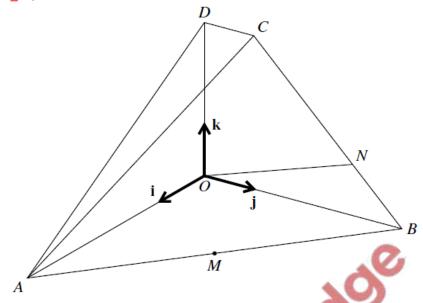
## <u>Vectors – 2022 A2 Nov Math</u>

(a)

1. Nov/2022/Paper\_9709\_31/No.11



In the diagram, OABCD is a solid figure in which OA = OB = 4 units and OD = 3 units. The edge OD is vertical, DC is parallel to OB and DC = 1 unit. The base, OAB, is horizontal and angle  $AOB = 90^{\circ}$ . Unit vectors  $\mathbf{i}$ ,  $\mathbf{j}$  and  $\mathbf{k}$  are parallel to OA, OB and OD respectively. The midpoint of AB is M and the point N on BC is such that CN = 2NB.

Express vectors $MD$ and $ON$ in terms of $\mathbf{i}$ , $\mathbf{j}$ and $\mathbf{k}$ .	[4]

<b>(b)</b>	Calculate the angle in degrees between the directions of $\overrightarrow{MD}$ and $\overrightarrow{ON}$ .	[3]
	.0	
(c)	Show that the length of the perpendicular from $M$ to $ON$ is $\sqrt{\frac{22}{5}}$ .	[4]
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<ol><li>Nov/2022/Paper_9709_32/No.6</li></ol>	2022/Paper 9709 32/	/No.6
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Relative to the origin O, the points A, B and C have position vectors given by

$$\overrightarrow{OA} = \begin{pmatrix} 1 \\ 3 \\ 1 \end{pmatrix}, \quad \overrightarrow{OB} = \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix} \quad \text{and} \quad \overrightarrow{OC} = \begin{pmatrix} 5 \\ 3 \\ -2 \end{pmatrix}.$$

(a)	Using a scalar product, find the cosine of angle BAC.	[4]
	Co	
	100	

<b>b</b> )	Hence find the area of triangle $ABC$ . Give your answer in a simplified exact form.					

<ol><li>Nov/2022/Paper_9709_33/No.9</li></ol>	3.	Nov/2022/	/Paper	9709	33/	/No.9
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With respect to the origin O, the position vectors of the points A, B and C are given by

$$\overrightarrow{OA} = \begin{pmatrix} 0 \\ 5 \\ 2 \end{pmatrix}, \quad \overrightarrow{OB} = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} \quad \text{and} \quad \overrightarrow{OC} = \begin{pmatrix} 4 \\ -3 \\ -2 \end{pmatrix}.$$

The midpoint of AC is M and the point N lies on BC, between B and C, and is such that BN = 2NC.

(a)	Find the position vectors of $M$ and $N$ .	[3]
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	16.0	
<b>(b)</b>	Find a vector equation for the line through $M$ and $N$ .	[2]
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