

Mathematics-Model Question Paper

1. [BT:C] The function $f(x) = \frac{x + \sqrt{x^2 + 1}}{2}$ is
 (A) an even function (B) a periodic function
 (C) an odd function (D) neither an even nor an odd function
2. [BT:K] Let $R = \{(1,3), (4,2), (2,4), (2,3), (3,1)\}$ be a relation on the set $A = \{1,2,3,4\}$. Then the relation R is
 (A) reflexive (B) transitive (C) symmetric (D) reflexive
3. [BT:K] If $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = \frac{x-1}{x+1}$ then interval of S is
 (A) $[0,3]$ (B) $[-1,1]$ (C) $\{0,1\}$ (D) $[-1,3]$
4. [BT:K] The argument of $-1 - i$ is
 (A) $\frac{\pi}{4}$ (B) $\frac{3\pi}{4}$ (C) $\frac{3\pi}{4}$ (D) $\frac{\pi}{4}$
5. [BT:K] The modulus of $z = 1 - \cos \theta + i \sin \theta$ is
 (A) $\sqrt{2}$ (B) $\sqrt{2} \sin \frac{\theta}{2}$ (C) $\sqrt{3}$ (D) $2 \cos \frac{\theta}{2}$
6. [BT:C] If $z = x + iy$ then $\frac{1+x+iy}{1+x-iy}$ is
 (A) $x - iy$ (B) $-x - iy$ (C) $-x + iy$ (D) $x + iy$
7. [BT:A] If $1-i$ is a root of equation $x^2 + ax + b = 0$ then the values of a and b are respectively
 (A) 2,1 (B) -2,2 (C) 2,2 (D) 2,-2
8. [BT:K] The product of the matrices $\begin{bmatrix} 7 & 5 \\ 3 & 3 \end{bmatrix}$ and $\begin{bmatrix} 7 & 5 \\ 3 & 3 \end{bmatrix}$ is equal to
 (A) 70 (B) [49] (C) [15] (D) [70]
9. [BT:K] If A is a square matrix of order 3 then $|kA|$ is
 (A) $k|A|$ (B) $-k|A|$ (C) $k^3|A|$ (D) $-k^3|A|$
10. [BT:K] If A is a scalar matrix with scalar $k \neq 0$, of order 3, then A^{-1} is
 (A) $\frac{1}{k^2} I$ (B) $\frac{1}{k^3} I$ (C) $\frac{1}{k} I$ (D) $k I$

11. [BT:K] If I is the unit matrix of order n , where $k \neq 0$ is a constant, then $\text{adj}(kI) =$
- (A) $kn(\text{adj } I)$ (B) $k(\text{adj } I)$ (C) $k^2(\text{adj } I)$ (D) $kn-1(\text{adj } I)$

(C) 4

12. [BT:C] If $nPr = 720nCr$, then the value of n is

(A) 6 (B) 5 (D) 7

13. [BT:K] How many triangles can be formed by joining the vertices of a hexagon?

(A) 120 (B) 60 (C) 20 (D) 10

14. [BT:A] If $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ then which one of the following holds for all $n \geq 1$, by the principle of mathematical induction

(A) $A^n = nA + (n-1)I$ (B) $A^n = nA - (n-1)I$
 (C) $A^n = 2^{n-1}A + (1-n)I$ (D) $A^n = 2^{n-1}A - (1-n)I$

15. [BT:A] The sum of the coefficients in the expansion of $(1-x)^{10}$ is

(A) 0 (B) 1 (C) 102 (D) 1024

16. [BT:K] The total number of terms in the expansion of $[(a+b)^2]^{18}$ is

(A) 11 (B) 36 (C) 37 (D) 35

17. [BT:C] If the n th term of an A.P. is $(2n-1)$, then the sum of n terms is

(A) n^2-1 (B) $(2n-1)$ (C) n^2 (D) n^2+1

18. [BT:C] What number must be added to 5, 13 and 29 so that sum may form a G.P.?

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

19. [BT:C] The value of $\lim_{x \rightarrow 1} \frac{x^{1/3}-1}{x-1}$ is

(A) $2/3$ (B) $-2/3$ (C) $1/3$ (D) $-1/3$

20. [BT:K] The function $f(x) = x|x| + x - 1$ is
 (A) continuous at $x=0$ only (C) continuous at both $x=0$ and $x=1$
 (B) continuous at $x=1$ only (D) discontinuous at $x=0, 1$
21. [BT:A] The coefficient of Lagrange's Mean Value theorem for the function $f(x) = x^2 + x - 1$ $a=1$ $b=2$ is
 (A) $-1 + 2 - 1, = 0$, (B) 1 (C) 0 (D) 0.5
22. [BT:K] At $x=0$ the function $f(x) = x|x|$ has
 (A) neither maximum nor minimum (C) maximum
 (B) minimum (D) point of inflexion
23. [BT:C] The equation of the tangent to the curve $y = \frac{x^3}{5}$ at $(-1, -1/5)$ is
 (A) $5y + 3x = 2$ (B) $5y - 3x = 2$ (C) $3x - 5y = 2$ (D) $3x + 3y = 2$
24. [BT:C] The value of $\int \frac{dx}{a^2 - x^2}$ is
 (A) $\frac{1}{2a} \log \left(\frac{a+x}{a-x} \right) + c$ (B) $\frac{1}{2a} \log \left(\frac{x-a}{x+a} \right) + c$
 (C) $\frac{1}{a} \tan^{-1} \frac{x}{a} + c$ (D) $\frac{1}{2a} \tan^{-1} \frac{x}{a} + c$
25. [BT:C] The value of $\int_0^1 2^x dx$ equals
 (A) $\frac{2^{x+1}}{x+1} + c$ (B) $\frac{2^x}{\log 2} + c$ (C) $2^x \log 2 + c$ (D) $2^{x+1} \log 2 + c$
26. [BT:A] The value of $\int_0^1 x(1-x)^4 dx$ is
 (A) $1/12$ (B) $1/30$ (C) $1/24$ (D) $1/20$
27. [BT:C] The value of $\int_0^{2\pi} \cos^3 2x dx$ is
 (A) $2/3$ (B) $1/3$ (C) 0 (D) $2\pi/3$
28. [BT:K] The area bounded by the line $y = x$, the x-axis, the ordinates $x = 1$, $x = 2$ is
 (A) $3/2$ (B) $5/2$ (C) $1/2$ (D) $7/2$
29. [BT:K] The degree of the differential equation $\sqrt{1 - \left(\frac{dy}{dx}\right)^2} = \frac{d^2y}{dx^2}$ is
 (A) 1 (B) 2 (C) 4 (D) 6

30. [BT:K] The differential equation of all non-vertical lines in a plane is

- (A) $\frac{dy}{dx} = 0$ (B) $\frac{d^2y}{dx^2} = 0$ (C) $\frac{dy}{dx} = m$ (D) $\frac{d^2y}{dx^2} = m$

31. [BT:K] The integrating factor of $\frac{dy}{dx} + 2\frac{y}{x} = e^{4x}$ is

- (A) x (B) x^2 (C) e^x (D) x

32. [BT:K] Solution of $\frac{dx}{dy} + mx = 0$ where $m < 0$ is

- (A) $x = ce^{my}$ (B) $x = ce^{-my}$ (C) $x = my + c$ (D) $x = c$

33. [BT:K] The length of the diameter of a circle with centre (2,1) and passing through the point (-2,1) is

- (A) 4 (B) 8 (C) $4\sqrt{5}$ (D) 2

34. [BT:K] The slope of the straight line $2x - 3y + 1 = 0$ is

- (A) $-2/3$ (B) $-3/2$ (C) $2/3$ (D) $3/2$

35. [BT:C] If $2x + 3y = 0$ and $3x - 2y = 0$ are the equations of two diameters of a circle, then its centre is

- (A) (1,-2) (B) (2,3) (C) (0,0) (D) (-3,2)

36. [BT:K] The eccentricity of the rectangular hyperbola is

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

37. [BT:C] The line $5x - 2y + 4k = 0$ is a tangent to $4x^2 - y^2 = 36$ then k is

- (A) $4/9$ (B) $2/3$ (C) $9/4$

38. [BT:C] The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if

- (A) $k=0$ or -1 (B) $k=0$ or -3 (C) $k=3$ or -3 (D) $k=3$ or -1

39. [BT:K] The conjugate lines through a focus of an ellipse are at an angle

- (A) $^\circ$ (B) 45° (C) 60° (D) 90°

40. [BT:C] A line makes an angle of 45° with OX and 60° with OY, what (acute) angle does it make with OZ?

- (A) 60° (B) 45° (C) 30° (D) 80°

41. [BT:K] If \vec{a} is a nonzero vector and k is a scalar such that $|\vec{a}| = 1$ then k is equal to
 (A) $|\vec{a}|$ (B) 1 (C) $\frac{1}{|\vec{a}|}$ (D) $\pm \frac{1}{|\vec{a}|}$

42. [BT:C] If $\vec{m} + \vec{j} + \vec{k}$ and $\vec{m} - \vec{j} + 2\vec{k}$ are perpendicular then m is
 (A) $\sqrt{3}$, $2 = 4$ and $\sqrt{3} = 9 + 2$ (B) 8 (C) 4 (D) 12

43. [BT:C] If $|\vec{a}| = |\vec{b}| = 4$, $\vec{a} \cdot \vec{b} = 3$ then $|\vec{a} \times \vec{b}|$ is
 (A) $3\sqrt{15}$ (B) 63 (C) 69 (D) $\sqrt{69}$

44. [BT:A] The value of $(\vec{a} \times \vec{b}) \cdot (\vec{a} \times \vec{b})$ is
 (A) $a^2 b^2 - (\vec{a} \cdot \vec{b})^2$ (B) $a^2 + b^2 + 2(\vec{a} \cdot \vec{b})^2$
 (C) $(a^2)(b^2)$ (D) $a^2 + b^2 + 2\cos 2(\cdot)$

45. [BT:C] If $f(x) = \begin{cases} kx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$ is the probability density function then the value of k is
 (A) $1/3$ (B) $1/6$ (C) $1/9$ (D) $1/12$

46. [BT:A] A trigonometric equation $\sin^{-1} x = \sin^{-1} a$ has solution for
 (A) $|a| \leq \frac{1}{\sqrt{2}}$ (B) all real values of a . (C) $|a| < \frac{1}{2}$ (D) $|a| > \frac{1}{2}$.

47. [BT:A] A person standing on the bank of a river observes that the angle of elevation of the top of a tree on the opposite bank of the river is 60° and when he retires 40 meters away from the tree the angle of the elevation becomes 30° , then the breadth of the river is
 (A) 20m (B) 30m (C) 40m (D) 60m

48. [BT:C] A random variable X has the following probability mass function:
 $P(X=2)=k/6, P(X=3)=k/4$ and $P(X=1)=k/12$. Then the value of k is
 (A) 1 (B) 2 (C) 3 (D) 4

49. [BT:C] A box contains 6 red and 4 white balls. If 3 balls are drawn at random, the probability of getting 2 white balls is
 (A) $1/20$ (B) $18/125$ (C) $4/25$ (D) $3/10$

50. [BT:C] If the mean and standard deviation of a binomial distribution with parameters n and p are 12 and 2 respectively. Then the value of p is
 (A) $1/2$ (B) $1/3$ (C) $2/3$ (D) $1/4$

Answers(Mathematics)

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|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1(D) | 2(C) | 3(B) | 4(D) | 5(D) | 6(D) | 7(B) | 8(D) | 9(C) | 10(B) |
| 11(B) | 12(A) | 13(C) | 14(B) | 15(A) | 16(C) | 17(C) | 18(B) | 19(C) | 20(C) |
| 21(D) | 22(A) | 23(B) | 24(A) | 25(B) | 26(B) | 27(B) | 28(A) | 29(C) | 30(C) |
| 31(B) | 32(B) | 33(B) | 34(C) | 35(C) | 36(B) | 37(C) | 38(B) | 39(D) | 40(A) |
| 41(D) | 42(C) | 43(A) | 44(A) | 45(C) | 46(C) | 47(A) | 48(B) | 49(D) | 50(C) |