Ch2

17. Solve this system by Gaussian elimination with partial pivoting:

$$\begin{bmatrix} 1 & -2 & 4 & 6 \\ 8 & -3 & 2 & 2 \\ -1 & 10 & 2 & 4 \end{bmatrix}.$$

a. How many row interchanges are needed?

b. Solve again but use only three significant digits of precision.

c. Repeat part (b) without any row interchanges. Do you get the same results?

38. Given system A:

$$A = \begin{bmatrix} 2 & -1 & 3 & 2 \\ 2 & 2 & 0 & 4 \\ 1 & 1 & -2 & 2 \\ 1 & 3 & 4 & -1 \end{bmatrix}.$$

Find the LU equivalent of matrix A that has 2's in each diagonal position of L rather than 1's.

▶61. Evaluate the 1-, 2-, and ∞-norms of these matrices:

$$A = \begin{bmatrix} 5 & -9 & 6 \\ 2 & -7 & 4 \\ 1 & 5 & 8 \end{bmatrix}.$$

$$B = \begin{bmatrix} 10.2 & 2.4 & 4.5 \\ -2.3 & 7.7 & 11.1 \\ -5.5 & -3.2 & 0.9 \end{bmatrix}.$$

83. This 2×2 matrix is obviously singular and is almost diagonally dominant. If the right-hand-side vector is [0, 0], the equations are satisfied by any pair where $x = y$.

$$\begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}.$$

a. What happens if you use the Jacobi method with these starting vectors: [1, 1], [1, −1], [−1, 1], [2, 5], [5, 2]?

b. What happens if the Gauss–Seidel method is used with the same starting vectors as in part (a)?

c. If the elements whose values are −2 in the matrix are changed slightly, to −1.99, the matrix is no longer singular but is almost singular. Repeat parts (a) and (b) with these new matrix.