1. You’re playing ping pong. The \( m = 10 \, \text{g} = 0.01 \, \text{kg} \) ball approaches with speed \( v_i = -10 \, \text{m/s} \). You give it a good whack with your paddle and send it back in the direction it came from with a speed \( v_f = 30 \, \text{m/s} \), as indicated in the diagram to the right.

a) What impulse (magnitude and direction) did you give to the ping pong ball? (4 points)

b) Suppose the collision between the paddle and the ball lasts 1 millisecond (0.001 s). On the diagram below, plot a plausible force versus time curve for the force applied by the paddle to the ball. Be sure to label the force axis with numerical values for the force in Newtons. (4 points)

Rewrite and sign the Honor Pledge: I pledge my honor that I have not violated the Honor Code during this examination.
2. Masses $m_1$ and $m_2$, travelling with velocities $+v_i$ and $-v_i$ have a head on collision. After the collision, mass $m_1$ is at rest while mass $m_2$ moves with velocity $v_f$ straight back in the direction it came from. A sketch is shown in the diagram to the right.

a) What is $m_2$ in terms of $m_1$, $v_i$, and $v_f$? Hint: don’t assume anything about energy conservation at this point! (4 points)

b) Suppose $v_f$ is such that the collision is completely \textbf{INELASTIC}. What is $m_2$ in terms of $m_1$ only? (2 points)

c) Suppose $v_f$ is such that the collision is completely \textbf{ELASTIC}. What is $m_2$ in terms of $m_1$ only? (6 points)