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8. [In this question  $\mathbf{i}$  and  $\mathbf{j}$  are horizontal unit vectors directed due east and due north respectively and position vectors are given relative to a fixed origin.]

At 7 am a ship leaves a port and moves with constant velocity. The position vector of the port is  $(-2\mathbf{i} + 9\mathbf{j})$  km.

At 7.36 am the ship is at the point with position vector  $(4\mathbf{i} + 6\mathbf{j})$  km.

- (a) Show that the velocity of the ship is  $(10\mathbf{i} - 5\mathbf{j}) \text{ km h}^{-1}$  (2)

- (b) Find the position vector of the ship  $t$  hours after leaving port. (2)

At 8.48 am a passenger on the ship notices that a lighthouse is due east of the ship.

At 9 am the same passenger notices that the lighthouse is now north east of the ship.

- (c) Find the position vector of the lighthouse. (4)

- (d) Find the position vector of the ship when it is due south of the lighthouse. (4)



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Q8

**(Total 12 marks)**

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**TOTAL FOR PAPER: 75 MARKS**

