Unit 5 - Week 3

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Assignment 3

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-10-07, 23:59 IST.

For Questions (1) to (4), consider the linear system $M\mathbf{x}=\mathbf{b}$ where $M \in \mathbb{M}_4(\mathbb{R})$ and $\mathbf{b}^T=[1,2,-1,-2]$.

1) If $M\mathbf{x}=\mathbf{b}$ has NO solution then M is invertible. *1 point*

- TRUE
- FALSE

No, the answer is incorrect.
Score: 0
Accepted Answers:
FALSE

2) If $M\mathbf{x}=\mathbf{b}$ has NO solution then the homogeneous system $M\mathbf{x}=\mathbf{0}$ has only the trivial solution. *1 point*

- TRUE
- FALSE

No, the answer is incorrect.
Score: 0
Accepted Answers:
FALSE

3) Let $\mathbf{c}^T=[-1,-2,1,2]\$. If M\mathbf{x}=\mathbf{b}$ has NO solution then the system $M\mathbf{x}=\mathbf{c}$ has no solution. *1 point*

- TRUE
- FALSE

No, the answer is incorrect.
Score: 0
Accepted Answers:
TRUE

4) Let $R=\mathrm{RREF}(M)$. If $M\mathbf{x}=\mathbf{b}$ has NO solution then $R[3,:]=[0,1,\star,\star]$ *1 point*

- TRUE
- FALSE

No, the answer is incorrect.
Score: 0
Accepted Answers:
FALSE

5) Let $M=\begin{bmatrix}1&1&4&5\\3&2&1&7\\7&8&9&3\\5&7&1&1\end{bmatrix}$ and $N=\begin{bmatrix}1&x_1&x_1^2&x_1^3\\1&x_2&x_2^2&x_2^3\\1&x_3&x_3^2&x_3^3\\1&x_4&x_4^2&x_4^3\end{bmatrix}$. Then *1 point*

- 11 divides $\det(M)$ and $\det(N)=\prod_{i<j}(x_j-x_i)$
- 13 divides $\det(M)$ and $\det(N)=\prod_{i<j}(x_j-x_i)$
- 11 divides $\det(M)$ and $\det(N)=\prod_{i<j}(x_i-x_j)$
- 13 divides $\det(M)$ and $\det(N)=\prod_{i<j}(x_i-x_j)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
11 *divides* $\det(M)$ *and* $\det(N)=\prod_{i<j}(x_j-x_i)$

6) For $M \in \mathbb{M}_n(\mathbb{R})$, consider the two statements given below. *1 point*

(a) The system $M\mathbf{x}=\mathbf{b}$ has a solution for every $\mathbf{b}$.

(b) The system $M\mathbf{x}=\mathbf{0}$ has a non-trivial solution. Then,

- there exists a choice for M and $\mathbf{b}$ such that both the statements are TRUE simultaneously.
- there does NOT exist M for which both the statements can hold TRUE simultaneously.

No, the answer is incorrect.
Score: 0
Accepted Answers:
there does NOT exist M for which both the statements can hold TRUE simultaneously.

7) Let $M=\begin{bmatrix}1&2&3&4&\dots&n\\2&2&3&4&\dots&n\\3&3&3&4&\dots&n\\..&..&..&..&\dots&n\\n&n&n&n&\dots&n\end{bmatrix}$ and $N=\begin{bmatrix}1^2&3^2&5^2&8^2\\9^2&11^2&13^2&16^2\\20^2&22^2&24^2&27^2\\31^2&33^2&35^2&38^2\end{bmatrix}$. Then *1 point*

- $\det(M)=(-1)^n n$ and $\det(N)=0$
- $\det(M)=(-1)^{n+1} n$ and \det(N) =0
- $\det(M)=(-1)^n n$ and $\det(N)\neq 0$
- $\det(M)=(-1)^{n+1} n$ and $\det(N)\neq 0$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\det(M)=(-1)^{n+1} n$ *and \det(N) =0*

8) Let $M=[m_{ij}]$ and $B=[p^{i-j}m_{ij}]$, for some $p\neq 0$. Also, let $N \in \mathbb{M}_4(\mathbb{R})$ be a matrix having all it's rows as $\begin{bmatrix}a&b&c&d\end{bmatrix}$. Then *1 point*

- $\det(B)=\det(M)$ and $\det(I+N)=1+a+b+c+d$
- $\det(B)\neq\det(M)$ but $\det(I+N)=1+a+b+c+d$
- $\det(B)=\det(M)$ and $\det(I+N)=1$
- $\det(B)\neq\det(M)$ but $\det(I+N)=1$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\det(B)=\det(M)$ *and* $\det(I+N)=1+a+b+c+d$

9) The NEGATIVE value of λ for which the system $\lambda x+3y=0,\ (\lambda+6)y=0$, in the unknowns x and y, has a non-trivial solution equals ....

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) -6.1,-5.9

1 point

10) Let $M \in \mathbb{M}_2(\mathbb{R})$ be an orthogonal matrix ($M^TM=MM^T=I_2\$$). Then, which among the following is TRUE? *1 point*

- If $\det(M)=1$ then $M=\begin{bmatrix}\cos\theta&\sin\theta\\-\sin\theta&\cos\theta\end{bmatrix}$, for some $\theta\in(-\pi,\ \pi]$, and M represents a reflection about a line passing through origin
- If $\det(M)=-1$ then $M=\begin{bmatrix}\cos\theta&\sin\theta\\\sin\theta&-\cos\theta\end{bmatrix}$, for some $\theta\in(-\pi,\ \pi]$ and M represents a counter-clockwise rotation through the angle θ
- If $\det(M)=1$ then $M=\begin{bmatrix}\cos\theta&\sin\theta\\-\sin\theta&\cos\theta\end{bmatrix}$, for some $\theta\in(-\pi,\ \pi]$, and M represents a counter-clockwise rotation through the angle $-\theta$
- Fix $n\geq 3$. Then, there exists orthogonal matrices $M\in\mathbb{M}_n(\mathbb{R})$ such that $\det(M)\neq\pm 1$

No, the answer is incorrect.
Score: 0
Accepted Answers:
If $\det(M)=1$ *then* $M=\begin{bmatrix}\cos\theta&\sin\theta\\-\sin\theta&\cos\theta\end{bmatrix}$, *for some* $\theta\in(-\pi,\ \pi]$, *and* M *represents a counter-clockwise rotation through the angle* $-\theta$