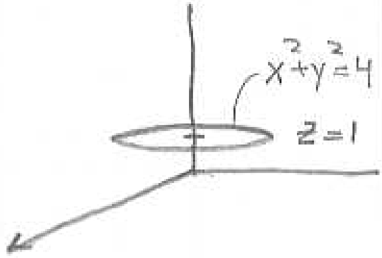
Page 912 #3

$\vec{F} = (z-2y)\vec{i} + (3x-4y)\vec{j} + (z+3y)\vec{k}$ $\quad$ C is $x^2+y^2=4$, $z=1$, counterclockwise



<u>Circulation</u> (From Ch 18)

$$\int_C \vec{F}\cdot d\vec{r} \qquad \vec{r} = \underset{x}{2\cos t}\,\vec{i} + \underset{y}{2\sin t}\,\vec{j} + \underset{z}{\vec{k}}$$

$$d\vec{r} = -2\sin t\,\vec{i} + 2\cos t\,\vec{j} + 0\vec{k}$$

$$= \int_C \left[(z-2y)(-2\sin t) + (3x-4y)(2\cos t)\right] dt$$

$$= \int_0^{2\pi} \left[(1-4\sin t)(-2\sin t) + (6\cos t - 8\sin t)(2\cos t)\right] dt$$

$$= \int_0^{2\pi} \left(-2\sin t + 8\sin^2 t + 12\cos^2 t - 16\sin t\cos t\right) dt$$

$$= \boxed{20\pi}$$

Circulation (from Ch 20)

$$\int_C \vec{F}\cdot d\vec{r} = \int_S \text{curl}\,\vec{F}\cdot d\vec{A} = \int_S \text{curl}\,\vec{F}\cdot\vec{k}\,dA$$

$$= \int_S (3\vec{i} + \vec{j} + 5\vec{k})\cdot\vec{k}\,dA = 5A = \boxed{20\pi}$$