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IMPORTANT 5 MARKS FOR SLOW LEARNERS

12th Standard

Maths

ANSWERS AVAILABLE IN

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Exam Time : 02:00:00 Hrs | Total Marks : 350

70 x 5 = 350

1) If A = $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & 4 \\ 2 & -4 & 3 \end{bmatrix}$, verify thatA(adj A)=(adj A)A = $|A|$ I_3.

2) If A = $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$, find the productsAB and BAand hence solve the system of equations x - y + z = 4, x - 2y - 2z = 9, 2x + y + 3z = 1.

3) Investigate for what values of λ and μ the system of linear equations x + 2y + z = 7, x + y + λz = μ, x + 3y − 5z = 5 has
(i) no solution
(ii) a unique solution
(iii) an infinite number of solutions

4) Investigate the values of λ and m the system of linear equations 2x + 3y + 5z = 9, 7x + 3y - 5z = 8, 2x + 3y + λz = μ, have
(i) no solution
(ii) a unique solution
(iii) an infinite number of solutions.

5) By using Gaussian elimination method, balance the chemical reaction equation:
$C_2 H_5 + O_2 \rightarrow H_2O + CO_2$

6) Solve the following system of linear equations by matrix inversion method:
x + y + z − 2 = 0, 6x − 4y + 5z − 31 = 0, 5x + 2y + 2z = 13.

7) Solve the following systems of linear equations by Cramer's rule:
$\frac{3}{x} - \frac{4}{y} - \frac{2}{z}$ - 0, $\frac{1}{x} + \frac{2}{y} + \frac{1}{z}$ - 2 = 0, $\frac{2}{x} - \frac{5}{y} - \frac{4}{z}$ + 1 = 0

8) If z_1,z_2, and z_3 are three complex numbers such that $|z_1|=1, |z_2|=2 |z_3|=3$ and $|z_1+z_2+z_3|=1$,show that

$|9z_1z_2+4z_1z_2+z_2z_3|=6$

9) If z=x+iy is a complex number such that $\mathrm{Im}\left(\frac{2z+1}{iz+1}\right)=0$ show that the locus of z is $2x^2+2y^2+x-2y=0$

10) If z=x+iy and $\arg\left(\frac{z-i}{z+2}\right)=\frac{\pi}{4}$, then show that $x^2+y^2+3x-3y+2=0$

11) If $2\cos a = x+\frac{1}{x}$ and $2\cos\beta = y+\frac{1}{y}$, show that

i) $\frac{x}{y}+\frac{y}{x}=2\cos(\alpha-\beta)$.

ii) $xy-\frac{1}{xy}=2i\sin(\alpha+\beta)$

iii) $\frac{x^m}{y^n}-\frac{y^n}{x^m}=2i\sin(m\alpha-n\beta)$

iv) $x^my^n+\frac{1}{x^my^n}=2\cos(m\alpha+n\beta)$

12) If z=x+iy and $\arg\left(\frac{z-1}{z+1}\right)=\frac{\pi}{2}$,then show that $x^2+y^2=1$.

13) Solve the equation (x-2)(x-7)(x-3)(x+2)+19=0

14) Solve the equation (2x-)(6x-1)(3x-2)(x-12)-7=0

15) Find all zeros of the polynomial $x^6-3x^5-5x^4+22x^3-39x^2-39x+135$, if it is known that 1+2i and $\sqrt{3}$ are two of its zeros.

16) Solve the following equation: $x^4-10x^3+26x^2-10x+1=0$

17) Solve the equation $6x^4-5x^3-38x^2-5x+6=0$ if it is known that $\frac{1}{3}$ is a solution.

18) Solve $\tan^{-1}\left(\frac{x-1}{x-2}\right)+\tan^{-1}\left(\frac{x+1}{x+2}\right)=\frac{\pi}{4}$

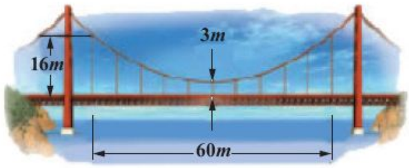
19)

Solve $\cos\left(\sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)\right) = \sin\left\{\cot^{-1}\left(\frac{3}{4}\right)\right\}$

20) Find the foci, vertices and length of major and minor axis of the conic
$4x^2+36y^2+40x-288y+532 = 0$.

21) Find the centre, foci, and eccentricity of the hyperbola
$11x^2-25y^2-44x+50y-256 = 0$

22) Parabolic cable of a 60m portion of the roadbed of a suspension bridge are positioned as shown below. Vertical Cables are to be spaced every 6m along this portion of the roadbed. Calculate the lengths of first two of these vertical cables from the vertex.



23) Assume that water issuing from the end of a horizontal pipe, 7 5 . m above the ground, describes a parabolic path. The vertex of the parabolic path is at the end of the pipe. At a position 2 5 . m below the line of the pipe, the flow of water has curved outward 3m beyond the vertical line through the end of the pipe. How far beyond this vertical line will the water strike the ground?

24) On lighting a rocket cracker it gets projected in a parabolic path and reaches a maximum height of 4m when it is 6m away from the point of projection. Finally it reaches the ground 12m away from the starting point. Find the angle of projection.

25) Find the vertex, focus, equation of directrix and length of the latus rectum of the following:
$x^2-2x+8y+17=0$

26) Identify the type of conic and find centre, foci, vertices, and directrices of each of the following :
$18x^2+12y^2-144x+48y+120 = 0$

27) Identify the type of conic and find centre, foci, vertices, and directrices of each of the following :
$9x^2-y^2-36x-6y+18 = 0$

28) By vector method, prove that $\cos(\alpha + \beta) = \cos\alpha \cos\beta - \sin\alpha \sin\beta$

29) With usual notations, in any triangle ABC, prove by vector method that $\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinc}$

30) Prove by vector method that $\sin(\alpha - \beta) = \sin\alpha \cos\beta - \cos\alpha \sin\beta$

31) Prove by vector method that the perpendiculars (attitudes) from the vertices to the opposite sides of a triangle are concurrent.

32) Using vector method, prove that $\cos(\alpha - \beta) = \cos\alpha \cos\beta + \sin\alpha \sin\beta$

33) Prove by vector method that sin(α + β)=sin α cos β + cos α sin β

34) If $\vec{a} = \vec{i} - \vec{j}, \vec{b} = \hat{i} - \hat{j} - 4\hat{k}, \vec{c} = 3\hat{j} - \hat{k}$ and $\vec{d} = 2\hat{i} + 5\hat{j} + \hat{k}$

(i) $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = [\vec{a}, \vec{b}, \vec{d}]\vec{c} - [\vec{a}, \vec{b}, \vec{c}]\vec{d}$

(ii) $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) = [\vec{a}, \vec{c}, \vec{d}]\vec{b} - [\vec{b}, \vec{c}, \vec{d}]\vec{a}$

35) Find the vector parametric, vector non-parametric and Cartesian form of the equation of the plane passing through the points (-1, 2, 0), (2, 2, -1)and parallel to the straight line $\frac{x-1}{1} = \frac{2y+1}{2} = \frac{z+1}{-1}$

36) Find the non-parametric form of vector equation, and Cartesian equation of the plane passing through the point (2,3,6) and parallel to the straight lines $\frac{x-1}{2} = \frac{y+1}{3} = \frac{z-3}{1}$ and $\frac{x+3}{2} = \frac{y-3}{-5} = \frac{z+1}{-3}$

37) Find the parametric vector, non-parametric vector and Cartesian form of the equations of the plane passing through the points (3,6,−2), (−1,−2,6) , and (6,−4,−2).

38) A ladder 17 metre long is leaning against the wall. The base of the ladder is pulled away from the wall at a rate of 5 m/s. When the base of the ladder is 8 metres from the wall.
How fast is the top of the ladder moving down the wall?

39) Find the acute angle between $y = x^2$ and $y = (x - 3)^2$.

40) A garden is to be laid out in a rectangular area and protected by wire fence. What is the largest possible area of the fenced garden with 40 metres of wire.

41) Expand tan x in ascending powers of x upto 5th power for $(-\frac{\pi}{2} < x < \frac{\pi}{2})$

42) Write the Maclaurin series expansion of the following function $\tan^{-1}(x)$; $-1 \le x \le 1$

43) Evaluate the following limit, if necessary use l'Hôpital Rule
$\lim_{x \to \frac{\pi}{2}} (\sin x)^{\tan x}$

44) Evaluate the following limit, if necessary use l'Hôpital Rule
$\lim_{x \to 0^+} (\cos x)^{\frac{1}{x^2}}$

45) Let $w(x, y) = xy + \frac{e^y}{y^2+1}$ for all $(x, y) \in R^2$. Calculate $\frac{\partial^2 w}{\partial y \partial x}$ and $\frac{\partial^2 w}{\partial x \partial y}$

46) If $U(x, y, z) = \log(x^3 + y^3 + z^3)$, find $\frac{\partial U}{\partial x} + \frac{\partial U}{\partial y} + \frac{\partial U}{\partial z}$

47) If $V(x,y) = e^x(x \cos y - y \sin y)$, then prove that $\frac{\partial^2 V}{\partial x^2} = \frac{\partial^2 V}{\partial y^2} = 0$

48) If (x,y) = log $\left(\frac{x^2+y^2}{x+y}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}$ = 1

49) If u=sin^{-1} $\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, Show that x $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y} = \frac{1}{2}tanu$

50) Evaluate$\int_1^4(2x^2-3)$ dx, as the limit of a sum

51) Evaluate the following integrals as the limits of sums.

$\int_0^1(5x+4)dx$

52) Prove that $\int_0^{\frac{\pi}{4}} \frac{sin2xdx}{sin^4x+cos^4x} = \frac{\pi}{4}$

53) Evaluate the following integrals using properties of integration:

$\int_{\frac{\pi}{8}}^{\frac{3\pi}{8}} \frac{1}{1+\sqrt{tanx}}dx$

54) Using integration find the area of the region bounded by triangle ABC, whose vertices A, B, and C are (−1,1), (3, 2), and (0,5) respectively

55) In a murder investigation, a corpse was found by a detective at exactly 8 p.m. Being alert, the detective also measured the body temperature and found it to be 70^{o}F. Two hours later, the detective measured the body temperature again and found it to be 60^{o}F. If the room temperature is 50^{o}F, and assuming that the body temperature of the person before death was 98.6^{o}F, at what time did the murder occur?
[log(2.43)=0.88789; log(0.5)=-0.69315]

56) At 10.00 A.M. a woman took a cup of hot instant coffee from her microwave oven and placed it on a nearby Kitchen counter to cool. At this instant the temperature of the coffee was 180^o F, and 10 minutes later it was 160^{o}F. Assume that constant temperature of the kitchen was 70^{o}F.
(i) What was the temperature of the coffee at 10.15A.M.?
(ii) The woman likes to drink coffee when its temperature is between 130^{o}F and 140^{o}F.between what times should she have drunk the coffee?

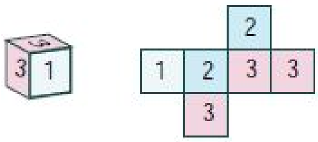
57) A pot of boiling water at 100^{o}C is removed from a stove at time t = 0 and left to cool in the kitchen. After 5 minutes, the water temperature has decreased to 80^{o}C , and another 5 minutes later it has dropped to 65^{o}C . Determine the temperature of the kitchen.

58) A retailer purchases a certain kind of' electronic device from a manufacturer. The manufacturer ,indicates that the defective rate of the device is 5%. The inspector of the retailer randomly picks 10

items from a shipment. What is the probability that there will be
(i) at least one defective item
(ii) exactly two defective items.

59) If the probability that a fluorescent light has a useful life of at least 600 hours is 0.9, find the probabilities that among 12 such lights
(i) exactly 10 will have a useful life of at least 600 hours;
(ii) at least 11 will have a useful life of at I least 600 hours; I
(iii) at least 2 will not have a useful life of at : least 600 hours.

60) A six sided die is marked '1' on one face, '2' on two of its faces, and '3' on remaining three faces. The die is rolled twice. If X denotes the total score in two throws.
(i) Find the probability mass function.
(ii) Find the cumulative distribution function.
(iii) Find $P(3 \leq X < 6)$ (iv) Find $P(X \geq 4)$.



61) A random variable X has the following probability mass function

x	1	2	3	4	5	6
f(x)	k	2k	6k	5k	6k	10k

Find
(i) $P(2 < X < 6)$
(ii) $P(2 \leq X < 5)$
(iii) $P(X \leq 4)$
(iv) $P(3 < X)$

62) Suppose that f (x) given below represents a probability mass function

x	1	2	3	4	5	6
f(x)	c^2	$2c^2$	$3c^2$	$4c^2$	c	2c

Find
(i) the value of c
(ii) Mean and variance.

63) Using the equivalence property, show that $p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$

64)
Define an operation$*$ on Q as follows: $a*b=\left(\frac{a+b}{2}\right)$; $a,b \in Q$.

Examine the existence of identity and the existence of inverse for the operation * on Q.

65) Verify whether the following compound propositions are tautologies or contradictions or contingency
$((p \to q) \wedge (q \to r)) \to (p \to r)$

66) Let M= $\left\{\begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in R - \{0\}\right\}$ and let * be the matrix multiplication.
Determine whether M is closed under $*$. If so, examine the commutative and associative properties satisfied by $*$ on M.

67) Let M= $\left\{\begin{pmatrix} x & x \\ x & x \end{pmatrix} : x \in R - \{0\}\right\}$ and let $*$ be the matrix multiplication.
Determine whetherM is closed under $*$. If so, examine the existence of identity, existence of inverse properties for the operation $*$ on M.

68) Let A be Q\{1}. Define $*$ on A by x*y = x + y − xy . Is $*$ binary on A? If so, examine the commutative and associative properties satisfied by $*$ on A.

69) Let A be Q\{1}. Define $*$ on A by x*y = x + y − xy . Is $*$ binary on A? If so, examine the existence of identity, existence of inverse properties for the operation $*$ on A.

70) Prove that p→(¬q V r) ≡ ¬pV(¬qVr) using truth table.

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