Section 3: The equation of a plane

Crucial points

1. **Make sure you know the form of the equation of a plane**
   The equation of the plane is $n_1x+n_2y+n_3z+d=0$ where $d=-\mathbf{a}\cdot\mathbf{n}$.
   The coefficients n_1, n_2 and n_3 give the direction vector normal to the plane and $\mathbf{a}$ is the position vector of a point on the plane.

2. **Remember that you can check whether a point lies on a plane by substituting the coordinates into the equation of the plane.**

3. **Make sure you know the different forms of the equation of a plane**
   In scalar product form: $\mathbf{r}.\mathbf{n}=\mathbf{a}.\mathbf{n}$
   In Cartesian form: $n_1x+n_2y+n_3z=d$ where $d=\mathbf{a}\cdot\mathbf{n}$.
   In both these cases $\mathbf{n}$ is a vector normal to the plane and $\mathbf{a}$ is the position vector of a point on the plane.
   In vector form: $\mathbf{r}=\mathbf{a}+\lambda\mathbf{b}+\mu\mathbf{c}$
   where $\mathbf{a}$ is the position vector of a point on the plane and $\mathbf{b}$ and $\mathbf{c}$ are both vectors which lie in the plane.

4. **Remember how to recognise the normal vector to a plane from its equation**
   For a plane with Cartesian equation $ax+by+cz=d$, the normal vector to the plane is $\begin{pmatrix} a \\ b \\ c \end{pmatrix}$.
   This is fundamental to all of your vector work. Make sure you know and understand it.

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