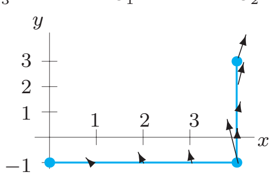
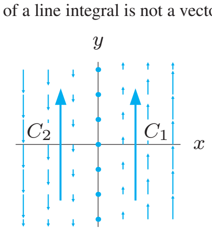
$(-0.0025e^{3t} + 1.0025e^{-t})\vec{i}$
$+(-0.005e^{3t} + 2.005e^{-t})\vec{j}$

Section 18.1

1 Negative
3 Zero
5 Zero
7 0
9 0
11 28
13 16
15 -48
17 $19/3$
19 20
21 28
23 C_1 is pos; C_2, C_3 are zero
25 C_1 is neg; C_2 is neg; C_3 is zero
27 $\int_{C_3} \vec{F} \cdot d\vec{r} < \int_{C_1} \vec{F} \cdot d\vec{r} < \int_{C_2} \vec{F} \cdot d\vec{r}$
29 (b)



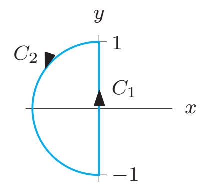
(c) 60
31 $a > 0$
33 $b < 0$
35 $c > 3$
37 0
39 Negative
41 0
43 Yes
49 $-GMm/8000$
51 Sphere of radius a centered at the origin
53 (a) $\phi(\vec{r}\,) = -\frac{Q}{4\pi\epsilon}\frac{1}{a} + \frac{Q}{4\pi\epsilon}\frac{1}{||\vec{r}\,||}$
(b) Because then $\phi(\vec{r}\,) = \frac{Q}{4\pi\epsilon}\frac{1}{||\vec{r}\,||}$
55 Value of a line integral is not a vector
57



59 True
61 True
63 False
65 False
67 False

Section 18.2

1 $\int_0^{\pi} (\cos^2 t - \sin^2 t)\, dt$
Other answers are possible
3 $\int_0^{2\pi} (-\sin t \cos(\cos t)$ $+$
$\cos t \cos(\sin t))dt$
5 24
7 -4
9 -6
11 9
13 $82/3$
15 12
17 116.28
19 12
21 21
23 0
25 $\int_C y^2 dx + z^2 dy + (x^2 - 5)dz$
27 $e^{-3y}\vec{i} - yz(\sin x)\vec{j} + (y+z)\vec{k}$
29 $18\pi^2$
31 -18π
33 (a)



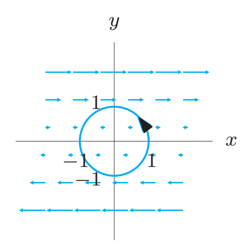
(b) $0; -3\pi/2$
37 (a) -5
(b) 5
(c) 0
41 (a) Greater than zero
(b) 88
(d) $t = 2 \pm 1/\sqrt{3}$
(e) 88; yes
43 Sign depends on C
45 $y = \pi/2, x = t, 0 \le t \le 3, \int_C \vec{F} \cdot d\vec{r} = 3$
47 True
49 True
51 False
53 False

Section 18.3

1 12
3 Negative, not path-independent
5 Negative, not path-independent
7 Path-independent
9 Path-independent
11 Path-independent
13 $f(x, y) = x^2 y + K$
15 $f(x, y, z) = e^{xyz} + \sin(xz^2) + C$
C = constant
17 -2
19 2
21 0
23 $e^3 - 1$
25 0
27 PQ
31 Yes
33 Yes.
35 $e^9 - 1$
37 (a) $-(1/3) - \pi$
(b) $3\pi/4$
39 $9\pi/4$
41 $e^{9/2} + \sin(3\sqrt{2}) - 1$
43 107; 109.5
45 -2
47 (b) No
49 (a) $\int_{C_2} \vec{F} \cdot d\vec{r}$
(b) $\int_{C_3} \vec{F} \cdot d\vec{r} < \int_{C_2} \vec{F} \cdot d\vec{r}$
$< \int_{C_4} \vec{F} \cdot d\vec{r} < \int_{C_1} \vec{F} \cdot d\vec{r}$
(c) $\int_{C_3} \vec{F} \cdot d\vec{r} = -\int_{C_4} \vec{F} \cdot d\vec{r} < 0$
51 -3.6
53 (a) $\vec{a}$
(b) $\vec{r}_0 \cdot \vec{a}$
(c) $10||\vec{a}\,||$
55 (a) $\pi/2$
(b) No
57 (a) $\vec{F} - \text{grad}\,\phi = x\,\text{grad}\,h$
(b) 50
59 (a) $\vec{F} - \text{grad}\,\phi = x\,\text{grad}\,h$
(b) 384
63 (b) Yes
65 Only if $\vec{F}$ is path-independent
67 $\vec{F} = \text{grad}\, f, f(x, y) = 50xy$
73 False
75 False
77 False
79 True
81 True
83 False

Section 18.4

1 No
3 No
5 $f(x, y) = x^3/3 + xy^2 + C$
7 Yes, $f = \ln A|xyz|$ where $A > 0$
9 No
11 -12
13 $1/2$
15 -3π
17 (a)



(b) $-\pi$
19 $e - \cos 1$
21 $-9\pi/8$
23 (a) 0
(b) 0
(c) 0
(d) -6π
(e) -6π
(f) 0
(g) -6π