2RM

SECOND REVISION TEST - 2023
MATHEMATICS

12 - Std

Time : 3.00 Hrs   Marks : 90

PART - I

Note : 1) Answer all the questions. 2) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer.   20 x 1 = 20

1. If $A = \begin{bmatrix} 1 & \tan\frac{\theta}{2} \\ -\tan\frac{\theta}{2} & 1 \end{bmatrix}$ and $AB = I_2$ then B =

   a) $\left(\cos^2\frac{\theta}{2}\right)A$ b) $\left(\cos^2\frac{\theta}{2}\right)A^T$ c) $\left(\cos^2\theta\right)I$ d) $\left(\sin^2\frac{\theta}{2}\right)A$

2. The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 6 & 8 \\ -1 & -2 & -3 & -4 \end{bmatrix}$ is

   a) 1   b) 2   c) 4   d) 3

3. If Z is a non zero complex number such that $2iz^2 = \bar{z}$ then | Z | is

   a) $\frac{1}{2}$ b) 1   c) 2   d) 3

4. A zero of $x^3 + 64$ is
   a) 0   b) 4   c) 4!   d) -4

5. The value of $\sin^{-1}(\cos x)$, $0 \le x \le \pi$ is

   a) $\pi - x$ b) $x - \frac{\pi}{2}$ c) $\frac{\pi}{2} - x$ d) $x - \pi$

6. The radius of the circle $3x^2 + by^2 + 4bx - 6by + by^2 = 0$ is

   a) 1   b) 3   c) $\sqrt{10}$ d) $\sqrt{11}$

7. The distance from the origin to the plane $3x - 6y + 2z + 7 = 0$ is
   a) 0   b) 1   c) 2   d) 3

8. If $\vec{a}, \vec{b}, \vec{c}$ are non - coplanar, non zero vectors such that $\left[\vec{a}, \vec{b}, \vec{c}\right] = 3$ then

   $\left\{\left[\vec{a} \times \vec{b}, \ \vec{b} \times \vec{c}, \ \vec{c} \times \vec{a}\right]\right\}^2$ is equal to

   a) 81   b) 9   c) 27   d) 18

9. The slope of the normal to the curve $f(x) = 2\cos 4x$ at $x = \frac{\pi}{12}$ is

   a) $-4\sqrt{3}$ b) -4 c) $\frac{\sqrt{3}}{12}$ d) $4\sqrt{3}$

10. The percentage error of fifth root of 31 is approximately how many times the percentage error in 31?

a) $\frac{1}{31}$ b) $\frac{1}{5}$ c) 5   d) 31

11. The value of $\int_{-\pi/2}^{\pi/2} \sin^2 x \cos x \, dx$ is

a) $\frac{3}{2}$ b) $\frac{1}{2}$ c) 0   d) $\frac{2}{3}$

12. The order and degree of the differential equation $\sqrt{\sin x}\,(dx + dy) = \sqrt{\cos x}\,(dx - dy)$ are
    a) 1, 2   b) 2, 2   c) 1, 1   d) 2, 1

13. If the probability mass function of a random variable is defined given below

x	-2	-1	0	1	2
$f(x)$	k	$2k$	$3k$	$4k$	$5k$

then the value of K is

a) $\frac{1}{15}$ b) $\frac{1}{10}$ c) $\frac{1}{3}$ d) $\frac{2}{3}$

14. Which of the following is a binary operation on N.
    a) Subtraction   b) multiplication   c) division   d) all of these

15. The number of rows in a truth table of a compound statement there involved 3 simple
    statements is   a) 9   b) 8   c) 6   d) 3

16. If z = x + iy the rectangle form of Re (−iz) is
    a) x   b) y   c) x + iy   d) −x + iy

17. All the roots of the polynomial $x^{20} + x^{18} + x^{16} + x^{12} + 10$ are   a) real roots
    b) complex roots but not real   c) positive real roots   d) negative real roots

18. The principal value of $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$ is

a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$ c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$

19. Area of the region bounded by the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ is

a) 12π b) 24π c) 36π d) 48π

20. The integrating factor for the differential equation $\frac{dy}{dx} + 2y \cot x = 3x^2 \csc^2 x$ is

a) sin x   b) cos x   c) $\sin^2 x$ d) $\cos^2 x$

PART - II   7 x 2 = 14

Note : i) Answer any seven questions. 2) Questions number 30 is compulsory.

21. If $A = \begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 14 & 7 \\ 7 & 7 \end{bmatrix}$ find A.

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22. If $A = \begin{bmatrix} 0 & 1 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$ are same type of boolean matrices then find $A \cup B$ and $B \cap C$

23. Find the value of $\left| \dfrac{2+i}{-1+2i} \right|$.

24. Find the principal value of $\sin^{-1}\left(\dfrac{-1}{2} \right)$.

25. Find the vertices of $9x^2 - 16y^2 = 144$.

26. A particle is fired straight up from the ground to reach a height of s feet in t seconds, where $s(t) = 128t - 16t^2$. Complete the maximum height of the particle reached.

27. Evaluate : $\displaystyle\int_0^{\pi/2} \sin^{10} x \, dx$.

28. Find dy for the function $y = \dfrac{(1-2x)^3}{3-4x}$.

29. If the probability density function for the random variable x is given by
$$f(x) = \begin{cases} k, & 1 \le x \le 5 \\ 0, & otherwise \end{cases}$$ then find the value of K.

30. Determine whether the three vectors $2\hat{i} + 3\hat{j} + \hat{k}$, $\hat{i} - 2\hat{j} + 2\hat{k}$ and $3\hat{i} + \hat{j} + 3\hat{k}$ are coplannar.

PART - III
7 x 3 = 21

Note : i) Answer any seven questions. ii) Questions number 40 is compulsory.

31. Solve by determinant method $5x - 2y + 16 = 0$, $x + 3y - 7 = 0$.

32. If α and β are the roots of the quadratic equation $17x^2 + 43x - 73 - 0$, construct a quadratic equation whose roots are $\alpha + 2$ and $\beta + 2$.

33. Simplify $\left(\dfrac{1+i}{1-i} \right)^3 - \left(\dfrac{1-i}{1+i} \right)^3$ into rectangular form.

34. A concrete bridge is designed as a parabolic arch. The road over bridge is 40m long and the maximum height of the arch is 15. Write the equation of the parabolic arch.

35. prove that $\left[\vec{a} + \vec{b}, \ \vec{b} + \vec{c}, \ \vec{c} + \vec{a} \right] = 2 \left[\vec{a}, \ \vec{b}, \ \vec{c} \right]$.

36. Product of two positive numbers is 20 and their sum is minimum, find the numbers.

37. Find the approximate value of $\sqrt{9.2}$ by linear approximation method without using calculator.

38. Construct a differential equation from the given equation $y = A\cos x + B\sin x$ by eliminating the constants A and B.

39. Two unbiased coins are tossed at the same time, find probability mass function for getting heads.

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40. A binary operation $*$ is defined on Q by $a * b = \dfrac{a+b}{2}$, $\forall a, b \in Q$ verify whether $*$ satisfies closure property, commutative closure property, commutative property and associative property.

PART - IV

Note : Answer all questions.

$7 \times 5 = 35$

41. a) Solve the system of linear equations, by Cramer's rule $x_1 - x_2 = 3$, $2x_1 + 3x_2 + 4x_3 = 17$, $x_2 + 2x_3 = 7$. **(OR)** b) If $z = x + iy$ is a complex number such that $Im\left(\dfrac{2z+1}{iz+1}\right) = 0$, show that the locus of z is $2x^2 + 2y^2 + x - 2y = 0$.

42. a) If $2 + i$ and $3 - \sqrt{2}$ are two roots of the equation
$x^6 - 13x^5 + 62x^4 - 126x^3 + 65x^2 + 127x - 140 = 0$ find the roots. **(OR)**

b) Find the value of $\tan\left(\cos^{-1}\left(\dfrac{1}{2}\right) - \sin^{-1}\left(\dfrac{-1}{2}\right)\right)$.

43. a) Find the equation of circle passing through (1, 0), (−1, 0) and (0, 1). **(OR)**
b) If $ax^2 + by^2 = 1$ and $(cx^2 + dy^2 = 1)$ are interseting orthogonally prove that
$\dfrac{1}{a} - \dfrac{1}{b} = \dfrac{1}{c} - \dfrac{1}{d}$.

44. a) If $\vec{a} = \vec{i} - \vec{j}$, $\vec{b} = \vec{i} - \vec{j} - 4\vec{k}$, $\vec{c} = 3\vec{j} - \vec{k}$ and $\vec{d} = 2\vec{i} + 5\vec{j} + \vec{k}$ then verify that
$\left(\vec{a} \times \vec{b}\right) \times \left(\vec{c} \times \vec{d}\right) = \left[\vec{a}\ \vec{c}\ \vec{d}\right]\vec{b} - \left[\vec{b}\ \vec{c}\ \vec{d}\right]\vec{a}$. **(OR)**

b) A right circular cylinder has radius r = 10 cm and height h = 20cm suppose that the radius of the cylinder is increased from 10cm to 10.1cm and the height does not change. Estimate the change in t he volume of the cylinder. Also, Calculate the relative error and percentage error.

45. a) Find the non parametric vector equation and Cartesian equation of a plane passing through a point (1, −2, 4) perpendicular to the plane x + 2y − 3z = 11 and parallel to the straight line $\dfrac{x+7}{3} = \dfrac{y+3}{-1} = \dfrac{z}{1}$. **(OR)**

b) Find the area of the region enclosed by the parabolas $y^2 = 4x$ and $x^2 = 4y$.

46. a) Find the dimensions of a largest rectangle which is inscribed in a circle of radius 10cm. **(OR)**

b) The growth of a population is proportional to the number present. It the population of a colony doubles in 50 years in how many year will be population become triple?

47. a) If the probability density function of a random variable x is given by
$f(x) = \begin{cases} ke^{\frac{-x}{3}}, & x > 0 \\ 0, & x < 0 \end{cases}$ then find (i) The value of k. ii) Distribution function
iii) P (x < 3) iv) p (5 ≤ x) v) P (x ≤ 4). **(OR)**
b) Let A = Q \ {1}, a binary operation $*$ is defined on A by x $*$ y = x + y − xy. verify whether $*$ has closure property on A? Then verify whether $*$ satisfies communitative law, associative law, identity·law, and inverse law.

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