

PHYS 301

Homework #1

Due : 25 January 2012

For all homework assignments this term, include complete and clear solutions with your answers. Assigned credit will be determined by both the accuracy of your answer and the completeness and clarity of the logic you employ in reaching your final result.

1. Consider a vector **A** of magnitude A making an angle θ above the positive x axis. Consider a vector **B** of magnitude B in the fourth quadrant making an angle ϕ below the positive x axis. Use the definitions and properties of the cross and dot products to show that :

$$\begin{aligned}\cos(\theta + \phi) &= \cos \theta \cos \phi - \sin \theta \sin \phi \\ \sin(\theta + \phi) &= \sin \theta \cos \phi + \sin \phi \cos \theta\end{aligned}$$

2. Consider the scalar function :

$$\phi = x y z + x^2 y^2 z^2$$

- a) Find the gradient of ϕ ; i.e., $\nabla \phi$.
- b) Find the divergence of $\nabla \phi$, i.e., $\nabla \cdot \nabla \phi$
- c) Find the curl of $\nabla \phi$, i.e., $\nabla \times (\nabla \phi)$

5 Pts for each part.

3. Boas, p. 307, no. 4 parts a) and b) . Ten points for each part.

4. Evaluate numerically

$$\delta_{ij} \delta_{jk} \delta_{km} \delta_{im}$$

where the δ are Kronecker deltas.