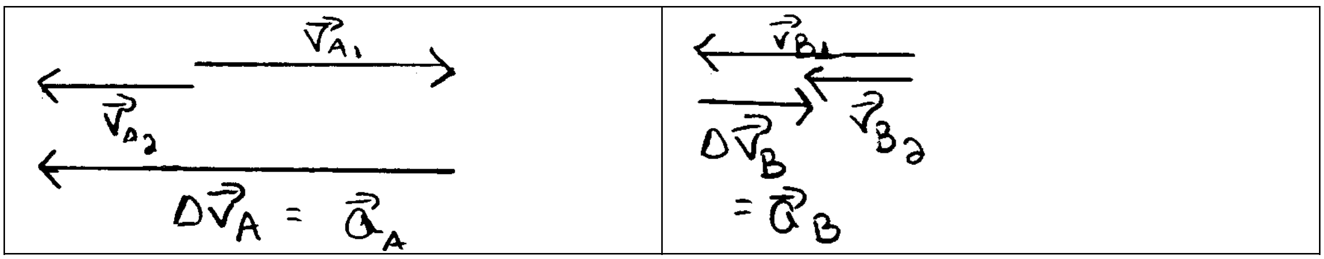
Test 1 solution: Problem 3 (Essay 11 points)
You may use diagrams and equations but no calculations in your response for this problem.
USE WHAT YOU'VE LEARNED FROM CLASS SO FAR TO GIVE A CONVINCING EXPLANATION OF YOUR ANSWER.

Two carts roll toward each other on a level table. The vectors represent the velocities of the carts just before and just after they collide.

A. Draw and label a vector for <u>each cart</u> to represent the *change in velocity* from before to after the collision. Make your vectors consistent with the vectors drawn above.



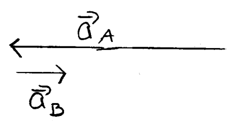
B. How do the magnitude and direction of Cart A's average acceleration compare with Cart B's average acceleration over the time interval shown? Explain your reasoning well enough to convince a classmate who disagrees with you.

The average acceleration can be defined as change velocity over change in time, because we do not know a set value for change in time we can represent acceleration as a relative comparison of changes in velocity. The change of velocity in cart A is towards the left while the change of velocity of cart B is to the right. The magnitude of the ΔV vector of A is about 3 times the size of the ΔV vector of B. So acceleration is approximately 3x to the left for cart A and 1x to the right for cart B.

Instructor's note: Essay questions are graded by listing all the key points that need to be included for a complete solution. Full credit is given if the essay is coherent and includes 80% of the key points.

The key point in the 2nd part of the essay is that average acceleration is proportional to delta v and points in the same direction. Thus looking directly at the Δv vectors lets us compare the direction and relative magnitude of the average acceleration vectors for carts A and B. A complete solution would also include a comment on why the average acceleration vectors look the way they do. Here follows two examples:

Cart A's average acceleration is about 4 times larger than cart B's average acceleration. Cart A's average acceleration vector points in the opposite direction of Cart B's average acceleration vector.



This makes sense because cart A must have an acceleration acting on it that causes it not only to stop but to turn around and begin moving in the opposite direction. Cart B only needs an acceleration vector to slow it down some.

Average acceleration is ΔV, the change in velocity, by definition. Cart A's acceleration vector looks that way because we went from a very positive to a negative velocity. the change in velocity should be large because we change the velocity a lot. The direction of Cart A's ΔV and Cart B's ΔV are opposite because in the before, the carts traveled in opposite directions and in the after, the directions are the same. So one of the cards changed direction. So their change in Velocities direction is shown by opposing ΔV Vectors.