

- (7)



7. [In this question $\mathbf{i}$ and $\mathbf{j}$ are horizontal unit vectors.]

Two boats, A and B , are each moving with constant acceleration.

At time t hours after noon, boat A has velocity $\mathbf{v}_A \text{ km h}^{-1}$, where

$$\mathbf{v}_A = 2\mathbf{i} + 3\mathbf{j} + (\mathbf{i} - 4\mathbf{j})t$$

(a) Find the magnitude of the acceleration of A .

(2)

When $t = 2$, the velocity of B is $(4\mathbf{i} + \mathbf{j}) \text{ km h}^{-1}$

When $t = 5$, the velocity of B is $(\mathbf{i} - 5\mathbf{j}) \text{ km h}^{-1}$

(b) Find the acceleration of B , giving your answer in terms of $\mathbf{i}$ and $\mathbf{j}$.

(2)

(c) Find the velocity of B at time $t = 0$, giving your answer in terms of $\mathbf{i}$ and $\mathbf{j}$.

(2)

At time T_1 hours after noon, both boats are moving with the same speed.

(d) Find the exact value of T_1

(4)

At time T_2 hours after noon, both boats are moving in the same direction.

(e) Show that $3T_2^2 + pT_2 + q = 0$, where p and q are integers to be found.

(3)



6. Two cars A and B are moving in the same direction along a straight horizontal road. Car A is moving with uniform acceleration 0.4ms^{-2} and car B is moving with uniform acceleration 0.5ms^{-2} . At the instant when B is 200m behind A , the speed of A is 35ms^{-1} and the speed of B is 44ms^{-1} . Find the speed of B when it overtakes A .

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- (c) Find the total time taken by the cyclist to travel from A to C . (3)