Subject: Linear Algebra Created by: Marija Stanojcic Revised:2/26/2018 ? ? ? is defined by number of rows and columns in the matrix. For the matrix that have m rows and n columns we say the size of the matrix is m x n. If matrix have the same number of rows (n) and columns (n), we call that matrix the squared (x) matrix. 2 ] squared 3x3 matrix matrix that has all elements equal to 0; The notation for this matrix is O. 1) 2) in some books, it can be E.  $\mathbf{O} = [\mathbf{0}], \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}, \text{ etc. } \mathbf{I} = [\mathbf{1}], \begin{bmatrix} 1 & 0 & 1 & 0 & 0 \\ 0 & 1 \end{bmatrix}, \begin{bmatrix} 0 & 1 & 0 \end{bmatrix}, \text{ etc. }$ We can add or subtract only matrices that are same sizes.  $= \begin{bmatrix} 1 & 4 & 7 \\ 8 & 6 & 2 \end{bmatrix}_{2 \ 3} = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2 \ 3} C = \begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 7 \end{bmatrix}$ Matrices A and B are the same sizes, because they both have 2 rows and 3 columns, matrix Chas the different size. So we can only do addition or subtraction with matrices A and B. For example, we can do A B.  $A - B = \begin{bmatrix} 1 & 4 & 7 \\ 8 & 6 & 2 \end{bmatrix} - \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} 1 - 1 & 4 - 2 & 7 - 3 \\ 8 - 4 & 6 - 5 & 2 - 6 \end{bmatrix} = \begin{bmatrix} 0 & 2 & 4 \\ 4 & 1 & -4 \end{bmatrix}$ If A is the matrix and c is the scalar (any number) then cA (this is the same as c x A) is the matrix that we get when we multiply each entry of the matrix A with the scalar c.

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We can multiply only matrices where the first matrix has the number of columns same as the number of rows of the second matrix. And new matrix AB will have same number of rows as the first matrix, and same number of columns as the second matrix. The next drawing will help you to understand.



rix A has size 2x3 (2 rows and 3 columns), and matrix B has size 4x3 (4 rows and 3 columns). The number of columns of the matrix A is 3, and the number of the rows of the

**2)** 
$$A = \begin{bmatrix} 1 & 2 & 4 \\ 2 & 6 & 0 \end{bmatrix} B = \begin{bmatrix} 4 & 1 & 4 & 3 \\ 0 & -1 & 3 & 1 \end{bmatrix} A$$

?





Now, we know that we can multiply these matrices, but <u>how do we multiply matrices</u>? We multiply each row of the first matrix with each column of the second matrix and put values in the specific order.

			4	1	4	3								
AB =	<sub>1</sub>	2	4, ,	1	2	1 r1	1	1	2	1	3	1	4	1
	12	6	0110	- 1	3	$[] = [_{2}$	1	2	2	2	З	2	Δ	]
	2	0	2	7	5	2 2	1	~	~	2	5	~	4	

How do we multiply row with column? The best way to explain this is with an example.

We are going to multiply the 1st row of the matrix A with the 1st column of the matrix B.

The first row of



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)  $A = \begin{bmatrix} 6 & 1 \\ 5 & 2 \end{bmatrix}$ ,  $A^{-1} = --- \begin{bmatrix} - & - \end{bmatrix} = \frac{2}{6 \cdot 2 - 1 \cdot 5} \begin{bmatrix} 2 & -1 \\ -5 & 6 \end{bmatrix} = \frac{2}{7} \begin{bmatrix} 2 & -1 \\ -5 & 6 \end{bmatrix} = \begin{bmatrix} - & -1 \\ -5 & 6 \end{bmatrix} = \begin{bmatrix} - & -1 \\ -5 & 6 \end{bmatrix}$ 



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