Exercise walk-through

Human Population Dynamics ▪ 3.8

eXercise

You must be able to

- use **crude birth rate** 出生率 and **crude death rate** 死亡率
- calculate a growth rate and the **doubling time** 倍增时间 (rule of 70)
- explain factors affecting human populations

Method — Birth and death rates

Crude birth rate (CBR) and **crude death rate (CDR)** are births/deaths per 1000 people per year. The natural growth rate is:

$$\% \text{ growth} = \frac{\text{CBR} - \text{CDR}}{10}.$$

(Dividing by 10 converts "per 1000" to a percentage.)

Method — A worked growth rate

CBR $= 30$, CDR $= 10$: growth $= \dfrac{30 - 10}{10} = 2\%$ per year.

Method — Doubling time (rule of 70)

The time for a population to double is approximately:

$$\text{doubling time} \approx \frac{70}{\%\ \text{growth rate}}.$$

At 2%, doubling time $= 70/2 = 35$ years.

Method — Factors

Growth is affected by health care (lowers CDR), education, economic development, and family planning (lower CBR).

Practice 2.1 ▪ 2 marks

A country has CBR $= 25$ and CDR $= 5$. Find the percent growth rate.

Solution 2.1

Worked steps

$$\frac{25-5}{10} = 2\% \quad \text{M1}\ \text{A1}.$$

Practice 2.2 ▪ 1 mark

Write the rule-of-70 doubling-time formula.

Solution 2.2

Method: Doubling time (rule of 70)

Worked steps

$$\text{doubling time} \approx \frac{70}{\%\ \text{growth rate}}$$ B1.

Practice 2.3 ▪ 1 mark

Find the doubling time for a 2% growth rate.

Solution 2.3

Method: Doubling time (rule of 70)

Worked steps

$70/2 = 35$ years B1.

Exam-style 3.1 ▪ 1 mark

The doubling time for a population growing at 3.5% is about

A 10 years

B 20 years

C 35 years

D 70 years

Solution 3.1

Method: Doubling time (rule of 70)

A 10 years

B 20 years ✓

C 35 years

D 70 years

Worked steps

B — $70/3.5 = 20$ years.

Exam-style 3.2 ▪ 2 marks

A country has CBR $= 40$ and CDR $= 12$ per 1000.
(a) Find the percent growth rate.
(b) Find the doubling time.

Solution 3.2

Method: Doubling time (rule of 70)

Worked steps

(a) $\dfrac{40-12}{10} = 2.8\%$ M1 A1. (b) $70/2.8 = 25$ years M1 A1.

Exam-style 3.3 ▪ 2 marks

Explain how improved health care can, at first, increase population growth.

Solution 3.3

Method: Factors

Worked steps

Better health care lowers the death rate (fewer people die) while birth rates stay high, so the gap between births and deaths widens, increasing growth M1 A1.