2 **(b)** On a particular day the velocity of the wind, in terms of $\vec{i}$ and $\vec{j}$, is $x\,\vec{i} - 3\,\vec{j}$, where $x \in \mathrm{N}$.
$\vec{i}$ and $\vec{j}$ are unit vectors in the directions East and North respectively.

To a man travelling due East the wind appears to come from a direction North $\alpha°$ West where $\tan\alpha = 2$.

When he travels due North at the same speed as before, the wind appears to come from a direction North $\beta°$ West where $\tan\beta = \frac{3}{2}$.

Find the actual direction of the wind.

$$\vec{V}_M = a\,\vec{i}$$
$$\vec{V}_{WM} = \vec{V}_W - \vec{V}_M$$
$$= (x\,\vec{i} - 3\,\vec{j}) - a\,\vec{i}$$
$$= (x-a)\,\vec{i} - 3\,\vec{j}$$

5

$$\tan\alpha = \frac{x-a}{3}$$
$$2 = \frac{x-a}{3} \quad \Rightarrow a = x-6$$

5

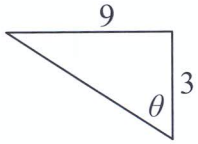
$$\vec{V}_M = a\,\vec{j}$$
$$\vec{V}_{WM} = \vec{V}_W - \vec{V}_M$$
$$= (x\,\vec{i} - 3\,\vec{j}) - a\,\vec{j}$$
$$= x\,\vec{i} - (3+a)\,\vec{j}$$

5

$$\tan\beta = \frac{x}{3+a}$$
$$\frac{3}{2} = \frac{x}{3+a} \quad \Rightarrow a = \frac{2x-9}{3}$$

5

$$\frac{2x-9}{3} = x-6 \quad \Rightarrow x = 9$$



$$\vec{V}_W = 9\,\vec{i} - 3\,\vec{j} \quad \Rightarrow \tan\theta = 3$$

direction of wind : from North 71.6° West

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