

Section 2: Natural logarithms and exponentials

Exercise level 2

1. Make x the subject of $a = be^{-kx}$
2. Make x the subject of $\ln x = a$
3. Make x the subject of $\ln y - \ln x = t$
4. The mass m of a radioactive substance after t seconds is modelled by $m = m_0 e^{-kt}$.
The time taken for the mass of the substance to halve is 2 minutes.
 - (i) Find the value of k to 3 significant figures.
 - (ii) How long does it take, to the nearest 10 seconds, for the substance to decay to 5% of its original mass?
5. The growth of a population of mice is modelled by $N = 50e^{0.1t}$, where N is the number of mice and t is measured in weeks.
 - (i) After how many weeks is the number of mice greater than 200?
 - (ii) What is the rate of increase in the population after 5 weeks?
 - (iii) Show that $\frac{dN}{dt} = kN$, giving the value of k .
 - (iv) What is the rate of increase in the population when there are 200 mice?
 - (v) Explain why this model is unlikely to be appropriate as N becomes very large.