

Question:

A bird flies in the east direction with a speed of 5 ms^{-1} . The wind is blowing towards north at a speed of 3 ms^{-1} . Determine the relative velocity of the bird with respect to the wind. Draw appropriate diagram for solving the problem.

Solution:

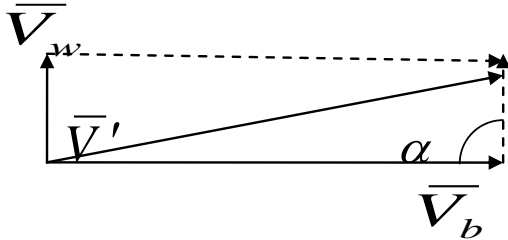
We will use a Galilean addition of velocities:

$$\vec{V} = \vec{V}_0 + \vec{V}',$$

where $\vec{V} = \vec{V}_b$ - the velocity of the bird with respect to the stationary coordinate system;

$\vec{V} = \vec{V}_w$ - the velocity of the moving coordinate system with respect to the stationary coordinate system;

\vec{V}' - the velocity of the bird with respect to the wind (moving coordinate system);



From the law of cosines:

$$V'^2 = V_w^2 + V_b^2 - 2 \cdot V_w \cdot V_b \cdot \cos \alpha = 3^2 + 5^2 - 2 \cdot 3 \cdot 5 \cdot \cos 90^\circ = 9 + 25 - 2 \cdot 3 \cdot 5 \cdot 0 = 34$$

Answer: $V' \approx 5.8 \frac{m}{s}$