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

At time t seconds, $t \geqslant 0$, a particle P is moving with velocity $\mathbf{v}\,\text{m s}^{-1}$, where

$$\mathbf{v} = 3(t+2)^2\,\mathbf{i} + 5t(t+2)\,\mathbf{j}$$

Position vectors are given relative to the fixed point O

At time $t = 0$, P is at the point with position vector $(-30\mathbf{i} - 45\mathbf{j})$ m.

(a) Find the position vector of P when $t = 3$

(4)

(b) Find the magnitude of the acceleration of P when $t = 3$

(4)

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

(c) Find the value of T

(2)

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Question 1 continued

(Total for Question 1 is 10 marks)