

Your Name: Cole
first

Bardin
last

Section: 62

Lab 2: Matrix Explorations

Spring 2022

As a convenience, this **answer template** is provided if you wish to easily submit your work. Be sure to save it as a PDF before submitting online! Only one submission is allowed.

Question 1: Solve a Linear System by Row Reducing the Augmented Matrix

The unique solution is: $\vec{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 6 \\ 6 \end{bmatrix}$

($x = 6, y = 6, z = 6$)

Question 2: Solve a Linear System with a Free Variable

a. Record the RAM from part a here. →

1	1	0	2
0	0	1	2
0	0	0	0

b. The solution is: $\vec{x} = \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 - y \\ y(\text{free}) \\ 2 \end{bmatrix}$

($x = 2 - y, y = y(\text{free}), z = 2$)

Question 3: Matrices in general do not commute.

Question 3a. Find the matrix below that commutes with A. Circle or highlight it.

i. $B = \begin{bmatrix} 3 & 4 \\ 4 & 3 \end{bmatrix}$

ii. $C = \begin{bmatrix} 1 & 2 \\ 2 & 2 \end{bmatrix}$

iii. $D = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

Question 3b. For $B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ to commute with $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, the matrix B must have the form:

i. $B = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$

ii. $B = \begin{bmatrix} a & b \\ -b & a \end{bmatrix}$

iii. $B = \begin{bmatrix} a & b \\ b & -a \end{bmatrix}$

iv. $B = \begin{bmatrix} a & b \\ -b & -a \end{bmatrix}$

Question 3c. For B to commute with the new matrix $F = \begin{bmatrix} 1 & 2 \\ -2 & 1 \end{bmatrix}$, B must have the form:

i. $B = \begin{bmatrix} a & b \\ b & a \end{bmatrix}$

ii. $B = \begin{bmatrix} a & b \\ -b & a \end{bmatrix}$

iii. $B = \begin{bmatrix} a & b \\ b & -a \end{bmatrix}$

iv. $B = \begin{bmatrix} a & b \\ -b & -a \end{bmatrix}$

Question 4: Commuting Pairs of Matrices

Question 4: The number of commuting pairs is: 23

Question 5: Trace of a matrix product AB

Question 5a: The trace of $A = \text{magic}(3)$ is: **15**

Question 5b: The number of pairs satisfying $\text{Tr}(AB) = \text{Tr}(BA)$ is: **All: 10,000**

Question 5c: The number of pairs satisfying $\text{Tr}(AB) = \text{Tr}(A) \cdot \text{Tr}(B)$ is: **219**

Question 6: Determinant of a matrix product AB .**Preview of Determinant**

Question 6: The number of matrix pairs satisfying $\det(AB) = \det(A) \det(B)$ is: **All: 10,000**

Question 7: Row Equivalent Matrices and the Reducing Matrix R

Question 7a. The matrix row-equivalent to A is: **B**

Question 7b. Record your value for R here: $R = \begin{bmatrix} 0.5 & 0.5 \\ 0.5 & -0.5 \end{bmatrix}$

Question 8: Solving Linear Systems $A\vec{x} = \vec{b}$ using `linsolve(A, b)`

Question 8a. Record the solution here: $\vec{x} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$

Question 8b. Record the RREF here.

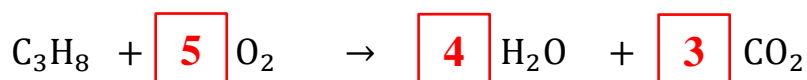
```
RREF of Augmented Matrix with rref():  
  1   0   0   1  
  0   1   0   2  
  0   0   1   3
```

Questions 9-10: A Stoichiometry Example/Combustion of Propane

a. Record the RREF here.

1	0	0	5
0	1	0	4
0	0	1	3

b. Balance the equation. Fill in a positive integer inside each box.



Ready to Submit?

Be sure all ten questions are answered. When your lab is complete, be sure to submit four files:

1. Your **completed Answer Template** as a PDF file
2. A copy of your **original MALAB Script**
3. A copy of your **MATLAB Live Script**
4. A **PDF** copy of your **MATLAB Live Script** (Save-Export to PDF...)

The due date is the day after your lab section by **11:59pm** to receive full credit. You have one more day, to submit the lab (but with a small penalty), and then the window closes, and your grade will be zero.