19.4

2:

- Direct Calculation:

$$\begin{aligned}\int_S \vec{F}\cdot d\vec{A} &= \int_0^{2\pi}\int_{-1}^{1} \sin\theta \ dz \ d\theta \\ &= 0\end{aligned}$$

- Divergence Theorem:

$$\begin{aligned}\int_S \vec{F}\cdot d\vec{A} &= \int_{-1}^{1}\int_0^{2\pi}\int_0^{1} \ dr \ d\theta \ dz \\ &= 0\end{aligned}$$

4:

6:

$$\begin{aligned}\int_S \vec{F}\cdot d\vec{A} &= \int_V 10dV \\ &= 240.\end{aligned}$$

8:

$$\begin{aligned}\int_S \vec{H}\cdot d\vec{A} &= \int_0^4\int_0^3\int_0^2 (y) \ dx \ dy \ dz \\ &= \int_0^4\int_0^3 2y \ dy \ dz \\ &= \int_0^4 9 \ dz \\ &= 36.\end{aligned}$$

10:

$$\begin{aligned}\int_S \vec{N}\cdot d\vec{A} &= \int_V \nabla\cdot\vec{N} \ dV \\ &= 0.\end{aligned}$$

14:

$$\begin{aligned}\int_S \vec{F}\cdot d\vec{A} &= \int_V \nabla\cdot\vec{F} \ dV \\ &= \int_V x+y+z \ dV \\ &= \int_0^{\pi}\int_0^{2\pi}\int_0^1 \rho(\sin\phi\cos\theta+\sin\phi\sin\theta+\cos\phi) \ \rho^2\sin\phi \ d\rho \ d\theta \ d\phi \\ &= 0\end{aligned}$$

16:

$$\begin{aligned}\int_S \vec{F}\cdot d\vec{A} &= \int_V \nabla\cdot\vec{F}d\vec{V} \\ &= \int_0^{\pi/4}\int_0^{2\pi}\int_2^3 3\rho^4\sin\phi \ d\rho \ d\theta \ d\phi \\ &= \frac{633(2-\sqrt{2})\pi}{5}\end{aligned}$$

22:

20.1

6:

$$\int_C \vec{F} \cdot d\vec{r} =$$

8:

10:

12:

22:

24:

20.2

2:

4:

10:

12:

28:

34:

20.3

4:

6:

8:

24:

28: