2. A particle Q of mass 3 kg is moving on a smooth horizontal surface.

Particle Q is moving with velocity $5\mathbf{i}\ \text{m s}^{-1}$ when it receives a horizontal impulse of magnitude $3\sqrt{82}\ \text{N s}$.

Immediately after receiving the impulse, the velocity of Q is $(x\mathbf{i} + y\mathbf{j})\ \text{m s}^{-1}$, where x and y are positive constants.

The kinetic energy **gained** by Q as a result of receiving the impulse is 138 J.

Find, in terms of **i** and **j**, the velocity of Q immediately after receiving the impulse.

(7)

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Question 2 continued

(Total for Question 2 is 7 marks)