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Padasalai's Centum Coaching Team – Special Question Paper

Maximum Marks : 200

MATHEMATICS

Time Allowed : 3

Hrs

Standard: 12

PART – A

Note: (i) All Questions are compulsory.

(ii) choose the most suitable answer from the given four alternatives

40×1= 40

1. If the rank of the matrix $\begin{pmatrix} \lambda & -1 & 0 \\ 0 & \lambda & -1 \\ -1 & 0 & \lambda \end{pmatrix}$ is 2, then λ is, a) 1 b) 2 c) 3 d) any real number
2. If A is a square matrix of order n then $|\text{adj}A|$ is a) $|A|^2$ b) $|A|^n$ c) $|A|^{n-1}$ d) $|A|$
3. If I is the unit matrix of order n, where $k \neq 0$ is a constant, then $\text{adj}(kI)$ is
a) $k^n \text{adj}(I)$ b) $k \text{adj}(I)$ c) $k^2 \text{adj}(I)$ d) $k^{n-1} \text{adj}(I)$
4. If \vec{p} and \vec{q} and $\vec{p} + \vec{q}$ are vectors of magnitude λ then the magnitude of $|\vec{p} - \vec{q}|$ is
a) 2λ b) $\sqrt{3}\lambda$ c) $\sqrt{2}\lambda$ d) 1
5. If a line makes 45° , 60° with positive direction of axes x and y then the angle it makes with the z axis is a) 30° b) 90° c) 45° d) 60°
6. $\vec{r} = s\vec{i} + t\vec{j}$ is the equation of
a) a straight line joining the points \vec{i} and \vec{j} b) xoy plane
c) yoz plane d) zox plane
7. If the magnitude of moment about the point $\vec{j} + \vec{k}$ of a force $\vec{i} + a\vec{j} - \vec{k}$ acting through the point $\vec{i} + \vec{j}$ is $\sqrt{8}$ then the value of a is a) 1 b) 2 c) 3 d) 4
8. If $z_n = \cos \frac{n\pi}{3} + i \sin \frac{n\pi}{3}$ then $z_1 z_2 z_3 \dots z_6$ is a) 1 b) -1 c) i d) -i
9. If $-\bar{z}$ lies in the third quadrant then z lies in the quadrant
a) first quadrant b) second quadrant c) third quadrant d) fourth quadrant
10. If $x = \cos\theta + i \sin\theta$ then the value of $x^n + \frac{1}{x^n}$ is a) $2\cos n\theta$ b) $2i \sin n\theta$ c) $2\sin n\theta$ d) $2i \cos n\theta$
11. The length of the latus rectum of the parabola $y^2 - 4x + 4y + 8 = 0$ is a) 8 b) 6 c) 4 d) 2
12. The directrix of the parabola $y^2 = x + 4$ is a) $x = \frac{15}{4}$ b) $x = -\frac{15}{4}$ c) $x = -\frac{17}{4}$ d) $x = \frac{17}{4}$
13. The length of the latus rectum of the parabola whose vertex (2, -3) and the directrix $x = 4$ is.
a) 2 b) 4 c) 6 d) 8
14. The eccentricity of the conic $9x^2 + 5y^2 - 54x - 40y + 116 = 0$ is a) $\frac{1}{3}$ b) $\frac{2}{3}$ c) $\frac{4}{9}$ d) $\frac{2}{5}$
15. The normal to the rectangular hyperbola $xy = 9$ at $(6, \frac{3}{2})$ meets the curve again at.
a) $(\frac{3}{8}, 24)$ b) $(-24, -\frac{3}{8})$ c) $(-\frac{3}{8}, -24)$ d) $(24, \frac{3}{8})$
16. A spherical snowball is melting in such a way that its volume is decreasing at a rate of $1 \text{ cm}^3 / \text{min}$. The rate at which the diameter is decreasing when the diameter is 10 cms is
a) $\frac{-1}{50\pi} \text{ cm/min}$ b) $\frac{1}{50\pi} \text{ cm/min}$ c) $\frac{-11}{75\pi} \text{ cm/min}$ d) $\frac{-2}{75\pi} \text{ cm/min}$
17. For what value of x is the rate of increase $x^3 - 2x^2 + 3x + 8$ is twice the rate of increase of x.
a) $(-\frac{1}{3}, -3)$ b) $(\frac{1}{3}, 3)$ c) $(-\frac{1}{3}, 3)$ d) $(\frac{1}{3}, 1)$
18. The curve $y = ax^3 + bx^2 + cx + d$ has a point of inflexion at $x = 1$ then
a) $a+b = 0$ b) $a+3b = 0$ c) $3a + b = 0$ d) $3a + b = 1$
19. If $u = f\left(\frac{y}{x}\right)$ then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$ is equal to. a) 0 b) 1 c) 2 u d) u

- 20 The curve $9y^2 = x^2(4-x^2)$ is symmetrical about. a) y axis. b) x axis. c) $y = x$ d) both the axes.
21. 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) $7/2$
- 22 The volume, when the curve $y = \sqrt{3+x^2}$ from $x = 0$ to $x = 4$ is rotated about x axis is
.a) 100π b) $\frac{100}{9}\pi$ c) $\frac{100}{3}\pi$ d) $100/3$
- 23 The length of the arc of the curve $x^{2/3} + y^{2/3} = 4$ is. a) 48 b) 24 c) 12 d) 96
- 24 Solution of $\frac{dx}{dy} + mx = 0$, where $m < 0$ is. a) $x = ce^{my}$. b) $x = ce^{-my}$. c) $x = my + c$. d) $x = c$.
- 25 The complementary function of $(D^2 + 1) y = e^{2x}$ is.
a) $(Ax+B)e^x$. b) $A \cos x + B \sin x$. c) $(Ax+B)e^{2x}$. d) $(Ax+B)e^{-x}$.
26. The particular integral of the differential equation $f(D) y = e^{ax}$ where $f(D) = (D-a) g(D)$, $g(a) \neq 0$ is.
a) me^{ax} b) $e^{ax} / g(a)$ c) $g(a) e^{ax}$ d) $xe^{ax} / g(a)$
27. Which of the following is not a binary operation on R ?
a) $a * b = ab$. b) $a * b = a - b$ c) $a * b = \sqrt{ab}$ d) $a * b = \sqrt{a^2 + b^2}$
- 28 A monoid becomes a group if it also satisfies the
a) closure axiom. b) associative axiom c) identity axiom
d) inverse axiom.
- 29 Which of the following is not a group ? a) $(Z_n, +_n)$. b) $(Z, +)$ c) $(Z, .)$ d) $(R, +)$
30. In 5 throws of a die, getting 1 or 2 is a success. The mean number of successes is
a) $5/3$ b) $3/5$ c) $5/9$ d) $9/5$
31. The mean of binomial distribution is 5 and its standard deviation is 2. Then the value of n and p are.
a) $(\frac{4}{5}, .25)$ b) $(25, \frac{4}{5})$ c) $(\frac{1}{5}, .25)$ d) $(25, \frac{1}{5})$
- 32 The marks secured by 400 students in a Mathematics test were normally distributed with mean 65. If 120 students got more marks above 85, the number of students securing marks between 45 and 65 is. a) 120 b) 20 c) 80 d) 160
- 33 The centre and radius of the sphere given by $x^2 + y^2 + z^2 - 6x + 8y - 10z + 1 = 0$
a) $(-3, 4, -5)$, 49 b) $(-6, 8, -10)$, 1 c) $(3, -4, 5)$, 7 d) $(6, -8, 10)$,
- 34 If $\vec{a}, \vec{b}, \vec{c}$ are three mutually perpendicular unit vectors, then $|\vec{a} + \vec{b} + \vec{c}| =$ a) 3 b) 9 c) $3\sqrt{3}$ d) $\sqrt{3}$
- 35 Which of the following is incorrect ? a) $\operatorname{Re}(Z) \leq |Z|$ b) $\operatorname{Im}(Z) \leq |Z|$ c) $Z\bar{Z} = |Z|^2$ d) $\operatorname{Re}(Z) \geq |Z|$
- 36 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) $\frac{a^2}{l^2} - \frac{b^2}{m^2} = \frac{(a^2 + b^2)^2}{n^2}$
- 37 Which of the following function is increasing in $(0, \infty)$ a) e^x . b) $1/x$ c) $-x^2$ d) x^{-2} .
- 39 The curved surface area of a sphere of radius 5, intercepted between two parallel planes of distance 2 and 4 from the centre is. a) 20π b) 40π c) 10π d) 30π
- 38 The amount present in a radio active element disintegrates at a rate proportional to its amount. The differential equation corresponding to the above statement is (k is negative)
a) $\frac{dp}{dt} = \frac{k}{p}$ b) $\frac{dp}{dt} = kt$ c) $\frac{dp}{dt} = kp$ d) $\frac{dp}{dt} = -kt$
- 39 In the set of integers with operation * defined by $a * b = a + b - ab$, the value of $3 * (4 * 5)$ is.
a) 25 b) 15 c) 10 d) 5
- 40 X is a random variable taking the values 3, 4 and 12 with probabilities $1/3$, $1/4$ and $5/12$. Then $E(X)$ is. a) 5 b) 6 c) 7 d) 3

PART - B

Note (i) Answer any ten questions

(ii) Question Number 55 is compulsory and choose any nine questions from the remaining

10×6=60

- 41 State and prove reversal law for inverses of matrices.
- 42 Examine the consistency of the following system of equations. If it is consistent then solve the same.
 $x - 4y + 7z = 14$; $3x + 8y - 2z = 13$; $7x - 8y + 26z = 5$
- 43 The mid point of the hypotenuse of a right angled triangle is equidistant from its vertices.
- 44 (a) If the points $(\lambda, 0, 3)$, $(1, 3, -1)$ and $(-5, -3, 7)$ are collinear then find λ .
 (b) Find the angle between the lines. $\vec{r} = 5\vec{i} - 7\vec{j} + \mu(-\vec{i} + 4\vec{j} + 2\vec{k})$
 $\vec{r} = -2\vec{i} + \vec{k} + \lambda(3\vec{i} + 4\vec{k})$
- 45 Simplify: $\frac{(\cos \alpha + i \sin \alpha)^3}{(\sin \beta + i \cos \beta)^4}$
- 46 If $(a_1 + ib_1)(a_2 + ib_2) \dots (a_n + ib_n) = A + iB$, prove that (i) $(a_1^2 + b_1^2)(a_2^2 + b_2^2) \dots (a_n^2 + b_n^2) = A^2 + B^2$
 (ii) $\tan^{-1}\left(\frac{b_1}{a_1}\right) + \tan^{-1}\left(\frac{b_2}{a_2}\right) + \dots + \tan^{-1}\left(\frac{b_n}{a_n}\right) = k\pi + \tan^{-1}\left(\frac{B}{A}\right)$, $k \in \mathbb{Z}$
- 47 Find the equation of the hyperbola whose foci are $(5, \pm 4)$ and eccentricity is $3/2$.
- 48 Show that $x^2 - y^2 = a^2$ and $xy = c^2$ cut orthogonally.
- 49 The current at time t in a coil with resistance R, inductance L and subjected to a constant electromotive force E is given by $i = \frac{E}{R} \left(1 - e^{-\frac{RT}{L}}\right)$ Obtain a suitable formula to be used when R is very small.
- 50 Solve : $\frac{dy}{dx} = 1 + x + y + xy$
- 51 Solve: $(2D^2 + 5D - 2)y = e^{-\frac{1}{3}x}$
- 52 Construct the truth table for $(p \vee q) \wedge r$
- 53 Show that the set of all 2 X 2 non-singular matrices forms a non-abelian infinite group under matrix multiplication, (where the entries belong to R).
- 54 If $f(x) = \begin{cases} \frac{A}{x} & , 1 < x < e^3 \\ 0 & , \text{elsewhere} \end{cases}$ is a probability density function of a continuous random variable X, find $p(x > e)$
- 55 (a) Find $\frac{\partial w}{\partial u}$ and $\frac{\partial w}{\partial v}$ if $w = \sin^{-1} xy$ where $x = u + v$, $y = u - v$.
 (b) Find the volume of the solid that results when the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ ($a > b > 0$) is revolved about the minor axis.

PART - C

Note (i) Answer any ten questions

(ii) Question Number 70 is compulsory and choose any nine questions from the remaining

10×10=100

56 If $A = \frac{1}{3} \begin{bmatrix} 2 & 2 & 1 \\ -2 & 1 & 2 \\ 1 & -2 & 2 \end{bmatrix}$, prove that $A^{-1} = A^T$.

57 Show that the lines $\frac{x-1}{1} = \frac{y+1}{-1} = \frac{z}{3}$ and $\frac{x-2}{1} = \frac{y-1}{2} = \frac{-z-1}{1}$ intersect and find their point of intersection.

58 If P represents the variable complex number z, find the locus of P $\arg \left(\frac{z-1}{z-i} \right) = \frac{\pi}{3}$

59 The arch of a bridge is in the shape of a semi-ellipse having a horizontal span of 40ft and 16ft high at the centre. How high is the arch, 9ft from the right or left of the centre.

60 Find the equation of the hyperbola if

(ii) its asymptotes are parallel to $x+2y-12=0$ and $x-2y+8=0$, (2,4) is the centre of the hyperbola and it passes through (2,0).

61 Find the axis, vertex, focus, directrix, equation of the latus rectum, length of the latus rectum for the following parabolas and hence draw their graphs. (iv) $y^2 - 8x + 6y + 9 = 0$

62 At noon, ship A is 100 km west of ship B. Ship A is sailing east at 35 km / hr and ship B is sailing north at 25 km / hr. How fast is the distance between the ships changing at 4.00 p.m.

63 Show that the volume of the largest right circular cone that can be inscribed in a sphere of radius a is $\frac{8}{27}$ (volume of the sphere).

64 Find the area of the region bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

65 Prove that the curved surface area of a sphere of radius r intercepted between two parallel planes at a distance a and b from the centre of the sphere is $2\pi r(b-a)$ and hence deduce the surface area of the sphere. ($b > a$).

Example 8.7 :

66 $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 2e^{3x}$ when $x = \log 2$, $y = 0$ and $x = 0$, $y = 0$

67 A drug is excreted in a patient's urine. The urine is monitored continuously using a catheter. A patient is administered 10 mg of drug at time $t = 0$, which is excreted at a rate of $-3t^{1/2}$ mg/h.

(i) What is the general equation for the amount of drug in the patient at time $t > 0$?

(ii) When will the patient be drug free?

68 Show that the set $G = \{a + b\sqrt{2} / a, b \in \mathbb{Q}\}$ is an infinite abelian group with respect to addition.

69 The total life time (in year) of 5 year old dog of a certain breed is a Random Variable whose distribution function is given by

$$F(x) = \begin{cases} 0 & , \text{ for } x \leq 5 \\ 1 - \frac{25}{x^2} & , \text{ for } x > 5 \end{cases}$$

(ii) less than 8 years (iii) anywhere between 12 to 15 years.

70 (a) Derive the equation of the plane in the intercept form. (both in vector and cartesian form)

(b) Trace the following curve : $y = x^3$

Padasalai's Centum Coaching Team

மாணவர்கள் செய்ய வேண்டியது என்ன?

1. **[Click Here & Enter Your Details \(Students Only\)](#)**
2. நமது பாடசாலை வலைதளத்தில் வழங்கப்படும் சிறப்பு வினாத்தாளை பிரிண்ட் எடுத்து விடுமுறை நாட்களில் முழுமையான, முறையான தேர்வு எழுதி வினாத்தாள் தயாரித்து வழங்கிய ஆசிரியருக்கு அனுப்பி வைக்க வேண்டும்.
3. A4 Size (Or) Legal Size உள்ள துணிக்கவர்கள் இரண்டு வாங்கிக்கொள்ள வேண்டும். ஒரு தாளில் வினாத்தாள் தயாரித்த ஆசிரியர் முகவரியை "பெறுநர்" பகுதியில் குறிப்பிட்டு அதில் தங்கள் விடைத்தாளை வைக்க வேண்டும்.
4. மற்றோரு கவரில் மாணவர்கள் தங்கள் சுயமுகவரியை "பெறுநர்" எனும் இடத்தில் எழுதி அதற்கு தேவையான அளவில் ஸ்டாம்ப்களையும் ஒட்டிய பிறகு, அக்கவரையும் விடைத்தாள் எழுதி அனுப்பும் கவருக்குள்ளேயே வைத்து அனுப்ப வேண்டும்.
5. ஒன்றுக்கும் மேற்பட்ட மாணவர்கள் இணைந்து விடைத்தாளை அனுப்பினால் மொத்தமாக ஒரே கவரில் அனுப்பலாம்.
6. ஆசிரியர்கள் தங்கள் விடைத்தாளை திருத்திய பிறகு தங்கள் சுயவிவரம் கவரில் (Return Cover) வைத்து தங்களுக்கு விரைவில் திருப்பி அனுப்புவார்.
7. தங்கள் விடைத்தாளை உரிய ஆசிரியருக்கு அனுப்பி வைத்த தேதியிலிருந்து 3 வாரங்களுக்குள் தங்களுக்கு மூல கிடைக்காவிடில் இங்கு தரப்பட்டுள்ள "புகார் பதிவு படிவத்தில்" தங்கள் விவரத்தை பதிவு செய்யவும். **[Click Here for Complaint Box!](#)**
8. Slow Learners மூது மட்டும் கவனம் செலுத்தாமல் மூத்திறன் மிகுந்த மாணவர்களுக்கும் உதவும் நோக்கில், மாணவர்களின் நலன் கருதி, இச்சேவையில் தங்களை இணைத்துக்கொண்டுள்ள பாடசாலை ஆசிரியர் குழுவினை, மாணவர்கள் மிகுந்த பணிவுடன் தொடர்பு கொண்டு திருத்தப்பட்ட விடைத்தாள் குறித்த தங்கள் சந்தேகங்களையும், ஆலோசனைகளையும் அலைபேசி மூலமாக பெறலாம்.

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