



Inspiring Excellence

BRAC University
Department of Mathematics & Natural Sciences
Principles of Physics-I (PHY 111)
Assignment-I

Spring, 2025

Full marks: 50

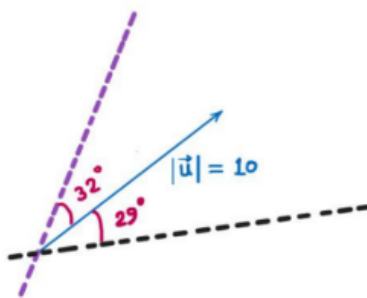
1. Two particles are located at $\vec{r}_1 = -4 \text{ m } \hat{x} + 6 \text{ m } \hat{y} - 4 \text{ m } \hat{z}$ and $\vec{r}_2 = 5 \text{ m } \hat{x} - 5 \text{ m } \hat{z}$.
 - i. Find the magnitudes of \vec{r}_1 and \vec{r}_2 .
 - ii. Find the directions (unit vectors) of those particles.
 - iii. What is the angle between the two vectors?
 - iv. Find the projection of \vec{r}_1 on \vec{r}_2 and vice-versa.
 - v. Find a unit vector orthogonal to both \vec{r}_1 and \vec{r}_2 .

(2+2+1+2+2)

2. In a region with Cartesian coordinate (x, y, z) with origin O at $(0, 0, 0)$, a particle moves from coordinate point $A(0, -2, -3)$ to $B(-2, 4, 6)$ and subsequently reaches to the point $C(4, -2, 0)$.
 - i. Write the position vectors \vec{r}_A and \vec{r}_B denoting the positions of point A and B respectively.
 - ii. Write down the first and second displacement vectors \vec{AB} and \vec{BC} respectively.
 - iii. What is the angle between the displacement vectors?
 - iv. What is the total displacement \vec{AC} ?
 - v. Find the magnitude and the direction of the total displacement vector with respect to the vector \vec{AB} .
 - vi. Find the angles the vector \vec{AC} makes with the x, y & z axis.

(3+2+1+1+2+3)

3.



Decompose the vector in the given direction.

(1.5+1.5)

4. Vector \vec{A} has magnitude 6 units and is in the direction of the $+x$ -axis. Vector \vec{B} has magnitude 4 units and lies in the xy -plane, making an angle of 30° with the $+x$ -axis. Find the vector product $\vec{C} = \vec{A} \times \vec{B}$.

(2+2+2)

5. Consider three vectors \vec{A} , \vec{B} & \vec{C} .

(a) What is the geometrical interpretation of cross product?

(b) If $\vec{A} = 3\hat{i} + 3\hat{j} + 2\hat{k}$ & $\vec{B} = -\hat{i} - 4\hat{j} + 2\hat{k}$, find out the area of the parallelogram whose adjacent sides are the vectors \vec{A} & \vec{B} .

(c) If $\vec{C} = 2\hat{i} + a\hat{j} + 2\hat{k}$, and the volume formed by \vec{A} , \vec{B} & \vec{C} is 2, then find out the value of a. Where \vec{A} & \vec{B} are given in (b).

(d) Find the vector $\vec{r} = \vec{A} + \vec{B} - 2\vec{C}$ and also find the angles between \vec{r} and positive x, y, z axes.

(2+2+3+3)

6. In unit-vector notation, $\vec{a} = 5\hat{i} + 4\hat{j} - 6\hat{k}$, $\vec{b} = -2\hat{i} + 2\hat{j} + 3\hat{k}$ & $\vec{c} = 4\hat{i} + 3\hat{j} + 2\hat{k}$.

(a) Find the angles between the vector $\vec{r} = \vec{a} - \vec{b} + \vec{c}$ and positive x, y, z axis.

(b) What is the vector component of \vec{a} along the direction of \vec{b} ?

(c) What is the vector component of \vec{a} perpendicular to the direction of \vec{b} but in the plane of \vec{a} and \vec{b} ?

(3+3+4)