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Exam II: MTH 221, Spring 2016

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QUESTION 1. (($\sqrt{\pi}+1$)/3.14). Let D be a subset of R^2 that consists of all points on the x-axis and all points on the y-axis. Then

(a) D is a subspace of R^2 and $dim(D) = 1$. (b) D is a subspace of R^2 and $dim(D) = 2$. ~~(c)~~ D is not a subspace of R^2 because it is not closed under addition (d) D is not a subspace of R^2 because it is not closed under scalar-multiplication. (e) D is not a subspace of R^2 because of (c) and (d).

(($\sqrt{\pi}+2$)/3.24). Given D is a subspace of R^4 and $dim(D) = 3$. Then

(1) Every 3 nonzero points in D form a basis for D. (2) Every 3 independent points in R^4 form a basis for D. (3) Every 2 nonzero points in D are independent ~~(4)~~ Every 4 nonzero points in D are dependent.

(($\sqrt{\pi}+3$)/3.34). Given $D = \{f(x) \in P_3 \mid f'(1) = 0\}$ is a subspace of P_3. Then

(a) $\{x-1, x^2-1\}$ forms a basis for D. (b) $\{x^2-2x\}$ forms a basis for D. (c) $\{1, x-1, x^2-1\}$ forms a basis for D. ~~(d)~~ $\{1, x^2-2x\}$ forms a basis for D.

(($\sqrt{\pi}+4$)/3.44). One of the following is not a subspace of $R^{2\times 2}$.

(1) $\{\begin{bmatrix} a & a \\ 2b & b \end{bmatrix} \mid a, b \in R\}$. ~~(2)~~ $\{\begin{bmatrix} a & a \\ 1 & 3b \end{bmatrix} \mid a, b \in R\}$. (3) $\{\begin{bmatrix} a & a+b \\ c & 3b \end{bmatrix} \mid a, b, c \in R\}$. (4) $\{\begin{bmatrix} -2a & 6a+b \\ 0 & 3c \end{bmatrix} \mid a, b, c \in R\}$

(($\sqrt{\pi}+5$)/3.54). Given $D = \{f(x) \in P_3 \mid \int_0^1 f(x)\,dx = 0\}$ is a subspace of P_3. Then

~~(a)~~ $\{2x-1, 3x^2-1\}$ forms a basis for D. (b) $\{2x-1, 3x^2-2x, 6x^2-2x-1\}$ forms a basis for D. (c) $\{x-0.5, x^2-2x\}$ forms a basis for D (d) $\{x-1, x^2-x\}$ forms a basis for D.

(($\sqrt{\pi}+6$)/3.64). Given $D = span\{(1,1,1,0), (-1,1,0,0), (0,4,2,0)\}$. Then we know that D is a subspace of R^4. Hence $dim(D) =$

(1) 4 (2) 3 ~~(3)~~ 2 (4) 1

(($\sqrt{\pi}+7$)/3.74). Given $D = span\{(1,1,1,0), (-1,1,0,0), (0,4,2,0)\}$. Then we know that D is a subspace of R^4. One of the following points does not belong (live) in D.

(a) (0, 6, 3, 0) ~~(b)~~ (4, 0, 1, 0) (c) (2, 0, 1, 0) (d) (0, 0, 0, 0)

(($\sqrt{\pi}+8$)/3.84). Given $D = span\{(1,1,1,0), (-1,1,0,0), (0,4,2,0)\}$. Then we know that D is a subspace of R^3. One of the following points belongs (lives) in D.

~~(1)~~ (5, 1, 3, 0) (2) (2, 0, 2, 0) (3) (2, 0, -2, 0) (4) (0, 3, 1, 0)

(($\sqrt{\pi}+9$)/3.94). Given $D = \{((a+2b, 2a+4b, 2c) \mid a, b, c \in R\}$. Then we know that D is a subspace of R^4. One of the following is a basis for D

(a) $\{(1,2,0), (2,4,0), (0,0,2)\}$ ~~(b)~~ $\{(1,2,0), (0,0,1)\}$ (c) $\{(1,2,0), (0,0,1), (0,2,0)\}$ (d) $\{(1,2,0)\}$

(($\sqrt{\pi}+10$)/3.104). One of the following is a basis for R^3

(1) $\{(1,2,1), (-1,-2,0), (0,0,1)\}$ (2) $\{(1,2,0), (0,2,1), (-2,-2,1)\}$ ~~(3)~~ $\{(1,1,1), (-1,4,7), (-2,-2,9)\}$ (4) $\{(1,2,1), (2,4,0), (0,0,2)\}$

(($\sqrt{\pi}+11$)/3.114). Given $D = \{A \in R^{2\times 2} \mid A^T = -A\}$. Then one of the following is true :

~~(a)~~ D is a subspace of $R^{2\times 2}$. (b) D is not a subspace of $R^{2\times 2}$ because D is not closed under addition. (c) D is a not subspace of $R^{2\times 2}$ because D is not closed under scalar-multiplication. (d)D is a not subspace of $R^{2\times 2}$ because of (b) and (c)

($\sqrt{2}+1$). Given $D = \{A \in R^{3\times 3} \mid A$ is upper triangular $\}$ is a subspace of $R^{3\times 3}$. Then $dim(D) =$

(1) 1 ~~(2)~~ 6 (3) 2 (4) 3

($\sqrt{2}+2$). Given Let $A = \begin{bmatrix} 4 & 0 & a_1 \\ 8 & 8 & a_2 \\ 12 & 8 & a_3 \end{bmatrix}$ such that $|A| = 20$. Consider the system of linear equations $AX = \begin{bmatrix} 0 \\ 0 \\ 5 \end{bmatrix}$. Then the value of x_3 is

(a) 0 (b) 5 ~~(c)~~ 8 (d) 4 (e) More information is needed.

($\sqrt{2}+3$). Given Let $A = \begin{bmatrix} 4 & 0 & a_1 \\ 8 & 8 & a_2 \\ 12 & 8 & a_3 \end{bmatrix}$ such that $|A| = 20$. Consider the system of linear equations $AX = \begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix}$. Then the value of x_1 is

~~(1)~~ 0 (2) $\frac{1}{2}$ (3) 2 (4) $\frac{1}{4}$ (5) 4

($\sqrt{2}+4$). One of the following is a basis for P_3

~~(a)~~ $\{x^2, x^2+x, x^2+1\}$ (b) $\{1, x^2+x, 2x^2+2x+3\}$ (c) $\{1, x^2+1, x^2+5\}$ (d) $\{x^2+1, x+1, x^2+2x+3\}$.

($\sqrt{2}+5$). Given A is row-equivalent to $B = \begin{bmatrix} 1 & 0 & 0 & -1 \\ -1 & 0 & 1 & 1 \\ 0 & 0 & -1 & 0 \\ -2 & 0 & 0 & 2 \end{bmatrix}$. Then $N(A)$ is

(1) $span\{(1,1,0,-1)\}$ (2) $span\{(1,0,0,-1)\}$ ~~(3)~~ $span\{(1,0,0,1),(0,1,0,0))\}$ (4) $span\{(1,0,0,0),(0,1,0,0))\}$

($\sqrt{2}+6$). Let A be a 3×3 matrix such that $C_A(\alpha) = (\alpha-2)(\alpha-a)^2$ for some real number a. Given $trace(A) = 12$. Then $|A| =$

(a) 20 (b) 10 (c) 24 ~~(d)~~ 50 (e) 12

($\sqrt{2}+7$). Given A is a 3×3 such that $C_A(\alpha) = (\alpha-3)(\alpha-2)(\alpha-4)$. Then one of the following is true:

~~(1)~~ A is similar to $D = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ (2) $|A| = 9$ (3) $trace(A+I) = 10$ (4) $|A^T| = \frac{1}{24}$.

($\sqrt{2}+8$). Let A be a 3×3 matrix such that $C_A(\alpha) = (\alpha-2)(\alpha-1)^2$, $E_1 = span\{(1,1,0),(0,1,0)\}$ and $E_2 = span\{(-1,-1,3)\}$. Then we know that there is an invertible matrix Q such that $Q^{-1}AQ = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$. One possibility for Q is

(a) $Q = \begin{bmatrix} 1 & -1 & 2 \\ 1 & -1 & 2 \\ 0 & 3 & 0 \end{bmatrix}$ ~~(b)~~ $Q = \begin{bmatrix} 1 & -2 & 0 \\ 1 & -2 & 1 \\ 0 & 6 & 0 \end{bmatrix}$ (c) $Q = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 1 & -1 \\ 0 & 0 & 3 \end{bmatrix}$ (d) $Q = \begin{bmatrix} -1 & 1 & 0 \\ -1 & 1 & 1 \\ 3 & 0 & 0 \end{bmatrix}$

($\sqrt{2}+9$). Let A be a 3×3 matrix such that $C_A(\alpha) = \alpha(\alpha-2)(\alpha-1)$. Then $|A^2+I| =$

(1) 1 (2) 36 ~~(3)~~ 10 (4) 6

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