

## CSI: Bullets a Flyin'

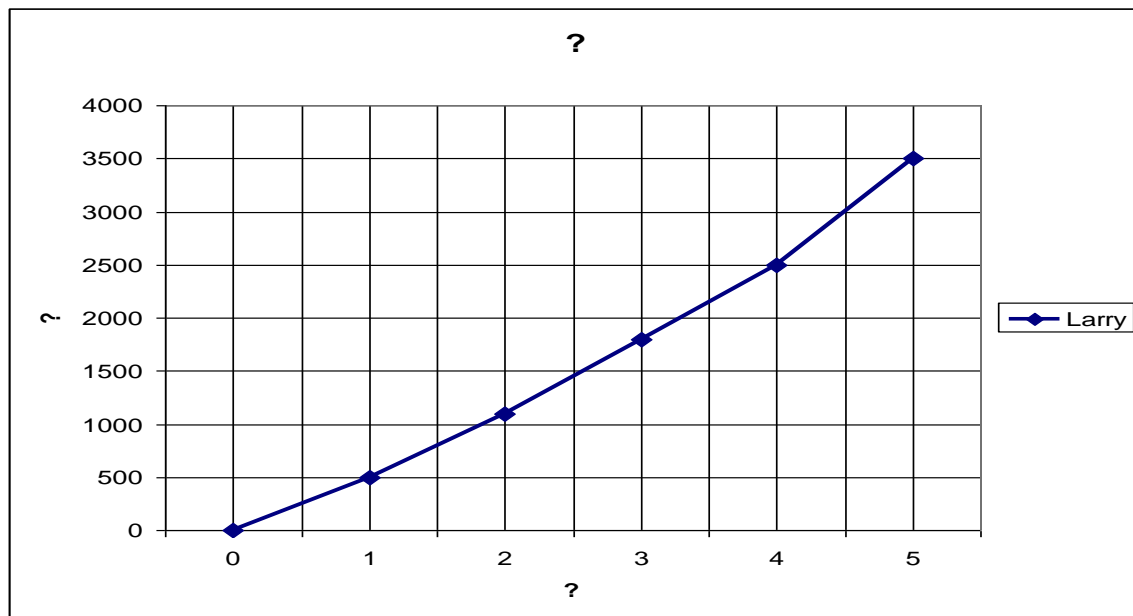
There's been an assassination at the new Glendale football stadium. Somebody in the rafters shot a player standing on the sidelines. The suspect managed to escape from the stadium before authorities could grab her/him.

The crime lab has done the math and it turns out that in order for this shot to be pulled off from the rafters the bullet **had to have an average speed of at least 500 m/s** in order for it to break through the player's helmet. Also, in order for the bullet to reach that speed in time, it had to have an **average acceleration of at least 350 m/s<sup>2</sup>**.

You rounded up 4 suspects: Manny, Moe, Jack, and Larry. Each suspect has a different type of rifle. You take each rifle to the shooting range and use special cameras to measure the distance the bullet has travelled over time. These observations are recorded below.

Time (s)	Distance Bullet Traveled (m)			
	Manny	Moe	Jack	Larry
0	0	0	0	0
1	500	100	200	500
2	1000	300	500	1100
3	1500	1000	1000	1800
4	2000	1400	1700	2500
5	2500	1500	2000	3500

- 1) Use the observations in the table above to complete the **distance vs. time graph** set up for you below. The line for Larry's gun has already been completed. You must create the lines for Manny, Moe and Jack. **Be sure to label your axes (including units) and give the graph a title.**



- 2) Use the slopes of each graph to calculate the average speed for each gun.  
Remember: **Average speed = total distance/total time**. Show your calculations below and **INCLUDE UNITS!!**:

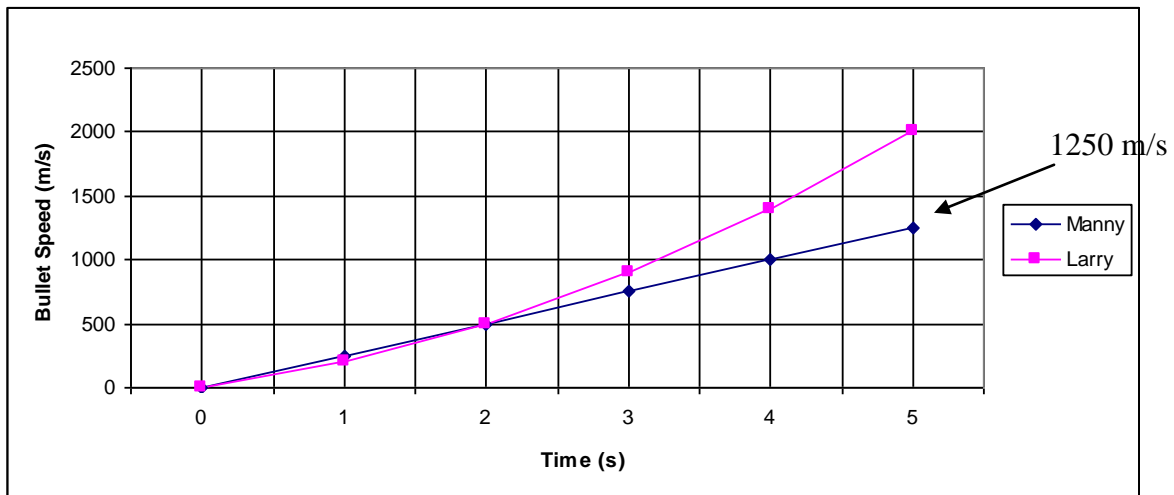
Manny =

Moe =

Jack =

Larry =

- 3) From your results in #2, who are the possible gunmen? Explain why.



Above is a graph of bullet speeds vs. time for Manny and Larry's guns. Use this graph to answer the following questions.

- 4) For each gun, describe whether the bullets are speeding up, slowing down, or moving at a constant speed. Also describe whether the rate of acceleration is increasing, decreasing, or staying constant.

Manny's gun =

Larry's gun =

- 5) Calculate the average acceleration of the bullets from each gun. Include units!  
Remember: **Ave. acceleration = (Final speed – Initial speed) / Time**

Manny =

Larry =

- 6) From these calculations, who must be the murderer? Explain why.