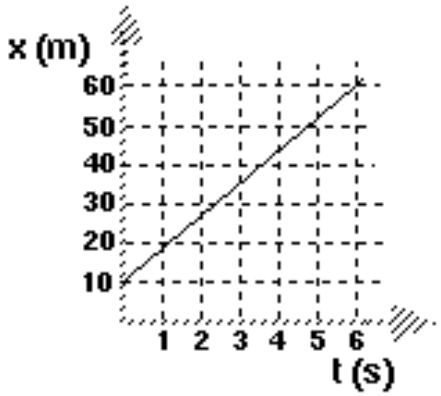
Graphing Tutorial: Converting x-t to v-t Graphs (Constant Velocity Model)

We have gained considerable experience making and interpreting graphs. We developed Ohm's Law by making circuits with increasing amounts of voltage and measuring the current. More recently we have made graphs of position vs. time ("x-t graphs") for tractors and interpreted graphs for other real-life situations.

Translating between representations is the key to your success. We discussed how the x-t graph is built out of a motion map (ticker tape diagram) and we are skilled at determining the slope of the line to create a mathematical representation (i.e., an equation) to represent motion.

There is another representation which flows out of the x-t graph. We might also be interested in graphing the relationship between ***velocity*** and ***time.*** This is the goal of this fifth graphing tutorial.

Consider the following graph, which describes the motion of Mr. Sullivan as he rides his rocket scooter along the bike path.



The graph shows that at time t=0sec Mr. Sullivan was 10 m away from the origin, and moved away from the origin at a constant rate for six seconds. At t=6 sec his location was 60 m away from the origin. The total distance he traveled was 50 m.

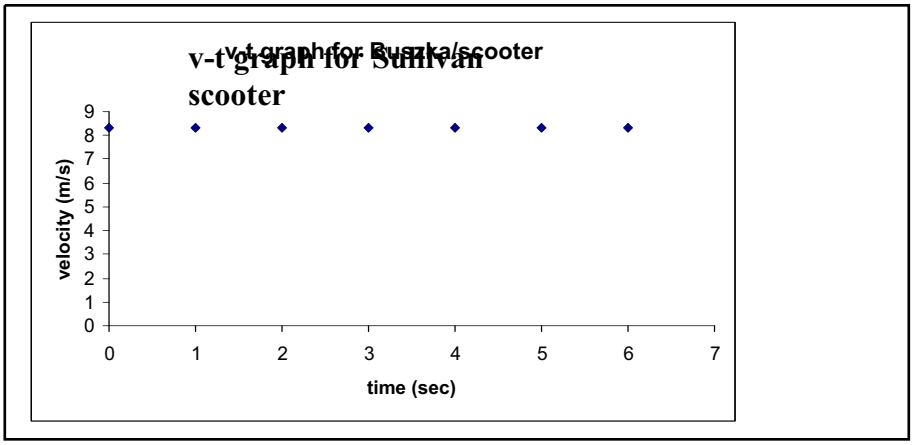
The velocity is given by the slope of the line:

Velocity = slope = rise/run = (60 m-10 m)/(6 sec – 0 sec) = ~8.33 m/s.

Since the velocity is constant for the entire time interval, we can create the following table that contains information about the velocity at each second:

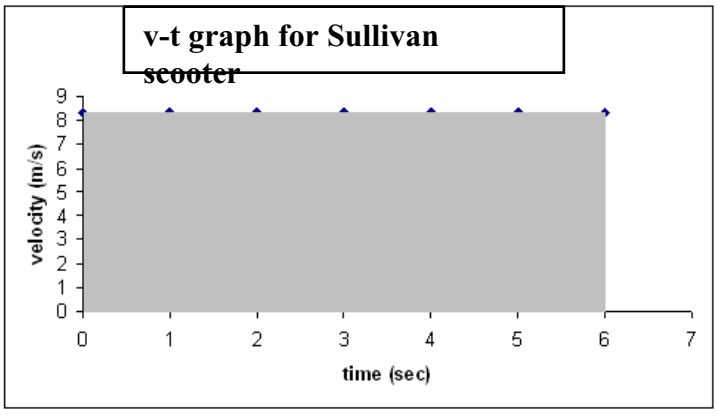
Time (sec)	Velocity (m/s)
0	8.33
1	8.33
2	8.33
3	8.33
4	8.33
5	8.33
6	8.33

We can then go ahead and graph this data:



This graph describes an object moving at a constant speed of 8.33 m/s in the positive direction. In other words, the *velocity* is +8.33 m/s.

Consider also the area underneath the best-fit line. The area is shown below in gray.



Challenging moment. Determine the area of this rectangle. You need the units: it does not have a height of 8.33, but a height of ***8.33 m/s***. *Is there any interesting relationship between the area of this rectangle and the distance Buszka traveled?*