Instructions

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Q1. The principal value of $\tan^{-1}\left(\tan\frac{3\pi}{5}\right)$ is:

A $\frac{2\pi}{5}$ B $\frac{-2\pi}{5}$ C $\frac{3\pi}{5}$ D $\frac{-3\pi}{5}$

Q2. If A is a square matrix of order 3 and |A| = 5, then the value of |2A'| is:

A -10 B 10 C -40 D 40

Q3. Which of the following statements is true for the function $f(x) = \begin{cases} x+3, & x \neq 0 \\ 1, & x = 0 \end{cases}$?

A f(x) is continuous and differentiable $\forall\ x \in \mathbb{R}$
B f(x) is continuous $\forall\ x \in \mathbb{R}$
C f(x) is continuous and differentiable $\forall\ x \in \mathbb{R} - (0)$
D f(x) is discontinuous at infinitely many points

Q4. The value of k for which $f(x) = \begin{cases} 3x+5, & x \geq 2 \\ kx^2, & x < 2 \end{cases}$ is a continuous function, is:

A $-\frac{11}{4}$ B $\frac{4}{11}$ C 11 D $\frac{11}{4}$

Q5. If A is a square matrix such that $A^2 = A$, then $(I - A)^3 + A$ is equal to:

A I B 0 C I - A D I + A

Q6. $\tan\left(\sin^{-1}\frac{3}{5} + \tan^{-1}\frac{3}{4}\right)$ is equal to:

A $\frac{7}{24}$ B $\frac{24}{7}$ C $\frac{3}{2}$ D $\frac{3}{4}$

Q7. If $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ nd (31 + 4A) (3I + 4A) = x^2I, then the value(s) x is/ are:

A $\pm\sqrt{7}$ B 0 C ± 5 D 25

Q8. A function $f : R_+ \to R$ (where R_+ is the set of all non-negative real numbers) defined by f(x) = 4x + 3 is:

A one-one but not onto
B onto but not one-one
C both one-one and onto
D neither one-one nor onto

Q9. If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$, then det (adj A) equals: **1 Mark**

A a^{27} B a^9 C a^6 D a^2

Q10. If A is a 3 × 3 matrix and |A| = -2, then value of |A (adj A)| is: **1 Mark**

A -2 B 2 C -8 D 8

Q11. The domain of the function $f(x) = \sin^{-1}(2x)$ is **1 Mark**

A $[0, 1]$
B $[-1, 1]$
C $\left[-\frac{1}{2}, \frac{1}{2}\right]$
D $[-2, 2]$

Q12. The function $f(x) = \frac{x-1}{x(x^2-1)}$ is discontinuous at **1 Mark**

A Exactly one point. **B** Exactly two points. **C** Exactly three points. **D** No point.

Q13. Let A = {1, 3, 5}. Then the number of equivalence relations in A containing (1, 3) is: **1 Mark**

A 1 **B** 2 **C** 3 **D** 4

Q14. If $x = 2\,at, y = at^2$, where a is a constant, then $\frac{d^2y}{dx^2}$ at $x = \frac{1}{2}$ is: **1 Mark**

A $\frac{1}{2}a$ **B** 1 **C** 2a **D** None of these

Q15. $f(x) = \begin{cases} \frac{\sqrt{1+px}-\sqrt{1-px}}{x}, & \text{if } 0 \le x < 0 \\ \frac{2x+1}{x-2}, & \text{if } 0 \le x \le 1 \end{cases}$ is continuous in the interval [-1, 1], then p is equal to: **1 Mark**

A -1 **B** $-\frac{1}{2}$ **C** $\frac{1}{2}$ **D** 1

Q16. If A and B are non - zero square matrices of the same order such that AB = 0, then

A adj A = 0 or adj B = 0 **B** adj A = 0 and adj B = 0
C |A| = 0 or |B| = 0 **D** None of these

Q17. $\cos^{-1}\frac{1}{2} + 2\sin^{-1}\frac{1}{2}$ is equal to:

A $\frac{\pi}{4}$ **B** $\frac{\pi}{6}$ **C** $\frac{\pi}{3}$ **D** $\frac{2\pi}{3}$

Q18. If A and B are symmetric matrices of the same order, then:

A AB is a symmetric matrix. **B** A - Bis askew-symmetric matrix.
C AB + BA is a symmetric matrix. **D** AB - BA is a symmetric matrix.

Q19. If A is a matrix of order m × n and B is a matrix such that AB^T and B^TA are both defined, then the order of matrix B is:

A m × m **B** n × n **C** n × m **D** m × n

Q20. The value of $\cos\left(\sin^{-1}\left(\frac{2}{3}\right)\right)$ is equal to :

A $\frac{\sqrt{4}}{8}$ **B** $\frac{\sqrt{4}}{3}$ **C** $\frac{\sqrt{5}}{4}$ **D** $\frac{\sqrt{5}}{3}$

Q21. If $A = \begin{bmatrix} -3 & 2 \\ 1 & -1 \end{bmatrix}$ and $I = \begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$, Find scalar k so that $A^2 + I = kA$.

Q22. Find the value of $= \frac{dy}{dx}$ at $\theta = \frac{\pi}{3}$, if $x = \cos\theta - \cos 2\theta,\ y = \sin\theta - \sin 2\theta$.

Q23. Find $(AB)^{-1}$ if $A = \begin{bmatrix} 1 & 0 \\ -4 & 2 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$.

Q24. Differentiate $\tan^{-1}\left(\frac{1+\cos x}{\sin x}\right)$ with respect to x.

Q25. Express $A = \begin{bmatrix} 4 & -3 \\ 2 & -1 \end{bmatrix}$ as a sum of a symmetric and a skew symmetric matrix. **2 Marks**

Q26. Check if the relation R on the set A = {1, 2, 3, 4, 5, 6} defined as R = {(x, y) : y is divisible by x} is (i) symmetric (ii) transitive. **2 Marks**

Q27. If $y = \sqrt{\tan\sqrt{x}}$, prove that $\sqrt{x}\frac{dy}{dx} = \frac{1+y^4}{4y}$.

Q28. If $y = \sqrt{\cos x + y}$, prove that $\frac{dy}{dx} = \frac{\sin x}{1-2y}$.

Q29. Evaluate:
$\sin^{-1}\left(\sin\frac{3\pi}{4}\right) + \cos^{-1}\left(\cos\frac{3\pi}{4}\right) + \tan^{-1}(1)$

Q30. Show that the relation R in the set R of real numbers, defined as R = {(a, b) : $a \le b^2$} is neither reflexive nor symmetric nor transitive. **2 Marks**

Q31. Find the matrix A such that **3 Marks**

$$[2 \quad 1 \quad 3]\begin{bmatrix} -1 & 0 & -1 \\ -1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix}\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix} = A$$

Q32. Find $\frac{dy}{dx}$ in the following: **3 Marks**

$x^3 + x^2y + xy^2 + y^3 = 81$

Q33. $\text{If } y = Ae^{mx} + Be^{nx}, \text{ show that } \frac{d^2y}{dx^2} - (m+n)\frac{dy}{dx} + mny = 0$ **3 Marks**

Q34. $\text{If } y = \sqrt{\cos x + \sqrt{\cos x + \sqrt{\cos x + \ldots \text{to } \infty}}}$, prove that $\frac{dy}{dx} = \frac{\sin x}{1-2y}$

Q35. Evaluate the following:

$\tan^{-1}\left(\tan\frac{5\pi}{6}\right) + \cos^{-1}\left\{\cos\left(\frac{13\pi}{6}\right)\right\}$

Q36. $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$, then verify that A'A = I

Q37. Three relation R_2 is defined in set A = {a, b, c} as follows:
R_2 = {(a, a)}
Find whether or not the relation R_2 on A is:
1. Reflexive.
2. Symmetric.
3. Transitive.

Q38. Differentiate w.r.t. x the function in Exercise:

$(5x)^{3\cos 2x}$

Q39. Let A = {1, 2, 3}, and let R_3 = {(1, 3), (3, 3)}. Find whether or not the relations R_3 on A is:
1. Reflexive.
2. Symmetric.
3. Transitive.

Q40. For what value of k is the function

$f(x) = \begin{cases} \frac{\sin 5x}{3x}, & \text{if } x \neq 0 \\ k, & \text{if } x = 0 \end{cases}$ is continuous at x = 0?

Q41. $\text{If } A = \begin{bmatrix} 1 & -2 & 0 \\ 2 & -1 & -1 \\ 0 & -2 & 1 \end{bmatrix}$ find A^{-1} and use it to solve the following system of equations:

x - 2y = 10, 2x - y – z = 8, - 2y + z = 7

Q42. $\text{If } A = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$, find $(AB)^{-1}$. **5 Marks**

Q43. If $x^{16}y^9 = (x+y)^{17}$, prove that $x\frac{dy}{dx} = 2y$ **5 Marks**

Q44. If $(\sin x)^y = (\cos y)^x$, Prove that $\frac{dy}{dx} = \frac{\log\cos y - y\cot x}{\log\sin x + x\tan y}$ **5 Marks**

Q45. **5 Marks**

If $y = x\sin(a+y)$, prove that $\frac{dx}{dx} = \frac{\sin^2(a+y)}{\sin(a+y) - y\cos(a+y)}$

Q46. If $y\sqrt{1-x^2} + x\sqrt{1-y^2} = 1$, prove that $\frac{dy}{dx} = -\sqrt{\frac{1-y^2}{1-x^2}}$ **5 Marks**

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