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1. At time t seconds, $t \geqslant 0$, a particle P has position vector $\mathbf{r}$ metres with respect to a fixed origin O, where

$$\mathbf{r} = (t^3 - 8t)\mathbf{i} + \left(\frac{1}{3}t^3 - t^2 + 2t\right)\mathbf{j}$$

(a) Find the acceleration of P when $t = 4$

(5)

At time T seconds, $T \geqslant 0$, P is moving in the direction of $(2\mathbf{i} + \mathbf{j})$

(b) Find the value of T

(3)

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Question 1 continued

Q1

(Total 8 marks)