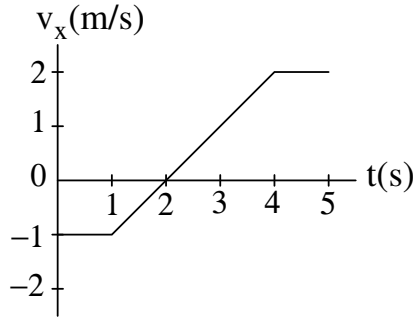
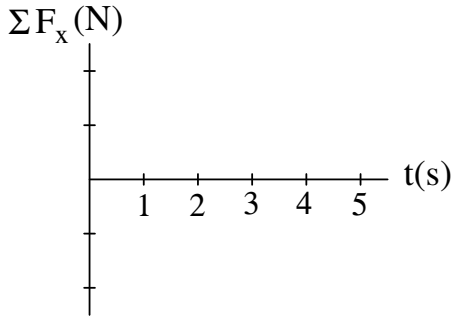
1. A 2.0 kg object, moving only in the x direction, has the velocity graph shown.



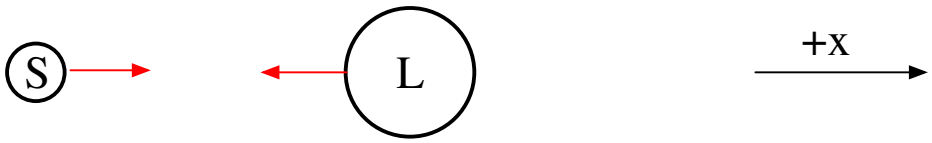


(a) What is the object's initial x momentum?_____ Final x momentum?_____

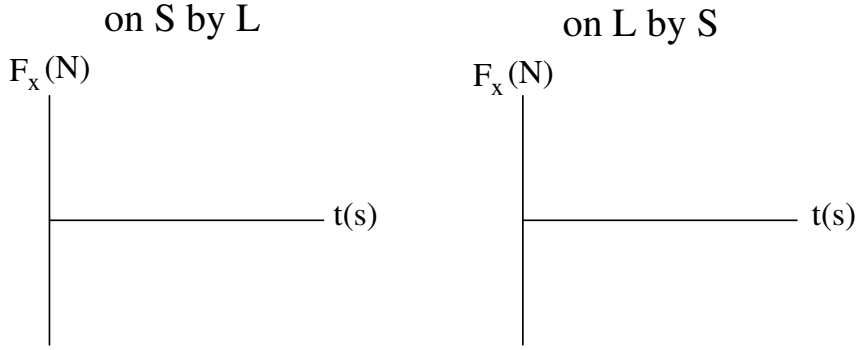
(b) What x impulse does the object experience?_____

(c) Draw the graph showing the net force on the object versus time. Show your work.

2. A small puck S and a larger, more massive puck L move toward one another, collide head on, and bounce apart, all on frictionless ice.



(a) Sketch force-versus-time graphs for the internal forces in this collision. Graph the x component of force in each case. Make the forces plausible.



(b) Compare the impulse experienced by S to the impulse experienced by L. Explain.

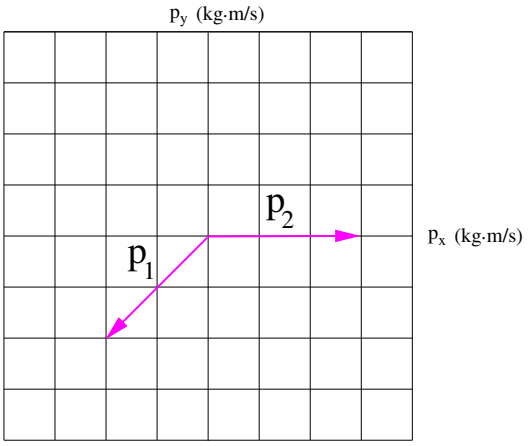
(c) Compare the momentum change of S to the momentum change of L. Explain.

(d) Compare the velocity change of S to the velocity change of L.

(e) What is the CHANGE in the SUM of the momenta of the two pucks? What are the EXTERNAL forces on the system of pucks, and do they sum to zero?

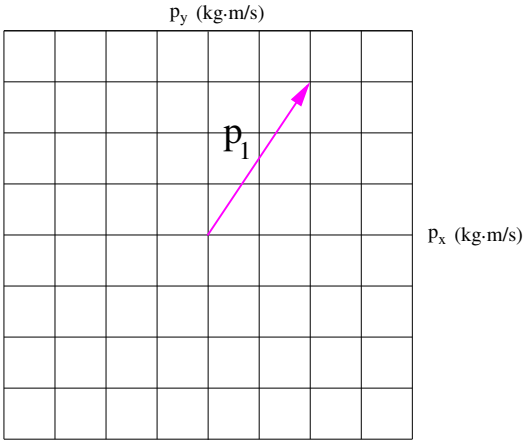
In 3-5, the sum of external forces is small enough to ignore.

3. An object initially at rest explodes into three fragments. The momentum vectors of two of the fragments are shown. (a) Draw $\vec{p}_3$, the momentum of the third fragment. Explain your drawing.



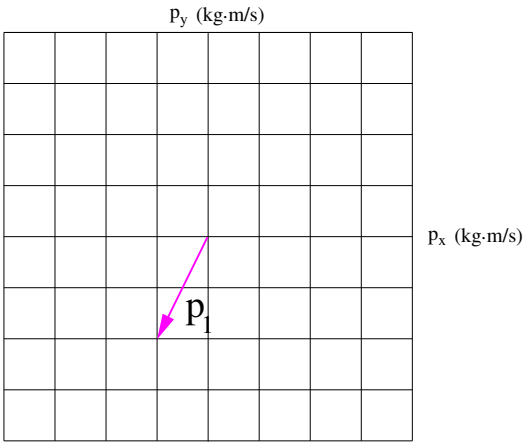
(b) If each of the three fragments has a mass of 2.0 kg, then how much mechanical energy was added to the three-fragment system by the explosion? One unit on the graph is 1.0 kg·m/s.

4. A 500-g ball traveling to the right at 8.0 m/s collides with and bounces off another ball, which was at rest. The figure shows the momentum vector $\vec{p}_1$ of the first ball after the collision. (a) Draw $\vec{p}_2$, the momentum of the second ball. One unit = 1.0 kg·m/s. Explain your drawing.



(b) If the collision is elastic (*i.e.* no mechanical energy lost), find the mass of the second ball.

5. A 500-g puck traveling to the right at 4.0 m/s collides with a second puck, initially at rest. The collision detonates one of a series of percussion caps taped around the moving puck. The figure shows the momentum vector $\vec{p}_1$ of the first puck after the little explosion. (a) Draw $\vec{p}_2$, the momentum of the second puck. One unit = 1.0 kg·m/s. Explain.



(b) If the mass of the second puck is 2.0 kg, how much mechanical energy did the little explosion add to the two-puck system?