4. **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

Using algebraic integration, find the exact value of

$$\int_{\frac{\pi}{18}}^{\frac{\pi}{12}} (\sin 3x + \cos 3x)^2 \, \mathrm{d}x$$

(5)

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Question 4 continued

(Total for Question 4 is 5 marks)

5.

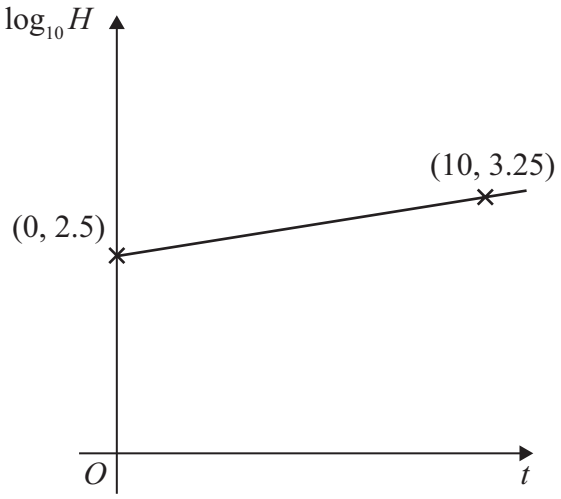


Figure 1

The recycling of household waste in a particular town is being monitored.

The number of households in the town, H, recycling their household waste, t years after monitoring began, is modelled by the equation

$$H = ab^t$$

where a and b are constants.

The line in Figure 1 shows the linear relationship between t and $\log_{10} H$

The line passes through the points (0, 2.5) and (10, 3.25)

Using this information,

(a) find, to 3 significant figures, the value of a and the value of b

(4)

(b) With reference to the model, interpret the value of the constant b

(1)

(c) Find the value of $\frac{dH}{dt}$ when $t = 5$, giving the answer to 2 significant figures.

(*Solutions relying entirely on calculator technology are not acceptable.*)

(2)

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