

Exercise walk-through

2.4

Population Dynamics

AP Human Geography

Birth, death and fertility measures

Indicator	Meaning
Crude birth rate (CBR)	Annual live births per 1,000 population.
crude death rate (CDR)	Annual deaths per 1,000 population.
Rate of natural increase (RNI)	Births minus deaths, excluding migration. Annual percent: $r_N = (CBR - CDR)/10$.
Total fertility rate (TFR)	Children per woman if current age-specific fertility rates persisted throughout her reproductive years.

Natural increase and doubling: attempt

Original fictional country

CBR = 37 births per 1,000 per year. CDR = 12 deaths per 1,000 per year.

Calculate RNI as an annual percentage. Estimate **doubling time** if this positive rate stays constant and migration is excluded.

Explain why using 25 as a percentage would be incorrect.

Natural increase and doubling: worked check

$$r_N = \frac{CBR - CDR}{10}$$

$$r_N = \frac{37 - 12}{10} = 2.5\% \text{ per year}$$

$$T_d \approx \frac{70}{r_N}$$

$$T_d \approx \frac{70}{2.5} = 28 \text{ years}$$

The difference is 25 per 1,000, equivalent to 2.5 per 100. The approximation assumes constant positive growth. Zero or negative growth has no finite doubling time under that assumption.

Natural decrease and total growth: attempt

Original fictional country, one year

Starting population: 100,000. Births: 800. Deaths: 1,100. Immigration: 2,000.
Emigration: 700.

Calculate natural change, net migration, total change and the ending population.

Evaluate: “Deaths exceed births, so the population must shrink.”

Population balance: worked check

Births and deaths produce natural change; immigration and emigration produce net migration.

$$\Delta P = (B - D) + (I - E)$$

$$\Delta P = (800 - 1100) + (2000 - 700) = 1000 \text{ people}$$

$$P_1 = P_0 + \Delta P$$

$$P_1 = 100000 + 1000 = 101000 \text{ people}$$

Natural change is -300 ; net migration is $+1300$. The population grows despite natural decrease. Official crude rates commonly use a midyear population denominator.

Exercises 2.1-2.2

2.1 Define the rate of natural increase.

[2]

2.2 A country has a CBR of 30 and a CDR of 10. Calculate its RNI.

[2]

Exercises 2.1-2.2

2.1 Define the rate of natural increase.

[2]

2.1

- the percentage growth of a population from births minus deaths, excluding migration

2.2 A country has a CBR of 30 and a CDR of 10. Calculate its RNI.

[2]

2.2

- $(30 - 10) \div 10 = 2.0\%$

Exercise 2.3 (a)

2.3 Country Y has a TFR of 1.6.

(a) State whether this is above or below replacement level.

[1]

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(a)

- below replacement (2.1)

Exercise 2.3 (b)

2.3 Country Y has a TFR of 1.6.

(b) Predict what happens to the population size over time, ignoring migration.

[1]

Exercise 2.3 (b)

2.3 Country Y has a TFR of 1.6.

(b) Predict what happens to the population size over time, ignoring migration. [1]

(b)

- the population will shrink/decline over time

Exercises 3.1-3.2

3.1 Replacement-level fertility is a total fertility rate of about

[1]

☐

A 0.5

B 1.0

C 2.1

D 4.0

3.2 With an RNI of 2% per year, the population doubles in roughly

[1]

☐

A 7 years

B 35 years

C 70 years

D 140 years

Exercises 3.1-3.2

3.1 Replacement-level fertility is a total fertility rate of about

[1]

☐

A 0.5

B 1.0

C 2.1

D 4.0

3.1 C

- about 2.1 children per woman replaces a couple plus child mortality

3.2 With an RNI of 2% per year, the population doubles in roughly

[1]

☐

A 7 years

B 35 years

C 70 years

D 140 years

3.2 B

- $70 \div 2 = 35$ years

Exercise 3.3 (a)

3.3 A country's infant mortality rate falls sharply over 20 years.

(a) State what IMR measures.

[1]

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(a)

- deaths of infants under age 1 per 1,000 live births

Exercise 3.3 (b)

3.3 A country's infant mortality rate falls sharply over 20 years.

(b) Explain what the fall suggests about development.

[1]

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[1]

(b)

- improving health care, nutrition, and sanitation – rising development