

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

**Department of Electrical and Computer Engineering**

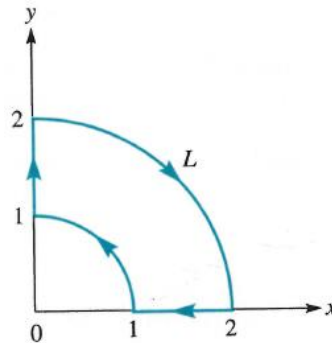
**ELEC 318 Electromagnetic Fields**

**HW #2, due January 29, 2015**

**Reading Assignment:** Chapter 3 (all)  
Chapter 4 (through Section 4.5)

**Written Assignment:**

1. Given the vectors  $\mathbf{A} = 2\hat{\mathbf{x}} + 4\hat{\mathbf{y}} + 10\hat{\mathbf{z}}$  and  $\mathbf{B} = -5\mathbf{r} + \hat{\phi} - 3\hat{\mathbf{z}}$ , 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  $\nabla V$  conservative? (b) Is  $\nabla V$  solenoidal? Why (not)?