**Remote Lab VECTORS** Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Course\_\_\_\_\_\_

Purpose: To determine the resultant of two or more vectors analytically and to verify the results using a website and graphical method.

Theory: Analytical method

Let's say two forces F1 (making an angle θ1, counterclockwise from the +X-axis) and F 2 (making an angle θ2, counterclockwise from the +X-axis) are acting on an object.


To find the resultant (net) force, FR we need to find the X and Y components of the two forces, as shown below:

|  |  |  |
| --- | --- | --- |
| Force | X component | Y component |
| F1 | F1 Cos θ1 | F1 Sin θ1 |
| F2 | F2 Cos θ2 | F2 Sin θ2 |
| $$F\_{R}=F\_{1}+F\_{2}$$ | Fx = F1 Cos θ1+ F2 Cosθ2 | Fy = F1 Sin θ1 + F2 Sin θ2 |

Magnitude of the resultant (FR) is given by; FR2= Fx2+ Fy2

Direction of the resultant, θR, measured from the +X axis counterclockwise, depends on the signs of Fx and Fy, as shown in the data table below.

|  |  |  |  |
| --- | --- | --- | --- |
| Case | Vector Diagram | θR | FR |
| Fx > 0 and Fy >0 |  | $$θ\_{R}=tan^{-1}\frac{F\_{y}}{F\_{x}}$$ | $$F\_{R}=\sqrt{F\_{x}^{2}+F\_{y}^{2}}$$ |
| Fx < 0 and Fy > 0 |  | $$A=tan^{-1}\frac{F\_{y}}{\left|F\_{x}\right|}$$$$θ\_{R}=180-A$$ | $$F\_{R}=\sqrt{F\_{x}^{2}+F\_{y}^{2}}$$ |
| Fx < 0 and Fy < 0 |  | $$B=tan^{-1}\left|\frac{F\_{y}}{F\_{x}}\right|$$$$θ\_{R}=180+B$$ | $$F\_{R}=\sqrt{F\_{x}^{2}+F\_{y}^{2}}$$ |
| Fx > 0 and Fy < 0 |  | $$C=tan^{-1}\frac{\left|F\_{y}\right|}{F\_{x}}$$$$θ\_{R}=360-C$$ | $$F\_{R}=\sqrt{F\_{x}^{2}+F\_{y}^{2}}$$ |

Procedure

A) From the website: <http://www.1728.org/vectors.htm>

Open the above website, enter the vectors, and obtain the magnitude, *FR* and direction, *θR* of the resultant. Enter your data in the data table.

B) Analytical Method

Using the analytical method (component method) find the magnitude, *FR* and direction, *θR* of the resultant. Complete the data table and attach your worksheets.

C) Do the graphical method exercise on page 5.

D) Write a conclusion and submit your report within a week.

Data Table

|  |  |
| --- | --- |
| Addition of Vectors | Resultant Vector |
| <http://www.1728.org/vectors.htm> | From website | Analytical method |
| 2.0 N @ 002.0 N @ 900 | *FR=**θR=*  | *FR=**θR=* |
| 2.0 N @ 00and3.0 N @ 900 | *FR=**θR=*  | *FR=**θR=* |
| 1.5 N @ 200and2.5 N @ 1200 | *FR=**θR=*  | *FR=**θR=* |
| 1.5 N @ 2002.5 N @ 12003.0 N @ 3000 | *FR=**θR=* | *FR=**θR=* |
| 1.0 N @ 300 1.5 N @ 14002.0 N @ 20003.0 N @ 3000 | *FR=* *θR=* | *FR=**θR=* |
| http://edugen.wileyplus.com/edugen/courses/crs6407/art/qb/qu/c01/EAT_1319521648216_0_399438379900267.gif | A = 1.6 N, B = 1.0 NC = 1.2 N, D = 2.6 N  | *FR=* *θR=* | *FR=**θR=* |

Exercise

Use the [graphical method](http://www.youtube.com/watch?v=NaMBAihHBwo) (clicking this hyperlink will open up a video) to find the magnitude (FR) & direction (*θR*) of the resultant for the case of addition of four vectors. Here you need to draw a vector diagram, using a protractor and ruler, following the tail-to-tip method, to scale. Show the direction of the vectors and identify FR & *θR* in the drawing.

|  |  |  |
| --- | --- | --- |
| http://edugen.wileyplus.com/edugen/courses/crs6407/art/qb/qu/c01/EAT_1319521648216_0_399438379900267.gif | A = 1.6 NB = 1.0 NC = 1.2 ND = 2.6 N  | *FR*= \_\_\_\_\_\_\_\_\_\_\_\_  *θR* = \_\_\_\_\_\_\_\_\_\_\_\_\_ |

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