Geometry 1

1. Write down the vector equation of a straight line through $\mathbf{r}_1 = 3\mathbf{i} + 4\mathbf{j}$ and $\mathbf{r}_2 = 8\mathbf{i} - 5\mathbf{j}$.
   Show that the equation can be written in the form $\frac{x-3}{5} = -\frac{y-4}{9}$.

2. Write down the vector equation of a straight line of gradient 3 with an intercept on the y-axis at $y = -2$. Obtain the Cartesian (x-y) form as well.

3. Find direction ratios for each line and hence the associated direction cosines.

4. Find the unit normal vector to each line.

5. Find the angle between the two lines and the angle between the two normals.

6. Find the perpendicular distance from the origin to each of the lines.

7. Write down the vector equation of a straight line through $\mathbf{r}_3 = 2\mathbf{i} + \mathbf{j} - 3\mathbf{k}$ and $\mathbf{r}_4 = 7\mathbf{i} - 2\mathbf{j} + 4\mathbf{k}$.
   Show that the equation can be written in the form $\frac{x-2}{5} = \frac{y-1}{-3} = \frac{z+3}{7}$.