Vector Analysis

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Objective of the experiment:

The purpose of this laboratory is to study vectors by using graphical, mathematical, and experimental methods.

Theory:

This lab relates to what we learn by having us find the Resultant Displacement with the equation DR = $\sqrt{D1^{2}}+D2^{2}$. We had to add the vectors together and use trigonometry to find the angles and measurements that we needed to complete the problem.

Procedure:

What we first did was find the vector graphically by drawing it on a graph and finding the angles and measurements from the graph and we also found the percent difference from what we got and the accepted value. Then, we used the same numbers and found the measurements mathematically and again found the percent difference from what we got and the accepted value. Finally, we found the vector my doing an experiment with a force table and after we achieved equilibrium we used our results and calculated the percent difference from the accepted value and what we got one last time.

Data:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| θB | θR | cosθR | R | Aₓ | AY | Bₓ | BY | Rₓ | RY |
| 50° | 25° | .906 | 181.3 | 100 | 0 | 64.3 | 76.6 | 164.3 | 76.6 |
| 60° | 30° | .866 | 173.2 | 100 | 0 | 50 | 86.6 | 150 | 86.6 |
| 70° | 35° | .819 | 163.8 | 100 | 0 | 34.2 | 94.0 | 134.2 | 94.0 |
| 80° | 40° | .766 | 153.2 | 100 | 0 | 17.4 | 98.5 | 117.4 | 98.5 |
| 90° | 45° | .707 | 141.4 | 100 | 0 | 0 | 100 | 100 | 100 |
| 100° | 50° | .643 | 128.5 | 100 | 0 | -17.4 | 98.5 | 82.6 | 98.5 |
| 110° | 55° | .574 | 114.7 | 100 | 0 | -34.2 | 94.0 | 65.8 | 94.0 |
| 120° | 60° | .5 | 100.0 | 100 | 0 | -50 | 86.6 | 50 | 86.6 |

Calculations:

Aₓ=AcosθA Rₓ = Aₓ+ Bₓ
Bₓ=BcosθB AY+BY=RY
AY=AsinθA R=$\sqrt{Rₓ}^{2}+RY^{2}$
BY=BsinθB θR=tan^-1(RY/ Rₓ)
cosθR
((|accepted - measured|)/accepted)x100

Results:

With the graphical method I was 2.9% off the accepted value of 102 units with 105 units for R, and I was 2.6% off the accepted value of 75° with 73° for θR.
With the mathematical method I was .59% off the accepted value of 102 units with 102.6 units for R, and I was .4% off the accepted value of 75° with 74.7° for θR.
With the experimental method we got it right on the dot and were 0% off for both R and θR.

Errors:

Some of the errors I could have had on the graphical one were that I probably did not read the mm on the meter stick correctly or that I did not measure it exact enough for the purpose of the experiment.

Conclusion:

I learned that there are many different ways and methods to find the same exact vector and you might not get the same results in every test that you perform, so it is not always good to go off of one method and think that you have the most correct answer because you could be off the correct answer by a little bit. The experiment did complete the objective because we got the exact answer that we needed to get to be 100% correct for this lab.

References:

We did not use any resources besides each other in this experiment.