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

A particle Q of mass 1.5 kg is moving on a smooth horizontal plane under the action of a single force **F** newtons. At time t seconds $(t \geqslant 0)$, the position vector of Q, relative to a fixed point O, is **r** metres and the velocity of Q is **v** m s^{-1}
It is given that

$$\mathbf{v} = (3t^2 + 2t)\mathbf{i} + (t^3 + kt)\mathbf{j}$$

where k is a constant.

Given that when $t = 2$ particle Q is moving in the direction of the vector $\mathbf{i} + \mathbf{j}$

(a) show that $k = 4$

(2)

(b) find the magnitude of **F** when $t = 2$

(4)

Given that $\mathbf{r} = 3\mathbf{i} + 4\mathbf{j}$ when $t = 0$

(c) find **r** when $t = 2$

(4)

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Question 4 continued

(Total for Question 4 is 10 marks)

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