

PHY115: Homework 1

Spring 2021

Deadline: January 27th

Discussion Questions (40 p)

1. Can you have a zero displacement and a nonzero average velocity? A nonzero velocity? Illustrate your answers on an $x - t$ graph.
2. Can you have zero velocity and nonzero average acceleration? Zero velocity and nonzero acceleration? Explain using a $v - t$ graph, and give an example of such motion.
3. An automobile is traveling west. Can it have a velocity toward the west and at the same time have an acceleration toward the east? Under what circumstances?

Exercises (60 p)

1. The fastest measured pitched baseball left the pitcher's hand at a speed of 45 m/s . If the pitcher was in contact with the ball over a distance of 1.5 m and produced constant acceleration, (a) what acceleration did he give the ball, and (b) how much time did it take him to pitch it?
2. The human body can survive an acceleration trauma incident (sudden stop) if the magnitude of the acceleration is less than 250 m/s^2 . If you are in an automobile accident with an initial speed of 105 km/h and you are stopped by an airbag that inflates from the dashboard, over what distance must the airbag stop you for you to survive the crash?
3. Two cars, A and B, move along the x-axis. Figure 1 is a graph of the positions of A and B versus time. (a) In motion diagrams, show the position, velocity, and acceleration of each of the two cars at $t = 0$, $t = 1 \text{ s}$ and $t = 3 \text{ s}$ (b) At what time(s), if any, do A and B have the same position? (c) Graph velocity versus time for both A and B. (d) At what time(s), if any, do A and B have the same velocity? (e) At what time(s), if any, does car A pass car B? (f) At what time(s), if any, does car B pass car A?

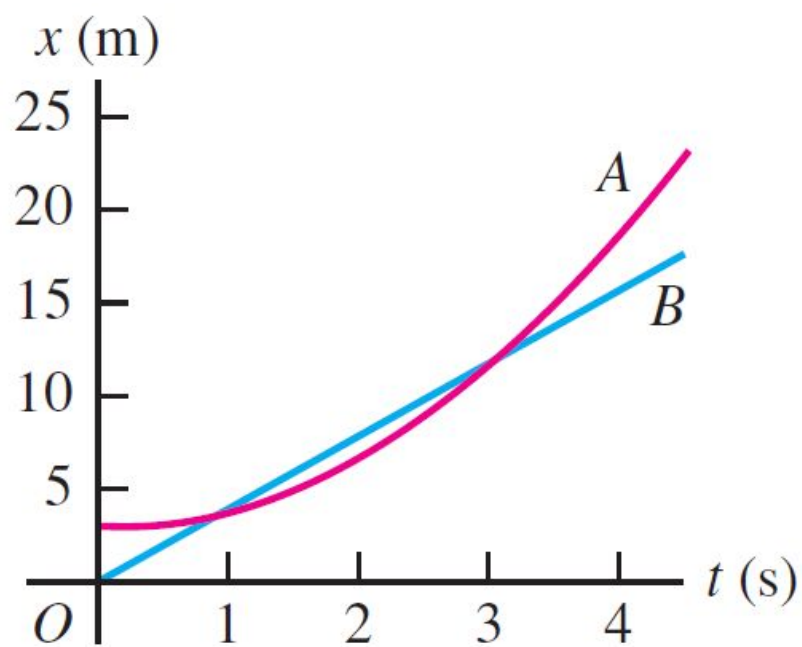


Figure 1: Position vs. time of two cars. © University Physics with Modern Physics, 13th Edition.