18.1

2: Positive.

4: Positive.

6: Zero.

8:

$$\int_C \vec{F} \cdot d\vec{r} = \int_0^5 2 \; dx$$
$$= 10$$

20:

$$\int_C \begin{pmatrix} 2x \\ 3y \end{pmatrix} \cdot d\vec{r} = 0$$

28:

- C_1: Positive.
- C_2: Zero.
- C_3: Zero.

30:

- C_1: Zero.
- C_2: Zero.
- C_3: Zero.

48: $\int_{C_2} 3\vec{G} \cdot d\vec{r} = 45$

50: $\int_{C_1+C_2} (\vec{G} - \vec{F}) \cdot d\vec{r} = 15$

18.2

2:

$$\int_C \vec{F} \cdot d\vec{r} = \int_{\pi/2}^{-\pi/2} \cos^2(t) - \sin^2(t) \; dt$$

10:

$$\int_C \vec{F} \cdot d\vec{r} = \int_1^5 2t \; dt$$
$$= 24$$

12:

$$\int_C \vec{F} \cdot d\vec{r} = -\int_0^{\pi/2} dt$$
$$= -\frac{\pi}{2}$$

14:

$$\int_C \vec{F} \cdot d\vec{r} = \int_0^2 2t\cos(t) - t^2\sin(t) \; dt$$
$$= 4\cos(2)$$

18:

$$\int_C \vec{F} \cdot d\vec{r} = \int_0^2 t + 5 \; dt$$
$$= 12$$

22:

$$\begin{aligned}\int_C \vec{F}\cdot d\vec{r} &= \int_0^{4\pi} 6\ dt\\ &= 24\pi\end{aligned}$$

24: (a)

$$\int_C 3dx + xydy = \int_C \begin{pmatrix}3\\ xy\end{pmatrix}\cdot d\vec{r}$$

(b)

$$\int_C \begin{pmatrix}100\cos x\\ e^y\sin x\end{pmatrix} = \int_C 100\cos x dx + e^y \sin x dy$$

30:

$$\begin{aligned}\int_C dx + ydy + zdz &= \int_0^{2\pi} 9t + \sin t(\cos t - 1)\ dt\\ &= `18\pi^2\end{aligned}$$

34:

$$\begin{aligned}\int_C xdy &= \int_0^{\pi/2} 2\cos^2 t - 2\sin t\ dt\\ &= \frac{1}{2}(\pi - 4)\end{aligned}$$

38:

$$\int_C \begin{pmatrix}x\\ y\end{pmatrix}\cdot d\vec{r} = 0$$

18.3

14:

$$\begin{aligned}\begin{pmatrix}\frac{\partial f}{\partial x}\\ \frac{\partial f}{\partial y}\end{pmatrix} &= \begin{pmatrix}2xy\\ x^2+8y^3\end{pmatrix}\\ f(x,y) &= x^2y + 2y^4\end{aligned}$$

16:

$$\begin{aligned}\int_C \vec{F}\cdot d\vec{r} &= \int_0^1 -4(4-4t)^2 + (15)(5t)^4\ dt\\ &= 1859\end{aligned}$$

18:

$$\begin{aligned}\int_C \vec{F}\cdot d\vec{r} &= f(3,1) - f(1,0)\\ &= 33\end{aligned}$$

20:

$$\begin{aligned}\int_C \vec{F}\cdot d\vec{r} &= f(2,3,-1) - f(1,1,1)\\ &= -10\end{aligned}$$

24:

$$\begin{aligned}\int_C \vec{F} \cdot d\vec{r} &= f(3, 18) - f(1, 2)\\ &= \sin(54) - \sin(2)\end{aligned}$$

30:

32: Since the partial derivative on y is not symmetric or antisymmetric in the same way that the partial derivative on x and z are, it cannot be the case that $\vec{F}$ is a gradient vector field.

38: