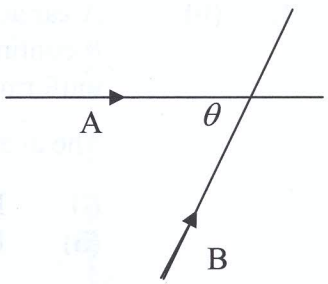
2011

2. **(a)** Two cars, A and B, travel along two straight roads which intersect at an angle θ where $\tan\theta = \frac{4}{3}$.



Car A is moving towards the intersection at a uniform speed of 5 m s^{-1}.
Car B is moving towards the intersection at a uniform speed of 10 m s^{-1}.

At a certain instant each car is 100 m from the intersection and approaching the intersection.

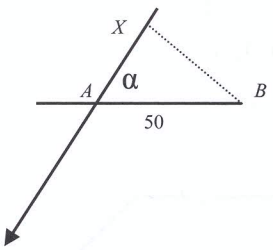
Find **(i)** the velocity of A relative to B
(ii) the shortest distance between the cars.

(i)

$$\vec{V}_A = 5\vec{i} + 0\vec{j}$$
$$\vec{V}_B = 6\vec{i} + 8\vec{j}$$
$$\vec{V}_{AB} = \vec{V}_A - \vec{V}_B \qquad 5$$
$$= -\vec{i} - 8\vec{j} \qquad 5$$

magnitude $= \sqrt{65}\ \text{m s}^{-1}$ 5

direction = West $\tan^{-1} 8$ South 5



(ii)

$$|BX| = 50\sin\alpha \qquad 5$$
$$= 50\left(\frac{8}{\sqrt{65}}\right)$$
$$= 49.6\ \text{m} \qquad 5$$

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