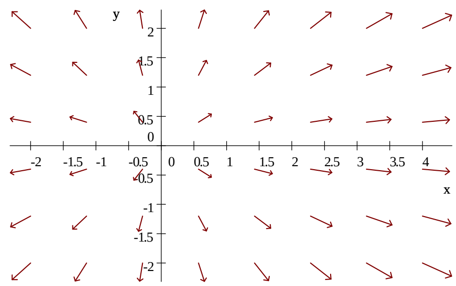
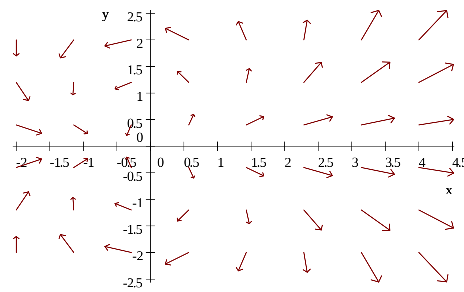
Chapter 5 Solutions

Section 5-1:

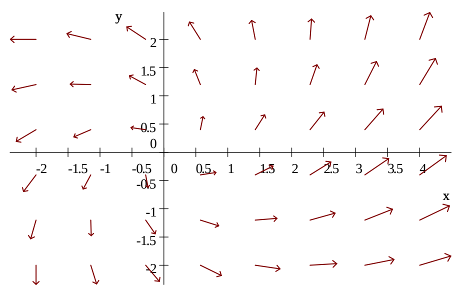
1.



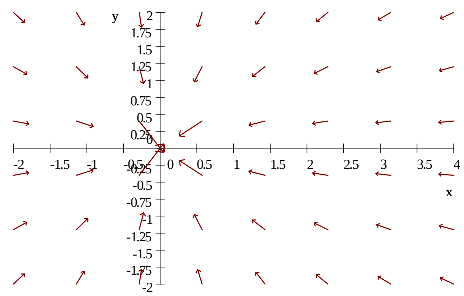
5.



3.



7.



8.

9. $\nabla U = \langle 3, 4 \rangle$

11. $\nabla U = \langle y, x \rangle$

13. $\nabla U = \langle 3x^2 \cos(xy) - x^3 y \sin(xy), -x^4 \sin(xy) \rangle$

15. $\nabla U = \langle \cos(x) \sinh(y), \sin(x) \cosh(y) \rangle$

17. $\nabla U = \langle 2xy, x^2 + 2yz, y^2 \rangle$

19. $\nabla U = \langle \sin(yz), xz \cos(yz), xy \cos(yz) \rangle$

21. $curl(\mathbf{F}) = \mathbf{0}$, $div(\mathbf{F}) = 3x^2 + 2y + 2z$, conservative

23. $curl(\mathbf{F}) = \langle 0, 0, 2x - 2y \rangle$, $div(\mathbf{F}) = 2x - 2y$

25. $curl(\mathbf{F}) = \langle 0, 0, 4y \rangle$, $div(\mathbf{F}) = 4x + 2z$

27. $curl(\mathbf{F}) = \langle 0, 0, 0 \rangle$, $div(\mathbf{F}) = 1$, conservative

29. $curl(\mathbf{F}) = \langle 0, -xe^x, ye^x \rangle$, $div(\mathbf{F}) = ze^x + e^x$

Section 5-2:

1.	$\frac{2}{3}$	17.	$\frac{206}{105}$
3.	0	19.	$8\pi^2$
5.	$\frac{\pi}{2}$	21.	$\frac{5\sqrt{5}-1}{12}$
7.	π	23.	$10\pi^2$
9.	$\frac{\pi^2}{2}$	25.	$-\pi$
11.	0	27.	18
13.	$-\pi$	29.	0
15.	0		

Section 5-3:

1.	$U(x,y) = xy + C$	17.	1
3.	$U(x,y) = xe^x + ye^y + C$	19.	1
5.	$U(x,y) = \sin(x)\cos(y) + y + C$	21.	2
7.	not conservative	23.	$\frac{41}{12}$
9.	$U(x,y) = e^x \sin(y) + C$	25.	2
11.	$U(x,y,z) = -32z + C$	27.	12
13.	$U(x,y,z) = \frac{x^2}{2} + xz + \frac{y^3}{3} + \frac{z^4}{4} + C$	29.	3
15.	not conservative		

Section 5-4:

1.	π	17.	$\frac{-2}{\pi}$
3.	0	19.	$\frac{8}{3}$
5.	0	21.	$\frac{1}{60}$
7.	1	23.	$\frac{12}{\pi^3} - \frac{1}{\pi}$
9.	0	25.	$\frac{12}{5}$
11.	0	27.	$\frac{3\pi}{8}$
13.	0	29.	64.13981
15.	0		

Section 5-5:

1. Surface Area $= \sqrt{26}$
3. Surface Area $= \frac{1}{32}(2+\pi)\pi$
5. Surface Area $= 3\pi\sqrt{2}$
7. Surface Area $= \frac{8}{3}\sqrt{2}$
9. $Flux = \frac{1}{2}$
11. $Flux = 0$
13. $Flux = 0$
15. $Flux = 0$
17. $Flux = \frac{-5}{6}$
19. $Flux = 4\pi$
21. $Flux = \frac{4\pi}{3}$
23. $Flux = 0$
25. $Flux = 0$

Section 5-6:

Compute the flux through the boundary ∂S of the solid S. Then use the divergence theorem to calculate the flux.

1. $Flux = 0$
3. $Flux = \frac{\pi}{2}$
5. $Flux = 4\pi$
7. $\int_{-1}^{1}\int_{-\sqrt{1-x^2}}^{\sqrt{1-x^2}}\int_{x^2+y^2}^{2-x^2-y^2}(2z+2)\,dzdydx = 4\pi$
9. $\int_0^1\int_0^{1-x}\int_0^{1-x-y} 3dzdydx = \frac{1}{2}$
11. $div\left(\langle x^3, y^3, z^3\rangle\right) = 3\left(x^2+y^2+z^2\right) = 3\rho^2$

    $\int_0^1\int_0^{\pi}\int_0^{2\pi}\left(3\rho^2\right)\rho^2\sin(\phi)\,d\rho d\phi d\theta = \frac{192}{5}\pi^5$
13. $Flux = 4k\pi$
15. $Flux = 4k\pi$
17. $Flux = 4k_1\pi$
19. $Flux = 4\left(k_1+k_2\right)\pi$

Section 5-7:

1. 2π
3. 0
5. 2π
7. 0
9. 0
11. $\frac{-1}{3}$
13. 2π
15. 2π
17. π
19. 4π
21. 100π
23. $\pi\sqrt{2}$

Section 5-8:

1.	$d\omega = ydx + xdy + 2zdz$	15.	2π
3.	$d\omega = dx + dy + dz$	17.	0
5.	$d\omega = e^x \cos(yz)\, dx - ze^x \cos(yz)\, dy - ye^x \cos(yz)\, dz$	19.	$-\frac{1}{2}$
7.	$d\omega = 0$	21.	2π
9.	$d\omega = (x^2 - 1)\, dy\hat{\ }dx + z^2 dy\hat{\ }dz$	23.	2π
11.	$d\omega = 0$	25.	$\frac{1}{2}$
13.	$d\omega = 3dx\hat{\ }dy\hat{\ }dz$	27.	$\frac{12\pi}{5}$