1. (a) Show that the determinant of matrix $M$ is given by: 
$$\det M = \varepsilon_{ijk}M_{i1}M_{j2}M_{k3}.$$ 
(b) Show that 
$$\varepsilon_{ijk}M_{in}M_{jn}M_{kr} = \varepsilon_{mnr}\varepsilon_{ijk}M_{i1}M_{j2}M_{k3}.$$ 
(c) Prove that the determinant of an orthogonal matrix $R$ is 1 ($\det R = 1$). 
(d) Now, show that $\hat{A} \times \hat{B}$ is a vector under an orthonormal coordinate transformation 
$$\hat{A} \rightarrow \hat{A}' = R\hat{A}, \quad \hat{B} \rightarrow \hat{B}' = R\hat{B}.$$ 
That is, show that $\hat{A} \times \hat{B}' = R(\hat{A} \times \hat{B})$. The book claims this is so on page 14, but equation 2.17 is no proof. Hint: Start with $\hat{A} \times \hat{B}'$ and substitute in the transformations. Insert a judicious choice of the identity matrix in the form $\delta_{pq} = R_{p},R_{q}^{T}$ (you’ll have to figure out the subscripts). Then use the identities in (a), (b) and (c) above.

2. Show that $\vec{V}(\nabla \cdot \vec{V})$ and $\nabla^{2}\vec{V}$ are fundamentally different by expressing these quantities in suffix notation.

3. Prove that 
$$\left(\hat{A} \times \hat{B}\right) \cdot (\hat{C} \times \hat{D}) = (\hat{A} \cdot \hat{C})(\hat{B} \cdot \hat{D}) - (\hat{A} \cdot \hat{D})(\hat{B} \cdot \hat{C}).$$

4. Pollack & Stump 2.6
5. Pollack & Stump 2.8
6. Pollack & Stump 2.9
7. Pollack & Stump 2.10
8. Pollack & Stump 2.11
9. Pollack & Stump 2.12
10. Pollack & Stump 2.13