Year 1 Applied Chapter: Forces and Motion – Vectors
Exam Questions (Total Marks 41)

Q1.

Two forces $\mathbf{F}_1$ and $\mathbf{F}_2$ act on a particle P.

The force $\mathbf{F}_1$ is given by $\mathbf{F}_1 = (-\mathbf{i} + 2\mathbf{j})$ N and $\mathbf{F}_2$ acts in the direction of the vector $(\mathbf{i} + \mathbf{j})$.

Given that the resultant of $\mathbf{F}_1$ and $\mathbf{F}_2$ acts in the direction of the vector $(\mathbf{i} + 3\mathbf{j})$,

(a) find $\mathbf{F}_2$

(7)

The acceleration of P is $(3\mathbf{i} + 9\mathbf{j})$ m s^{-2}. At time $t = 0$, the velocity of P is $(3\mathbf{i} - 22\mathbf{j})$ m s^{-1}

(b) Find the speed of P when $t = 3$ seconds.

(4)

(Total for question = 11 marks)

Q2.

Two forces $(4\mathbf{i} - 2\mathbf{j})$ N and $(2\mathbf{i} + q\mathbf{j})$ N act on a particle P of mass 1.5 kg. The resultant of these two forces is parallel to the vector $(2\mathbf{i} + \mathbf{j})$.

(a) Find the value of q.

(4)

At time $t = 0$, P is moving with velocity $(-2\mathbf{i} + 4\mathbf{j})$m s^{-1}.

(b) Find the speed of P at time $t = 2$ seconds.

(6)

(Total 10 marks)

Q3.

Two forces, $(4\mathbf{i} - 5\mathbf{j})$ N and $(p\mathbf{i} + q\mathbf{j})$ N, act on a particle P of mass m kg. The resultant of the two forces is **R**. Given that **R** acts in a direction which is parallel to the vector $(\mathbf{i} - 2\mathbf{j})$,

(a) find the angle between **R** and the vector **j**,

(3)

(b) show that $2p + q + 3 = 0$.

(4)

Given also that $q = 1$ and that P moves with an acceleration of magnitude $8\sqrt{5}$ m s^{-2},

(c) find the value of m.

(7)

(Total 14 marks)

Q4.
A particle is acted upon by two forces $\mathbf{F}_1$ and $\mathbf{F}_2$, given by

$\mathbf{F}_1 = (\mathbf{i} - 3\mathbf{j})$ N,

$\mathbf{F}_2 = (p\mathbf{i} + 2p\mathbf{j})$ N, where p is a positive constant.

(a) Find the angle between $\mathbf{F}_2$ and $\mathbf{j}$.

(2)

The resultant of $\mathbf{F}_1$ and $\mathbf{F}_2$ is $\mathbf{R}$. Given that $\mathbf{R}$ is parallel to $\mathbf{i}$,

(b) find the value of p.

(4)

(Total 6 marks)