



Homework Assignment
On VECTORS

1. The vector equations of the lines L_1 and L_2 are given by:

$$L_1: \quad \mathbf{r} = \mathbf{i} + 3\mathbf{j} + 5\mathbf{k} + \lambda(\mathbf{i} + 2\mathbf{j} - \mathbf{k})$$

$$L_2: \quad \mathbf{r} = -2\mathbf{i} + 3\mathbf{j} - 4\mathbf{k} + \mu(2\mathbf{i} + \mathbf{j} + 4\mathbf{k}),$$

where λ and μ are parameters.

- (a) Show that L_1 and L_2 intersect and find the coordinates of B , their point of intersection.
- (b) Show that L_1 is perpendicular to L_2 .

The point A with x -coordinate 4 lies on L_1 and the point C with x -coordinate 6 lies on L_2 .

- (c) Find, in its simplest form, the exact area of the triangle ABC .

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2. The points A and B have coordinates $(3, 9, -7)$ and $(13, -6, -2)$ respectively.

- (a) Find, in vector form, an equation for the line l which passes through A and B .
- (b) Show that the point C with coordinates $(9, 0, -4)$ lies on l .

The point D is the point on l closest to the origin, O .

- (c) Find the coordinates of D .
- (d) Find the area of triangle OAB to 3 significant figures.
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3. Referred to an origin O , the points A and B have position vectors given by:

$$\begin{aligned}\overrightarrow{OA} &= 7\mathbf{i} + 3\mathbf{j} + 8\mathbf{k} \\ \overrightarrow{OB} &= 5\mathbf{i} + 4\mathbf{j} + 6\mathbf{k}\end{aligned}$$

- (a) Show that the point P with position vector given by:

$$\overrightarrow{OP} = (5 - 2\lambda)\mathbf{i} + (4 + \lambda)\mathbf{j} + (6 - 2\lambda)\mathbf{k}$$

where λ is a parameter, lies on the straight line L passing through the points A and B .

- (b) Find the value of λ for which OP is perpendicular to L .

With centre O and radius OA , a circle is drawn to cut the line L at the points A and C .

- (c) Determine the position vector of C .
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4. A line l_1 passes through the point A , with position vector $5\mathbf{i} + 3\mathbf{j}$, and the point B , with position vector $-2\mathbf{i} - 4\mathbf{j} + 7\mathbf{k}$.

- (a) Write down an equation of the line l_1 .

A second line l_2 has equation $\mathbf{r} = \mathbf{i} - 3\mathbf{j} - 4\mathbf{k} + \mu(\mathbf{i} + 2\mathbf{j} + 3\mathbf{k})$, where μ is a parameter.

- (b) Show that l_1 and l_2 are perpendicular to each other.

- (c) Show that the two lines meet, and find the position vector of the point of intersection.

The point C has position vector $2\mathbf{i} - \mathbf{j} - \mathbf{k}$.

- (d) Show that C lies on l_2 .

The point D is the image of C after reflection in the line l_1 .

- (e) Find the position vector of D .
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