\[ \frac{\Delta X}{\Delta t} = V_{x, ave} \]
\[ \frac{\Delta P_x}{\Delta t} = F_{\text{net},x} \]
Reciprocity

1. The windshield of a bus traveling at high speed hits a hovering insect and smashes it. Which of the following is true?

1) The magnitude of the change of velocity of the insect is larger than that of the bus.
2) The magnitude of the change of velocity of the bus is larger than that of the insect.
3) The magnitudes of these two velocity changes are equal.

2. The windshield of a bus traveling at high speed hits a hovering insect and smashes it. Which of the following is true?

1) The magnitude of the change of momentum of the insect is larger than that of the bus.
2) The magnitude of the change of momentum of the bus is larger than that of the insect.
3) The magnitudes of these two momentum changes are equal.

3. The windshield of a bus traveling at high speed hits a hovering insect and smashes it. Which of the following is true?

1) The windshield exerts a larger force on the insect than the insect exerts on the windshield.
2) The insect exerts a larger force on the windshield than the windshield exerts on the insect.
3) The magnitudes of these two forces are equal.

\[
\frac{\Delta F_{\text{net}, \text{bus}}}{m_{\text{bus}}} = \frac{\Delta p_{\text{bus}}}{m_{\text{bus}}} = \frac{\Delta p_{\text{bug}}}{m_{\text{bug}}} = \frac{\Delta F_{\text{bus}, \text{bug}}}{m_{\text{bug}}} \Delta V_{\text{bug}}
\]
Ponderable: You'll get a kick out of this

You kick a soccer ball as it rolls by. Your kick is perpendicular to its initial path. The ball ends up being deflected by 20 degrees, but stays on the ground. How hard did you kick it?