

2.11 Logarithmic Functions

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

KEY WORDS domain 定义域 • vertical asymptote 垂直渐近线 • logarithmic function 对数函数
• logarithm 对数

Objective

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

You must be able to:

- state the **domain** 定义域, **vertical asymptote** 垂直渐近线, and key point of $f(x) = \log_b(x)$
- relate the log graph to the exponential graph

1 Worked examples

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

■ **The logarithmic function**

$f(x) = \log_b(x)$ has:

- domain $x > 0$, range all real numbers;
- a **vertical asymptote** at $x = 0$;
- it always passes through $(1, 0)$;
- for $b > 1$ it is increasing.

Its graph is the reflection of b^x across $y = x$.

■ **Reading a log graph**

For $f(x) = \log_2(x)$: $f(1) = 0$, $f(2) = 1$, $f(4) = 2$, $f(8) = 3$ – each time x **doubles**, f rises by 1. The curve climbs without bound but never reaches the line $x = 0$ (its vertical asymptote), and $f(x)$ is undefined for $x \leq 0$.

2 Practice

2.1 State the domain of $f(x) = \log_b(x)$. [1]

2.2 State the vertical asymptote of the log function. [1]

2.3 State the point every $\log_b$ graph passes through. [2]

3 Exam-style questions

3.1 The domain of $f(x) = \log_b(x)$ is [1]

- A** all real numbers
- B** $x > 0$
- C** $x \geq 0$
- D** $x \neq 0$

3.2 The graph of $\log_b(x)$ has a vertical asymptote at [1]

- A** $x = 0$
- B** $x = 1$
- C** $y = 0$
- D** $y = 1$

3.3 $f(x) = \log_2(x)$.

(a) State $f(1)$. [1]

(b) State $f(2)$. [1]

(c) State $f(4)$. [1]

Solutions

2.1 $x > 0$.

2.2 $x = 0$.

2.3 $(1, 0)$.

3.1 B.

3.2 A.

3.3 (a) 0. (b) 1. (c) 2.