

1996 HLC Q2 Apm

c

(i)

$\vec{v}_B = -25.6 \hat{i}$

$|\vec{v}_C| = 32 \Rightarrow \vec{v}_C = a\hat{i} + b\hat{j}$ where $a^2 + b^2 = 32^2$

$\vec{v}_{CB} = x\hat{i} - x\hat{j}$ where $x > 0$ (Appears to be travelling due east)

$\vec{v}_{CB} = \vec{v}_C - \vec{v}_B$

$\Rightarrow x\hat{i} - x\hat{j} = a\hat{i} + b\hat{j} - (-25.6\hat{i})$

$\Rightarrow x = a + 25.6 \Rightarrow a = x - 25.6$

and $-x = b \Rightarrow b = -x$

$\therefore (x - 25.6)^2 + (-x)^2 = 32^2$

$\Rightarrow x^2 - 51.2x + (25.6)^2 + x^2 = 32^2$

Solve \Rightarrow

$x = 31.46$ (where $x > 0$)

$\vec{v}_C = a\hat{i} + b\hat{j} = (31.46 - 25.6)\hat{i} + (-31.46)\hat{j}$

$\vec{v}_C = 5.86\hat{i} - 31.46\hat{j}$

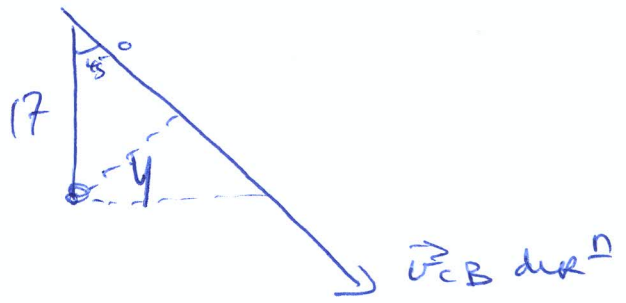
$\therefore \text{Dir}^n \text{ E } \tan^{-1} \frac{31.46}{5.86} \text{ S}$

$\text{E } 79.45^\circ \text{ S}$

(ii) $\vec{v}_{CB} = x\hat{i} - x\hat{j} = 31.46\hat{i} - 31.46\hat{j}$

$|\vec{v}_{CB}| = \sqrt{(31.46)^2 + (-31.46)^2} = 44.49 \text{ km/hour}$

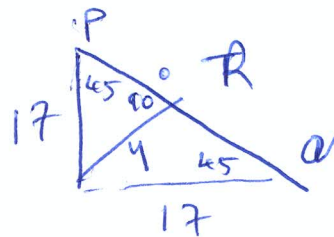
(iii) shortest distance y



$\frac{y}{17} = \sin 45^\circ$

$y = 17 \sin 45^\circ \Rightarrow y = 12.02 \text{ km}$

(iv)



$\text{Time PQ} = \frac{\text{Dist PQ}}{|\vec{v}_{CB}|}$

$\text{Dist PQ} = 2 \text{ Dist PR} = 2(17 \cos 45^\circ) = 17\sqrt{2}$

$\therefore \text{Time PQ} = \frac{17\sqrt{2}}{44.49}$

$\text{Time PQ} = 0.54 \text{ hours}$