4.1 Organizing Data into Matrices

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	1996	1998	2000
Imports	4.678	5.185	6.964
Exports	1.295	1.331	1.402

1. 1996: 4.678
   2000: 6.964 million units

2. 0.507 million units

3. 5.562 million units

4. % increase $\frac{\text{new} - \text{original}}{\text{original}}$

$$\frac{2000 - 1996}{2000}$$

IMPORTS

$$\frac{6.964 - 4.678}{4.678} = .48867 \approx 48.9\%$$

$$\frac{1.402 - 1.295}{1.295} = .083 \approx 8.3\%$$

EXPORTS

$$\begin{array}{c} \\ \text{imports} \\ \text{exports} \end{array} \begin{array}{c} \begin{array}{ccc} 1996 & 1998 & 2000 \end{array} \\ \begin{bmatrix} 4.678 & 5.185 & 6.964 \\ 1.295 & 1.331 & 1.402 \end{bmatrix} \end{array}$$

A matrix is a rectangular array of numbers written within brackets.

you represent it with a capital letter and classify it by its dimensions.

Dimensions : horizontal $\times$ vertical
(order) rows $\times$ columns

$$A = \begin{bmatrix} 5 & 1 \\ -2 & 6 \\ 3 & 7 \end{bmatrix} \qquad \text{order: } 3 \times 2$$

State the dimensions

a) $\begin{bmatrix} 4 & 5 & 0 \\ -2 & 0.5 & 17 \end{bmatrix}$ **2 × 3**

b) $\begin{bmatrix} 8 & -3 & 15 \end{bmatrix}$ **1 × 3**

c) $\begin{bmatrix} 10 & 2 & 2 \\ 1 & 6 & -4 \\ 0 & -9 & -1 \\ -7 & 8 & 5 \end{bmatrix}$ **4 × 3**

Each number in a matrix is a matrix element. You can identify it by it's position in the matrix.

a_{13} is the element in the first row and 3rd column.

Find a) $a_{33} = -1$ b.) $a_{11} = 10$ c.) $a_{21} = 1$

4.2 Adding and Subtracting Matrices

1. $\begin{bmatrix} 10+4 & 0+4 \\ -2+4 & -5+4 \end{bmatrix}$

2. $\begin{bmatrix} 5-2 & 3-2 \\ -1-2 & 0-2 \end{bmatrix}$

3. $\begin{bmatrix} -2+3 & 0-3 \\ 1-3 & -5+3 \end{bmatrix}$

4.2

★ When adding and subtracting matrices they must have the same <u>dimensions</u> (or <u>order</u>)

To add, add the corresponding elements which are in the same position in each matrix.

✓1

ex $\begin{bmatrix} 1 & -2 & 0 \\ 3 & -5 & 7 \end{bmatrix} + \begin{bmatrix} 3 & 9 & -3 \\ -9 & 6 & 12 \end{bmatrix} = \begin{bmatrix} 4 & 7 & -3 \\ -6 & 1 & 19 \end{bmatrix}$

ex $\begin{bmatrix} -12 & 24 \\ -3 & 5 \\ -1 & 10 \end{bmatrix} + \begin{bmatrix} -3 & 1 \\ 2 & -4 \\ -1 & 5 \end{bmatrix} = \begin{bmatrix} -15 & 25 \\ -1 & 1 \\ -2 & 15 \end{bmatrix}$

When Subtracting, you have to distribute the minus sign to each element in the 2nd matrix.

✓3 ex $\begin{bmatrix} 6 & -9 & 7 \\ -2 & 1 & 8 \end{bmatrix} - \begin{bmatrix} -4 & 3 & 0 \\ 6 & 5 & 10 \end{bmatrix}$

$\begin{bmatrix} 6 & -9 & 7 \\ -2 & 1 & 8 \end{bmatrix} + \begin{bmatrix} 4 & -3 & 0 \\ -6 & -5 & -10 \end{bmatrix}$

ex $\begin{bmatrix} -3 & 5 \\ -1 & 10 \end{bmatrix} + \begin{bmatrix} +3 & -1 \\ -2 & +4 \end{bmatrix}$ $\begin{bmatrix} 10 & -12 & 7 \\ -8 & -4 & -2 \end{bmatrix}$

$\begin{bmatrix} 0 & 4 \\ -3 & 14 \end{bmatrix}$

The additive identity matrix for the set of all $m \times n$ matrices is the zero matrix, whose elements are all zeros. $0 + 5 = 5$

$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix} + \begin{bmatrix} -1 & 10 & -5 \\ 0 & 2 & -3 \end{bmatrix} =$

The opposite or additive inverse has all elements with opposite signs from the original. When you add them you get **ZERO**.

$\begin{bmatrix} 14 & 5 \\ 0 & -2 \end{bmatrix} + \begin{bmatrix} -14 & -5 \\ 0 & 2 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$