

Vectors

Phys109

Fall 2019

- a) The magnitude of a 2-dimensional vector is 10 and its direction $\theta = 135^\circ$. Find its components. Answer: $A_x = -7.07$, $A_y = 7.07$

b) Find the magnitude and direction of the vector $\vec{v} = 2\hat{i} - 2\sqrt{3}\hat{j}$. Answer: $|\vec{v}| = 4m$, $\theta = 300^\circ$
- Answer the following by using the data given in the figure:
 - Find the magnitudes and directions of the vectors. Answer: $|\vec{A}| = 5m$, $\theta_A = 55^\circ$, $|\vec{B}| = 2m$, $\theta_B = 147^\circ$
 - Write the vector in unit vector notation. $\vec{A} = 2.8\hat{i} + 4.0\hat{j}$, $\vec{B} = -1.6\hat{i} + 1.0\hat{j}$
 - If it is known that $\frac{1}{2}\vec{A} - 2\vec{B} + 3\vec{C} = 0$, Find the magnitude and direction of \vec{C} . Answer: $\vec{C} = 1.58\hat{i} - 0.05\hat{j}$

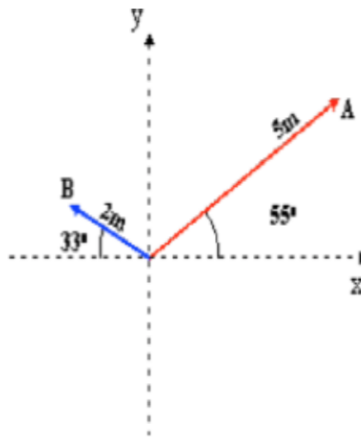


Figure 1: Problem no.2

3. Find the real number b so that vector \vec{A} and \vec{B} given below are perpendicular. $\vec{A} = -2\hat{i} - b\hat{j}$, $\vec{B} = -8\hat{i} + b\hat{j}$. Answer: $b = 4$, (Perpendicular means the angle between two vectors is 90°)
4. Given $\vec{A} = 3\hat{i} - 4\hat{j} + 4\hat{k}$, $\vec{B} = 2\hat{i} + 4\hat{j} - 8\hat{k}$ find vector \vec{C} , given by $\vec{C} = 2\vec{A} - \frac{1}{2}\vec{B}$ in unit vector notation. Answer: $\vec{C} = 5\hat{i} - 10\hat{j} + 12\hat{k}$.
5. The two vectors \vec{a} and \vec{b} (in the figure) have equal magnitudes of 10.0 m and the angles are $\theta_1 = 30^\circ$ and $\theta_2 = 105^\circ$. Find the (a) x and (b) y components of their vector sum: \vec{r} , (c) the magnitude of $|\vec{r}|$, and (d) the angle \vec{r} makes with the positive direction of the x axis. Answer: (a)1.50,(b) 12.07, (c) 12.16, (d) $\theta = 83^\circ$ (b)

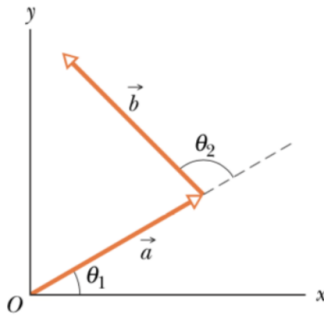


Figure 2: Problem no.5

6. If \vec{B} is added to $\vec{C} = 3.0\hat{i} + 4.0\hat{j}$, the result is a vector in the positive direction of the y axis, with a magnitude equal to that of C. What is the magnitude of B? Answer: 2
7. If $\vec{d}_1 = 3\hat{i} + 2\hat{j} + 4\hat{k}$ and $\vec{d}_2 = 5\hat{i} + 2\hat{j} + \hat{k}$, then what is $\vec{d}_1 \cdot \vec{d}_2$ and the angle between them. Answer: 23, $\theta = 38^\circ$
8. For the following three vectors, $\vec{A} = 2\hat{i} + 3\hat{j} - 4\hat{k}$, $\vec{B} = -3\hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{C} = 7\hat{i} - 8\hat{j}$, find:
- $\vec{A} \cdot \vec{C}$
 - $\vec{A} \cdot \vec{B}$
 - $\vec{C} \cdot \vec{B}$

Answer: (a)-10, (b) -2, (c) -53

9. Find each vector in unit vector notation,

- (a) \vec{P} : 10 m, at 25° counterclockwise from $+x$,
- (b) \vec{Q} : 12m, at 10° counterclockwise from $+y$,
- (c) \vec{R} : 8m, at 20° clockwise from $-y$,
- (d) \vec{S} : 9m, at 40° clockwise from $-y$.

Find the resultant vector of the four vectors in unit vector form, its magnitude and the angle with positive direction of x axis.

Answer: $\vec{P} = 9\hat{i} + 4\hat{j}$, $\vec{Q} = -2\hat{i} + 11.7\hat{j}$, $\vec{R} = -2.7\hat{i} - 7.5\hat{j}$, $\vec{S} = 5.7\hat{i} - 6.8\hat{j}$,
 $\vec{D} = 10\hat{i} + 1.4\hat{j}$, $|\vec{D}| = 10.09$, $\theta = 8^\circ$

10. The Cartesian coordinates of a point in xy plane are given to be $(x, y) = (-3, 4)$ m. Write the position vector in unit vector notation. What is its angle with positive direction of x axis. Answer: $\vec{R} = -3\hat{i} + 4\hat{j}$, $\theta = 127^\circ$