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 4.00

Find the inverse of the matrix $\begin{bmatrix} 8 & 6 \\ 5 & 4 \end{bmatrix}$.

Simplify your answer and don't put in an extra characters or spaces.

$$\begin{bmatrix} 8 & 6 \\ 5 & 4 \end{bmatrix}^{-1} =$$

Check

Question **2**

Not complete

Points out of 8.00

Use the inverse found in the previous problem to solve the system

8x +6y = 2

5x + 4y = -1

First set up the equivalent matrix vector equation $A\vec{x} = \vec{b}$?

What is *A*?

What is $\vec{b}$?

In the last problem you computed the inverse of *A*: $\begin{bmatrix} 2 & -3 \\ \frac{-5}{2} & 4 \end{bmatrix}$

To find the solution using the inverse method, we compute $\vec{x} = A^{-1}\vec{b}$ (The reason why is that we use the same algebraic process from the inverse: we multiply both sides of the equation by this inverse, apply associativity, cancel *A* by its inverse, and use the Identity matrix to reduce to get $\vec{x} = A^{-1}\vec{b}$).

What is $\vec{x}$? Simplify your response and don't add in any extra characters or spaces.

Check

Question **3**

Not complete

Points out of 1.00

Is the statement "If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and $ab - cd \neq 0$ then *A* is not invertible." 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 text.

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

Check

Question **4**

Not complete

Points out of 2.00

How many pivots does $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ have?

- ◯0
- ◯1
- ◯2
- ◯3

If a 3x3 matrix has less than 3 pivots, is it invertible?

- ◯yes
- ◯no

Check

Question **5**

Not complete

Points out of 2.00

Which term is equivalent to being invertible?

- ○ singular
- ○ nonsingular

What is $(AB)^{-1}$

- ○ $A^{-1}B^{-1}$
- ○ $B^{-1}A^{-1}$
- ○ other

Check

Question **6**

Not complete

Points out of 3.00

Matrix multiply $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix} \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$

Is this the same as a replacement on the generic matrix $\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$?

- yes
- no

Which row, if any, is replaced?

- row 1
- row 2
- row 3
- none of them

Is $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$ an elementary matrix?

- yes
- no

What is the inverse of $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$?

- $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -\frac{1}{2} & 0 & 1 \end{bmatrix}$
- $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 2 & 0 & 1 \end{bmatrix}$
- other

Which 2x2 elementary matrix E corresponds to replacement of $r_2' = 3r_1 + r_2$ via E $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$. Fill in the entries of the elementary matrix:

Check

Question **7**

Not complete

Points out of 5.00

Suppose that *AB=AC* where *B* and *C* are *nxp* matrices and *A* is invertible. Show that *B=C*. Is this true, in general, when A is not invertible?

First write out the argument to show that *B=C* and answer the following:

Step 1: Of the following, which should be our first step?

- cross out the *A*s
- multiply both sides of the equation *AB=AC* by A^{-1} on the left
- multiply both sides of the equation *AB=AC* by A^{-1} on the right
- any of the above is a good first step
- two of the above would be a good first step

Step 2: What property should be used next (in step 2) to continue simplifying the above equation?

- associativity
- $A^{-1}A = I$
- $AA^{-1} = I$
- other

Step 3: What property should be used next (in step 3) to continue simplifying the above equation?

- associativity
- $A^{-1}A = I$
- $AA^{-1} = I$
- Identity matrix *I* multiplied by any matrix *M* leaves the matrix *M* unchanged: *IM=M*

What does the matrix equation look like after performing step 3?

- *IB=IC*
- B=C
- other

For the second part of the question, is it true, in general, that *AB =AC* implies *B=C*, when *A* is not invertible?

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 **8**

Not complete

Points out of 4.00

Suppose *A* is *n*×*n* and the equation $A\vec{x}=\vec{0}$ has only the trivial solution. Explain why *A* has *n* pivot columns and *A* is row equivalent to I_n, the *n*×*n* identity matrix. What happens to the pivots when *A* is not square?

Part a) Which argument follows directly from the condition that $A\vec{x}=\vec{0}$ has only the trivial solution?

- ○ *A* must have a pivot in each column of the coefficient matrix
- ○ *A* must have a pivot in each row of the coefficient matrix
- ○ both
- ○ none of the above, since $A\vec{x}=\vec{0}$ can't have only the trivial solution

Part b) Why must must *A* have a pivot in each column of the coefficient matrix?

- ○ Because *A* is square
- ○ Then there are no free parameters in the system $A\vec{x}=\vec{0}$, since it has only the trivial solution, not infinitely many solutions. Thus there must be a pivot position in each column

Part c) Why must *A* have have a pivot in each row?

- ○ Because *A* is square
- ○ Then there are no free parameters in the system $A\vec{x}=\vec{0}$, since it has only the trivial solution, not infinitely many solutions. Thus there must be a pivot position in each row

Part d) Write out the full argument for the following and compare it with general feedback when you finish all the hw:

Suppose *A* is *n*×*n* and the equation $A\vec{x}=\vec{0}$ has only the trivial solution. Explain why *A* has *n* pivot columns and *A* is row equivalent to I_n, the *n*×*n* identity matrix.

Part e) For the second part of the question, what happens to the pivots when *A* is not square?

- ○ If $A\vec{x}=\vec{0}$ then A must have a pivot in each column of the coefficient matrix
- ○ If $A\vec{x}=\vec{0}$ then *A* must have a pivot in each row of the coefficient matrix
- ○ both must be true
- ○ none of the above, since $A\vec{x}=\vec{0}$ can't have only the trivial solution if *A* is not square

Check

Question **9**

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 2.2, including

- matrices: invertible (nonsingular) matrix, noninvertible (singular) matrix, elementary matrix
- determinant and inverse of a 2x2 matrix
- connection between invertibility and unique solutions
- inverse of a product of matrices and inverse of a transpose

and consider 2.1, including

- matrices: diagonal matrix [and main diagonal], zero matrix
- matrix operations: matrix addition, scalar multiplication of a matrix, matrix multiplication, powers of a matrix, left (or right) multiplication, transpose of a matrix
- matrix multiplication by linear combinations of the columns of A using weights from the corresponding column of B or by the dot products of a row of A with the corresponding column of B.
- algebraic properties that do hold for matrix multiplication: associativity and one-sided distributivity
- algebraic properties that don't hold for matrix multiplication: commutativity

Since the material builds on itself, consider whether there is any material from before this module that you want to brush up on:

1.1

- 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

1.2

- 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

1.3

- algebra of vectors: coordinates, addition of vectors, scalar multiplication of vectors, properties like associativity under addition (property ii on p. 29), a linear combination with weights, zero vector, span of a set of vectors=all the linear combinations, is a vector in the span?, vector equation $\longrightarrow$ augmented matrix
- geometry of vectors in 2D and 3D: directed segment, parallelogram for addition, on same line for scalar multiplication of vectors, origin=zero vector, a linear combination geometrically in the plane or 3D, span=all the linear combinations geometrically in the plane or 3D, spaces of subsets of R^n spanned by vectors

1.4

- algebra of matrix vector equation $A\vec{x} = \vec{b}$:
  - multiply a matrix and a column vector by linear combinations of the columns of *A* using weights from $\vec{x}$
  - span of the columns of *A* = set of all linear combinations of the columns of *A*
  - matrix vector equation $\longrightarrow$ vector equation $\longrightarrow$ augmented matrix
  - equations generic vectors $\vec{b}$ must satisfy to be in the span (Example 3)
  - dot products of rows of *A* with $\vec{x}$,
- geometry of solutions of matrix vector equation $A\vec{x} = \vec{b}$: spaces of subsets of R^3 spanned by the column vectors of A, geometry of such spaces (Figure 1)
- Theorem 4: relationship of consistency of $A\vec{x} = \vec{b}$ to always being a linear combination to spanning the entire R^m, where *m* is the number of rows, to having a pivot position in every row of *A*.
- identity matrix *I*

1.5

- algebra of homogeneous systems: $A\vec{x} = \vec{0}$
- algebraic solutions of homogenous systems always include the trivial solution=$\vec{0}$. nontrivial solutions, if any exist, are parameterized in parametric vector form using free variables to express those as well as the variables with pivots and then decomposed algebraically to showcase the algebra and geometry giving $t\vec{v}$ or $s\vec{u} + t\vec{v}$ or similar, where each free variable is attached to a vector.
- geometry of solutions of homogeneous systems are geometric spaces through the origin like lines, planes, or hyperplanes
- algebra of nonhomogeneous systens: $A\vec{x} = \vec{b}$
- solutions of nonhomogeneous systems in parametric vector form can be decomposed algebraically to showcase the algebra and geometry like $\vec{p} + t\vec{v}$, vectors ending on the line parallel to $\vec{v}$ or $\vec{p} + s\vec{u} + t\vec{v}$, vectors ending on the plane parallel to the one spanned by $\vec{u}, \vec{v}$...
- geometry of solutions of nonhomogeneous systems are geometric spaces translated away from the origin via adding $\vec{p}$

1.7

- linearly independent set of vectors and connection to a homogeneous equation having only the trivial solution
- linearly dependent set of vectors and connection to nontrivial solutions existing and providing a dependance relation
- geometry of linearly independent set of 2 vectors: independent directions in space versus along the same line (Figure 1)
- geometry of linearly independent set of 3 or more vectors: no one vector is in the span of the rest, i.e. they are all needed to span the space versus redundancy in the geometric space they span in the sense that they aren't all needed to generate the same space under linear combinations (Figure 2)
- linearly independent columns of a matrix
- redundancy of $\vec{0}$ in a set of vectors $\{\vec{v}_1 = \vec{0}, \vec{v}_2, \ldots \vec{v}_n\}$ (Theorem 9)

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

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