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.
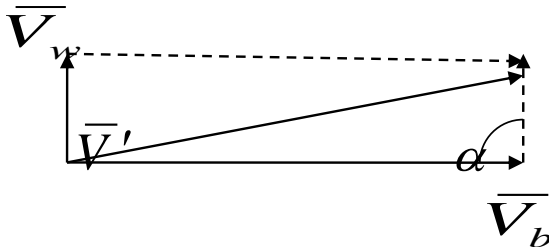
Solution:
We will use a Galilean addition of velocities:
$$\overline{V} = \overline{V}_0 + \overline{V}',$$
where $\overline{V} = \overline{V}_b$ - the velocity of the bird with respect to the stationary coordinate system;

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

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

From the law of cosines:
$$V'^2 = V_w^2 + V_b^2 - 2 \cdot V_w \cdot V_b \cdot \cos\alpha = 3^2 + 5^2 - 2\cdot 3 \ \cdot 5 \ \cdot\cos 90^0 = 9 \ + 25 \ - 2\cdot 3\cdot 5\cdot 0 = 34$$

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