

**Vectors – 2022 A2 June**

1. **March/2022/Paper\_9709/32/No.10**

The points  $A$  and  $B$  have position vectors  $2\mathbf{i} + \mathbf{j} + \mathbf{k}$  and  $\mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$  respectively. The line  $l$  has vector equation  $\mathbf{r} = \mathbf{i} + 2\mathbf{j} - 3\mathbf{k} + \mu(\mathbf{i} - 3\mathbf{j} - 2\mathbf{k})$ .

- (a) Find a vector equation for the line through  $A$  and  $B$ . [3]

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- (b) Find the acute angle between the directions of  $AB$  and  $l$ , giving your answer in degrees. [3]

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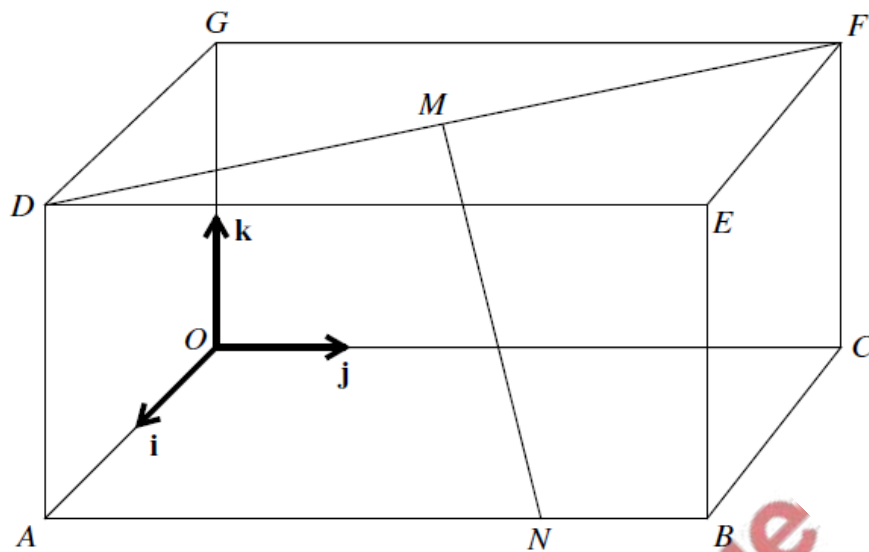
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In the diagram,  $OABCDEFG$  is a cuboid in which  $OA = 2$  units,  $OC = 4$  units and  $OG = 2$  units. Unit vectors  $\mathbf{i}$ ,  $\mathbf{j}$  and  $\mathbf{k}$  are parallel to  $OA$ ,  $OC$  and  $OG$  respectively. The point  $M$  is the midpoint of  $DF$ . The point  $N$  on  $AB$  is such that  $AN = 3NB$ .

- (a) Express the vectors  $\vec{OM}$  and  $\vec{MN}$  in terms of  $\mathbf{i}$ ,  $\mathbf{j}$  and  $\mathbf{k}$ . [3]

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- (b) Find a vector equation for the line through  $M$  and  $N$ . [2]

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(b) Given also that  $l$  and  $m$  are perpendicular, find the values of  $a$  and  $b$ .

[4]

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(c) When  $a$  and  $b$  have these values, find the position vector of the point of intersection of  $l$  and  $m$ . [2]

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- (c) Hence find the position vector of the reflection of  $A$  in  $l$ . [2]