National Advanced Driving Simulator

STEAM Institute – Velocity Activity
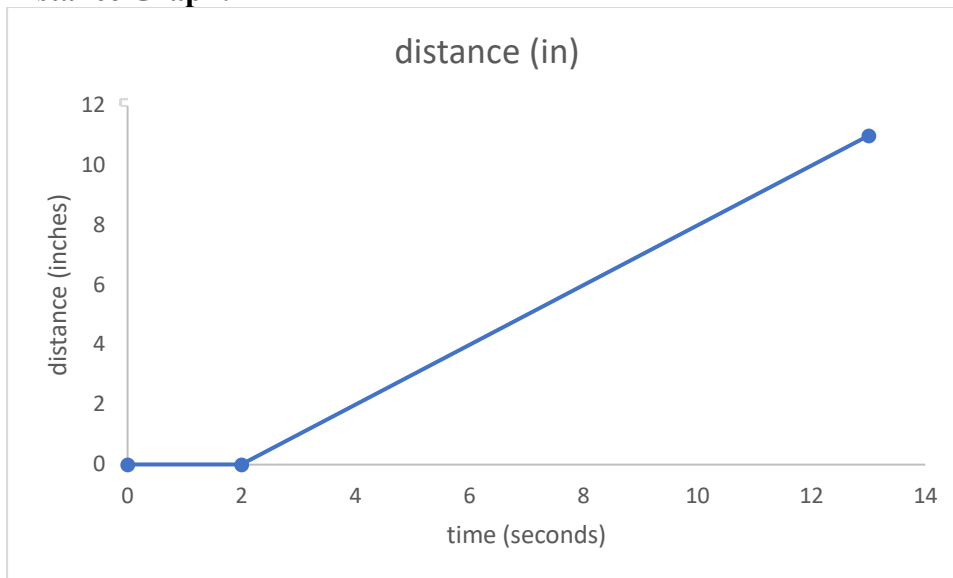
Supply List:
1. Paper
2. Pen or pencil

Summary:

From graphs of distance versus time, we will create velocity versus time. At home, you will recreate an object's motion based on the distance and velocity graphs. We will learn a safety measure called Time to Collision (TTC)

Distance Graph:

Velocity Calculations:

1. Calculate velocity

   a. Determine velocity from 0 to 2 seconds

      i. What is the change in distance between 0 and 2 seconds

      ii. What is the change in time between 0 and 2 seconds?

      iii. Calculate velocity as the change in distance divided by the change in time

   b. Repeat step (a) between each pair of points on the distance versus time graph to calculate velocity

2. Fill in the table

3. Draw the velocity graph

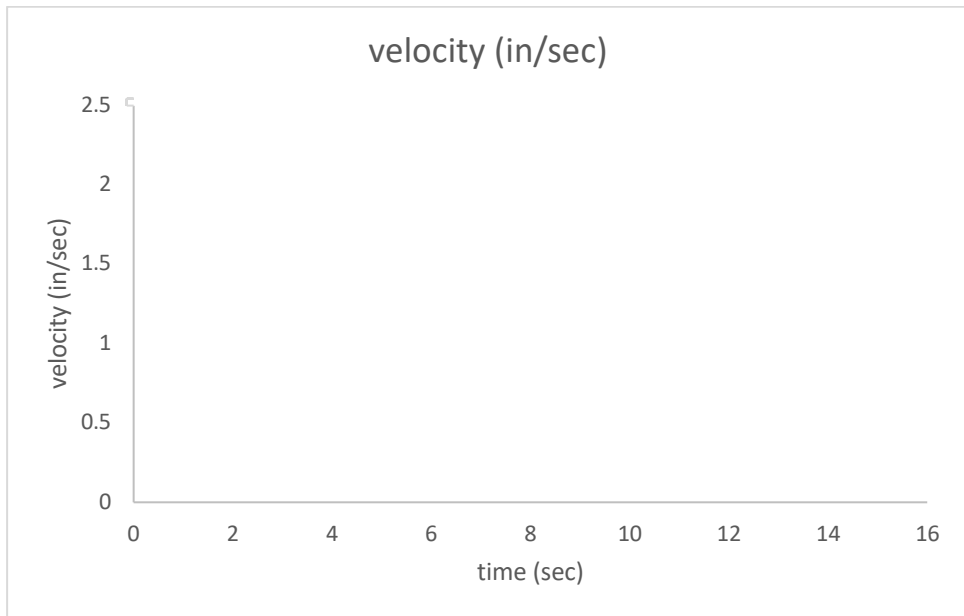| Change in Distance (in)	Change in Time (seconds)	Velocity (in/s)
0	2	0

distance (in)

velocity (in/sec)

velocity (in/sec)
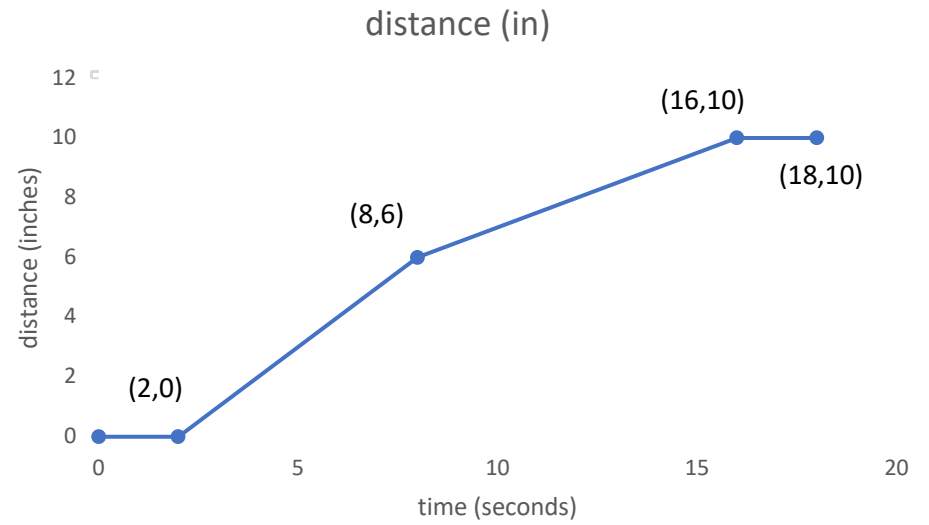
distance (in)
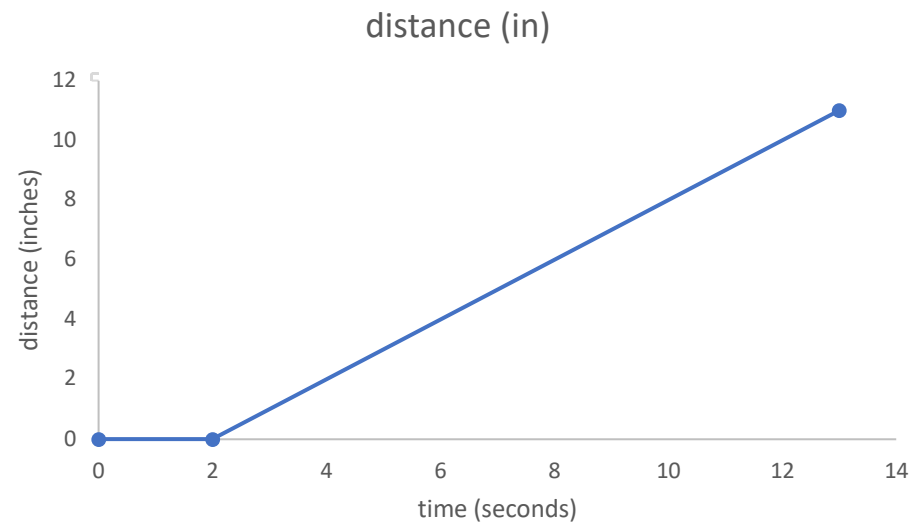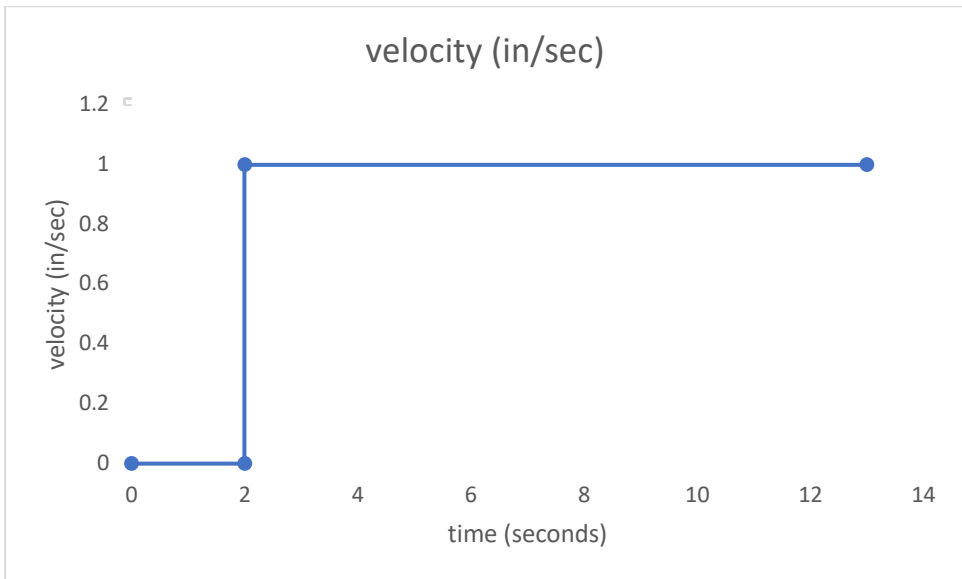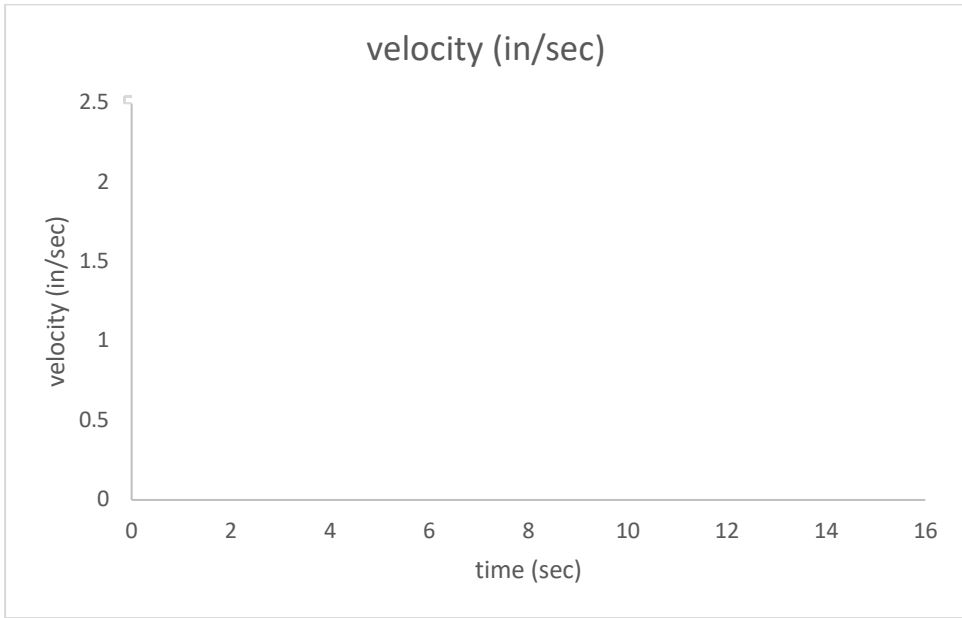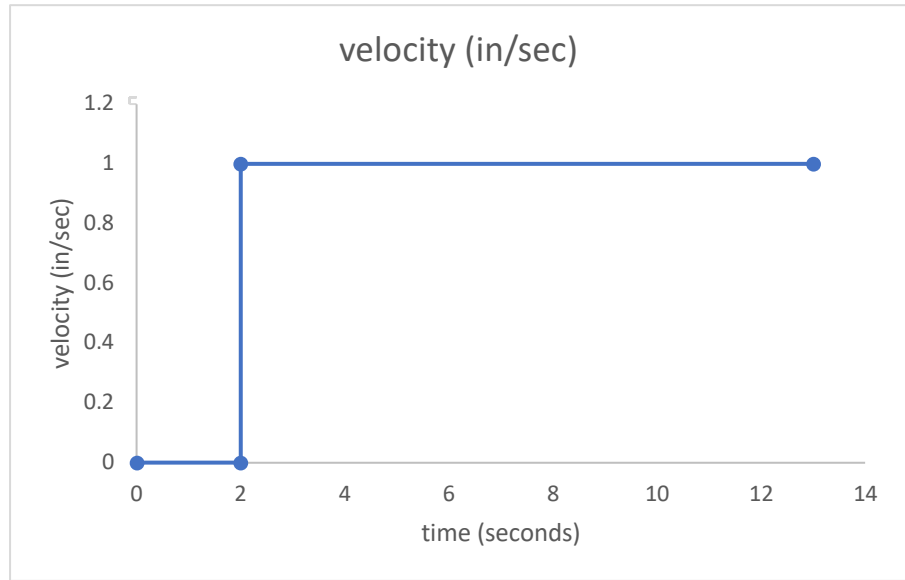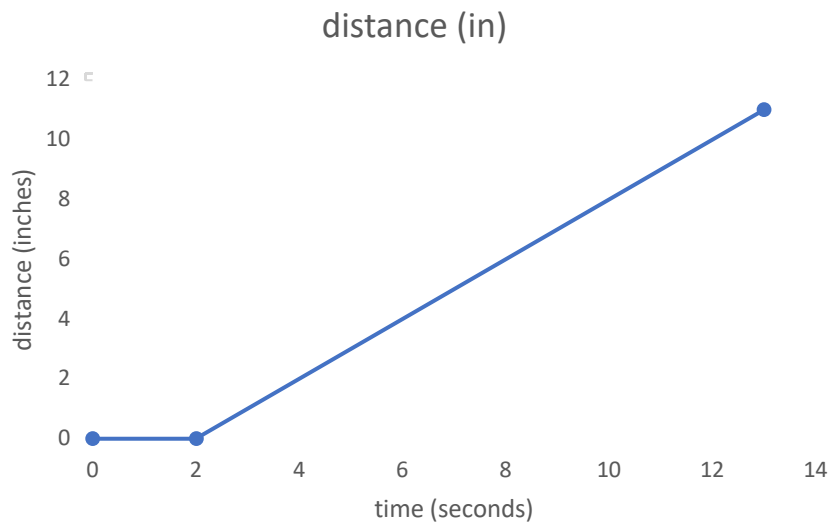
velocity (in/sec)
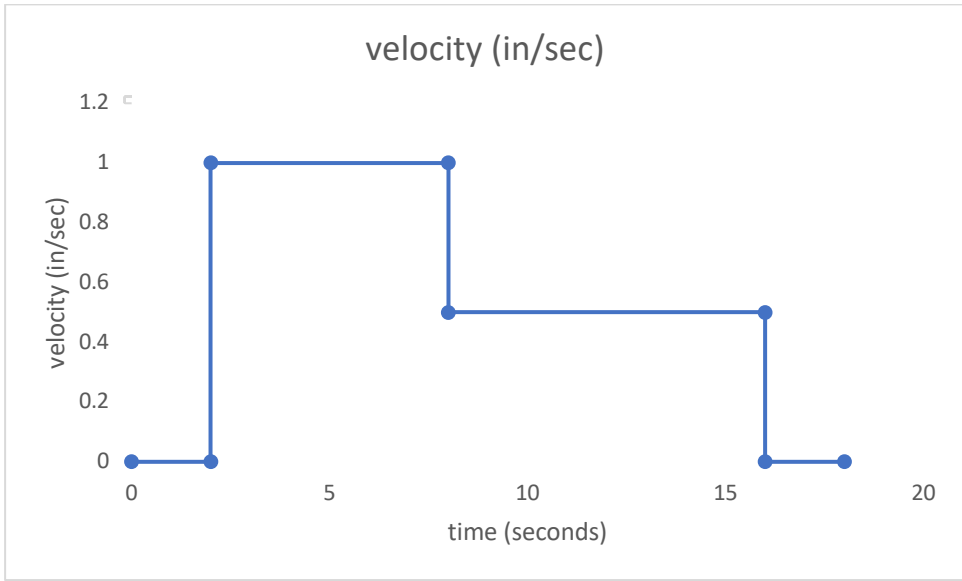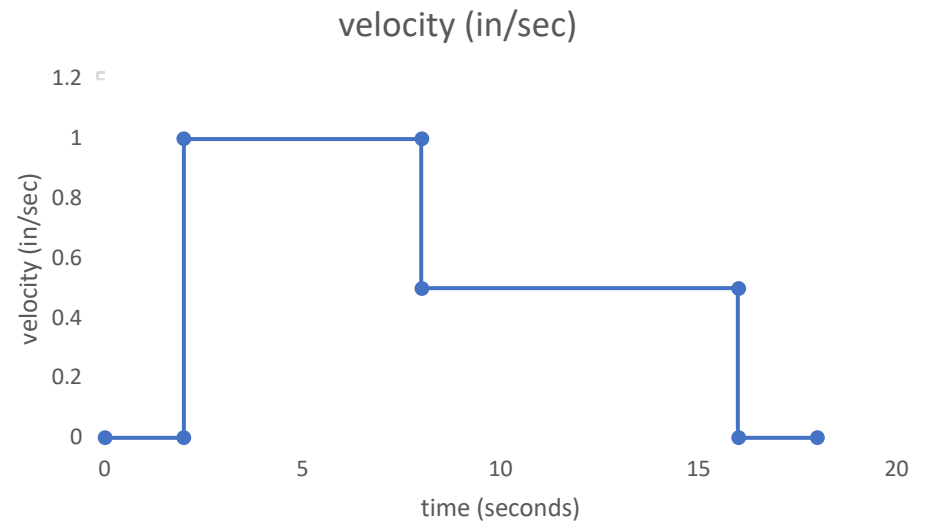

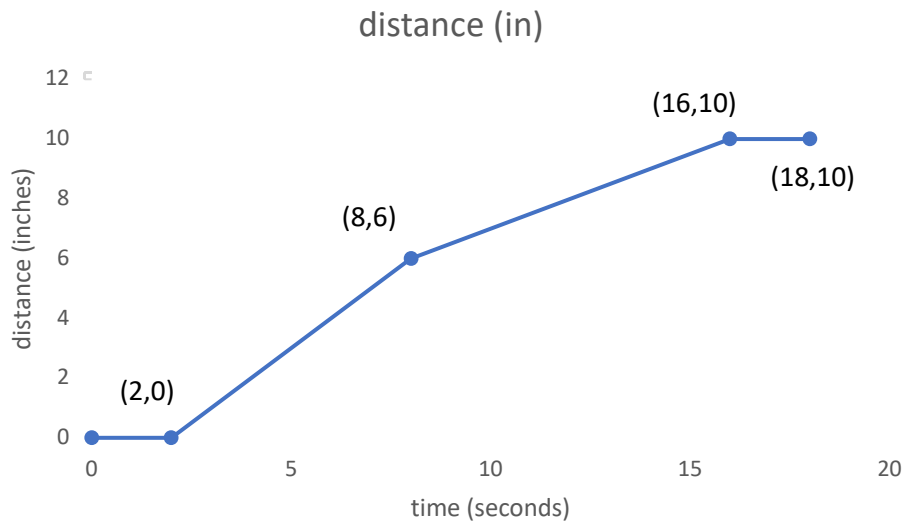1 in   2 in   3 in   4 in   5 in   6 in   7 in   8 in   9 in   10 in   11 in

Change in Distance (in)	Change in Time (seconds)	Velocity (in/s)
0	2	0

distance (in)

distance (inches)

time (seconds)

(2,0)

(8,6)

(16,10)

(18,10)

velocity (in/sec)

velocity (in/sec)

time (sec)

velocity (in/sec)

distance (in)

distance (inches)

(16,10)

(18,10)

(8,6)

(2,0)

time (seconds)

velocity (in/sec)

velocity (in/sec)

time (seconds)
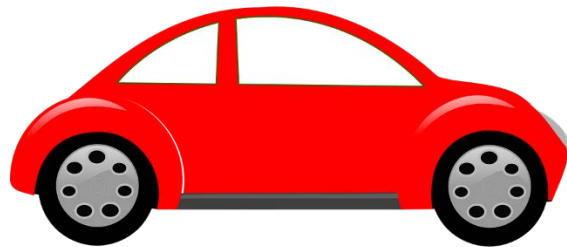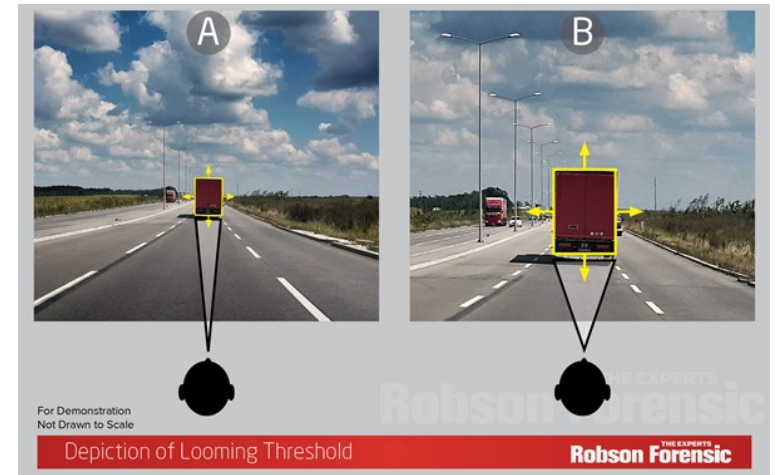
1 in   2 in   3 in   4 in   5 in   6 in   7 in   8 in   9 in   10 in   11 in

Questions:

1. Was it easier to move your finger using distance as a reference or velocity?

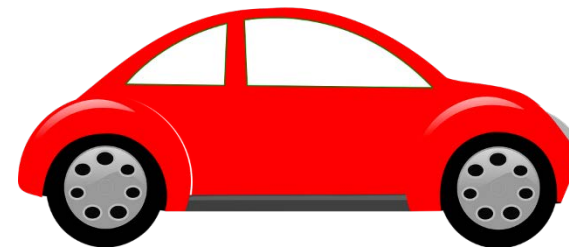2. Why do you think it was easier to use one than the other?

Time to Collision:

1) We use a measure called Time to Collision (TTC) in automotive safety applications.

   a) TTC is measured in time. It tells you how much time you have before a collision

   b) TTC is a good measure of a *looming cue*

2) Imagine the rear bumper of a car is some distance ahead of your front bumper.

   a) We use range between vehicles as the distance

   b) We use the *difference* in velocity, (lead car velocity – follow car velocity)

   c) $TTC = \dfrac{-\ range}{(lead\ vel\ -\ follow\ vel)}$

3) *Compute TTC using information in the image below*

For Demonstration
Not Drawn to Scale

Depiction of Looming Threshold

Robson Forensic

800 in

100 in/sec

20 in/sec