

Exercise walk-through

Semi-log Plots ■ 2.15

eXercise

You must be able to

- explain how a **semi-log plot** 半对数图 linearizes exponential data
- relate the slope and intercept to the model $y = a \cdot b^x$

Method — Semi-log plots

A semi-log plot graphs $\log(y)$ against x . For exponential data $y = a \cdot b^x$,

$$\log(y) = \log a + x \log b,$$

which is **linear** in x . So exponential data appear as a **straight line** on a semi-log plot; the slope is $\log b$ and the intercept is $\log a$.

Method — From the line back to the model

Suppose a semi-log plot of some data is a straight line with slope 0.3 and intercept 1. Then $\log b = 0.3$ and $\log a = 1$, so $b = 10^{0.3} \approx 2$ and $a = 10^1 = 10$. The exponential model is $y \approx 10 \cdot 2^x$.

Practice 2.1 ■ 1 mark

State what a semi-log plot graphs.

Solution 2.1

Method: Semi-log plots

Worked steps

$\log(y)$ against x **B1**.

Practice 2.2 ■ 1 mark

State what a straight line on a semi-log plot indicates.

Solution 2.2

Worked steps

the data are exponential **B1**.

Practice 2.3 ■ 2 marks

For $y = a \cdot b^x$, what does $\log(y)$ equal?

Solution 2.3

Worked steps

$$\log(y) = \log a + x \log b \quad \text{M1} \quad \text{A1}.$$

Exam-style 3.1 ■ 1 mark

A semi-log plot graphs

A y vs x

B $\log(y)$ vs x

C $\log(y)$ vs $\log(x)$

D x vs y

Solution 3.1

Method: Semi-log plots

A y vs x

B $\log(y)$ vs x



C $\log(y)$ vs $\log(x)$

D x vs y

Worked steps

B.

Exam-style 3.2 ■ 1 mark

A straight line on a semi-log plot indicates the data are

- A** linear
- B** exponential
- C** quadratic
- D** constant

Solution 3.2

A linear

B exponential 

C quadratic

D constant

Worked steps

B.

Exam-style 3.3 ■ 1 mark

$$y = a \cdot b^x.$$

- (a) Take $\log$ of both sides.
- (b) State the slope of $\log(y)$ vs x .
- (c) State the vertical intercept.

Solution 3.3

Worked steps

(a) $\log(y) = \log a + x \log b$ **B1**. (b) $\log b$ **B1**. (c) $\log a$ **B1**.