5. [*In this question,* **i** *and* **j** *are horizontal perpendicular unit vectors.*]

A particle Q of mass 2 kg is moving on a smooth horizontal surface.

Particle Q is moving with velocity $4\mathbf{i}\ \text{m s}^{-1}$ when it receives a horizontal impulse $\mathbf{I}$ N s.

The magnitude of $\mathbf{I}$ is $4\sqrt{10}$ N s.

Immediately after receiving the impulse, the velocity of Q is $\lambda(\mathbf{i}+\mathbf{j})\ \text{m s}^{-1}$, where λ is a positive constant.

(a) Find the value of λ.

(5)

(b) Find $\mathbf{I}$ in terms of $\mathbf{i}$ and $\mathbf{j}$.

(1)

The angle between the direction of the impulse and the initial direction of motion of Q is $\theta°$

(c) Find the value of θ.

(2)

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Question 5 continued

(Total for Question 5 is 8 marks)