PRACTICE PAPER

9

MATHEMATICS

Time allowed: 45 minutes **Maximum Marks: 200**

General Instructions: *As given in Practice Paper – 1.*

Section–A

Choose the correct option:

1. **If A is any square matrix, then**
   (*a*) $A + A'$ is skew symmetric matrix (*b*) $A - A'$ is symmetric
   (*c*) AA' is symmetric (*d*) AA' is skew symmetric

2. **The value of determinant** $\begin{vmatrix} 0 & xy^2 & xz^2 \\ x^2y & 0 & yz^2 \\ x^2z & zy^2 & 0 \end{vmatrix}$ **is**
   (*a*) $2xyz$ (*b*) $2x^3y^3z^3$ (*c*) 0 (*d*) $4xyz$

3. **If** $B\begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 6 & 0 \\ 0 & 6 \end{bmatrix}$ **is a equal matrix then what is matrix B ?**
   (*a*) $\begin{bmatrix} 4 & 2 \\ 1 & 1 \end{bmatrix}$ (*b*) $\begin{bmatrix} 4 & 2 \\ -1 & 1 \end{bmatrix}$ (*c*) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (*d*) I

4. **If** $f(x) = (x-2)^2$ **then** $f''(0)$ **is equal to**
   (*a*) 0 (*b*) 1 (*c*) -2 (*d*) 2

5. **A point on the ellipse** $4x^2 + 9y^2 = 36$ **where the tangent is equally inclined to the axis is**
   (*a*) $\left(\frac{9}{\sqrt{13}}, \frac{4}{\sqrt{13}}\right)$ (*b*) $\left(-\frac{9}{\sqrt{13}}, \frac{4}{\sqrt{13}}\right)$ (*c*) $\left(\frac{9}{\sqrt{13}}, -\frac{4}{\sqrt{13}}\right)$ (*d*) All of these

6. $\int \frac{dx}{x\sqrt{x^4-1}}$ **is equal to**
   (*a*) $\frac{1}{2}\sec^{-1}(x^2) + C$ (*b*) $\sec^{-1}(x^2) + C$ (*c*) $\sec^{-1}x + C$ (*d*) $\tan^{-1}(x^2) + C$

7. **The integral** $\int \frac{x^9\,dx}{(4x^2+1)^6}$ **is equal to**

(a) $\frac{1}{5x}\left(4+\frac{1}{x^2}\right)^{-5}+C$ (b) $\frac{1}{5}\left(4+\frac{1}{x^2}\right)^{-5}+C$ (c) $\frac{1}{10x}(5)^{-5}+C$ (d) $\frac{1}{10}\left(\frac{1}{x^2}+4\right)^{-5}+C$

8. $\int \frac{x^2-1}{x^3\sqrt{2x^4-2x^2+1}}dx$ is equal to

(a) $\frac{\sqrt{2x^4-2x^2+1}}{x^2}+C$ (b) $\frac{\sqrt{2x^4-2x^2+1}}{x^3}+C$ (c) $\frac{\sqrt{2x^4-2x^2+1}}{x}+C$ (d) $\frac{\sqrt{2x^4-2x^2+1}}{2x^2}+C$

9. The value of $\int_0^{\pi/2}\log\left(\frac{4+3\sin x}{4+3\cos x}\right)dx$ is

(a) 2 (b) $\frac{3}{4}$ (c) 0 (d) -2

10. The area of the region bounded by the curves $x = at^2$ and $y = 2at$ between the ordinate corresponding to $t = 1$ and $t = 2$ is

(a) $\frac{56}{3}a^2$ sq. units (b) $\frac{40}{3}a^2$ sq. units (c) 5π sq. units (d) None of these

11. Which of the following is not a homogeneous function of x and y?

(a) x^2+2xy (b) $2x-y$ (c) $\cos^2\left(\frac{y}{x}\right)+\frac{y}{x}$ (d) $\sin x-\cos y$

12. Solution of the differential equation $\frac{dx}{x}+\frac{dy}{y}=0$ is

(a) $\frac{1}{x}+\frac{1}{y}=C$ (b) $\log x.\log y=C$ (c) $xy=C$ (d) $x+y=C$

13. A point out of following points lie in plane represented by $2x+3y\leqslant 12$ is

(a) (0, 3) (b) (3, 3) (c) (4, 3) (d) (0, 5)

14. The probability distribution of a discrete random variable X is given below:

X	1	2	4	$2A$	$3A$	$5A$
$P(X)$	$\frac{1}{2}$	$\frac{1}{5}$	$\frac{3}{25}$	$\frac{1}{10}$	$\frac{1}{25}$	$\frac{1}{25}$

If $E[X] = 2.94$ then the value of A is

(a) 3 (b) 4 (c) 5 (d) 6

15. In a box containing 100 bulbs, 10 are defective. The probability that out of a sample of 5 bulbs, none is defective is

(a) 10^{-1} (b) $\left(\frac{1}{2}\right)^5$ (c) $\left(\frac{9}{10}\right)^5$ (d) $\left(\frac{9}{10}\right)$

Section–B (B1)

16. Let R be the relation in the set {1, 2, 3, 4} given by

$R = \{(1, 2), (2, 2), (1, 1), (4, 4), (1, 3), (3, 3), (3, 2)\}$ then

R is

(a) reflexive and symmetric but not transitive. (b) reflexive and transitive but not symmetric.

(c) symmetric and transitive but not reflexive. (d) equivalence relation.

17. Let R be the relation in the set N given by $R = \{(a, b) : a = b - 2, b > 6\}$. Choose the correct answer.

(a) $(2, 4) \in R$ (b) $(3, 8) \in R$ (c) $(6, 8) \in R$ (d) $(8, 7) \in R$

18. The domain of the function $f : R \to R$ defined by $f(x) = \sqrt{x^2-4}$ is

(a) $[-2, 2]$ (b) $(-2, 2)$ (c) $(-\infty, -2] \cup [2, \infty)$ (d) $(-\infty, \infty)$

19. Let * be a binary operation on Z as $a * b = a - b$ then $2 * 3$ is equal to

(a) 1 (b) -1 (c) 2 (d) 3

20. If $f : N \to R$ be the function defined by $f(x) = \frac{2x-1}{2}$ and $g : Q \to R$ be another function defined by $g(x) = x + 2$ then $gof\left(\frac{5}{2}\right)$ is equal to

(a) 2 (b) 1 (c) $\frac{5}{2}$ (d) none of these

21. $\tan^{-1}\frac{3}{4} + \tan^{-1}\frac{3}{5} - \tan^{-1}\frac{8}{19}$ is equal to

(a) $\frac{\pi}{4}$ (b) $\frac{-\pi}{4}$ (c) $\frac{3\pi}{4}$ (d) $\frac{\pi}{2}$

22. Find the value of $\tan\left[2\tan^{-1}\frac{1}{2} - \cot^{-1}3\right]$

(a) $\frac{9}{13}$ (b) $\frac{4}{9}$ (c) $\frac{-9}{13}$ (d) 0

23. $\cot\left(\frac{\pi}{4} - 2\cot^{-1}3\right)$ is equal to

(a) 7 (b) -7 (c) 5 (d) 0

24. What is the value of $\tan\left[\frac{1}{2}\cos^{-1}\left(\frac{3}{5}\right)\right] + \tan\left[\frac{1}{2}\cos^{-1}\left(\frac{4}{5}\right)\right]$?

(a) $\frac{5}{6}$ (b) $\frac{-5}{6}$ (c) $\frac{1}{2}$ (d) 0

25. If $A = \begin{bmatrix} 1 & -3 & 2 \\ 2 & 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -1 & -1 \\ 1 & 0 & -1 \end{bmatrix}$. The matrix '$C$' such that $A + B + C$ is null matrix, is

(a) $\begin{bmatrix} -3 & 4 & -1 \\ -3 & 0 & -1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 2 & 3 \\ -1 & -2 & 3 \end{bmatrix}$ (c) $\begin{bmatrix} -1 & -2 & 3 \\ 1 & 2 & -3 \end{bmatrix}$ (d) None of these

26. If A and B are square matrices of the same order, then the value of $(A + B)(A - B)$ is equal to

(a) $A^2 - B^2$ (b) $A^2 + BA + AB - B^2$

(c) $A^2 - B^2 + BA - AB$ (d) $A^2 - BA + B^2 + AB$

27. The value of the determinant $\begin{vmatrix} \log_3 512 & \log_4 3 \\ \log_3 8 & \log_4 9 \end{vmatrix}$ is

(a) 15 (b) $\frac{15}{2}$ (c) 10 (d) 0

28. If $A = \begin{bmatrix} 3 & 1 \\ 2 & -3 \end{bmatrix}$, then $|adj\, A|$ is

(a) $\frac{-1}{19}A$ (b) $\frac{1}{19}A$ (c) A (d) -11

29. The function $f(x) = |x| + |x - 2|$ is

(a) differentiable at $x = 0$ and at $x = 2$ (b) differentiable at $x = 0$ but not at $x = 2$.

(c) not differentiable at $x = 0$ and at $x = 2$. (d) none of these

30. The value of c in Rolle's Theorem for the function $f(x) = x^2 + 2x - 8$, $\forall\, x \in [-2, 3]$ is

(a) -2 (b) -1 (c) 3 (d) none of these

31. **The derivative of $\tan x$ w.r.t. $\sin x$ is**

(*a*) $\tan^2 x$ (*b*) $\sec x$ (*c*) $\frac{\tan x}{\sin x}$ (*d*) $\sec^3 x$

32. **The function $f(x) = \frac{x^2 - x - 6}{x - 3}$ is not defined for $x = 3$. In order to make $f(x)$ continuous at $x = 3$, $f(3)$ should be defined as**

(*a*) 1 (*b*) 3 (*c*) 5 (*d*) none of these

33. **If $xy = a^2$ and $S = b^2x + c^2y$ where a, b and c are positive constants then the minimum value of S is**

(*a*) abc (*b*) $bc\sqrt{a}$ (*c*) $2abc$ (*d*) none of these

34. $\int \frac{dx}{e^x + e^{-x}}$ **is equal to**

(*a*) $\tan^{-1}(e^x) + C$ (*b*) $\tan^{-1}(e^{-x}) + C$ (*c*) $\log(e^x - e^{-x}) + C$ (*d*) $\log(e^x + e^{-x}) + C$

35. $\int \frac{\cos 2x\, dx}{(\sin x + \cos x)^2}$ **is equal to**

(*a*) $\frac{-1}{\sin x + \cos x} + C$ (*b*) $\log|\sin x + \cos x| + C$

(*c*) $\log|\sin x - \cos x| + C$ (*d*) $\frac{1}{(\sin x + \cos x)^2} + C$

36. **If $x = \int_0^y \frac{dt}{\sqrt{1 + 9t^2}}$ and $\frac{d^2y}{dx^2} = ay$, then a is equal to**

(*a*) 3 (*b*) 6 (*c*) 9 (*d*) 1

37. **The area of the region above x-axis, included between the parabola $y^2 = ax$ and the circle $x^2 + y^2 = 2ax$ is**

(*a*) $\left(\frac{\pi}{4} - \frac{2}{3}\right)$ sq. units (*b*) $a^2\left(\frac{\pi}{4} - \frac{2}{3}\right)$ sq. units (*c*) $\frac{2}{3}\pi$ sq. units (*d*) $a^2\left(\frac{\pi}{4} + \frac{2}{3}\right)$ sq. units

38. **Given that $\frac{dy}{dx} = ye^x$ such that at $x = 0$, $y = e$. The value of $y (y > 0)$ when $x = 1$ will be**

(*a*) e^e (*b*) $\log C$ (*c*) 1 (*d*) 0

39. ***Read the following statements.***

Statement I : The differential equation $\frac{dy}{dx} + \frac{2x}{(1+x)^2}y = \frac{1}{(1+x^2)^2}$ is linear differential equation.

Statement II : The differential equation $\frac{dx}{dy} + Px = Q$, where P and Q are functions of y, is a linear differential equation.

Choose the correct option:

(*a*) Statement I is correct but statement II is not correct.

(*b*) Statement II is correct but statement I is not correct.

(*c*) Both statements I and II are correct.

(*d*) None of these

40. *Read the following statements.*

Statement I : The unit vector perpendicular to both $\hat{i}-\hat{j}$ and $\hat{i}+\hat{j}$ forming right handed system is $\hat{k}$.

Statement II : $\hat{a}=\dfrac{\vec{a}}{|\vec{a}|}$ is a unit vector.

Choose the correct option:

(*a*) Statement I is correct but statement II is not correct.

(*b*) Statement II is correct but statement I is not correct.

(*c*) Both statements I and II are correct.

(*d*) None of these

41. **If the sum of two unit vectors is also a unit vector then the angle between the two vectors is**

(*a*) $\frac{\pi}{3}$ (*b*) $\frac{\pi}{2}$ (*c*) $\frac{\pi}{4}$ (*d*) $\frac{2\pi}{3}$

42. **If** $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^3 \end{vmatrix}=0$ **and the vectors** $A(1, a, a^2)$, $B(1, b, b^2)$, $C(1, c, c^2)$ **are non-coplanar then the value of** abc **is**

(*a*) –2 (*b*) 0 (*c*) 1 (*d*) –1

43. **If** $\vec{a},\vec{b},\vec{c}$ **are three non-coplanar vectors and** $\vec{p},\vec{q},\vec{r}$ **are vectors defined by the relationship** $\vec{p}=\dfrac{\vec{b}\times\vec{c}}{[\vec{a}\,\vec{b}\,\vec{c}]}$, $\vec{q}=\dfrac{\vec{c}\times\vec{a}}{[\vec{a}\,\vec{b}\,\vec{c}]}$, $\vec{r}=\dfrac{\vec{a}\times\vec{b}}{[\vec{a}\,\vec{b}\,\vec{c}]}$, **then the value of** $\vec{p}\cdot(\vec{a}+\vec{b})+\vec{q}\cdot(\vec{b}+\vec{c})+\vec{r}\cdot(\vec{c}+\vec{a})$ **is**

(*a*) 0 (*b*) 3 (*c*) 1 (*d*) 2

44. **The image of the point (1, 6, 3) in the line** $\dfrac{x}{1}=\dfrac{y-1}{2}=\dfrac{z-2}{2}$ **is**

(*a*) (2, 0, 5) (*b*) (1, 3, 4) (*c*) (1, 0, 7) (*d*) (– 3, – 2, 0)

45. **The distance of the point (–1, –5, –10) from the point of intersection of the line** $\vec{r}=2\hat{i}-\hat{j}+2\hat{k}+\lambda(3\hat{i}+4\hat{j}+2\hat{k})$ **and the plane** $\vec{r}.(\hat{i}-\hat{j}+\hat{k})=5$ **is**

(*a*) 14 units (*b*) 12 units (*c*) 140 units (*d*) 13 units

46. **If a line makes an angle of 300, 600, 900 with the positive direction of** x, y, z**–axes, respectively, then the direction cosines are**

(*a*) $\pm\left(\frac{\sqrt{3}}{2},\frac{1}{2},0\right)$ (*b*) $\pm\left(\frac{-\sqrt{3}}{2},\frac{-1}{2},5\right)$ (*c*) $\pm\left(\frac{\sqrt{3}}{5},\frac{1}{2},\sqrt{5}\right)$ (*d*) $\pm\left(\frac{\sqrt{7}}{2},\frac{-5}{2},3\right)$

47. **The Cartesian form of the plane** $\vec{r}.\{5\hat{i}-\hat{j}+2\hat{k}\}=8$ **is**

(*a*) $5x-2y-3z=6$ (*b*) $5x-y-3z=8$ (*c*) $5x-y+2z=8$ (*d*) None of these

48. **The probability that a student is not a swimmer is 1/5. Then the probability that out of five students, four are swimmer is**

(*a*) ${}^5C_4\left(\frac{4}{5}\right)^4\frac{1}{5}$ (*b*) $\left(\frac{4}{5}\right)^4\frac{1}{5}$ (*c*) ${}^5C_1\left(\frac{4}{5}\right)^4\frac{1}{5}$ (*d*) none of these

49. **If** A **and** B **are two events such that** $P(A)\neq 0$ **and** $P(B/A)=1$**, then**

(*a*) $A\subset B$ (*b*) $B\subset A$ (*c*) $B=\phi$ (*d*) $A=\phi$

50. **If** $P(A/B)>P(A)$**, then which of the following is correct?**

(*a*) $P(B/A)<P(B)$ (*b*) $P(A\cap B)<P(A).P(B)$ (*c*) $P(B/A)>P(B)$ (*d*) $P(B/A)=P(B)$