$\cos\theta = \frac{0}{(2)(2)} = 0 \Rightarrow \cos\theta = 90^\circ$

## EXERCISE

1. Given the two Vectors:
$\vec{OA} = i + 5j$ and $\vec{OB} = 5i - j$
Find: a) The magnitude and direction of each Vector
b) Determine if the Vectors are parallel or perpendicular.

2. A point P(4, 2) is on a Cartesian plane. Given a position Vector $\vec{OA} = 2i + 4j$ and using a scale of 1cm for 1unit on both axes

a) Draw Vectors $\vec{OA}$, and $\vec{PB}$, where $\vec{OA} = \vec{PB}$
b) Write down the coordinates of B. Join the points to obtaine OABP.
c) Name the figure
d) Express $\vec{OB}$ in terms of i and j and find its magnitude and direction.

Now the angle can be found by direct measurement if the vectors are represented in the diagram to scale. OR By calculation as follows

$V(\sqrt{3}, 1)$, $\theta_1 = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right) \Rightarrow \theta_1 = 30°$

$W(-1, \sqrt{3})$, $\theta_2 = \tan^{-1}\left(\frac{\sqrt{3}}{-1}\right) + 180°$, $\theta_2 =$

$\theta_2 = -60° + 180° \Rightarrow \theta_2 = 120°$

$\alpha = \theta_2 - \theta_1 = 120° - 30° \Rightarrow \alpha = 90°$

Hence $\overrightarrow{OV}$ and $\overrightarrow{OW}$ are perpendicular.

METHOD B: Dot Product = 0

$V(\sqrt{3}, 1)$, $W(-1, \sqrt{3})$

$V \cdot W = (\sqrt{3})(-1) + (1)(\sqrt{3}) = 0 + 0$

$\Rightarrow V \cdot W = 0$

Hence the vectors are perpendicular.

The Angle between two vectors can also be calculated using the formula

$$\cos\theta = \frac{W \cdot V}{|W||V|}$$

$\theta$ = Angle between the vectors

Using the above example.

$W \cdot V = V \cdot W = 0$

$|W| = \sqrt{(-1)^2 + (\sqrt{3})^2} = \sqrt{1+3} = \sqrt{4} = 2$

$|V| = \sqrt{(\sqrt{3})^2 + (1)^2} = \sqrt{3+1} = \sqrt{4} = 2$.