1. (3 points) Find vector equations for the line passing through the two points with position vectors \( \mathbf{r}_1 \), \( \mathbf{r}_2 \) and the plane through the three (not co-linear) points with position vectors \( \mathbf{r}_1 \), \( \mathbf{r}_2 \) and \( \mathbf{r}_3 \). Sketch them separately.

2. (3 points) In this problem \( \mathbf{e}_j \), \( j = 1, 2, 3 \) is an orthonormal right-handed basis and when indices are repeated, ESC is implied. Are the following statements true or false? (No justification needed)

   (a) \( (a_j \mathbf{e}_j) \times (b_i \mathbf{e}_i) = \epsilon_{ijk} a_i b_j \mathbf{e}_k \)

   (b) \( \epsilon_{ijk} \epsilon_{ijk} = 6 \)

   (c) \( \mathbf{a} \cdot (\mathbf{b} \times \mathbf{c}) = (\mathbf{c} \times \mathbf{a}) \cdot \mathbf{b} \)
3. (4 points) Prove that for any vectors $\vec{a}, \vec{b}, \vec{c}$ and $\vec{d}$, the following identity holds:

$$(\vec{a} \times \vec{b}) \cdot (\vec{c} \times \vec{d}) = (\vec{a} \cdot \vec{c})(\vec{b} \cdot \vec{d}) - (\vec{a} \cdot \vec{d})(\vec{b} \cdot \vec{c})$$