Section 6.3

① a) $A+B$

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

$$= \begin{bmatrix} 8 & -1 & 5 \\ 8 & -8 & 14 \end{bmatrix}$$

b) $A-2B$

$$= A + (-2B)$$

$$= \begin{bmatrix} 1 & -2 & 4 \\ 3 & 1 & 6 \end{bmatrix} + (-2)\begin{bmatrix} 7 & 1 & 1 \\ 5 & -9 & 8 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & -2 & 4 \\ 3 & 1 & 6 \end{bmatrix} + \begin{bmatrix} -14 & -2 & -2 \\ -10 & 18 & -16 \end{bmatrix}$$

$$= \begin{bmatrix} -13 & -4 & 2 \\ -7 & 19 & -10 \end{bmatrix}$$

② a) $\begin{bmatrix} 2 & 0 & 4 \\ 8 & 1 & -6 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

$$= \begin{bmatrix} 2 & 0 & 4 \\ 8 & 1 & -6 \end{bmatrix}$$ because $AI = A$

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

$$= \begin{bmatrix} 10 & 26 \\ 27 & 14 \end{bmatrix}$$

The operation we're doing is called the dot product.

$2(3) + 0(9) + 4(1) = 10$

(2) c)
$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \begin{bmatrix} 4 & -2 & 1 \\ 9 & -1 & 2 \end{bmatrix}$$

$1(4) + 2(9) = 22$

$$= \begin{bmatrix} 22 & 0 & -3 \\ 48 & 2 & -5 \\ 74 & 4 & -7 \end{bmatrix}$$

d) $\begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is undefined.

(The multiplication is not possible.)

Sizes are $(3 \times 2)(3 \times 3)$

not equal

(3)
$$\begin{bmatrix} 10 & 20 & 2 \\ 15 & 11 & 4 \\ 12 & -8 & -6 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 15 \\ 30 \\ 44 \end{bmatrix}$$

Coefficients

Variables (column)

Constants (column)

(4)

$$\begin{array}{c} \\ \text{Amy} \\ \text{Billy} \end{array}\begin{bmatrix} \text{Test 1} & \text{Test 2} \\ 89 & 75 \\ 60 & 72 \end{bmatrix} \qquad \begin{array}{c} \text{Test 1 Weight} \\ \text{Test 2 Weight} \end{array}\begin{bmatrix} 0.4 \\ 0.6 \end{bmatrix}$$

A $\qquad$ B

$$AB = \begin{array}{c} \\ \text{Amy} \\ \text{Billy} \end{array}\begin{bmatrix} T1 & T2 \\ 89 & 75 \\ 60 & 72 \end{bmatrix}\begin{array}{c} T1 \\ T2 \end{array}\begin{bmatrix} 0.4 \\ 0.6 \end{bmatrix}$$

$$= \begin{array}{c} \\ \text{Amy} \\ \text{Billy} \end{array}\begin{bmatrix} 80.6 \\ 67.2 \end{bmatrix}$$

Note: Categories must match up

Alternatively:

$$\begin{bmatrix} T1\text{ Weight} & T2\text{ Weight} \\ 0.4 & 0.6 \end{bmatrix} \qquad \begin{array}{c} \\ \text{Test 1} \\ \text{Test 2} \end{array}\begin{bmatrix} \text{Amy} & \text{Billy} \\ 89 & 60 \\ 75 & 72 \end{bmatrix}$$

A $\qquad$ B

$$AB = \begin{bmatrix} T1 & T2 \\ 0.4 & 0.6 \end{bmatrix}\begin{array}{c} T1 \\ T2 \end{array}\begin{bmatrix} \text{Amy} & \text{Billy} \\ 89 & 60 \\ 75 & 72 \end{bmatrix}$$

$$= \begin{bmatrix} \text{Amy} & \text{Billy} \\ 80.6 & 67.2 \end{bmatrix}$$

(5)

$$\begin{matrix} & \text{Line I} & \text{Line II} \\ \text{Bicycles} \\ \text{Tricycles} \end{matrix}\begin{bmatrix} 8 & 11 \\ 7 & 15 \end{bmatrix} \qquad \begin{matrix} \text{Line I} \\ \text{Line II} \end{matrix}\begin{bmatrix} 4 \\ 3 \end{bmatrix}$$

A $\qquad$ B

$$AB = \begin{matrix} & \text{I} & \text{II} \\ B \\ T \end{matrix}\begin{bmatrix} 8 & 11 \\ 7 & 15 \end{bmatrix} \begin{matrix} \text{I} \\ \text{II} \end{matrix}\begin{bmatrix} 4 \\ 3 \end{bmatrix}$$

$$= \begin{matrix} B \\ T \end{matrix}\begin{bmatrix} 65 \\ 73 \end{bmatrix}$$

Note: Categories must match up.

Alternatively:

$$\begin{matrix} \text{Line I} & \text{Line II} \end{matrix}\begin{bmatrix} 4 & 3 \end{bmatrix} \qquad \begin{matrix} & B & T \\ \text{Line I} \\ \text{Line II} \end{matrix}\begin{bmatrix} 8 & 7 \\ 11 & 15 \end{bmatrix}$$

A $\qquad$ B

$$AB = \begin{matrix} & \text{Line I} & \text{Line II} \end{matrix}\begin{bmatrix} 4 & 3 \end{bmatrix} \begin{matrix} & B & T \\ \text{Line I} \\ \text{Line II} \end{matrix}\begin{bmatrix} 8 & 7 \\ 11 & 15 \end{bmatrix}$$

$$= \begin{matrix} & B & T \end{matrix}\begin{bmatrix} 65 & 73 \end{bmatrix}$$