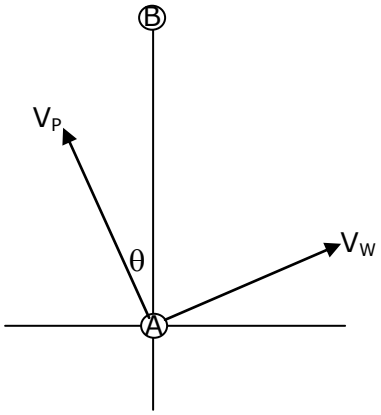
Q- The airport B is due north of airport A. On a particular day the velocity of wind is (80i+25j) km/h. Relative to the air an aircraft flies with constant speed 208 km/h. When the aircraft flies directly from A to B
(a) Show its speed relative to the ground is 217km/h
(b)After flying from A to B the aircraft returns directly to A. If the time taken on the outward journey is T_1 hours and return journey is T_2 hours find T1/T2

As the aircraft will be drifted by the wind, to go directly to port B it is to be flied in such a direction that the direction of the resultant velocity is towards B.

(a) Let the plane is flied at an angle θ, west of north then the velocity can be written as



$$\vec{V}_P = \left(-208\sin\theta * i + 208\cos\theta\, j\right) km/hr$$

And wind velocity is

$$\vec{V}_W = \left(80 * i + 25 * j\right) km/h$$

Hence the resultant velocity of the plane is given by

$$\vec{V} = \left(-208\sin\theta + 80\right) i + \left(208\cos\theta + 25\right) j$$

For this resultant velocity to be towards north, its i component must be zero. This gives

$-208 \sin\theta + 80 = 0$

Or $\sin\theta = 80/208 = 0.3846$; $\theta = 22.62^0$; and $\cos\theta = 0.923$

Hence the resultant velocity of the plane is by substituting the values is given by

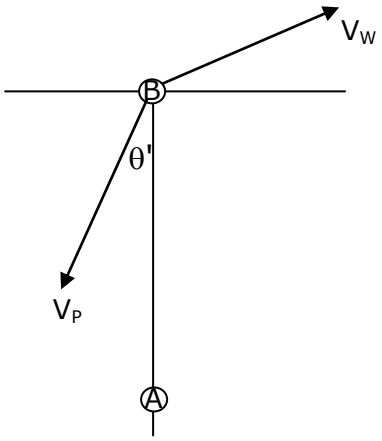
$$\vec{V} = 0i + \left(208 * 0.923 + 25\right) j = 217\, j$$

Hence the velocity of the plane relative to ground is 217 km/h towards north.

If the distance between A and B is d then the time taken will be

$T_1 = d/217$ hours.

(b) Now similarly for the return journey



Let the plane is flied at an angle θ, west of south, then the velocity can be written as

$$\vec{V}_P = \left(-208\sin\theta * i - 208\cos\theta\, j\right) km/hr$$

And wind velocity is the same

$$\vec{V}_W = \left(80 * i + 25 * j\right) km/h$$

Hence the resultant velocity of the plane is given by

$$\vec{V} = \left(-208\sin\theta + 80\right)i + \left(-208\cos\theta + 25\right)j$$

For this resultant velocity to be towards south, its i component must be zero. This gives

$-208 \sin\theta + 80 = 0$

Or $\sin\theta = 80/208 = 0.3846$; $\theta = 22.62^0$;
$\cos\theta = 0.923$

Hence the resultant velocity of the plane is by substituting the values is given by

$$\vec{V} = 0i + \left(-208 * 0.923 + 25\right)j = -167\,j$$

Hence the velocity of the plane relative to ground is 167 km/h towards south.

The distance between A and B is d hence the time taken will be

$T_2 = d/167$ hours.

Hence $T_1/T_2 = 167/217 = 0.77$