Lab Section:
TA Name: Student Name:
Links to the (youtube) instructional videos are at the bottom of the web page:

Part 7-1: (After watching video 7-1)

1. Regarding the program “7-1-stop” from the video:
    a. what is plotted on the horizontal axis, and what is the interval between horizontal tic marks?

    b. two different measures are plotted on the vertical scale. What are they and what is the interval (for each) between vertical tic marks?

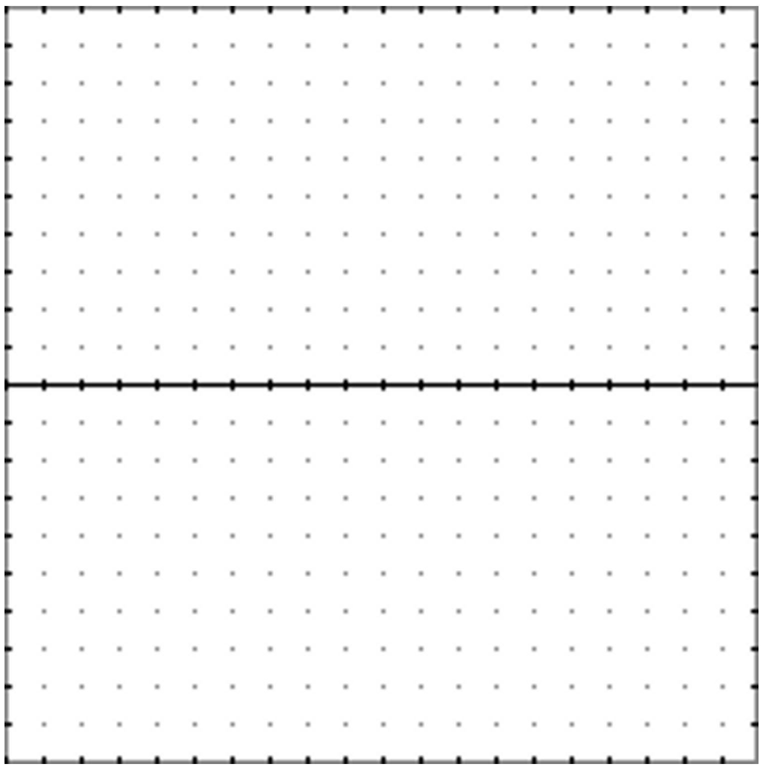
    c. What do the green and red colors signify?

2. Explain with your own words what the program does?

3. Below, add comments to provide physical interpretations of each statement with a # at the left. (See the example lines)

```
clear()

m1, m2 = 0.2, 0.2             # masses equal

pos1, pos2 = 0.01, 0.31       # cart 2 30cm to the right of cart 1

v1, v2 = 1, 0                 # car1 moving right, car2 stationary

t, dt = 0, 0.001              #

pe = 0                        #

while t < 1:

  dot(t*200, 50), dot(t*200, -70)

  dot(t*200, pos1*50+50, red); dot(t*200, pos2*50+50, green)

  dot(t*200, v1*20-70, red); dot(t*200, v2*20-70, green)

  t = t + dt              #


  pos1, pos2 = pos1 + v1*dt, pos2 + v2*dt  #


  if pos1 > pos2:

    break;
```

4. Predict what the graph will look like.



5. Run the program to validate your answers above. Please indicate any confusions or misconceptions that this resolved (or questions it raised for you). There is no loss of credit for confusions honestly described.
   An incentive: Many students learn much when they identify, examine, and resolve these confusions. (this course is less about finding the correct answer than knowing how to think about the problems, and those who figure out how to think about them tend to get the right answers)

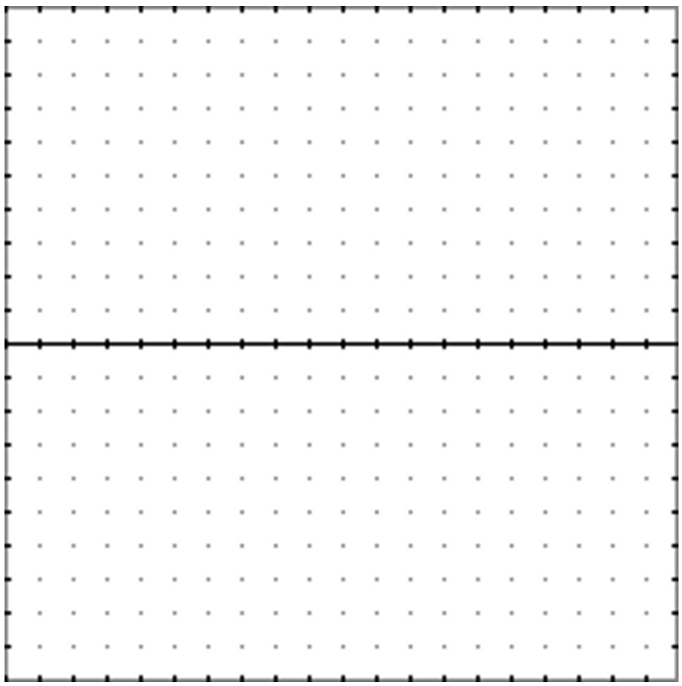
6. Which of the following qualitatively describes the motion of the two carts colliding (you might want to review time 0:15 to 0:26 of the video):
    a. Before the collision, cart 1 is moving, and cart 2 is stationary. Afterwards, cart 1 is stationary, and cart 2 is moving **at approximately the same** velocity as cart 1 was moving prior to the collision.
    b. Before the collision, cart 1 is moving, and cart 2 is stationary. Afterwards, cart 1 is stationary, and cart 2 is moving **much slower** than cart 1 was moving prior to the collision.
    c. Before the collision, cart 1 is moving, and cart 2 is stationary. Afterwards, cart 1 is stationary, and cart 2 is moving **much faster** than cart 1 was moving prior to the collision.
    d. Before the collision, cart 1 is moving, and cart 2 is stationary. During the collision, the carts bounce off each other and are travelling at approximately the same speed away from each other.

Part 7-2: (After watching video 7-2)

1. Below, add comments to provide physical interpretations of each statement added in this video (denoted by a ##).

```
clear()
m1, m2 = 0.2, 0.2             # masses equal
pos1, pos2 = 0.01, 0.31       # cart 2 30cm to the right of cart 1
v1, v2 = 1, 0                 # car1 moving right, car2 stationary
t, dt = 0, 0.001
k = 0.001
while t < 1:
  dot(t*200, 50), dot(t*200, -70)
  dot(t*200, pos1*50+50, red); dot(t*200, pos2*50+50, green)
  dot(t*200, v1*20-70, red); dot(t*200, v2*20-70, green)
  t = t + dt
  pos1, pos2 = pos1 + v1*dt, pos2 + v2*dt
  dist = pos2-pos1        ##

  force = k / (dist*dist) ##

  a1, a2 = -force/m1, force/m2  # f = m * a
  v1, v2 = v1 + a1*dt, v2 + a2*dt  ##
```

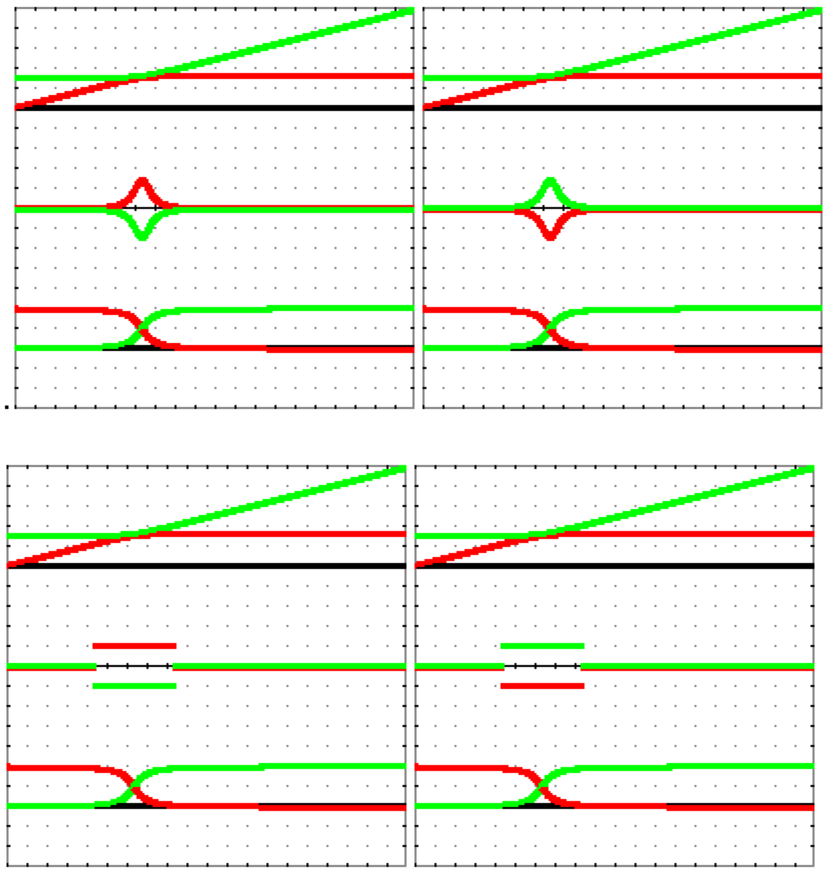
2. Predict what the graphs will look like.



3. Run the program to validate your answers above. Please indicate any confusions, misconceptions that this resolved (or questions it raised for you). There is no loss of credit for confusions honestly described.
An incentive: Many students learn much when they identify, examine, and resolve these confusions. (this course is less about finding the correct answer than knowing how to think about the problems)

Part 7-3: (After watching video 7-3)

1. Indicate which graph willl be plotted by program 7-3-accel.py



2. Run the program to validate your answers above. Please indicate any confusions, misconceptions that this resolved (or questions it raised for you). There is no loss of credit for confusions honestly described.

3. Explain with your own words differences between the acceleration graph in the last lab (a collision with a stationary bumper) and this acceleration graph (a collision with a stationary cart of the same mass).

4. Write with your own words the definition of “momentum” (You can read about it in your physics course book, but do not copy it)

5. Complete the table below.
   a. Note: Momentum of a moving object is equal to mass * velocity.
   b. Final velocities can be determined after program completion using the interactive window

	Mass	Initial Velocity (before collision)	Final Velocity (after collision)	Initial momentum (before collision)	Final momentum (after collision)
Cart 1					
Cart 2					

   c. Compute the sum “total” momentum of the two carts (momentum of cart 1 + momentum of cart 2) before collision and after collision.

6. In this question, we examine the effect of reducing the mass of Cart 1.
   a. Predict how the collision would qualitatively change if the mass of Cart1 was reduced from 0.2 to 0.1 kg and why.

b. Modify program 7-3-accel to validate your answer to part 4. If there are differences between your prediction and conjecture the cause.

c. Complete the table below.

	Mass	Initial Velocity (before collision)	Final Velocity (after collision)	Initial momentum (before collision)	Final momentum (after collision)
Cart 1					
Cart 2					

d. Compute the sum “total” momentum of the two carts (momentum of cart 1 + momentum of cart 2) before collision and after collision.