3.15

$\vec{B} = (\hat{r}r\cos\phi + \hat{\phi}\sin\phi)$

$\oint B.dl = ?$

$\int_{\phi=\pi/2}^{0} \sin\phi r d\phi = -1$

$\int_{r=1}^{2} r\cos\phi dr = \frac{3}{2}$

$\int_{\phi=1}^{\pi/2} \sin\phi r d\phi = 2$

$\int_{r=2}^{1} r\cos\phi dr = 0$

$\oint \vec{B}.d\vec{l} = -1 + \frac{3}{2} + 2 = \frac{5}{2}$

$$b)\nabla \times B = \frac{1}{r}\begin{vmatrix} \hat{r} & r\hat{\phi} & \hat{z} \\ \frac{\partial}{\partial r} & \frac{\partial}{\partial \phi} & \frac{\partial}{\partial z} \\ r\cos\phi & r\sin\phi & 0 \end{vmatrix} = \frac{1}{r}\hat{z}(\sin\phi + r\sin\phi) = \hat{z}\sin\phi(1+\frac{1}{r})$$

$$\int \nabla \times B.ds = \int_{\phi=0}^{\pi/2}\int_{r=1}^{2} \sin\phi(1+\frac{1}{r})rdrd\phi = \frac{5}{2}$$