

Exercise walk-through

Population Growth and Resource Availability ■ 3.5

eXercise

You must be able to

- use the **growth-rate** formula (births — deaths, plus migration)
- calculate a percent growth rate
- link resources to exponential vs logistic growth

Method — Growth rate

A population's growth depends on births, deaths, and migration:

$$\text{growth rate} = (\text{births} + \text{immigration}) - (\text{deaths} + \text{emigration}).$$

Method — Percent growth rate

As a percentage of the population:

$$\% \text{ growth} = \frac{\text{births} - \text{deaths}}{\text{population}} \times 100.$$

(For humans, often expressed per 1000 people.)

Method — A worked calculation

A country of 1000 has 30 births and 10 deaths in a year: $\text{growth} = 30 - 10 = 20$;
 $\text{percent} = \frac{20}{1000} \times 100 = 2\%$.

Method — Resources shape the curve

With abundant resources, growth is **exponential** (J-curve); as resources become limited, growth slows to **logistic** (S-curve), leveling at carrying capacity.

Practice 2.1 ■ 1 mark

Write the percent growth-rate formula (births and deaths).

Solution 2.1

Method: Percent growth rate

Worked steps

$$\% = \frac{\text{births} - \text{deaths}}{\text{population}} \times 100 \quad \text{B1}.$$

Practice 2.2 ■ 2 marks

A population of 2000 has 60 births and 20 deaths. Find the percent growth rate.

Solution 2.2

Method: Percent growth rate

Worked steps

$$\frac{60 - 20}{2000} \times 100 = 2\% \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 1 mark

What shape is growth with unlimited resources?

Solution 2.3

Method: Resources shape the curve

Worked steps

J-shaped (exponential) **B1**.

Exam-style 3.1 ■ 1 mark

With limited resources, population growth follows a

- A** J-shaped (exponential) curve
- B** S-shaped (logistic) curve
- C** straight line
- D** decreasing curve

Solution 3.1

Method: Resources shape the curve

A J-shaped (exponential) curve

B S-shaped (logistic) curve



C straight line

D decreasing curve

Worked steps

B — an S-shaped (logistic) curve.

Exam-style 3.2 ■ 2 marks

A town of 5000 has 100 births, 40 deaths, 30 immigrants, and 10 emigrants in a year.

- (a) Find the net population change.
- (b) Find the percent growth rate.

Solution 3.2

Method: Percent growth rate

Worked steps

$$(a) (100 + 30) - (40 + 10) = 80 \quad \text{M1} \quad \text{A1}. \quad (b) \frac{80}{5000} \times 100 = 1.6\% \quad \text{M1} \quad \text{A1}.$$

Exam-style 3.3 ■ 2 marks

Explain why a population's growth slows as it approaches its carrying capacity.

Solution 3.3

Method: Resources shape the curve

Worked steps

As the population nears carrying capacity, resources become limited and competition rises, so births fall and deaths rise, slowing growth **M1** **A1**.