Question 17 **(7 marks)**

Plane Π is represented by the equation: $\underset{\sim}{r} = \begin{pmatrix} 3 \\ 1 \\ 5 \end{pmatrix} + \lambda \begin{pmatrix} -2 \\ 2 \\ 3 \end{pmatrix} + \mu \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix}$.

(a) Determine $\begin{pmatrix} -2 \\ 2 \\ 3 \end{pmatrix} \times \begin{pmatrix} 2 \\ 1 \\ 0 \end{pmatrix}$ and describe what this represents. (1 mark)

(b) Show that the equation of plane Π can be written as $x - 2y + 2z = 11$. (2 marks)

Consider sphere S with its centre at point $A\ (3, 4, -1)$.

(c) Determine the Cartesian equation for S if plane Π is tangential to this sphere. (4 marks)