Answer on Question #70237, Physics / Classical Mechanics

A migrating bird is initially flying south at 8 m/s. To avoid hitting a high-rise building, the bird veers and changes its velocity to 5 m/s east over a period of 2 s. What is the bird's average acceleration (magnitude and direction) during this 2 s interval?

Solution

The acceleration

$$\mathbf{a} = \frac{\Delta \mathbf{v}}{\Delta t}.$$

The change of velocity is $\Delta \mathbf{v} = \mathbf{v}_{fin} - \mathbf{v}_{init}$.

Since the vectors of initial and final velocity are perpendicular to each other the absolute value of $\Delta \mathbf{v}$ is given by

$$|\Delta \mathbf{v}| = \sqrt{v_f^2 + v_i^2} = \sqrt{5^2 + 8^2} = 9.4\ m/s.$$

The magnitude of acceleration

$$a = \frac{|\Delta \mathbf{v}|}{\Delta t} = \frac{9.4}{2} = 4.7\ m/s^2.$$

Because

$$\alpha = \arctan\frac{v_f}{v_i} = \arctan\frac{5}{8} = 32°$$

the direction of the acceleration is $32°$ N of E.

Answer: $4.7\ m/s^2$, $32°$ N of E.