41. \[ 8\sqrt{2} \left[ \cos \left( -\frac{5\pi}{6} \right) + i \sin \left( -\frac{5\pi}{6} \right) \right] \]

43. \[ 5 \left( \cos \frac{\pi}{3} + i \sin \frac{\pi}{3} \right) = \frac{5}{2} + \frac{5\sqrt{3}}{2i} \]
\[ 5 \left( \cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3} \right) = -\frac{5}{2} - \frac{5\sqrt{3}}{2i} \]

45. \[ \cos \frac{\pi}{6} + i \sin \frac{\pi}{6} = \frac{\sqrt{3}}{2} + \frac{1}{2} \]
\[ \cos \frac{5\pi}{6} + i \sin \frac{5\pi}{6} = -\frac{\sqrt{3}}{2} + \frac{1}{2} \]
\[ \cos \frac{3\pi}{2} + i \sin \frac{3\pi}{2} = i \]

47. \[ A^* = \begin{bmatrix} -1 - 4i & 3 + i \\ 3 - i & 2 - i \end{bmatrix} \]

49. \((-3 + 28i, 14 + 8i)

51. \((-5, 1 - 2i)\)

53. \(\sqrt{38}\)

55. \(4\)

57. Unitary

59. Not unitary

61. Not Hermitian

63. \(\lambda_1 = -1, \mathbf{v}_1 = (-2 + i, 5)\)
\(\lambda_2 = 5, \mathbf{v}_2 = (5, 2 + i)\)

**Chapter 8 MATLAB (page 476)**

1. (a) \[ \begin{bmatrix} -8 + 7i & 3 - 2i \\ -3 + 2i & 9 + 4i \end{bmatrix} \]
(b) \[ \begin{bmatrix} -3 & 3 & 0 \\ 6i & 0 & -9 + 6i \end{bmatrix} \]
(c) \[ \begin{bmatrix} 0.0385 - 0.1923i & 0.4231 - 0.1154i \\ 0.3462 + 0.2692i & -0.1923 - 0.0385i \end{bmatrix} \]
(d) \[ \begin{bmatrix} 5 & -1 & 4 + 6i \\ -1 & 1 & 0 \\ 4 - 6i & 0 & 13 \end{bmatrix} \]
(e) \(11 - 8i\)
(f) \[ \begin{bmatrix} 18 - 35i & -23 - 32i \\ 23 - 44i & 18 - 25i \end{bmatrix} \]

3. (a) Neither (b) Normal (c) Neither (d) Normal

**Chapter 9**

**Section 9.1 (page 484)**

1. \(f\)

3. \(a\)

5. \(b\)

7.

9.

11.

13.
15. 

25. 

17. 

27. 

19. 

29. 

21. 

31. 

23. 

33. \(2 \leq x \leq 5\) 
\(1 \leq y \leq 7\) 

35. \(y \leq \frac{3}{2}x\) 
\(y \leq -x + 5\) 
\(y \geq 0\) 

37. \(x + \frac{3}{7}y \leq 12\) 
\(\frac{4}{3}x + \frac{3}{7}y \leq 15\) 
\(x \geq 0\) 
\(y \geq 0\)
39. \( x = \) amount in one account  
\( y = \) amount in other account  
\( x + y \leq 20,000 \)  
\( x \geq 5000 \)  
\( y \geq 5000 \)  
\( 2x \leq y \)

41. \( x = \) # of ounces of food X  
\( y = \) # of ounces of food Y  
\( 20x + 10y \geq 300 \)  
\( 15x + 10y \geq 150 \)  
\( 10x + 20y \geq 200 \)  
\( x, y \geq 0 \)

**SECTION 9.2** (page 492)

1. Maximum is 17 at \((3, 4)\)  
   Minimum is 0 at \((0, 0)\)

3. Maximum is 20 at \((4, 0)\)  
   Minimum is 0 at \((0, 0)\)

5. Maximum is 740 at \((60, 20)\)  
   Minimum is 0 at \((0, 0)\)

7. Maximum is 2100 at any point on line segment between \((30, 45)\) and \((60, 20)\)  
   Minimum is 0 at \((0, 0)\)

9. No maximum  
   Minimum is 35 at \((5, 3)\)

11. No maximum  
   Minimum is 20 at \((10, 0)\)

13. Maximum is 160 at \((40, 0)\)  
   Minimum is 104 at \((24, 8)\)

15. Maximum is 56 at \((24, 8)\)  
   Minimum is 36 at \((36, 0)\)

17. Maximum is 12 at \((3, 6)\)

19. Maximum is 10 at \((0, 10)\)

21. 200 units of model costing $250  
    50 units of model costing $400  
    Maximum profit: $11,500

23. 3 bags of brand X  
    6 bags of brand Y  
    Minimum cost: $195

25. \( z \) is maximum at any point on the line segment between points \((2, 0)\) and \(\left(\frac{20}{13}, \frac{45}{13}\right)\).

27. The constraint \( x \leq 10 \) is extraneous.

29. Feasible set is empty, no maximum

31. (a) No value of \( t \)  
   (b) \( t < 0 \)  
   (c) \( t > 0 \)  
   (d) No value of \( t \)

**SECTION 9.3** (page 507)

1. \[
\begin{array}{cccc}
 x_1 & x_2 & s_1 & s_2 \\
 2 & 1 & 1 & 0 \\
 1 & 1 & 0 & 1 \\
 -1 & -2 & 0 & 0 \\
 \end{array}
\]

   Basic Variables  
   \[ s_1 \]  
   \[ s_2 \]
3. Basic

\[
\begin{array}{cccccc}
 x_1 & x_2 & x_3 & s_1 & s_2 & b \\
1 & 2 & 0 & 1 & 0 & 12 \\
1 & 0 & 1 & 0 & 1 & 8 \\
-2 & -3 & -4 & 0 & 0 & 0 \\
\end{array}
\]

Variables

5. Objective function should be maximized, not minimized.

7. All constraints must be \( \leq \).

9. Maximum is 8 at (8, 0)

11. Maximum is 210 at (0, 21, 21)

13. Maximum is 43 at (7, 3)

15. Maximum is \( \frac{83}{19} \) at \((\frac{16}{19}, 0, 0, \frac{5}{19})\)

17. Maximum is 25 at (23, 0, 2) or \((\frac{43}{3}, 0, \frac{32}{3})\)

19. Maximum is 24 at (0, 12, 0, 0)

21. 200 units at $250
    50 units at $400
    Maximum profit: $11,500

23. 50 acres of carrots
    0 acres of celery and lettuce
    Maximum profit: $3000

25. 322 of Model A
    764 of Model B
    484 of Model C
    Maximum profit: $79,310

27. 9 television ads
    4 newspaper ads
    Maximum audience: 147,000,000

29. $100,000 of type A
    $62,500 of type B
    $87,500 of type C
    Maximum return: $26,500

31. 8 audits, 8 tax returns
    Maximum revenue: $18,400

33. After one iteration, the simplex tableau is as follows.

Basic

\[
\begin{array}{cccccc}
 x_1 & x_2 & s_1 & s_2 & b \\
-\frac{1}{2} & 0 & 1 & \frac{3}{2} & 7 \\
-\frac{1}{2} & 1 & 0 & \frac{1}{2} & 2 \\
-2 & 0 & 0 & 1 & 4 \\
\end{array}
\]

Variables

35. After one iteration, \( x_1 = 2, x_2 = 0 \), and \( z = 5 \).

Bringing \( x_2 \) in the basis after another iteration,
\( x_1 = \frac{20}{19}, x_2 = \frac{45}{19} \), and \( z \) still equals 5.

37. Maximum is \( \frac{85100}{177} \) at \( (0, \frac{2740}{531}, \frac{28250}{531}, \frac{16655}{531}) \)

SECTION 9.4 (page 518)

1. (Maximize)

Objective function:
\[ z = 4y_1 + 4y_2 \]

Constraints:
\[ 2y_1 + y_2 \leq 3 \]
\[ y_1 + 2y_2 \leq 3 \]
\[ y_1, y_2 \geq 0 \]

3. (Maximize)

Objective function:
\[ z = 23y_1 + 10y_2 + 40y_3 \]

Constraints:
\[ 3y_1 + y_2 + 8y_3 \leq 4 \]
\[ 2y_1 + y_3 \leq 1 \]
\[ y_1 + y_2 + 2y_3 \leq 1 \]
\[ y_1, y_2, y_3 \geq 0 \]

5. (Maximize)

Objective function:
\[ z = 7y_1 + 4y_2 \]

Constraints:
\[ y_1 + y_2 \leq 14 \]
\[ y_1 + 2y_2 \leq 20 \]
\[ 2y_1 + y_2 \leq 24 \]
\[ y_1, y_2 \geq 0 \]

7. (a) Minimum is 4 (1, 1)

(b) (Maximize)

Objective function:
\[ z = 3y_1 + 5y_2 \]

Constraints:
\[ y_1 + 3y_2 \leq 2 \]
\[ 2y_1 + 2y_2 \leq 2 \]
\[ y_1, y_2 \geq 0 \]

(c) Maximum is 4 at \( (\frac{1}{2}, \frac{1}{2}) \)

9. (a) Minimum is 8 at \( (\frac{4}{3}, \frac{5}{3}) \)

(b) (Maximize)

Objective function:
\[ z = 3y_1 + 2y_2 \]

Constraints:
\[ y_1 + y_2 \leq 1 \]
\[ y_1 + 2y_2 \leq 4 \]
\[ y_1, y_2 \geq 0 \]

(c) Maximum is 8 at (2, 1)

11. (a) Minimum is 9 at \( (\frac{1}{2}, 2) \)

(b) (Maximize)

Objective function:
\[ z = 4y_1 + 2y_2 \]

Constraints:
\[ 4y_1 \leq 6 \]
\[ y_1 + y_2 \leq 3 \]
\[ y_1, y_2 \geq 0 \]

(c) Maximum is 9 at \( (\frac{3}{2}, \frac{3}{2}) \)
13. Minimum is 1.8 at (1, 1.8)
15. Minimum is 6 at (1, 4)
17. Minimum is 18 at \( \left( \frac{1}{3}, 2, \frac{2}{3} \right) \)
19. Minimum is 64 at \( \left( \frac{4}{3}, 4, 16 \right) \)
21. 1 liter of dietary drink I
   1 liter of dietary drink II
   Minimum cost: $5
23. 3 liters of dietary drink I
   0 liters of dietary drink II
   Minimum cost: $3
25. \( \frac{5}{3} \) liters of dietary drink I
   \( \frac{4}{3} \) liters of dietary drink II
   Minimum cost: $19
27. 5 liters of dietary drink I
   0 liters of dietary drink II
   Minimum cost: $5
29. 22.5 days for plant I
   10.5 days for plant II
   4.75 days for plant III
   Minimum operating cost: $2,152,500
31. 0 days for refinery I
   120 days for refinery II
   Minimum operating cost: $3,600,000
33. Minimum is 87.14 at \( (21.43, 2.86, 25.71, 0) \)

**Section 9.5 (page 529)**

1. \[ \begin{array}{rrrrr} x_1 & x_2 & s_1 & s_2 & b \\ 2 & 1 & -1 & 0 & 4 \\ 1 & 1 & 0 & 1 & 8 \\ -10 & -4 & 0 & 0 & 0 \end{array} \]  
   Basic Variables

2. \[ \begin{array}{rrrrr} x_1 & x_2 & s_1 & s_2 & b \\ 2 & 1 & 1 & 0 & 4 \\ 1 & 3 & 0 & -1 & 2 \\ 1 & 1 & 0 & 0 & 0 \end{array} \]  
   Basic Variables

5. \[
\begin{array}{rrrrrrr} x_1 & x_2 & x_3 & s_1 & s_2 & s_3 & b \\ 4 & 1 & 0 & -1 & 0 & 0 & 10 \\ 1 & 1 & 3 & 0 & 1 & 0 & 30 \\ 2 & 1 & 4 & 0 & 0 & 0 & 16 \\ -1 & 0 & -1 & 0 & 0 & 0 & 0 \end{array}
\]
   Basic Variables

7. Maximum is 12 at (0, 6)
9. Minimum is 16 at any point on the line segment between (0, 8) and (2, 7)
11. Maximum is 25 at (5, 20, 0)
13. Maximum is 40 at (0, 8)
15. Maximum is 30 at (5, 20, 0)
17. Minimum is 15 at (5, 10)
19. Minimum is -20 at \( (11, \frac{1}{2}, 0) \)
21. Maximum is 9 at (4, 1)
23. Maximum is 4 at (1, 4)
25. Maximum is 9 at (4, 5)
27. Maximum is 3 at (0, 3)
29. 300 tires from \( S_1 \) to \( C_1 \)
   600 tires from \( S_1 \) to \( C_2 \)
   200 tires from \( S_2 \) to \( C_1 \)
   Minimum cost: $1100
31. 600 tires from \( S_1 \) to \( C_2 \)
   500 tires from \( S_2 \) to \( C_1 \)
   Minimum cost $1100
33. \[
\begin{array}{c|c|c}
Customer 1 & Customer 2 \\
\hline
Factory 1 & 0 & 200 \\
Factory 2 & 200 & 100 \\
\hline
\end{array}
\]
   Minimum cost $14,500
35. 9 television ads
4 newspaper ads
   Maximum audience: 147,000,000
37. \[
\begin{array}{l|ll}
 & \text{Outlet I} & \text{Outlet II} \\
\hline
\text{Plant A} & a & 5000 - a \\
\text{Plant B} & 3000 - a & a \\
\end{array}
\]
Minimum cost: $40,000

**Review Exercises – Chapter 9 (page 531)**

1. Maximum is 47 at (5, 8)

3. Minimum is 3 at (3, 0)
   Maximum is 29 at (5, 8)

5. Minimum is at (0, 6)
   Maximum is at 29 at (5, 8)

7. Maximum is 20 at (0, 9.6, 0.8)

9. Maximum is 232 at (100, 132)

11. Maximum is 3599 at (110, 537, 146)

13. (Maximize) Minimum is 75 at (5, 2)

15. Objective function: 
   Constraints: 
   \[ z = 30y_1 + 75y_2 \]
   \[ y_1 + 3y_2 \leq 7 \]
   \[ y_1 + 6y_2 \leq 3 \]
   \[ 2y_1 + 4y_2 \leq 1 \]
   \[ y_1, y_2 \geq 0 \]

23. Minimum is 75 at (5, 2)

25. Minimum is 6006 at \( \left( \frac{81}{2}, 138, 111 \right) \)

29. Minimum is \( \frac{118}{3} \) at \( \left( \frac{4}{3}, \frac{1}{3}, 0 \right) \)

31. Maximum is 31 at (1, 15)

33. Maximum is 67 at (7, 27, 26)

35. Minimum is 90 at (10, 0, 0)

37. Maximum is $500 for 2 vests and 5 purses.

39. Minimum is $4800 for 7 days on mine A, 5 days on mine B, and 24 days on mine C.

**Chapter 10**

Section 10.1 (page 541)

1. 0.4281 \times 10^4

3. -0.262 \times 10^1

5. -0.121 \times 10^{-2}

7. 0.125 \times 10^0

9. (a) 0.331 \times 10^3
   (b) 0.3310 \times 10^3

11. (a) -0.926 \times 10^2
    (b) -0.9265 \times 10^2

13. (a) 0.438 \times 10^0
    (b) 0.4375 \times 10^0

15. (a) 0.143 \times 10^0
    (b) 0.1429 \times 10^0

17. Approximate: -3700
   Exact: -3694.7352

19. Approximate: \( x = 23.8, y = 0 \)
   Exact: \( x = 10, y = 1 \)