1a)

$$\langle 1,3,1\rangle \times \langle 2,-1,5\rangle = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 3 & 1 \\ 2 & -1 & 5 \end{vmatrix} = \begin{vmatrix} 3 & 1 \\ -1 & 5 \end{vmatrix}\hat{i} - \begin{vmatrix} 1 & 1 \\ 2 & 5 \end{vmatrix}\hat{j} + \begin{vmatrix} 1 & 3 \\ 2 & -1 \end{vmatrix}\hat{k} = \boxed{16\hat{i} - 3\hat{j} - 7\hat{k}}$$

1b)

$$(\hat{i} + 2\hat{j}) \times (2\hat{i} - 3\hat{j}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 0 \\ 2 & -3 & 0 \end{vmatrix} = \begin{vmatrix} 2 & 0 \\ -3 & 0 \end{vmatrix}\hat{i} - \begin{vmatrix} 1 & 0 \\ 2 & 0 \end{vmatrix}\hat{j} + \begin{vmatrix} 1 & 2 \\ 2 & -3 \end{vmatrix}\hat{k} = \boxed{-7\hat{k}}$$

2)

$$A = \left| \left(\langle 1,2,1\rangle - \langle 3,1,6\rangle \right) \times \left(\langle 2,5,2\rangle - \langle 1,2,1\rangle \right) \right|$$

$$= \left| \langle -2,1,-5\rangle \times \langle 1,3,1\rangle \right|$$

$$= \left| \det \begin{pmatrix} \hat{i} & \hat{j} & \hat{k} \\ -2 & 1 & -5 \\ 1 & 3 & 1 \end{pmatrix} \right|$$

$$= \left| \begin{vmatrix} 1 & -5 \\ 3 & 1 \end{vmatrix}\hat{i} - \begin{vmatrix} -2 & -5 \\ 1 & 1 \end{vmatrix}\hat{j} + \begin{vmatrix} -2 & 1 \\ 1 & 3 \end{vmatrix}\hat{k} \right|$$

$$= \left| \langle 16,-3,-7\rangle \right|$$

$$= \sqrt{16^2 + (-3)^2 + (-7)^2}$$

$$= \boxed{\sqrt{314}}$$