INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH MOHALI

MTH101 : Linear Algebra (2023-24) **Tutorial 01 (August 31, 2023)**

1. Let $u = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$, $v = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$, and $w = \begin{pmatrix} 2\sin(\pi/2) \\ \cos(\pi/3) \end{pmatrix}$ be vectors in $\mathbb{R}^2$.

   (a) Calculate the following:

(i). $u + v$	(iii). $u.v$	(v). $u - 2v + 3w$
(ii). $v - 2w$	(iv). $(u - v).(u - w)$	(vi). $(u.w)u + (v.w)u$

   (b) Are there real numbers $\alpha, \beta \in \mathbb{R}$ for which $w = \alpha u + \beta v$?

   (c) Fixing a coordinate frame of perpendicular x-axis and y-axis, plot $u, u + v$ and $u + v + w$ on the plane.

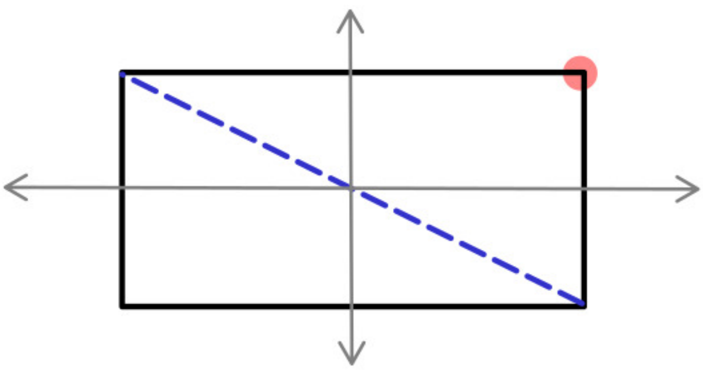
   (d) If we rotate u by an angle of $\pi/2$ to reach another vector u', then what will be the coordinates of u'?

2. Using the idea of rotations, convince yourself that

   (a). $\sin(-\theta) = -\sin(\theta)$ (b). $\cos(-\theta) = \cos(\theta)$

3. *Think about it*. Take two distinct vectors $u, v \in \mathbb{R}^2$. The set $\{(1 - \alpha)u + \alpha v : \alpha \in \mathbb{R}\}$ is called then *line* joining u and v. Why should this set be named line?

4. *A fun task*. Look at the following rectangle.



   Its red corner corresponds to the vector $\begin{pmatrix} 2 \\ 1 \end{pmatrix}$. If you flip this rectangle about the blue diagonal as shown in the image above, then what vector will correspond to the new location of the red corner?