

Chapter C4: Momentum Transfer and the Center of Mass

C4.2: Position, Velocity and Momentum

1. This section is mostly a bunch of important definitions.
2. Don't be alarmed by the dx 's. Read dx as $\Delta x \equiv$ change in x component of the position.
3. Speed \equiv magnitude of velocity vector.
4. $\text{mag}(\vec{v})$ is often written as $|\vec{v}|$.

Examples

1. I leave from my house and fly to school in my personal flying device (PFD). I fly in a straight line; the components of my displacement are 5 miles east and 2 miles north. I make the journey in 20 minutes. What is my velocity during this trip?
2. After school, I take my PFD and fly to Northeast Harbor. I travel in a straight line, 8 miles in a direction of 37 degrees west of south. My PFD and I have a mass of 250 kg. The trip takes 30 minutes. What is the momentum of my PFD and I during the flight?

C4.3: Interactions Transfer Momentum

Interactions between two particles conserve the total momentum of the two objects. However, the momentum of individual particles are changed by the interaction. The

momentum gained by one particle is equal to the momentum lost by the other particle.

The symbol for momentum transfer is:

C4.5 Center of Mass

Eq. (C4.7a), Eq. (C4.8) and Eqs. (C4.9a–c) are identical. They are different ways of writing the same thing.

The equation that defines the center of mass is the equation for a *weighted average*.

$$\text{average test score} = \frac{1}{N} (s_1 + s_2 + \cdots + s_N) .$$

$$\text{average test score weighted by height} = \frac{1}{h_1 + h_2 + \cdots + h_N} (h_1 s_1 + h_2 s_2 + \cdots + h_N s_N) .$$

C4.6: How the Center of Mass Moves

What is the main point of the derivation on the top of p. 51?