

- 1 The coefficients of x^2 and x^3 in the expansion of $(3 - 2x)^6$ are a and b respectively. Find the value of $\frac{a}{b}$. [4]

$$(3 - 2x)^6 = {}^6C_0 (3)^6 (-2x)^0 + {}^6C_1 (3)^5 (-2x)^1 + {}^6C_2 (3)^4 (-2x)^2$$

$$+ {}^6C_3 (3)^3 (-2x)^3 + \dots$$

$$= 729 - 2916x + 4860x^2 - 4320x^3 + \dots$$

$$\rightarrow a = 4860, \quad b = -4320 \quad \rightarrow \frac{a}{b} = -\frac{9}{8} \neq$$

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- 2 Relative to an origin O , the position vectors of points A and B are given by

$$\vec{OA} = \begin{pmatrix} 3 \\ -6 \\ p \end{pmatrix} \quad \text{and} \quad \vec{OB} = \begin{pmatrix} 2 \\ -6 \\ -7 \end{pmatrix},$$

and angle $AOB = 90^\circ$.

- (i) Find the value of p .

[2]

$$\vec{OA} \cdot \vec{OB} = 0 \rightarrow (3)(2) + (-6)(-6) + (p)(-7) = 0$$

$$\rightarrow 6 + 36 - 7p = 0 \rightarrow 7p = 42$$

$$\rightarrow p = 6 \quad \#$$

The point C is such that $\vec{OC} = \frac{2}{3}\vec{OA}$.

- (ii) Find the unit vector in the direction of \vec{BC} .

[4]

$$\vec{OC} = \frac{2}{3} \begin{pmatrix} 3 \\ -6 \\ 6 \end{pmatrix} = \begin{pmatrix} 2 \\ -4 \\ 4 \end{pmatrix} \rightarrow \vec{BC} = \vec{OC} - \vec{OB} = \begin{pmatrix} 2 \\ -4 \\ 4 \end{pmatrix} - \begin{pmatrix} 2 \\ -6 \\ -7 \end{pmatrix}$$

$$\rightarrow \vec{BC} = (0, 2, 11) \quad \rightarrow |\vec{BC}| = \sqrt{(0)^2 + (2)^2 + (11)^2} = \sqrt{125}$$

$$\rightarrow \text{Unit Vector of } \vec{BC} = \frac{1}{\sqrt{125}} (0, 2, 11)$$

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