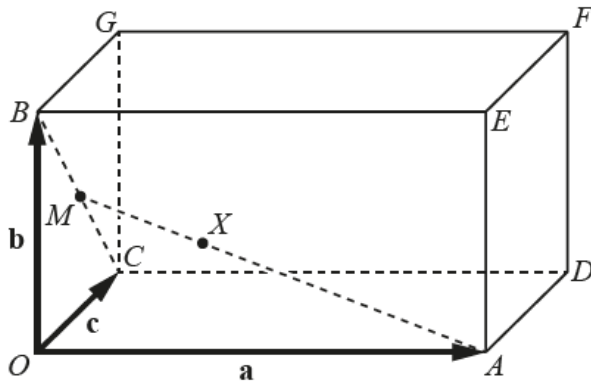


Vectors – 2021/20 GCE Pure Mathematics A**1. Nov/2021/Paper_H240/02/No.9**

Points A , B and C have position vectors \mathbf{a} , \mathbf{b} and \mathbf{c} relative to an origin O in 3-dimensional space. Rectangles $OADC$ and $BEFG$ are the base and top surface of a cuboid.



- The point M is the midpoint of BC .
- The point X lies on AM such that $AX = 2XM$.

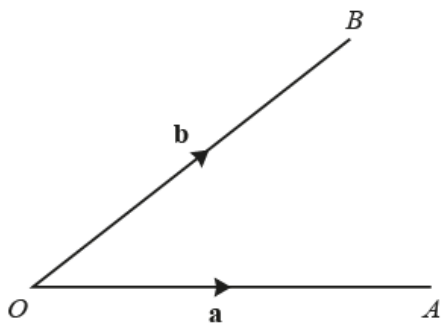
(a) Find \overrightarrow{OX} in terms of \mathbf{a} , \mathbf{b} and \mathbf{c} , simplifying your answer.

[4]

(b) Hence show that the lines OF and AM intersect.

[2]

2. Nov/2020/Paper_H240/01/No.5



The diagram shows points A and B , which have position vectors \mathbf{a} and \mathbf{b} with respect to an origin O . P is the point on OB such that $OP : PB = 3:1$ and Q is the midpoint of AB .

- (a) Find \overrightarrow{PQ} in terms of \mathbf{a} and \mathbf{b} . [2]

The line OA is extended to a point R , so that PQR is a straight line.

- (b) Explain why $\overrightarrow{PR} = k(2\mathbf{a} - \mathbf{b})$, where k is a constant. [2]
- (c) Hence determine the ratio $OA : AR$. [4]

3. Nov/2020/Paper_H240/02/No.7

A and B are fixed points in the x - y plane. The position vectors of A and B are \mathbf{a} and \mathbf{b} respectively.

State, with reference to points A and B , the geometrical significance of

(a) the quantity $|\mathbf{a} - \mathbf{b}|$, [1]

(b) the vector $\frac{1}{2}(\mathbf{a} + \mathbf{b})$. [1]

The circle P is the set of points with position vector \mathbf{p} in the x - y plane which satisfy

$$\left| \mathbf{p} - \frac{1}{2}(\mathbf{a} + \mathbf{b}) \right| = \frac{1}{2}|\mathbf{a} - \mathbf{b}|.$$

(c) State, in terms of \mathbf{a} and \mathbf{b} ,

(i) the position vector of the centre of P , [1]

(ii) the radius of P . [1]

It is now given that $\mathbf{a} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ and $\mathbf{p} = \begin{pmatrix} x \\ y \end{pmatrix}$.

(d) Find a cartesian equation of P . [4]