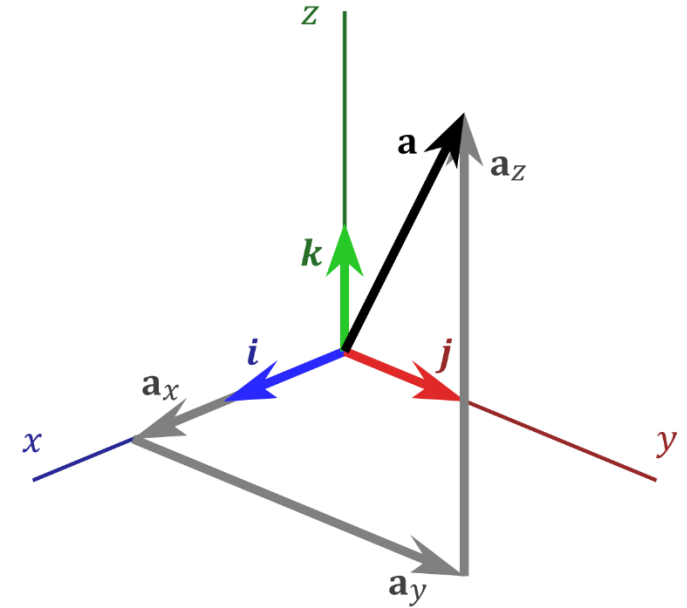


Siddhardhan

# Vector Operations

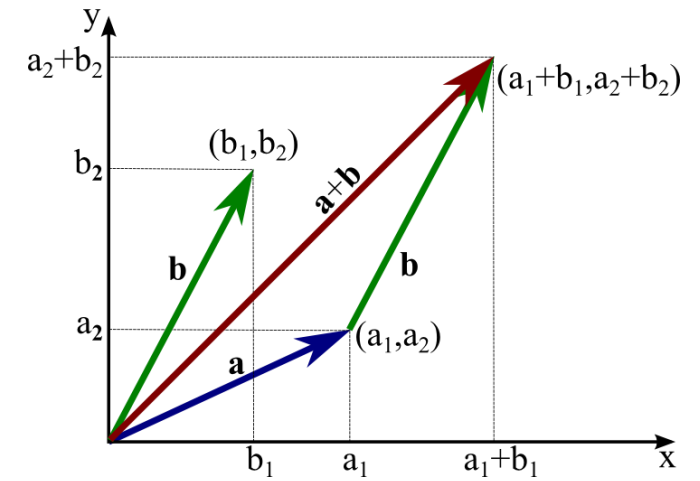
## - Part 2

Math for Machine Learning

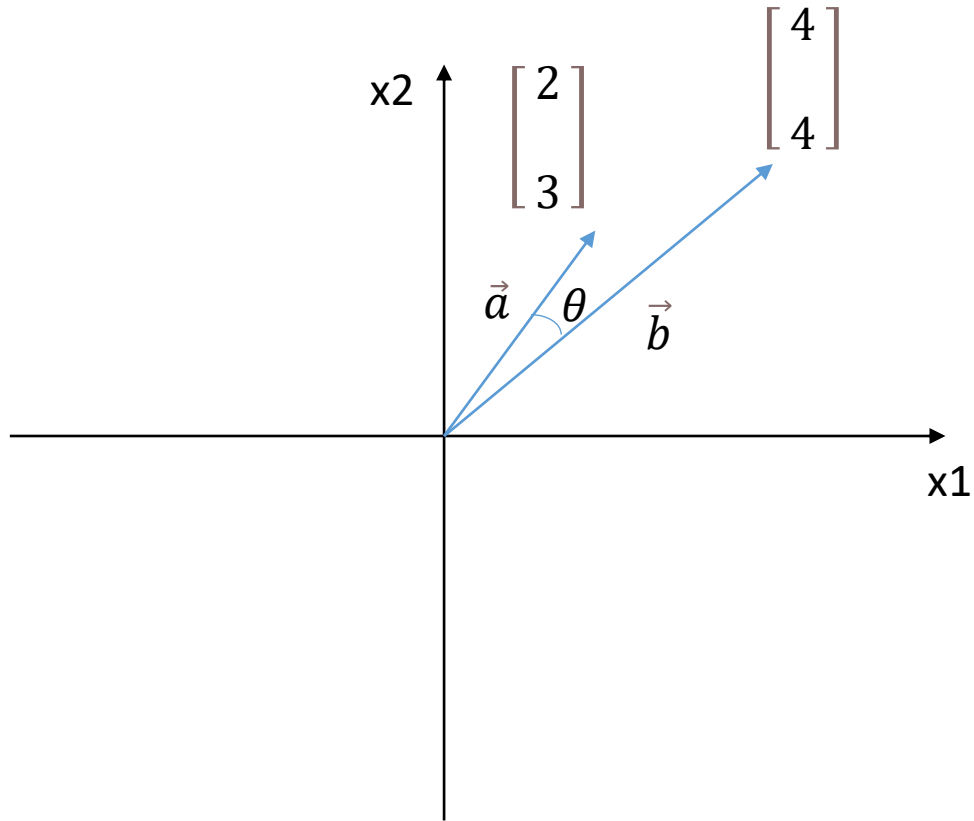


## Vector Operations – Part 2

1. Dot Product of 2 Vectors
2. Cross Product of 2 Vectors
3. Projection of vector



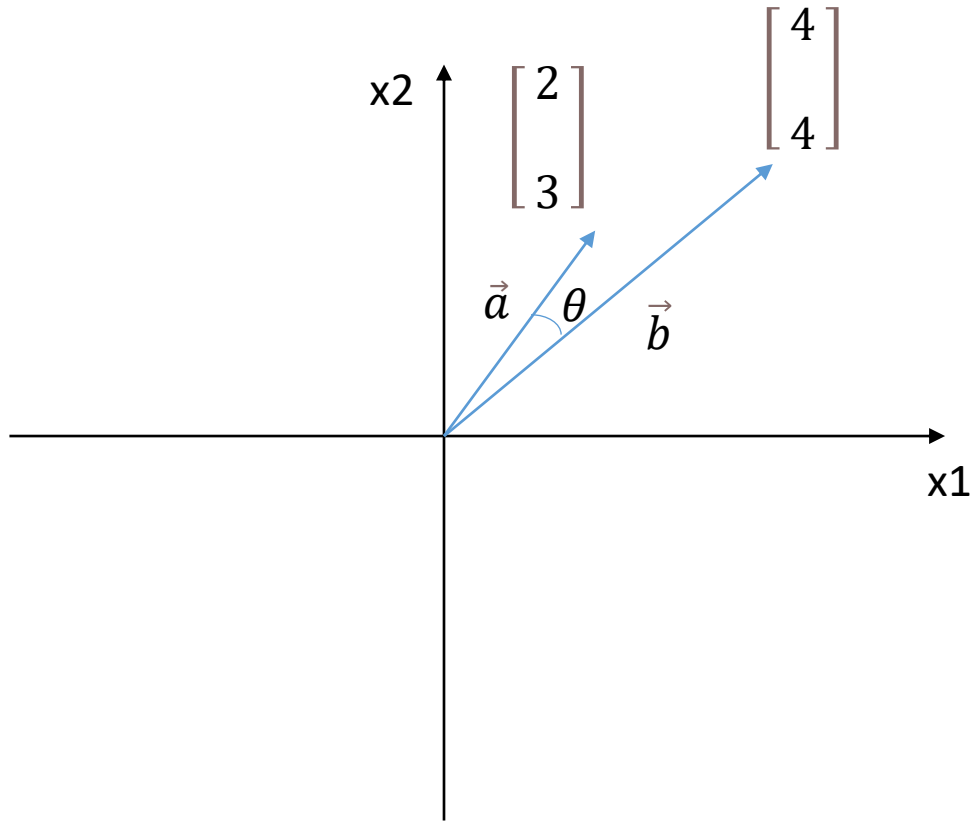
## Dot Product of 2 Vectors



$$\begin{bmatrix} 2 \\ 3 \end{bmatrix} \bullet \begin{bmatrix} 4 \\ 4 \end{bmatrix} = (2 \times 4) + (3 \times 4) = 20$$

$$\vec{a} \cdot \vec{b} = |\vec{a}| |\vec{b}| \cos \theta$$

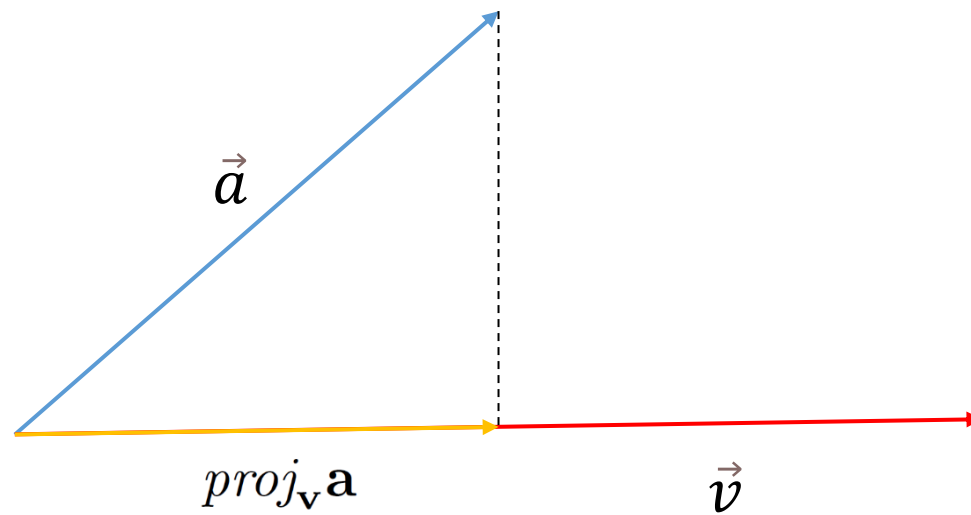
## Cross Product of 2 Vectors



$$\vec{a} \times \vec{b} = |\vec{a}| |\vec{b}| \sin \theta$$

$$\vec{a} \times \vec{b} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ a_x & a_y & a_z \\ b_x & b_y & b_z \end{vmatrix} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ 2 & 3 & 0 \\ 4 & 4 & 0 \end{vmatrix} = \mathbf{i}(3 \cdot 0 - 0 \cdot 4) - \mathbf{j}(2 \cdot 0 - 0 \cdot 4) + \mathbf{k}(2 \cdot 4 - 3 \cdot 4) = \mathbf{i}(0 - 0) - \mathbf{j}(0 - 0) + \mathbf{k}(8 - 12) = \{0; 0; -4\}$$

## Projection of Vector



$$proj_{\vec{v}} \vec{a} = \frac{\vec{a} \cdot \vec{v}}{\|\vec{v}\|^2} \vec{v}$$