Linear Algebra MAT313 Fall 2022
Professor Sormani
Lesson 2 Solving Linear Systems

Warning: do not start this lesson until you have completed Lesson 1 and submitted the classwork/homework (at least HW1-HW6) and received feedback from the professor and made necessary fixes.

Please be sure to mark down the date and time that you start this lesson. Carefully take notes on pencil and paper while watching the lesson videos. Pause the lesson to try classwork before watching the video going over that classwork. If you work with any classmates, be sure to write their names on the problems you completed together. Please wear masks when meeting with classmates even if you meet off campus.

You will cut and paste the photos of your notes and completed classwork and a selfie taken holding up the first page of your work in a googledoc entitled:

MAT313F22-lesson2-lastname-firstname

and share editing of that document with me <u>sormanic@gmail.com</u>. You will also include your homework and any corrections to your homework in this doc.

If you have a question, type **QUESTION** in your googledoc next to the point in your notes that has a question and email me with the subject MAT313 QUESTION. I will answer your question by inserting a photo into your googledoc or making an extra video.

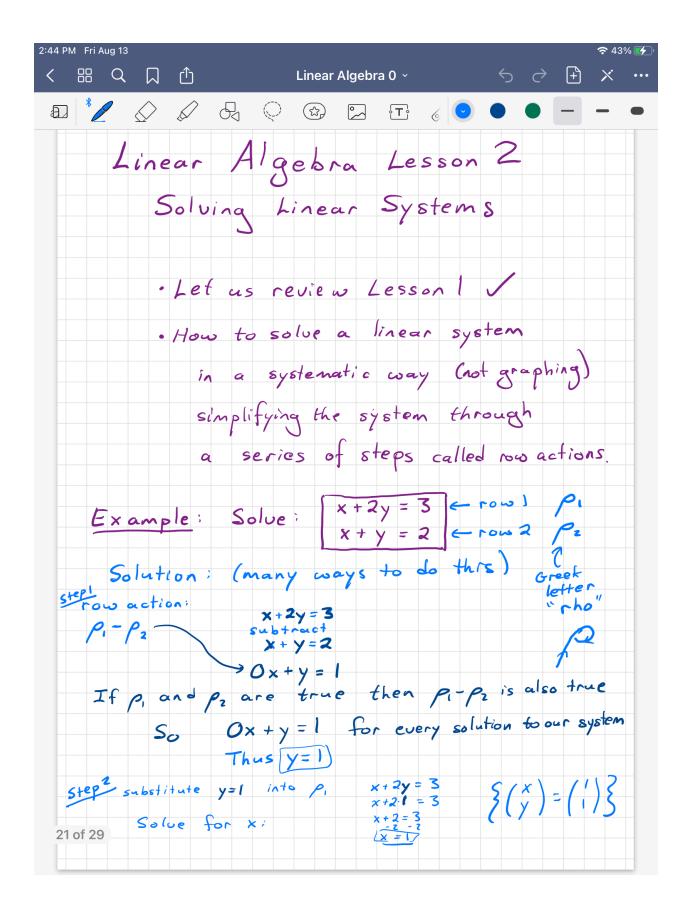
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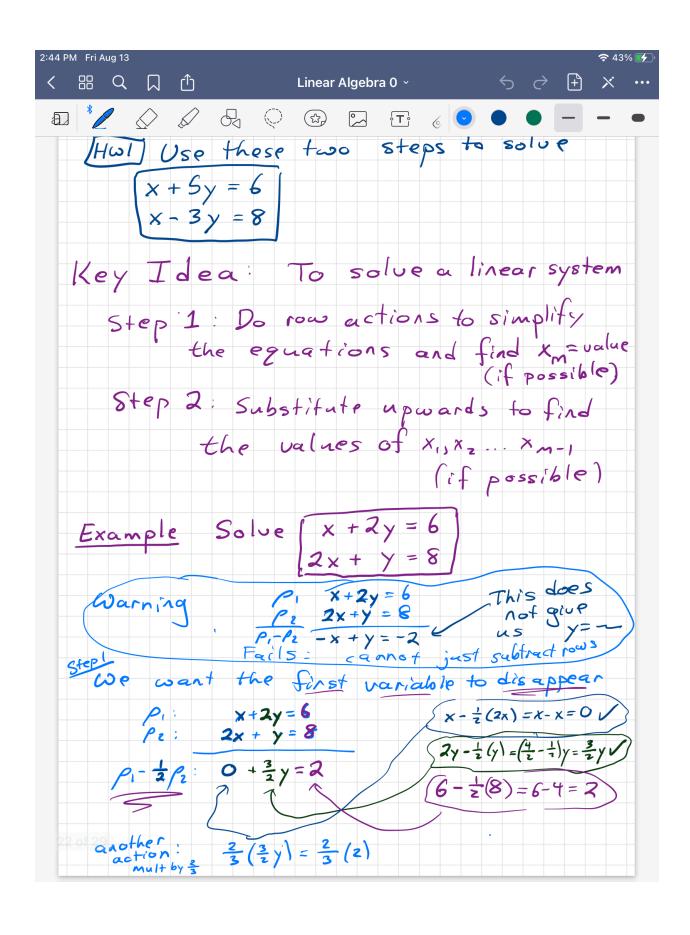
This lesson has two parts each in its own playlist. Scroll down for the second playlist. Be sure to learn the methods taught in this lesson even if you already learned to solve a system in another course. I am teaching the method that leads to an algorithm that works with many equations and many unknowns. There are 10 HW problems.

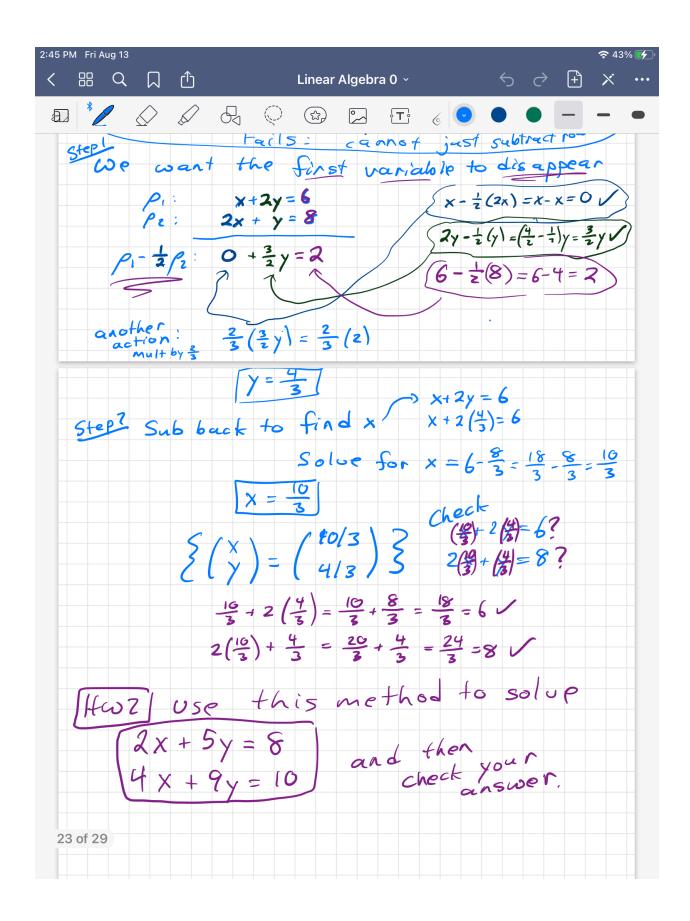
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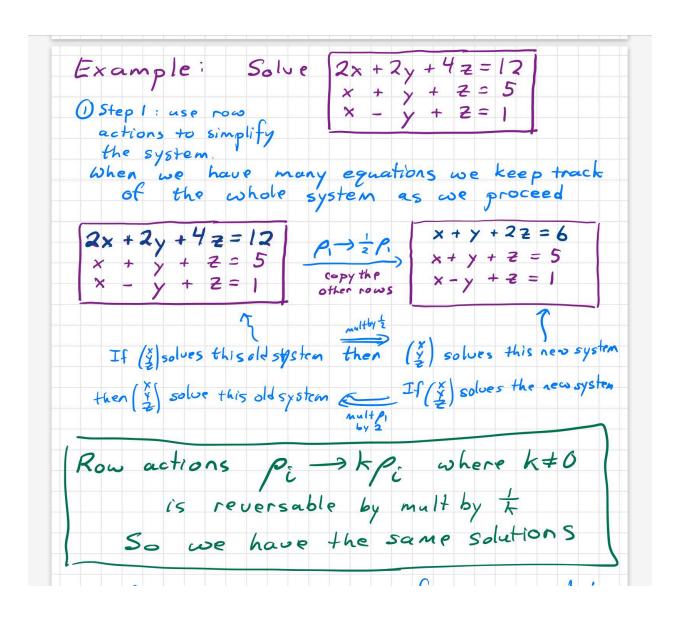
Part 1: Using Row Actions to Solve a Linear System Watch Playlist 313F21-2-1to7

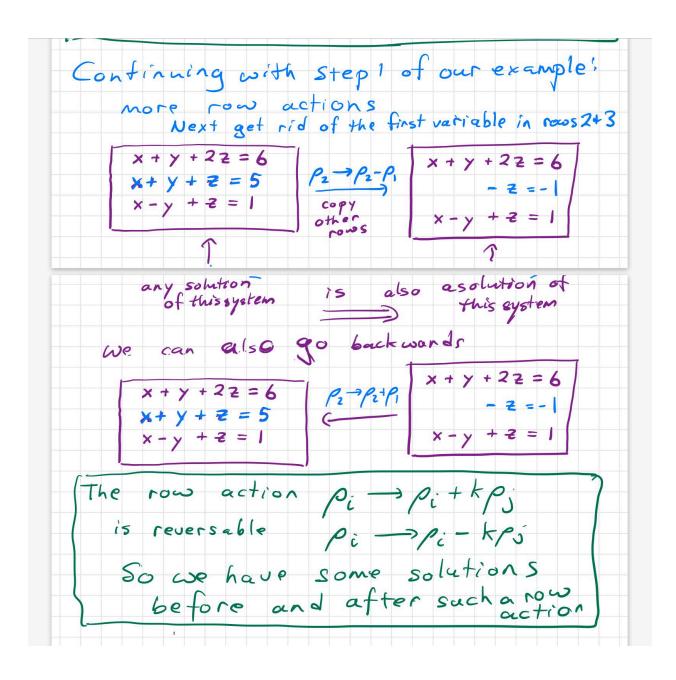
Here we solve one particular system and explain what row actions are and introduce Echelon form.

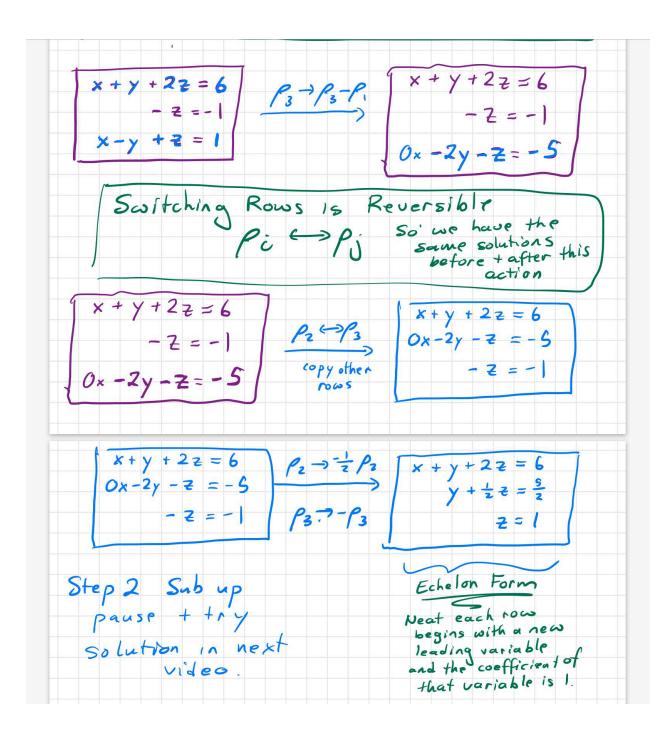


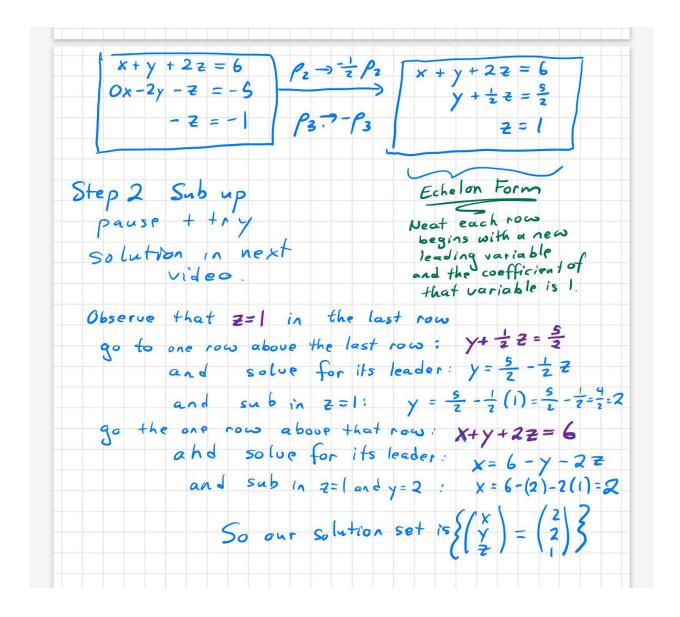












The second part of the lesson may be watched after a break starting here.

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Part II: How to Solve Any Linear System

Watch Playlist 313F21-2-8to12

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"How to solve a Linear System" is in video 313F21-2-8 and the Example 1 rewritten using this technique is in video 313F21-2-8 and 313F21-2-9:

How to Solve a Linear System:

Step 1: Row Reductions to Echelon Form

Row Actions which are reversable

scale · Pi -> kpi where k+0

skew · Pi -> Pi + kpj

switch · Pi => Pj

Step 2: Sub up

Start with final row; solve for its leader

Next to last row: solve for its leader

Sub in previous variables

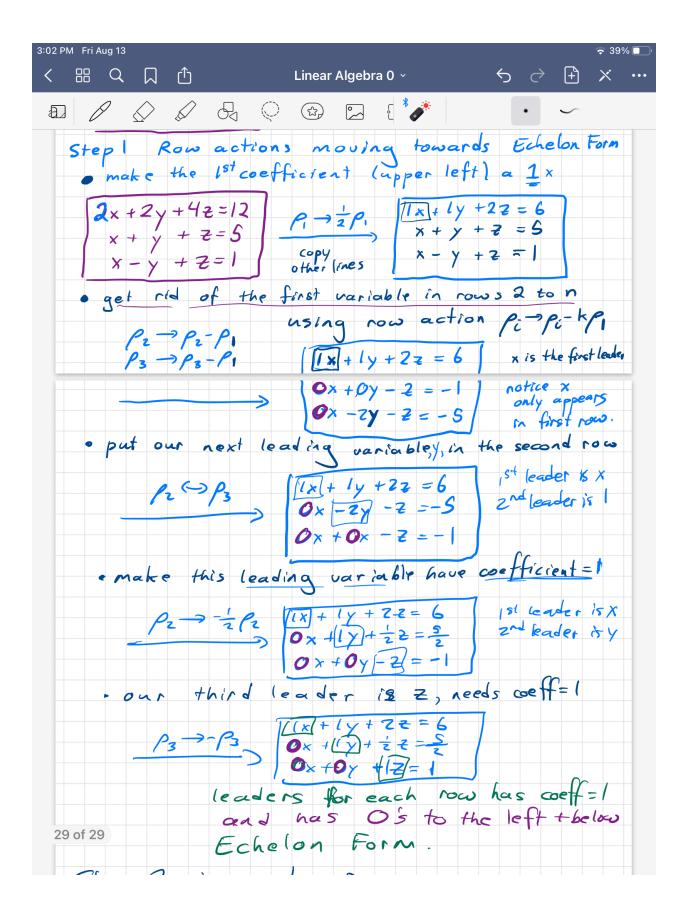
when all rows are done we have a solution.

Example above rewritten (method to use for )

Ax + 2y + 4z=12

x + y + z=5

x - y + z=1



Step 2 Sub up

Echelon Form

Pause + try

Neat each row

begins with a new

leading variable

video.

Observe that z=1 in the last row

go to one row above the last row: y + ½ z = ½

and solve for its leader: y = ½ - ½ z

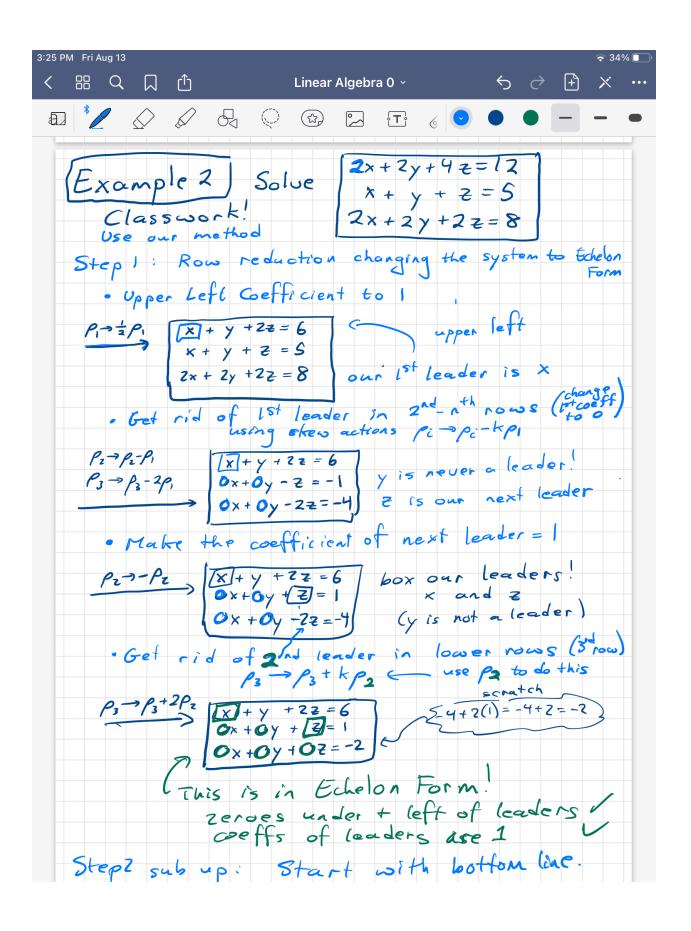
and sub in z=1: y = ½ - ½ (1) = ½ - ½ - ½ = ½

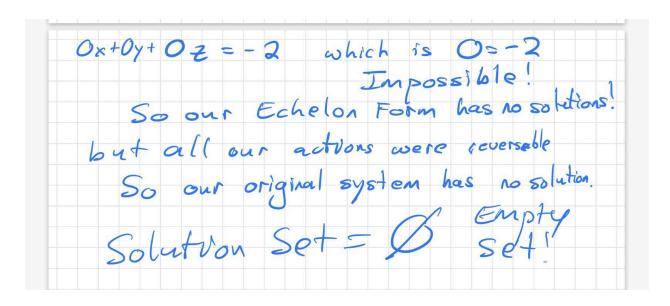
and solve for its leader: x = 6 - y - 2 z

and sub in z=1 and y=2: x = 6-(2)-2(1)=2

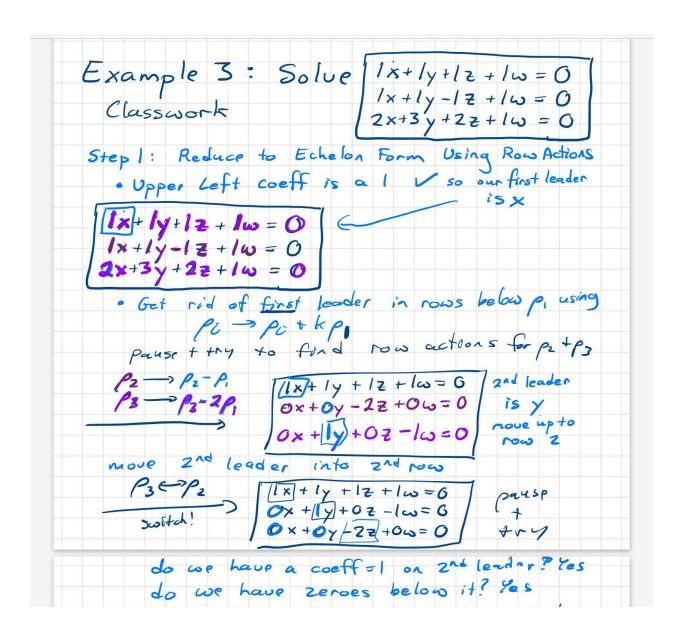
So our solution set is { (x ) - (2) }

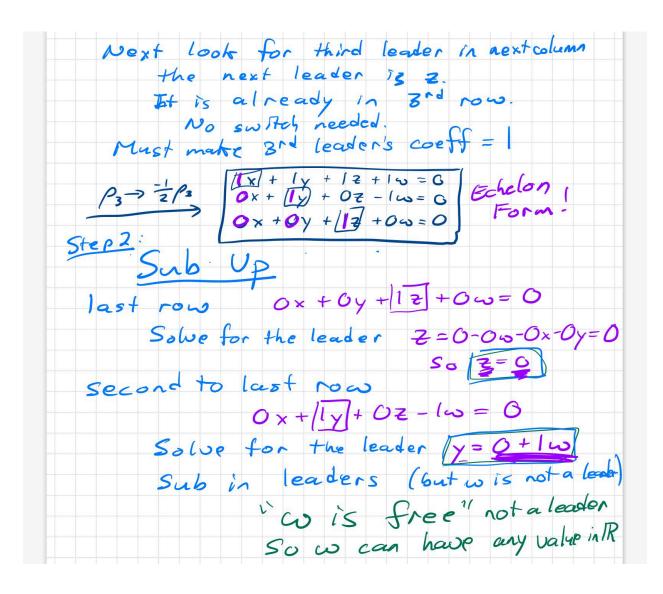
Example 2 is in video 313F21-2-10

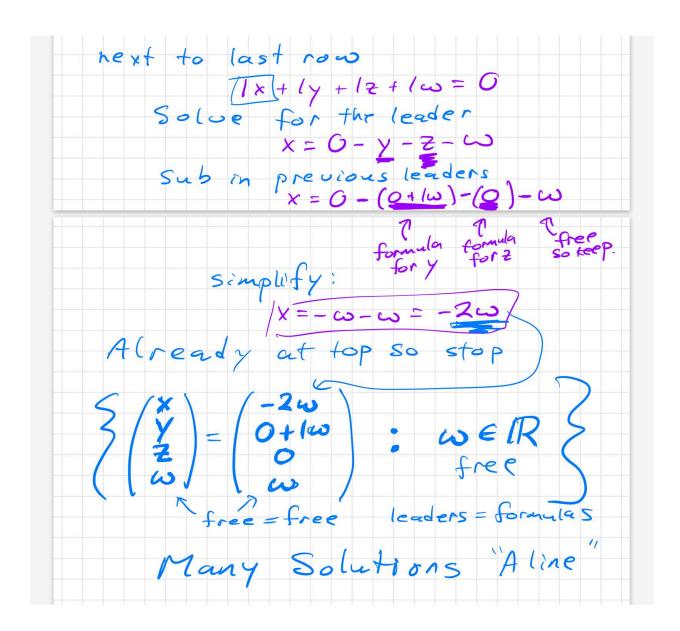




Example 3 is in the last two videos 313F21-2-11 and 313F21-2-12 which you should watch pausing and trying as you work:







## Homework:

Be sure to watch both playlists of videos before doing this homework!

Use this method from class:

## How to Solve a Linear System

Do Row Actions to

Echelon Form:

Make upper left leader into a l

using scaling (or switch if o)

Put a box on the leader.

Put zeroes below this leader

using stew by leaders row

using stew by leaders row

Move down to the next row

and make sure the next

and make sure the next

column has a leader which is l

column has a leader which is l

to lumn has a header which is l

then repeat the blue step

then repeat the blue step

Until in Echelon Form

Until in Echelon Form

Each leader should be a line box

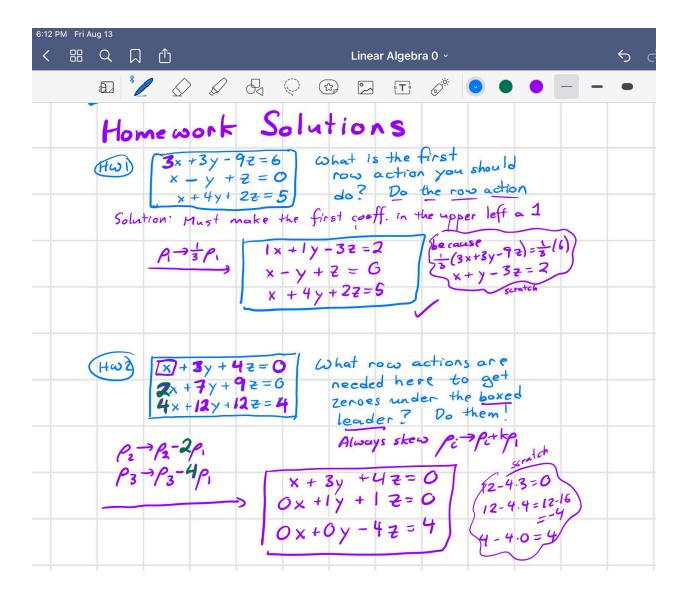
Below and left of leaders are Os.

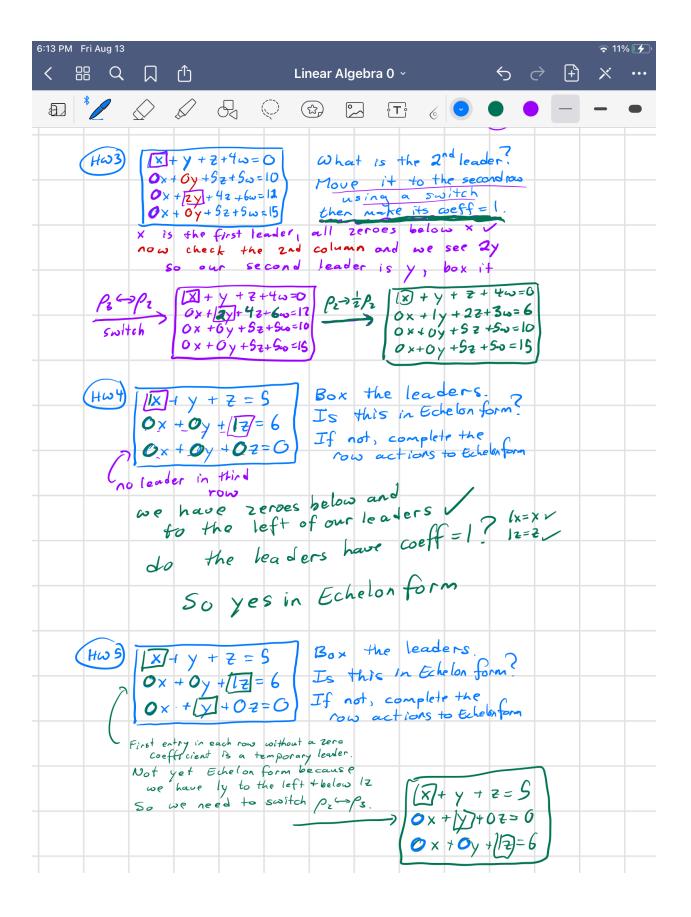
Check the answers to each problem before doing the next.

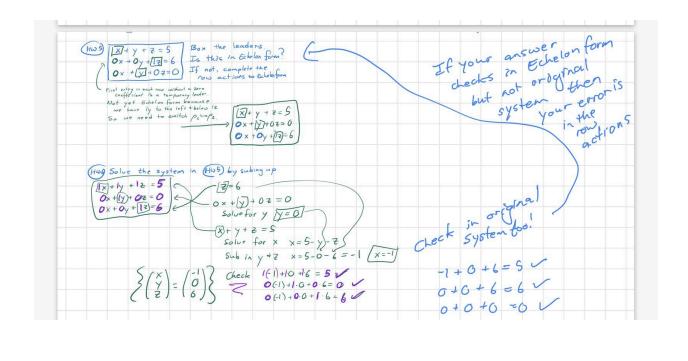
Lesson	2 Homework (answers below)
HWI	3x +3y -9z=6 What is the first row action you should now action you should do? Do the row action
Hwg	(X)+3y+4z=0 What row actions are  2x+7y+9z=0  4x+12y+12z=4  leader? Do them!
нω3	$\boxed{X+y+z+4\omega=0}$ What is the 2 <sup>nd</sup> leader. $0x+0y+5z+5\omega=10$ Move it to the second row $0x+zy+4z+6\omega=11$ $0x+0y+5z+5\omega=15$ then make its coeff = 1.
ΗωΨ	X + y + Z = S   Box the leaders. ?  Ox + Oy + 1Z = 6   Is this in Echelon form?  Ox + Oy + OZ = O   If not, complete the row actions to Echelon form
Hw 3	Ox + y + 2= 6  Ox + 0y + 1z = 6  Is this in Echelon form?  Ox + y + 0z=0  The not, complete the row actions to Echelon form
Hwg	Solve the system in (HWS) by subing up
	) Solve the system in (HW4)
Hw8	) Solve the system in (HWI)
Hwa	Solve the system in (HWZ)  Solve the system in (HWZ)
	D Solve the system in (HW3)
of 35	

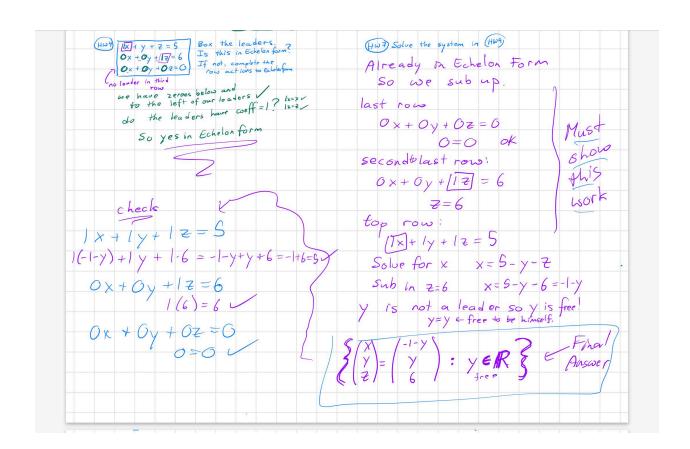
## **HW Solutions (only check after trying each)**

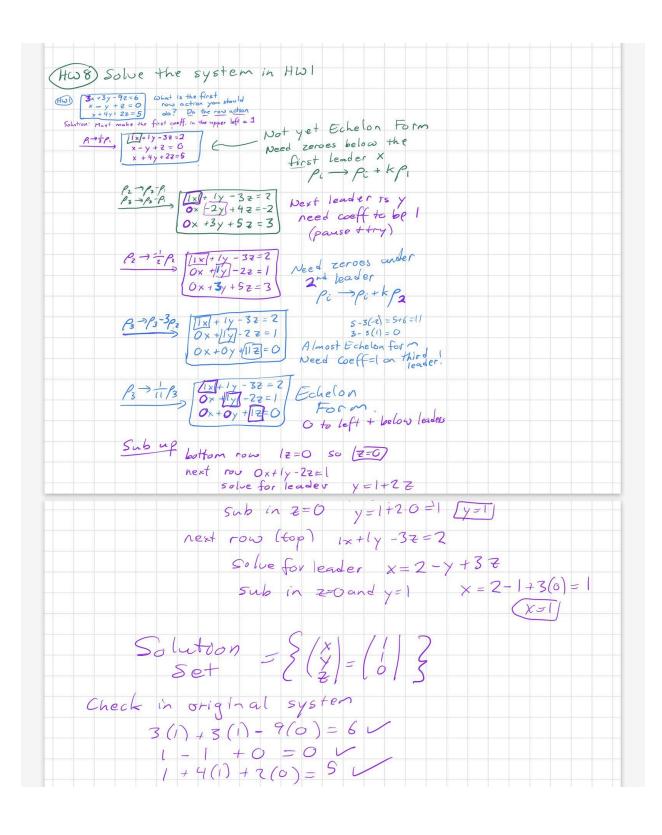
Note your solution is only correct if you do the same row actions in the same order exactly as solved below. If you do something different, and do not know why it is wrong, send a question.











(Hwa) Solve the system in (HwZ)
Solution (submit showing all work)  Your final answer should be a set  with x=1 y=   z=-   The street this providing
If you did not get this enail me QUESTION to book at your work
Solution (sub mit showing all work)
If you did not get this email me QUESTIGN to look at your work
to look at your work

It is very important to email me if you do not understand why any of your problems are incorrect. See how to email questions at the top of this document.

You can use your Lehman id and hand instead of your face in your selfie. This can be helpful if you are not dressed well or are shy or have difficulty taking a selfie.