

PHYS 301

HOMework #1

Due : 20 Jan. 2017

Please read carefully the course syllabus and especially the formatting guidelines for homework. All homework assignments must be submitted in hard copy at the beginning of class on the day they are due. You must show complete work for all your solutions.

1. Consider the unit cube with opposite vertices at $(0, 0, 0)$ and $(1, 1, 1)$. Find the angle between the vector from the origin to $(1, 1, 1)$ and the vector from the origin to $(1, 1, 0)$.
2. Position vector P has scalar length P lies in the first quadrant making an angle θ above the x axis. Position vector Q has scalar length Q lies in the fourth quadrant making an angle ϕ below the x axis. Use the properties of the cross product to derive the sin addition formula :

$$\sin(\theta + \phi) = \sin \theta \cos \phi + \sin \phi \cos \theta$$

3. A force F acting in the $x - y$ plane is described by :

$$\mathbf{F} = y \hat{\mathbf{x}} - x \hat{\mathbf{y}}$$

Find the value of the line integral for this vector over the path given by $y = x^2$ from $x = 0$ to $x = 2$.

4. For all parts of this problem, surface S is the rectangle defined by $y \in [0, 2]$ and $z \in [0, 3]$ in the yz plane. Calculate the surface integrals

$$\iint_S \mathbf{f} \cdot d\mathbf{A}$$

where :

a) $\mathbf{f} = 10 \hat{\mathbf{x}}$

b) $\mathbf{f} = -10 \hat{\mathbf{x}}$

c) $\mathbf{f} = 10 \hat{\mathbf{x}} + 6 \hat{\mathbf{y}} - 18 \hat{\mathbf{z}}$

- d) Find a non - zero vector \mathbf{f} such that the surface integral is zero. (There are both obvious and less obvious ways to accomplish this).

Five points for each part.