# 4.4. Basic Operations with Matrices

Tuesday, October 3, 2017 9:17 AM

Goals: (1) Add and Subtract Matrices

(2) Multiply a number to a matrix

(3) Multiply matrices.

(1) Add / Subtract

$$\begin{pmatrix} 2 & 1 \\ 4 & 6 \end{pmatrix} + \begin{pmatrix} -35 & 7 \\ 5 & -8 \end{pmatrix} = \begin{pmatrix} -33 & 8 \\ 9 & -2 \end{pmatrix}$$

$$\begin{pmatrix} 2 & 1 \\ 4 & 6 \end{pmatrix} - \begin{pmatrix} -35 & 7 \\ 5 & -8 \end{pmatrix} = \begin{pmatrix} 37 & -6 \\ -1 & 14 \end{pmatrix}$$

Note: We can only add / subtract matrices of the same size.

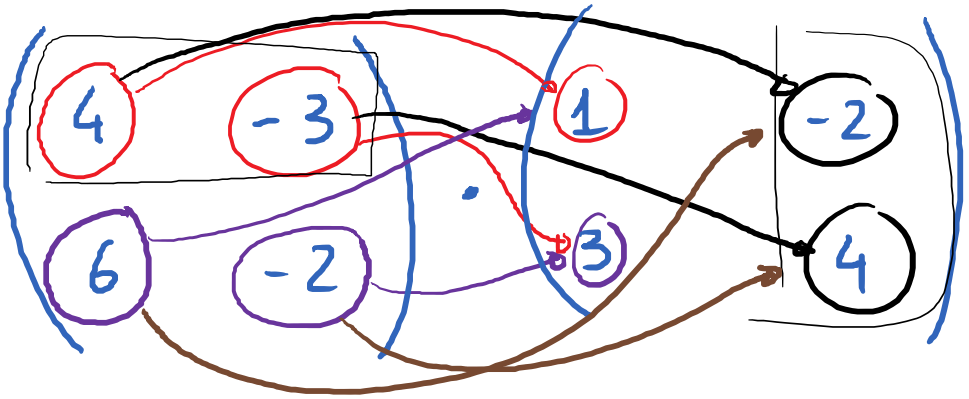
(2) Multiply a matrix by a number

$$7 \cdot \begin{pmatrix} 2 & 1 \\ 4 & 6 \end{pmatrix} = \begin{pmatrix} 14 & 7 \\ 28 & 42 \end{pmatrix}$$

Do it entry by entry

Tuesday, October 3, 2017 9:25 AM

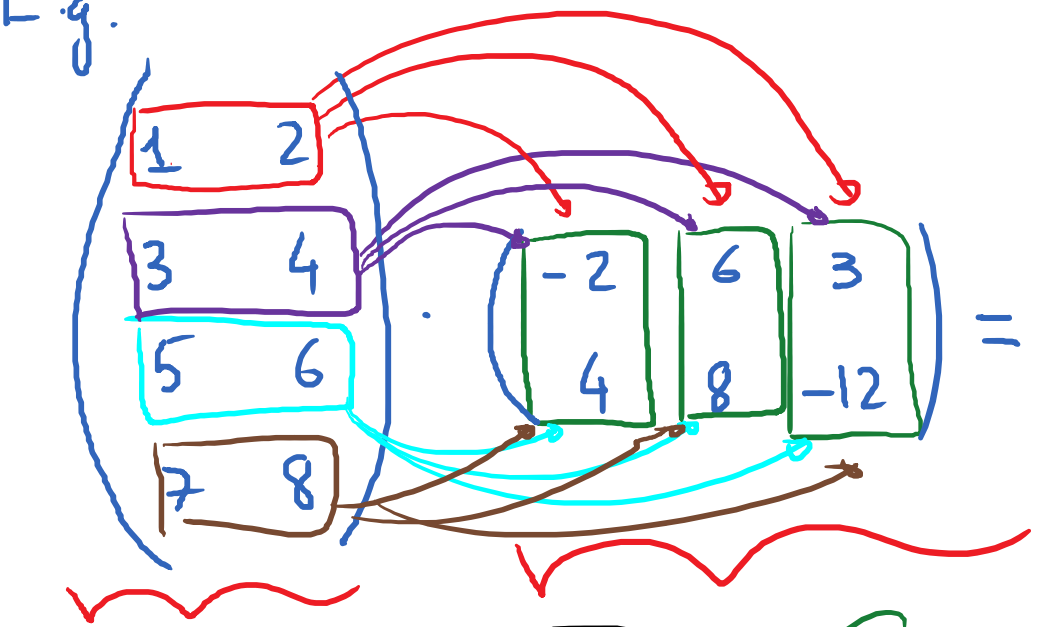
(3) Multiply 2 matrices.




$$= \begin{pmatrix} \boxed{4\cdot 1 + (-3)\cdot 3} & \boxed{4\cdot(-2) + (-3)\cdot 4} \\ \boxed{6\cdot 1 + (-2)\cdot 3} & \boxed{6\cdot(-2) + (-2)\cdot 4} \end{pmatrix}$$

$$= \begin{pmatrix} -5 & -20 \\ 0 & -20 \end{pmatrix}$$

Eg.




4 by 2 2 by 3

| | | |
|---|---|---|
| $1\cdot(-2)+2\cdot4$ | $1\cdot6+2\cdot8$ | $1\cdot3+2\cdot(-12)$ |
| $3\cdot(-2)+4\cdot4$ | $3\cdot6+4\cdot8$ | $3\cdot3+4\cdot(-12)$ |
| | | |
| | | |

4 by 3

In general, $(m\text{-by-}n)\cdot(n\text{-by-}q)=(m\text{-by-}q)$

Revenue of a car dealer.

Sell 4 models : N, T, H, M

In a given week :

10 cars of model N

5 cars of model T

8 cars of model H

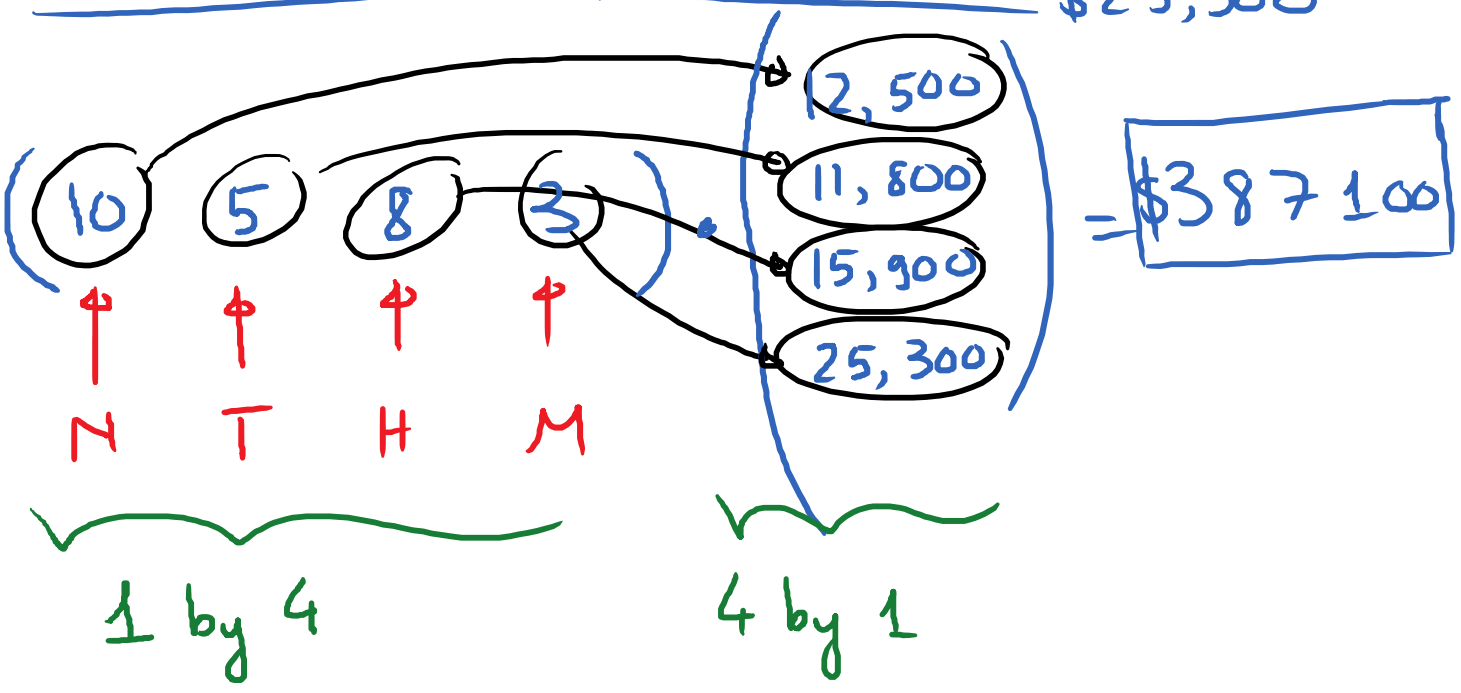
3 cars of model M

A car of model N sells for $12,500

T $11,800

H $15,900

M $25,300



**Note:** Matrix Multiplication is **NOT** commutative.

$$\underbrace{\begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix}}_{A} \cdot \underbrace{\begin{pmatrix} 1 & -1 \\ 2 & 5 \end{pmatrix}}_{B} = \begin{pmatrix} 2 & -2 \\ 6 & 15 \end{pmatrix}$$

$$\underbrace{\begin{pmatrix} 1 & -1 \\ 2 & 5 \end{pmatrix}}_{B} \underbrace{\begin{pmatrix} 2 & 0 \\ 0 & 3 \end{pmatrix}}_{A} = \begin{pmatrix} 2 & -3 \\ 4 & 15 \end{pmatrix}$$

$$A \cdot B \neq B \cdot A \quad \text{in general.}$$