2.9 Logarithmic Expressions

Name: _____ Class: _____ Date: _____ **Total: 13 marks**

KEY WORDS logarithmic • base

Objective

Build the skills to answer exam questions on **logarithmic expressions**.

You must be able to:

- convert between **logarithmic** and exponential form
- evaluate simple logarithms

1 Key knowledge and worked examples

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

■ Logarithms

$\log_b(y) = x$ means exactly $b^x = y$. A logarithm answers the question "**what exponent?**".

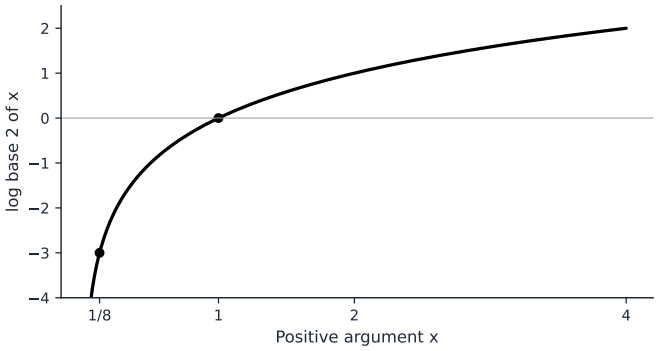
- $\log_{10}$ is the **common log**;
- ln is the **natural log** (base e).

■ Example

$\log_2(8) = 3$ because $2^3 = 8$.

■ Worked application: A negative logarithm is a valid exponent

Because $2^{-3} = 1/8$, $\log_2(1/8) = -3$. A negative answer is allowed even though a real logarithm must have a positive argument. The base must satisfy $b > 0$ and $b \neq 1$. Also $\log_2(1) = 0$ because $2^0 = 1$, whereas $\log_2(0)$ has no real value: no real exponent makes a positive base equal zero. Use the exponential statement to check both the answer and the allowed input.



2 Practice

2.1 Rewrite $\log_b(y) = x$ in exponential form. [1]

2.2 Evaluate $\log_2(8)$. [1]

2.3 Evaluate $\log_{10}(1000)$. [2]

3 Exam-style questions

3.1 $\log_b(y) = x$ is equivalent to [1]

- ☐ **A** $b^y = x$
- **B** $b^x = y$
- **C** $x^b = y$
- **D** $y^x = b$

3.2 $\log_3(9)$ equals [1]

- ☐ **A** 2
- **B** 3
- **C** 9
- **D** 27

3.3 Evaluate each.

(a) $\log_5(25)$. [1]

(b) $\log_{10}(100)$. [1]

(c) $\log_2(1)$. [1]

3.4 (a) Evaluate $\log_3(1/27)$ and check it in exponential form. [2]

(b) Explain why $\log_3(0)$ has no real value, although a negative logarithm can exist. [2]