1D Motion Problems

1. Hendrik runs by Laura and takes her pencil. He is initially running a constant 4.0 m/s. It takes Laura 1.0 second to realize what has happened and begin to chase Hendrik. Hendrik quickly (immediately for this problem) speeds up to 6.0 m/s while Laura is running 8.0 m/s along the same line.

a. Draw a single graph that includes graphs of position vs time for both of them.
b. Use the graph to determine when she catches him.
c. Use the graph to determine how far she traveled.

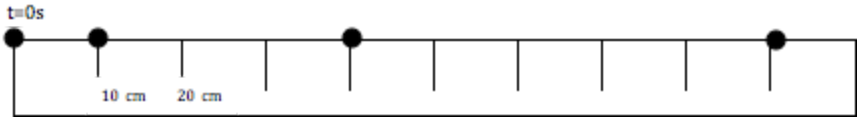
2. Tiyana is riding her bike 12.0 m/s east along a long, straight road. Leif begins riding 10.0 m/s west along the same road, but begins 1.00 mile east of Tiyana's position.

a. Draw a single graph that includes graphs of position vs time for both of them.
b. Use the graph to determine the time before they meet.
c. Use the graph to determine the distance each travels.

3. Town A is 60.0 miles from town B. A driver is going to drive the road in two segments. For the first segment, the driver is going to travel at 45.0 miles/hour. **The goal is to average 60 miles/hour.**

a. Calculate the speed the driver must travel in the second segment if the first segment is 45.0 minutes.
b. Calculate the speed the driver must travel in the second segment if the first segment is 45.0 miles.
c. Draw position vs time graphs to represent each of the motions described.

4. The diagram below shows the positions of a ball at 0.2 second intervals as it rolls from rest along a meter stick. Assume the ball had a constant acceleration.



a. Determine the average velocity of the ball for the motion.
b. Calculate the acceleration of the ball.
c. Calculate the final velocity of the ball.
d. Determine the position of the ball at 0.3 seconds.

5. A car is traveling along a long, straight road. Starting at a stop sign, the car speeds up with a constant acceleration of 4.0 m/s/s for 6.0 seconds. It then maintains that speed for 450 m. Finally, it comes to a stop over 8.0 seconds.

a. Draw a motion diagram for the given three part motion.
b. Setting the stop sign as zero position, determine the car's position at the end of the first 6 seconds.
c. Calculate the amount of time the car maintained a constant velocity.
d. Determine the car's final position at the end of the motion.

6. You are driving 25.0 m behind an unmarked police car. Both of you are traveling 110. km/h. Your phone alerts you that there is a text, so you look down for 2.00 seconds to see who sent it. Unfortunately, the police officer begins slowing down the instant you look down. The police car's acceleration is 5.00 m/s^2.
a. Calculate the distance to the police car when you look up.
b. It now takes you 0.400 seconds to realize that you have to brake. Describe what happens if your acceleration is also 5.00 m/s^2. (Is the outcome positive or negative?)

7. You are driving toward a traffic signal when the light turns yellow. Your speed is the legal 55.0 km/h and your best acceleration while slowing is 5.00 m/s^2. Your minimum reaction time is 0.750 seconds before you begin braking. Explain whether you should you stop or should you go in the following situations:
a. You are 40.0 meters from the intersection and the yellow light is 2.20 seconds long.
b. You are 32.0 meters from the intersection and the yellow light is 2.20 seconds long.
c. You are 32.0 meters from the intersection and the yellow light is 2.00 seconds long.

8. A ball is dropped from 2 meters above the ground. How fast is it traveling immediately before it hits the ground?

9. Hamzah throws a ball directly up in the air with an initial speed of 25 m/s.
a. Calculate the maximum height above release the ball reached.
b. Determine the time the ball is in the air.

10. Amelia has a vertical leap of 1.0 meters. Calculate the speed she needed to have as she left the ground.

11. Ari is standing by a window when he sees a ball travel straight up past the window. 2.5 seconds later, the ball came back down past the window.
a. Calculate the speed the ball was traveling when it first reached his window.
b. Calculate how high the ball went above his window.

12. Kristin is riding the Power Tower at Cedar Point. She is traveling upward at 15 m/s, 20 m above the ground when her shoe comes off.
a. Determine how long will it take for her shoe to reach the ground.
b. Calculate the fast her shoe will be traveling when it reaches the ground.
c. Determine how far will the shoe have traveled from the time it leaves her foot until it reaches the ground.