Vector Analysis

Physics Lab I

Name:_____

A: Vector Exercise I

You should be provided with a ruler, protractor and calculator. Consult with your lab instructor if you do not have these materials.

Graph: On Graph Sheet A draw the two vectors $\vec{A}$ and $\vec{B}$ using the following data ($A = 7\ cm, \theta_A = 30°$) and ($B = 4\ cm,\ \theta_B = 150°$). Add these vectors graphically for the vector sum $\vec{C} = \vec{A} + \vec{B}$, by using the tip-to-tail method. Measure the length C and direction θ_C of vector $\vec{C}$.

$C =$ _____, $\theta_C =$ _____.

Next, draw the x and y components of $\vec{C}$: (C_x, C_y). Measure the length of each of the components.

$C_x =$ _____, $C_y =$ _____.

Calculate: From the original data for $\vec{A}$ and $\vec{B}$, compute their x and y components: (A_x, A_y) and (B_x, B_y).

$A_x =$ _____, $A_y =$ _____.

$B_x =$ _____, $B_y =$ _____.

Add these together for alternative values of the x and y components of $\vec{C}$:

$C'_x = A_x + B_x =$ _____.

$C'_y = A_y + B_y =$ _____.

From these values, calculate alternate values for the length C' and direction θ'_C of $\vec{C}$.

$C' =$_____, $\theta'_C =$ _____.

Compare: Are the two sets of values for the vector $\vec{C}$ equal? I.e., is it true that $C = C'$, $\theta_C = \theta'_C$, $C_x = C'_x$, and $C_y = C'_y$? _____ If not, what are possible reasons why they are not exactly the same?

B: Vector Exercise II

Graph: On Graph Sheet B draw the two vectors $\vec{A}$ and $\vec{B}$ using the following data: $(A_x = -4\ cm,\ A_y = +3\ cm)$ and $(B_x = +4.5\ cm,\ B_y = -4\ cm)$. Add these vectors graphically for the vector sum of $\vec{C} = \vec{A} + \vec{B}$, by using the tip-to-tail method. Measure the length C and direction θ_C of vector $\vec{C}$.

$C =$ _____, $\theta_C =$ _____.

Next, draw the x and y components of $\vec{C}$: (C_x, C_y). Measure the length of each component.

$C_x =$ _____, $C_y =$ _____.

Calculate: Add the x and y components of $\vec{A}$ and $\vec{B}$ for alternative values of the x and y components of $\vec{C}$:

$C'_x = A_x + B_x =$ _____.

$C'_y = A_y + B_y =$ _____.

From these values, calculate alternate values for the length C' and direction θ'_C of $\vec{C}$.

$C' =$ _____, $\theta'_C =$ _____.

Compare: Are the two sets of values for the vector $\vec{C}$ equal? I.e., is it true that $C = C'$, $\theta_C = \theta'_C$, $C_x = C'_x$, and $C_y = C'_y$? _____ If not, what are possible reasons why they are not exactly the same?

C: Vector Exercise III

Graph: On Graph Sheet C draw the two vectors $\vec{A}$ and $\vec{B}$ using the following data: ($\theta_A = 135°$, $A = 5\ cm$) and ($B_x = +1.0\ cm$, $B_y = -8\ cm$). Add these vectors graphically for the vector sum of $\vec{C} = \vec{A} + \vec{B}$, using the tip-to-tail method. Measure the length C and direction θ_C of vector $\vec{C}$.

$C =$ _____, $\theta_C =$ _____.

Next, draw the x and y components of $\vec{C}$: (C_x, C_y). Measure the length of each component.

$C_x =$ _____, $C_y =$ _____.

Calculate: Add the x and y components of $\vec{A}$ and $\vec{B}$ for alternate values of the x and y components of $\vec{C}$:

$C'_x = A_x + B_x =$ _____.

$C'_y = A_y + B_y =$ _____.

From these values, calculate alternate values for the length C' and direction θ'_C of $\vec{C}$.

$C' =$ _____, $\theta'_C =$ _____.

Compare: Are the two sets of values for the vector $\vec{C}$ equal? I.e., is it true that $C = C'$, $\theta_C = \theta'_C$, $C_x = C'_x$, and $C_y = C'_y$? _____ If not, what are possible reasons why they are not exactly the same?

D: Vector Exercise IV

Graph: On Graph Sheet D draw the two vectors $\vec{A}$ and $\vec{B}$ using the following data: $(A_x = +10.5\,cm,\ A_y = +3cm)$ and $(\theta_B = 235°,\ B = 4\,cm)$. Add these vectors graphically for the vector sum of $\vec{C} = \vec{A} + \vec{B}$, using the tip-to-tail method. Measure the length C and direction θ_C of vector $\vec{C}$.

$C =$ _____, $\theta_C =$ _____.

Next, draw the x and y components of $\vec{C}$: (C_x, C_y). Measure the length of each component.

$C_x =$ _____, $C_y =$ _____.

Calculate: Add the x and y components of $\vec{A}$ and $\vec{B}$ for alternate values of the x and y components of $\vec{C}$:

$C'_x = A_x + B_x =$ _____.

$C'_y = A_y + B_y =$ _____.

From these values, calculate alternative values for the length C' and direction θ'_C of $\vec{C}$.

$C' =$ _____, $\theta'_C =$ _____.

Compare: Are the two sets of values for the vector $\vec{C}$ equal? I.e., is it true that $C = C'$, $\theta_C = \theta'_C$, $C_x = C'_x$, and $C_y = C'_y$? _____ If not, what are possible reasons why they are not exactly the same?