

1. A medical researcher is studying the number of hours, T , a patient stays in hospital following a particular operation.

The histogram on the page opposite summarises the results for a random sample of 90 patients.

- (a) Use the histogram to estimate $P(10 < T < 30)$ (2)

For these 90 patients the time spent in hospital following the operation had

- a mean of 14.9 hours
- a standard deviation of 9.3 hours

Tomas suggests that T can be modelled by $N(14.9, 9.3^2)$

- (b) With reference to the histogram, state, giving a reason, whether or not Tomas' model could be suitable. (1)

Xiang suggests that the frequency polygon based on this histogram could be modelled by a curve with equation

$$y = kxe^{-x} \quad 0 \leq x \leq 4$$

where

- x is measured in **tens of hours**
- k is a constant

- (c) Use algebraic integration to show that

$$\int_0^n xe^{-x} dx = 1 - (n + 1)e^{-n} \quad (4)$$

- (d) Show that, for Xiang's model, $k = 99$ to the nearest integer. (3)

- (e) Estimate $P(10 < T < 30)$ using
 (i) Tomas' model of $T \sim N(14.9, 9.3^2)$ (1)

- (ii) Xiang's curve with equation $y = 99xe^{-x}$ and the answer to part (c) (2)

The researcher decides to use Xiang's curve to model $P(a < T < b)$

- (f) State one limitation of Xiang's model. (1)

