Section 3: Modelling curves

Exercise level 1

1. Two variables s and t are related by the formula $s = at^c$, where a and c are constants.
   (i) Show that this relationship can be written as $\log s = \log a + c \log t$.
   (ii) Explain why the model can be tested by plotting log s against log t.

   Values of s and t are recorded in an experiment.

s	9	13	16	18	20	22
t	5	10	15	20	25	30

   (iii) Plot the graph of log s against log t and use your graph to estimate the values of a and c.

2. Two variables a and b are related by the formula $b = mn^a$, where m and n are constants.
   (i) Show that this relationship can be written as $\ln b = \ln m + a \ln n$.
   (ii) Explain why the model can be tested by plotting ln b against a.

   In an experiment, the following values of a and b are obtained.

a	0.5	1.0	1.5	2.0	2.5	3.0	3.5
b	4.5	4.0	3.6	3.2	2.9	2.6	2.3

   (iii) Plot the graph of ln b against a and use your graph to estimate the values of m and n.

3. In an experiment, the temperature of a cooling jacket is measured in ^{o}C after t minutes, and the following data is found:

t minutes	0	3	6	10	14	20
θ °C	60	44.1	30.9	19.9	12.9	6.7

   The experimenter expects the data to fit a law of the form $\theta = ka^{-t}$.
   (i) Plot a graph of log θ against t.
   (ii) Use your graph to find the law which the experimenter seeks.