

Vectors

Questions

1 For each of the vectors below find the magnitude and the angle the vector makes with the positive x axis.

- a) $(6\mathbf{i} + 3\mathbf{j})$ b) $(\mathbf{i} + 4\mathbf{j})$ c) $(-4\mathbf{i} + 3\mathbf{j})$ d) $(-5\mathbf{i} - 3\mathbf{j})$
 e) $(3\mathbf{i} - 2\mathbf{j})$

2 The table below gives the magnitude and direction of a number of vectors. Express each in the form $a\mathbf{i} + b\mathbf{j}$, where \mathbf{i} and \mathbf{j} are unit vectors in the direction Ox and Oy respectively.

Vector	Magnitude	Direction(as measured from positive x axis)
P	6	30°
Q	9	60°
R	4.5	150°
S	12	240°

3 Find the speed of a body moving with velocity $(6\mathbf{i} - 8\mathbf{j})\text{ms}^{-1}$

4 Find the speed of a body moving with velocity $(-3\mathbf{i} + 10\mathbf{j})\text{ms}^{-1}$

5 A particle is moving with velocity $(2\mathbf{i} + a\mathbf{j})\text{ms}^{-1}$ has speed 5.2ms^{-1} . Find the two possible values of a .

6 A particle has an initial position vector of $(6\mathbf{i} - 8\mathbf{j})\text{m}$. If the particle moves with constant velocity of $(5\mathbf{i} + 3\mathbf{j})\text{ms}^{-1}$, find its position vector after:

- a) 3 seconds b) 7 seconds.

- 7 How far is the particle in question 6 from the origin after 12 seconds?
- 8 A particle has initial position vector $(7\mathbf{i} + 5\mathbf{j})\text{m}$. The particle moves with constant velocity of $(2p\mathbf{i} + q\mathbf{j})\text{ms}^{-1}$ and after three seconds it has position vector $(-17\mathbf{i} - \mathbf{j})\text{ms}^{-1}$.
- 9 Given that $\mathbf{a} = 3\mathbf{i} + 6\mathbf{j}$ and $\mathbf{b} = -2\mathbf{i} + 5\mathbf{j}$, find the magnitude of each of the following and angle that they make with the positive x axis
a) $\mathbf{a} + \mathbf{b}$ b) $\mathbf{a} - \mathbf{b}$ c) $2\mathbf{a} - \mathbf{b}$ d) $4\mathbf{a} + 2\mathbf{b}$
- 10 Two joggers Chris (C) and Gwyneth (G) are moving with constant velocities across a level plane. At a certain instant Chris and Gwyneth have position vectors $(-60\mathbf{i} + 170\mathbf{j})$ and $(90\mathbf{i} - 100\mathbf{j})$ respectively. Thirty seconds later they meet at the point with position vector $(300\mathbf{i} + 20\mathbf{j})$.
a) find in vector form the velocity of C and G .
b) Calculate the magnitude of the velocity of C relative to G .
- 11 The velocities of two particles P and Q are $(a\mathbf{i} - 7\mathbf{j})\text{ms}^{-1}$ and $(5\mathbf{i} + b\mathbf{j})\text{ms}^{-1}$ respectively. The velocity of Q relative to P is $(2\mathbf{i} - 3\mathbf{j})\text{ms}^{-1}$. Find a and b .
- 12 The velocities of two particles P and Q are $(14\mathbf{i} + 7\mathbf{j})\text{ms}^{-1}$ and $(5\mathbf{i} + 12\mathbf{j})\text{ms}^{-1}$ respectively. Find:
a) the speed of Q .
b) the velocity of Q relative to P .
c) the angle between the velocity in part (b) and the vector \mathbf{j} .