

# Assignment 1

Surbhi Agarwal

**Abstract**—This document solves a problem from Points and Vectors, where it finds the angle between a given Force and displacement vector

Download all python codes from

<https://github.com/>

and latex-tikz codes from

<https://github.com/>

Substituting these values in Equation 2.0.1,

$$\cos(\theta) = \frac{16}{(5\sqrt{2})(5\sqrt{2})} = \frac{8}{25}$$

$$\Rightarrow \theta = \arccos\left(\frac{8}{25}\right)$$

$$\Rightarrow \theta \approx 71.3^\circ$$

Thus, the angle between  $\mathbf{F}$  and  $\mathbf{d}$  is approximately  $71.3^\circ$

## 1 PROBLEM

Find the angle between the force  $\mathbf{F} = \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix}$  and displacement  $\mathbf{d} = \begin{pmatrix} 5 \\ 4 \\ 3 \end{pmatrix}$

## 2 EXPLANATION

Let the angle between  $\mathbf{F}$  and  $\mathbf{d} = \theta$

$$\cos(\theta) = \frac{\mathbf{F} \cdot \mathbf{d}}{\|\mathbf{F}\| \|\mathbf{d}\|} \quad (2.0.1)$$

Here, the scalar product of the vectors  $\mathbf{F}$  and  $\mathbf{d}$  can be given as,

$$\mathbf{F} \cdot \mathbf{d} = \mathbf{F}^T \mathbf{d} \quad (2.0.2)$$

## 3 SOLUTION

Using Equation 2.0.2 and substituting the values,

$$\mathbf{F} \cdot \mathbf{d} = \begin{pmatrix} 3 \\ 4 \\ -5 \end{pmatrix}^T \begin{pmatrix} 5 \\ 4 \\ 3 \end{pmatrix}$$

$$\Rightarrow \mathbf{F} \cdot \mathbf{d} = \begin{pmatrix} 3 & 4 & -5 \end{pmatrix} \begin{pmatrix} 5 \\ 4 \\ 3 \end{pmatrix} = 16$$

$$\|\mathbf{F}\| = \sqrt{3^2 + 4^2 + (-5)^2} = 5\sqrt{2}$$

$$\|\mathbf{d}\| = \sqrt{5^2 + 4^2 + 3^2} = 5\sqrt{2}$$