Exercise walk-through

Logarithmic Functions ▪ 2.11

eXercise

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

Method — 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 $y = x$.

Method — 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 $x \leq 0$.

Practice 2.1 ▪ 1 mark

State the domain of $f(x) = \log_b(x)$.

Solution 2.1

Worked steps

$x > 0$ **B1**.

Practice 2.2 ▪ 1 mark

State the vertical asymptote of the log function.

Solution 2.2

Method: The logarithmic function

Worked steps

$x = 0$ **B1**.

Practice 2.3 ▪ 2 marks

State the point every $\log_b$ graph passes through.

Solution 2.3

Method: The logarithmic function

Worked steps

$(1, 0)$ **B1** **B1**.

Exam-style 3.1 ▪ 1 mark

The domain of $f(x) = \log_b(x)$ is

A all real numbers

B $x > 0$

C $x \geq 0$

D $x \neq 0$

Solution 3.1

A all real numbers

B $x > 0$ ✓

C $x \geq 0$

D $x \neq 0$

Worked steps

B.

Exam-style 3.2 ▪ 1 mark

The graph of $\log_b(x)$ has a vertical asymptote at

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

Solution 3.2

A $x = 0$ ✓

B $x = 1$

C $y = 0$

D $y = 1$

Worked steps

A.

Exam-style 3.3 ▪ 1 mark

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

(a) State $f(1)$.

(b) State $f(2)$.

(c) State $f(4)$.

Solution 3.3

Worked steps

(a) 0 **B1**. (b) 1 **B1**. (c) 2 **B1**.