

King Fahd University of Petroleum and Minerals

Electrical Engineering Department

PROBLEM SESSION # 2

Problem 1.a) Find the surface integral of $\mathbf{F} = 5 \mathbf{a}_y$ over S , where S is a cubical surface 3 units of length of the side with a corner at the origin. One of the faces of the cube lies in the first quadrant of the x - y plane. **(b)** Repeat (a) for $\mathbf{F} = x^2 y^2 \mathbf{a}_x$.

Problem 2.a) Evaluate the surface integral of $\mathbf{F} = \frac{\mathbf{a}_r}{r^2}$ over the spherical surface of radius 4 centered at the origin. **(b)** Repeat part (a) for $\mathbf{F} = \frac{\sin^2 \phi}{r^2} \mathbf{a}_r + \cos \phi \mathbf{a}_\theta$. **(c)** Repeat part (a) for $\mathbf{F} = \mathbf{a}_x$.

Problem 3. Consider the conical surface S shown in figure 1. The cone has height h and base radius a . Evaluate the closed surface integral of the following vector fields: **(a)** $\mathbf{F} = r \mathbf{a}_r$. **(b)** $\mathbf{F} = r \mathbf{a}_\theta$. **(c)** $\mathbf{F} = \cos \phi \mathbf{a}_\phi + r \mathbf{a}_\theta$.

Problem 4. Consider the closed cylindrical surface of height h and base radius a as shown in figure 2. Evaluate the closed surface integral of \mathbf{F} over this surface if: **(a)** $\mathbf{F} = \rho^2 \mathbf{a}_\rho + \rho \sin \phi \mathbf{a}_\phi + \rho^2 \sin \phi \mathbf{a}_z$. **(b)** $\mathbf{F} = x \mathbf{a}_x + z \mathbf{a}_z$.

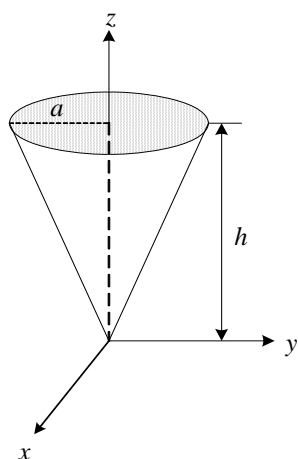


Figure 1: The surface for problem 3

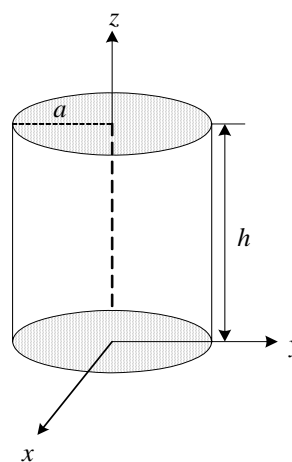


Figure 2: The surface for problem 4