

Experiment 1.1 Navigating Vectors

Aim: To experience scalars, distance travelled and speed; vectors, displacement and velocity. (*Exploring Physics Stage 2*)

Relevant Definitions:

Vector: A quantity which has both direction and magnitude (size/length).

Displacement: The magnitude of the vector from the initial position to the subsequent position.

Bearing: The angular direction measured from one position in relation to another.

Distance: The length of the path covered by a body in motion.

Pace: A single step taken while walking or running.

Apparatus:

Stopwatch

Field Compass

Pen & Paper

Procedure:

1. Find area where the experiment can take place.
2. Mark said point as Point A (starting point).
3. Align direction of yourself to east using the field compass.
4. Start the timing on your stopwatch, walk 100 paces in the direction you are facing.
5. After walking 100 paces, align your compass to north and walk 50 paces.
6. Now align your compass to north-west and walk 50 paces.
7. Finally align your stopwatch south and walk 75 paces.
8. End timing on stopwatch, marking this finishing point as Point B.
9. Walk back to Point A, counting how many paces it takes you to get back there.
10. Record all data with pen & paper.

Diagram:

Please see attached paper.

Data:

| | Point A to Point B | Point B to Point A |
|-------|--------------------|--------------------|
| Time | 3:30 minutes | 24.97 seconds |
| Paces | 275 | 47 |

Post-Lab Discussion

1. As shown on diagram.

2. The diagram is much more accurate than the results we produced. In the experiment itself, the magnitude of my displacement was 47 paces, while on the scaled diagram they were 60 paces. This shows a large discrepancy between the expected result and the obtained result, showing the true inaccuracy of how the experiment was conducted. This inaccuracy can easily be trivialized by various methods explained in question 5.

3. a) $100 + 50 + 50 + 75 = 275$ paces

b) speed = distance / time

3:30 mins = 0.055 hours

speed = $275 / 0.055$

speed = **5000 paces h^{-1}**

c) Displacement as measured from Point A to Point B: **60 paces 6°**

d) Velocity = Displacement / time

Velocity = $275 / 198$

= 1.39 paces s^{-1}

5. The uncertainties of the experiment are the essentially due to human error. It is near possible to maintain a consistently length'd pace. It is also difficult to walk in exactly the direction you want to go, often due to faulty and inaccurate compasses. Due to these circumstances, there is a lot of uncertainty in the experiment, however by changing the unit used from paces to metres, we can get a more accurate result as such errors of inconsistency would get ironed out. Repeating the experiment multiple times and averaging it would ensure any inaccuracies are ironed out. Using a professional grade compass would also iron out the issues with getting the exact bearing.

Conclusion:

In conclusion, I have discovered that this experiment was quite inaccurate with a 13 pace difference in intended displacement and attained displacement. This is a 26.77% inaccuracy, but this can easily be changed in a few ways, such as changing the units used to a static unit such a metres, rather than using a dynamic unit such as paces. Using higher grade equipment would also make the bearings much more accurate while conducting the experiment.