Problem 1: Find the following vectors, without using determinant, but by using the properties of cross products.

1. $(\hat{i} \times \hat{j}) \times \hat{k}$
2. $(\hat{i} + 2\hat{j}) \times (\hat{i} - \hat{j} + 2\hat{k})$

Problem 2: Let $P(0, -2, 0)$, $Q(4, 1, -2)$, $R(5, 3, 1)$ be points in the 3-D space.

1. Find the area of the triangle PQR.
2. Find a nonzero vector orthogonal to the plane passing through points P, Q and R.

Problem 3: Find the volume of the parallelepiped determined by the vectors

$$\vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$$

$$\vec{b} = -\hat{i} + \hat{j} + 2\hat{k}$$

$$\vec{c} = 2\hat{i} + \hat{j} + 4\hat{k}$$