Date \_\_\_\_\_ Pd\_\_\_\_

## Unit 3 Review:

1. Consider a collision between a small car and a heavy truck. In such a collision, how does the size of the force exerted on the car by the truck compare with the size of the force exerted on the truck by the car? Explain your reasoning.

- 2. a. Draw a velocity-time graph for a ball thrown vertically into the air during its up-and-down motion.
  - b. Draw a force diagram for the thrown ball when it reaches its highest point.



- c. At the highest point, is the velocity zero? Explain.
- d. At the highest point, is the acceleration zero? Explain.

e. At the highest point, is the net force zero (i.e. are the forces balanced)? Explain how you know.

3. The figure below is a snapshot looking down on a bowling ball moving at constant velocity from left to right on a smooth, level floor. At the position shown, the ball is given a short, sharp hit in a direction perpendicular to the ball's initial motion.



a. On the diagram, draw a path that the ball might follow after the hit. Explain your reasoning for the path you drew.

b. Immediately after the hit, will the speed of the ball be equal to, greater than, or smaller than the ball's velocity before the hit? Explain your reasoning.

c. How will the velocity of the ball behave as time goes by after the blow? That is, will either the magnitude or the direction of the velocity change? If so, how?

- 4. You push a grocery cart along a level floor in the presence of friction effects between the cart and the floor.
  - a. Draw force diagrams for **you**, the **cart**, and the **floor/earth**. Fully label all vectors.



you

floor/Earth

cart

b. While you are making the cart **speed up**, how does the size of the force you apply on the cart compare to the size of the force the cart exerts on you? Explain.

c. While you are making the cart **speed up**, how does the size of the frictional force on the *cart* by the floor compare to the frictional force on *you* by the floor?

- d. Identify all of the Newton's Third Law pairs in your force diagrams.
- 5. A 35 kg child pulls a 12 kg wagon up a hill at 0.6 m/s. The wagon exerts 60 N of force on the child. a. Draw a **quantitative** force diagram for the **wagon**.



b. Explain how you applied Newton's **first** law to make the force diagram quantitative.

- c. Explain how you applied Newton's **third** law to make the force diagram quantitative.
- 6. "The winning team in a tug of war contest is the team that puts more force on the rope." Is this a true statement? Explain your reasoning. If the statement is false, then explain how one team can win the contest.