Navigation - Airplanes

Wednesday, October 12, 2016 11:45 AM

Similar to River Crossings

We will be using the following vector addition:

$$\vec{V}_p + \vec{V}_w = \vec{V}_g$$

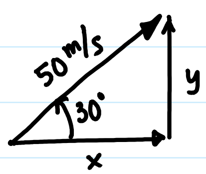
$\vec{V}_p$ = velocity of the plane (airspeed)
$\vec{V}_w$ = velocity of the wind (wind speed)
$\vec{V}_g$ = velocity of the plane as seen from the ground (ground speed)

Our big challenge now is that $\vec{V}_p$ and $\vec{V}_w$ will almost never be perpendicular to each other. We'll need to break our vectors into components.

Example: A plane has a velocity of 50 m/s at 30° N of E ($\vec{V}_p$) and it encounters a wind of 25 m/s at 45° E of S ($\vec{V}_w$). What is the velocity as seen from the ground?

$$\vec{V}_p + \vec{V}_w = \vec{V}_g$$

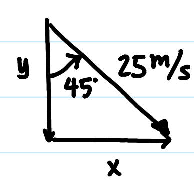
$\vec{V}_p$ = 50 m/s at 30° N of E



$x = 50\cos 30° = 43.30 \rightarrow$

$y = 50\sin 30° = 25 \uparrow$

$\vec{V}_w$ = 25 m/s at 45° E of S

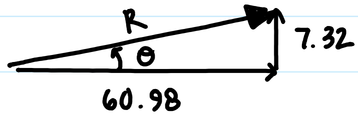


$x = 25\sin 45 = 17.68 \rightarrow$

$y = 25\cos 45 = 17.68 \downarrow$

x-comp: $43.30 + 17.68 = 60.98 \rightarrow$

y-comp: $25 + (-17.68) = 7.32 \uparrow$



$R^2 = (60.98)^2 + (7.32)^2$

$\sqrt{R^2} = \sqrt{3772.1428}$

$R = 61.4\ m/s$

$\theta = \tan^{-1}\left(\frac{7.32}{60.98}\right) = 6.8^\circ$

$\theta = 7^\circ$

$\vec{R} = 61.4\ m/s$ at 7° N of E

Complete remainder of worksheet questions (# 9 – 12)