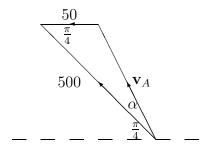
## Question

An aeroplane has velocity  $\mathbf{v}_A$  relative to still air. If it flies in a wind with velocity  $\mathbf{v}_W$  what is the velocity of the aeroplane relative to the ground?

An aeroplane moves in a northwesterly direction at  $500 \text{kmh}^{-1}$  due to the fact that there is an easterly wind (i.e. from the east) of  $50 \text{kmh}^{-1}$ . Determine how fast and in what direction the aeroplane would have traveled if there was no wind.

## Answer

 $\mathbf{v} = \mathbf{v}_A + \mathbf{v}_W$  as  $\mathbf{v}_A$  is relative to still air; when there is a wind the plane has  $\mathbf{v}_A$  relative to the wind.



cosine rule:

$$\mathbf{v}_A^2 = 500^2 + 50^2 - 2 \times 50 \times 500 \cos \frac{\pi}{4}$$
  
 $\Rightarrow \mathbf{v}_A = 466 \text{kmh}^{-1}$ 

sine rule:

$$\frac{50}{\sin \alpha} = \frac{466}{\sin \frac{\pi}{4}}$$

$$\Rightarrow \sin \alpha = \frac{25\sqrt{2}}{466}$$

$$\Rightarrow \alpha = 0.076 \text{ rads}$$