

1.1	(2/3) ¹⁰ = 0.0173 yd; 6(2/3) ¹⁰ = 0.104 yd (compared to a total of 5 yd)			
1.3	5/9	1.4	9/11	1.5 7/12
1.6	11/18	1.7	5/27	1.8 25/36
1.9	6/7	1.10	15/26	1.11 19/28
1.13	\$1646.99	1.15	Blank area = 1	
1.16	At $x = 1$: $1/(1+r)$; at $x = 0$: $r/(1+r)$; maximum escape at $x = 0$ is $1/2$.			

- | | | | | | |
|-----|----------|-----|-----|-----|----------|
| 2.1 | 1 | 2.2 | 1/2 | 2.3 | 0 |
| 2.4 | ∞ | 2.5 | 0 | 2.6 | ∞ |
| 2.7 | e^2 | 2.8 | 0 | 2.9 | 1 |

- $$\begin{aligned}
4.1 \quad & a_n = 1/2^n \rightarrow 0; S_n = 1 - 1/2^n \rightarrow 1; R_n = 1/2^n \rightarrow 0 \\
4.2 \quad & a_n = 1/5^{n-1} \rightarrow 0; S_n = (5/4)(1 - 1/5^n) \rightarrow 5/4; R_n = 1/(4 \cdot 5^{n-1}) \rightarrow 0 \\
4.3 \quad & a_n = (-1/2)^{n-1} \rightarrow 0; S_n = (2/3)[1 - (-1/2)^n] \rightarrow 2/3; R_n = (2/3)(-1/2)^n \rightarrow 0 \\
4.4 \quad & a_n = 1/3^n \rightarrow 0; S_n = (1/2)(1 - 1/3^n) \rightarrow 1/2; R_n = 1/(2 \cdot 3^n) \rightarrow 0 \\
4.5 \quad & a_n = (3/4)^{n-1} \rightarrow 0; S_n = 4[1 - (3/4)^n] \rightarrow 4; R_n = 4(3/4)^n \rightarrow 0 \\
4.6 \quad & a_n = \frac{1}{n(n+1)} \rightarrow 0; S_n = 1 - \frac{1}{n+1} \rightarrow 1; R_n = \frac{1}{n+1} \rightarrow 0 \\
4.7 \quad & a_n = (-1)^{n+1} \left(\frac{1}{n} + \frac{1}{n+1} \right) \rightarrow 0; S_n = 1 + \frac{(-1)^{n+1}}{n+1} \rightarrow 1; R_n = \frac{(-1)^n}{n+1} \rightarrow 0
\end{aligned}$$

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|-----|--------------|------|--------------|-----|--------------|
| 5.1 | D | 5.2 | Test further | 5.3 | Test further |
| 5.4 | D | 5.5 | D | 5.6 | Test further |
| 5.7 | Test further | 5.8 | Test further | | |
| 5.9 | D | 5.10 | D | | |

- 6.5 (a) D

Note: In the following answers, $I = \int^\infty a_n dn$; ρ = test ratio.

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|------|----------------------|------|------------------------|------|----------------------|
| 6.7 | D, $I = \infty$ | 6.8 | D, $I = \infty$ | 6.9 | C, $I = 0$ |
| 6.10 | C, $I = \pi/6$ | 6.11 | C, $I = 0$ | 6.12 | C, $I = 0$ |
| 6.13 | D, $I = \infty$ | 6.14 | D, $I = \infty$ | 6.18 | D, $\rho = 2$ |
| 6.19 | C, $\rho = 3/4$ | 6.20 | C, $\rho = 0$ | 6.21 | D, $\rho = 5/4$ |
| 6.22 | C, $\rho = 0$ | 6.23 | D, $\rho = \infty$ | 6.24 | D, $\rho = 9/8$ |
| 6.25 | C, $\rho = 0$ | 6.26 | C, $\rho = (e/3)^3$ | 6.27 | D, $\rho = 100$ |
| 6.28 | C, $\rho = 4/27$ | 6.29 | D, $\rho = 2$ | 6.31 | D, cf. $\sum n^{-1}$ |
| 6.32 | D, cf. $\sum n^{-1}$ | 6.33 | C, cf. $\sum 2^{-n}$ | 6.34 | C, cf. $\sum n^{-2}$ |
| 6.35 | C, cf. $\sum n^{-2}$ | 6.36 | D, cf. $\sum n^{-1/2}$ | | |

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| <p>7.1 C</p> <p>7.5 C</p> <p>9.1 D, cf. $\sum n^{-1}$</p> <p>9.3 C, $I = 0$</p> <p>9.5 C, cf. $\sum n^{-2}$</p> <p>9.7 D, $\rho = 4/3$</p> <p>9.9 D, $\rho = e$</p> <p>9.11 D, $I = \infty$, or cf. $\sum n^{-1}$</p> <p>9.13 C, $I = 0$, or cf. $\sum n^{-2}$</p> <p>9.15 D, $\rho = \infty$, $a_n \not\rightarrow 0$</p> <p>9.17 C, $\rho = 1/27$</p> <p>9.19 C</p> <p>9.21 C, $\rho = 1/2$</p> <p>9.22 (a) C</p> | <p>7.2 D</p> <p>7.6 D</p> <p>(b) D</p> <p>10.1 $x < 1$</p> <p>10.4 $x \leq \sqrt{2}$</p> <p>10.7 $-1 \leq x < 1$</p> <p>10.10 $x \leq 1$</p> <p>10.13 $-1 < x \leq 1$</p> <p>10.16 $-1 < x < 3$</p> <p>10.19 $x < 3$</p> <p>10.22 No x</p> <p>10.25 $n\pi - \pi/6 < x < n\pi + \pi/6$</p> | <p>7.3 C</p> <p>7.7 C</p> <p>9.2 D, $a_n \not\rightarrow 0$</p> <p>9.4 D, $I = \infty$, or cf. $\sum n^{-1}$</p> <p>9.6 C, $\rho = 1/4$</p> <p>9.8 C, $\rho = 1/5$</p> <p>9.10 D, $a_n \not\rightarrow 0$</p> <p>9.12 C, cf. $\sum n^{-2}$</p> <p>9.14 C, alt. ser.</p> <p>9.16 C, cf. $\sum n^{-2}$</p> <p>9.18 C, alt. ser.</p> <p>9.20 C</p> <p>(c) $k > e$</p> <p>10.2 $x < 3/2$</p> <p>10.5 All x</p> <p>10.8 $-1 < x \leq 1$</p> <p>10.11 $-5 \leq x < 5$</p> <p>10.14 $x < 3$</p> <p>10.17 $-2 < x \leq 0$</p> <p>10.20 All x</p> <p>10.23 $x > 2$ or $x < -4$</p> |
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|--|---|---|
| <p>10.3 $x \leq 1$</p> <p>10.6 All x</p> <p>10.9 $x < 1$</p> <p>10.12 $x < 1/2$</p> <p>10.15 $-1 < x < 5$</p> <p>10.18 $-3/4 \leq x \leq -1/4$</p> <p>10.21 $0 \leq x \leq 1$</p> <p>10.24 $x < \sqrt{5}/2$</p> | <p>13.4 $\binom{-1/2}{0} = 1; \binom{-1/2}{n} = \frac{(-1)^n(2n-1)!!}{(2n)!!}$</p> <p>Answers to part (b), Problems 5 to 19:</p> | <p>13.5 $-\sum_1^{\infty} \frac{x^{n+2}}{n}$</p> <p>13.7 $\sum_0^{\infty} \frac{(-1)^n x^{2n}}{(2n+1)!}$</p> <p>13.9 $1 + 2 \sum_1^{\infty} x^n$</p> <p>13.11 $\sum_0^{\infty} \frac{(-1)^n x^n}{(2n+1)!}$</p> <p>13.13 $\sum_0^{\infty} \frac{(-1)^n x^{2n+1}}{n!(2n+1)}$</p> <p>13.15 $\sum_0^{\infty} \binom{-1/2}{n} (-1)^n \frac{x^{2n+1}}{2n+1}$</p> <p>13.16 $\sum_0^{\infty} \frac{x^{2n}}{(2n)!}$</p> <p>13.18 $\sum_0^{\infty} \frac{(-1)^n x^{2n+1}}{(2n+1)(2n+1)!}$</p> <p>13.20 $x + x^2 + x^3/3 - x^5/30 - x^6/90 \dots$</p> <p>13.21 $x^2 + 2x^4/3 + 17x^6/45 \dots$</p> <p>13.22 $1 + 2x + 5x^2/2 + 8x^3/3 + 65x^4/24 \dots$</p> <p>13.23 $1 - x + x^3 - x^4 + x^6 \dots$</p> |
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- | | |
|--|--|
| <p>13.6 $\sum_0^{\infty} \binom{1/2}{n} x^{n+1}$ (see Example 2)</p> <p>13.8 $\sum_0^{\infty} \binom{-1/2}{n} (-x^2)^n$ (see Problem 13.4)</p> <p>13.10 $\sum_0^{\infty} \frac{(-1)^n x^{4n+2}}{(2n+1)!}$</p> <p>13.12 $\sum_0^{\infty} \frac{(-1)^n x^{4n+1}}{(2n)!(4n+1)}$</p> <p>13.14 $\sum_0^{\infty} \frac{x^{2n+1}}{2n+1}$</p> <p>13.17 $2 \sum_{\text{odd } n}^{\infty} \frac{x^n}{n}$</p> <p>13.19 $\sum_0^{\infty} \binom{-1/2}{n} \frac{x^{2n+1}}{2n+1}$</p> | |
|--|--|

- 13.24 $1 + x^2/2! + 5x^4/4! + 61x^6/6! \dots$
 13.25 $1 - x + x^2/3 - x^4/45 \dots$
 13.26 $1 + x^2/4 + 7x^4/96 + 139x^6/5760 \dots$
 13.27 $1 + x + x^2/2 - x^4/8 - x^5/15 \dots$
 13.28 $x - x^2/2 + x^3/6 - x^5/12 \dots$
 13.29 $1 + x/2 - 3x^2/8 + 17x^3/48 \dots$
 13.30 $1 - x + x^2/2 - x^3/2 + 3x^4/8 - 3x^5/8 \dots$
 13.31 $1 - x^2/2 - x^3/2 - x^4/4 - x^5/24 \dots$
 13.32 $x + x^2/2 - x^3/6 - x^4/12 \dots$
 13.33 $1 + x^3/6 + x^4/6 + 19x^5/120 + 19x^6/120 \dots$
 13.34 $x - x^2 + x^3 - 13x^4/12 + 5x^5/4 \dots$
 13.35 $1 + x^2/3! + 7x^4/(3 \cdot 5!) + 31x^6/(3 \cdot 7!) \dots$
 13.36 $u^2/2 + u^4/12 + u^6/20 \dots$
 13.37 $-(x^2/2 + x^4/12 + x^6/45 \dots)$
 13.38 $e(1 - x^2/2 + x^4/6 \dots)$
 13.39 $1 - (x - \pi/2)^2/2! + (x - \pi/2)^4/4! \dots$
 13.40 $1 - (x - 1) + (x - 1)^2 - (x - 1)^3 \dots$
 13.41 $e^3[1 + (x - 3) + (x - 3)^2/2! + (x - 3)^3/3! \dots]$
 13.42 $-1 + (x - \pi)^2/2! - (x - \pi)^4/4! \dots$
 13.43 $-[(x - \pi/2) + (x - \pi/2)^3/3 + 2(x - \pi/2)^5/15 \dots]$
 13.44 $5 + (x - 25)/10 - (x - 25)^2/10^3 + (x - 25)^3/(5 \cdot 10^4) \dots$
- 14.6 Error $< (1/2)(0.1)^2 \div (1 - 0.1) < 0.0056$
 14.7 Error $< (3/8)(1/4)^2 \div (1 - \frac{1}{4}) = 1/32$
 14.8 For $x < 0$, error $< (1/64)(1/2)^4 < 0.001$
 For $x > 0$, error $< 0.001 \div (1 - \frac{1}{2}) = 0.002$
 14.9 Term $n + 1$ is $a_{n+1} = \frac{1}{(n+1)(n+2)}$, so $R_n = (n + 2)a_{n+1}$.
 14.10 $S_4 = 0.3052$, error < 0.0021 (cf. $S = 1 - \ln 2 = 0.307$)
- 15.1 $-x^4/24 - x^5/30 \dots \simeq -3.376 \times 10^{-16}$
 15.2 $x^8/3 - 14x^{12}/45 \dots \simeq 1.433 \times 10^{-16}$
 15.3 $x^5/15 - 2x^7/45 \dots \simeq 6.667 \times 10^{-17}$
 15.4 $x^3/3 + 5x^4/6 \dots \simeq 1.430 \times 10^{-11}$
- | | | |
|---------------------------------------|--|----------|
| 15.5 0 | 15.6 12 | 15.7 10! |
| 15.8 1/2 | 15.9 -1/6 | 15.10 -1 |
| 15.11 4 | 15.12 1/3 | 15.13 -1 |
| 15.14 $t - t^3/3$, error $< 10^{-6}$ | 15.15 $\frac{2}{3}t^{3/2} - \frac{2}{5}t^{5/2}$, error $< \frac{1}{7}10^{-7}$ | |
| 15.16 $e^2 - 1$ | 15.17 $\cos \frac{\pi}{2} = 0$ | |
| 15.18 $\ln 2$ | 15.19 $\sqrt{2}$ | |
- | | | |
|----------------------|--------------|--------------|
| 15.20 (a) 1/8 | (b) 5e | (c) 9/4 |
| 15.21 (a) 0.397117 | (b) 0.937548 | (c) 1.291286 |
| 15.22 (a) $\pi^4/90$ | (b) 1.202057 | (c) 2.612375 |
| 15.23 (a) 1/2 | (b) 1/6 | (c) 1/3 |
| 15.24 (a) $-\pi$ | (b) 0 | (c) -1 |
| (d) 0 | (e) 0 | (f) 0 |
- 15.27 (a) $1 - \frac{v}{c} = 1.3 \times 10^{-5}$, or $v = 0.999987c$
 (b) $1 - \frac{v}{c} = 5.2 \times 10^{-7}$
 (c) $1 - \frac{v}{c} = 2.1 \times 10^{-10}$
 (d) $1 - \frac{v}{c} = 1.3 \times 10^{-11}$
- 15.28 $mc^2 + \frac{1}{2}mv^2$
 15.29 (a) $F/W = \theta + \theta^3/3 \dots$
 (b) $F/W = x/l + x^3/(2l^3) + 3x^5/(8l^5) \dots$

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|-------|--|--------------|----------------------------|-------------------|------------------------|
| 15.30 | (a) $T = F(5/x + x/40 - x^3/16000 \dots)$ | | | | |
| | (b) $T = \frac{1}{2}(F/\theta)(1 + \theta^2/6 + 7\theta^4/360 \dots)$ | | | | |
| 15.31 | (a) finite | (b) infinite | | | |
| 16.1 | (c) overhang: | 2 | 3 | 10 | |
| | books needed: | 32 | 228 | 2.7×10^8 | |
| 16.4 | C, $\rho = 0$ | 16.5 | D, $a_n \not\rightarrow 0$ | 16.6 | C, cf. $\sum n^{-3/2}$ |
| 16.7 | D, $I = \infty$ | 16.8 | D, cf. $\sum n^{-1}$ | 16.9 | $-1 \leq x < 1$ |
| 16.10 | $ x < 4$ | 16.11 | $ x \leq 1$ | 16.12 | $ x < 5$ |
| 16.13 | $-5 < x \leq 1$ | | | | |
| 16.14 | $1 - x^2/2 + x^3/2 - 5x^4/12 \dots$ | | | | |
| 16.15 | $-x^2/6 - x^4/180 - x^6/2835 \dots$ | | | | |
| 16.16 | $1 - x/2 + 3x^2/8 - 11x^3/48 + 19x^4/128 \dots$ | | | | |
| 16.17 | $1 + x^2/2 + x^4/4 + 7x^6/48 \dots$ | | | | |
| 16.18 | $x - x^3/3 + x^5/5 - x^7/7 \dots$ | | | | |
| 16.19 | $-(x - \pi) + (x - \pi)^3/3! - (x - \pi)^5/5! \dots$ | | | | |
| 16.20 | $2 + (x - 8)/12 - (x - 8)^2/(2^5 \cdot 3^2) + 5(x - 8)^3/(2^8 \cdot 3^4) \dots$ | | | | |
| 16.21 | $e[1 + (x - 1) + (x - 1)^2/2! + (x - 1)^3/3! \dots]$ | | | | |
| 16.22 | $\arctan 1 = \pi/4$ | 16.23 | $1 - (\sin \pi)/\pi = 1$ | | |
| 16.24 | $e^{\ln 3} - 1 = 2$ | 16.25 | -2 | | |
| 16.26 | $-1/3$ | 16.27 | $2/3$ | | |
| 16.28 | 1 | 16.29 | $6!$ | | |
| 16.30 | (b) For $N = 130$, $10.5821 < \zeta(1.1) < 10.5868$ | | | | |
| 16.31 | (a) 10^{430} terms. For $N = 200$, $100.5755 < \zeta(1.01) < 100.5803$ | | | | |
| 16.31 | (b) 2.66×10^{86} terms. For $N = 15$, $1.6905 < S < 1.6952$ | | | | |
| 16.31 | (c) $e^{e^{200}} = 10^{3.1382 \times 10^{86}}$ terms. For $N = 40$, $38.4048 < S < 38.4088$ | | | | |

Chapter 2

	x	y	r	θ
4.1	1	1	$\sqrt{2}$	$\pi/4$
4.2	-1	1	$\sqrt{2}$	$3\pi/4$
4.3	1	$-\sqrt{3}$	2	$-\pi/3$
4.4	$-\sqrt{3}$	1	2	$5\pi/6$
4.5	0	2	2	$\pi/2$
4.6	0	-4	4	$-\pi/2$
4.7	-1	0	1	π
4.8	3	0	3	0
4.9	-2	2	$2\sqrt{2}$	$3\pi/4$
4.10	2	-2	$2\sqrt{2}$	$-\pi/4$
4.11	$\sqrt{3}$	1	2	$\pi/6$
4.12	-2	$-2\sqrt{3}$	4	$-2\pi/3$
4.13	0	-1	1	$3\pi/2$
4.14	$\sqrt{2}$	$\sqrt{2}$	2	$\pi/4$
4.15	-1	0	1	$-\pi$ or π
4.16	5	0	5	0
4.17	1	-1	$\sqrt{2}$	$-\pi/4$
4.18	0	3	3	$\pi/2$
4.19	4.69	1.71	5	$20^\circ = 0.35$
4.20	-2.39	-6.58	7	$-110^\circ = -1.92$
5.1	1/2	-1/2	$1/\sqrt{2}$	$-\pi/4$
5.2	-1/2	-1/2	$1/\sqrt{2}$	$-3\pi/4$ or $5\pi/4$
5.3	1	0	1	0
5.4	0	2	2	$\pi/2$
5.5	2	$2\sqrt{3}$	4	$\pi/3$
5.6	-1	0	1	π
5.7	7/5	-1/5	$\sqrt{2}$	$-8.13^\circ = -0.14$
5.8	1.6	-2.7	3.14	$-59.3^\circ = -1.04$
5.9	-10.4	22.7	25	$2 = 114.6^\circ$
5.10	-25/17	19/17	$\sqrt{58/17}$	$142.8^\circ = 2.49$
5.11	17	-12	20.8	$-35.2^\circ = -0.615$
5.12	2.65	1.41	3	$28^\circ = 0.49$
5.13	1.55	4.76	5	$2\pi/5$
5.14	1.27	-2.5	2.8	$-1.1 = -63^\circ$
5.15	21/29	-20/29	1	$-43.6^\circ = -0.76$
5.16	1.53	-1.29	2	$-40^\circ = -0.698$
5.17	-7.35	-10.9	13.1	$-124^\circ = -2.16$
5.18	-0.94	-0.36	1	201° or -159° , 3.51 or -2.77

- 5.19 $(2 + 3i)/13; (x - yi)/(x^2 + y^2)$
 - 5.20 $(-5 + 12i)/169; (x^2 - y^2 - 2ixy)/(x^2 + y^2)^2$
 - 5.21 $(1 + i)/6; (x + 1 - iy)/[(x + 1)^2 + y^2]$
 - 5.22 $(1 + 2i)/10; [x - i(y - 1)]/[x^2 + (y - 1)^2]$
 - 5.23 $(-6 - 3i)/5; (1 - x^2 - y^2 + 2iy)/[(1 - x)^2 + y^2]$
 - 5.24 $(-5 - 12i)/13; (x^2 - y^2 + 2ixy)/(x^2 + y^2)$
 - 5.26 1
 - 5.27 $\sqrt{13/2}$
 - 5.28 1
 - 5.29 $5\sqrt{5}$
 - 5.30 $3/2$
 - 5.31 1
 - 5.32 169
 - 5.33 5
 - 5.34 1
 - 5.35 $x = -4, y = 3$
 - 5.36 $x = -1/2, y = 3$
 - 5.37 $x = y = 0$
 - 5.38 $x = -7, y = 2$
 - 5.39 $x = y = \text{any real number}$
 - 5.40 $x = 0, y = 3$
 - 5.41 $x = 1, y = -1$
 - 5.42 $x = -1/7, y = -10/7$
 - 5.43 $(x, y) = (0, 0), \text{ or } (1, 1), \text{ or } (-1, 1)$
 - 5.44 $x = 0, y = -2$
 - 5.45 $x = 0, \text{ any real } y; \text{ or } y = 0, \text{ any real } x$
 - 5.46 $y = -x$
 - 5.47 $(x, y) = (-1, 0), (1/2, \pm\sqrt{3}/2)$
 - 5.48 $x = 36/13, y = 2/13$
 - 5.49 $x = 1/2, y = 0$
 - 5.50 $x = 0, y \geq 0$
 - 5.51 Circle, center at origin, radius = 2
 - 5.52 y axis
 - 5.53 Circle, center at $(1, 0), r = 1$
 - 5.54 Disk, center at $(1, 0), r = 1$
 - 5.55 Line $y = 5/2$
 - 5.56 Positive y axis
 - 5.57 Hyperbola, $x^2 - y^2 = 4$
 - 5.58 Half plane, $x > 2$
 - 5.59 Circle, center at $(0, -3), r = 4$
 - 5.60 Circle, center at $(1, -1), r = 2$
 - 5.61 Half plane, $y < 0$
 - 5.62 Ellipse, foci at $(1, 0)$ and $(-1, 0)$, semi-major axis = 4
 - 5.63 The coordinate axes
 - 5.64 Straight lines, $y = \pm x$
 - 5.67 $v = (4t^2 + 1)^{-1}, a = 4(4t^2 + 1)^{-3/2}$
 - 5.68 Motion around circle $r = 1$, with $v = 2, a = 4$
 - 6.2 $D, \rho = \sqrt{2}$
 - 6.3 $C, \rho = 1/\sqrt{2}$
 - 6.4 $D, |a_n| = 1 \not\rightarrow 0$
 - 6.5 D
 - 6.6 C
 - 6.7 $D, \rho = \sqrt{2}$
 - 6.8 $D, |a_n| = 1 \not\rightarrow 0$
 - 6.9 C
 - 6.10 $C, \rho = \sqrt{2}/2$
 - 6.11 $C, \rho = 1/5$
 - 6.12 C
 - 6.13 $C, \rho = \sqrt{2/5}$
 - 7.1 All z
 - 7.2 $|z| < 1$
 - 7.3 All z
 - 7.4 $|z| < 1$
 - 7.5 $|z| < 2$
 - 7.6 $|z| < 1/3$
 - 7.7 All z
 - 7.8 All z
 - 7.9 $|z| < 1$
 - 7.10 $|z| < 1$
 - 7.11 $|z| < 27$
 - 7.12 $|z| < 4$
 - 7.13 $|z - i| < 1$
 - 7.14 $|z - 2i| < 1$
 - 7.15 $|z - (2 - i)| < 2$
 - 7.16 $|z + (i - 3)| < 1/\sqrt{2}$
 - 8.3 See Problem 17.30.

- 9.1 $(1-i)/\sqrt{2}$ 9.2 i 9.3 $-9i$
 9.4 $-e(1+i\sqrt{3})/2$ 9.5 -1 9.6 1
 9.7 $3e^2$ 9.8 $-\sqrt{3}+i$ 9.9 $-2i$
 9.10 -2 9.11 $-1-i$ 9.12 $-2-2i\sqrt{3}$
 9.13 $-4+4i$ 9.14 64 9.15 $2i-4$
 9.16 $-2\sqrt{3}-2i$ 9.17 $-(1+i)/4$ 9.18 1
 9.19 16 9.20 i 9.21 1
 9.22 $-i$ 9.23 $(\sqrt{3}+i)/4$ 9.24 $4i$
 9.25 -1 9.26 $(1+i\sqrt{3})/2$ 9.29 1
 9.30 $e^{\sqrt{3}}$ 9.31 5 9.32 $3e^2$
 9.33 $2e^3$ 9.34 $4/e$ 9.35 21
 9.36 4 9.37 1 9.38 $1/\sqrt{2}$
- 10.1 $1, (-1 \pm i\sqrt{3})/2$ 10.2 $3, 3(-1 \pm i\sqrt{3})/2$
 10.3 $\pm 1, \pm i$ 10.4 $\pm 2, \pm 2i$
 10.5 $\pm 1, (\pm 1 \pm i\sqrt{3})/2$ 10.6 $\pm 2, \pm 1 \pm i\sqrt{3}$
 10.7 $\pm\sqrt{2}, \pm i\sqrt{2}, \pm 1 \pm i$ 10.8 $\pm 1, \pm i, (\pm 1 \pm i)/\sqrt{2}$
 10.9 $1, 0.309 \pm 0.951i, -0.809 \pm 0.588i$
 10.10 $2, 0.618 \pm 1.902i, -1.618 \pm 1.176i$
 10.11 $-2, 1 \pm i\sqrt{3}$ 10.12 $-1, (1 \pm i\sqrt{3})/2$
 10.13 $\pm 1 \pm i$ 10.14 $(\pm 1 \pm i)/\sqrt{2}$
 10.15 $\pm 2i, \pm\sqrt{3} \pm i$ 10.16 $\pm i, (\pm\sqrt{3} \pm i)/2$
 10.17 $-1, 0.809 \pm 0.588i, -0.309 \pm 0.951i$
 10.18 $\pm(1+i)/\sqrt{2}$ 10.19 $-i, (\pm\sqrt{3}+i)/2$
 10.20 $2i, \pm\sqrt{3}-i$ 10.21 $\pm(\sqrt{3}+i)$
 10.22 $r = \sqrt{2}, \theta = 45^\circ + 120^\circ n: 1+i, -1.366+0.366i, 0.366-1.366i$
 10.23 $r = 2, \theta = 30^\circ + 90^\circ n: \pm(\sqrt{3}+i), \pm(1-i\sqrt{3})$
 10.24 $r = 1, \theta = 30^\circ + 45^\circ n:$
 $\pm(\sqrt{3}+i)/2, \pm(1-i\sqrt{3})/2, \pm(0.259+0.966i), \pm(0.966-0.259i)$
 10.25 $r = \sqrt[10]{2}, \theta = 45^\circ + 72^\circ n: 0.758(1+i), -0.487+0.955i,$
 $-1.059-0.168i, -0.168-1.059i, 0.955-0.487i$
 10.26 $r = 1, \theta = 18^\circ + 72^\circ n: i, \pm 0.951+0.309i, \pm 0.588-0.809i$
 10.28 $\cos 3\theta = \cos^3 \theta - 3 \cos \theta \sin^2 \theta$
 $\sin 3\theta = 3 \cos^2 \theta \sin \theta - \sin^3 \theta$
- 11.3 $3(1-i)/\sqrt{2}$ 11.4 -8 11.5 $1+i$ 11.6 $13/5$
 11.7 $3i/5$ 11.8 $-41/9$ 11.9 $4i/3$ 11.10 -1
- 12.20 $\cosh 3z = \cosh^3 z + 3 \cosh z \sinh^2 z, \sinh 3z = 3 \cosh^2 z \sinh z + \sinh^3 z$
 12.22 $\sinh x = \sum_{n=0}^{\infty} \frac{x^{2n+1}}{(2n+1)!}, \cosh x = \sum_{n=0}^{\infty} \frac{x^{2n}}{(2n)!}$
 12.23 $\cos x, |\cos x|$
 12.24 $\cosh x$
 12.25 $\sin x \cosh y - i \cos x \sinh y, \sqrt{\sin^2 x + \sinh^2 y}$
 12.26 $\cosh 2 \cos 3 - i \sinh 2 \sin 3 = -3.725 - 0.512i, 3.760$
 12.27 $\sin 4 \cosh 3 + i \cos 4 \sinh 3 = -7.62 - 6.55i, 10.05$
 12.28 $\tanh 1 = 0.762$ 12.29 1
 12.30 $-i$ 12.31 $(3+5i\sqrt{3})/8$
 12.32 $-4i/3$ 12.33 $i \tanh 1 = 0.762i$
 12.34 $i \sinh(\pi/2) = 2.301i$ 12.35 $-\cosh 2 = -3.76$
 12.36 $i \cosh 1 = 1.543i$ 12.37 $\cosh \pi$

- 14.1 $1 + i\pi$
 14.3 $\text{Ln } 2 + i\pi/6$
 14.5 $\text{Ln } 2 + 5i\pi/4$
 14.7 $i\pi/2$
 14.9 $e^{-\pi}$
 14.11 $\cos(\text{Ln } 2) + i \sin(\text{Ln } 2) = 0.769 + 0.639i$
 14.12 $-ie^{-\pi/2}$
 14.13 $1/e$
 14.14 $2e^{-\pi/2}[i \cos(\text{Ln } 2) - \sin(\text{Ln } 2)] = 0.3198i - 0.2657$
 14.15 $e^{-\pi \sinh 1} = 0.0249$
 14.16 $e^{-\pi/3} = 0.351$
 14.17 $\sqrt{2} e^{-3\pi/4} e^{i(\text{Ln } \sqrt{2} + 3\pi/4)} = -0.121 + 0.057i$
 14.18 -1
 14.20 1
 14.22 $-1/2$
 14.2 $-i\pi/2$ or $3\pi i/2$
 14.4 $(1/2) \text{Ln } 2 + 3\pi i/4$
 14.6 $-i\pi/4$ or $7\pi i/4$
 14.8 $-1, (1 \pm i\sqrt{3})/2$
 14.10 $e^{-\pi^2/4}$
 14.19 $-5/4$
 14.21 -1
 14.23 $e^{\pi/2} = 4.81$
- 15.1 $\pi/2 + 2n\pi \pm i \text{Ln } (2 + \sqrt{3}) = \pi/2 + 2n\pi \pm 1.317i$
 15.2 $\pi/2 + n\pi + (i \text{Ln } 3)/2$
 15.3 $i(\pm\pi/3 + 2n\pi)$
 15.4 $i(2n\pi + \pi/6), i(2n\pi + 5\pi/6)$
 15.5 $\pm [\pi/2 + 2n\pi - i \text{Ln } (3 + \sqrt{8})] = \pm[\pi/2 + 2n\pi - 1.76i]$
 15.6 $i(n\pi - \pi/4)$
 15.7 $\pi/2 + n\pi - i \text{Ln } (\sqrt{2} - 1) = \pi/2 + n\pi + 0.881i$
 15.8 $\pi/2 + 2n\pi \pm i \text{Ln } 3$
 15.9 $i(\pi/3 + n\pi)$
 15.10 $2n\pi \pm i \text{Ln } 2$
 15.11 $i(2n\pi + \pi/4), i(2n\pi + 3\pi/4)$
 15.12 $i(2n\pi \pm \pi/6)$
 15.13 $i(\pi + 2n\pi)$
 15.14 $2n\pi + i \text{Ln } 2, (2n + 1)\pi - i \text{Ln } 2$
 15.15 $n\pi + 3\pi/8 + i \text{Ln } 2/4$
 15.16 $(\text{Ln } 2)/4 + i(n\pi + 5\pi/8)$
- 16.2 Motion around circle $|z| = 5$; $v = 5\omega$, $a = 5\omega^2$.
 16.3 Motion around circle $|z| = \sqrt{2}$; $v = \sqrt{2}$, $a = \sqrt{2}$.
 16.4 $v = \sqrt{13}$, $a = 0$
 16.5 $v = |z_1 - z_2|$, $a = 0$
 16.6 (a) Series: $3 - 2i$ Parallel: $5 + i$ (b) Series: $2(1 + i\sqrt{3})$ Parallel: $i\sqrt{3}$
 16.7 (a) Series: $1 + 2i$ Parallel: $3(3 - i)/5$ (b) Series: $5 + 5i$ Parallel: $1.6 + 1.2i$
 16.8 $[R - i(\omega CR^2 + \omega^3 L^2 C - \omega L)] / [(\omega CR)^2 + (\omega^2 LC - 1)^2]$; this simplifies to $\frac{L}{RC}$ if $\omega^2 = \frac{1}{LC} \left(1 - \frac{R^2 C}{L}\right)$, that is, at resonance.
 16.9 (a) $\omega = \frac{R}{2L} \pm \sqrt{\frac{R^2}{4L^2} + \frac{1}{LC}}$ (b) $\omega = 1/\sqrt{LC}$
 16.10 (a) $\omega = -\frac{1}{2RC} \pm \sqrt{\frac{1}{4R^2 C^2} + \frac{1}{LC}}$ (b) $\omega = 1/\sqrt{LC}$
 16.12 $(1 + r^4 - 2r^2 \cos \theta)^{-1}$

- 17.1 -1 17.2 $(\sqrt{3} + i)/2$
 17.3 $r = \sqrt{2}, \theta = 45^\circ + 72^\circ n : 1 + i, -0.642 + 1.260i, -1.397 - 0.221i,$
 $-0.221 - 1.397i, 1.260 - 0.642i$
 17.4 $i \cosh 1 = 1.54i$ 17.5 i
 17.6 $-e^{-\pi^2} = -5.17 \times 10^{-5}$ or $-e^{-\pi^2} \cdot e^{\pm 2n\pi^2}$
 17.7 $e^{\pi/2} = 4.81$ or $e^{\pi/2} \cdot e^{\pm 2n\pi}$
 17.8 -1 17.9 $\pi/2 \pm 2n\pi$
 17.10 $\sqrt{3} - 2$ 17.11 i
 17.12 $-1 \pm \sqrt{2}$ 17.13 $x = 0, y = 4$
 17.14 Circle with center $(0, 2)$, radius 1
 17.15 $|z| < 1/e$ 17.16 $y < -2$
 17.26 1 17.27 (c) $e^{-2(x-t)^2}$
 17.28 $1 + \left[\frac{a^2 + b^2}{2ab} \right]^2 \sinh^2 b$ 17.29 $(-1 \pm i\sqrt{3})/2$
 17.30 $e^x \cos x = \sum_{n=0}^{\infty} \frac{x^n 2^{n/2} \cos n\pi/4}{n!}$
 $e^x \sin x = \sum_{n=0}^{\infty} \frac{x^n 2^{n/2} \sin n\pi/4}{n!}$

Chapter 3

$$2.3 \quad \begin{pmatrix} 1 & 0 & -3 \\ 0 & 1 & 5 \end{pmatrix}, \quad x = -3, y = 5)$$

$$2.4 \quad \begin{pmatrix} 1 & 0 & -1/2 & 1/2 \\ 0 & 1 & 0 & 1 \end{pmatrix}, \quad x = (z + 1)/2, y = 1$$

$$2.5 \quad \begin{pmatrix} 1 & 1/2 & -1/2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad \text{no solution}$$

$$2.6 \quad \begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & -1 & 0 \end{pmatrix}, \quad x = 1, z = y$$

$$2.7 \quad \begin{pmatrix} 1 & 0 & -4 \\ 0 & 1 & 3 \\ 0 & 0 & 0 \end{pmatrix}, \quad x = -4, y = 3$$

$$2.8 \quad \begin{pmatrix} 1 & -1 & 0 & -11 \\ 0 & 0 & 1 & 7 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad x = y - 11, z = 7$$

$$2.9 \quad \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad \text{inconsistent, no solution}$$

$$2.10 \quad \begin{pmatrix} 1 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad \text{inconsistent, no solution}$$

$$2.11 \quad \begin{pmatrix} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -3 \end{pmatrix}, \quad x = 2, y = -1, z = -3$$

$$2.12 \quad \begin{pmatrix} 1 & 0 & 0 & -2 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}, \quad x = -2, y = 1, z = 1$$

$$2.13 \quad \begin{pmatrix} 1 & 0 & 0 & -2 \\ 0 & 1 & -2 & 5/2 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad x = -2, y = 2z + 5/2$$

$$2.14 \quad \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad \text{inconsistent, no solution}$$