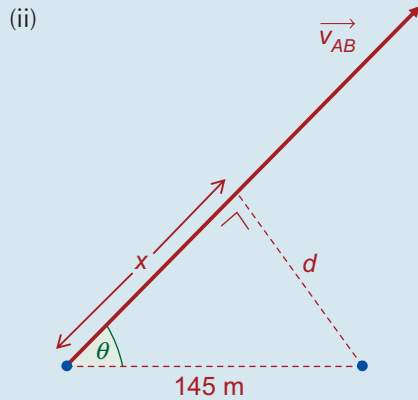


Q. 3. (i) $\vec{v}_A = 21\vec{i}$
 $\vec{v}_B = -20\vec{j}$
 $\vec{v}_{AB} = \vec{v}_A - \vec{v}_B$
 $= 21\vec{i} + 20\vec{j}$ m/s



Wait until B reaches the intersection.

$$\text{Time} = \frac{\text{distance}}{\text{speed}} = \frac{100}{20} = 5 \text{ s}$$

Find how far A has travelled in this time.

$$\begin{aligned} \text{Distance} &= \text{speed} \times \text{time} \\ &= 21 \times 5 = 105 \text{ m} \end{aligned}$$

$$\begin{aligned} \Rightarrow \text{Distance from } O &= 250 - 105 \\ &= 145 \text{ m} \end{aligned}$$

$$\tan \theta = \frac{20}{21}$$

$$\Rightarrow \sin \theta = \frac{20}{29}$$

$$\text{But, } \sin \theta = \frac{d}{145}$$

$$\Rightarrow \frac{d}{145} = \frac{20}{29}$$

$$\Rightarrow d = 100 \text{ m}$$

(iii) $x^2 + d^2 = 145^2$... but $d = 100$

$$\Rightarrow x = \sqrt{145^2 - 100^2} = 105$$

$$\text{Time} = \frac{\text{relative distance}}{\text{relative speed}}$$

$$= \frac{105}{\sqrt{21^2 + 20^2}}$$

$$= 3.62 \text{ s}$$

Q. 4. (i) $\text{Time} = \frac{\text{distance}}{\text{speed}}$
 $= \frac{100}{5}$
 $= 20 \text{ s}$

(ii) Distance travelled by B = speed \times time = $8 \times 20 = 160 \text{ m}$
 \Rightarrow Distance from $O = 200 - 160 = 40 \text{ m}$
 \Rightarrow Distance between A and $B = 40 \text{ m}$

(iii) $\vec{v}_A = -5 \cos \theta \vec{i} - 5 \sin \theta \vec{j}$
 $= -5\left(\frac{4}{5}\right)\vec{i} - 5\left(\frac{3}{5}\right)\vec{j}$
 $= -4\vec{i} - 3\vec{j}$

$$\vec{v}_B = -8\vec{i}$$

$$\begin{aligned} \vec{v}_{AB} &= \vec{v}_A - \vec{v}_B \\ &= 4\vec{i} - 3\vec{j} \end{aligned}$$

$$\begin{aligned} \Rightarrow |\vec{v}_{AB}| &= \sqrt{4^2 + (-3)^2} \\ &= 5 \text{ m/s} \end{aligned}$$

$$\tan \theta = \frac{3}{4}$$

$$\Rightarrow \theta = 36.87^\circ$$

$$\Rightarrow 36.87^\circ \text{ S of E}$$

(iv) $\tan \theta = \frac{3}{4}$

$$\Rightarrow \sin \theta = \frac{3}{5}$$

$$\text{But, } \sin \theta = \frac{d}{40}$$

$$\Rightarrow \frac{d}{40} = \frac{3}{5}$$

$$\Rightarrow d = 24 \text{ m}$$

(v) $x^2 + d^2 = 40^2$... but $d = 24$

$$\Rightarrow x = \sqrt{40^2 - 24^2} = 32 \text{ m}$$

$$\text{Time} = \frac{\text{relative distance}}{\text{relative speed}}$$

$$= \frac{32}{5} = 6.4 \text{ s}$$

But, A and B had already been travelling for 20 seconds.

$$\Rightarrow \text{Time} = 26 \text{ s}$$

(vi) A : Distance from intersection = $100 - 5t$

B : Distance from intersection = $200 - 8t$

$$\Rightarrow \text{Equidistant from } O \text{ when } 100 - 5t = 200 - 8t$$

$$\Rightarrow 3t = 100$$

$$\Rightarrow t = \frac{100}{3}$$

$$= 33\frac{1}{3} \text{ s}$$

