

Suppose you have an arbitrary vector(non-zero magnitude) and want to find a unit vector in its direction, then we divide each component of vector by its magnitude. This process of dividing is called the normalization and the resultant vector is said to be normalized.

$$\text{Let we have: } \vec{v} = \begin{pmatrix} -2 \\ 3 \\ -5 \end{pmatrix}$$

$$\implies \text{its magnitude} = |\vec{v}| = \sqrt{(-2)^2 + 3^2 + (-5)^2} = \sqrt{4 + 9 + 25} = \sqrt{38}$$

Now dividing each component of  $\vec{v}$  by  $|\vec{v}|$  to get the normalized vector  $\hat{v}$ :

$$\text{Normalized Vector} = \hat{v} = \frac{\vec{v}}{|\vec{v}|} = \frac{1}{\sqrt{38}} \vec{v} = \frac{1}{\sqrt{38}} \begin{pmatrix} -2 \\ 3 \\ -5 \end{pmatrix} = \begin{pmatrix} \frac{-2}{\sqrt{38}} \\ \frac{3}{\sqrt{38}} \\ \frac{-5}{\sqrt{38}} \end{pmatrix}$$