

Taking $x = 16$ and $y = -12$ gives $\vec{v}_{ST} = 12\vec{i} - 12\vec{j}$. This is towards the south-east.

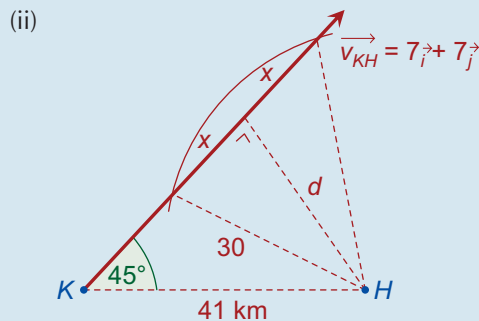
$$\Rightarrow \vec{v}_S = 16\vec{i} - 12\vec{j} \text{ m/s.}$$

- Q. 11.** (i) $\vec{v}_H = 17\vec{i}$
 $\vec{v}_K = x\vec{i} + y\vec{j}$
 $\vec{v}_{KH} = \vec{v}_K - \vec{v}_H = (x - 17)\vec{i} + y\vec{j}$
 \vec{v}_{KH} north-east
 $\Rightarrow x - 17 = y \Rightarrow x = y + 17$
 Also, $|\vec{v}_K| = 25$
 $\Rightarrow \sqrt{x^2 + y^2} = 25 \dots$ but $x = y + 17$
 $\Rightarrow (y + 17)^2 + y^2 = 625$
 $\Rightarrow y^2 + 34y + 289 + y^2 = 625$
 $\Rightarrow 2y^2 + 34y - 336 = 0$
 $\Rightarrow y^2 + 17y - 168 = 0$
 $\Rightarrow (y + 24)(y - 7) = 0$
 $\Rightarrow y = -24, y = 7$
 $\Rightarrow x = -7, x = 24$

Taking $x = -7$ and $y = -24$ gives $\vec{v}_{KH} = -24\vec{i} - 24\vec{j}$. This is not towards the north-east. It is, in fact, from the north-east. These values of x and y are therefore excluded.

Taking $x = 24$ and $y = 7$ gives $\vec{v}_{KH} = 7\vec{i} + 7\vec{j}$. This is towards the north-east.

$$\Rightarrow \vec{v}_K = 24\vec{i} + 7\vec{j} \text{ km/h}$$



$$\sin 45^\circ = \frac{d}{41}$$

$$\Rightarrow d = 41 \sin 45^\circ$$

$$= 29 \text{ km}$$

- (iii) Draw a circle of radius 30 km with centre at H .

As long as the relative path, \vec{v}_{KH} is inside this circle, K and H will be within 30 km of each other. This will be for a relative distance of $2x$.

$$x^2 + d^2 = 30^2 \dots \text{ but } d = 29$$

$$\Rightarrow x = \sqrt{30^2 - 29^2} = \sqrt{59}$$

$$\Rightarrow 2x = 2\sqrt{59}$$

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

$$= \frac{2\sqrt{59}}{\sqrt{7^2 + 7^2}} = 1.55 \text{ h}$$

$$= 93 \text{ mins.}$$

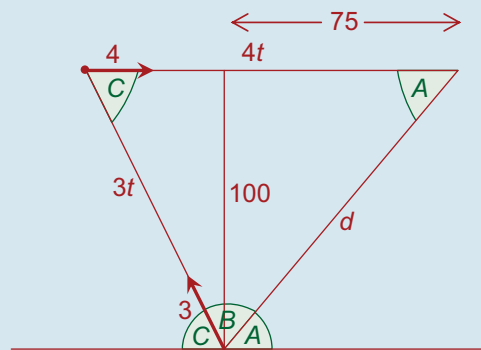
Exercise 4F

- Q. 1.** Let t = the time taken to cross the river.

The boat will head upstream at 3 m/s, and would travel a distance of $3t$.

Meanwhile, the river carries the boat downstream a distance $4t$.

The boat lands 75 m downstream.



$$\tan A = \frac{100}{75} = \frac{4}{3}$$

$$\Rightarrow A = 53.13^\circ$$

$$d^2 = 75^2 + 100^2$$

$$\Rightarrow d = 125 \text{ m}$$

Using the Sine Rule:

$$\frac{3t}{\sin A} = \frac{4t}{\sin B} \dots \text{ but } \sin A = \frac{4}{5}$$