Chapter 3

GCSE and **A-Level Pure Mathematics**
Vectors I

Calculator Needed

3.1 Cartesian Form ⇒ Polar Form

Previously, the vector ***r*** was studied,

$$\boldsymbol{r} = \begin{pmatrix} 8.4 \\ -3.7 \end{pmatrix}$$

A vector written in this way is in ***Cartesian*** form.

By using

- A quick sketch
- The Theorem of Pythagoras,
- The *arctan* function

vector ***r*** rewrote was rewritten as a magnitude and a direction.

It turned out that ***r*** has a magnitude of 9.179, at an angle of 336.2°
A vector written in this way is in ***polar*** form.

3.2 Polar Form ⇒ Cartesian Form

Converting from ***polar*** form back into ***Cartesian*** form is the reverse of the problem studied last lesson. A simple, clear diagram avoids "obviously wrong answers".

Example

Convert the vector ***r***, of magnitude 9.179 and direction 336.2° into the form

$$\boldsymbol{r} = \begin{pmatrix} p \\ q \end{pmatrix}$$

Teaching Video: http://www.NumberWonder.co.uk/v9009/3.mp4

Watch the video before
writing out your answer.

☞

[4 marks]

3.3 Exercise

Any solution based entirely on graphical or numerical methods is not acceptable. Make the method used clear.

Marks available : 50

Question 1

Write each of the following vectors in the form $\begin{pmatrix} p \\ q \end{pmatrix}$

(i) Vector $\boldsymbol{a}$ of magnitude 32, and direction 160°.

[4 marks]

(ii) Vector $\boldsymbol{b}$ of magnitude 640, and direction 245°.

[4 marks]

(iii) Vector ***c*** of magnitude 145, and direction 110°.

[4 marks]

(iv) Vector ***d*** of magnitude 2.6, and direction 300°.

[4 marks]

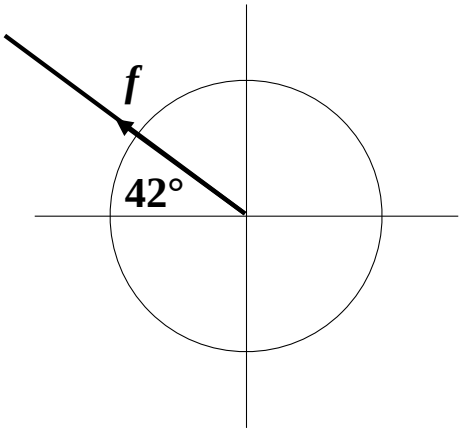
(v) Vector ***e*** of magnitude 13, and direction 72°.

[4 marks]

Question 2

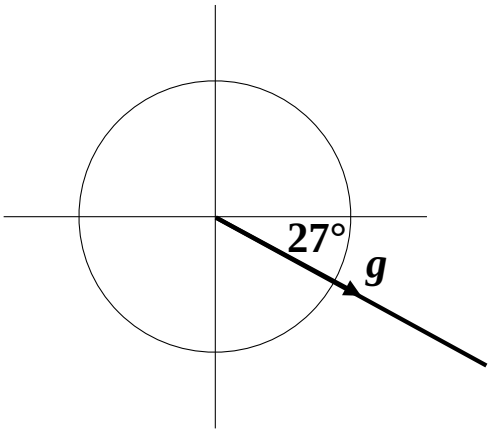
Express each of the vectors shown in the following diagrams in the form $\begin{pmatrix} p \\ q \end{pmatrix}$

(i) $|\boldsymbol{f}| = 32$



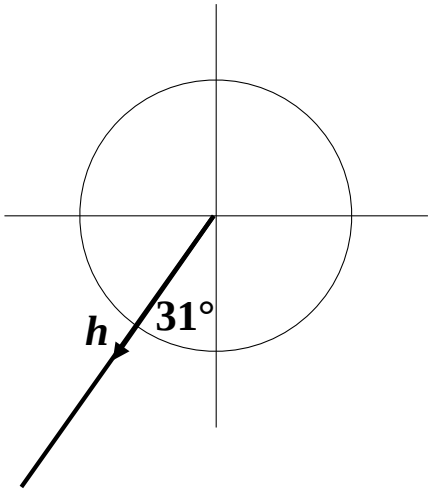
[4 marks]

(ii) $|\boldsymbol{g}| = 78$



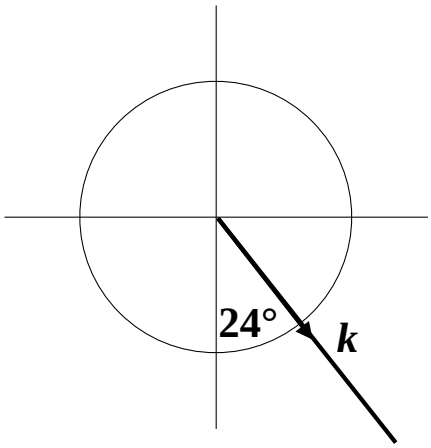
[4 marks]

(iii) $|\boldsymbol{h}| = 104$



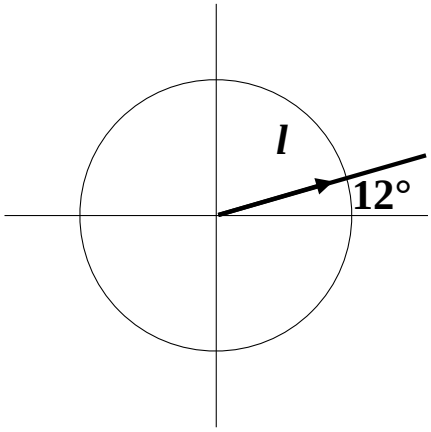
[4 marks]

(iv) $|\boldsymbol{k}| = 0.3$



[4 marks]

(v) $|\boldsymbol{l}| = 1700$



[4 marks]

Question 3

Two vectors are $\boldsymbol{a} = \begin{pmatrix} -7 \\ 3 \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$

Determine the magnitude and the direction of the vector $\boldsymbol{a} + \boldsymbol{b}$

[4 marks]

Question 4

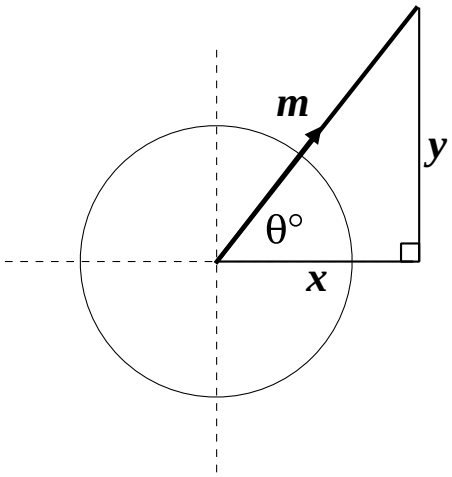
Two vectors are $\boldsymbol{c} = \begin{pmatrix} 17 \\ -3 \end{pmatrix}$ and $\boldsymbol{d} = \begin{pmatrix} 12 \\ 9 \end{pmatrix}$

Determine the magnitude and the direction of the vector $\boldsymbol{c} - \boldsymbol{d}$

[4 marks]

Question 5

In the right angled triangle, calculate, in terms of $|\boldsymbol{m}|$ and θ, the length of the sides marked x and y.



[2 marks]