CHAPTER 1 ❑ MATLAB EXERCISES

1. Consider the linear system of Example 7 in Section 1.2.

$$\begin{aligned} x - 2y + 3z &= 9 \\ -x + 3y \quad &= -4 \\ 2x - 5y + 5z &= 17 \end{aligned}$$

(a) Use the MATLAB command **rref** to solve the system.

(b) Let A be the coefficient matrix of the system, and B the right-hand side.

$$A = \begin{bmatrix} 1 & -2 & 3 \\ -1 & 3 & 0 \\ 2 & -5 & 5 \end{bmatrix} \qquad B = \begin{bmatrix} 9 \\ -4 \\ 17 \end{bmatrix}$$

Use the MATLAB command **A\B** to solve the system.

2. Enter the matrix

$$A = \begin{bmatrix} -3 & 2 & 4 & 5 & 1 \\ 3 & 0 & 2 & -2 & 0 \\ -9 & 4 & 6 & 12 & 2 \end{bmatrix}$$

Use the MATLAB command **rref(A)** to find the reduced row-echelon form of A. What is the solution to the linear system represented by the augmented matrix A?

3. Solve the linear system

$$\begin{aligned} 16x - 120y + 240z - 140w &= -4 \\ -120x + 1200y - 2700z + 1680w &= 60 \\ 240x - 2700y + 6480z - 4200w &= -180 \\ -140x + 1680y - 4200z + 2800w &= 140 \end{aligned}$$

You can display more significant digits of the answer by typing **format long** before solving the system. Return to the standard format by typing **format short.**

4. Use the MATLAB command **rref(A)** to determine which of the following matrices are row-equivalent to

$$B = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{bmatrix}.$$

(a) $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 0 & -1 & -2 \\ 0 & 1 & 2 & 3 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 3 & 2 & 4 \\ 5 & 6 & 7 & 8 \\ 9 & 10 & 11 & 12 \end{bmatrix}$ (c) $\begin{bmatrix} 12 & 11 & 10 & 9 \\ 4 & 3 & 2 & 1 \\ 8 & 7 & 6 & 5 \end{bmatrix}$

5. Let A be the coefficient matrix, and B the right-hand side of the linear system of equations

$$\begin{aligned} 3x + 3y + 12z &= 6 \\ x + y + 4z &= 2 \\ 2x + 5y + 20z &= 10 \\ -x + 2y + 8z &= 4. \end{aligned}$$

Enter the matrices A and B, and form the augmented matrix C for this system by using the MATLAB command **C = [A B].** Solve the system using **rref**.

6. The MATLAB command **polyfit** allows you to fit a polynomial of degree $n - 1$ to a set of n data points in the plane

$(x_1, y_1), \quad (x_2, y_2), \quad . \ . \ . \ , \quad (x_n, y_n).$

Find the fourth-degree polynomial that fits the five data points of Example 2 in Section 1.3 by letting

$$x = \begin{bmatrix} -2 \\ -1 \\ 0 \\ 1 \\ 2 \end{bmatrix} \qquad y = \begin{bmatrix} 3 \\ 5 \\ 1 \\ 4 \\ 10 \end{bmatrix}$$

and entering the MATLAB command **polyfit(x,y,4)**.

7. Find the second-degree polynomial that fits the points $(1, -2)$, $(2, 4)$, $(-4, -6)$.

8. Find the sixth-degree polynomial that fits the seven points $(0, 0)$, $(-1, 4.5)$, $(-2, 133)$, $(-3, 1225.5)$, $(1, -0.5)$, $(2, 3)$, $(3, 250.5)$.

9. The following table gives the world population in billions for five different years.

Year	*Population (in billions)*
1960	3.0
1970	3.7
1975	4.1
1980	4.5
1985	4.8

Use **p=polyfit(x,y,4)** to fit the fourth-degree polynomial to this data. Then use **f=polyval(p,1990)** to estimate the world population for the year 1990. (The actual world population in 1990 was 5.3 billion.)