Graphing Motion: the 100m Sprint. Name: _____

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

Equipment: Stopwatches, trundle wheel, chalk

Method: Set up 10-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 ten-metre interval** (s) for Subject _____ (1, 2, or 3)		**Average Velocity during each 10m interval** (m/s)	**Mid-point Time** (s) (from column B or C or D) (see note on right)
	Subject 1	Subject 2	Subject 3			v=d/t (ie. 10m/Column F)	
0	0	0	0	-	-	0	0
10				0 - 10m			
20				10 - 20m			
30				20 - 30m			
40				30 - 40m			
50				40 - 50m			
60				50 -60m			
70				60 - 70m			
80				70 - 80m			
90				80 - 90m			
100				90 - 100m			

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 35 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?

Eg. If
10m: 2.36s
20m: 4.24s

Column F:
Time For Each 10m Interval = 4.24s – 2.36s = **1.88s**
(it took 1.88s to run from the 10m mark to the 20m mark)

Column G:
Average velocity in each 10m interval,
v = d/t
v = 10m/1.88s
v = **5.3m/s**
(the runner's average velocity between the 10m mark and the 20m mark was 5.3m/s)

Column H:
Mid-point time = (2.36s + 4.24s)/2 = **3.3s**
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 5.3m/s was the actual (or "instantaneous") velocity at the 3.3s mark. This is only an approximation, but it's the best we can do with the available data.