

4.

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

*[In this question, \mathbf{i} is a unit vector due east and \mathbf{j} is a unit vector due north.
Position vectors are given relative to a fixed origin O .]*

At time t seconds, $t \geq 1$, the position vector of a particle P is \mathbf{r} metres, where

$$\mathbf{r} = ct^{\frac{1}{2}}\mathbf{i} - \frac{3}{8}t^2\mathbf{j}$$

and c is a constant.

When $t = 4$, the bearing of P from O is 135°

(a) Show that $c = 3$

(3)

(b) Find the speed of P when $t = 4$

(4)

When $t = T$, P is accelerating in the direction of $(-\mathbf{i} - 27\mathbf{j})$.

(c) Find the value of T .

(4)