

9. The amount of antibiotic, y milligrams, in a patient's bloodstream, t hours after the antibiotic was first given, is modelled by the equation

$$y = ab^t$$

where a and b are constants.

- (a) Show that this equation can be written in the form

$$\log_{10} y = t \log_{10} b + c$$

expressing the constant c in terms of a .

(2)

A doctor measures the amount of antibiotic in the patient's bloodstream at regular intervals for the first 5 hours after the antibiotic was first given.

She plots a graph of $\log_{10} y$ against t and finds that the points on the graph lie close to a straight line passing through the point $(0, 2.23)$ with gradient -0.076

- (b) Estimate, to 2 significant figures, the value of a and the value of b .

(2)

With reference to this model,

- (c) (i) give a practical interpretation of the value of the constant a ,

(ii) give a practical interpretation of the value of the constant b .

(2)

- (d) Use the model to estimate the time taken, after the antibiotic was first given, for the amount of antibiotic in the patient's bloodstream to fall to 30 milligrams. Give your answer, in hours, correct to one decimal place.

(2)

- (e) Comment on the reliability of your estimate in part (d).

(1)