

# Activity 6: Linear Motion

One of the most fundamental applications of linear graphs in physics is to the situation where an object moves with a constant speed.

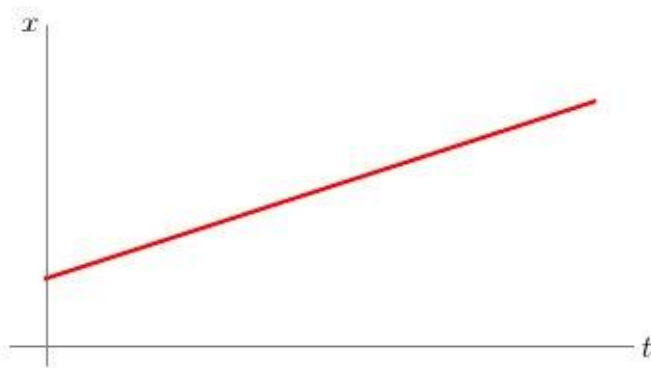
1. Choose a member of your group to walk at steady pace in a straight line. (Have that group member start from an agreed upon spot like a wall or table.) After walking for a brief period of time, the group member should start dropping the provided “trail markers” straight down (don’t throw) and begin counting “one-one thousand, two-two thousand...” Each second, they should drop successive markers straight down as they walk.
  - (a) Using the provided meter sticks, measure the distance from the starting point to the trail markers. Record that information in the table provided. (The distance to the first trail marker should be put in the zero time spot.)
  - (b) Using the grid provided, make a plot of the data putting the distance on the y-axis and the time on the x-axis. Draw the line that best fits the data. (Since this is real data it may not fit perfectly.) In physics, we call this a position-versus-time graph.
  - (c) Find the slope and y-intercept for your position-versus-time graph (Make sure to include the proper units and don’t forget about significant figures).
  - (d) Explain, in your own words, what are the physical meanings of the slope and the y-intercepts.



2. Shown below is the position-versus-time graph for a student walking with constant pace.

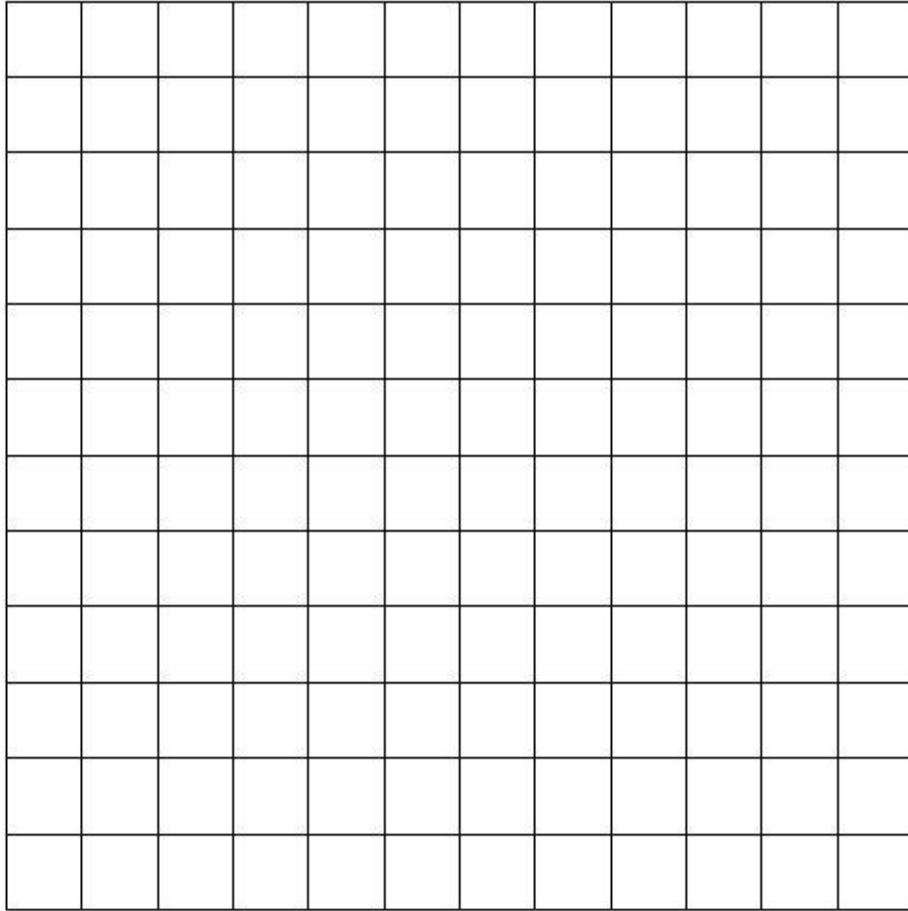
(a) On the same axes, add the position-versus-time graph for another student who starts at the same location at  $t=0$  but is walking faster than the first student.

(b) Using a different color pen, add another position-versus-time graph for a student who starts at the same location at  $t=0$  but is walking slower than the first student. Label your graphs as “faster” and “slower”.



3. Choose a different member of your group to walk at steady pace in a straight line. This time the group member should walk towards an agreed upon spot (again a wall or table) while dropping trail markers.
- (a) Using the provided meter sticks, measure the distance from the *agreed upon spot* to the trail markers. Record that information in the table provided.
  - (b) Make a position-versus-time graph for the data.
  - (c) Find the slope and y-intercept for your position-versus-time graph (along with their proper units).
  - (d) Explain, in your own words, how and why the slope of this graph is different from the slope of your first graph.

Time (seconds)	Distance to Trail Marker (centimeters)
0	
1	
2	
3	
4	
5	



4. Sketch position-versus-time graphs for the following motions. Include a numerical scale on both axes with units that are reasonable for the motion. Some numerical information is given in the problem, but for other quantities, make reasonable estimates. Assume all speeds are constant.

(a) A student takes  $10 \text{ min}$  to walk to the bus stop. She waits  $5 \text{ min}$  for the bus. She gets on the bus and arrives at campus after another  $10 \text{ min}$ . Assume that all motion is along a straight street.



(b) A man leaves his house and slowly walks his dog down the street. The dog spies a cat, yanks the leash out of his owner's hands, and runs after the cat back towards the man's house. Assume the dog runs past the man's house. (Plot the dog's position.)



(c) Two lovers run towards each other and hug. Please name each member of your happy couple and label their graphs.

