

Q1. Solve for x :

$$2x - 9\sqrt{x} + 4 = 0$$

Q2. Solve for x :

$$\frac{2^{2x+3} + 1}{9} = 2^x$$

Q3. Solve for x :

$$\log_2 x + \log_4 x + \log_8 x = \frac{11}{6}$$

Q4. Solve for x , where $x > 1$:

$$2\log_x 3 + \log_3 x = 3$$

Q5. The area, A cm², of a bacterial culture at time t hours is modeled by the equation:

$$A = pe^{qt}$$

where p and q are constants. It is observed that after 2 hours, the area is 12 cm², and after 5 hours, the area is 36 cm².

- (a) Find the exact values of p and q .
- (b) What does the value of p represent?

Q6. The number of individuals, N , in a population of rare birds on an island is modeled by:

$$N = \frac{600}{1 + 5e^{-0.2t}}$$

where t is the time in years since the study began.

- (a) Calculate the number of birds present at the start of the study.
- (b) Show that the time t for the population to reach P individuals is given by:

$$t = 5 \ln \left(\frac{5P}{600 - P} \right)$$

- (c) How many years does it take for the population to reach 500?
- (d) According to this model, the population will never exceed a certain value. State this value and explain why.

Q7. The temperature, $\theta^\circ\text{C}$, of a hot drink t minutes after it is made is modeled by the equation:

$$\theta = \theta_s + (\theta_0 - \theta_s)e^{-kt}$$

where θ_s is the surrounding room temperature, θ_0 is the initial temperature of the drink, and k is a positive constant. A coffee is made at 90°C in a room where the ambient temperature is 22°C . After 10 minutes, the coffee has cooled to 56°C .

- (a) What is the value of k ?
- (b) How long does it take for the coffee to reach 35°C ?
- (c) How long does it take for the coffee to reach room temperature?