

Matrix Theory(EE5609) Assignment 1

Anshum Agrawal
Roll No- AI20MTECH11006

Abstract—This Assignment explains the concept of a vector parallel to resultant of two other vectors and finds a vector of given magnitude parallel to resultant vector

Download all python codes from

<https://github.com/anshum0302/EE5609/blob/master/assignment1/solu1.py>

and latex-tikz codes from

<https://github.com/anshum0302/EE5609/blob/master/assignment1/assign1.tex>

1 PROBLEM STATEMENT

Find a vector of magnitude 5 units, and parallel to the resultant of the vectors $\mathbf{a} = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix}, \mathbf{b} = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$.

2 THEORY

Resultant \mathbf{R} of two vectors \mathbf{a} and \mathbf{b} is the sum of two vectors. So

$$\mathbf{R} = \mathbf{a} + \mathbf{b} \quad (2.0.1)$$

$$\Rightarrow \mathbf{R} = \begin{pmatrix} a1 \\ a2 \\ a3 \end{pmatrix} + \begin{pmatrix} b1 \\ b2 \\ b3 \end{pmatrix} \quad (2.0.2)$$

$$\Rightarrow \mathbf{R} = \begin{pmatrix} a1 + b1 \\ a2 + b2 \\ a3 + b3 \end{pmatrix}. \quad (2.0.3)$$

If \mathbf{R} is a vector of magnitude $\|\mathbf{R}\|$ then unit vector in the direction of \mathbf{R} is $\frac{\mathbf{R}}{\|\mathbf{R}\|}$

And vector of magnitude λ parallel to \mathbf{R} is $\frac{\lambda \mathbf{R}}{\|\mathbf{R}\|}$

3 SOLUTION

First find resultant \mathbf{R} of $\mathbf{a} = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$

$$\mathbf{R} = \mathbf{a} + \mathbf{b} \quad (3.0.1)$$

$$\Rightarrow \mathbf{R} = \begin{pmatrix} 2 \\ 3 \\ -1 \end{pmatrix} + \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix} \quad (3.0.2)$$

$$\Rightarrow \mathbf{R} = \begin{pmatrix} 2+1 \\ 3-2 \\ -1+1 \end{pmatrix} \quad (3.0.3)$$

$$\Rightarrow \mathbf{R} = \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix}. \quad (3.0.4)$$

Magnitude of \mathbf{R} is

$$\|\mathbf{R}\| = \sqrt{3^2 + 1^2 + 0^2} \quad (3.0.5)$$

$$\Rightarrow \|\mathbf{R}\| = \sqrt{10} \quad (3.0.6)$$

$$(3.0.7)$$

Then unit vector \mathbf{r} along \mathbf{R} is

$$\mathbf{r} = \frac{\mathbf{R}}{\|\mathbf{R}\|} \quad (3.0.8)$$

$$\Rightarrow \mathbf{r} = \frac{1}{\sqrt{10}} \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} \quad (3.0.9)$$

Then vector of magnitude 5 units parallel to resultant \mathbf{R} is given by

$$\mathbf{u} = 5\mathbf{r} \quad (3.0.10)$$

$$\Rightarrow \mathbf{u} = \frac{5}{\sqrt{10}} \begin{pmatrix} 3 \\ 1 \\ 0 \end{pmatrix} \quad (3.0.11)$$

$$\Rightarrow \mathbf{u} = \begin{pmatrix} 4.7434 \\ 1.5811 \\ 0 \end{pmatrix} \quad (3.0.12)$$