

# **PHYS 301**

## **HOMEWORK #5**

**Due : 20 Feb. 2015**

1. Use the properties of the Kronecker delta and the Levi - Civita permutation tensor to determine the numerical values of :

$$\text{a) } \delta_{ij} \delta_{jk} \delta_{km} \delta_{im} \quad \text{b) } \epsilon_{ijk} \epsilon_{ijk}$$

2. Use Einstein summation notation to prove the identity :

$$\nabla \cdot (f \mathbf{g}) = \mathbf{g} \cdot \nabla f + f (\nabla \cdot \mathbf{g})$$

where  $f$  is a scalar and  $\mathbf{g}$  is a vector.

3. If  $\mathbf{r}$  is the position vector :

$$\mathbf{r} = x \hat{\mathbf{x}} + y \hat{\mathbf{y}} + z \hat{\mathbf{z}}$$

and  $r$  represents the magnitude of the position vector, use the identity in problem 2 to evaluate

$$\nabla \cdot (r^3 \mathbf{r})$$

4. Use Einstein summation notation to determine the value of :

$$\mathbf{A} \cdot (\mathbf{B} \times \mathbf{A})$$