Sept 2021

$Q1$. Choose the set of correct options.

Options:

A. Consider two real 3×3 matrices A and B. If $AB = 0$, then one of the matrices among A and B must have determinant 0.

B. If $cA = 0$ for some matrix A and some non-zero real number c, then A must be 0.

C. If one column is the sum of other two columns of a 3×3 real matrix, then the determinant of that matrix is zero.

D. A system of lienar equation $Ax = 0$ may have no solution.

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$Q2$. Let A and B two matrices such that $(A - I)(B - I) = I$, where I denotes the identity matrix of order n. Which of the following options are correct?

Options:

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

B. $AB = A + B$

C. $BA = A + B$

D. $BA = AB$

==========

$Q3$. Consider the follwing systems of lienar equations:

System I :

$$\begin{aligned} x + y &= 2 \\ 3x + 2y &= 1 \end{aligned}$$

System II :

$$\begin{aligned} x + 3y + 5z &= 2 \\ 2x - y - 3z &= 1 \\ 4x + 5y - z &= -3 \end{aligned}$$

Using the above two systems of linear equations answer the given subquestions

Sub Questions:

Q1) Which of the following options is correct?

Options :

A. System I has no solution.
B. System I has infinitely many solutions.
C. System I has a unique solution.
D. None of these.

Q2) Which of the following options is correct?

Options :

A. System II has no solution.
B. System II has infinitely many solutions.
C. System II has a unique solution.
D. None of these.

Jan 2022

$Q4$. Match the system of lienar equations in Column A with their number of solutions in column B and their geomertic representation in Column C

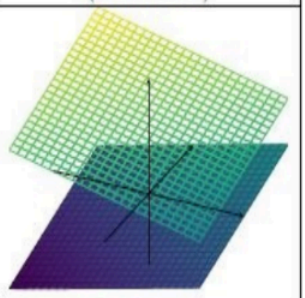
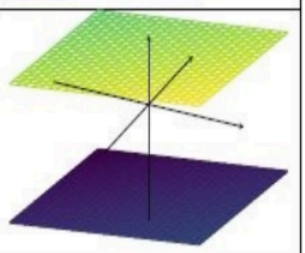
	System of linear equations (Column A)		Number of solutions (Column B)		Geometric representations (Column C)
i)	$x-y-z=8, -x+y+z=4$	a)	No solution	1)	
ii)	$x+y-z=3, x-y+z=3$	b)	Infinitely many solutions	2)	

Table: M2Q1:1

Options:

A. $i) \rightarrow b \rightarrow 1, ii) \rightarrow a \rightarrow 2$

B. $i) \rightarrow a \rightarrow 1, ii) \rightarrow b \rightarrow 2$

C. $i) \rightarrow b \rightarrow 2, ii) \rightarrow a \rightarrow 1$

D. $i) \rightarrow a \rightarrow 2, ii) \rightarrow b \rightarrow 1$

May 2022

$Q5$. If $A + 3I = 0$, where A is a 2×2 matrix and I is the identity matrix of order 2, then find out the $det(A)$

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$Q6$. If matrix $A = \begin{bmatrix} 3 & -3 \\ -3 & 3 \end{bmatrix}$ and $A^2 = \lambda A$, then find the value of λ.

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$Q7$. If $\begin{bmatrix} a+4 & 3b \\ 8 & -6 \end{bmatrix} = \begin{bmatrix} 2a+2 & b+2 \\ 8 & a-8b \end{bmatrix}$, then find the value of $a + 2b$

Sept 2022

$Q8$. Consider the matrix $A = \begin{bmatrix} a & a \\ -a & a \end{bmatrix}$, for some real number a

Answer the given subquestions:

Sub Questions:

Q1) If $A^4 = \beta\alpha^4 I$, then what is the value of β?

Q2) Find the value of $a + \lambda$ for which $det(A - \lambda I) = 0$, where λ is a real number (treat a as a variable)

Jan 2023

$Q9$. Match the system of linear equations in Column A with their number of solutions in column B and their geometrix representation in column C

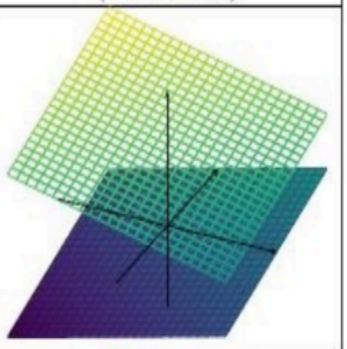
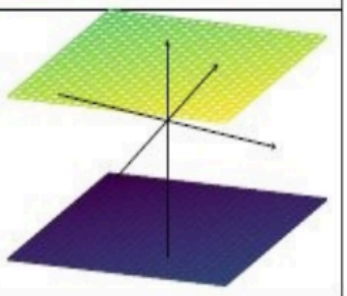
	System of linear equations (Column A)		Number of solutions (Column B)		Geometric representations (Column C)
i)	$x-y-z=8, -x+y+z=4$	a)	No solution	1)	
ii)	$x+y-z=3, x-y+z=3$	b)	Infinitely many solutions	2)	

Table: M2Q1:1

Choose the correct option from the following:

Options :

A. i) → b → 1, ii) → a → 2.
B. i) → a → 1, ii) → b → 2.
C. i) → b → 2, ii) → a → 1.
D. i) → a → 2, ii) → b → 1.

==========

$Q10$. Which of the following matrices are not the square of a 3×3 matrix with real entries?

Options:

A. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$

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

D. $\begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$

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$Q11$. Let M and N be two 3×3 matrices such that $MN = NM$.

Based on the above data, answer the given subquestions.

Sub Questions:

Q1) Which of the following is true?

Options:

A.$M^2N = N^2M$

B. $M^2 + N^2 = (M + N)^2$

C. $M^2 - N^4 = \left(M - N^2\right)\left(M + N^2\right)$

D. None of the other options are true.

Q2) Suppose further that $M \neq N^2$ and $M^2 = N^4$, then which of the following is true?

Options:

A. $det\left(M^2 + MN^2\right) = 1$

B. $det\left(M^2 + MN^2\right) < 0$

C. $det\left(M^2 + MN^2\right)$ can be any real number

D.None of the other options are true.

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$Q12$. If A and B are two skew-symmetric matrices of order n, i.e., $A^T = -A$ and $B^T = -B$, where A^T denotes the transpose of A, then

Options :

A. AB is a skew-symmetric matrix.
B. AB is a symmetric matrix (M is a symmetric matrix if $M^T = M$).
C. AB is a symmetric matrix if A and B commute.
D. AB must be a diagonal matrix.

May 2023

$Q13$. Match the system of linear equations in Column A with their number of solutions in column B and their geometric representation in Column C.

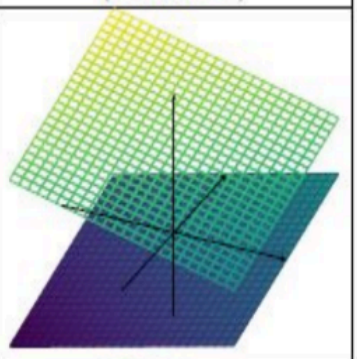
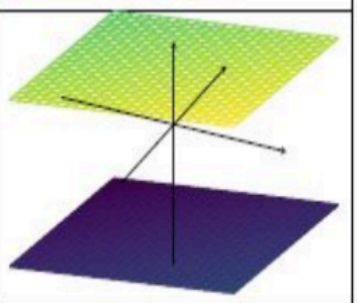
	System of linear equations (Column A)		Number of solutions (Column B)		Geometric representations (Column C)
i)	$x-2y-z=8, -x+2y+z=4$	a)	No solution	1)	
ii)	$x+y-z=3, x-y+z=3$	b)	Infinitely many solutions	2)	

Table: M2Q1:1

Choose the correct option from the following:

Options :

A. i) → b → 1, ii) → a → 2.

B. i) → a → 1, ii) → b → 2.

C. i) → b → 2, ii) → a → 1.

D. i) → a → 2, ii) → b → 1.

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$Q14$. Which of the following matrices satisfy $A^k = 0$ for some natural number k ?

Options:

A. $\begin{bmatrix} 4 & -4 & 0 & 0 \\ 4 & -4 & 0 & 0 \\ 0 & 0 & 4 & -4 \\ 0 & 0 & 4 & -4 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 3 & 2 & 1 \\ 0 & 0 & 2 & 2 \\ 0 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$

D. $\begin{bmatrix} -1 & 0 & 0 & 1 \\ 0 & -1 & 0 & 2 \\ 0 & 0 & -1 & 2 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

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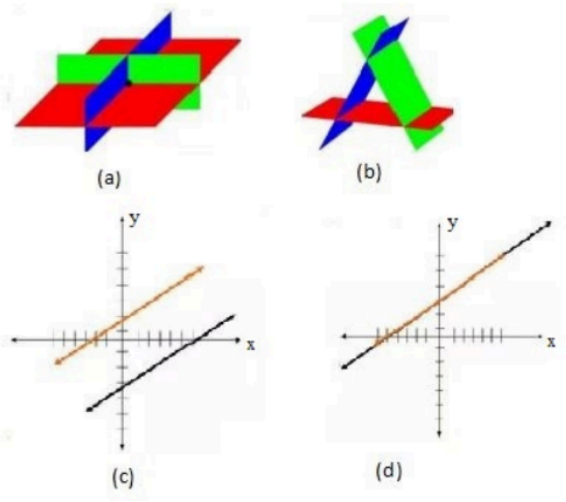
$Q15$. Let $A = \begin{pmatrix} 2022 & 2023 & 2024 \\ 2022 & 2021 & 2022 \\ 2022 & 2022 & 2022 \end{pmatrix}$. What is the determinant of $\frac{1}{2}A$?

Sept 2023

$Q16$. Consider the following images representing systems of linear equations



Choose the correct option(s) from the foolowing

Options:

A. The figures (a) and (d) represent systems with unique solution.
B. The figures (b) and (c) represent systems with no solution.
C. The figures (b) and (d) represent systems with infinitely many solutions.
D. The figures (a) and (d) represent consistent systems of linear equations.

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$Q17$. Let A be a 3×3 matrix such that $A^T = -A$. Then $det(A) =$

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$Q18$. Let A be a 3×3 matrix such that $det(A) = 2$. If B is a matrix obtained from A by swapping the second and third row, and then multiplying the first row by -3, then $det(B) =$

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$Q19$. Let $A = \begin{pmatrix} 1 & -2 \\ -3 & 4 \end{pmatrix}$ and $det(A - xI) = x^2 - ax + b$, then $a - b =$

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$Q20$. Let $B = \begin{pmatrix} -6 & 3 & 4 \\ 7 & 2 & -1 \\ 2 & 4 & 2 \end{pmatrix}$

What is the determinant of B?

Jan 2024

$Q21$. Find the determinant of

$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

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$Q22$. Find the determinant of $\begin{bmatrix} a & b & 0 & c \\ d & e & 5 & f \\ g & h & 4 & i \\ 0 & 0 & -5 & 0 \end{bmatrix}$ given the determinat of the matrix $\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$ is 2.

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$Q23$. Let $A = \begin{bmatrix} 1 & \frac{1}{3} \\ c & d \end{bmatrix}$ such that $A^2 = 0$

Sub Questions:

Q1) Find the value of c.

Q2) Find the value of d.

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$Q24$. Consider the following system of linear equations:

$$\begin{aligned} 2x - y + 3z &= 0 \\ ax - y + z &= 0 \\ 4x - 2y + 7z &= 0 \end{aligned}$$

Sub Questions:

Q1) Does there exist an "a" such that the system has infinitely many solutions? If yes, find the value of "a", else write the answer as 100.

Q2) Does there exist an "a" such that the system has no solution? If yes, find the value of "a", else write the answer as 100.