

17.3

1) $F(x, y, z) = \langle z, x, y \rangle$

$$0 \leq x \leq 4 \quad 0 \leq y \leq 2$$

$$0 \leq z \leq 3$$

$$\text{divergence} = 0$$

2) $\text{div}(F) = 3$

$$\int_0^{2\pi} \int_0^1 \int_0^2 2 \, x \, dz \, dx \, dt$$

$$= 4\pi$$

$$5) F(x, y, z) = \left\langle 0, 0, \frac{z^3}{3} \right\rangle$$

$$\operatorname{Div}(F) = z^2$$

$$\rho = 0 \dots 1$$

$$\phi = 0 \dots \pi$$

$$\theta = 0 \dots 2\pi$$

$$\int_0^{2\pi} \int_0^{\pi} \int_0^1 \rho^2 \cos^2 \phi \rho \sin \phi \, d\rho \, d\phi \, d\theta$$

$$7) F = \langle x^2z, yx, xyz \rangle$$

$$\begin{aligned} \operatorname{Div}(F) &= x^2 + y^2 + z^2 \\ &= x^2 + z^2 \end{aligned}$$

$$\begin{aligned} \int_0^{2\pi} \int_0^2 \int_0^3 (x^2 + z^2) x \, dz \, dx \, d\theta \\ = 60\pi \end{aligned}$$

$$11) \operatorname{div}(F) = 3x^2 + 3z^2$$

$$0 \leq \rho \leq 2 \quad = 3(\rho^2 \sin^2 \phi \cos^2 \theta$$

$$0 \leq \phi \leq \pi/2 \quad + \rho^2 \cos^2 \phi)$$

$$0 \leq \theta \leq \pi/2$$

$$\int_0^{\pi/2} \int_0^{\pi/2} \int_0^2 3r^4 (\sin^2 \phi \cos^2 \theta + \cos^2 \phi) \cdot \sin \phi$$

$$= \frac{32\pi}{5}$$

15) $\text{Dir} = 2$

$$r = 0..3$$

$$\theta = 0..2\pi$$

$$z = 0..9-r^2$$

$$= \int_0^{2\pi} \int_0^3 \int_0^{9-r^2} 2 \cdot r \, dz \, dr \, d\theta$$

$$= 81\pi$$