

7. Relative to a fixed origin O , the position vectors of the points A , B and C are

$$\vec{OA} = -3\mathbf{i} + \mathbf{j} - 9\mathbf{k}, \quad \vec{OB} = \mathbf{i} - \mathbf{k}, \quad \vec{OC} = 5\mathbf{i} + 2\mathbf{j} - 5\mathbf{k} \text{ respectively.}$$

(a) Find the cosine of angle ABC .

(4)

The line L is the angle bisector of angle ABC .

(b) Show that an equation of L is $\mathbf{r} = \mathbf{i} - \mathbf{k} + t(\mathbf{i} + 2\mathbf{j} - 7\mathbf{k})$.

(4)

(c) Show that $|\vec{AB}| = |\vec{AC}|$.

(2)

The circle S lies inside triangle ABC and each side of the triangle is a tangent to S .

(d) Find the position vector of the centre of S .

(7)

(e) Find the radius of S .

(5)