

### Matrix Multiplication - a review

$$\begin{pmatrix} 2 & -1 & 5 \\ 1 & 0 & 4 \end{pmatrix} \begin{pmatrix} 0 & 6 \\ -1 & 4 \\ 1 & 2 \end{pmatrix} = \begin{pmatrix} 2(0) + (-1)(-1) + 5(1) & 2(6) + (-1)(4) + 5(2) \\ 1(0) + 0(-1) + 4(1) & 1(6) + 0(4) + 4(2) \end{pmatrix}$$

$\begin{matrix} R \times C & & R \times C \\ \textcircled{2} \times \textcircled{3} & & \textcircled{3} \times \textcircled{2} \end{matrix} \Rightarrow 2 \times 2$   
 can multiply if the same  
 $= \begin{pmatrix} 6 & 18 \\ 4 & 14 \end{pmatrix}$

On graphing calculator

```
[A]*[B]
[[6 18]
 [4 14]]
```

Note  $A \times B \neq B \times A$

$(2 \times 2) \quad (3 \times 3)$

```
[A]*[B]
[[6 18]
 [4 14]]
[B]*[A]
[[6 0 24]
 [2 1 11]
 [4 -1 13]]
```

\* NOTE that matrix multiplication is not commutative! (order matters)

### Solving Equations using Matrices

Consider the equation:  $3x = 12$

$$3\left(\frac{1}{3}\right)x = 12\left(\frac{1}{3}\right)$$

multiplying by the inverse

$$\textcircled{1}x = 4$$

1 is special!

$$x = 4$$

Consider the following matrix equation:

$$\begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix} X = \begin{bmatrix} -18 & -20 \\ 8 & 9 \end{bmatrix}$$

A X = B

(2x2) (2x2) = (2x2)

match match

$$AX = B$$

$$A^{-1}(AX) = A^{-1}B$$

↑ inverse of A

$$IX = A^{-1}B$$

↑ identity matrix .... like 1 in normal arithmetic

$$X = A^{-1}B$$

$$X = \begin{bmatrix} -146 & -163 \\ 60 & 67 \end{bmatrix}$$

$$[A]^{-1} * [B] = \begin{bmatrix} -146 & -163 \\ 60 & 67 \end{bmatrix}$$

What does  $A \cdot A^{-1} = ?$

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \text{ is the identity matrix (I)}$$

$$[A] * [A]^{-1} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$[A]^{-1} * [A] = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \rightarrow \text{identity matrix (3x3)}$$

Example

$$\begin{bmatrix} 2 & 4 \\ 3 & -1 \end{bmatrix} X + \begin{bmatrix} 2 & 4 \\ -3 & 10 \end{bmatrix} = \begin{bmatrix} 4 & 6 \\ 5 & 7 \end{bmatrix}$$

$$AX + B = C$$

$$\begin{bmatrix} 2 & 4 \\ 3 & -1 \end{bmatrix} X = \begin{bmatrix} 4 & 6 \\ 5 & 7 \end{bmatrix} - \begin{bmatrix} 2 & 4 \\ -3 & 10 \end{bmatrix}$$

$$\begin{bmatrix} 2 & 4 \\ 3 & -1 \end{bmatrix} X = \begin{bmatrix} 2 & 2 \\ 8 & -3 \end{bmatrix}$$

$$AX = B$$

$$A^{-1}AX = A^{-1}B$$

$$IX = A^{-1}B$$

$$X = A^{-1}B$$

```
[A]^-1*[B]
... -.71428571431
... .8571428571 ]]
Ans+Frac
[[17/7 -5/7]
[-5/7 6/7 ]]
```

fractions

this doesn't display all values unless you scroll

$$X = \begin{bmatrix} 17/7 & -5/7 \\ -5/7 & 6/7 \end{bmatrix}$$