

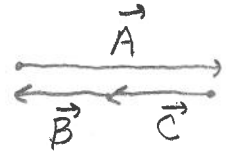
$$\text{ave.} = 8.1$$

$$\sigma = 2.1$$

Quiz #3: Vectors and Coordinate Systems

Problem 1 (2 points)

Three vectors \vec{A} , \vec{B} , and \vec{C} add together to yield zero: $\vec{A} + \vec{B} + \vec{C} = 0$. The vectors \vec{A} and \vec{C} point in *opposite* directions and their magnitudes are related by the expression: $A = 2C$. Which one of the following conclusions is correct?



B

- (a) \vec{A} and \vec{B} have equal magnitudes and point in opposite directions.
- (b) \vec{B} and \vec{C} have equal magnitudes and point in the same direction.
- (c) \vec{B} and \vec{C} have equal magnitudes and point in opposite directions.
- (d) \vec{A} and \vec{B} point in the same direction, but \vec{A} has twice the magnitude of \vec{B} .
- (e) \vec{B} and \vec{C} point in the same direction, but \vec{C} has twice the magnitude of \vec{B} .

Problem 2 (4 points)

Vector $\vec{A} = -1.00\hat{i} + -2.00\hat{j}$ and vector $\vec{B} = 3.00\hat{i} + 4.00\hat{j}$. What are the magnitude and direction of vector $\vec{C} = 3.00\vec{A} + 2.00\vec{B}$?

$$C_x = 3A_x + 2B_x = 3(-1.00) + 2(3.00) = \underline{3.00}$$

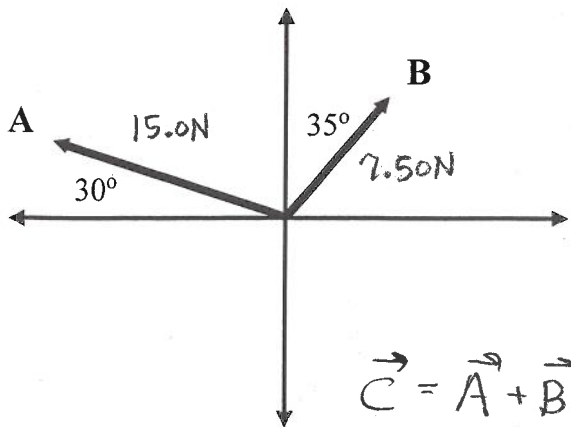
$$C_y = 3A_y + 2B_y = 3(-2.00) + 2(4.00) = \underline{2.00}$$

$$|\vec{C}| = \sqrt{C_x^2 + C_y^2} = \sqrt{(3.00)^2 + (2.00)^2} \rightarrow \underline{|\vec{C}| = 3.61}$$

$$\theta = \tan^{-1}\left(\frac{C_y}{C_x}\right) = \tan^{-1}\left(\frac{2.00}{3.00}\right) \rightarrow \underline{\theta = 33.7^\circ}$$

Problem 3 (4 points)

Two force vectors, \vec{A} and \vec{B} , are shown below. Force \vec{A} has a magnitude of 15.0 N and force \vec{B} has a magnitude of 7.50 N. Find the magnitude and direction of $\vec{A} + \vec{B}$



$$\vec{A} = -(15.0\text{N}) \cos 30^\circ \hat{i} + (15.0\text{N}) \sin 30^\circ \hat{j}$$

$$= \underline{-(13.0\text{N}) \hat{i}} + \underline{(7.50\text{N}) \hat{j}}$$

$$\vec{B} = (7.50\text{N}) \sin 35^\circ \hat{i} + (7.50\text{N}) \cos 35^\circ \hat{j}$$

$$= \underline{(4.30\text{N}) \hat{i}} + \underline{(6.14\text{N}) \hat{j}}$$

$$\vec{C} = \vec{A} + \vec{B} = (-13.0\text{N} + 4.30\text{N}) \hat{i} + (7.50\text{N} + 6.14\text{N}) \hat{j}$$

$$= \underline{-(8.70\text{N}) \hat{i}} + \underline{(13.6\text{N}) \hat{j}}$$

$$|\vec{C}| = \sqrt{(-8.70\text{N})^2 + (13.6\text{N})^2} = \underline{16.2\text{N}}$$

$$\underline{\theta = 123^\circ}$$

$$\theta = \tan^{-1}\left(\frac{13.6\text{N}}{-8.70\text{N}}\right) = \underline{-57.4^\circ}$$

wrong quadrant so add 180°