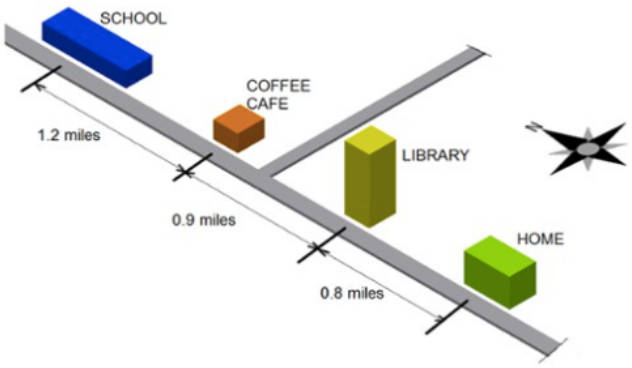
Motion Modeling Assignment

INTRODUCTION

Motion is a change in position over time. We describe motion using terms such as distance, displacement, speed, and velocity. Kinematics is the science of describing the motion of objects using words, diagrams, numbers, graphs, and equations.

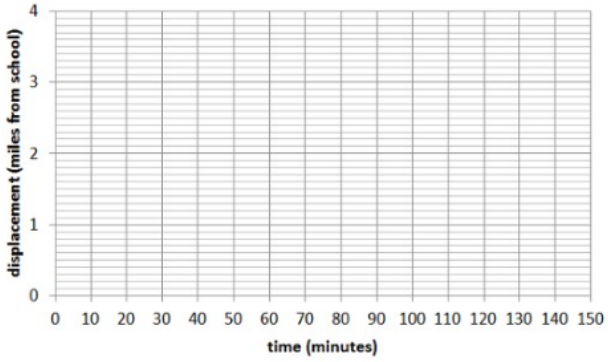
In this activity you will interpret words and diagrams that describe motion, to graphically model the motion using a motion graph. You will also represent the motion using numbers (and direction, when applicable) to indicate the magnitude of distance, displacement, speed, and velocity. Inversely, you will also interpret a graphical model of motion and describe the motion represented in words.

After school, a student jogged from school to the library. It took the student 35 minutes to get to the library, where he spent 10 minutes browsing and checking out a book. He then walked to the coffee shop, on the same street, in 15 minutes. He spent 40 minutes sitting at a table in the coffee shop and reading the book before heading home. He walked home in 25 minutes and remained there until the next morning.



1. Use the distances shown in the diagram above to draw a motion graph of the student along the street, in which he begins walking from school to the library at t = 0 minutes. Show 2.5 hours of time after he left school. Be sure to include axis labels, scales, and units.

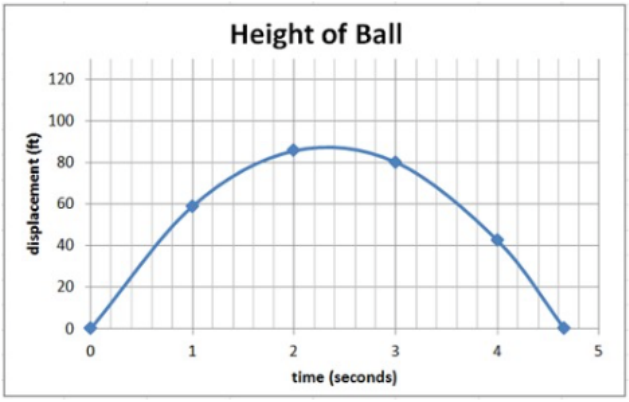
   Assume that a positive displacement is from school toward home.



Using your motion graph, answer each of the following IN YOUR ENGINEERING NOTEBOOK:

a. What is the student's displacement after 1.5 hours? Plot a point on your graph to correspond to this position and label it "Point A".
b. What is the total distance the student had walked after an hour and a half?
c. What was the student's displacement at 1 hour and 50 minutes? Plot a point on your graph to correspond to this position and label it "Point C".
d. What is the total distance the student had walked when he arrived home?
e. At what speed (in miles per hour) was the student walking 20 minutes after he left school?
f. If home is due South of school, what is the velocity of the student at t = 50 minutes? Give the magnitude of velocity in miles per hour.
   What is the student's speed at t = 1 hour?

2. The following graph represents the vertical motion of a ball thrown straight up into the air.



Using the motion graph, answer the following IN YOUR ENGINEERING NOTEBOOK. Show your work or explain your answer.

a. What is the displacement of the ball at t = 4 seconds?
b. What is the total distance the ball has traveled at t = 3 seconds?
c. What is the average speed of the ball between t = 0 and t = 2 seconds?
d. What is the average velocity of the ball between t = 3 and t = 4 seconds?
e. How long did it take before the ball returned to its original height?

3. Create a motion graph on graph paper in your engineering notebook, but do not define the units or scales for the graph. If possible, exchange your graph with a classmate who is also in the Design class.

   Write a short story or a description of a scenario that might be represented by your partner's graph. Label the axes, show scales and units for the graph.