Chapter 1 Modelling

1. Consider a population p of bacteria that grows at a rate proportional to the current population, that is, $\dfrac{dp}{dt} = rp$.

   a. Find the rate constant r if the population doubles in 12 days.

   b. If $p = 200$ initially (when $t = 0$), what is the population when $t = 18$ days?

2. Some chemical reactions require heat energy to occur. Suppose you are designing an experiment that requires a solution to remain above $60°$ C for its duration and that your lab remains at a constant $20°$ C. Assume the transmission coefficient is $k = 2$ hours^{-1}.

    a. Write a differential equation describing this situation using Newton's law of cooling.

    b. What initial temperature is required if the experiment takes 30 minutes?