From Griffiths: 1.4, 1.7, 1.20, 1.29, 1.32, 1.38, 1.42, 1.44, 1.47

1. Prove that $(\mathbf{A} \times \mathbf{B}) \cdot (\mathbf{C} \times \mathbf{D}) = (\mathbf{A} \cdot \mathbf{C})(\mathbf{B} \cdot \mathbf{D}) - (\mathbf{A} \cdot \mathbf{D})(\mathbf{B} \cdot \mathbf{C})$
2. Problem 1.12 with new function: $h(x, y) = 15(4x^2 - 4xy + 3y^2 + 16x - 29y - 11)$
3. Let $\mathbf{r} = x\hat{\mathbf{i}} + y\hat{\mathbf{j}} + z\hat{\mathbf{k}}$ and $r = |\mathbf{r}|$. Prove $\mathbf{A} \cdot \nabla\left(\frac{1}{r}\right) = -\frac{\mathbf{A} \cdot \mathbf{r}}{r^3}$
4. (a) Sketch a picture of the vector field $\mathbf{F}(\mathbf{r}) = \mathbf{r}$.
   (b) Calculate directly the flux of $\mathbf{F}(\mathbf{r})$ outward through the surface of the unit cube defined by $0 \leq x, y, z \leq 1$.
   (c) Calculate the flux using Gauss's theorem.