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) $\vec{a}\,.\,\vec{b} = 1$ b) $\vec{a}\,.\,\vec{b} = 0$ 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) $Sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ b) $Sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$ c) $Sin^{-1}(2)$ d) $Sin^{-1}\left(\sqrt{3}\right)$

9. If $\vec{a}$ is any vector, the value of $\left|\vec{a} \times \vec{i}\right|^2 + \left|\vec{a} \times \vec{j}\right|^2 + \left|\vec{a} \times \vec{k}\right|^2$ 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) $|z_1 + z_2| \le |z_1| + |z_2|$ b) $|z_1 + z_2| \ge |z_1| + |z_2|$

c) $|z_1 - z_2| \le |z_1| + |z_2|$ d) $|z_1 - z_2| \ge |z_1| - |z_2|$

13. If n is a positive integer than one and $a = \cos\frac{2\pi}{n} + i \sin\frac{2\pi}{n}$ then $1 + a + a^2 + ... + a^{n-1} =$ _____

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) $al^3 + 2alm^2 + m^2 n = 0$ 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) $a^2 b^2$ 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 cm^2/sec b) $6\sqrt{2}$ cm^2/sec c) $3\sqrt{2}$ cm^2/sec d) 6 cm^2/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 ≤ -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 modulo5, $x\in Z/x=5k+4,k\in z\}$ represents

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

41. If $f(x)=k\sin\frac{\pi x}{5},0\le x\le 5$ 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 $P(X\ge 1)$ 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