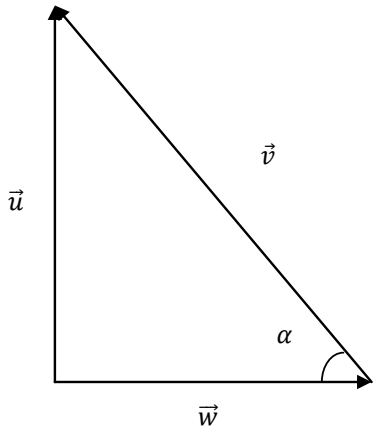
Let vectors $\vec{w}$, $\vec{v}$ and $\vec{u}$ represent velocities of wind, airplane with respect to air and airplane with respect to the ground respectively. Airplane's velocity is the resultant of sum of vectors $\vec{v}$ and $\vec{w}$. So, we have $\vec{u} = \vec{v} + \vec{w}$. As the wind is blowing from the west and airplane needs to fly northward, we get a right triangle with hypotenuse $\vec{v}$ (see the diagram below).



Using the Pythagorean theorem, we get the equation for the speed of airplane with respect to the ground:

$$|\vec{u}| = \sqrt{|\vec{v}|^2 - |\vec{w}|^2} = \sqrt{600^2 - 120^2} = \sqrt{345600} \approx 588\ km/h$$

The direction is determined by angle α. It can be found from:

$\cos\alpha = \frac{|\vec{w}|}{|\vec{v}|} = \frac{120}{600} = 0.2.$

$\alpha = \operatorname{acos} 0.2 \approx 78.5°.$

So, the plane must fly 78.5 degrees from west to north.