

Sect 1.2  
Answer key

1. reduced echelon form: a, b  
echelon form: d  
not echelon form: c

2. reduced echelon form: a  
echelon form: b  
not echelon: c, d

3. 
$$\begin{bmatrix} \boxed{1} & 0 & -1 & -2 \\ 0 & \boxed{1} & 2 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{array}{l} \text{Pivot columns} \\ \leftarrow 1 \ \& \# \ 2 \end{array}$$

$$\begin{bmatrix} \boxed{1} & 2 & 3 & 4 \\ 4 & \boxed{5} & 6 & 7 \\ 6 & 7 & 8 & 9 \end{bmatrix}$$

4. 
$$\begin{bmatrix} \boxed{1} & 0 & -1 & 0 \\ 0 & \boxed{1} & 2 & 0 \\ 0 & 0 & 0 & \boxed{1} \end{bmatrix} \begin{array}{l} \text{pivot columns} \\ \leftarrow 1, 2 \ \& \# \ 4 \end{array}$$

$$\begin{bmatrix} \boxed{1} & 3 & 5 & 7 \\ 3 & \boxed{5} & 7 & 9 \\ 5 & 7 & 9 & \boxed{1} \end{bmatrix}$$

7. 
$$\begin{cases} x_1 = -5 - 3x_2 \\ x_2 \text{ free} \\ x_3 = 3 \end{cases}$$

8. 
$$\begin{cases} x_1 = -9 \\ x_2 = 4 \\ x_3 \text{ free} \end{cases}$$

9. 
$$\begin{cases} x_1 = 4 + 5x_3 \\ x_2 = 5 + 6x_3 \\ x_3 \text{ free} \end{cases}$$

10. 
$$\begin{cases} x_1 = -4 + 2x_2 \\ x_2 \text{ free} \\ x_3 = -7 \end{cases}$$

11. 
$$\begin{cases} x_1 = \frac{4}{3}x_2 - \frac{2}{3}x_3 \\ x_2 \text{ free} \\ x_3 \text{ free} \end{cases}$$

12. 
$$\begin{cases} x_1 = 5 + 7x_2 - 6x_4 \\ x_2 \text{ free} \\ x_3 = -3 + 2x_4 \\ x_4 \text{ free} \end{cases}$$

13. 
$$\begin{cases} x_1 = 5 + 3x_2 \\ x_2 = 1 + 4x_5 \\ x_3 = \text{free} \\ x_4 = 4 - 9x_5 \\ x_5 \text{ free} \end{cases}$$

14. 
$$\begin{cases} x_1 = -9 - 7x_3 \\ x_2 = 2 + 6x_3 + 3x_4 \\ x_3 \text{ free} \\ x_4 \text{ free} \\ x_5 = 0 \end{cases}$$

15. a) consistent - unique  
b) inconsistent

19. a) inconsistent if  $h=2 \ \& \# \ k \neq 8$   
b) unique solution if  $h \neq 2$   
c) consistent if  $h=2 \ \& \# \ k=8$

20. a) inconsistent if  $h=9, k \neq 6$   
b) unique if  $h \neq 9$   
c) consistent if  $h=9, k=6$

~~21. a)~~

- 21. a) false
- b) false
- c) true
- d) true
- e) false

- 22. a) false
- b) false
- c) true
- d) false
- e) true

- 23. yes
- 24. system inconsistent
- 25. system consistent
- 26. unique solution
- 27. unique if & only if every column in the coef matrix is a pivot column

33.  $p(t) = 7 + 6t - t^2$