# Padasalai's Centum Coaching Team – Special Question Paper

## MATHS

**DATE:** **TIME: 3 hrs**

**CLASS: XII** **Max.Marks:200**

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**SECTION – A** **[40x1=40]**

**N.B. i) Answer all the questions.**
**ii) Each questions carries one mark.**

1. f A is a matrix of order 3, then det(kA)
   1) $k^3$ det (A) 2) $k^2$ det (A) 3) k det (A) 4) det (A)

2. Inverse of $\begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$ is 1) $\begin{bmatrix} 2 & -1 \\ -5 & 3 \end{bmatrix}$ 2) $\begin{bmatrix} -2 & 5 \\ 1 & -3 \end{bmatrix}$ 3) $\begin{bmatrix} 3 & -1 \\ -5 & -3 \end{bmatrix}$ 4) $\begin{bmatrix} -3 & 5 \\ 1 & -2 \end{bmatrix}$

3. If the equation -2x + y + z = $l$ ; x - 2y +z = m ; x + y -2z = n such that $l$+m+n = 0, then the system has
   1) a non-zero unique solution 2) trivial solution
   3) infinitely many solution 4) No solution

4. In the system of 3 linear equations with three unknowns, if $\Delta = 0$, $\Delta_x = 0$, $\Delta_y = 0, \Delta_z = 0$ and atleast one 2x2 minor of $\Delta \neq 0$ then the system is
   1) consistent 2) inconsistent
   3) consistent and the system reduces to two equations
   4) consistent and the system reduces to a single equation.

5. If $\vec{u} = \vec{a} \times (\vec{b} \times \vec{c}) + \vec{b} \times (\vec{c} \times \vec{a}) + \vec{c} \times (\vec{a} \times \vec{b})$, then
   1) u is a unit vector 2) $\vec{u} = \vec{a} + \vec{b} + \vec{c}$ 3) $\vec{u} = \vec{0}$ 4) $\vec{u} \neq \vec{0}$

6. If $\vec{p}, \vec{q}$ and $\vec{p} + \vec{q}$ are vectors of magnitude $\lambda$ then the magnitude of $|\vec{p} - \vec{q}|$ is
   1) $2\lambda$ 2) $\sqrt{3}\lambda$ 3) $\sqrt{2}\lambda$ 4) 1

7. If $\overrightarrow{PR} = 2\vec{i} + \vec{j} + \vec{k}$, $\overrightarrow{QS} = -\vec{i} + 3\vec{j} + 2\vec{k}$ then the area of the quadrilateral PQRS is
   1) $5\sqrt{3}$ 2) $10\sqrt{3}$ 3) $5\frac{\sqrt{3}}{2}$ 4) $\frac{3}{2}$

8. If $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \times \vec{b}) \times \vec{c}$ for non-coplanar vectors $\vec{a}, \vec{b}, \vec{c}$ then
   1) $\vec{a}$ parallel to $\vec{b}$ 2) $\vec{b}$ parallel to $\vec{c}$ 3) $\vec{c}$ parallel to $\vec{a}$ 4) $\vec{a} + \vec{b} + \vec{c} = \vec{0}$

9. shortest distance of the point (2 , 10 , 1) from the plane $\vec{r} \cdot \left[3\vec{i} - \vec{j} + 4\vec{k}\right] = 2\sqrt{26}$ is
   1) $2\sqrt{26}$ 2) $\sqrt{26}$ 3)2 4) $\frac{1}{\sqrt{26}}$

10. The vector equation of a plane whose distance from the origin is p and perpendicular to a unit vector $\hat{n}$ is 1. $\vec{r} \cdot \vec{n} = p$ 2. $\vec{r} \cdot \hat{n} = q$ 3. $\vec{r} \times \vec{n} = p$ 4. $\vec{r} \cdot \hat{n} = p$

11. The points $z_1, z_2, z_3, z_4$ in the complex plane are the vertices of a parallelogram taken in order if and only if
   1) $z_1 + z_4 = z_2 + z_3$ 2) $z_1 + z_3 = z_2 + z_4$ 3) $z_1 + z_2 = z_3 + z_4$ 4) $z_1 - z_2 = z_3 - z_4$

12. If $z_n = \cos\frac{n\pi}{3} + i\sin\frac{n\pi}{3}$ then $z_1 z_2 z_3 \ldots z_6$ is

1) 1 2) -1 3) i 4) –i

13. If $a = \cos\alpha - i\sin\alpha$, $b = \cos\beta - i\sin\beta$, $c = \cos\gamma - i\sin\gamma$ then $(a^2c^2 - b^2)/abc$ is

1) $\cos 2(\alpha - \beta + \gamma) + i\sin 2(\alpha - \beta + \gamma)$ 2) $-2\cos(\alpha - \beta + \gamma)$

3) $-2i\sin(\alpha - \beta + \gamma)$ 4) $2\cos(\alpha - \beta + \gamma)$

14. Identify the correct statement

1. Sum of the moduli of two complex numbers is equal to their modulus of the sum
2. Modulus of the product of the complex numbers is equal to the sum of their moduli
3. Arguments of the product of two complex numbers is the product of their arguments.
4. Arguments of the product of two complex numbers is equal to sum of their arguments.

15. The vertex of the parabola $x^2 = 8y - 1$ 1) $\left(-\frac{1}{8}, 0\right)$ 2) $\left(\frac{1}{8}, 0\right)$ 3) $\left(0, \frac{1}{8}\right)$ 4) $\left(0, -\frac{1}{8}\right)$

16. The length of the semi-major and the length of semi-minor axis of the ellipse $\frac{x^2}{144} + \frac{y^2}{169} = 1$ is

1) 26, 12 2) 13, 24 3) 12, 26 4) 13, 12

17. The sum of the distance of any point on the ellipse $4x^2+9y^2 = 36$ from $(\sqrt{5}, 0)$ and $(-\sqrt{5}, 0)$ is

1) 4 2)8 3)6 4)18

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

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

19. The angle between the curves $\frac{x^2}{25} + \frac{y^2}{9} = 1$ and $\frac{x^2}{8} - \frac{y^2}{8} = 1$ is

1) $\frac{\pi}{4}$ 2) $\frac{\pi}{3}$ 3) $\frac{\pi}{6}$ 4) $\frac{\pi}{2}$

20. The parametric equation of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ are

1) $x = a\sin^3\theta$, $y = a\cos^3\theta$ 2) $x = a\cos^3\theta$, $y = a\sin^3\theta$

3) $x = a^3\sin\theta$, $y = a^3\cos\theta$ 4) $x = a^3\cos\theta$, $y = a^3\sin\theta$

21. The value of 'a' so that the curves $y = 3e^x$ and $y = \frac{a}{3}e^{-x}$ intersect orthogonally is

1) -1 2) 1 3) $\frac{1}{3}$ 4) 3

22. A continuous graph $y = f(x)$ is such that $f'(x) \to \infty$ as $x \to x_1$ at $(x_1, y_1)$. Then $y = f(x)$ has a

1. vertical tangent $y = x_1$
2. horizontal tangent $x = x_1$
3. vertical tangent $x = x_1$
4. horizontal tangent $y = y_1$

23. An asymptote to the curve $y^2(a + 2x) = x^2(3a - x)$ is

1) $x = 3a$ 2) $x = -\frac{a}{2}$ 3) $x = \frac{a}{2}$ 4) $x = 0$

24. The curve $y^2(2+x) = x^2(6-x)$ exists for

1. $-2 < x \leq 6$ 2. $-2 \leq x \leq 6$ 3. $-2 < x < 6$ 4. $-2 \leq x < 6$

25. The area of the region bounded by the graph of y = sinx and y = cosx between x = 0 and $x = \frac{\pi}{4}$ is 1) $\sqrt{2}+1$ 2) $\sqrt{2}-1$ 3) $2\sqrt{2}-2$ 4) $2\sqrt{2}+2$

26. The volume generated when the region bounded by y = x, y =1, x = 0 is rotated about y-axis is

1) $\frac{\pi}{4}$ 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{3}$ 4) $\frac{2\pi}{3}$

27. The curved surface area of a sphere of radius 5, intercepted between two parallel planes of distance 2 and 4 from the centre is

1) $20\pi$ 2) $40\pi$ 3) $10\pi$ 4) $30\pi$

28. $\int_0^a f(x)dx + \int_0^a f(2a-x)dx =$

1. $\int_0^a f(x)dx$ 2. $2\int_0^a f(x)dx$ 3. $\int_0^{2a} f(x)dx$ 4. $\int_0^{2a} f(a-x)dx$

29. The degree of the differential equation $\sqrt{1+\left(\frac{dy}{dx}\right)^{1/3}} = \frac{d^2y}{dx^2}$ is

1) 1 2) 2 3) 3 4) 6

30. The amount present in a radioactive element disintegrates at a rate proportional to its amount. The differential equation corresponding to the above statement is ( k is negative)

1) $\frac{dp}{dt} = \frac{k}{p}$ 2) $\frac{dp}{dt} = kt$ 3) $\frac{dp}{dt} = kp$ 4) $\frac{dp}{dt} = -kt$

31. If $f'(x) = \sqrt{x}$ and $f(1) = 2$, then $f(x)$ is

1) $-\frac{2}{3}(x\sqrt{x}+2)$ 2) $\frac{3}{2}(x\sqrt{x}+2)$ 3) $\frac{2}{3}(x\sqrt{x}+2)$ 4) $\frac{2}{3}x(\sqrt{x}+2)$

32. Identify the incorrect statement.

1. The order of a differential equation is the order of the highest order derivative occurring in it.
2. The degree of the differential equation is the degree of the highest order derivative which occurs in it. (The derivatives are free from radicals and fractions).
3. $\frac{dy}{dx} = \frac{f_1(x,y)}{f_2(x,y)}$ is the first order and first degree homogeneous differential equation.
4. $\frac{dy}{dx} + xy = e^x$ is a linear differential equation in $x$.

33. In the set of real numbers R, an operation * is defined by a * b = $\sqrt{a^2+b^2}$

Then the value of (3 * 4)* 5 is

1)5 2)$5\sqrt{2}$ 3)25 4)50

34. In the multiplicative group of $n^{th}$ roots of unity, the inverse of $\omega^k$ is (k < n)

1) $\omega^{1/k}$ 2) $\omega^{-1}$ 3) $\omega^{n-k}$ 4) $\omega^{n/k}$

35. In the set of integers under the operation * defined by a * b = a + b -1, the identity element is

1)0 2)1 3)a 4)b

36. In congruence modulo5, $\{x \in z / x = 5k+2,\ k \in z\}$ represents

1. $[0]$ 2. $[5]$ 3. $[7]$ 4. $[2]$.

37. Variance of the random variable X is 4. Its mean is 2. Then $E(X^2)$ is

1)2 2)4 3)6 4)8

38. In 5 throws of a die, getting 1 or 2 is a success. The mean number of successes is

1. $\frac{5}{3}$ 2. $\frac{3}{5}$ 3. $\frac{5}{9}$ 4. $\frac{9}{5}$

39. If the mean and standard deviation of a binomial distribution are 12 and 2. Then the value of its parameter p is

1. $\frac{1}{2}$ 2. $\frac{1}{3}$ 3. $\frac{2}{3}$ 4. $\frac{1}{4}$

40. A discrete random variable X has probability mass function p(x), then

1. $0 \le p(x) \le 1$ 2. $p(x) \ge 0$ 3. $p(x) \le 1$ 4. $0 < p(x) < 1$

## SECTION - B

**N.B: i) Answer any TEN questions. [10x6=60]**

**ii) Question 55 is compulsory and choose any NINE questions from the remaining**

**(iii) Each questions carries 6 marks.**

41. (i) If $A = \begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ -1 & 1 \end{bmatrix}$, then verify that $(AB)^{-1} = B^{-1}A^{-1}$.

(ii) If $A = \begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ -1 & 1 \end{bmatrix}$, then verify that $(AB)^{T} = B^{T}A^{T}$.

42. Solve the following non-homogeneous equations of three unknowns

x+y+2z = 4; 2x+2y+4z = 8 ;3x+3y+6z = 10.

43. Show that $\begin{bmatrix} \vec{a}+\vec{b} & \vec{c} & \vec{b}+\vec{c} \end{bmatrix} = \begin{bmatrix} \vec{a} & \vec{b} & \vec{c} \end{bmatrix}$

44. (i) Find the direction cosines of the line joining (2, -3, 1) and (3, 1, -2).

(ii) Find the angle between the following planes 2x-3y+4z = 1 and -x+y = 4.

45. For any polynomial equation p(x)=o with real coefficients, imaginary(complex) roots occur in conjugate pairs.

46. $(a+b+c)(a+b\omega+c\omega^2)(a+b\omega^2+c\omega) = a^3+b^3+c^3-3abc$

47. It took 14 sec for a thermometer to rise from -19° C to 100° C when it was taken from a freezer and placed in boiling water. Show that somewhere along the way the mercury was rising at exactly 8.5° C/sec.

48. If $u$ is homogenous function of $x$ and $y$ of degree $n$, prove that $x\frac{\partial^2 u}{\partial x \partial y} + y\frac{\partial^2 u}{\partial y^2} = (n-1)\frac{\partial u}{\partial y}$.

49. Find the area included between the parabola $y^2 = 4ax$ and its latus rectum.

50. The temperature T of a cooling object drops at a rate proportional to the difference T-S, where S is constant temperature of surrounding medium. If initially T=150□ C,find the temperature of the cooling object at any time t.

51. Show that $p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$

52. State and prove cancellation laws on groups.

53. Find the probability distribution of the number of sixes is throwing three dice once.

54. The probability distribution of a random variable X is given below:

| X | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| P(X=x) | 0.1 | 0.3 | 0.5 | 0.1 |

If $Y= X^2+2X$ find the mean and variance of Y.

55. (i) Find the equation of the ellipse if the length of the semi major axis, and the latus rectum are 7 and $\frac{80}{7}$ respectively, the centre is (2, 5) and the major axis is parallel to the y-axis.

(OR)

(ii) Prove the inequality $(1+x)^n > 1+nx$ is true whenever $x > 0$ and n >1.

## Section – C

**N.B. (i) Answer any TEN questions.**
**(ii) Question No: 70 is compulsory and choose any NINE questions from remaining.**
**(iii) Each questions carries 10 marks. [10x10=100]**

56. Show that the equations x+y+z = 6, x+2y+3z = 14, x+4y+7z = 30 are consistent and solve them.

57. Altitudes of a triangle are concurrent – prove by vector method.

58. 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.

59. Find all the values of $(\sqrt{3}+i)^{\frac{2}{3}}$.

60. Find the axis, vertex, focus, equation of directrix, latus rectum , length of the latus rectum for the parabola $y^2+8x-6y+1=0$ and hence sketch the graph.

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

62. Find the eccentricity, centre, foci, vertices of the ellipse $36x^2+4y^2-72x+32y-44=0$ and draw the diagram.

63. Two sides of a triangle have length 12 m and 15m. The angle between them is increasing at a rate of $2^\circ$/min. How fast is the length of third side increasing when the angle between the sides of fixed length is $60^\circ$?

64. Find the points of inflection and determine the intervals of convexity and concavity of the Gaussion curve $y = e^{-x^2}$.

65. If $w=u^2e^v$ where $u=\frac{x}{y}$ *and* $v=y\log x$, *find* $\frac{\partial w}{\partial x}$ *and* $\frac{\partial w}{\partial y}$.

66. Find the length of the curve $4y^2 = x^3$ between x = 0 and x = 1.

67. Solve the differential equation dy= x3 dy+3x2ydx+secx(secx+tanx)dx

68. Show that the set of four functions $f_1, f_2, f_3, f_4$ on the set of non-zero complex numbers C- { 0 } defined by $f_1(z) = z,\ f_2(z) = -z,\ f_3(z) = \frac{1}{z},\ f_4(z) = -\frac{1}{z}, \forall z \in C - \{0\}$ forms an abelian group with respect to the composition of functions.

69. The air pressure in a randomly selected tyre put on a certain model new car is normally distributed with mean value 31 psi and standard deviation 0.2 psi.
(i)What is the probability that the pressure for a randomly selected tyre
(a) between 30.5 and 31.5 psi (b) between 30 and 32 psi.
(ii) What is the probability that the pressure for a randomly selected tyre exceeds 30.5 psi? [ Area table: P(0<z<2.5) = 0.4938 ].

70. a) Find the area of the region between the line y = x + 1 and the curve $y = x^2 - 1$.

**(OR)**

Solve $(2\sqrt{xy} - x)\,dy + y\,dx = 0$

# 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 சுயவிலாசமிட்ட கவரில் (Return Cover) வைத்து தங்களுக்கு விரைவில் திருப்பி அனுப்புவார்.
7. தங்கள் விடைத்தாளை உரிய ஆசிரியருக்கு அனுப்பி வைத்த தேதியிலிருந்து 3 வாரங்களுக்குள் தங்களுக்கு மூள கிடைக்காவிடில் இங்கு தரப்பட்டுள்ள "புகார் பதிவு படிவத்தில்" தங்கள் விவரத்தை பதிவு செய்யவும். **Click Here for Complaint Box!**
8. Slow Learners மீது மட்டும் கவனம் செலுத்தாமல் மீத்திறன் 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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**If any doubt, Please contact our Padasalai's Centum Coaching Team Co-ordinator:**

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