A

18221 **120 MINUTES**

1. Let *a, b, c* be distinct rational numbers such that $a + b + c = 0$. Then the equation $ax^2 + bx + c = 0$ has:
   A) Two non real complex roots B) Two irrational roots
   C) Two rational roots D) One rational root and one irrational root

2. Which of the following is not true of the graph of the function $y = 3^{-x}$
   A) The curve lies above the x-axis
   B) The curve does not pass thorough the origin
   C) The curve cuts one of the axis
   D) The value of y increases when x increases

3. The domain of the real valued function $y = \sqrt{(x-5)(3-x)}$ is:
   A) $[-3, 5]$ B) $[-5, -3]$ C) $[3, 5]$ D) $[-5, 3]$

4. The centroid of the triangle formed by the lines $x = 0, y = 0$ *and* $5x + 3y = 15$ is:
   A) $(1, \frac{5}{3})$ B) $(\frac{5}{3}, \frac{3}{5})$ C) $(\frac{3}{5}, \frac{5}{3})$ D) $(\frac{5}{3}, 1)$

5. The equation of the tangent to the parabola $y^2 - 2x - 6y + 5 = 0$ at the point $(-2, 3)$ is:
   A) $x + 2 = 0$ B) $x - 2 = 0$ C) $y + 3 = 0$ D) $y - 3 = 0$

6. The number of common tangents to the circles $x^2 + y^2 = 36$ *and* $x^2 - 6x + y^2 = 0$ is:
   A) 0 B) 1 C) 2 D) 4

7. If $\cos\alpha, \cos\beta, \cos\gamma$ are the direction cosines of a straight line then $sin^2\alpha + sin^2\beta + sin^2\gamma =$
   A) 1 B) 2 C) 3 D) $\frac{1}{2}$

8. The angle between the line joining $(3, 2, -2)$ and $(4, 1, -4)$ and the line joining $(4, -3, 3)$ and $(6, -2, 2)$ is:
   A) $\frac{\pi}{6}$ B) $\frac{\pi}{4}$ C) $\frac{\pi}{3}$ D) $\frac{\pi}{2}$

9. If the plane $2x + 3y - 5z = 0$ contains the straight line $\frac{x}{l} = \frac{y}{4} = \frac{z}{2}$ then the value of l is:
   A) 1 B) -1 C) 2 D) -2

10. The function of $f(x) = e^{x-1}$ has:

A) A local minimum at $x = 1$
B) A local maximum at $x = 1$
C) A local minimum at $x = 1$ and a local maximum at $x = 1$
D) Neither local maximum nor local minimum

11. $\int_0^1 x(1-x)^{\frac{1}{2}}\, dx =$

A) $\frac{3}{2}$ B) 7 C) $\frac{2}{3}$ D) $\frac{4}{15}$

12. The area bounded by the curve $y = |x+2|$, the *x*-axis and the straight lines $x = 3$, $x = -3$ *is*

A) 3 square units B) 5 square units
C) 13 square units D) 21 square units

13. A fair die is thrown twice. The sum of numbers appearing is observed to be 8. The conditional probability that 3 has appeared at least once is:

A) $\frac{2}{5}$ B) $\frac{3}{8}$ C) $\frac{5}{36}$ D) $\frac{11}{36}$

14. Let $a_n = n - n\sqrt{1-\frac{1}{n}}$. Then $\lim_{n\to\infty} a_n =$

A) 0 B) 1 C) $\frac{1}{2}$ D) $\frac{1}{4}$

15. The limit of the series $\sum_{n=0}^{\infty} \frac{1}{(2n)!}$

A) e B) $e + e^2$ C) $\frac{e+e^2}{2}$ D) $\frac{e^2+1}{2e}$

16. Let $f_n(x) = \begin{cases} 1, & if -\frac{1}{n} \le x \le \frac{1}{n} \\ 0, & otherwise. \end{cases}$

Then which of the following is true about the sequence (f_n)

A) $f_n(x)$ converges to 0 for all x
B) $f_n(x)$ converges to 1 for all x
C) $f_n(x)$ converges to 1 for all $x \in (0,1)$
D) $f_n(x)$ converges to 0 for all $x \in (0,1)$

17. For the surface $z = 2x^4 + 4xy + y^2$, the origin is

A) a saddle point B) a minimum point

C) a maximum point D) None of these types of points

18. Let $f(x) =$ the greatest integer $< x$ and

$$g(x) = \begin{cases} 0 \; if \; x \; is \; an \; integer \\ x - f(x) otherwise \end{cases}$$

Then which of the following is true about $f + g$.

A) Continuous at 0 and discontinuous at 1
B) Continuous at 1 and discontinuous at 0
C) Continuous at 0 and discontinuous at $\frac{1}{2}$
D) Continuous at $\frac{1}{2}$ and discontinuous at 0

19. Let f, g be functions defined on $[0, \pi]$ as follows:

$$f(x) = \begin{cases} \sin x \; if \; 0 \le x \le \pi/2 \\ 0, \; otherwise \end{cases}$$

$$g(x) = \begin{cases} \sin\left(\frac{1}{x}\right) \; if \; 0 < x \le \pi/2 \\ 0, \; otherwise \end{cases}$$

Then which of the following is true.
A) f is of bounded variation and g is not of bounded variation in $[0, \pi]$
B) g is of bounded variation and f is not of bounded variation in $[0, \pi]$
C) f and g are of bounded variation in $[0, \pi]$
D) f is not of bounded variation and g is not of bounded variation in $[0, \pi]$

20. Let $f(x) = x + 1 \; and \; \alpha(x) = \sin x$. Then $\int_0^{\pi/2} f(x) \, d\alpha(x) =$
A) 0 B) $\frac{\pi}{2}$ C) π D) 2π

21. Let $\{E_n : n \in N\}$ be a collection of Lebesgue measurable sets and let *m* denote Lebesgue measure. Then which of the following is not necessarily true
A) $m\,(\cap_{n \in N} E_n) = \lim_{n\to\infty} m\,(E_n) \; if \; E_{n+1} \subseteq E_n$ for all *n*

B) $m\,(\cap_{n \in N} E_n) = m\,(E_1) \; if \; E_n \subseteq E_{n+1}$ for all *n*

C) $m\,(\cup_{n \in N} E_n) = \lim_{n\to\infty} m\,(E_n) \; if \; E_n \subseteq E_{n+1}$ for all *n*

D) $m\,(\cup_{n \in N} E_n) = m\,(E_1) \; if \; E_{n+1} \subseteq E_n$ for all *n*

22. If $z = e^{1+2i}$ then $|z| =$
A) e B) e^5 C) $e^{\sqrt{5}}$ D) $\sqrt{5}$

23. Let u_1, u_2 ------u_n be the n^{th} roots of unity for $n \geq 3$. Then which of the following is not necessarily true.

A) At least one u_i is not real
B) At most two roots are real
C) At least two roots are real
D) If $u_1 \neq 1$ and if u_1 is real then $u_1 = -1$.

24. If the radius of convergence of the power series $\sum \alpha_n z^n$ is 2 then the radius of convergence of $\sum {\alpha_n}^2 z^n$ is

A) 1
B) 2
C) $\sqrt{2}$
D) 4

25. Which of the following function has a removable singularity at $z = 0$.

A) $f(z) = e^{1/z}$
B) $f(z) = \sin\left(\frac{1}{z}\right)$
C) $f(z) = \frac{\sin z}{z}$
D) $f(z) = \frac{\sin z}{z+1}$

26. Let γ be the circle $|z| = 2$. Then $\left(\frac{1}{2\pi i}\right) \int_\gamma \frac{e^z - 1}{z-1} dz =$

A) 0
B) e
C) $e + 1$
D) $e - 1$

27. The order of (1, 2) in the group $Z_6 \oplus Z_8$ is

A) 6
B) 8
C) 12
D) 16

28. Which of the following groups is isomorphic to $Z_{10} \oplus Z_{12}$

A) $Z_2 \oplus Z_{60}$
B) $Z_3 \oplus Z_{40}$
C) $Z_5 \oplus Z_{24}$
D) Z_{120}

29. Let G be a group of order 49. Then

A) G is Abelian
B) G is cyclic
C) G is non- Abelian
D) $Z(G)$ has order 7

30. Let S_3 be the symmetric group on three symbols. Then the order of the commutator subgroup of S_3 is

A) 1
B) 2
C) 3
D) 6

31. Let $\mathbb{Q}^*$ denote the multiplicative group of non zero rationals. Let H be the subgroup generated by $\frac{1}{2}$. Then which of the following pairs of cosets are equal.

A) $2\,H$ and $3\,H$
B) $\frac{1}{3}\,H$ and $\frac{2}{3}\,H$
C) $\frac{1}{4}\,H$ and $\frac{3}{4}\,H$
D) $\frac{1}{5}\,H$ and $\frac{1}{6}\,H$

32. Let $\mathbb{Q}^*$ denote the multiplicative group of non zero rationals. Let $f: \mathbb{Q}^* \to \mathbb{Q}^*$ be the homomorphism given by $f(x) = x^2$. Then the order of $\mathbb{Q}^*/\ker f$ is

A) 1 B) 2 C) 4 D) infinite

33. Let G be a group of order 40 and H, K be subgroups of order 5 and 20 respectively. Then which of the following is true?

A) H and K are normal subgroups of G
B) H is a normal subgroup of G and K is not normal in G
C) H is not normal in G and K is normal in G
D) H is not normal in G and K is also not normal in G

34. The number of elements in the group of units of the ring Z_{50} is:

A) 25 B) 20 C) 10 D) 5

35. The number of zeros of the polynomial$x^2 - 5x + 6$ in the ring Z_{10} is:

A) 2 B) 3 C) 4 D) 5

36. The characteristic of the ring Z_6 x Z_8 is:

A) 6 B) 8 C) 24 D) 48

37. Which of the following is a solution for x in the congruence relation $(127)^{12} \equiv x$ mod (12)?

A) 1 B) 2 C) 5 D) 7

38. Let A be the set of all polynomials given by $A = \{x^4 + ax^3 + bx^2 + cx + 2 : a, b, c \text{ are integers}\}$. Check the validityof the following statements about A

i. 1 is not a zero of any polynomial in A
ii. 2 is not a zero of any polynomial in A
iii. 3 is not a zero of any polynomial in A
iv. 4 is not a zero of any polynomial in A

A) i and ii only are true B) iii and iv only are true
C) ii and iii only are true D) i and iv only are true

39. Let Z_3 be the field of integers mod 3. Let a be a zero of $x^2 + x + 2$ and $Z_a(a)$ be the Splitting field of $x^2 + x + 2$ over Z_a. Then $a^4 =$

A) 1 B) 2 C) 1+a D) $1 + a^2$

40. The degree of the splitting field of $x^3 - 2$ over the rationals is:

A) 3 B) 4 C) 5 D) 6

41. Let A be a 5 x 5 nilpotent matrix. Which of the following is necessarily true of A?

A) A is invertible
B) 0 is the only eigen value of A
C) At least one row of A has all entries zero
D) All diagonal entries of A are zero

42. Let $A = (a_{ij}),\ B = (b_{ij}),\ C = (c_{ij})$ be 10 x 10 matrices with the following properties. $a_{11} = 1$ and det $A = 1, b_{11} = 0$ and $b_{ij} = a_{ij}$ for all other (i, j) and det $B = -1, c_{11} = 2$ and $c_{ij} = a_{ij}$ for all other (i, j). Then det $C =$

A) 0 B) 1 C) 2 D) 3

43. Which of the following matrix is row equivalent to the 3 x 3 identity matrix?

A) $\begin{bmatrix} 2 & 1 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ B) $\begin{bmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ C) $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \end{bmatrix}$ D) $\begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 1 \\ 3 & 3 & 2 \end{bmatrix}$

44. Let A be a 5 x 5 matrix of rank 4. Then the system of linear equations $AX = 0$ has

A) Exactly one non zero solution
B) Exactly 4 non zero solutions
C) No non zero solutions
D) Infinitely many non zero solutions

45. Let A be a 4 x 4 matrix such that $A^2 + A - I = 0$ where I is the identity matrix. Which of the following is not necessarily true?

A) A is invertible B) $A + I$ is invertible
C) $A^2 + I$ is invertible D) $A - I$ is invertible

46. Let $V = \mathbb{Z}_3^3$ be the 3–dimensional vector space over the field $\mathbb{Z}_3$. Then which of the following is a linearly independent set in V

A) { (1, 2, 0), (0, 1, 1), (1, 1, 0) }
B) { (1, 2, 0), (1, 1, 1), (2, 0, 1) }
C) { (1, 2, 0), (1, 0, 1), (0, 2, 2) }
D) { (1, 2, 0), (2, 1, 2), (2, 1, 1) }

47. Let W be the subspace of $\mathbb{R}^3$ spanned by { (1, 2, 1), (1, 3, 1) }. Then which of the following is in W.

A) (1, 5, 2) B) (2, 3, 2) C) (2, 5, 3) D) (3, 5, 7)

48. Let Wbe the subspace of $\mathbb{R}^3$ spanned by (0, 1, 1). Then which of the following pairs of vectors belong to the same element in the quotient space $\mathbb{R}^3/\ W$.

A) (1, 2, 1) and (1, 0, -1) B) (1, 1, 2) and (1, -1, 1)
C) (1, -1, 1) and (1, -2, 1) D) (1, 2, -1) and (1, 1, 0)

49. Let L be the line joining (1, 1) and (2, -1) in the plane $\mathbb{R}^2$. Then which of the following points lie on the line parallel to L and passing through the origin.

A) (1, 2) B) (2, 1) C) (-1, 1) D) (-1, 2)

50. Which of the following is a linear transformation from $\mathbb{R}^3 \to \mathbb{R}^3$.
A) $f\,(x,y,z) = (\,x+y,\ x-y,\ xy)$
B) $f\,(x,y,z) = (\,1+z,\ 1-x,\ y)$
C) $f\,(x,y,z) = (\,2x+y,\ 3x+z,\ 2z)$
D) $f\,(x,y,z) = (\,2x+3y,\ 2\,x-3y,\ 1)$

51. Let $f:\ \mathbb{R}^4 \to \mathbb{R}^4$ be defined by $f:(x,y,z,t) = (x-y, x-z, x-t, 0)$. Then dimension of null space of f is:
A) 0 B) 1 C) 2 D) 3

52. Let $T:\ \mathbb{R}^4 \to \mathbb{R}^3$ be a linear transformation which is represented by the

Matrix $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 2 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$. Then which of the following is true

A) T is one to one and onto B) T is one to one and not onto
C) T is onto but not one to one D) T is not one to one and not onto

53. Which of the following is the minimal polynomial of the matrix $\begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 2 & 1 & 0 \\ 0 & 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 0 & 2 \end{bmatrix}$

A) $(x-1)^2\,(x-2)^3$ B) $(x-1)^2\,(x-2)^2$

C) $(x-1)\ (x-2)^3$ D) $(x-1)\ (x-2)$

54. For which of the following values of a and b the matrix $\begin{bmatrix} a & b & 0 \\ 0 & a & 0 \\ 0 & 0 & b \end{bmatrix}$ is diagonalizable.

A) $a=0,\ b=1$ B) $a=1,\ b=1$
C) $a=1,\ b=-1$ D) $a=0,\ b=0$

55. The GCD of the numbers 2^7 x 3^5 x 5^6 x 13^3 and 2^5 x 3^7 x 5^3 x 13^6 is
A) 390 B) 6^4 x 65^3 C) 6^5 x 65^3 D) 6^7 x 65^6

56. Let $\emptyset$ denote the Euler totient function. Then $\emptyset$ (1024) =
A) 1023 B) 512 C) 256 D) 64

57. Which of the following is true?
A) $2^{12} \equiv 1\ (mod\ 21)$ B) $2^{12} \equiv -1\ (mod\ 21)$
C) $2^{10} \equiv -1\ (mod\ 21)$ D) $2^{10} \equiv 1\ (mod\ 21)$

58. The system of equations $2x \equiv 3\ (mod\ 5)$ and $3x \equiv 4\ (mod\ 7)$ has
A) No solution
B) Exactly one solution $(mod\ 35)$
C) Exactly two solutions $(mod\ 35)$
D) Exactly six solutions $(mod\ 35)$

59. Which of the following is the differential equation of the family of curves $y^2 = 4c(x+c)$
A) $y = 2x\frac{dy}{dx} + y\left(\frac{dy}{dx}\right)^2$ B) $y = 2x\frac{dy}{dx} - y\left(\frac{dy}{dx}\right)^2$

C) $y = 2x\frac{dy}{dx} + y^2\left(\frac{dy}{dx}\right)^2$ D) $y = 2x\frac{dy}{dx} - y^2\left(\frac{dy}{dx}\right)^2$

60. The solution of the differential equation:
$\cos(x-y)\,dx = x\sin(x-y)dy - x\sin(x-y)dx$ is
A) $x\sin(x-y) + \cos(x-y) = c$
B) $x\sin(x-y) - \cos(x-y) = c$
C) $x\sin(x-y) = c$
D) $x\cos(x-y) = c$

61. The Wronskian of the solutions of the equation $y'' - y = 0$ is
A) $2e^{2x}$ B) $2e^{-2x}$ C) -2 D) 2

62. The Bessel function $J_{-2}(x) =$
A) $-J_2(x)$ B) $-2J_0(x)$ C) $J_2(-x)$ D) $J_2(x)$

63. The number of regular singular points of the function:
$(x^3 + x^2 - 6x)\frac{d^2y}{dx^2} + x^2\frac{dy}{dx} + (x-2)y = 0$ is

A) 0 B) 1 C) 2 D) 3

64. The integral of the equation $y\,dx - z\,dx + dy - dx = 0$ is
A) $y - z = ce^x$ B) $y - z = ce^{-x}$

C) $y + z = ce^x$ D) $y + z = ce^{-x}$

65. If $sin^2x\,u_{xz} + A\,u_{xy} + cos^2x u_{yy} = u_z$ is parabolic then the value of A is
A) $\sin 2x$ B) $\cos 2x$ C) $2\sin x$ D) $2\cos x$

66. The complete integral of the equation:
$pqz = p^2(xq-p) + q^2(yp-q)$ is

A) $z = ax + by + \frac{1}{ab}(a^3+b^3)$ B) $z = ax + by - \frac{1}{ab}(a^3+b^3)$

C) $z = ax + by - \frac{a+b}{ab}$ D) $z = ax + by + \frac{a+b}{ab}$

67. Which of the following is not a metric on $\mathbb{R}^2$. Here $x = (x_1, x_2)$ and y= (y_1, y_2).

A) $d(x,y) = |x_1 - y_1| + |x_2 - y_2|$

B) $d(x,y) = (x_1 - y_1)^2 + (x_2 - y_2)^2$

C) $d(x,y) = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2}$

D) $d(x,y) = \max\{ |x_1 - y_1|, |x_2 - y_2| \}$

68. Let $X = \{1, 2, 3, 4, 5\}$ and τ_1, τ_2, τ_3 be topologies on X given as follows.
$\tau_1 = \{X, \emptyset, \{1,2\}\}$, $\tau_2 = \{X, \emptyset, \{1\}, \{1,2\}\}$ and τ_3 is the discrete topology.
Then which of the following is true

A) τ_1 and τ_2 are metrizable
B) τ_2 and τ_3 are metrizable
C) τ_1 is metrizable and τ_2 is not metrizable
D) τ_2 is not metrizable and τ_3 is metrizable

69. Let $\mathbb{R}$ be the space of all reals with discrete topology. Let $\mathbb{R}^+$ be the subspace of all positive reals and $\mathbb{Q}^+$ be the subspace of all positive rationals. Then which of the following is true
A) The closure of $\mathbb{Q}^+$ in $\mathbb{R}$ is $\mathbb{R}^+$
B) The closure of $\mathbb{R}^+$ in $\mathbb{R}$ is $\mathbb{R}^+ \cup \{0\}$
C) The interior of $\mathbb{Q}^+$ in $\mathbb{R}$ is $\mathbb{Q}^+$
D) The interior of $\mathbb{R}^+$ in $\mathbb{R}$ is $\mathbb{Q}^+$

70. Let X be the space of all continuous real valued functions on [0, 1] with metric given by $d(f,g) = sup\ |f(x) - g(x)|$. Let

$$\alpha(x) = \begin{cases} x^2 : 0 \le x \le 1/2 \\ \frac{1}{4} : 1/2 \le x \le 1 \end{cases} \quad \text{and} \quad \beta(x) = \begin{cases} \frac{1}{4} : 0 \le x \le 1/2 \\ x^2 : 1/2 \le x \le 1 \end{cases}$$

Then $d(\alpha, \beta) =$

A) 0 B) 1 C) ¼ D) ¾

71. Let τ be the topology on the reals R for which $\{(-\infty, a) : a > 0\}$ is a base. Let $(a_n), (b_n)$ be sequences where $a_n = (-1)^n$ and $b_n = (-1)^n + 1$. Then which of the following is true in (X, τ).
A) (a_n) converges to 1 and (b_n) converges to 2
B) (a_n) converges to -1 and (b_n) converges to 2
C) (a_n) converges to 1 and (b_n) converges to 0
D) (a_n) converges to -1 and (b_n) converges to 0

72. Let $\mathbb{R}$ be the real line and $\mathbb{Q}$ be the subspace of rationals. Then which of the following is true about a continuous function $f : \mathbb{R} \to \mathbb{Q}$

A) f can be both one to one and onto

B) f can be one to one and not onto

C) f can be onto but not one to one

D) f can not be one to one and can not be onto

73. Let X be the real line with usual topology and $Y = \mathbb{R}$ with discrete topology. Which of the following $f : X \times Y \to X \times Y$ is continuous?

A) $f(x,y) = (x+y, x+y)$

B) $f(x,y) = (x+y, y)$

C) $f(x,y) = (x+1, x)$

D) $f(x,y) = (x,\ x+1)$

74. Let $e = (1,1,1,...)$ and $f = (1, \frac{1}{2}, \frac{1}{3}, ...)$ be sequences. With the usual notations which of the following is true.

A) $e \in l^1$ and $f \in l^1$

B) $e \in l^1$ and $f \in l^\infty$

C) $e \in l^\infty$ and $f \in l^2$

D) $e \in l^\infty$ and $f \in l^1$

75. Let X be the normal linear space $\mathbb{R}^3$ with norm $\| \ \|_2$ and Y = { (0, y, z) : y, z ∈ R}. Let $F : X/Y \to X$ be defined by $F((x,y,z) + Y) = (x,0,0)$. Then $\| F \| =$

A) 0

B) 1

C) 2

D) ½

76. Let $X = C^3$ be the normed linear space with norm $\| \ \|_2$. Let $F : X \to X$ be defined by $F(x,y,z) = (x, x+y, x+y+z)$. Then which of the following is not true.

A) F is closed and continuous but not open

B) F is closed and open but not continuous

C) F is closed, continuous and open

D) F is closed but not continuous and not open

77. Let X be the Hilbert space R^2. Then the set orthogonal to the point (1, 1) in R^2 is:

A) The set of points on the straight lines $x = 0$ and y= 0.

B) The set of points on the straight lines $x +$ y = 0.

C) The set of points on the straight lines $x -$ y = 0.

D) The set of points on the straight lines $x -$ y = 1.

78. Let H be the Hilbert space and $x, y \in H$ be such that $\| x \| = 7$ and $\| y \| = 1$ and $\| x + y \| = 8$. Then $\| x - y \| =$

A) 6

B) 5

C) 4

D) $\sqrt{2}$

79. Let $H = l^2$ be the complex Hilbert space and f be the linear functional defined by $f(x(1), x(2), \dots)) = ix(1) - x(2)$. Let $e_n = (0, 0, \dots, 0, 1, 0, \dots)$ where 1 occurs in the n^th^ position. Then which of the following is true.

A) $\sum_{n=1}^{\infty} |f(e_n)|^2 \leq \sqrt{2}$ B) $\sum_{n=1}^{\infty} |f(e_n)|^2 \leq 2$

C) $\sum_{n=1}^{\infty} |f(e_n)|^2 \leq 1$ D) $\sum_{n=1}^{\infty} |f(e_n)|^2 \leq \frac{1}{2}$

80. Let H be the complex Hilbert space C^3 and the operator T on H be represented by the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & i & 0 \\ 0 & 0 & -1 \end{bmatrix}$. Then which of the following is true.

A) T is self adjoint and unitary
B) T is not self adjoint and not unitary
C) T is self adjoint but not unitary
D) T is unitary but not self adjoint