9D Acute Angles Between Lines & Planes

1. The lines l_1 and l_2 have vector equations:

$$\boldsymbol{r} = (2\boldsymbol{i} + \boldsymbol{j} + \boldsymbol{k}) + t(3\boldsymbol{i} - 8\boldsymbol{j} - \boldsymbol{k})$$

and

$$\boldsymbol{r} = (7\boldsymbol{i} + 4\boldsymbol{j} + \boldsymbol{k}) + s(2\boldsymbol{i} + 2\boldsymbol{j} + 3\boldsymbol{k})$$

Given that l_1 and l_2 intersect, find the size of the acute angle between the lines, to 1 decimal place.

r.n = k for equation of a plane notes

2. The plane Π passes through the point A and is perpendicular to the vector $\boldsymbol{n}$.
   Given that $\overrightarrow{OA} = \begin{pmatrix} 2 \\ 3 \\ -5 \end{pmatrix}$ and $\boldsymbol{n} = \begin{pmatrix} 3 \\ 1 \\ -1 \end{pmatrix}$, with O being the origin, find an equation of the plane:

a) In scalar product form

b) In Cartesian form

3. Find the acute angle between the line $\boldsymbol{l}$ with equation:

$$\boldsymbol{r} = 2\boldsymbol{i} + \boldsymbol{j} - 5\boldsymbol{k} + \lambda(3\boldsymbol{i} + 4\boldsymbol{j} - 12\boldsymbol{k})$$

and the plane with equation:

$$\boldsymbol{r}.(2\boldsymbol{i} - 2\boldsymbol{j} - \boldsymbol{k}) = 2$$

4. Find the acute angle between the planes with equations $\boldsymbol{r}.\begin{pmatrix}4\\4\\-7\end{pmatrix}=13$ and $\boldsymbol{r}.\begin{pmatrix}7\\-4\\4\end{pmatrix}=6$.