

Write your name here

Surname

Other Names

AS/A Level Mathematics

2D Vectors

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled..
- Answer the questions in the spaces provided
– there may be more space than you need.
- You should show sufficient working to make your methods clear.
Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- The marks for **each** question are shown in brackets
– use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

1 Three forces $(3\mathbf{i} + 2p\mathbf{j})$ N, $(-2\mathbf{i} + 5\mathbf{j})$ N and $(4q\mathbf{i} + 5\mathbf{j})$ N act on a particle A .

Given A is in equilibrium find the values of p and q .

(Total for question 1 is 4 marks)

2 A particle P of mass 0.8kg moves under the action of a force F N.

The acceleration of P is $(-3\mathbf{i} + 5\mathbf{j})$.

(a) Find the angle between the acceleration and the vector \mathbf{i} . (2)

(b) Find the magnitude of F . (3)

(Total for question 2 is 5 marks)

3 A particle P of mass 2kg moves with constant acceleration under the action of a force F N.

The initial velocity of P is $(-2\mathbf{i} + 6\mathbf{j})$ ms⁻¹ and after 4 seconds the velocity of P is $(7\mathbf{i} + 2\mathbf{j})$ ms⁻¹.

Find, to three significant figures:

(a) the magnitude of the acceleration, (3)

(b) the angle between F and the vector \mathbf{i} . (3)

(Total for question 3 is 6 marks)

4 The resultant of two forces F_1 and F_2 is $(\mathbf{i} - 14\mathbf{j})$ N.

Given that $F_1 = (2p\mathbf{i} - 4q\mathbf{j})$ N and $F_2 = (3q\mathbf{i} + 4p\mathbf{j})$ N find the values of p and q .

(Total for question 4 is 5 marks)

5 A particle P moves with a constant velocity of $(4\mathbf{i} - \mathbf{j})$ ms⁻¹.

(a) Find the speed of P . (2)

(b) Find the direction of motion of P , giving your answer as a bearing. (3)

(Total for question 2 is 5 marks)

6 A particle P moves with constant acceleration $(3\mathbf{i} - 4\mathbf{j})$ ms⁻².

At time $t = 0$, P has speed u ms⁻¹

At time $t = 3$, P has velocity $(-5\mathbf{i} + 2\mathbf{j})$ ms⁻¹

Find the value of u .

(Total for question 6 is 5 marks)

7 The resultant of two forces F_1 and F_2 is parallel to $\mathbf{i} + \mathbf{j}$.

Given that $F_1 = (3\mathbf{i} - 2\mathbf{j})$ N and $F_2 = (p\mathbf{i} + 2p\mathbf{j})$ N, where p is a positive constant.

Find the value of p .

(Total for question 7 is 5 marks)