

10 A singer has a social media account with a number of followers. The singer releases a new song and the number of followers grows exponentially.

The number of followers, F , may be modelled by the formula

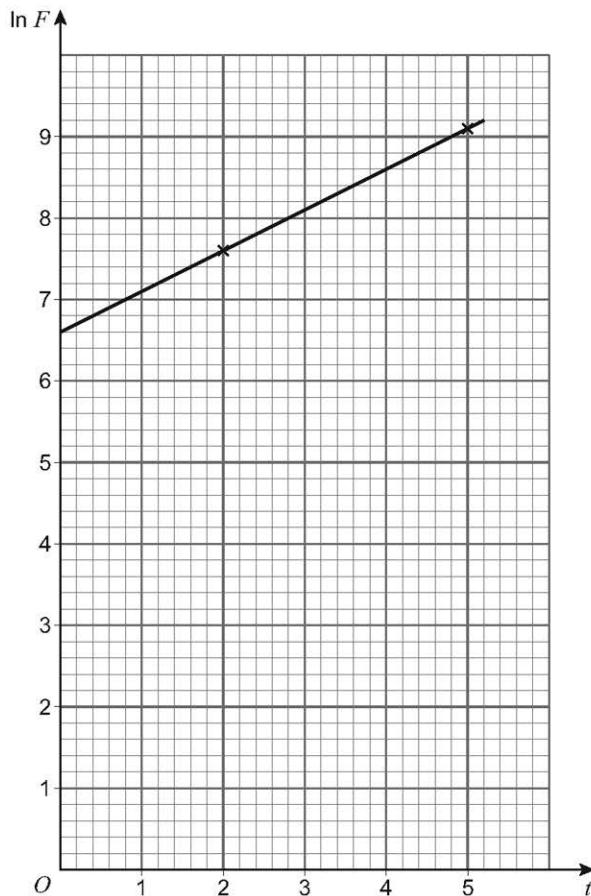
$$F = ae^{kt}$$

where t is the number of days since the song was released and a and k are constants.

- Two days after the song is released the account has 2050 followers.
- Five days after the song is released the account has 9200 followers.

On the graph below $\ln F$ has been plotted against t for these two pieces of data.

A line has been drawn passing through these two data points.



10 (a) (i) Show that $\ln F = \ln a + kt$ [2 marks]

10 (a) (ii) Using the graph, estimate the value of the constant a and the value of the constant k [4 marks]

10 (b) (i) Show that $\frac{dF}{dt} = kF$ [2 marks]

10 (b) (ii) Using the model, estimate the rate at which the number of followers is increasing 5 days after the song is released. [2 marks]

10 (c) The singer claims that 30 days after the song is released, the account will have more than a billion followers.

Comment on the singer's claim. [1 mark]