

- 14 If the population has an initial size of 15 000, what does the model predict for the long-term behaviour of the population?

Options

- A The population decreases until it disappears.
 B The population declines to a finite (non-zero) equilibrium level.
 C The population increases to a finite equilibrium level.
 D The population size increases without limit.

Questions 15 and 16

The population P_n is measured at the end of year n for a rare breed of animal which is protected from exploitation. A plot of $(P_{n+1} - P_n)/P_n$ against P_{n+1} is found to be well fitted by the straight line

$$\frac{P_{n+1} - P_n}{P_n} = 1.21 - 0.00509 P_{n+1}.$$

- 15 Using the notation of Unit 3, select the option which is closest to the parameter M of the logistic model for this population.
 16 Using the notation of Unit 3, select the option which is closest to the parameter a (measured in units of year^{-1}) of the logistic model for this population.

Options for Questions 15 and 16

- A 0.004 21 B 0.005 09 C 0.793 D 1.21
 E 151 F 167 G 192 H 238

Questions 17 and 18

The growth of a population P with time t (measured in years), when not exploited, is described by the differential equation

$$\frac{dP}{dt} = 0.25 P \left(1 - \frac{P}{2000} \right).$$

It is now proposed to exploit the population by taking a fixed proportion of the population each year.

- 17 Select the option which is the proportion of the population which should be taken per year in order to give, in the long run, the maximum sustainable yield.

Options

- A $12\frac{1}{2}\%$ B 25% C $37\frac{1}{2}\%$ D 50%
 E $62\frac{1}{2}\%$ F 75% G $87\frac{1}{2}\%$ H 100%

- 18 Select the option which is the annual maximum sustainable yield from the population.

Options

- A 125 B 250 C 500 D 750
 E 1000 F 1500 G 2000 H 4000