

- » Welcome
- » Materials
- » Assignments
- » **STACK**
- » Homework Submission
- » ONLINE EXAM
- » END EXAM 8.12

## MS-A0001 - Matrix Algebra, 26.10.2020-08.12.2020

Dashboard / Courses / School of Science / department of... / ms-a0001 - ma... / Sections / STACK / Lecture 2

<b>Started on</b>	Thursday, 29 October 2020, 3:53 PM
<b>State</b>	Finished
<b>Completed on</b>	Thursday, 29 October 2020, 4:26 PM
<b>Time taken</b>	32 mins 58 secs
<b>Grade</b>	<b>2.00</b> out of 2.00 ( <b>100%</b> )

Question **1** [Flag question](#) Mark 1.00 out of 1.00 Correct

Let's solve the system of linear equations

$$\begin{cases} -6 \cdot x_1 - 2 \cdot x_2 = -6 \\ -5 \cdot x_1 + 4 \cdot x_2 = -22 \end{cases}$$

using Gaussian elimination. First transform the system into matrix form  $A\mathbf{x} = \mathbf{b}$  where  $A$  is the coefficient matrix,  $\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$  and  $\mathbf{b}$  contains the constant terms on the right side of the equations.

Input the augmented matrix  $[A|\mathbf{b}]$  as the first intermediate step:

$$\left[ \begin{array}{cc|c} -6 & -2 & -6 \\ -5 & 4 & -22 \end{array} \right]$$

Your last answer was interpreted as follows:

$$\begin{bmatrix} -6 & -2 & -12 \\ -5 & 2 & -21 \end{bmatrix}$$

Next compute the reduced row echelon form of the augmented matrix using row operations. Input the resulting matrix  $\text{rref}[A|\mathbf{b}]$ :

$$\left[ \begin{array}{cc|c} 1 & 0 & 3 \\ 0 & 1 & -3 \end{array} \right]$$

Your last answer was interpreted as follows:

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

From this matrix we can deduce the amount the solutions to the system and the solutions themselves. Input the number of solutions to the system. If there are an infinite number of solutions, input inf.

1

Your last answer was interpreted as follows:

1

Your answer is partially correct. Keep trying!

Your answer is incorrect.

One or more elements of the augmented matrix are incorrect.

Marks for this submission: 0.33/0.33.

Your answer is incorrect.

The reduced row echelon form is incorrect.

Marks for this submission: 0.33/0.33.

Your answer is correct!

The number of solutions is correct!

Marks for this submission: 0.33/0.33.

### Worked solution:

First collect the coefficients into matrix  $A$ . In the left column we will have the coefficients of variable  $x_1$  and in the right column we will similarly have the coefficients of variable  $x_2$ . On the first row we will have the coefficients from the first equation and on the second row we will have the coefficients from the second equation. The resulting matrix is

$$A = \begin{bmatrix} -6 & -2 \\ -5 & 4 \end{bmatrix}.$$

Now collect the constant terms into the column vector  $\mathbf{b}$ . The resulting vector is

$$\mathbf{b} = \begin{bmatrix} -6 \\ -22 \end{bmatrix}.$$

Now the augmented matrix must be

$$[A|\mathbf{b}] = \begin{bmatrix} -6 & -2 & -6 \\ -5 & 4 & -22 \end{bmatrix}.$$

Next we compute the  $\text{rref}$  form of the matrix.

$$\begin{aligned} [A|\mathbf{b}] &= \begin{bmatrix} -6 & -2 & -6 \\ -5 & 4 & -22 \end{bmatrix} \xrightarrow{-\frac{R_1}{6}} \begin{bmatrix} 1 & \frac{1}{3} & 1 \\ -5 & 4 & -22 \end{bmatrix} \\ &\xrightarrow{R_2+5 \cdot R_1} \begin{bmatrix} 1 & \frac{1}{3} & 1 \\ 0 & \frac{17}{3} & -17 \end{bmatrix} \\ &\xrightarrow{\frac{3 \cdot R_2}{17}} \begin{bmatrix} 1 & \frac{1}{3} & 1 \\ 0 & 1 & -3 \end{bmatrix} \\ &\xrightarrow{R_1 - \frac{R_2}{3}} \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & -3 \end{bmatrix} \end{aligned}$$

Interpreting the matrix back into a system of equations we immediately see the unique solution:

$$\begin{cases} x_1 = 2 \\ x_2 = -3 \end{cases}$$

A correct answer is  $\begin{bmatrix} -6 & -2 & -6 \\ -5 & 4 & -22 \end{bmatrix}$ .

A correct answer is  $\begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & -3 \end{bmatrix}$ .

A correct answer is 1, which can be typed in as follows: 1

Question **2** [Flag question](#) Mark 1.00 out of 1.00 Correct

Solve the system

$$\begin{cases} -4 \cdot x_3 - x_2 - 2 \cdot x_1 = 25 \\ 4 \cdot x_3 - 3 \cdot x_2 - x_1 = -75 \\ 3 \cdot x_3 - 2 \cdot x_2 + x_1 = 50 \end{cases}.$$

$x_1 =$  66

Your last answer was interpreted as follows:

66

$x_2 =$  -37

Your last answer was interpreted as follows:

-37

$x_3 =$  -30

Your last answer was interpreted as follows:

-30

Your answer is correct!

Your answer is correct!

Marks for this submission: 0.33/0.33.

Your answer is correct!

Marks for this submission: 0.33/0.33.

Your answer is correct!

Marks for this submission: 0.33/0.33.

### Worked solution:

Our job is to solve the system

$$\begin{cases} -4 \cdot x_3 - x_2 - 2 \cdot x_1 = 25 \\ 4 \cdot x_3 - 3 \cdot x_2 - x_1 = -75 \\ 3 \cdot x_3 - 2 \cdot x_2 + x_1 = 50 \end{cases}.$$

First transform the system of linear equations into matrix form by computing the coefficient matrix  $A$ , variable vector  $\mathbf{x}$  and constant vector  $\mathbf{b}$  such that  $A\mathbf{x} = \mathbf{b}$ . In matrix form the system is

$$\underbrace{\begin{bmatrix} -2 & -1 & -4 \\ -1 & -3 & 4 \\ 1 & -2 & 3 \end{bmatrix}}_{=A} \underbrace{\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}}_{=\mathbf{x}} = \underbrace{\begin{bmatrix} 25 \\ -75 \\ 50 \end{bmatrix}}_{=\mathbf{b}}.$$

Next create the augmented matrix  $B = [A|\mathbf{b}]$ .

$$B = \begin{bmatrix} -2 & -1 & -4 & 25 \\ -1 & -3 & 4 & -75 \\ 1 & -2 & 3 & 50 \end{bmatrix}$$

Now transform  $B$  to reduced row echelon form by using row operations.

$$\begin{aligned} &\xrightarrow{-\frac{1}{2}R_1} \begin{bmatrix} 1 & \frac{1}{2} & 2 & -\frac{25}{2} \\ -1 & -3 & 4 & -75 \\ 1 & -2 & 3 & 50 \end{bmatrix} \\ &\xrightarrow{R_2+1 \cdot R_1} \begin{bmatrix} 1 & \frac{1}{2} & 2 & -\frac{25}{2} \\ 0 & -\frac{5}{2} & 6 & -\frac{175}{2} \\ 1 & -2 & 3 & 50 \end{bmatrix} \\ &\xrightarrow{R_3+(-1) \cdot R_1} \begin{bmatrix} 1 & \frac{1}{2} & 2 & -\frac{25}{2} \\ 0 & -\frac{5}{2} & 6 & -\frac{175}{2} \\ 0 & -\frac{5}{2} & 1 & \frac{125}{2} \end{bmatrix} \\ &\vdots \\ &\vdots \\ &\longrightarrow \begin{bmatrix} 1 & 0 & 0 & 66 \\ 0 & 1 & 0 & -37 \\ 0 & 0 & 1 & -30 \end{bmatrix} \end{aligned}$$

Finally we interpret the row reduced matrix back into a system of equations.

$$\begin{cases} 1 \cdot x_1 + 0 \cdot x_2 + 0 \cdot x_3 = 66 \\ 0 \cdot x_1 + 1 \cdot x_2 + 0 \cdot x_3 = -37 \\ 0 \cdot x_1 + 0 \cdot x_2 + 1 \cdot x_3 = -30 \end{cases}$$

eli

$$\begin{cases} x_1 = 66 \\ x_2 = -37 \\ x_3 = -30 \end{cases}.$$

A correct answer is 66, which can be typed in as follows: 66

A correct answer is -37, which can be typed in as follows: -37

A correct answer is -30, which can be typed in as follows: -30

[Finish review](#)

◀ Lecture 1

Lecture 3 ▶



Tuki / Support  
**Opiskelijoille / Students**

- MyCourses instructions for students
- email: mycourses(at)aalto.fi

**Opettajille / Teachers**

- MyCourses help
- MyTeaching Support form

Palvelusta

- MyCourses rekisteriseloste
- Tietosuojailmoitus
- Palvelukuvaus
- Saavutettavuusseloste

About service

- MyCourses protection of privacy
- Privacy notice
- Service description
- Accessibility summary

Service

- MyCourses registerbeskrivning
- Dataskyddsmiddelände
- Beskrivning av tjänsten
- Sammanfattning av tillgängligheten

