Vectors Magnitude - Direction Form

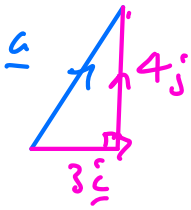
$\underline{i}$ is a unit vector in the x-direction (East)

$\underline{j}$ is a unit vector in the y-direction (North)

$\underline{k}$ is a unit vector in the z-direction (Vertically upwards)

Magnitude

Suppose $\underline{a} = 3\underline{i} + 4\underline{j}$



$|\underline{a}| = \sqrt{3^2+4^2} = 5$

Unit vector in same direction as $\underline{a}$

$$= \frac{\underline{a}}{|\underline{a}|} = \frac{1}{5}\underline{a}$$ in this case

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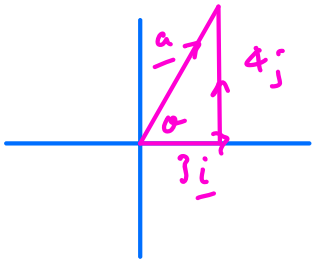
Find $\underline{a}$ in magnitude-direction form



$\theta = \tan^{-1}\frac{4}{3} = 53.1^\circ$

$\underline{a}$ has magnitude 5 and makes an angle of 53.1° with the positive x-axis

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Exercise 11c

1h) $|-4\underline{i} - \underline{j}| = \sqrt{(-4)^2+(-1)^2} = \sqrt{17}$

2c) $\underline{a} = \begin{pmatrix}2\\3\end{pmatrix}$ $\underline{b} = \begin{pmatrix}3\\-4\end{pmatrix}$ $\underline{c} = \begin{pmatrix}5\\-1\end{pmatrix}$

$$3\underline{b} - 2\underline{c} = 3\begin{pmatrix}3\\-4\end{pmatrix} - 2\begin{pmatrix}5\\-1\end{pmatrix}$$

$$= \begin{pmatrix}-1\\-10\end{pmatrix}$$

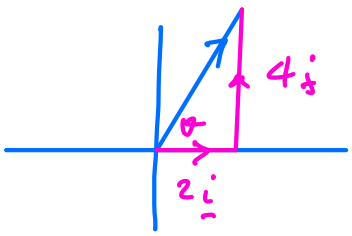
$$\left|\begin{pmatrix}-1\\-10\end{pmatrix}\right| = \sqrt{(-1)^2+(-10)^2} = \sqrt{101}$$

3d) $\underline{d} = \underline{i} - 3\underline{j}$ $|\underline{d}| = \sqrt{1^2+(-3)^2} = \sqrt{10}$

unit vector in direction of $\underline{d}$

$$= \frac{\underline{d}}{\sqrt{10}} = \frac{1}{\sqrt{10}}\underline{i} - \frac{3}{\sqrt{10}}\underline{j}$$

4d)

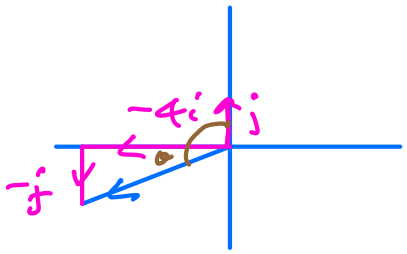


$\theta = \tan^{-1}\left(\frac{4}{2}\right)$

$\theta = 63.4°$

angle with +ve x-axis

5d)

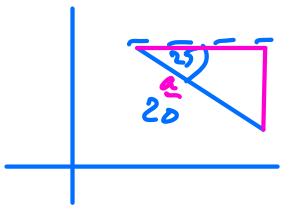


$\theta = \tan^{-1}\frac{1}{4} = 14.0°$

$\angle$ with $\underline{j}$ $= 90 + 14.0$

$= 104°$

6 c)



$\underline{a} = 20\cos 25\,\underline{i} - 20\sin 25\,\underline{j}$

$= 18.1\,\underline{i} - 8.45\,\underline{j}$

or $\begin{pmatrix} 18.1 \\ -8.45 \end{pmatrix}$

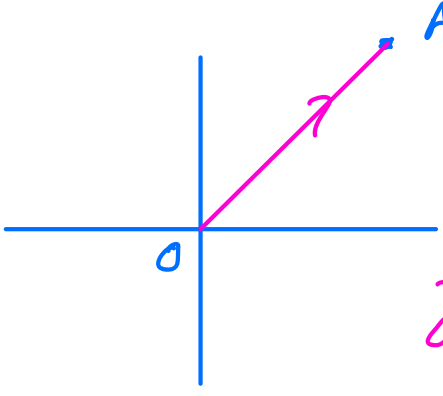
Classwork Q1a, Q2a, Q3a
Q4a, Q5a, Q6a

Position Vectors

The point A(7,10) has position vector $\begin{pmatrix} 7 \\ 10 \end{pmatrix}$

or $7\,\underline{i} + 10\,\underline{j}$

It is the vector from the origin O(0,0) to A(7,10)



$\overrightarrow{OA} = \begin{pmatrix} 7 \\ 10 \end{pmatrix}$

Exercise 11J

1) A(3,−1) B(4,5) C(−2,6)

a) i $\overrightarrow{OA} = 3\underline{i} - \underline{j}$ $\overrightarrow{OB} = 4\underline{i} + 5\underline{j}$ $\overrightarrow{OC} = -2\underline{i} + 6\underline{j}$

ii $\overrightarrow{AB} = \overrightarrow{AO} + \overrightarrow{OB} = \begin{pmatrix} -3 \\ 1 \end{pmatrix} + \begin{pmatrix} 4 \\ 5 \end{pmatrix} = \begin{pmatrix} 1 \\ 6 \end{pmatrix} = \underline{i} + 6\underline{j}$

iii $\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC} = \begin{pmatrix} -3 \\ 1 \end{pmatrix} + \begin{pmatrix} -2 \\ 6 \end{pmatrix} = \begin{pmatrix} -5 \\ 7 \end{pmatrix} = -5\underline{i} + 7\underline{j}$

Homework Exercise 11D
