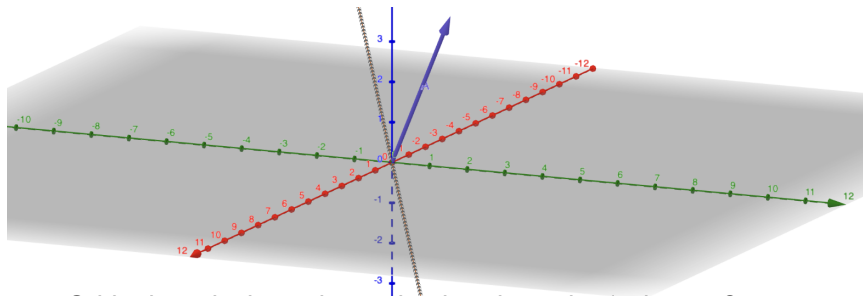


# Math 2240: Introduction to Linear Algebra: Dr. Sarah



- Critical analysis and creative inquiry: why / why not?
- Diverse perspectives and disciplines (alg, geo, tech, apps)
- Linear Objects
- Linear Operations

I care about your success and feel a great responsibility to you as my student

### Try it Out!

- book readings
- interactive videos
- practice quizzes
- handwrite practice
- think-share-pair-compare

### Review and Understand Misconceptions

- feedback
- re-engage solutions
- fill-in guides
- debriefs
- revise and reflect

### Solidify and Make Connections

- problem sets
- in-class assessments
- final project

Making mistakes is integral to the learning process and enriches our understanding as we extend content and clear up misconceptions.

Handwrites, begin assignments and major assignments have strict deadlines of 10:30am our next academic day. All other activities are those you should attempt for completion by then, but you'll have 2nd chances that remain open until closer to the corresponding in-class assessment. Some days are lighter than others and it will help you to progress on upcoming activities in advance, especially major assignments. Plan to spend 3.5–5 hours between classes, on average, as per the University-wide Statement on Student Engagement with Courses (our hybrid class is officially designed by the registrar and scheduled by the university for our third hour to be a part of the activities between classes).

	Class Monday	Between Classes (by 10:30am Wednesday)	Class Wednesday	Between Classes (by 10:30am Monday)
1/13– 1/15	active learning handwrite course overview module 1 overview	2240 interactive video download Maple (free) access e-text 1.1 read the e-text 1.1 interactive video 1.1 practice quiz syllabus	1.1 handwrite, activities t-shirt Wednesday	turn in 1.1 handwrite 1.2 read the e-text 1.2 interactive video 1.2 practice quiz Maple intro video practice submitting PDF add ASULearn profile pic Zoom update & profile pic
1/22	university break		1.2 handwrite, activities	re-engage 1.1 handwrite turn in 1.2 handwrite 1.3 read the e-text 1.3 interactive video 1.3 practice quiz
1/27– 1/29	1.3 handwrite, activities	re-engage 1.2 handwrite turn in 1.3 handwrite 1.4 read the e-text 1.4 interactive video 1.4 practice quiz	1.4 handwrite, activities t-shirt Wednesday	re-engage 1.3 handwrite turn in 1.4 handwrite 1.5 read the e-text 1.5 interactive video 1.5 practice quiz
2/3– 2/5	1.5 handwrite, activities	re-engage 1.4 handwrite turn in 1.5 handwrite 1.7 read the e-text 1.7 interactive video 1.7 practice quiz <a href="#">begin problem set 1</a>	1.7 handwrite, activities t-shirt Wednesday	re-engage 1.5 handwrite turn in 1.7 handwrite card sort 1 review 1 practice quiz



1.1 read Linear Algebra and its Applications



Mark as done



1.1 interactive video

To do ▾



1.1 practice quiz

To do ▾

▼ need help?/course info

Collapse all

Welcome to linear algebra!



My Materials: Linear Algebra and its Applications by David Lay, Steven Lay, and Judi McDonald



need help from me, tutoring, your classmates, or tech support?





# 1.1 read *Linear Algebra and its Applications*

Mark as done

Mark 1.1 read *Linear Algebra and its Applications* as done

read 1.1 in the e-text *Linear Algebra and its Applications* by David Lay, Steven Lay, and Judi McDonald at the top of our ASULearn. If you have difficulty, you can access a [PDF of the beginning of Chapter 1](#). I recommend taking notes on concepts and examples, especially relating to:

- algebra of linear equations: [coefficients](#) and variables
- geometry of linear equations in 2D and 3D: [lines](#) and [planes](#)
- [solution set](#): inconsistent: 0 [solutions](#); [consistent](#): 1 [unique](#) solution or [infinite solutions](#)
- matrix of a linear system: [coefficient](#) matrix, [augmented matrix](#), [triangular](#) form
- [row equivalent](#) systems
- algorithm for solving a linear system using [elementary row operations](#) of [replacement](#), [interchange](#), and [scaling](#)

Items from this section on the [fill-in-guide](#) are items 1, 2, 34, 35, 42.

When you are finished, manually mark the box in ASULearn as done.

# solutions

---

The solutions to a system of equations is a representation of the entire set of assignment of variables that makes all the equations (simultaneously) hold. A solution is one assignment, but may not represent them all, whereas the plural version "solutions" (ie the solution set) should. For instance if a

matrix reduces to 
$$\begin{bmatrix} 1 & 0 & -1 & 1 \\ 0 & 1 & 2 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

then it has [infinite solutions](#) because we don't have full [pivots](#) for all the variables. One solution is  $(1,1,0)$ , but to express all solutions, it would be  $(1+t, 1-2t, t)$ , as  $t$  varies over the reals, by [parameterizing](#) the [free variable](#) and then solving for the variables with [pivots](#). This concept is first explored in 1.1 in the book.

OK

## interactive video activities, repeatable

★ 28 Question(s) answered



You have answered 28 questions, click below to submit your answers.


✔ Submit Answers

### Answered questions

Score

0:55	What is the equation for the heads?	1 / 1
0:58	What is the equation for the feet?	1 / 1
1:09	Solve the system $x+y=17$ , $4x+2y=48$ and write the solution ...	1 / 1
2:25	What is the solution set for the Evelyn Boyd Granville ch...	1 / 1
2:50	What operation uses $x$ in $x+y=17$ to eliminate the term	1 / 1




 1.1 read Linear Algebra and its Applications 

✓ Done

 1.1 interactive video



To do ▾

 1.1 practice quiz

**You must**

✓ Receive a grade


✗ Receive a passing grade

 1.1 read Linear Algebra and its Applications 

✓ Done

 1.1 interactive video

✓ Done ▾

 1.1 practice quiz

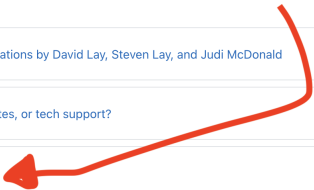
To do ▾

# Welcome to linear algebra!

 My Materials: Linear Algebra and its Applications by David Lay, Steven Lay, and Judi McDonald

 need help from me, tutoring, your classmates, or tech support?

 in-class items, video slides and more



1.1 interactive video

Evelyn Boyd Granville  
second Black woman we know of—PhD in mathematics

Image 1 Credit: <https://www.visionaryproject.org/2020/11/evelyn/>  
Image 2 Credit: Marge Murray. Courtesy of Evelyn Boyd Granville

...this was the most interesting job of my lifetime—to be a member of a group responsible for writing computer programs to track the paths of vehicles in space

Rabbits and chickens have been placed in a cage. You count 48 feet and seventeen heads. Let  $x$  = rabbits,  $y$  = chickens. heads? feet? solve—three different methods?

1.1 Math 2240: Introduction to Linear Algebra



## Dr. Sarah's Linear Algebra (in-class items, video slides...) -

The best way to contact me is during office hours or on the ASULearn need help forum, as I us

- [syllabus and grading policies](#)
- [What is Due When?](#)

Date

work is due by 10:30am

7 May - Wed  
[assigned time at finals](#)

turn in video presentation in ASULearn assignment by the during the assigned time, conduct final project peer review an

## Linear Systems of Matrix and Vector E

15 Jan - Wed

- 2240 interactive video [slides, interactions](#)
- download or access Maple (free) and open the program
- access the e-text
- 1.1 read [Linear Algebra and its Applications](#)
- 1.1 interactive video [slides, Maple, Desmos, interactions](#)
- 1.1 practice quiz
- syllabus

13 Jan - Mon

class: [1.1 handwrite](#), [additional activities](#) [t-shirt Thur](#)  
class: [course and module 1 overview](#), [active learning handw](#)



practice with instantaneous feedback from me, repeatable **Instantaneous Feedback** opens after you **Check** a response, so you can retake it. For a box, **red x for feedback**.

1	k	0
---	---	---

<input type="text" value="1"/> ✖	$-k^2 + 1$	<input type="text" value="0"/> ✖
----------------------------------	------------	----------------------------------

Incorrect  
Incorrect multiply-k times 0 and add it to 1. Simplify

Part d) Notice that the matrix is now in row echelon or **Gaussian** form, with items below the diagonal n it for **solutions** via **pivots**. A **pivot** is the first nonzero entry in a row, reading from left to right. Here 1 is there any row with a **pivot** for  $x_2$ ?



- yes for all  $k$  ✖ look for  $k(s)$  that makes row 2 column 2 nonzero in **Gaussian** to have a **pivot**. So
- only when  $k = \pm 1$
- only when  $k \neq \pm 1$
- other

Part e) Does this system ever have infinitely many **solutions**, for a  $k$ ?

- yes

Use my feedback to check responses until correct.

- 1.1 read Linear Algebra an...
- 1.1 interactive video
- 1.1 practice quiz

 1.1 read Linear Algebra and its Applications 

✓ Done

 1.1 interactive video

✓ Done ▾

 1.1 practice quiz

To do ▾

Re-attempt quiz

Grading method: Highest grade

Grade to pass: 70.00 out of 100.00

## Summary of your previous attempts

Attempt	State	Points / 31.00	Grade / 100.00	Review
1	Finished	18.90	60.97	<a href="#">Review</a>



## practice instantaneous feedback from me: Check—repeatable

Part d) What equation does the new row 2 correspond to?

$$1 \times x_2 = 1 \times$$

Part e) Solve the system using partial elimination of this value into the equation corresponding to row 1

$$(x_1, x_2) = (1 \times, 1 \times)$$

Incorrect

try using **Gaussian** again. multiply each entry in row 1 by minus -3 and add it to the corresponding entry in row 2

The correct answer is: 4  
0.00 points out of 1.00

*Instantaneous feedback from the Check: repeatable*

We solve this system of 2 equations in 2 unknowns. Use **Gaussian elimination** on the augmented matrix corresponding to the system. Notice that your **elimination** will only need one step:  $r'_2 = -3r_1 + r_2$ . So multiply each entry in row 1 by minus -3 and add it to the corresponding entry in row 2 to reduce to

**Gaussian**. The reduced matrix is  $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 8 \end{bmatrix}$ . Then use row 2  $2x_2 = 8$  to solve for  $x_2 = 4$ . Next back substitute this value of 4 into row 1  $x_1 + 2x_2 = 3$  to find  $x_1 = 3 - 2x_2$ .

*General feedback below each question when you Review a try*

general feedback below each question when you Review a try  
solidify the material  
second chance

## *Fill-In Guide—Fill In and Bring to Classes*

- 2) augmented matrix—example of a system and its augmented matrix
- 3) augmented matrix and how we convert from a row of an augmented matrix after strict Gaussian back to the equation it represents in terms of coefficients and variables—example
- 4) back substitution from row echelon form after strict Gaussian in an augmented matrix—example
- 5) consistent—definition

## *In-class Activities*

- bring your notes and the fill-in guide with you
- active learning and guided discovery that is review or extension
- small group—help each other—and whole class activities  
I'm here to help!
- individual and group assessments



polllev.com/drsarah314 Open ended response

polllev.com/drsarah314  
You can respond once

This question is anonymous. No names will be tracked.

A
B
C
D
E

no eating or drinking at tables, but you may step away  
if you need to hydrate or similar!

## Feedback files

 personalizedfeedback.pdf

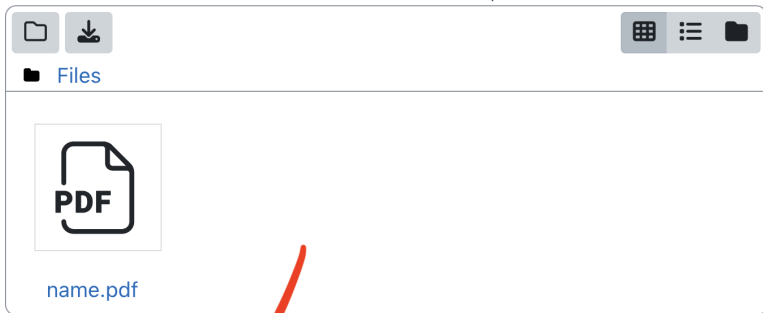
## Grade breakdown

<b>scale</b>	no grade	Padawan (still training)	Jedi	Jedi Master	see your personalized feedback
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- Padawans are training to one day become a Jedi. **resubmit**
- Both Jedi and Jedi Master ratings earn completion.
- I'll respond with feedback on your PDF and re-engage solutions will also open

Add submission

Maximum file size: 800 MB, maximum number of files: 1



Accepted file types:

PDF document .pdf

Save changes

Cancel



## Feedback files



## Grade breakdown

<b>scale</b>	no grade	Padawan (still training)	Jedi	Jedi Master	see your personalized feedback
--------------	----------	--------------------------------	------	----------------	-----------------------------------

begin major assignment or study guide  
glossary, re-engage, debrief, card sort, surveys



begin problem set 1

✓ Done ▾

**by 10:30am**



re-engage 1.5 handwriting



Not available unless any of: It is after .

Show more ▾



turn in 1.7 handwriting

To do ▾



card sort 1

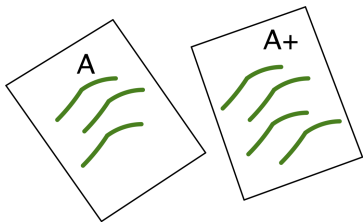
To do ▾





## Grades

- Effective ASULearn Engagement 35%  
try again, keep scrolling down, I'm here to help!
- Problem Sets 30%
- In-class Assessments 20%
- Final Project 10%
- Effective Class Engagement 5%



grading scale:  $A \geq 93$ ;  $90 \leq A- < 93$ ;  $87 \leq B+ < 90$ ...

## Material from MAT 1110 and Prior Courses

- algebra like  $5!$ ,  $2x + 3y = 0$  & solutions of eqs like  $x = -\frac{3y}{2}$
- area and volume
- coordinate/analytic geometry like geo of  $(1, 2)$ ,  $(1, 2, 3)$
- linear approximations
- lines
- functions, function notation and compositions like  $f \circ g(x)$
- limits applied to diverse objects
- representations, mathematical reasoning and justifications, including algebraic, numerical, and geometric
- sin and cos trigonometry
- summation notation/series notation  $\sum_1^n f(n)$
- curves and surfaces in 2D and 3D
- technology use

*Zoom check-in for help on activities (internet allowing)*

Welcome to linear algebra!


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 need help from me, tutoring, your classmates, or tech support?

 in-class items, video slides and more

drop in during posted times—no appointment needed—  
I want to hear how you are doing!

## Where to Get Help Outside of Class

- Zoom
-  need help from me, math dept tutoring, your classmates, or tech support?
- use my instant feedback and personalized feedback to help you learn **keep scrolling down**
- <https://sites.google.com/appstate.edu/mat-2240-syllabus-s25/student-advice>

I care about you and your success!



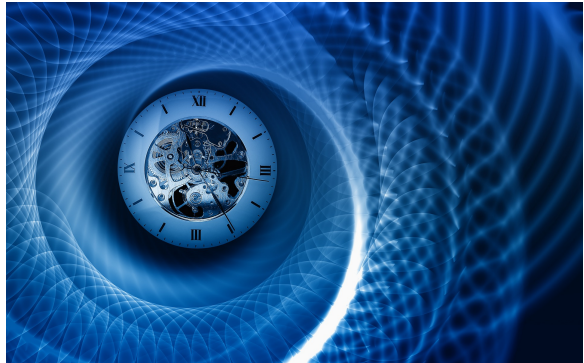
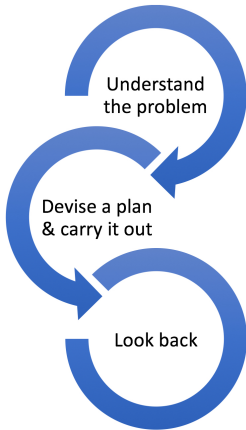
*Linear algebra is often one of the first classes students see that is not procedural. It is full of new mathematical language, abstract and spatial thinking, algebraic arguments, visual arguments, real-life numerical applications, and other analyses that students must internalize in order to succeed. It is also a class where a computer algebra software system is required. Students who did well in earlier classes through short term memorization often struggle in linear algebra.*

Christine Andrews-Larson, Jason Siefken, and Rahul Simha (2022). "Report on a US-Canadian Faculty Survey on Undergraduate Linear Algebra: Could Linear Algebra Be an Alternate First Collegiate Math Course?" *Notices of the American Mathematical Society* 69(5) p. 809.



*Make it Stick: The Science of Successful Learning* by Peter C Brown, Henry L. Roediger III, and Mark A. McDaniel

# *Do you have time for this course?*






<https://mathequalslove.blogspot.com/p/free-classroom-posters.html>

<https://www.leaderinme.org/blog/the-power-of-a-growth-mindset/>

- Zoom

-  need help from me, math dept tutoring, your classmates, or tech support?

- use my instant feedback and personalized feedback to help you learn **keep scrolling down**

I care about you and your success!