2. [*In this question, the perpendicular unit vectors* **i** *and* **j** *are in a horizontal plane.*]

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

A particle P is moving on a smooth horizontal plane.

At time t seconds $(t \geqslant 0)$, the position vector of P, relative to a fixed point O, is **r** metres and the velocity of P is $\mathbf{v}\ \text{m s}^{-1}$ where

$$\mathbf{v} = \left(4t^2 - 5t\right)\mathbf{i} + \left(-10t - 12\right)\mathbf{j}$$

When $t = 0$, $\mathbf{r} = 2\mathbf{i} + 6\mathbf{j}$

(a) Find **r** when $t = 2$

(4)

When $t = T$ particle P is moving in the direction of the vector $\mathbf{i} - 2\mathbf{j}$

(b) Find the value of T

(3)

(c) Find the exact magnitude of the acceleration of P when $t = 2.5$

(3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 2 continued

Question 2 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 2 continued

(Total for Question 2 = 10 marks)