You can preview this quiz, but if this were a real attempt, you would be blocked because:

This quiz is not currently available

Question **1**

Not complete

Points out of 1.00

Is $\begin{bmatrix} 1 & -2 & -1 & 4 \\ 0 & 0 & -7 & 14 \\ 0 & 0 & 14 & -28 \end{bmatrix}$ in row echelon form?

- yes as there are 0s below the diagonal
- not yet as we must eliminate anything below a pivot

Assume we have a row in an augmented matrix that is reduced to row echelon form and looks like
[2 3 4 0]
What is this equivalent to if the variables are $x, y,$ and z for columns 1, 2 and 3, respectfully?

- $x = \frac{3}{2} + 2z$
- $2x + 3y + 4z = 0$
- both of the above
- none of the above

Check

Question **2**

Not complete

Points out of 5.00

Given the matrix $\begin{bmatrix} 1 & -3 & 0 & 5 \\ -1 & 1 & 5 & 2 \\ 0 & 1 & 1 & 0 \end{bmatrix}$, what is the first step of strict Gaussian (use replacement but not scaling) and for the purpose of ASULearn, don't swap rows either, although that is allowed in strict Gaussian.

$r_2' =$

$r_1 + r_2$

What is the matrix after applying this one replacement?

1	-3	0	5
0	1	1	0

Check

Question **3**

Not complete

Points out of 2.00

Open up

https://www.geogebra.org/m/xktyhnw9

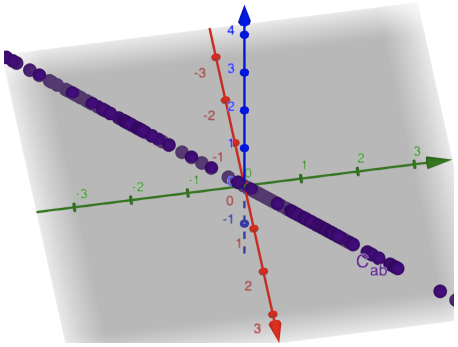
and physically move the slider to see what we form as a varies. What does the slider show about $(1-a, 2+a, a)$?

- ○ we trace out a point
- ○ we trace out a line
- ○ we trace out a plane
- ○ other

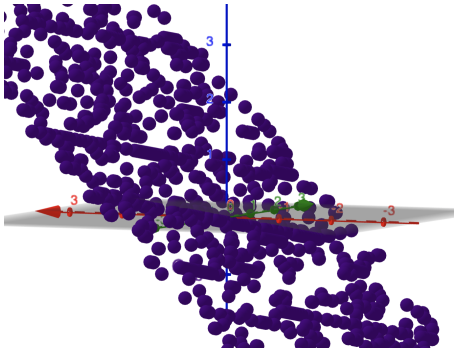
Next open up

https://www.geogebra.org/m/pfvhwuyx

and physically move the sliders (a lot! like adjust one and move the other and vice a versa) to see what we form as a and b vary. After you have created many different points, turn the plot to see whether all the points traced are in the same plane in 3-space, like this "head on" view.



In the "head on" view of a plane, points look like they are on a line but that is because we have turned it to visualize it that way. From here we can see that nothing is outside of it. Here is a different view of the same data where it is much harder to see that all the points are on the same plane:



How about in the GeoGebra link, what do the sliders and turning the graph show about $(a+b, a, b)$?

- ○ we trace out a plane
- ○ we don't trace out a plane

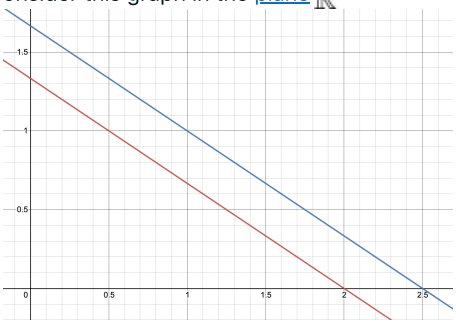
Check

Question **4**

Not complete

Points out of 4.00

Consider this graph in the plane $\mathbb{R}^2$



.

Which augmented matrix that is in row echelon form corresponds to this graph?

- $\begin{bmatrix} 2 & 3 & 4 \\ 0 & 4 & 5 \end{bmatrix}$
- $\begin{bmatrix} 2 & 3 & 4 \\ 0 & 0 & 1 \end{bmatrix}$
- $\begin{bmatrix} 2 & 3 & 4 \\ 0 & 0 & 0 \end{bmatrix}$
- $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$
- none of the above

For the pivots, we look across each row to the first nonzero entry and match that to the variable its spot is in. How many variables are missing a pivot?

What are the solutions algebraically?

- 1 unique solution $\left(\frac{1}{8}, \frac{5}{4}\right)$
- no concurrent solutions
- infinite solutions $\left(2 - \frac{3}{2}y, y\right)$
- infinite solutions (x, y)
- other

What are the solutions geometrically?

- a point
- no concurrent solutions
- a line with one free variable
- a plane with two free variables
- other

Check

Question **5**

Not complete

Points out of 2.00

The augmented matrix $\begin{bmatrix} 1 & -3 & 0 & 5 \\ 0 & 4 & 1 & 0 \\ 0 & 0 & 7 & 7 \end{bmatrix}$ is in row echelon form as all the pivots have been used to eliminate what came below them.

What are the pivots?

- 1, -3, 0, 5
- 1, -3, 1, 5
- 1, 4, 7
- other

What is the geometry of the system?

- 3 lines that intersect in one point
- 3 planes that intersect in one point, like the corner of a room
- other

Check

Question **6**

Not complete

Points out of 5.00

As a review, examine strict Gaussian (i.e. replacement but no scaling) of the augmented matrix $\begin{bmatrix} 3 & 3 & 3 & 3 \\ 3 & 3 & 5 & 5 \\ 6 & 6 & 8 & 8 \\ 9 & 9 & 11 & 11 \end{bmatrix}$

First we use the top left spot to eliminate what comes below it

$\xrightarrow{r_2'=-r_1+r_2} \begin{bmatrix} 3 & 3 & 3 & 3 \\ 0 & 0 & 2 & 2 \\ 6 & 6 & 8 & 8 \\ 9 & 9 & 11 & 11 \end{bmatrix}$

$\xrightarrow{r_3'=-2r_1+r_3} \begin{bmatrix} 3 & 3 & 3 & 3 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 2 & 2 \\ 9 & 9 & 11 & 11 \end{bmatrix}$

$\xrightarrow{r_4'=-3r_1+r_4} \begin{bmatrix} 3 & 3 & 3 & 3 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 2 & 2 \end{bmatrix}$

Next we use the next pivot to eliminate what comes below it

$\xrightarrow{r_3'=-r_2+r_3} \begin{bmatrix} 3 & 3 & 3 & 3 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 2 \end{bmatrix}$

$\xrightarrow{r_4'=-r_2+r_4} \begin{bmatrix} 3 & 3 & 3 & 3 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

Since there are no more pivots to eliminate what comes below, we are in Gaussian and can examine the pivots, free variables (if any), and solutions (if any).

For the pivots, we look across each row to the first nonzero entry and match that to the variable its spot is in. How many variables are missing a pivot?

- ○0
- ○1
- ○2
- ○other

Does z have a pivot, and if so what is it?

- ○it is missing a pivot so it is free
- ○yes, it is 3
- ○yes, it is 2
- ○yes, but it is a different number

What are the solutions algebraically?

- ○1 unique solution $(0, 1)$
- ○1 unique solution $(0, 0, 1)$

○no concurrent solutions

○infinite solutions $(-y, y, 1)$

○infinite solutions $(-z, 1, z)$

○infinite solutions $(1 - y - z, y, z)$

○other

What are the solutions geometrically?

○a point

○no concurrent solutions

○an infinite line

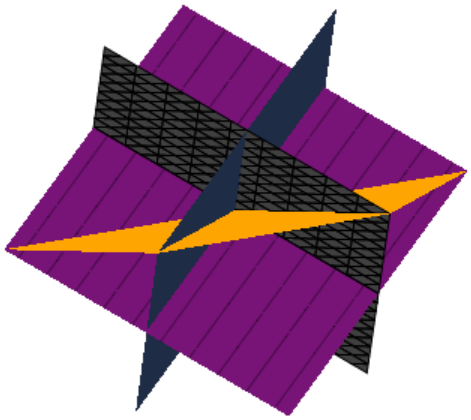
○an infinite plane

○an infinite volume

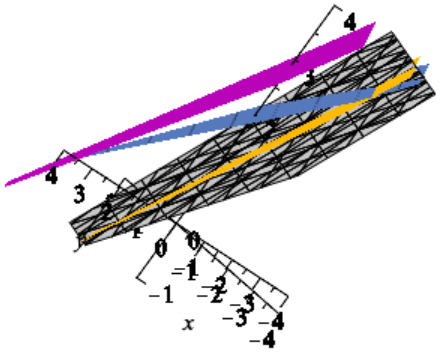
○other

Consider the following graphs. Which corresponds to this system?

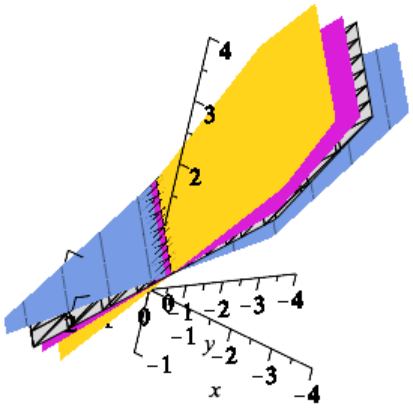
graph 1:



graph 2:



graph 3:



- graph 1
- graph 2
- graph 3

Check

Question **7**

Not complete

Points out of 32.00

Look at the augmented matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 7 \end{bmatrix}$. Reduce to row echelon form using strict Gaussian (yes replacement, but no scaling) and, for the purposes of ASULearn, don't swap rows either. What row operation should we use if we want to strictly follow Gaussian elimination?

$r_2' =$ ☐ $r_1 + r_2$.

What is the reduced matrix?

☐	☐	☐
☐	☐	☐

Once in row echelon form, before examining systems for pivots and free variables, we should first check for consistency or inconsistency.
What does row 2 tell us about the system's solutions?

- ○ there are infinite solutions since x_2 is missing a pivot
- ○ there are no solutions

I've modified the 7 to a 6: $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \end{bmatrix}$. Reduce to row echelon form using strict Gaussian (yes replacement, but no scaling) and, for the purposes of ASULearn, don't swap rows either. What row operation should we use if we want to strictly follow Gaussian elimination?

$r_2' =$ ☐ $r_1 + r_2$.

What is the row echelon form?

☐	☐	☐
☐	☐	☐

There is no row showing inconsistency so we can progress to pivots and free variables (if any).

A variable has a pivot when we look across the rows and see a leading nonzero entry as a coefficient of that variable in some row. Which variables have pivots?

- ○ only x_1
- ○ only x_2
- ○ x_1 and x_2

Any variables without pivots are free, if any. Which variables are free, if any?

- ○ only x_1

○only x_2

○ x_1 and x_2

○neither are free

How many solutions do we have?

○none

○one unique solution

○infinitely many, a line

○infinitely many, a plane

○infinitely many, a volume

Can a system of 2 equations and 2 unknowns ever have a unique solution?

○as long as the slope of the lines is different

○not possible

Next, look at the augmented matrix $\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 7 & 0 \end{bmatrix}$. This is a homogeneous system in 3-space R^3 since the equal column is all zeros. Reduce it to row echelon form using strict Gaussian (yes replacement, but no scaling) and, for the purposes of ASULearn, don't swap rows either. What is the row echelon form?

A variable has a pivot when we look across the rows and see a leading nonzero entry as a coefficient of that variable in some row. Which variables have pivots?

○only x_1

○only x_2

○only x_3

○ x_1 and x_2

○x_1 and x_3

○x_2 and x_3

What does the 1 in row 2 show us?

○that x_1 has a pivot

○that x_2 has a pivot

○that x_3 has a pivot

Any variables without pivots are free, if any. Which variables are free, if any?

○only x_1

○only x_2

- ○ only x_3
- ○ x_1 and x_2
- ○ x_1 and x_3
- ○ x_2 and x_3

How many solutions do we have?

- ○ none
- ○ one unique solution
- ○ infinitely many, a line
- ○ infinitely many, a plane
- ○ infinitely many, a volume

Can a system of 2 equations and 3 unknowns ever have a unique solution?

- ○ yes
- ○ no, 2 planes can't intersect in a single solution

Check

Question **8**

Not complete

Points out of 1.00

Find the general solution of the system whose augmented matrix is given using by-hand Gaussian. $\begin{bmatrix} 1 & 3 & 4 & 7 \\ 3 & 9 & 7 & 6 \end{bmatrix}$

Gaussian reduce the matrix using one row operation, following the strict Gaussian method.

1	3	4	7

Which variables are free, if any?

- ○only x_1
- ○only x_2
- ○only x_3
- ○x_1 and x_2
- ○x_1 and x_3
- ○x_2 and x_3
- ○other

What is x_3?

- ○free so s or x_3
- ○3
- ○other

What is x_2?

- ○free so t or x_2
- ○0
- ○3
- ○other

What is x_1? (Simplify your response)

- ○7-3t or equivalent
- ○7-4t or equivalent
- ○7-3t-4s or equivalent
- ○-5-3t or equivalent
- ○other

Check

Question **9**

Not complete

Points out of 1.00

Use row operations to reduce the matrix to Gauss-Jordan (reduced row echelon form). Identify the pivot positions in the final matrix and in the original matrix, and list the pivot columns. $\begin{bmatrix} 1 & 2 & 1 & 1 \\ 3 & 6 & 1 & 1 \\ 7 & 14 & 1 & 1 \end{bmatrix}$

Follow the strict Gaussian method using the first two replacement row operations. What is the resulting matrix (of only the 1st two operations)?

1	2	1	1

Next use the resulting row 2 to reduce row 3. The resulting matrix will be in Gaussian form:

1	2	1	1

There will be 2 additional operations to obtain Gauss-Jordan (scaling row 2, and then using row 2 to reduce row 1 via replacement to obtain 0s above the diagonal in row 1). What is the resulting matrix?

1	2		

Where are the pivots positions in the final matrix (corresponding to the the first nonzero number in each row, if they exist)?

○on the diagonal ○the 1 in row 1 and the first 1 in row 2 ○other

Where are the pivots positions in the original matrix?

○on the diagonal ○the first 1 in row 1 and the first 1 in row 2 ○other

Which columns are pivot columns?

○all three ○column 1 and column 2 ○column 1 and column 3 ○other

Check

Question **10**

Not complete

Points out of 1.00

Determine the value(s) of h and k, so that the matrix is the augmented matrix of a linear system that is a) inconsistent, b)unique solutions, c) infinite solutions. Use by-hand Gaussian elimination.

$x_1 + hx_2 = 2$

$4x_1 + 8x_2 = k.$

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

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

$r_2' =$

$r_1 + r_2.$

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

When, if ever, are we missing a pivot for x_2?

- ○always
- ○never
- ○$h = 2$
- ○$h \neq 2$
- ○$k = 8$
- ○$k \neq 8$
- ○other

Part a) Determine the value(s) of h and k, so that the matrix is the augmented matrix of a linear system that is inconsistent

- ○$h = 2$ and $k = 8$
- ○$h = 2$ and $k \neq 8$
- ○$h \neq 2$ and $k = 8$
- ○$h \neq 2$ and $k \neq 8$
- ○other

Part b) Determine the value(s) of h and k, so that the matrix is the augmented matrix of a linear system that is unique

- ○$h = 2$
- ○$h \neq 2$
- ○$h \neq 2$ and $k \neq 8$

○other

Part c) Determine the value(s) of h and k, so that the matrix is the augmented matrix of a linear system that has infinite solutions.

○$h = 2$ and $k = 8$
○$h = 2$ and $k \neq 8$
○$h \neq 2$ and $k = 8$
○$h \neq 2$ and $k \neq 8$
○other

Check

Question **11**

Not complete

Points out of 1.00

Is the statement "If one row in an echelon form of an augmented matrix is [0 0 0 5 0], then the associated linear system is inconsistent." 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 **12**

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 1.2, including

- matrix of a linear system: row echelon form (Gaussian), reduced row echelon form (Gauss-Jordan)
- pivots: pivot position of a matrix, pivot column of a matrix
- row reduction algorithm we will most commonly use: elimination by forward phase and back substitution to row echelon form
- solution set: inconsistent: 0 solutions; consistent: 1 unique solution or infinite solutions with free variables and parametric solutions

Consider also 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