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7. [*In this question* **i** *and* **j** *are horizontal unit vectors due east and due north respectively and position vectors are given relative to a fixed origin O.*]

A ship A is moving with constant velocity $(2\mathbf{i} - 14\mathbf{j})\,\text{km h}^{-1}$. At 2 pm the position vector of ship A is $(8\mathbf{i} + 7\mathbf{j})$ km.

A ship B is moving with constant velocity $(12\mathbf{i} - 4\mathbf{j})\,\text{km h}^{-1}$. At 2 pm the position vector of ship B is $(\mathbf{i} + 2\mathbf{j})$ km.

(a) Show that at time t hours after 2 pm,

$$\overrightarrow{BA} = [(7 - 10t)\mathbf{i} + (5 - 10t)\mathbf{j}]\,\text{km}$$

(5)

(b) Hence find the length of time for which the ships are within 2 km of each other.

(7)

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Question 7 continued

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Q7