

# RH 1.9

MATH 5, Jones

Tejas Patel

## Refrigerator Homework

**10**

$$\begin{aligned}AD &= I \\A^{-1}(AD) &= A^{-1}I \\(A^{-1}A)D &= A^{-1}I \\ID &= A^{-1} \\D &= A^{-1}\end{aligned}$$

**24**

$$\begin{aligned}(B - C)D &= 0 \\(B - C)DD^{-1} &= 0D^{-1} \\(B - C)I &= 0 \\B - C &= 0 \\B &= C\end{aligned}$$

**29**

$$\begin{aligned}C^{-1}(A + X)B^{-1} &= I_n \\(A + X)B^{-1} &= CI_n = C \\A + X &= CB \\X &= CB - A\end{aligned}$$

**30**

a: B is invertible because it appears in an equation where both sides represent the inverse of an invertible matrix. If B were not invertible, the equation would not properly define an inverse on the left-hand side. b:  $(A - AX)^{-1} = X^{-1}B$ .  
 $A - AX = B^{-1}X$ .

$$A = AX + B^{-1}X.$$

$$A = (A + B^{-1})X.$$

$$X = (A + B^{-1})^{-1}A$$

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Because if its invertible its linearly independent, meaning it spans  $\mathbb{R}^n$ . Simple stuff really

## **Computer Homework: Next 10 Pages**

2.2 RH Review Homework

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### Review Homework: Section 2.2 Homework

Question 1, 2.2.1

HW Score: 80%, 8 of 10 points  
Points: 0.8 of 1

#### Question list

Question 1

Find the inverse of the matrix.

$$\begin{bmatrix} 8 & 5 \\ 2 & 6 \end{bmatrix}$$

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A. The inverse matrix is  $\begin{bmatrix} \frac{3}{19} & -\frac{5}{38} \\ -\frac{1}{19} & \frac{4}{19} \end{bmatrix}$ .  
(Type an integer or simplified fraction for each matrix element.)

B. The matrix is not invertible.

Question 2

Question 3

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Review Homework: Section 2.2 Homework Question 2, 2.2.10 HW Score: 80%, 8 of 10 points  
Points: 0.8 of 1

Question list

Use matrix algebra to show that if A is invertible and D satisfies  $AD = I$ , then  $D = A^{-1}$ .

Choose the correct answer below.

A. Add  $A^{-1}$  to both sides of the equation  $AD = I$  to obtain  $AD + A^{-1} = I + A^{-1}$ ,  $DI = A^{-1}$ , and  $D = A^{-1}$ .  
B. Left-multiply each side of the equation  $AD = I$  by  $A^{-1}$  to obtain  $A^{-1}AD = A^{-1}I$ ,  $ID = A^{-1}$ , and  $D = A^{-1}$ .  
C. Right-multiply each side of the equation  $AD = I$  by  $A^{-1}$  to obtain  $ADA^{-1} = IA^{-1}$ ,  $DI = A^{-1}$ , and  $D = A^{-1}$ .  
D. Add  $A^{-1}$  to both sides of the equation  $AD = I$  to obtain  $A^{-1} + AD = A^{-1} + I$ ,  $ID = A^{-1}$ , and  $D = A^{-1}$ .

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Review Homework: Section 2.2 Homework

Question 3, 2.2.25  
Part 5 of 5

HW Score: 80%, 8 of 10 points  
Points: 0.8 of 1

Suppose A, B, and C are invertible  $n \times n$  matrices. Show that ABC is also invertible by introducing a matrix D such that  $(ABC)D = I$  and  $D(ABC) = I$ .

It is assumed that A, B, and C are invertible matrices. What does this mean?

A.  $A^{-1}$ ,  $B^{-1}$ , and  $C^{-1}$  are all not equal to the identity matrix.  
 B.  $A^{-1}$ ,  $B^{-1}$ , and  $C^{-1}$  are all equal to the identity matrix.  
 C.  $A^{-1}$ ,  $B^{-1}$ , and  $C^{-1}$  exist.  
 D.  $A^{-1}$ ,  $B^{-1}$ , and  $C^{-1}$  all have determinants equal to zero.

Now assume that  $(ABC)D = I$ . Since A, B, and C are invertible, this equation can be solved for D. Which operation will remove A from the left side of this equation?

A. Left multiply both sides of the equation by  $A^{-1}$ .  
 B. Subtract  $A^{-1}$  from both sides of the equation.  
 C. Right multiply both sides of the equation by  $A^{-1}$ .  
 D. Subtract A from both sides of the equation.

Perform the operation determined in the previous step and simplify both sides of the equation.

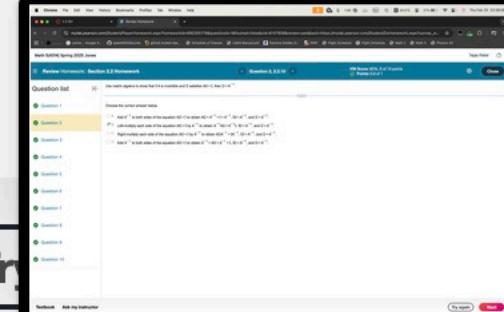
$(BC)D = A^{-1}$   
(Type the terms of your expression in the same order as they appear in the original expression.)

Perform similar operations to remove B and C from the left side of the equation to solve for D.

$D = C^{-1}B^{-1}A^{-1}$

Thus, D satisfying  $(ABC)D = I$  exists. Why does the expression for D found above also satisfy  $D(ABC) = I$ , thereby showing that ABC is invertible? Select the correct choice below and, if necessary, fill in the answer box within your choice.

A. After substituting the expression for D, taking the inverse of both sides of the equation results in the equation  $I = ABCD$ .  
 B. After substituting the expression for D, right multiplying the product by  $\square$  results in the equation  $I = ABCD$ .  
 C. After substituting the expression for D, left multiplying the product by  $\square$  results in the equation  $I = ABCD$ .  
 D. After substituting the expression for D, the product  $DABC$  simplifies to  $I$  by repeated application of the associative property and the definition of inverse matrices.



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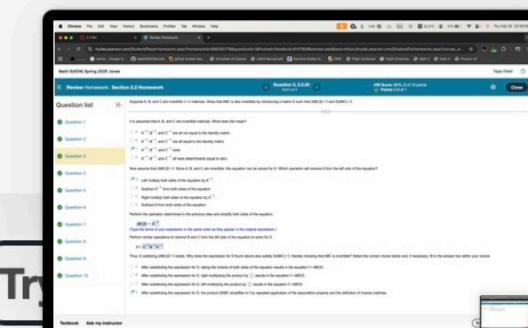
Review Homework: Section 2.2 Homework Question 4, 2.2.27 HW Score: 80%, 8 of 10 points  
Points: 0.8 of 1

Solve the equation  $AB = BC$  for A, assuming that A, B, and C are square matrices and B is invertible.

A =  $BCB^{-1}$  (Simplify your answer.)

Question list

- Question 1
- Question 2
- Question 3
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- Question 10



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Review Homework: Section 2.2 Homework Question 5, 2.2.30 Part 2 of 2 HW Score: 80%, 8 of 10 points Points: 0.8 of 1

Close

Question list

Suppose A, B, and X are  $n \times n$  matrices with A, X, and  $A - AX$  invertible, and suppose that  $(A - AX)^{-1} = X^{-1}B$ . Complete parts (a) and (b) below.

a. Explain why B is invertible. Choose the correct answer below.

A. Since  $X^{-1}B$  is equal to  $(A - AX)^{-1}$  and  $(A - AX)^{-1}$  is invertible,  $X^{-1}B$  is also invertible. Since  $X^{-1}B$  is invertible and  $X^{-1}$  is invertible, B must be invertible.

B. Solving the equation  $(A - AX)^{-1} = X^{-1}B$  for B yields  $X(A - AX)^{-1} = B$ . Since X is invertible and  $(A - AX)^{-1}$  is invertible, the product  $X(A - AX)^{-1} = B$  is also invertible.

C. Solving the equation  $(A - AX)^{-1} = X^{-1}B$  for B yields  $(A - AX)^{-1}X = B$ . Since X is invertible and  $(A - AX)^{-1}$  is invertible, the product  $(A - AX)^{-1}X = B$  is also invertible.

D. Multiply both sides of equation  $(A - AX)^{-1} = X^{-1}B$  by  $B^{-1}$  to obtain  $X^{-1} = (A - AX)^{-1}B^{-1}$ . Now multiply both sides by  $(A - AX)$  to obtain the equation  $B^{-1} = (A - AX)X^{-1}$ . Thus, the inverse of B exists and B must be invertible.

b. Solve the equation  $(A - AX)^{-1} = X^{-1}B$  for X.

$$X = (A + B^{-1})^{-1}A$$

Question 5

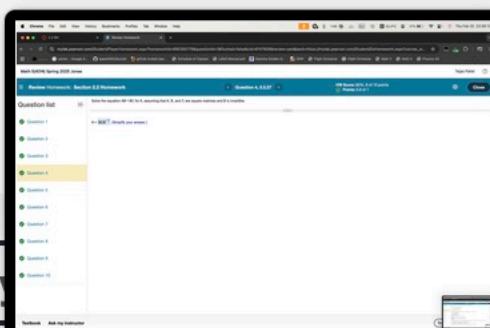
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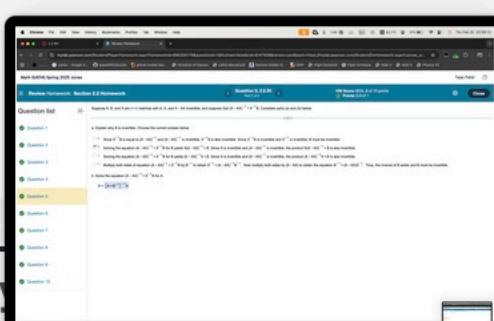
Review Homework: Section 2.2 Homework Question 6, 2.2.31 HW Score: 80%, 8 of 10 points  
Points: 0.8 of 1

Question list Explain why the columns of an  $n \times n$  matrix A are linearly independent when A is invertible.

Choose the correct answer below.

A. If A is invertible, then A has an inverse matrix  $A^{-1}$ . Since  $AA^{-1} = A^{-1}A = I$ , A must have linearly independent columns.  
B. If A is invertible, then A has an inverse matrix  $A^{-1}$ . Since  $AA^{-1} = I$ , A must have linearly independent columns.  
C. If A is invertible, then for all  $\mathbf{x}$  there is a  $\mathbf{b}$  such that  $A\mathbf{x} = \mathbf{b}$ . Since  $\mathbf{x} = \mathbf{0}$  is a solution of  $A\mathbf{x} = \mathbf{0}$ , the columns of A must be linearly independent.  
D. If A is invertible, then the equation  $A\mathbf{x} = \mathbf{0}$  has the unique solution  $\mathbf{x} = \mathbf{0}$ . Since  $A\mathbf{x} = \mathbf{0}$  has only the trivial solution, the columns of A must be linearly independent.

Question 1 Question 2 Question 3 Question 4 Question 5 Question 6 Question 7 Question 8 Question 9 Question 10



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Review Homework: Section 2.2 Homework Question 7, 2.2.33 HW Score: 80%, 8 of 10 points  
Points: 0.8 of 1

Question list Suppose A is  $n \times n$  and the equation  $Ax = 0$  has only the trivial solution. Explain why A has n pivot columns and A is row equivalent to  $I_n$ .

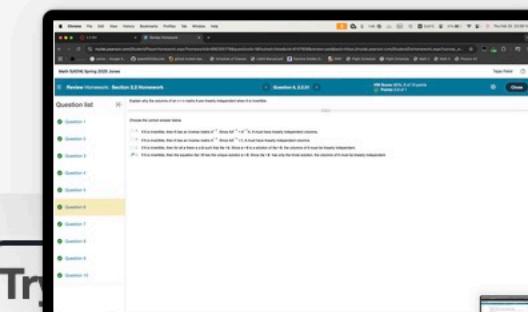
Choose the correct answer below.

A. Suppose A is  $n \times n$  and the equation  $Ax = 0$  has only the trivial solution. Then there are no free variables in this equation, thus A has n pivot columns. Since A is square and the n pivot positions must be in different rows, the pivots in an echelon form of A must be on the main diagonal. Hence A is row equivalent to the  $n \times n$  identity matrix,  $I_n$ .

B. Suppose A is  $n \times n$  and the equation  $Ax = 0$  has only the trivial solution. Then there are no free variables in this equation, thus A has n pivot columns. Since A is square and the n pivot positions must be in different rows, the pivots in A must be on the main diagonal. Hence A is the  $n \times n$  identity matrix,  $I_n$ .

C. Suppose A is  $n \times n$  and the equation  $Ax = 0$  has only the trivial solution. Then there are n free variables in this equation, thus A has n pivot columns. Since A is square and the n pivot positions must be in different rows, the pivots in an echelon form of A must be on the main diagonal. Hence A is row equivalent to the  $n \times n$  identity matrix,  $I_n$ .

Question 1 Question 2 Question 3 Question 4 Question 5 Question 6 Question 7 Question 8 Question 9 Question 10



2.2 RH Review Homework

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Review Homework: Section 2.2 Homework Question 8, 2.2.34 HW Score: 80%, 8 of 10 points  
Points: 0.8 of 1

Question list Suppose A is  $n \times n$  and the equation  $Ax = b$  has a solution for each  $b$  in  $\mathbb{R}^n$ . Explain why A must be invertible. [Hint: Is A row equivalent to  $I_n$ ?]

Question 1 Choose the correct answer below.

A. If the equation  $Ax = b$  has a solution for each  $b$  in  $\mathbb{R}^n$ , then A has a pivot position in each row. Since A is square, the pivots must be on the diagonal of A. It follows that A is row equivalent to  $I_n$ . Therefore, A is invertible.

B. If the equation  $Ax = b$  has a solution for each  $b$  in  $\mathbb{R}^n$ , then A has one pivot position. It follows that A is row equivalent to  $I_n$ . Therefore, A is invertible.

C. If the equation  $Ax = b$  has a solution for each  $b$  in  $\mathbb{R}^n$ , then A has a pivot position in each row. Since A is square, the pivots must be on the diagonal of A. It follows that A is  $I_n$ . Therefore, A is invertible.

D. If the equation  $Ax = b$  has a solution for each  $b$  in  $\mathbb{R}^n$ , then A does not have a pivot position in each row. Since A is square, and  $I_n$  is square, A is row equivalent to  $I_n$ . Therefore, A is invertible.

Question 2

Question 3

Question 4

Question 5

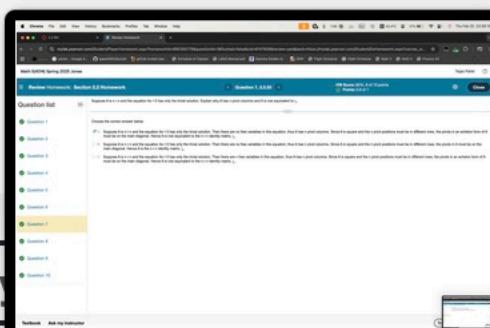
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Review Homework: Section 2.2 Homework Question 9, 2.2.42 HW Score: 80%, 8 of 10 points  
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Question list

Find the inverse of the given matrix, if it exists.

$$A = \begin{bmatrix} 1 & -2 & 1 \\ 2 & -3 & 1 \\ 4 & -2 & -2 \end{bmatrix}$$

Find the inverse. Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

A.  $A^{-1} = \boxed{\phantom{000}}$   
(Type an integer or decimal for each matrix element.)

B. The matrix A does not have an inverse.

Question 1

Question 2

Question 3

Question 4

Question 5

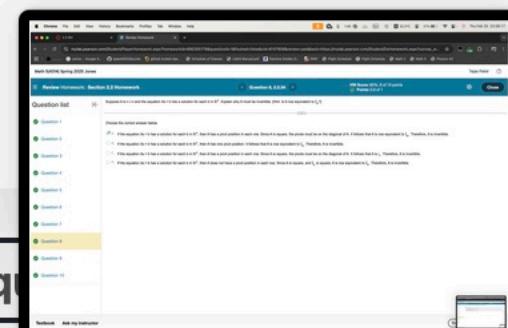
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Review Homework: Section 2.2 Homework

Question 10, 2.2.47 Part 2 of 2

HW Score: 80%, 8 of 10 points  
Points: 0.8 of 1

Question list

Question 1

Question 2

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Question 10

Let  $A = \begin{bmatrix} 1 & 5 \\ 1 & 6 \\ 1 & 11 \end{bmatrix}$ . Construct a  $2 \times 3$  matrix C (by trial and error) using only 1, -1, and 0 as entries, such that  $CA = I_2$ . Compute  $AC$  and note that  $AC \neq I_3$ .

$C = \begin{bmatrix} 1 & 1 & -1 \\ -1 & 1 & 0 \end{bmatrix}$

$AC = \begin{bmatrix} -4 & 6 & -1 \\ -5 & 7 & -1 \\ -10 & 12 & -1 \end{bmatrix}$

(Simplify your answer.)

