

**THE CITADEL
THE MILITARY COLLEGE OF SOUTH CAROLINA**

Department of Electrical and Computer Engineering

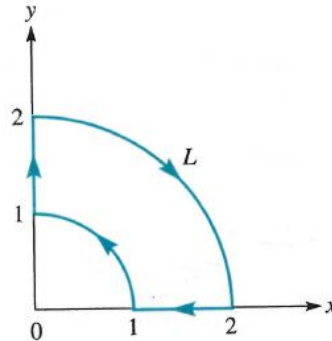
ELEC 318 Electromagnetic Fields

HW #2, due January 29, 2015

Reading Assignment: Chapter 3 (all)
Chapter 4 (through Section 4.3)

Written Assignment:

1. Given the vectors $\mathbf{A} = 2\hat{\mathbf{x}} + 4\hat{\mathbf{y}} + 10\hat{\mathbf{z}}$ and $\mathbf{B} = -5\hat{\mathbf{r}} + \hat{\phi} - 3\hat{\mathbf{z}}$, determine
 - (a) $\mathbf{A} + \mathbf{B}$ at $P(0, 2, -5)$ in the Cartesian system, and
 - (b) the angle between \mathbf{A} and \mathbf{B} at $P(0, 2, -5)$.
2. Let $\mathbf{H} = 5r \sin \phi \hat{\mathbf{r}} - rz \cos \phi \hat{\phi} + 2r \hat{\mathbf{z}}$. At point $P(2, 30^\circ, -1)$, determine
 - (a) the component of \mathbf{H} normal to $r = 2$, and
 - (b) the component of \mathbf{H} tangential to $\phi = 30^\circ$.
3. Determine the gradients of the following fields:
 - (a) $U = e^{x+2y} \cosh(z)$, and
 - (b) $T = \frac{3z}{r} \cos \phi$.
4. Given $\mathbf{F} = r^2 \sin \phi \hat{\mathbf{r}} + z \cos \phi \hat{\phi} + rz \hat{\mathbf{z}}$, calculate the total flux of \mathbf{F} outward through the hollow cylinder defined by $2 \leq r \leq 3, 0 \leq z \leq 5$.
5. Given $\mathbf{A} = r \sin \phi \hat{\mathbf{r}} + r^2 \hat{\phi}$, determine $\oint_L \mathbf{A} \cdot d\mathbf{l}$ if L is the path drawn in the figure.



6. Let $V = \frac{\sin \theta \cos \phi}{R}$. (a) Is ∇V conservative? (b) Is ∇V solenoidal? Why (not)?