

MATHEMATICS

(Common to all Candidates)

1. If I is the unit matrix of order n , Where $K \neq 0$ is a constant then $adj(KI) =$ _____

- a) $K^n(adjI)$ b) $K^{n-1}(adjI)$ c) $K^2(adjI)$ d) $K(adjI)$

2. The equation $\begin{vmatrix} 2x & 0 & 0 \\ x+2 & x+1 & 0 \\ x+3 & x+4 & x^2+1 \end{vmatrix} = 0$ has the solution

- a) $x = -1, -2, -3$ b) $x = 0, -1, \pm i$ c) $x = -2, -3, -4$ d) $x = 0, 0, 0$

3. If $\rho(A) = \rho(A, B)$ then the system is

- a) Consistent and has infinitely many solution
 b) Consistent and has unique solution
 c) Consistent
 d) Inconsistent

4. The value of $\begin{vmatrix} \cos \frac{\pi}{12} + i \sin \frac{\pi}{12} & 0 & 0 \\ 0 & \cos \frac{\pi}{6} + i \sin \frac{\pi}{6} & 0 \\ 0 & 0 & \cos \frac{\pi}{8} + i \sin \frac{\pi}{8} \end{vmatrix} =$ _____

- a) $\frac{-1-i}{\sqrt{2}}$ b) $\frac{1+i}{\sqrt{2}}$ c) $\frac{-1+i}{\sqrt{2}}$ d) $\frac{1-i}{\sqrt{2}}$

5. If A is square matrix then $A A' + A'A$ is a

- a) Unit Matrix b) Null Matrix c) Symmetric Matrix d) Skew Symmetric Matrix

6. If \vec{a} and \vec{b} are unit vectors having opposite directions, which one of the following is true?

- a) $\vec{a} \cdot \vec{b} = 1$ b) $\vec{a} \cdot \vec{b} = 0$ c) $\vec{a} \times \vec{b} = 0$ d) $|\vec{a}| |\vec{b}| = 2$

7. If \vec{a} and \vec{b} are two unit vectors and θ is the angle between them, then $(\vec{a} - \vec{b})$ is a unit vector if
- a) $\theta = \frac{\pi}{4}$ b) $\theta = \frac{\pi}{2}$ c) $\theta = \frac{\pi}{3}$ d) $\theta = \frac{2\pi}{3}$
8. The angle between the planes $x + y + z = 10$ and z axis is _____
- a) $\text{Sin}^{-1}\left(\frac{2}{\sqrt{3}}\right)$ b) $\text{Sin}^{-1}\left(\frac{1}{\sqrt{3}}\right)$ c) $\text{Sin}^{-1}(2)$ d) $\text{Sin}^{-1}(\sqrt{3})$
9. If \vec{a} is any vector, the value of $|\vec{a} \times \vec{i}|^2 + |\vec{a} \times \vec{j}|^2 + |\vec{a} \times \vec{k}|^2$ is _____
- a) a^2 b) $2a^2$ c) $3a^2$ d) 0
10. If $|z - z_1| = |z - z_2|$ then the locus of z is
- a) a circle with centre at the origin
b) a circle with centre at z_1
c) a straight line passing through the origin
d) a perpendicular bisector of the line joining z_1 and z_2
11. If $\frac{1+x}{1-x} = \cos 2\theta + i \sin 2\theta$, then x is equal to
- a) $i \tan \theta$ b) $i \tan 2\theta$ c) $i \cot \theta$ d) $i \cot 2\theta$
12. Which of the following is incorrect?
- a) $|z_1 + z_2| \leq |z_1| + |z_2|$ b) $|z_1 + z_2| \geq |z_1| + |z_2|$
c) $|z_1 - z_2| \leq |z_1| + |z_2|$ d) $|z_1 - z_2| \geq |z_1| - |z_2|$
13. If n is a positive integer than one and $a = \cos \frac{2\pi}{n} + i \sin \frac{2\pi}{n}$ then
- $1 + a + a^2 + \dots + a^{n-1} =$ _____
- a) 0 b) 1 c) -1 d) n
14. The point of contact of the tangent $y = mx + c$ and the parabola $y^2 = 4ax$ is
- a) $\left(\frac{a}{m^2}, \frac{2a}{m}\right)$ b) $\left(\frac{2a}{m^2}, \frac{a}{m}\right)$ c) $\left(\frac{a}{m}, \frac{2a}{m^2}\right)$ d) $\left(\frac{-a}{m^2}, \frac{-2a}{m}\right)$
15. The curve with parametric equation $x = 1 + 4 \cos \theta$, $y = 2 + 3 \sin \theta$ is _____
- a) a circle b) a parabola c) an ellipse d) a hyperbola

16. The intercept cut off by the plane $2x + y - z = 5$ with the axes is

- a) $\frac{2}{5}, \frac{1}{5}, \frac{-1}{5}$ b) $\frac{5}{2}, \frac{1}{5}, -5$ c) 2,1,-1 d) -2,-1,1

17. The condition that the line $lx + my + n = 0$ may be a normal to the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

is

- a) $al^3 + 2alm^2 + m^2n = 0$ b) $\frac{a^2}{l^2} + \frac{b^2}{m^2} = \frac{(a^2 + b^2)^2}{n^2}$
c) $\frac{a^2}{l^2} + \frac{b^2}{m^2} = \frac{(a^2 - b^2)^2}{n^2}$ d) $\frac{a^2}{l^2} - \frac{b^2}{m^2} = \frac{(a^2 + b^2)^2}{n^2}$

18. The hyperbola with foci at (0,-1),(0,3) and one vertex at the origin is _____

- a) $3y^2 - x^2 - 6y = 0$ b) $3x^2 - y^2 + 6x = 0$
c) $3x^2 - y^2 + 6y = 0$ d) $3x^2 - y^2 - 6x = 0$

19. $x = x_0$ is a root of even for the equation $f'(x) = 0$ then $x = x_0$ is a

- a) Maximum point b) Minimum point c) Inflexion point d) Critical point

20. The area of the largest rectangle that can be inscribed in the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

is _____

- a) ab b) a^2b^2 c) $2ab$ d) $\sqrt{2}ab$

21. If the length of the diagonal of a square is increasing at the rate of 0.2m/sec, what is the rate of increase of its area when the side is $\frac{30}{\sqrt{2}}$ cm?

- a) $3 \text{ cm}^2/\text{sec}$ b) $6\sqrt{2} \text{ cm}^2/\text{sec}$ c) $3\sqrt{2} \text{ cm}^2/\text{sec}$ d) $6 \text{ cm}^2/\text{sec}$

22. In the law of mean, the value of ' θ ' satisfies the condition

- a) $\theta > 0$ b) $\theta < 0$ c) $\theta < 1$ d) $0 < \theta < 1$

23. If there is an error of 0.01 cm in the diameter of sphere when its radius is 5 cm, then the percentage error in its surface area is

- a) 0.1 % b) 0.2 % c) 0.02 % d) 2.0 %

24. In which region the curve $y^2(a + x) = x^2(3a - x)$

- a) $X > 0$ b) $x \leq -a$ and $x > 3a$ c) $-a < x < 3a$ d) $0 < x < 3a$

25. The curve $x^3 + y^3 = 3axy$ is symmetrical about _____.

- a) a) $x=0$ b) $y=0$ c) both axis d) $y=x$

26. $\int_0^a f(x)dx + \int_0^a f(2a - x)dx =$ _____
- a) $\int_0^a f(x)dx$ b) $2 \int_0^a f(x)dx$ c) $\int_0^{2a} f(x)dx$ d) $\int_0^{2a} f(a - x)dx$
27. $\int_{-1}^0 |x + 1|dx$ is
- a) $\frac{-1}{2}$ b) $\frac{1}{2}$ c) 2 d) -2
28. The volume of the solid obtained when the area between the line joining the points (0,0) and (2, 3) and x-axis is rotated about x-axis is _____
- a) 2π b) 4π c) 8π d) 6π
29. The area between the parabolas $y^2 = 16x$ and the line $y = x$ is _____
- a) $\frac{442}{3}$ b) $\frac{441}{3}$ c) $\frac{128}{3}$ d) $\frac{256}{3}$
30. The differential equation formed by eliminating A and B from the relation $y = e^x(A \cos 3x + B \sin 3x)$ is
- a) $y'' - 2y' - 10y = 0$ b) $y'' - 2y' + 10y = 0$ c) $y'' + 2y' + 10y = 0$
d) $y'' + 2y' - 10y = 0$
31. If $y = e^{-4x}(A \cos 3x + B \sin 3x)$ then
- a) $(D^2 - D - 12)y = 0$ b) $(D^2 + 8D + 25)y = \cos 3x + \sin 3x$
c) $(D^2 + 8D + 25)y = 0$ d) $(D^2 - 8D + 25)y = e^{-4x}$
32. The differential equation satisfied by the all straight in xy plane is _____
- a) $\frac{dy}{dx} = a$ constant b) $\frac{d^2y}{dx^2} = 0$ c) $y + \frac{dy}{dx} = 0$ d) $\frac{d^2y}{dx^2} + y = 0$
33. The particular integral of $\frac{d^2y}{dx^2} + 9y = 1 + \sin 3x$ is _____
- a) $\frac{-x \cos 3x}{6} + \frac{1}{9}$ b) $\frac{x \sin 3x}{6}$ c) $\frac{-x \cos 3x}{6} + \frac{1}{10}$ d) $\frac{x \cos 3x}{6} + 9$
34. If $x \frac{dy}{dx} = y(\log y - \log x + 1)$ then the solution of the equation is
- a) $x \log \frac{y}{x} = cy$ b) $y \log \frac{x}{y} = cx$ c) $\log \frac{x}{y} = cy$ d) $\log \frac{y}{x} = cx$
35. The complementary function of differential equation $(D^2 - 1)y = \cos x$ is
- a) $Ae^x + Be^{-x}$ b) $Ae^{-x} + Be^{-x}$ c) $Ae^{2x} + Be^{-2x}$ d) $Ae^x + Be^x$
36. The particular integral of the differential equation $(D^3 + 1)y = x$ is
- a) x b) $-x$ c) $2x$ d) $\frac{x}{2}$

37. An element of order 2 in the group $(C - \{0\}, \bullet)$ is _____.

- a) $1-i$ b) $2+i$ c) $e^{i\pi}$ d) $\frac{2-i}{\sqrt{3}}$

38. The set $G = \{1, \omega, \omega^2\}$ of all the cube roots of unity forms an abelian group with respect to multiplication. Then the inverse of $\frac{1 + \omega + \omega^2 - \omega^7}{1 + \omega}$ is _____.

- a) $-(1 + \omega^2)$ b) $-(1 + \omega)$ c) ω d) $-\omega$

39. If a,b,c are any three elements of the group $(G, *)$ and $(a * b) * x = c$ then $x =$ _____.

- a) $c * (a^{-1} * b^{-1})$ b) $c * (b^{-1} * a^{-1})$ c) $(a^{-1} * b^{-1}) * c$
d) $(b^{-1} * a^{-1}) * c$

40. In congruence modulo 5, $x \in Z / x = 5k + 4, k \in z\}$ represents

- a) $[0]$ b) $[5]$ c) $[4]$ d) $[2]$

41. If $f(x) = k \sin \frac{\pi x}{5}, 0 \leq x \leq 5$ is a p.d.f. then the value of $k =$ _____.

- a) $\frac{2\pi}{5}$ b) $\frac{3\pi}{10}$ c) $\frac{\pi}{10}$ d) $\frac{\pi}{5}$

42. In a Poisson distribution if standard deviation is $\sqrt{2}$ then $P(X \geq 1)$ is _____.

- a) $1 - e^{-2}$ b) $1 + e$ c) $1 - e^2$ d) $1 - e^{-1}$

43. A die is thrown 100 times. If getting an odd number is success, then the variance of the number of success is _____.

- a) 50 b) 40 c) 25 d) 20

44. If 2 cards are drawn from a well shuffled pack of 52 cards, the probability that they are of the same colours with replacement is

- a) $\frac{1}{2}$ b) $\frac{25}{51}$ c) $\frac{26}{51}$ d) $\frac{25}{102}$

45. The binomial distribution have the mean

- a) n^2p b) np c) npq d) np^2