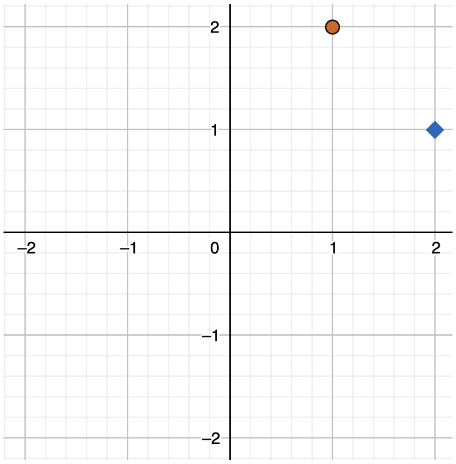
Question **1**

Not complete

Points out of 6.00

One reason Calculus II with Analytic Geometry is a prerequisite for linear algebra is because of the analytic geometry in that class where course goals include visualizations and equations of curves and surfaces and linear intersections in 2D and 3D. As a review,

Consider this graph of two points (I made them thick so you could see them better). Which is the point (1,2) in 2-space $\mathbb{R}^2$?

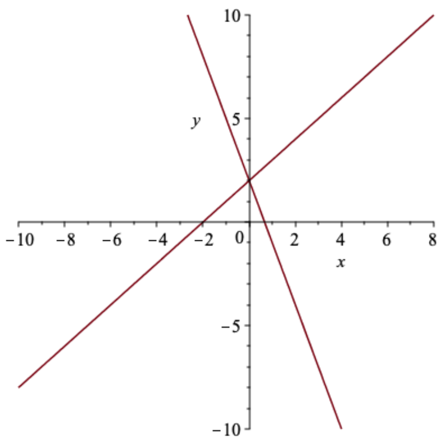


- the orange circle
- the blue diamond
- other

Plot (-1,3) in your notes. Which quadrant is it in?

- quadrant 1
- quadrant 2
- quadrant 3
- quadrant 4

Next, consider this graph of two lines. Which is $y = x + 2$ inside of 2-space $\mathbb{R}^2$?



- the line that goes into quadrant 4
- the line that goes into quadrant 3

other

Is $y = x + 2$ parallel to $y = x$?

yes

no

What is the slope and *y*-intercept of $y = -3x + 2$ and what do they tell us?

the slope is -3 and the line is decreasing

the slope is 2 and the line is increasing

the y-intercept is -3 which is the point on the *y*-axis the line goes through

the y-intercept is 2 which is the point on the *y*-axis the line goes through

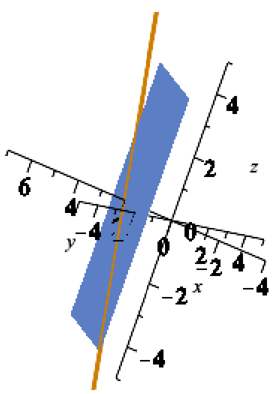
In your notes plot 3-space axes with *x* coming out of the board, *y* to the right, and *z* upward. In this coordinate system, plot the point (1,2,3), which is a point in quadrant 1 in 3-space. As we are creating the point, what do we do with the 3?

3 units out of the board

3 units to the right

3 units up

Consider the graph below which shows a line and a plane both going through the point (0,2,0) on the *y*-axis. In this representation of 3-space, the graph has been turned so that the *y*-axis is to the left, where the 6 is shown, with *z* up and *x* into the board on the right where the 4 is shown. Which is $y = x + 2$ inside of 3-space $\mathbb{R}^3$?



the orange line

the blue plane

Check

Question **2**

Not complete

Points out of 1.00

Here are two equations:

equation 1: $4x_1 - 5x_2 = x_1x_2$

equation 2: $x_2 = 2(\sqrt{6} - x_1) + x_3$

Which equation(s), if any, is/are linear?

- ○ equation 1
- ○ equation 2
- ○ both equations
- ○ neither equation

Check

Question **3**

Not complete

Points out of 1.00

Gaussian elimination will be important to us all semester long. Solve the system by using elementary row operations on the equations. Follow the systematic Gaussian elimination procedure to find the solution to the system of equations. (Simplify your answer. Type an ordered pair.)

$x_1 + 2x_2 = -2$

$7x_1 + 8x_2 = 10.$

Part a) What is the augmented matrix for the system? $\begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix}$=

[ ]	[ ]	[ ]
[ ]	[ ]	[ ]

Part b) What row operation should we use if we want to strictly follow Gaussian elimination?

$r_2' =$

[ ]

$r_1 + r_2.$

Part c) What is the matrix after applying this replacement row operation?

[ ]	[ ]	[ ]
[ ]	[ ]	[ ]

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

[ ]

x_2=

[ ]

Part e) Solve the system using part d) to find x_2 and then use back substitution of this value into the equation corresponding to row 1 in order to find the value of x_1.

(x_1, x_2)=(

[ ]

,

[ ]

)

Check

Question **4**

Not complete

Points out of 1.00

Find the point (x_1, x_2) that lies on the line $x_1 + 2x_2 = 9$ and on the line $x_1 - x_2 = -3$ using the by-hand Gaussian elimination method.

What row operation should you use if you want to strictly follow Gaussian elimination?

$r_2' =$ [ ] $r_1 + r_2$.

After applying replacement, solve for the variables.

(x_1, x_2)=([ ] , [ ])

Why does solving the equations for solutions give the desired point?

- a. We want a point on both lines, so it must satisfy each equation of the line. The method of Gaussian finds concurrent points, when they exist
- b. it shouldn't
- c.other

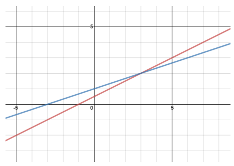
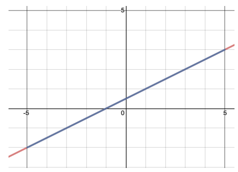
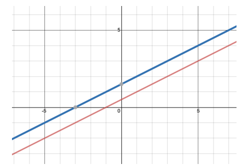
Check

Question **5**

Not complete

Points out of 1.00

Drag and drop the tiles below the table into the relevant portion in the table.

size of solution set	**one unique solution**	**infinitely many solutions**	**no solutions**
linear system algebraic equations			
linear system geometric graphs			
solution set			
consistent or inconsistent			

x-2y=-1 , -x+3y=3	x-2y=-1, -x+2y=1	x-2y=-1, -x+2y=3	the unique point (3,2)
no points	points (x,y) on the line x-2y=-1	consistent	inconsistent

Check

Question **6**

Not complete

Points out of 1.00

Determine the value(s) of h such that the matrix is the augmented matrix of a consistent linear system. Solve the system by using elementary row operations. Follow the systematic Gaussian elimination procedure to find the solution to the system of equations.

$x_1 + hx_2 = 2$

$3x_1 + 12x_2 = 4.$

Part a) What is the augmented matrix for the system? $\begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix}$=

☐	☐	☐
☐	☐	☐

Part b) What row operation should you use if you want to strictly follow Gaussian elimination?

$r_2' =$

☐

$r_1 + r_2.$

Part c) Multiply each entry in row 1 by the constant from part b) and add it to the corresponding entry in row 2. (Simplify your responses and don't add in any extra spaces or characters).

1	h	2
☐	☐	☐

Part d) What value(s) of h makes the matrix an augmented matrix of a consistent linear system?

- ○ all h
- ○ only when $h \neq 12$
- ○ only when $h = 12$
- ○ only when $h \neq 4$
- ○ only when $h = 4$
- ○ other

Check

Question **7**

Not complete

Points out of 1.00

Solve the system by using elementary row operations. Follow the systematic Gaussian elimination procedure to find the solution to the system of equations. How many solutions are there for different values of k?

$x_1 + kx_2 = 0$

$kx_1 + x_2 = 1.$

Part a) What is the augmented matrix for the system? $\begin{bmatrix} a & b & c \\ d & e & f \end{bmatrix}$=

☐	☐	☐
☐	☐	☐

Part b) What row operation should you use if you want to strictly follow Gaussian elimination?

$r_2' =$

☐

$r_1 + r_2.$

Part c) Multiply each entry in row 1 by the constant from part b) and add it to the corresponding entry in row 2. (Simplify your responses and don't add in any extra spaces or characters).

1	k	0
☐	$-k^2 + 1$	☐

Part d) Notice that the matrix is now in row echelon or Gaussian form, with items below the diagonal reduced as much as possible, so we can critically analyze it for solutions via pivots. A pivot is the first nonzero entry in a row, reading from left to right. Here 1 is a pivot for the x_1 spot in row 1 no matter what k is. Is there any row with a pivot for x_2?

○ yes for all k

○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

○no

Part f) How many solutions are there for a k so that $k \neq \pm 1$?

○0

○1

○∞

Part g) How many solutions are there for a k so that $k = \pm 1$?

○0

○1

○∞

Check

Question **8**

Not complete

Points out of 1.00

Is the statement "Every elementary row operation is reversible" true or false?

For true/false questions, the book instructs: if a statement is false, provide a specific counterexample. If it is true, quote a phrase and page number from the book.

○True and I found a phrase and page number from the text

○False and I can provide a counterexample

○other

Check

Question **9**

Not complete

Points out of 1.00

Is the statement "A 5×6 matrix has six rows" true or false? Explain.

For true/false questions, the book instructs: if a statement is false, provide a specific counterexample. If it is true, quote a phrase and page number from the book.

○True and I found a phrase and page number from the text

○False and I can provide a counterexample

○other

Check

Question **10**

Not complete

Points out of 1.00

True or False:

The solution set of a linear system involving variables $x_1, .., x_n$ is a list of numbers $(s_1, \ldots, s_n)$ that makes each equation in the system a true statement when the values $(s_1, \ldots, s_n)$ are substituted for $x_1, .., x_n$ respectively.

For true/false questions, the book instructs: if a statement is false, provide a specific counterexample. If it is true, quote a phrase and page number from the book.

○True and I found a phrase and page number from the text

○False and I can provide a counterexample

○other

Check

Question **11**

Not complete

Points out of 1.00

True or False:

Two fundamental questions about a linear system involve existence and uniqueness.

For true/false questions, the book instructs: if a statement is false, provide a specific counterexample. If it is true, quote a phrase and page number from the book.

- True and I found a phrase and page number from the text
- False and I can provide a counterexample
- other

Check

Question **12**

Not complete

Points out of 1.00

Find the elementary row operation for Gaussian elimination that transforms the first matrix into the second:

To turn $\begin{bmatrix} 1 & -2 & 1 & 0 \\ 0 & 5 & -2 & 8 \\ 4 & -1 & 3 & -6 \end{bmatrix} \to \begin{bmatrix} 1 & -2 & 1 & 0 \\ 0 & 5 & -2 & 8 \\ 0 & 7 & -1 & -6 \end{bmatrix}$

- a. interchange
- b. scaling
- c. $r_2' = -4r_1 + r_2$
- d. $r_3' = -4r_1 + r_3$
- e.other replacement

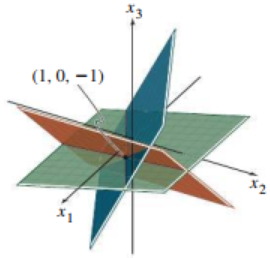
Check

Question **13**

Not complete

Points out of 6.00

Consider this system of equations represented by three planes in 3-space $\mathbb{R}^3$ in this image from our textbook *Linear Algebra and Its Applications* by David Lay, Steven Lay, and Judi McDonald.



How many solutions does the system have

- ◯ no solutions
- ◯ infinitely many solutions
- ◯ a unique solution

Why?

- ◯ the three planes are all distinct so there is no solution to this system.
- ◯ each equation determines a plane and we can see that each pair of planes intersects in a line. The solutions are the 3 lines.
- ◯ the point (1,0,-1) is the only point that lies in all three planes.

Check

Question **14**

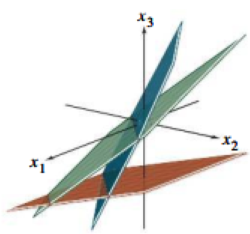
Not complete

Points out of 2.00

Consider the system of linear equations with the augmented matrix $\begin{bmatrix} 0 & 1 & -4 & 8 \\ 2 & -3 & 2 & 1 \\ 4 & -8 & 12 & 1 \end{bmatrix}$. This matrix can be reduced using row operations and Gaussian to the augmented matrix $\begin{bmatrix} 2 & -3 & 2 & 1 \\ 0 & 1 & -4 & 8 \\ 0 & 0 & 0 & 15 \end{bmatrix}$. How many solutions does this system have?

- one unique solution
- no solutions
- infinitely many solutions

Next, consider the plot of the 3 planes corresponding to the original system.



What does the plot show?

- each equation determines an infinite plane and we can see that the planes are not parallel and so as we continue the graph indefinitely, this forces there to be one unique solution.
- we can see that the there is no point that lies on all three planes. Thus the system has no solution and is inconsistent.
- we can see that each pair of planes intersect in a line. The solutions are the 3 lines.

Check

Question **15**

Not complete

Points out of 1.00

To solidify and prepare for upcoming work, review and contemplate your knowledge and any questions that remain as related to definitions, concepts, computations, and examples from 1.1, including

- 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

When you have finished reviewing and reflecting, select one of the following (both receive full credit)

○ I currently have no questions

○ I will continue solidifying and understand that help is available in Dr. Sarah's more extensive feedback that follows below each question after I finish and open back up an entire practice quiz (this is more extensive than the hints that I can access during the open quiz), in Dr. Sarah's glossary/Wiki which is embedded into ASULearn from the linked terms, in Dr. Sarah's office hours and forum, and in Math Lab and Tutoring

Check