n + \log_b x$

B $n \log_b x$



C $(\log_b x)^n$

D $\log_b(nx)$

Worked steps

B.

Exam-style 3.3 ■ 1 mark

Expand $\log_2(8x)$.

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

Solution 3.3

Worked steps

(a) $\log_2 8 + \log_2 x$ **B1**. (b) 3 **B1**. (c) $3 + \log_2 x$ **B1**.