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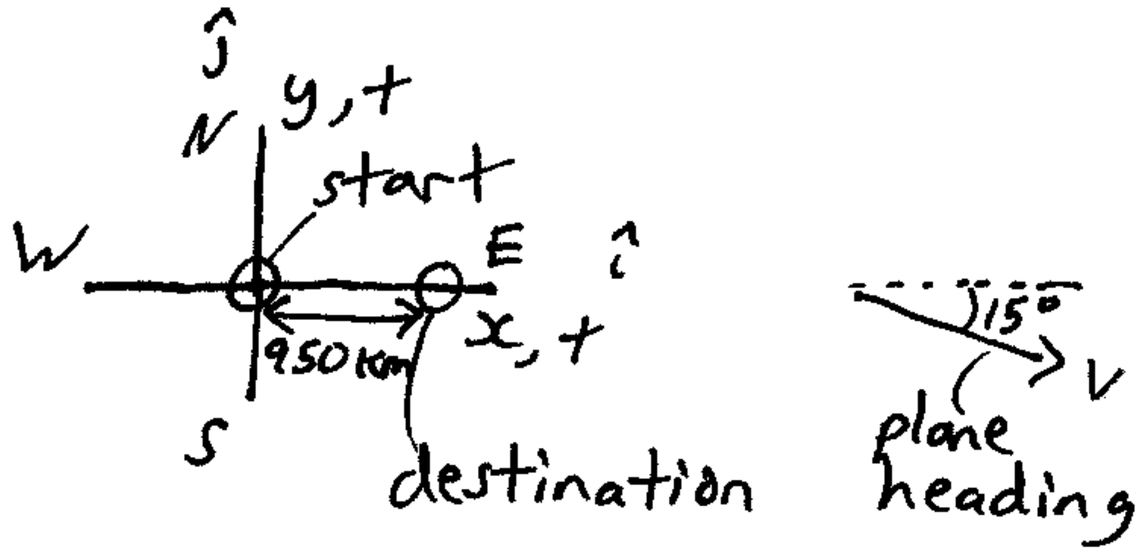
This is a 2-D problem involving relative motion.

The pilot of a plane intends to fly directly east in the presence of a wind, a distance of 950 km. The plane has an airspeed of 630 km/h, and the pilot calculates that the plane must fly with a heading of 15° south of east. If the plane arrives at the destination 1.8 hours later, what was the velocity vector of the wind?

Solution:




Use the vector equation: $\vec{v}_P = \vec{v}_B + \vec{v}_{PB}$

$\vec{v}_P = \frac{950\text{ km}}{1.8\text{ h}}\,\hat{i}$ ( velocity of the plane relative to the ground )

$\vec{v}_B = a\hat{i} + b\hat{j}$ ( velocity of the wind relative to the ground — a and b are constants)

$\vec{v}_{PB} = v\cos 15^\circ \hat{i} - v\sin 15^\circ \hat{j}$ ( velocity of the plane relative to the wind — v is the magnitude of this velocity v = 630 km/h )

$\vec{v}_{PB} = 630\cos 15^\circ \hat{i} - 630\sin 15^\circ \hat{j}$

Substitute:

$$\frac{950}{1.8}\hat{i} = a\hat{i} + b\hat{j} + 630\cos 15°\hat{i} - 630\sin 15°\hat{j}$$

By comparsion,

$$\frac{950}{1.8} = a + 630\cos 15°$$

$$a = -80.8$$

and, $0 = b - 630\sin 15°$

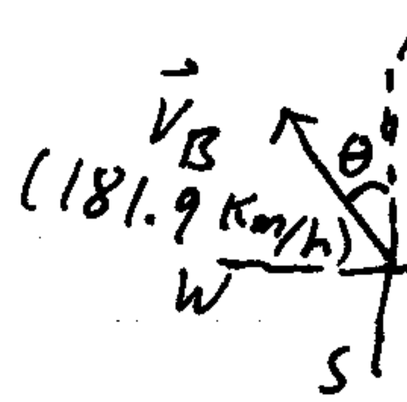
$$b = 163$$

The velocity vector of the wind is:

$$\vec{V}_B = -80.8\hat{i} + 163\hat{j} \text{ (answer)}$$

$$|\vec{V}_B| = \sqrt{(-80.8)^2 + (163)^2}$$

$$= 181.9 \text{ km/h}$$




$$\theta = \tan^{-1}\left(\frac{80.8}{163}\right)$$

$$\theta = 26.4°$$

The wind speed is 182 km/h, 26° west of north. (answer)