MATRIX ARITHMETIC

element

scalar multiplication

$$4 \begin{bmatrix} 2 & -3 & 4 \\ 6 & 0 & 5 \end{bmatrix} - 3 \begin{bmatrix} 5 & 7 & -2 & 9 \\ 8 & 6 & 5 & -3 \end{bmatrix}$$

Dimensions:
# of Rows X # of Columns

2 X 3

2 X 4   = not possible

Addition/Subtraction — must have same dimensions

$$4 \begin{bmatrix} 2 & -3 & 4 \\ 6 & 0 & 5 \end{bmatrix} - 3 \begin{bmatrix} 5 & 7 & -2 \\ 8 & 6 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 8 & -12 & 16 \\ 24 & 0 & 20 \end{bmatrix} \boxed{+} \begin{bmatrix} -15 & -21 & 6 \\ -24 & -18 & -15 \end{bmatrix}$$

$$= \begin{bmatrix} -7 & -33 & 22 \\ 0 & -18 & 5 \end{bmatrix}$$

$$\begin{bmatrix} 5 & -2 & 1 & 4 \\ 3 & 6 & -1 & 7 \end{bmatrix} \cdot \begin{bmatrix} 8 & -3 \\ 0 & -1 \\ -9 & 5 \\ 2 & 4 \end{bmatrix}$$

Multiplication:
Rows of 1st matrix $\ast$ Columns of the 2nd

$2 \times \textcircled{4} \quad \textcircled{4} \times 2$

must be same

Final dimension: 2×2

$$= \begin{bmatrix} 40+0+-9+8 & -15+2+5+16 \\ 24+0+9+14 & -9+-6+-5+28 \end{bmatrix} = \begin{bmatrix} 39 & 8 \\ 47 & 8 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 7 \\ 8 \\ 4 \end{bmatrix} \cdot \begin{bmatrix} 2 & 3 \end{bmatrix} = \begin{bmatrix} 2 & 3 \\ 14 & 21 \\ 16 & 24 \\ 8 & 12 \end{bmatrix}$$

$4 \times \textcircled{1} \quad \textcircled{1} \times \underline{2}$

4×2

$4 \times \underline{7} \cdot \underline{7} \times 9 = 4 \times 9$

$5 \times 3 \cdot 3 \times 11 = 5 \times 11$

Cue Ball Incorporated makes pool tables for home, commercial, and professional use. The amount of time required to pack, load, and install each type is summarized in matrix T, with all times in hours. The cost of these components in dollars per hour is summarized in matrix C for two of its warehouses, one on the West Coast and the other in the Midwest.

a) What is the cost to pack, load, and install a commercial pool table from the coastal warehouse?

$$\text{Coastal} = (1.5)(10) + (0.5)(12) + (2.2)(13.5) = \$50.70$$

b) From the Midwest warehouse?

$$MW = 1.5(8) + (0.5)(10.50) + (2.2)(12.5) = 44.75$$

c) Compute the product of TC using your calculator. Explain the meaning of the numbers.

$$T = \begin{array}{c} \\ \text{Home} \\ \text{Comm} \\ \text{Prof} \end{array} \begin{array}{ccc} \text{Pack} & \text{Load} & \text{Install} \\ \left[\begin{array}{ccc} 1 & 0.2 & 1.5 \\ 1.5 & 0.5 & 2.2 \\ 1.75 & 0.75 & 2.5 \end{array}\right] \end{array}$$

$$C = \begin{array}{c} \\ \text{Cost} \end{array} \begin{array}{c} \text{Pack} \\ \text{Load} \\ \text{Install} \end{array} \begin{array}{cc} \text{Coast} & \text{Midwest} \\ \left[\begin{array}{cc} 10/hr & 8 \\ 12 & 10.5 \\ 13.5 & 12.5 \end{array}\right] \end{array}$$

$$TC = \begin{array}{c} \\ \text{Home} \\ \text{Comm} \\ \text{Prof} \end{array} \begin{array}{cc} \text{Coast} & MW \\ \left[\begin{array}{cc} 32.65 & 28.85 \\ 50.70 & 44.75 \\ 60.25 & 53.125 \end{array}\right] \end{array}$$