Vector-ish problems

Question 1

Given that $\mathbf{u} = \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -1 \\ 2 \\ 4 \end{pmatrix}$, find $3\mathbf{u} - 2\mathbf{v}$ in component form.

Question 2

The point Q divides the line joining P(–1, –1, 0) to R(5, 2, –3) in the ratio 2 : 1. Find the coordinates of Q.

Question 3

A, B and C have coordinates (–3, 4, 7), (–1, 8, 3) and (0, 10, 1) respectively.

(*a*) Show that A, B and C are collinear.

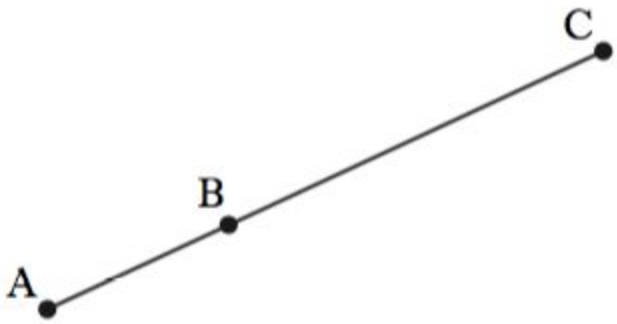
(*b*) Find the coordinates of D such that $\overrightarrow{AD} = 4\overrightarrow{AB}$.

Question 4

Relative to a suitable coordinate system A and B are the points (–2, 1, –1) and (1, 3, 2) respectively.

A, B and C are collinear points and C is positioned such that BC = 2AB.

Find the coordinates of C.



Question 5

E(–2, –1, 4), P(1, 5, 7) and F(7, 17, 13) are three collinear points.

P lies between E and F.

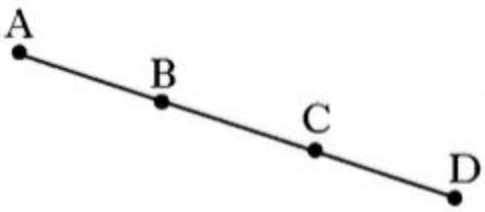
What is the ratio in which P divides EF?

Question 6

A and B are the points (–1, –3, 2) and (2, –1, 1) respectively.

B and C are the points of trisection of AD, that is AB = BC = CD.

Find the coordinates of D.



Question 7

The vector $\boldsymbol{u}$ has components $\begin{pmatrix} -3 \\ 0 \\ 4 \end{pmatrix}$.

Which of the following is a unit vector parallel to $\boldsymbol{u}$?

A $-\frac{3}{5}\boldsymbol{i}+\frac{4}{5}\boldsymbol{k}$

B $-3\boldsymbol{i}+4\boldsymbol{k}$

C $-\frac{3}{\sqrt{7}}\boldsymbol{i}+\frac{4}{\sqrt{7}}\boldsymbol{k}$

D $-\frac{1}{3}\boldsymbol{i}+\frac{1}{4}\boldsymbol{k}$

Question 8

P is the point $(-1, 2, -1)$ and Q is $(3, 2, -4)$.

(*a*) Write down $\overrightarrow{PQ}$ in component form.

(*b*) Calculate the length of $\overrightarrow{PQ}$.

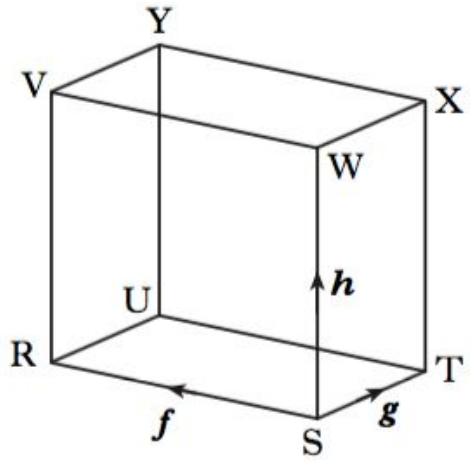
(*c*) Find the components of a unit vector which is parallel to $\overrightarrow{PQ}$.

Question 9

In the diagram RSTU, VWXY represents a cuboid.

$\overrightarrow{SR}$ represents vector $\boldsymbol{f}$, $\overrightarrow{ST}$ represents vector $\boldsymbol{g}$ and $\overrightarrow{SW}$ represents vector $\boldsymbol{h}$.

Express $\overrightarrow{VT}$ in terms of $\boldsymbol{f}$, $\boldsymbol{g}$ and $\boldsymbol{h}$.



Question 10

The diagram shows a square-based pyramid of height 8 units.

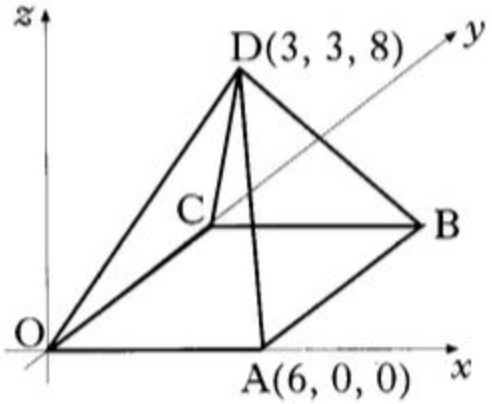
Square OABC has a side length of 6 units.

The coordinates of A and D are (6, 0, 0) and (3, 3, 8).

C lies on the y-axis.

(a) Write down the coordinates of B.

(b) Determine the components of $\overrightarrow{DA}$ and $\overrightarrow{DB}$.



Question 11

The diagram shows a cuboid OABC, DEFG.

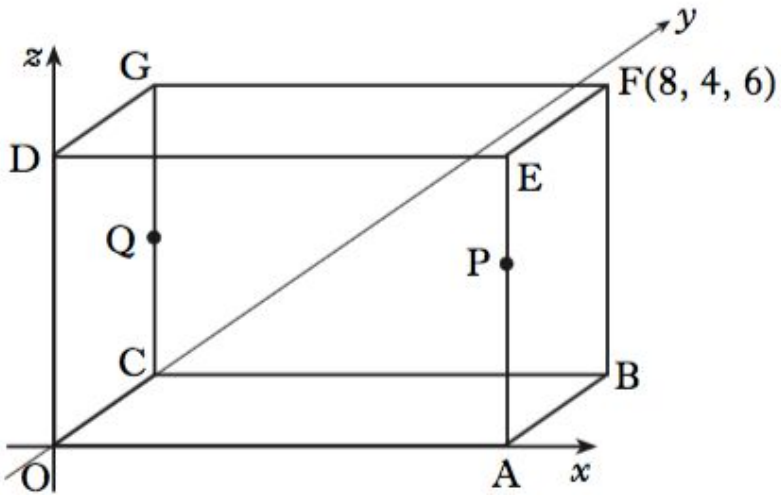
F is the point (8, 4, 6).

P divides AE in the ratio 2:1.

Q is the midpoint of CG.

(*a*) State the coordinates of P and Q.

(*b*) Write down the components of $\overrightarrow{PQ}$ and $\overrightarrow{PA}$.

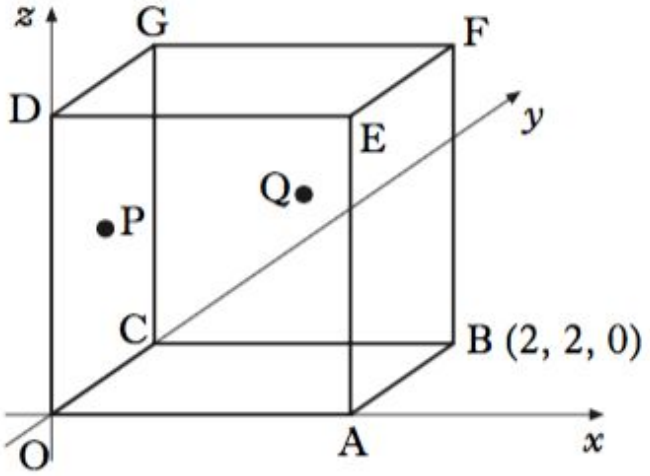


Question 12

OABCDEFG is a cube with side 2 units, as shown in the diagram.

B has coordinates (2, 2, 0).

P is the centre of face OCGD and Q is the centre of face CBFG.



(*a*) Write down the coordinates of G.

(*b*) Find $\boldsymbol{p}$ and $\boldsymbol{q}$, the position vectors of points P and Q.

Question 13

The diagram shows a cuboid OABC, DEFG.

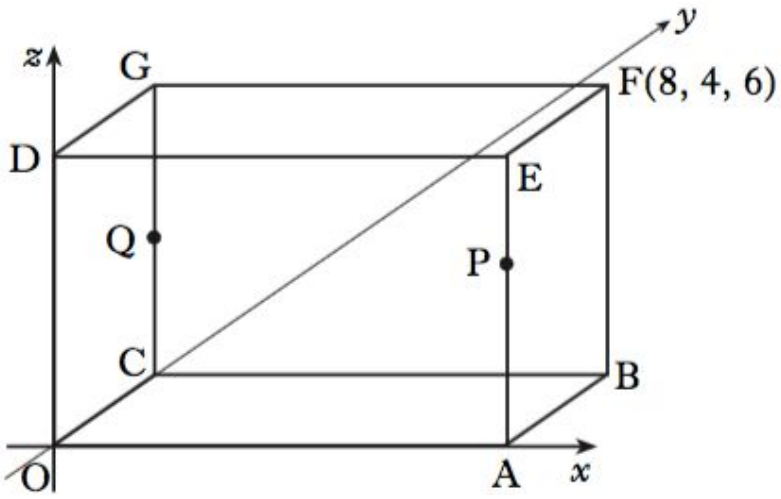
F is the point (8, 4, 6).

P divides AE in the ratio 2:1.

Q is the midpoint of CG.

(*a*) State the coordinates of P and Q.

(*b*) Write down the components of $\overrightarrow{PQ}$ and $\overrightarrow{PA}$.



Question 14

D,OABC is a pyramid. A is the point (12, 0, 0), B is (12, 6, 0) and D is (6, 3, 9).

F divides DB in the ratio 2:1.

(*a*) Find the coordinates of the point F. **4**

(*b*) Express $\overrightarrow{AF}$ in component form. **1**