11.3) Magnitude and direction

Worked example

Find the magnitude of the vector:

$3\boldsymbol{i} + 4\boldsymbol{j}$

$-5\boldsymbol{i} + 12\boldsymbol{j}$

$7\boldsymbol{i} - 24\boldsymbol{j}$

Your turn

Find the magnitude of the vector:

$-6\boldsymbol{i} - 8\boldsymbol{j}$

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Worked example

Find a unit vector in the direction of:

$$\boldsymbol{a} = 8\boldsymbol{i} + 15\boldsymbol{j}$$

$$\boldsymbol{b} = -9\boldsymbol{i} + 12\boldsymbol{j}$$

Your turn

Find a unit vector in the direction of:

$$\boldsymbol{c} = 3\boldsymbol{i} - 4\boldsymbol{j}$$

$$\hat{c} = \frac{1}{5}(3\boldsymbol{i} - 4\boldsymbol{j}) \text{ or } \begin{pmatrix} 0.6 \\ -0.8 \end{pmatrix}$$

Worked example

Given $\boldsymbol{a} = 8\boldsymbol{i} - 6\boldsymbol{j}$ and $\boldsymbol{b} = 9\boldsymbol{i} + 7\boldsymbol{j}$, find $|2\boldsymbol{b} - 3\boldsymbol{a}|$

Your turn

Given $\boldsymbol{a} = 5\boldsymbol{i} + 2\boldsymbol{j}$ and $\boldsymbol{b} = 3\boldsymbol{i} - 4\boldsymbol{j}$, find: $|4\boldsymbol{a} - 5\boldsymbol{b}|$

$\sqrt{809}$

Worked example

Find the angle between the vector $2\boldsymbol{i} + 3\boldsymbol{j}$ and the positive y-axis.

Your turn

Find the angle between the vector $4\boldsymbol{i} + 5\boldsymbol{j}$ and the positive x-axis.

$51.3°$ (3 sf)

Worked example

Vector $\boldsymbol{a}$ has magnitude 5 and make an angle of $60°$ with $\boldsymbol{i}$.
Find $\boldsymbol{a}$ in $\boldsymbol{i}, \boldsymbol{j}$ and column vector format.

Your turn

Vector $\boldsymbol{b}$ has magnitude 10 and make an angle of $30°$ with $\boldsymbol{j}$.
Find $\boldsymbol{b}$ in $\boldsymbol{i}, \boldsymbol{j}$ and column vector format.

$$\boldsymbol{b} = 5\boldsymbol{i} + 5\sqrt{3}\boldsymbol{j} = \begin{pmatrix} 5 \\ 5\sqrt{3} \end{pmatrix}$$

Worked example

A vector $\boldsymbol{a} = p\boldsymbol{i} + q\boldsymbol{j}$ has magnitude 68 and makes an angle θ with the positive x-axis where $\sin\theta = \frac{8}{17}$. Find all the possible vectors

Your turn

A vector $\boldsymbol{a} = p\boldsymbol{i} + q\boldsymbol{j}$ has magnitude 26 and makes an angle θ with the positive x-axis where $\sin\theta = \frac{5}{13}$. Find all the possible vectors

$p = 10, q = 24$

$p = 10, q = -24$

$p = -10, q = 24$

$p = -10, q = -24$

Worked example

In triangle PQR, $\overrightarrow{PQ} = \boldsymbol{i} + 2\boldsymbol{j}$ and $\overrightarrow{PR} = 8\boldsymbol{i} - 15\boldsymbol{j}$.

Find the area of triangle PQR

Your turn

In triangle PQR, $\overrightarrow{PQ} = 2\boldsymbol{i} + \boldsymbol{j}$ and $\overrightarrow{PR} = 9\boldsymbol{i} - 12\boldsymbol{j}$.

Find the area of triangle PQR

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