

Mathematics 2
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Lecture 10

جامعة الجميع الذكية

تسعى لتكون الكيان الأول الذي يتبنى مبدأ المجتمع التعليمي
التعاوني ويقدم العلم مقابل العمل لتنمية وبناء المجتمعات.

MAT 122

Linear Algebra by Spreadsheet



جامعة الجميع الذكية
EVERYONE'S SMART UNIVERSITY

Learn how to use Excel for the addition and subtraction of matrices.

Learn how to use Excel for the multiplication of matrices.

Learn how to use Excel for calculating the determinants.

Learn how to use Excel for obtaining the inverse of the matrix.

Learn how to use Excel for adjoint of a matrix

Learn how to use Excel for obtaining the transpose of the matrix.

Learn how to use Excel for solving system of equations.

1- Addition and Subtraction of Matrices by spreadsheet

I. Addition and Subtraction of Matrices

Rule: Matrices can be added or subtracted if and only if they have the same sizes, and both matrices must have only real numbers as entries.

Always remember that there is no direct command in MS-Excel to add/subtract two matrices.

Example:

Given $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ $B = \begin{bmatrix} 7 & 8 & 9 \\ 10 & 11 & 12 \end{bmatrix}$ Compute the sum of A and B.

To do this operation in MS-Excel, the following procedures are to be followed:

1. Input the entries to Excel. Matrix A will be in cells (A1:C2) and Matrix B cells (A5:C6) as shown below.
2. In cell A9 type $=A1+A5$ then press Enter.
3. Value 8 will appear as result of sum of 1+7.

To do this operation in MS-Excel, the following procedures are to be followed:

4. Click on Cell A9 then Press Ctrl c to copy the cell
5. Highlight cells that range A9:C10.
6. Press Ctrl v to paste the result of adding two matrices as shown below.

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1- Addition and Subtraction by Spreadsheet

You can do the same procedures for subtracting two matrices. You only need to change the command in number 2 by typing `=A1-B5`.

	A	B	C
1	1	2	3
2	4	5	6
3			
4			
5	7	8	9
6	10	11	12
7			
8			
9	8	10	12
10	14	16	18

2- Multiplication of Matrices by Spreadsheet

II. Multiplication of Matrices.

A. Scalar Multiplication

Scalar multiplication is defined by multiplying each entry of the matrix by a certain constant k .

Example:

Given $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and the constant $k=5$. Compute kA

2- Multiplication of Matrices by Spreadsheet

To do this operation in MS-Excel, the following procedures are to be followed:

1. Input the entries to Excel. Matrix A will be in cells (A1:C2).
2. Click on cell A5, then type $=5*A1$, press Enter.
3. The value of 5 will appear in Cell A5 as result of product 1 times 5.

To do this operation in MS-Excel, the following procedures are to be followed:

4. Copy cell A5 by clicking on cell A5 then press Ctrl c.
5. Highlight the cells that range A5:C6.

6. Press Ctrl v to paste the result of multiplying a constant (k) to matrix A as shown below.

	A	B	C
1	1	2	3
2	4	5	6
3			
4			
5	5	10	15
6	20	25	30

B. Multiplication of two Matrices

Rule: Matrix multiplication is possible only when the number of columns in the first matrix are equal to the number of rows in the second matrix, and both matrices must have only real numbers as entries.

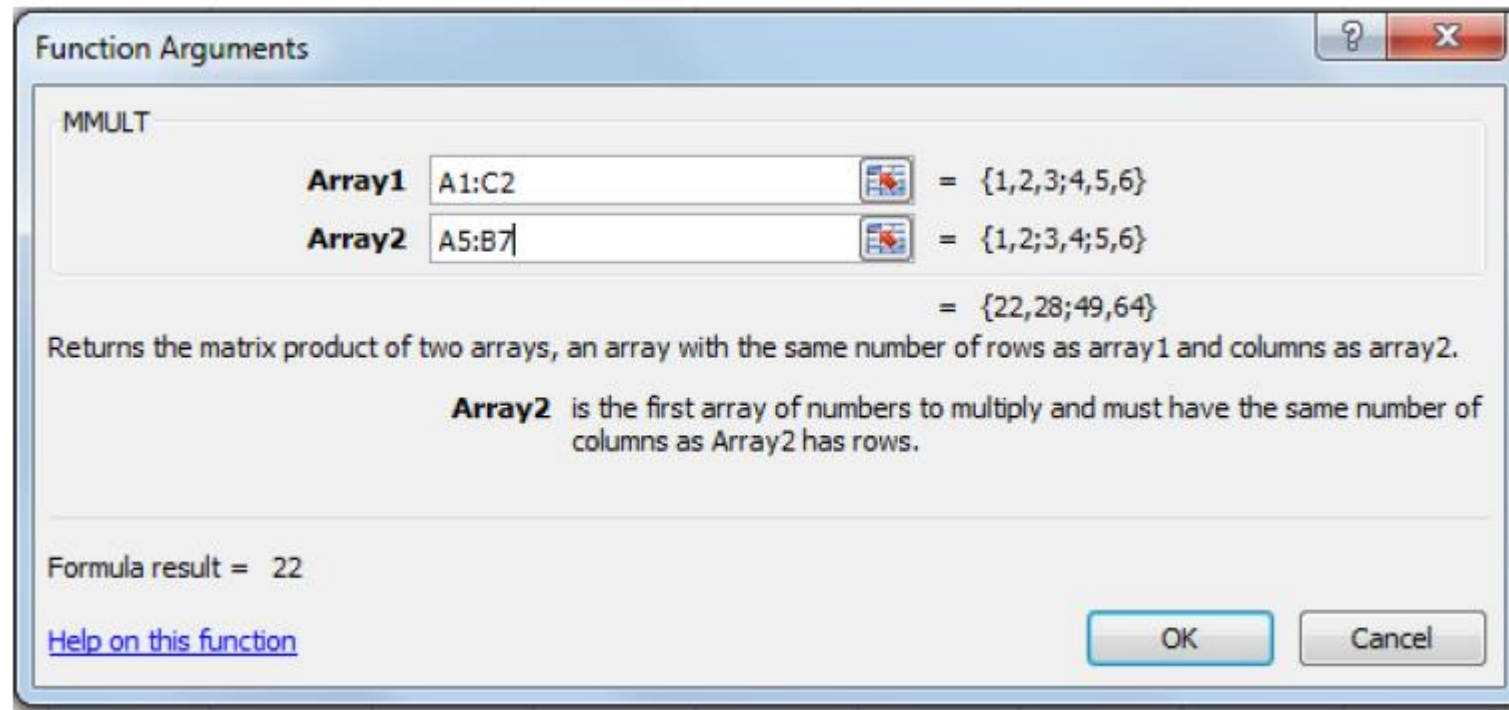
Example: Given $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$ Compute AB .

2- Multiplication for two Matrices

To do this operation in MS-Excel, the following procedures are to be followed:

1. Input the entries to Excel. Matrix A will be in cells (A1:C2) and Matrix B cells (A5:B7)
2. Select cell A9
3. Click on “Formulas” in the menu bar, then select “MMULT” from “Math & Trig” Menu, or simply click on f_x . and select the two matrices as shown below. Then press OK.

2- Multiplication for two Matrices



2- Multiplication for two Matrices

4. Copy cell A9 by clicking on cell A5 then press Ctrl c.
5. Highlight the cells that range A9:B10.
6. Press F2.
7. Press Ctrl + Shift + Enter, the result of multiplying two matrices will appear as shown below.

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2- Multiplication for two Matrices

	A	B	C
1	1	2	3
2	4	5	6
3			
4			
5	1	2	
6	3	4	
7	5	6	
8			
9	22	28	
10	49	64	

3- Determinants by Spreadsheet

III. Determinants and Singular Matrices

Example:

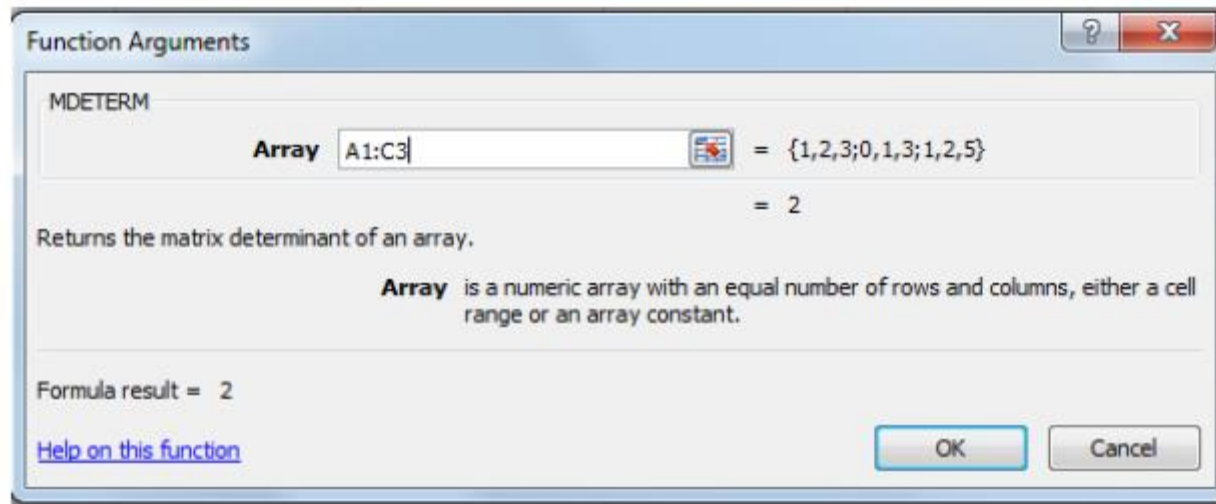
Given $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 1 & 2 & 5 \end{bmatrix}$ Compute the determinant of matrix A which is usually denoted by $\det(A)$ or $|A|$.

To do this operation in MS-Excel, the following procedures are to be followed:

1. Input the entries to Excel. Matrix A will be in cells (A1:C3).
2. Click on cell A5
3. Click on “Formulas” in the menu bar, then select “MDETERM” from “”Math & Trig” Menu, or simply click on f_x . and select the Matrix A (Range From A1 to C3) as shown below. Then press OK.

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3- Determinants by Spreadsheet



4. The value 2 will appear as a result as shown below.

	A	B	C
1	1	2	3
2	0	1	3
3	1	2	5
4			
5	2		

4- The inverse of a matrix by Spreadsheet

IV. The Inverse of a Matrix

Rule: The matrix should be square a matrix and the $\det(A)$ should be non-zero. If $\det(A)=0$, the inverse matrix does not exist and A is said to be singular or noninvertible.

Example:

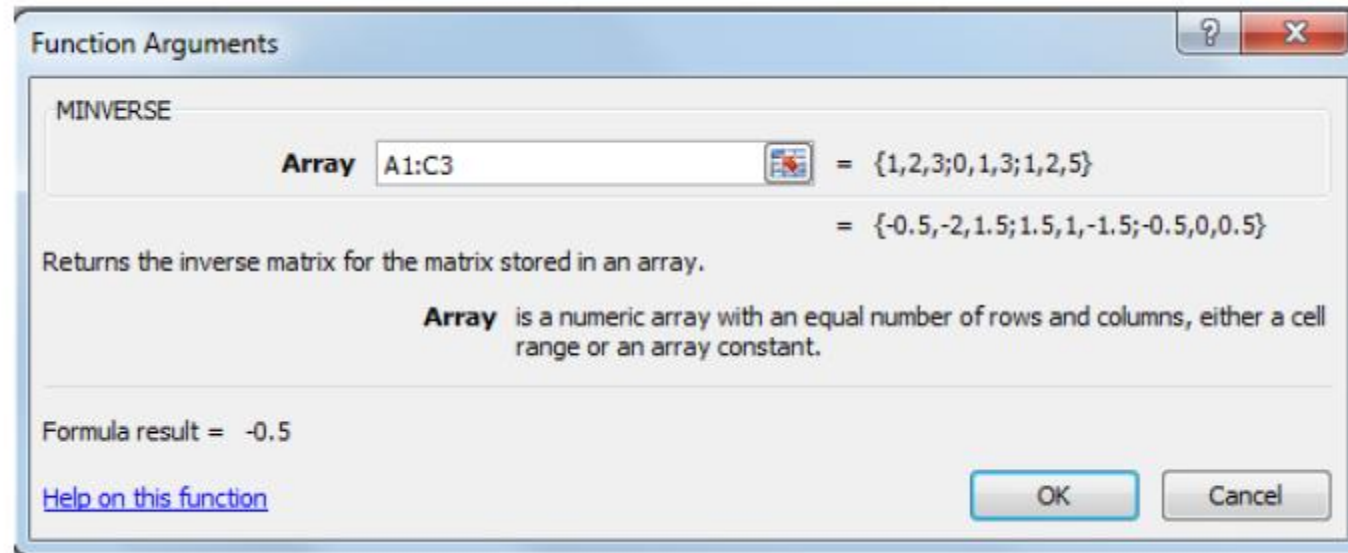
Given $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 1 & 2 & 5 \end{bmatrix}$ Compute inverse matrix (A^{-1})

4- The inverse of a matrix by Spreadsheet

To do this operation in MS-Excel, the following procedures are to be followed:

1. Input the entries to Excel. Matrix A will be in cells (A1:C3).
2. Click on cell A5
3. Click on “Formulas” in the menu bar, then select “MINVERSE” from “Math & Trig” Menu, or simply click on f_x . and select the Matrix A (Range From A1 to C3) as shown below. Then press OK.

4- The inverse of a matrix by Spreadsheet



4. Copy cell A5 by clicking on cell A5 then press Ctrl c.
5. Highlight the cells that range A5:C7.
6. Press F2.
7. Press Ctrl + Shift + Enter, the result of multiplying two matrices will appear as shown below.

4- The inverse of a matrix by Spreadsheet

	A	B	C
1	1	2	3
2	0	1	3
3	1	2	5
4			
5	-0.5	-2	1.5
6	1.5	1	-1.5
7	-0.5	0	0.5

5- Adjoint of Matrix -- $\text{Adj}(A)$ by Spreadsheet

V. Adjoint of Matrix $\text{Adj}(A)$.

Rule: If A a square matrix and $\det(A) \neq 0$, then $A^{-1} = \frac{1}{\det(A)} \text{Adj}(A)$

Example:

Given $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 1 & 2 & 5 \end{bmatrix}$ Compute $\text{Adj}(A)$.

To do this operation in MS-Excel, the following procedures are to be followed:

1. Input the entries to Excel. Matrix A will be in cells (A1:C3).
2. As described above, do the following:
 - a. Compute $\det(A)$.
 - b. Compute A^{-1} .
 - c. Multiply A^{-1} by the $\det(A)$._____

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5- Adjoint of Matrix -- $\text{Adj}(A)$ by Sp

	A	B	C
1	1	2	3
2	0	1	3
3	1	2	5
4			
5	-1	-4	3
6	3	2	-3
7	-1	0	1

6- Transpose of matrix by Spreadsheet

VI. Transpose of Matrix A^T

Rule: Transpose means to change column of the matrix to rows and vice versa.

Example:

Given $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 1 & 2 & 5 \end{bmatrix}$ Find the transpose of A which is usually denoted by matrix (A^T) .

To do this operation in MS-Excel, the following procedures are to be followed:

1. Input the entries to Excel. Matrix A will be in cells (A1:C3).
2. Select cells that range from A1 to C3. Then press Ctrl c to copy them.
3. Click on Cell A5

4. Click on the small arrow at Paste icon and select Transpose.

	A	B	C
1	1	2	3
2	0	1	3
3	1	2	5
4			
5	1	0	1
6	2	1	2
7	3	3	5

7- Solving system of equations by Spreadsheet

VII. Solve Systems Using Matrix Equations

Rule: The determinant of A should be non-zero.

Example:

Given the system bellow:

$$X + 2Y + 3Z = 6 \quad \text{-----}1$$

$$2X - Y + Z = 2 \quad \text{-----}2$$

$$5X + 2Y = 7 \quad \text{-----}3$$

Find the value of X , Y and Z .

To solve this problem:

1. Form the matrices $AB=C$

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 1 \\ 5 & 2 & 0 \end{bmatrix} \begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 6 \\ 2 \\ 7 \end{bmatrix}$$

2. Find the $\det(A)$. since the $\det(A) = 35$, proceed to step 3

To solve this problem:

3. Find A^{-1} .
4. Multiply A^{-1} by C. the result is the answer for X,Y and Z.

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

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7- Solving system of equations by Sp

	A	B	C	D	E
1	1	2	3		6
2	2	-1	1		2
3	5	2	0		7
4					
5	35				
6					
7	- 2/35	6/35	1/7		
8	1/7	- 3/7	1/7		
9	9/35	8/35	- 1/7		
10					
11	1				
12	1				
13	1				



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قال الله تعالى :

وَيَسْأَلُونَكَ عَنِ الرُّوحِ قُلِ
الرُّوحُ مِنْ أَمْرِ رَبِّي وَمَا أُوتِيتُمْ
مِّنَ الْعِلْمِ إِلَّا قَلِيلًا



سورة الإسراء



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