**Scientist\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Per\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**My Role \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Group Members\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Lab 3: Graphing Motion

**I Purpose/Question:**

To find average velocity and graph motion.

How can we use the distance vs. time graph to describe the position and speed of an object?

**II Theoretical:** Explain the following in paragraph form:

Explain how you measure speed of an object and what units you would use.

**III Procedure:**

**Materials:**

Stopwatch, meter stick, graph paper.

**Procedure:**

1. Each member of the group will have a specific role:

* **Timers** –Four people: these members will use the stopwatches to measure and record the time at specific distance intervals (Timer 5 meters, Timer 10 meters, Timer 15 meters, Timer 20 meters)
* **Recorder** –One of the timers is in charge of writing down all of the times after each race.
* **Travelers** – 2 people : each participant will travel the course at 2 different rates:

1. **Slow** rate of motion: **‘Foot-to-foot’ –** keep a **steady** pace
2. **Medium** rate motion: **‘Skipping’ –** keep a **steady** pace
3. **Fast** rate of motion: **‘Running’ –** keep a **steady** pace
4. **‘Slow-to-fast’** – **changing** pace - this participant will **start at a slow** and **gradually increase** the pace during the course.
5. Measure times at each distance and record in table.
6. Use a graph paper (*take it ‘landscape’*) to **graph** ***distance vs. time*** for the four “runs”.
   1. put all four lines on one graph. (Use different colors)
7. If lines are not perfect, make a best fit line for each run.
8. Calculate the slope of lines any straight lines. **Show work!**
9. Calculate the average velocity for “runs 1, 2, 3”. **Show work!**
10. **Analysis**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Position  (meters) | Time (seconds) | | | |
| Foot to Foot | Skipping | Running | Slow 🡪 Fast |
| 0 | 0 seconds | 0 seconds | 0 seconds | 0 seconds |
| 5 |  |  |  |  |
| 10 |  |  |  |  |
| 15 |  |  |  |  |
| 20 |  |  |  |  |

Answer the following questions in your notebook. *Show all of your work for the math questions.*

1. Calculate the average speed for **each** of the walkers.
2. Just by looking at your graph, how can you tell which person is walking the fastest? Explain.
3. According to the graph, who walked at a constant speed? How do you know? Explain your answer.
4. According to the graph, who walked slower in the beginning and then faster towards

the end? How do you know? Explain your answer.

1. What is the mathematical definition of the slope of a line?
2. What is the *physics* meaning of the slope of this graph? (think about the units and what it means in the real world)
3. When you graph distance vs. time, what does the slope of the line tell you…
   1. If the line is straight, what does that tell you about the speed?
   2. If the line is curved, what does that tell you about the speed?
   3. If the angle of the line is steeper, what does that tell you about the speed?
   4. If the angle of the line is shallower, what does that tell you about the speed?
4. **Conclusion**

Write conclusion in your notebook in paragraph form:

* Restate the purpose
* Answer the purpose question, and explain how you did this using your data and graph.
* How do you know your data is reasonable?
* How can you use a graph to interpret data in other situations?