Graphing Motion: the 100m Sprint. Name: _____

Aim: To record information on displacement and time for a sprinter running a 100m sprint.

Equipment: Stopwatch, trundle wheel, chalk

Method: Set up 5-metre intervals on a 100m running track.

When the starter says "go", the timers start timing and the sprinter run towards the finish.

The timers stop their stopwatches when the sprinter runs past them.

Collect data for at least three sprinters. (If a bike is available you might like to collect data for a 100m bike sprint as well.)

A	B	C	D	E	F	G	H
Displacement (m)	**Split Times** (s)			**Times for each five-meter interval** (s) for Subject _____ (1, 2, or 3)		**Average Velocity during each 5m interval** (m/s)	**Mid-point Time** (s) (from Columns B or C or D) (see note on right)
	Subject 1	Subject 2	Subject 3			v=x/t (ie. 5m/Column F)	
0	0	0	0	-	-	0	0
5				0-5m			
10				5-10m			
15				10-15m			
20				15-20m			
25				20-25m			
30				25-30m			
35				30-35m			
40				35-40m			
45				40-45m			
50				45-50m			
55				50-55m			
60				55-60m			
65				60-65m			
70				65-70m			
75				70-75m			
80				75-80m			
85				80-85m			
90				85-90m			
95				90-95m			
100				95-100m			

Eg. If
10m: 2.36s
15m: 3.24s

Column F:
Time For Each 5m Interval = 3.24s – 2.36s = **0.88s**
(it took 0.88s to run from the 10m mark to the 15m mark)

Column G:
Average velocity in each 5m interval,
v = x/t
v = 5m/0.88s
v = **5.68m/s**
(the runner's average velocity between the 10m mark and the 15m mark was 5.68m/s)

Column H:
Mid-point time
= (2.36s + 3.24s)/2 = **2.8s**
The average velocity in each time interval is fairly close to the actual velocity half way in time between the start of the interval and the end of the time interval (the mid-point time).
When we draw a velocity vs time graph we will assume that the average velocity of 5.68m/s was the actual (or "instantaneous") velocity at the 2.8s mark. This is only an approximation, but it's the best we can do with the available data.

Draw

- **Displacement vs Time graphs** (Column A vs Columns B, C, and D) for your three subjects on one set of axes with displacement on the y-axis and time on the x-axis. Draw a "line-of-best-fit".
- a **Velocity vs Time graph** (Column G vs Column H) for **one** of the subjects with velocity on the y-axis and time on the x-axis. (see the Column H note in the text box.) Draw a line-of-best-fit.

Q1. How far did each subject run in 1 second?
(i) _____
(ii) _____
(iii) _____

Q2. How far did each subject run in 2 seconds?
(i) _____
(ii) _____
(iii) _____

Q3. How far did each subject run in 3 seconds?
(i) _____
(ii) _____
(iii) _____

Q4. How much time did it take for each subject to run 8 metres?
(i) _____
(ii) _____
(iii) _____

(Note: the answers to Qs 5-7 below are not necessarily the same as the answers to Qs 1-3)

Q5. How far did each subject run in the first second?
(i) _____
(ii) _____
(iii) _____

Q6. How far did each subject run in the second second?
(i) _____
(ii) _____
(iii) _____

Q7. How far did each subject run in the third second?
(i) _____
(ii) _____
(iii) _____

Q8. What do you notice about the distances in questions 5, 6 and 7?

Q9. How can you judge a runner's velocity from a Displacement vs Time graph?

Q10. How did the runners' velocities change during their sprints?