Chapters C2 & C3:
Vectors, Velocity, and Momentum Transfer

Physics I

College of the Atlantic

1. Consider two displacement vectors: $\vec{A}$ has a magnitude of 100 meters and a direction of 30 degrees north of east. Vector $\vec{B}$ has a magnitude of 200 meters and a direction of 60 degrees south of east.

   (a) Write each vector in component form.

   (b) Sketch $\vec{A}$ and $\vec{B}$ and $\vec{A} + \vec{B}$.

   (c) Determine the components of $\vec{A} + \vec{B}$.

   (d) What is the magnitude and direction of $\vec{A} + \vec{B}$?

2. During a "sufficiently short" time interval of 0.25 s, a bird moves a displacement of 4.0 m east, 1.0 m south, and 0.1 m downward. What are the components of the bird's velocity at this time in a reference frame in standard orientation on the earth's surface? What is the bird's speed?

3. At a certain moment of time, a fish is at the location $(-4m, 5m)$. Four seconds later, the fish is at the location $(2m, -3m)$.

   (a) What is the fish's velocity, in components?

   (b) What is the magnitude and direction of the fish's velocity?

4. A 3 kg cart moving at 4 m/s to the right hits a 10 kg cart that is at rest. After the collision, the 3 kg cart is moving to the left at 1 m/s.

   (a) How much momentum does the left cart transfer to the right cart?

   (b) What is the velocity of the right cart after the collision?

   (c) Draw an arrow diagram for this situation.