14H Exponentials in Data

$$y = ax^n$$

$$y = ab^x$$

1. The data shows the rank (by size) and population of some UK cities.

   The relationship between P and R can be modelled by the formula:

$$P = aR^n$$

   Where a and n are constants.

a) Draw a table giving values of $\log R$ and $\log P$ to 2 decimal places

City	Birmingham	Leeds	Glasgow	Sheffield	Bradford
Rank, R	2	3	4	5	6
Population, P	1,000,000	730,000	620,000	530,000	480,000

| City	Birmingham	Leeds	Glasgow	Sheffield	Bradford

b) Plot a graph of $\log R$ against $\log P$ using the values from your table, and draw a line of best fit

c) Use your graph to estimate the values of a and n to two significant figures

2. The graph shown represents the growth of a population of bacteria, P over a period of t hours. The graph has a gradient of 0.6 and meets the vertical axis at (0,2) as shown.

A scientist suggests that this growth can be modelled by the equation $P = ab^t$, where a and b are constants to be found.

a) Write down an equation for the line
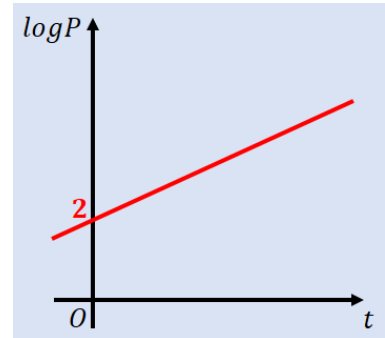
b) Using your answer to part a or otherwise, find the values of a and b, giving them to 3sf where necessary

c) Interpret the meaning of the constant a in this model