

# ANSWERS TO EXERCISES

## Exercise Set 1.1 (page 8)

1. (a), (c), and (f) are linear equations; (b), (d), and (e) are not linear equations
3. (a)  $a_{11}x_1 + a_{12}x_2 = b_1$   
 $a_{21}x_1 + a_{22}x_2 = b_2$  (b)  $a_{11}x_1 + a_{12}x_2 + a_{13}x_3 = b_1$   
 $a_{21}x_1 + a_{22}x_2 + a_{23}x_3 = b_2$   
 $a_{31}x_1 + a_{32}x_2 + a_{33}x_3 = b_3$  (c)  $a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + a_{14}x_4 = b_1$   
 $a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + a_{24}x_4 = b_2$
5. (a)  $2x_1 = 0$   
 $3x_1 - 4x_2 = 0$   
 $x_2 = 1$  (b)  $3x_1 - 2x_3 = 5$   
 $7x_1 + x_2 + 4x_3 = -3$   
 $-2x_2 + x_3 = 7$

7. (a)  $\begin{bmatrix} -2 & 6 \\ 3 & 8 \\ 9 & -3 \end{bmatrix}$  (b)  $\begin{bmatrix} 6 & -1 & 3 & 4 \\ 0 & 5 & -1 & 1 \end{bmatrix}$  (c)  $\begin{bmatrix} 0 & 2 & 0 & -3 & 1 & 0 \\ -3 & -1 & 1 & 0 & 0 & -1 \\ 6 & 2 & -1 & 2 & -3 & 6 \end{bmatrix}$

9. (a), (d), and (e) are solutions; (b) and (c) are not solutions
11. (a) No points of intersection  
 (b) Infinitely many points of intersection:  $x = \frac{1}{2} + 2t, y = t$   
 (c) One point of intersection:  $(-8, -4)$

13. (a)  $x = \frac{3}{7} + \frac{5}{7}t, y = t$   
 (b)  $x_1 = \frac{7}{3} + \frac{5}{3}r - \frac{4}{3}s, x_2 = r, x_3 = s$   
 (c)  $x_1 = -\frac{1}{8} + \frac{1}{4}r - \frac{5}{8}s + \frac{3}{4}t, x_2 = r, x_3 = s, x_4 = t$   
 (d)  $v = \frac{8}{3}t_1 - \frac{2}{3}t_2 + \frac{1}{3}t_3 - \frac{4}{3}t_4, w = t_1, x = t_2, y = t_3, z = t_4$
15. (a)  $x = \frac{1}{2} + \frac{3}{2}t, y = t$   
 (b)  $x_1 = -4 - 3r + s, x_2 = r, x_3 = s$

17. (a) Add 2 times the second row to the first row.  
 (b) Add the third row to the first row, or interchange the first row and the third row.

19. (a) All values of  $k \neq 2$   
 (b) All values of  $k$
25.  $2x + 3y + z = 7$   
 $2x + y + 3z = 9$   
 $4x + 2y + 5z = 16$
27.  $x + y + z = 12$   
 $2x + y + 2z = 5$   
 $-x + z = 1$

True/False 1.1

- (a) True (b) False (c) True (d) True (e) False (f) False (g) True (h) False

## Exercise Set 1.2 (page 22)

1. (a) Both (b) Both (c) Both (d) Both (e) Both (f) Both (g) Row echelon form

3. (a)  $x = -37, y = -8, z = 5$   
 (b)  $w = -10 + 13t, x = -5 + 13t, y = 2 - t, z = t$   
 (c)  $x_1 = -11 - 7s + 2t, x_2 = s, x_3 = -4 - 3t, x_4 = 9 - 3t, x_5 = t$   
 (d) No solution

5.  $x_1 = 3, x_2 = 1, x_3 = 2$  7.  $x = -1 + t, y = 2s, z = s, w = t$  9.  $x_1 = 3, x_2 = 1, x_3 = 2$

11.  $x = -1 + t, y = 2s, z = s, w = t$  13. Has nontrivial solutions 15.  $x_1 = 0, x_2 = 0, x_3 = 0$

17.  $x_1 = -\frac{1}{4}s, x_2 = -\frac{1}{4}s - t, x_3 = s, x_4 = t$  19.  $w = t, x = -t, y = t, z = 0$  21.  $I_1 = -1, I_2 = 0, I_3 = 1, I_4 = 2$

23. (a) Consistent; unique solution  
 (b) Consistent; infinitely many solutions  
 (c) Inconsistent  
 (d) Insufficient information provided