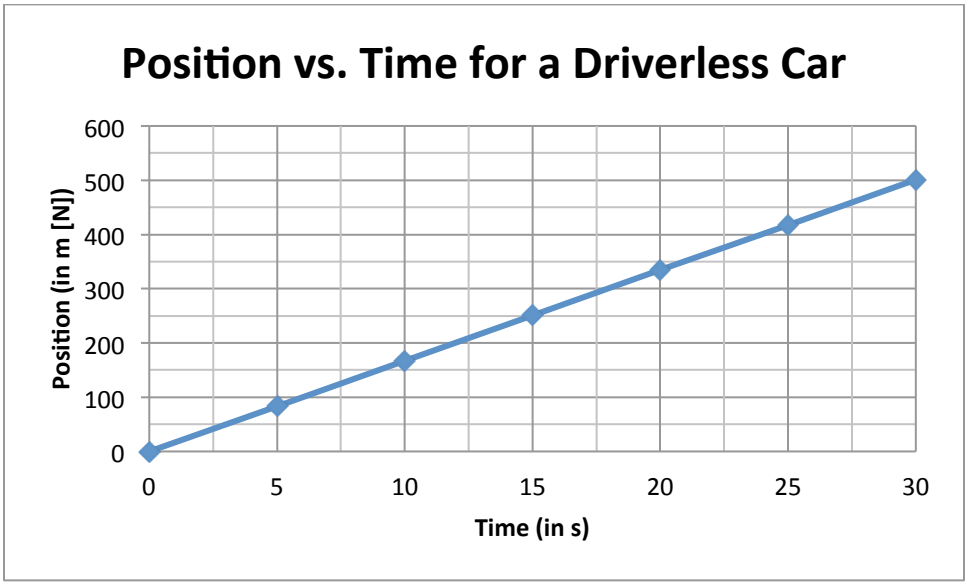
Graphing Motion in One Dimension (Teacher)

The displacement of a driverless car moving in a straight line at a constant speed may produce the following data:

Table 1: Position of a driverless car

Time (in s)	Position (in m [N])
0.0	0.0
5.0	83.5
10.	167.0
15	250.5
20.	334.0
25	417.5
30.	501.0

Plot *Position vs. Time* on the following grid. Review the handout, *Rules for Making Graphs.*

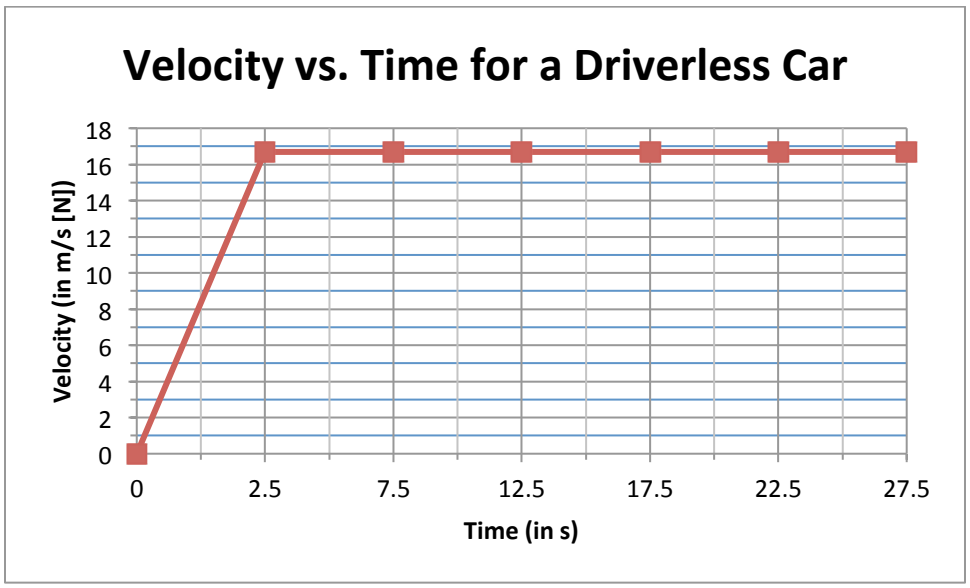


Next, create a table for the velocity of the driverless car. Recall that $\overrightarrow{v_{av}} = \frac{\Delta d}{\Delta t}$ where $\overrightarrow{v_{av}}$ is the ***average velocity***, where $\overrightarrow{\Delta d}$ is the ***displacement*** over the time interval, and Δt is the elapsed ***time***. In this case, the average velocity for each 5 s interval should be plotted at the midpoint of the time interval (i.e. every 2.5 s).

Table 2: Average velocity of a driverless car

Time (in s)	Velocity (in m/s [N])
0.0	0
2.5	16.7
7.5	16.7
12.5	16.7
17.5	16.7
22.5	16.7
27.5	16.7

Plot *Velocity vs. Time* on the following grid.



Discussion

1. Describe the position-time graph.
   The position-time graph is a straight line with a constant slope.

2. What can you determine about the movement of the car from this graph?
   The car is moving with a constant rate of change.

3. Calculate the slope of the position-time graph. Show your work.

4. How does this slope compare to the velocity you calculated for the car? Should these results be the same? Why or why not?
   The slope is the same as the velocity calculated for the car. These results should be the same because the car is moving at a constant velocity.

5. Would there be a difference if you plotted the Distance-Time graph for this data? Why or why not?
   If the Distance-Time graph were plot, there would be no difference since the car is moving in the same direction throughout. If the car were changing direction but going at a constant speed, there would be a difference in the Position-Time and Distance-Time graphs.

6. Calculate the area under the Velocity-Time curve. Show your work.

7. How does this area compare to the displacement of the car for the same time period?
   The area under the curve should be equal to the displacement of the car for the same time period (501.0 m).