Total No. of Printed Pages: 13

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CPG-EE-2018 (Mathematics)-(SET-Y)

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Time: 1½ Hours	30/01/18 Anti30/2/18 Total Questions: 100	Sr. No. Max. Marks: 100
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Candidate's Name — Father's Name —	Mother's Name	Date of Birth
Date of Exam :		
(Signature of the Candidate	e)_	(Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

- 1. All questions are *compulsory* and carry equal marks. The candidates are required to attempt all questions.
- 2. The candidates must return the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
- 4. The candidate must not do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers must not be ticked in the question booklet.
- 5. Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.
- 6. There will be negative marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Before answering the questions, the candidates should ensure that they have been supplied correct & complete question booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

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1.	If $A = \begin{bmatrix} x \\ 3 \end{bmatrix}$	$\begin{bmatrix} 3 \\ x \end{bmatrix}$ and $ A^3 = 343$ then x =	a ting	
	$(1) \pm 2$		$(3) \pm 4$	(4) ± 7

- 2. For two non-singular matrices of the same order, the reversal law of multiplication does not hold for:
 - (1) transpose

(2) adjoint

(3) conjugate

- (4) transposed conjugate
- **3.** If α is an eigen value of a non-singular matrix A, then $\frac{|A|}{\alpha}$ is an eigen value of :
 - (1) adj A
- (2) A
- (3) A^{-1}
- (4) None of these
- 4. If the roots of the equation $x^3 + 3px^2 + 3qx + r = 0$ are in G. P. then:
 - (1) $p^3 = r^2 q^3$

(2) $p^3r^2 = q^3$

(3) $p^3 = rq^3$

- (4) $p^3r = q^3$
- **5.** For the equation $x^8 + 5x^3 + 2x 3 = 0$, the least number of imaginary roots is:
- (3) 2

- $\lim_{x\to 0} \frac{\tan x \sin x}{\sin^3 x} =$
 - (1) 3/4
- (2) 3/2
- (3) 1/4
- (4) 1/2
- If a given curve of nth degree has n asymptotes, then the number of points at which these asymptotes cut the curve, is:
 - (1) n-1
- (2) n (n-1)
- (3) n (n-2)
- (4) n (n-3)
- The radius of curvature for the cardioide $r = a (1 + \cos \theta)$ is given by $\rho =$

 - $(1) \frac{a}{2}\cos\frac{\theta}{2} \qquad (2) \frac{3a}{4}\cos\frac{\theta}{2}$
 - (3) $\frac{2a}{3}\cos\frac{\theta}{2}$

- (4) $\frac{4a}{3}\cos\frac{\theta}{2}$
- **9.** The area common to the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is:
 - (1) $32\frac{a^2}{3}$ (2) $16\frac{a^2}{3}$ (3) $8\frac{a^2}{3}$ (4) $\frac{a^2}{3}$

10. The point of oscul-inflexion is a:

(1) an ellipse

(3) a circle

(3) Double cusp of second species

then the locus of these tangents is:

12.	Radius of the sphere $2x^2 + 2y^2 + 2z^2 - 2$	2x + 4y + 2z + 3 = 0 is:
	(1) 2 (2) 0	(3) 4 (4) 8
13.	The condition that the plane $4x^2 - y^2 + 3z^2 = 0$, is:	lx + my + nz = 0 may touch the cor
	$(1) 4l^2 - 12m^2 + 3n^2 = 0$	$(2) 3l^2 - 12m^2 + 4n^2 = 0$
	$(3) 3l^2 - 6m^2 + 4n^2 = 0$	$(4) 4l^2 - 6m^2 + 3n^2 = 0$
14.	The pole of the plane $lx + my + nz = p$	w. r. t. the conicoid $ax^2 + by^2 + cz^2 = 1$ is:
	$(1) \left(\frac{l}{a}, \frac{m}{b}, \frac{n}{c}\right)$	$(2) \left(\frac{a}{lp}, \frac{b}{mp}, \frac{c}{np}\right)$
	(3) $\left(\frac{pl}{a}, \frac{pm}{b}, \frac{pn}{c}\right)$	$(4) \left(\frac{1}{ap}, \frac{m}{bp}, \frac{n}{cp}\right)$
15.	The equation of the plane which cuts the	ne paraboloid $x^2 - 2y^2 - z = 0$ in a conic with i
	centre at the point $\left(2, \frac{3}{2}, 4\right)$, is:	
	(1) 4x - 6y + z - 5 = 0	(2) $4x - 6y - z + 5 = 0$
	(3) $4x+6y+z+5=0$	(4) 4x + 6y - z - 5 = 0
16.	The statement "The number of primes	s infinite" is known as :
	(1) Fundamental theorem of arithmetic	c (2) Euclid's first theorem
-	(3) Euclid's second theorem	(4) Wilson's theorem
17.	When 2 ²⁰ is divided by 7, the remaind	er is:
	(1) 4 (2) 3	(3) 2 (4) 1
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(1) Double cusp with change of species (2) Double cusp of first species

11. For two given confocal conics, if the tangents drawn (one to each) are perpendicular

(2) a hyperbola

(4) a straight line

(4) Single cusp with change of species

18.
$$\phi(450) =$$

- (1) 90
- (2) 100
- (3) 110
- (4) 120

19. If sin(u+iv) = x+iy, then which of the following is true?

(1)
$$\frac{x^2}{\sin^2 u} + \frac{y^2}{\cos^2 u} = 1$$

(2)
$$\frac{x^2}{\sin^2 u} - \frac{y^2}{\cos^2 u} = 1$$

(3)
$$\frac{x^2}{\cos h^2 v} - \frac{y^2}{\sin h^2 v} = 1$$

(4)
$$\frac{x^2}{\cos^2 u} - \frac{y^2}{\sin^2 u} = 1$$

20. If
$$\tan^{-1} 2x + \tan^{-1} 3x = \pi/4$$
, then $x = 0$:

- (1) $\frac{1}{6}$
- (2) $\frac{3}{4}$
- (3) $\frac{2}{3}$

Integrating factor of the differential equation $x^2y dx - (x^3 + y^3) dy = 0$ is:

- (2) $\frac{1}{14}$
- (3) $\frac{1}{xy^3}$ (4) $\frac{1}{x^4}$

22. Solution of the equation
$$p = \log(px - y)$$
 is :

 $(1) \quad y = cx - e^c$

 $(2) \quad y = cx - \log c$

(3) $y = cx + c^2$

(4) $y = cx + e^{c}$

23. Orthogonal trajectories of
$$y^2 = 4ax$$
 are given by :

(1) $2y^2 + x^2 = c^2$

(2) $2x^2 + y^2 = c^2$

(3) $x^2 + y^2 = c^2$

 $(4) 2x^2 - y^2 = c^2$

24. For the differential equation
$$\frac{d^2y}{dx^2} - 4y = e^x + \sin 2x$$
, the particular Integral (P. I.) is :

(1) $-\frac{1}{3}e^x - \frac{1}{8}\cos 2x$

(2) $\frac{1}{3}e^x - \frac{1}{9}\sin 2x$

- (3) $-\frac{1}{2}e^x \frac{1}{8}\sin 2x$
- (4) $\frac{1}{3}e^x + \frac{1}{8}\sin 2x$

25. Solution of
$$(x-3y-z) dx + (2y-3x) dy + (z-x) dz = 0$$
 is:

- (1) $x^2 + 2y^2 z^2 + 6xy + 2xz = c$
- (2) $x^2 + 2y^2 z^2 6xy + 2xz = c$
- (3) $x^2 + 2y^2 + z^2 + 6xy 2xz = c$ (4) $x^2 + 2y^2 + z^2 6xy 2xz = c$

- If \vec{a} , \vec{b} , \vec{c} are unit vectors such that \vec{b} and \vec{c} are non-parallel and $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{2} \vec{b}$, then the angles which \vec{a} makes with \vec{b} and \vec{c} are:
 - (1) $\pi/2, \pi/3$

(2) $\pi/3, \pi/2$

(3) $\pi/3, \pi/4$

- (4) $\pi/2, \pi/4$
- A particle moves along the curve given by $x = 3t^2$, $y = t^2 2t$, $z = t^3$. The acceleration at t = 1 in the direction of vector $\hat{i} + \hat{j} - \hat{k}$ is:
- (2) $\frac{3}{\sqrt{2}}$
- (3) $\frac{4}{\sqrt{3}}$ (4) $\frac{2}{\sqrt{2}}$
- The unit normal vector to the surface $x^4 3xyz + z^2 + 1 = 0$ at the point (1, 1, 1) is : 28.
 - $(1) \quad \frac{1}{\sqrt{11}} \left(\hat{i} + 3\hat{j} \hat{k} \right)$

(2) $\frac{1}{\sqrt{11}}(\hat{i}-3\hat{j}-\hat{k})$

(3) $\frac{1}{\sqrt{11}}(\hat{i}-3\hat{j}+\hat{k})$

- (4) $\frac{1}{\sqrt{11}} (\hat{i} + 3\hat{j} + \hat{k})$
- If ϕ is a scalar point function and \overrightarrow{f} is a vector point function, then which of the following is true in an orthogonal curvilinear system?
 - (1) div $(grad \phi) = 0$

(2) curl $(curl \vec{f}) = \vec{0}$

(3) curl $(\operatorname{div} \overline{f}) = \overline{0}$

- (4) div $(curl \vec{f}) = 0$
- If S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$, then $\iint (xdydz + y dz dx + zdxdy) =$
 - (1) $2\pi a^3$

- (2) $\frac{4}{3}\pi a^3$ (3) $4\pi a^3$ (4) $\frac{3}{4}\pi a^3$
- For the function $f(x) = \sin 2x$ in $\left[0, \frac{\pi}{2}\right]$, the Rolle's theorem is applicable, value of 'C'
 - is:
 - $(1) \pi/3$

- (3) $\pi/6$ (4) $3\pi/8$
- 32. $\lim_{(x,y)\to(0,0)} \frac{x^2y}{x^4+y^2} =$
 - (1) 1/2

(4) limit does not exist

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33. If
$$u = \sin^{-1} \frac{x^2 + y^2}{x + y}$$
, then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{\partial u}{\partial y}$

- (2) $\cos u$ (3) $\tan u$
- (4) cot u

34.
$$\lim_{x \to 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x} \right) =$$

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

The arc-rate of rotation of the binormal at a point of the curve is known as:

(1) Tangent vector

(2) Principal normal

(3) Normal vector

(4) Torsion vector

36. If $z = ae^{-b^2t}\cos bx$, then eliminating the constants a and b, the PDE obtained is :

$$(1) \quad \frac{\partial^2 z}{\partial t^2} + \frac{\partial z}{\partial x} = 0$$

(1) $\frac{\partial^2 z}{\partial t^2} + \frac{\partial z}{\partial r} = 0$ (2) $\frac{\partial^2 z}{\partial r^2} = \frac{\partial^2 z}{\partial t^2}$ (3) $\frac{\partial^2 z}{\partial r^2} + \frac{\partial z}{\partial t} = 0$ (4) $\frac{\partial^2 z}{\partial r^2} = \frac{\partial z}{\partial t}$

(3)
$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial z}{\partial t} = 0$$

$$(4) \quad \frac{\partial^2 z}{\partial x^2} = \frac{\partial z}{\partial t}$$

Solution of the equation p + q = z is:

- (1) $f(x-y, y + \log z) = 0$
- (2) $f(x-y, y-\log z) = 0$
- (3) $f(x+y, y-\log z) = 0$
- (4) f(x-y, y-z) = 0

The equation $u_{xx} + 2u_{yy} + u_{zz} = 2u_{xy} + 2u_{yz}$ is:

- (1) parabolic
- (2) elliptic
- (3) hyperbolic
- (4) None of these

A string is stretched between the fixed points (0, 0) and (1, 0) and released at rest from the position $u = A \sin \pi x$. The subsequent displacement u(x, t) is given by :

(1) A cos c πt cos πx

(2) $A \sin (\pi x + ct)$

(3) $A \sin c \pi t \sin \pi x$

(4) $A \cos c \pi t \sin \pi x$

Particular integral of $(D^2 - D'^2)z = \cos(x + y)$ is:

- (1) $\frac{x}{4}\sin(x+y)$ (2) $x\sin(x+y)$ (3) $\frac{x}{2}\sin(x+y)$ (4) $\frac{x}{2}\cos(x+y)$

The resultant of two forces P and Q is R. The resolved part of R in the direction of P is of magnitude Q. The angle between P and Q is:

(1)
$$2\cos^{-1}\sqrt{\frac{P}{2Q}}$$

(1)
$$2\cos^{-1}\sqrt{\frac{P}{2Q}}$$
 (2) $2\sin^{-1}\sqrt{\frac{P}{2Q}}$ (3) $\sin^{-1}\sqrt{\frac{P}{2Q}}$ (4) $\cos^{-1}\sqrt{\frac{P}{2Q}}$

(3)
$$\sin^{-1} \sqrt{\frac{P}{2O}}$$

$$(4) \quad \cos^{-1} \sqrt{\frac{P}{2Q}}$$

42.	acting at an arbitrary chosen point of the	e bod	dy can be reduced in general to a force ly and a: Negative force (4) Couple
43.	is called:		s of the couple is coincident with this line Wrench (4) Screw
-1.	(1) Ivuil line (2) Central axis	(0)	(1) Second
44.	If a body is slightly displaced and it rerequilibrium is categorized as:	nain	s in equilibrium in any position, then the
	(1) Stable (2) Unstable		
45.	The constant ratio which the limiting frie	ctior	bears to the normal reaction is called:
	(1) Co-efficient of friction	(2)	Statical friction
	(3) Dynamical friction	(4)	Normal friction
46.	The set of all limit points of a set $A \subseteq R$	is ca	lled a:
	(1) Closure of set A	(2)	Open cover of set A
	(3) Derived set of A	(4)	Limiting set of A
47.	$\lim_{n \to \infty} \left(\frac{2}{1} \cdot \frac{3}{2} \cdot \frac{4}{3} \cdot \dots \cdot \frac{n}{n-1} \right)^{1/n} =$		
	(1) 0 (2) 1/2	(3)	1 (4) 2
48.	The series $\sum_{n=3}^{\infty} x^{\log n}$ is:		entropy of the second s
	(1) Convergent	(2)	Divergent
	(3) Convergent if $x < \frac{1}{e}$	(4)	Convergent if $x < e$
49.	The series $x + \frac{x^2}{2} + \frac{x^3}{3} + \dots$		
	(1) Converges absolutely(3) Does not converge	(2) (4)	Converges conditionally None of these
50.	The infinite product $\prod_{n=1}^{\infty} \left(1 + \frac{x}{n}\right)$, $x < 0$:		
	(1) Diverges to zero	(2)	Converges to 1
A X 5 4	(3) Converges absolutely	(4)	Converges to 2
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51.
$$J_{n-1}(x) + J_{n+1}(x) =$$

$$(1) \quad \frac{n}{x} J_n(x)$$

$$(2) \quad \frac{n}{x} J'_n \quad (x)$$

$$(3) \ \frac{x}{2n} J_n(x)$$

(1)
$$\frac{n}{x} J_n(x)$$
 (2) $\frac{n}{x} J'_n(x)$ (3) $\frac{x}{2n} J_n(x)$ (4) $\frac{2n}{x} J_n(x)$

52.
$$P'_{n+1}(x) - xP'_n(x) =$$

(1) n
$$P_n(x)$$

(2)
$$(n+1) P_n(x)$$

(1)
$$n P_n(x)$$
 (2) $(n+1) P_n(x)$ (3) $(n+1) P_{n+1}(x)$ (4) $(2n+1) P_n(x)$

(4)
$$(2n+1) P_n(x)$$

53.
$$H'_n(x) =$$

(1)
$$H_{n+1}(x)$$

(2)
$$n H_{n-1}(x), n \ge 1$$
 (3) $n H_{n+1}(x)$ (4) $2n H_{n-1}(x), n \ge 1$

(4)
$$2n H_{n-1}(x), n \ge 1$$

54. L
$$(t e^{-4t} \sin 3t) =$$

(1)
$$\frac{6(s+4)}{(s^2+8s+25)^2}$$
 (2) $\frac{3(s+4)}{(s^2+8s+25)^2}$

(2)
$$\frac{3(s+4)}{(s^2+8s+25)^2}$$

(3)
$$\frac{6(s+4)}{(s^2+6s+25)^2}$$
 (4) $\frac{3(s+4)}{(s^2+6s+25)^2}$

$$(4) \quad \frac{3(s+4)}{(s^2+6s+25)^2}$$

55. Fourier transform of
$$f(x)$$
 defined by $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$ is:

(1)
$$\frac{2}{s}\cos as$$
 (2) $\frac{4}{s}\sin as$ (3) $\frac{1}{s}\sin as$

(2)
$$\frac{4}{s}\sin as$$

(3)
$$\frac{1}{s}\sin as$$

$$(4) \quad \frac{2}{s} \sin as$$

56. C language is available for which of the operating systems?

- (1) DOS
- (2) UNIX
- (3) Windows (4) All of these

Which of the following is invalid?

- (1) 'a'
- (2) 'ab'
- (3) ' ' (4) " "

The continue command cannot be used with:

- (1) do
- (2) for
- (3) Switch (4) While

Which of the following operator has lowest priority?

- (1) ||
- (2) +
- (3) %
- (4) ++

60. What should be the expression return value for a do-while to terminate?

- (1) -1 (2) 1 (3) 0 (4) NULL

61. It f(x) = x + 1, $x \in [1, 3]$ and partition $P = \{1, 2, 3\}$, then L(f, P) and U(f, P) are:

- (1) 2, 4
- (2) 3, 6
- (3) 4, 7
- (4) 5,7

				A
62.	Value of the integral $\int_{1}^{1} ([x]-x) dx$, [x] be	eing l	the greatest inte	ger function, is:
	(1) -1 (2) 0	(3)	1	(4) 2
63.	The integral $\int_{0}^{1} x^{n} e^{-mx} dx$ converges for : (1) $n < -1$ (2) $n > -1$			
	(1) $n < -1$ (2) $n > -1$	(3)	n < -1, m > 1	(4) $n < -2, m < 1$
64.	$\int_{1}^{\infty} \frac{\sin x}{x^{n}} dx$ converges absolutely for:			
	(1) $n = 0$ (2) $n < 1$	(3)	n = 1	
65.	If A be any subset of a metric space			
	$(1) (A \cap B)^{\circ} = A^{\circ} \cap B^{\circ}$		$(A \cup B)^{\circ} = A^{\circ}$	JB°
	$(3) (A^{\circ} \cup B^{\circ}) \subset (A \cup B)^{\circ}$			
66.	The concepts of continuity and uniform	m cor	ntinuity are equi	valent on:
	(1) a closed set	(2)	an open set	
	(3) a compact set	(4)	a finite set	
67.	Consider the statements :			
	(a) Every Cauchy sequence in a metri	ic spa	ice is convergen	
	(b) A metric space is complete if e subsequence.		cauchy sequer	nce in it has a converge.
	Which of the above is true?			
	(1) Both (a) and (b)	(2		apalalanjanya 4
	(3) Only (b)	(4	Neither (a) no	or (b)
68				
	(a) In a group, the order of an elemen	nt an	d its inverse are	same.
	(b) Let $(G, .)$ be a group and $a \in G$ be	e of o	rder m, then an	= e if and only if m/n .

- Which of the above is true?
- (1) Both (a) and (b)

(2) Only (a)

(3) Only (b)

(4) Neither (a) nor (b)

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- **69.** Let $\phi: G \to G'$ be a homomorphism. The homo-morphism ϕ is an isomorphism of Gonto G' if and only if:
 - (1) Ker $\phi = 0$
- (2) Ker $\phi = \{e\}$ (3) $\phi(a^{-1}) = [\phi(a)]^{-1}$ (4) $\phi(e) = e'$
- **70.** If $G = \{1, i, -1, -i\}$ is a multiplicative group, then order of -i is:
- (2) 3
- (3) 2

- 71. Consider the statements:
 - (a) Union of two subgroups of a group is also a subgroup of that group.
 - (b) Intersection of two subgroups of a group is also a subgroup of that group. Which of the above is true?
 - (1) Only (a)

(2) Only (b)

(3) Both (a) and (b)

- (4) Neither (a) nor (b)
- 72. Choose the wrong statement:
 - (1) Every field is an integral domain
 - (2) Every field is a division ring
 - (3) Every division ring is a field
 - (4) Every finite non-zero integral domain is a field
- If S and T are co-maximal ideals of a commutative ring R with unity then:
 - (1) $ST = S \cap T$

(2) $ST = S \cup T$

(3) ST = R

- (4) $S \cap T = R$
- 74. Choose the incorrect statement:
 - (1) If R is a UFD, then so is R[x].
 - (2) If R is an integral domain with unity, then every irreducible element in R[x] is an irreducible polynomial.
 - (3) If F is a field, then every irreducible polynomial of F[x] is irreducible element of
 - (4) Eisenstein's criterion is necessary for the irreducibility of a polynomial.
- The velocity of a particle moving in a straight line is given by $v^2 = 2x e^x$, then its 75. (1) $\frac{v^2}{2x}(x-1)$ (2) $\frac{v^2}{2}(x+1)$ (3) $\frac{v^2}{2x}(x+1)$ (4) $\frac{v}{2x}(x+1)$

76.	Let	$P(r,\theta)$	be	the	position	of	a	moving	particle	at	time	t,	then	its	transverse
	acce	leration	is:										or from		e if it

$$(1) \quad \frac{1}{r} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right)$$

$$(2) \quad \frac{1}{r} \frac{d}{dt} \left(r^2 \frac{d\theta}{dt} \right)$$

(1)
$$\frac{1}{r}\frac{d}{dt}\left(r\frac{d\theta}{dt}\right)$$
 (2) $\frac{1}{r}\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right)$ (3) $\frac{1}{r^2}\frac{d}{dt}\left(r\frac{d\theta}{dt}\right)$ (4) $\frac{d}{dt}\left(r^2\frac{d\theta}{dt}\right)$

$$(4) \quad \frac{d}{dt} \left(r^2 \, \frac{d\theta}{dt} \right)$$

77. A particle is moving with S. H. M. with amplitude a. The distance x from the centre where the velocity is half that of the maximum velocity is given by:

(1)
$$\frac{2}{3}a$$

(2)
$$\frac{1}{2}a$$

$$(3) \quad \frac{2}{\sqrt{3}}a$$

(3)
$$\frac{2}{\sqrt{3}}a$$
 (4) $\frac{\sqrt{3}}{2}a$

If the maximum horizontal range of a projectile is R, then the greatest height attained

(1)
$$\frac{1}{2}R$$

(2)
$$\frac{1}{3}R$$

$$(3) \ \frac{1}{4}R$$

$$(4) \quad \frac{3}{4}R$$

To a man walking at the rate of 5 km/hr, rain appears to fall vertically. If its real velocity is 10 km/hr, then its real direction to the horizontal is:

(1)
$$\theta = \pi/6$$

(2)
$$\theta = \pi/2$$

(3)
$$\theta = \pi/4$$

(4)
$$\theta = \pi/3$$

80. A particle describes an ellipse under a central orbit, the velocity at any point of its

(1)
$$v^2 = \lambda \left(\frac{2}{r} - \frac{1}{a}\right)$$
 (2) $v^2 = \lambda \left(\frac{2}{r} - \frac{1}{2a}\right)$ (3) $v^2 = \lambda \left(\frac{1}{r} - \frac{2}{a}\right)$ (4) $v^2 = \lambda \left(\frac{1}{r} - \frac{1}{a}\right)$

81. If
$$x^2 + y^2 = v^2 - u^2$$
 and $xy = -uv$, then $\frac{\partial (u, v)}{\partial (x, y)} = \frac{\partial (u, v)}{\partial (x, y)}$

(1)
$$\frac{x^2 - y^2}{u^2 - v^2}$$

$$(2) \quad \frac{x^2 + y^2}{u^2 - v^2}$$

(3)
$$\frac{x^2 - y^2}{u^2 + v^2}$$

(1)
$$\frac{x^2 - y^2}{u^2 - v^2}$$
 (2) $\frac{x^2 + y^2}{u^2 - v^2}$ (3) $\frac{x^2 - y^2}{u^2 + v^2}$ (4) $\frac{x^2 + y^2}{u^2 + v^2}$

82.
$$\int_0^{\pi/2} \sin^3 x \cos^{5/2} x \, dx =$$

(1)
$$\frac{8}{77}$$
 (2) $\frac{4}{77}$ (3) $\frac{3}{44}$

(2)
$$\frac{4}{77}$$

(3)
$$\frac{3}{44}$$

(4)
$$\frac{7}{44}$$

83. Value of
$$\int_0^4 \int_0^{2\sqrt{z}} \int_0^{\sqrt{4z-x^2}} dz \, dx \, dy$$
 is:

- $(2) 8\pi$
- (3) 16π
- $(4) 32\pi$

If f and g are piecewise smooth periodic functions with fourier co-efficients c_n and d_n respectively, then the result $\frac{1}{T} \int_{-T/2}^{T/2} f(t) \overline{g(t)} dt = \sum_{k=-\infty}^{\infty} c_k \overline{d}_k$, is known as:

(1) Conjugate property

(2) Parseval equality

(3) Parseval identity

(4) Dirichlet identity

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85.	The analytic functi	ion whose real part i	$s e^x (x \cos y - y s$	in y), is:
	$(1) ze^z + c$	(2) $z \sin z + c$	$(3) ze^{-z} + c$	$(4) ze^{z+1} + c$
86.	Invariant points of	the bilinear transfor	rmation $w = \frac{(2+i)^2}{2}$	$\frac{z-2}{z}$ are:
		(2) $1 \pm 2i$		
87.	Under the transfo	rmation $w+1=\frac{4}{x^2}$,	the unit circle in	the w-plane corresponds to
	which curve of the (1) Circle	~		(4) Hyperbola
88.	The basis of the si	ub-space spanned b	y the vectors (-3,	1, 2), (0, 1, 3), (2, 1, 0), (1, 1, 1)
	(1) {(1, 1, 1), (0, 1,0), (0,0,1)}	(2) {(1, 1, 1), (0,	1, 3), (0,0,1)}
	(3) {(1, 1, 1), (0, 1, 2	2), (0, 0, 2)}	(4) {(1, 1, 1), (0,	2, 1), (0,0,1)}
89.	possible values of	subspaces of V and dim $(W_1 \cap W_2)$ are: (2) 1, 2 or 3		$W_2 = 5$, dim $V = 7$, then the $W_2 = 5$, do or $W_2 = 5$, do or $W_2 = 5$, dim $W_2 = 5$, di
90.	Let $T: \mathbb{R}^3 \to \mathbb{R}^3$	be a linear transforr	nation given by T	$\Gamma(x, y, z) = \left(\frac{x}{2}, \frac{y}{2}, 0\right)$. The rank
	of T is: (1) 3	(2) 4	(3) 1	(4) 2
91.	following is incorr (1) $\rho(T_2T_1) = \rho(T_2)$ (2) $\rho(T_2T_1) \le \rho(T_2)$ (3) $\rho(T_2T_1) = \rho(T_2)$	ect? if T_1 is singular		rmations, then which of the
92.	The co-ordinates of	f vector (1, 1, 1) rela	tive to basis (1, 1,	2), (2, 2, 1), (1, 2, 2) are:
	$(1) \left(\frac{2}{3}, \frac{1}{3}, 0\right)$	(2) $\left(\frac{2}{3}, \frac{2}{3}, 0\right)$	$(3) \left(\frac{1}{3}, \frac{2}{3}, 0\right)$	$(4) \left(\frac{1}{3}, \frac{1}{3}, 0\right)$
93.	Select the incorrec	t one out of the follo	wing. Dual space	is also named as :
	(1) Algebraic dua		(2) Double Gen	nerated
	(3) Conjugate		(4) Algebraic C	Conjugate
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- 94. Choose the wrong statement:
 - (1) Every normed linear space is an inner product space.
 - (2) Every finite dimensional vector space is an inner product space.
 - (3) Every inner product space is a metric space.
 - (4) Every finite dimensional inner product space has an orthogonal basis.
- **95.** Number of real roots of $x^5 5x + 2 = 0$ is :
 - (1) 2
- (2) 4
- (3) 3
- (4) 5
- 96. The order of convergence of Newton-Raphson iteration formula is:
 - (1) 2
- (2) 1.618
- (3) 1.5
- (4)
- **97.** The convergence in Gauss-Seidal method as compared to Jacobi's method for solving the system of three non-homogeneous linear equations in three variables, is faster by :
 - (1) Three times

(2) Two times

(3) n times

- (4) Convergence are equal
- **98.** The fourth divided difference of the polynomial $3x^3 + 11x^2 + 5x + 11$ over the points x = 0, 1, 4, 6 and 7 is:
 - (1) 3
- (2) 7
- (3) 11
- (4) 17

- 99. Which of the following is correct?
 - (1) $\nabla = 1 E$

(2) $\nabla = 1 + E^{-1}$

(3) $\nabla = E^{-1} - 1$

- (4) $\nabla = 1 E^{-1}$
- **100.** For the IVP y' = -y, $y(0) = y_0$ when the second order Runge-Kutta method is applied with step size h, then y(h) =
 - (1) $\frac{y_0}{2} (h^2 2h + 1)$

(2) $\frac{y_0}{2} (h^2 - 2h + 2)$

(3) $\frac{y_0}{2} (h^2 - 2h - 2)$

(4) $\frac{y_0}{2} \left(h - \frac{h^2}{2} + \frac{h^3}{6} \right)$

Total No. of Printed Pages: 13

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

CPG-EE-2018 (Mathematics)-(SET-Y)

B Used to	Verify Jumble Chart 30/6/18 20/06/18 Auf 30/6/18	Sr. No.	10918	
Time : 1½ Hours Roll No. (in figures)	Total Questions: 100	Sr. No.	Max. Marks : 100	
Candidate's Name — — — Father's Name — — — Date of Exam : — — — — — — — — — — — — — — — — — —	Da	ate of Birth—		
(Signature of the Candidate)		(Signature of	the Invigilator)	

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

- 1. All questions are *compulsory* and carry equal marks. The candidates are required to attempt all questions.
- 2. The candidates must return the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
- 4. The candidate must not do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers must not be ticked in the question booklet.
- 5. Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.
- 6. There will be negative marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Before answering the questions, the candidates should ensure that they have been supplied correct & complete question booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

CPG-EE-2018(Mathematics)-(SET-Y)/(B)

1.	For two given confocal conics, if the tan	igen	its drawn (one to each) are perpendicular,
	then the locus of these tangents is:		
	(1) an ellipse	(2)	a hyperbola
	(3) a circle	(4)	a straight line
2.	Radius of the sphere $2x^2 + 2y^2 + 2z^2 - 2z^2$	c + 4	y + 2z + 3 = 0 is:
	(1) 2 (2) 0	(3)	4 (4) 8
3.	The condition that the plane $lx + my + r$	ız =	0 may touch the cone $4x^2 - y^2 + 3z^2 = 0$,
	is:		
	$(1) 4l^2 - 12m^2 + 3n^2 = 0$	(2)	$3l^2 - 12m^2 + 4n^2 = 0$
	$(3) 3l^2 - 6m^2 + 4n^2 = 0$	(4)	$4l^2 - 6m^2 + 3n^2 = 0$
4.	The pole of the plane $lx + my + nz = p$ w.	r. t.	the conicoid $ax^2 + by^2 + cz^2 = 1$ is:
	(1) $\left(\frac{l}{a}, \frac{m}{b}, \frac{n}{c}\right)$	(2)	$\left(\frac{a}{lp}, \frac{b}{mp}, \frac{c}{np}\right)$
			(lp' mp' np)
	(3) $\left(\frac{pl}{a}, \frac{pm}{b}, \frac{pn}{c}\right)$	(4)	$\left(\frac{1}{ap}, \frac{m}{bp}, \frac{n}{cp}\right)$
5	The equation of the plane which cute the		$\frac{(r-r-r)}{(r-r-r)}$
5.		pai	raboloid $x^2 - 2y^2 - z = 0$ in a conic with its
	centre at the point $\left(2, \frac{3}{2}, 4\right)$, is:		
			4x - 6y - z + 5 = 0
	(3) 4x + 6y + z + 5 = 0	(4)	4x + 6y - z - 5 = 0
6.	The statement "The number of primes is	infi	nite" is known as :
	(1) Fundamental theorem of arithmetic	(2)	Euclid's first theorem
	(3) Euclid's second theorem	(4)	Wilson's theorem
7.	When 2 ²⁰ is divided by 7, the remainder	r is :	
	(1) 4 (2) 3		
8.	φ (450) =		

(1) 90 (2) 100 (3) 110

(4) 120

9.	If $sin(u+iv) = x + iy$, then which of the following is true?
	(1) $\frac{x^2}{\sin^2 u} + \frac{y^2}{\cos^2 u} = 1$ (2) $\frac{x^2}{\sin^2 u} - \frac{y^2}{\cos^2 u} = 1$ (3) $\frac{x^2}{\cos^2 u} - \frac{y^2}{\sin^2 u} = 1$ (4) $\frac{x^2}{\cos^2 u} - \frac{y^2}{\sin^2 u} = 1$
10.	$ cos h^{2}v sin h^{2}v $ If $tan^{-1} 2x + tan^{-1} 3x = \pi/4$, then $x = 0$: (1) $\frac{1}{6}$ (2) $\frac{3}{4}$ (3) $\frac{2}{3}$ (4) $\frac{5}{6}$
11.	Let $T_1: U \to V$ and $T_2: V \to W$ be two linear transformations, then which of the following is incorrect? (1) $\rho(T_2T_1) = \rho(T_2)$ if T_1 is singular (2) $\rho(T_2T_1) \le \rho(T_2)$ (3) $\rho(T_2T_1) = \rho(T_2)$ if T_1 is invertible (4) If T_1, T_2 are invertible then T_2T_1 is also invertible
12.	The co-ordinates of vector (1, 1, 1) relative to basis (1, 1, 2), (2, 2, 1), (1, 2, 2) are: (1) $\left(\frac{2}{3}, \frac{1}{3}, 0\right)$ (2) $\left(\frac{2}{3}, \frac{2}{3}, 0\right)$ (3) $\left(\frac{1}{3}, \frac{2}{3}, 0\right)$ (4) $\left(\frac{1}{3}, \frac{1}{3}, 0\right)$
13.	Select the incorrect one out of the following. Dual space is also named as: (1) Algebraic dual (2) Double Generated (3) Conjugate (4) Algebraic Conjugate
14.	Choose the wrong statement: (1) Every normed linear space is an inner product space. (2) Every finite dimensional vector space is an inner product space. (3) Every inner product space is a metric space. (4) Every finite dimensional inner product space has an orthogonal basis.
15.	Number of real roots of $x^5 - 5x + 2 = 0$ is: (1) 2 (2) 4 (3) 3 (4) 5

16. The order of convergence of Newton-Raphson iteration formula is: (4) 1 (3) 1.5 (1) 2

(2) 1.618

The convergence in Gauss-Seidal method as compared to Jacobi's method for solving the system of three non-homogeneous linear equations in three variables, is faster by

(1) Three times

(2) Two times

(3) n times

(4) Convergence are equal

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- **18.** The fourth divided difference of the polynomial $3x^3 + 11x^2 + 5x + 11$ over the points x = 0, 1, 4, 6 and 7 is:
 - (1) 3
- (2) 7
- (3) 11
- (4) 17

- 19. Which of the following is correct?
 - (1) $\nabla = 1 E$

(2) $\nabla = 1 + E^{-1}$

(3) $\nabla = E^{-1} - 1$

- $(4) \quad \nabla = 1 E^{-1}$
- **20.** For the IVP y' = -y, $y(0) = y_0$ when the second order Runge-Kutta method is applied with step size h, then y(h) =
 - (1) $\frac{y_0}{2} (h^2 2h + 1)$

(2) $\frac{y_0}{2} (h^2 - 2h + 2)$

(3) $\frac{y_0}{2} (h^2 - 2h - 2)$

- (4) $\frac{y_0}{2} \left(h \frac{h^2}{2} + \frac{h^3}{6} \right)$
- 21. Consider the statements:
 - (a) Union of two subgroups of a group is also a subgroup of that group.
 - (b) Intersection of two subgroups of a group is also a subgroup of that group.

 Which of the above is true?
 - (1) Only (a)

(2) Only (b)

(3) Both (a) and (b)

- (4) Neither (a) nor (b)
- 22. Choose the wrong statement:
 - (1) Every field is an integral domain
 - (2) Every field is a division ring
 - (3) Every division ring is a field
 - (4) Every finite non-zero integral domain is a field
- 23. If S and T are co-maximal ideals of a commutative ring R with unity then:
 - (1) $ST = S \cap T$
- (2) $ST = S \cup T$
- (3) ST = R
- $(4) S \cap T = R$

- 24. Choose the incorrect statement:
 - (1) If R is a UFD, then so is R[x].
 - (2) If R is an integral domain with unity, then every irreducible element in R[x] is an irreducible polynomial.
 - (3) If F is a field, then every irreducible polynomial of F[x] is irreducible element of F[x].
 - (4) Eisenstein's criterion is necessary for the irreducibility of a polynomial.

25.	The velocity of a particle	moving in a	straight line	is given by	$v^2 = 2x e$	e^x , then its
	acceleration is:					

(1)
$$\frac{v^2}{2x}(x-1)$$

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

(3)
$$\frac{v^2}{2x}(x+1)$$

$$(4) \quad \frac{v}{2x}(x+1)$$

26. Let
$$P(r, \theta)$$
 be the position of a moving particle at time t, then its transverse acceleration is:

$$(1) \ \frac{1}{r} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right)$$

$$(1) \quad \frac{1}{r} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right) \qquad (2) \quad \frac{1}{r} \frac{d}{dt} \left(r^2 \frac{d\theta}{dt} \right) \qquad (3) \quad \frac{1}{r^2} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right) \qquad (4) \quad \frac{d}{dt} \left(r^2 \frac{d\theta}{dt} \right)$$

(3)
$$\frac{1}{r^2} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right)$$

$$(4) \quad \frac{d}{dt} \left(r^2 \, \frac{d\theta}{dt} \right)$$

27. A particle is moving with S. H. M. with amplitude a. The distance x from the centre where the velocity is half that of the maximum velocity is given by:

(1)
$$\frac{2}{3}a$$

(2)
$$\frac{1}{2}a$$

$$(3) \quad \frac{2}{\sqrt{3}}a$$

(4)
$$\frac{\sqrt{3}}{2}a$$

(1)
$$\frac{1}{2}R$$

(2)
$$\frac{1}{3}R$$

(3)
$$\frac{1}{4}R$$

(4)
$$\frac{3}{4}R$$

(1)
$$\theta = \pi/6$$

(2)
$$\theta = \pi/2$$

(3)
$$\theta = \pi/4$$

(4)
$$\theta = \pi/3$$

(1)
$$v^2 = \lambda \left(\frac{2}{r} - \frac{1}{a}\right)$$
 (2) $v^2 = \lambda \left(\frac{2}{r} - \frac{1}{2a}\right)$ (3) $v^2 = \lambda \left(\frac{1}{r} - \frac{2}{a}\right)$ (4) $v^2 = \lambda \left(\frac{1}{r} - \frac{1}{a}\right)$

31.
$$J_{n-1}(x) + J_{n+1}(x) =$$

$$(1) \quad \frac{n}{x} J_n(x)$$

$$(2) \quad \frac{n}{x} J'_n \quad (x)$$

$$(3) \quad \frac{x}{2n} J_n(x)$$

(1)
$$\frac{n}{x} J_n(x)$$
 (2) $\frac{n}{x} J'_n(x)$ (3) $\frac{x}{2n} J_n(x)$ (4) $\frac{2n}{x} J_n(x)$

32.
$$P'_{n+1}(x) - xP'_n(x) =$$

(1)
$$n P_n(x)$$

(2)
$$(n+1) P_n(x)$$

(2)
$$(n+1) P_n(x)$$
 (3) $(n+1) P_{n+1}(x)$ (4) $(2n+1) P_n(x)$

(4)
$$(2n+1) P_n(x)$$

33.
$$H'_n(x) =$$

$$(1) \quad H_{n+1}(x)$$

(2)
$$n H_{n-1}(x), n \ge 1$$
 (3) $n H_{n+1}(x)$

(4)
$$2n H_{n-1}(x), n \ge 1$$

34. L
$$(t e^{-4t} \sin 3t) =$$

(1)
$$\frac{6(s+4)}{(s^2+8s+25)^2}$$

(2)
$$\frac{3(s+4)}{(s^2+8s+25)^2}$$

(3)
$$\frac{6(s+4)}{(s^2+6s+25)^2}$$

(4)
$$\frac{3(s+4)}{(s^2+6s+25)^2}$$

35. Fourier transform of
$$f(x)$$
 defined by $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$ is:

$$(1) \quad \frac{2}{s} \cos as$$

(1)
$$\frac{2}{s}\cos as$$
 (2) $\frac{4}{s}\sin as$ (3) $\frac{1}{s}\sin as$

(3)
$$\frac{1}{s}\sin as$$

(4)
$$\frac{2}{s}\sin as$$

C language is available for which of the operating systems?

- (1) DOS
- (2) UNIX
- (3) Windows
- (4) All of these

Which of the following is invalid?

- (2) 'ab'
- (3)

The continue command cannot be used with:

- (2) for
- (3) Switch
- (4) While

Which of the following operator has lowest priority?

- (2) +
- (3) % (4) ++

What should be the expression return value for a do-while to terminate?

- (1) -1
- (2) 1
- (3) 0

41. For the function $f(x) = \sin 2x$ in $\left[0, \frac{\pi}{2}\right]$, the Rolle's theorem is applicable, value of 'C' is:

- (1) $\pi/3$

- $(4) 3\pi/8$

42. $\lim_{(x,y)\to(0,0)} \frac{x^2y}{x^4+y^2} =$

(1) 1/2

(2) 1

(3) 0

(4) limit does not exist

43. If $u = \sin^{-1} \frac{x^2 + y^2}{x + y}$, then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} =$

- (1) sin u
- (2) cos u
- (3) tan u
- (4) cot u

44.
$$\lim_{x \to 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x} \right) =$$

$$(1) -\frac{1}{3}$$

(2)
$$\frac{1}{3}$$

(3)
$$-\frac{2}{3}$$

(4)
$$\frac{2}{3}$$

The arc-rate of rotation of the binormal at a point of the curve is known as:

(1) Tangent vector

(2) Principal normal

(3) Normal vector

(4) Torsion vector

If $z = ae^{-b^2t}\cos bx$, then eliminating the constants a and b, the PDE obtained is:

$$(1) \quad \frac{\partial^2 z}{\partial t^2} + \frac{\partial z}{\partial x} = 0$$

(2)
$$\frac{\partial^2 z}{\partial x^2} = \frac{\partial^2 z}{\partial t^2}$$

(3)
$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial z}{\partial t} = 0$$

$$(4) \quad \frac{\partial^2 z}{\partial x^2} = \frac{\partial z}{\partial t}$$

47. Solution of the equation p + q = z is:

(1)
$$f(x-y, y + \log z) = 0$$

(2)
$$f(x-y, y-\log z) = 0$$

(3)
$$f(x+y, y-\log z) = 0$$

(4)
$$f(x-y, y-z) = 0$$

The equation $u_{xx} + 2u_{yy} + u_{zz} = 2u_{xy} + 2u_{yz}$ is:

- (1) parabolic
- (2) elliptic
- (3) hyperbolic
- (4) None of these

A string is stretched between the fixed points (0, 0) and (1, 0) and released at rest from the position $u = A \sin \pi x$. The subsequent displacement u(x, t) is given by :

(1) $A \cos c \pi t \cos \pi x$

(2) $A \sin(\pi x + ct)$

(3) $A \sin c \pi t \sin \pi x$

(4) $A \cos c \pi t \sin \pi x$

Particular integral of $(D^2 - D'^2)z = \cos(x + y)$ is:

- (1) $\frac{x}{4}\sin(x+y)$ (2) $x\sin(x+y)$ (3) $\frac{x}{2}\sin(x+y)$ (4) $\frac{x}{2}\cos(x+y)$

Integrating factor of the differential equation $x^2y dx - (x^3 + y^3) dy = 0$ is:

- (2) $\frac{1}{v^4}$ (3) $\frac{1}{xv^3}$

52. Solution of the equation $p = \log(px - y)$ is :

 $(1) \quad y = cx - e^c$

(2) $y = cx - \log c$

(3) $y = cx + c^2$

(4) $y = cx + e^{c}$

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53. Orthogonal trajectories of $y^2 = 4ax$ are given by :

$$(1) \quad 2y^2 + x^2 = c^2$$

$$(2) \quad 2x^2 + y^2 = c^2$$

(3)
$$x^2 + y^2 = c^2$$

$$(4) 2x^2 - y^2 = c^2$$

54. For the differential equation $\frac{d^2y}{dx^2} - 4y = e^x + \sin 2x$, the particular Integral (P. I.) is:

$$(1) \quad -\frac{1}{3}e^x - \frac{1}{8}\cos 2x$$

(2)
$$\frac{1}{3}e^x - \frac{1}{8}\sin 2x$$

(3)
$$-\frac{1}{3}e^x - \frac{1}{8}\sin 2x$$

(4)
$$\frac{1}{3}e^x + \frac{1}{8}\sin 2x$$

55. Solution of (x-3y-z) dx + (2y-3x) dy + (z-x) dz = 0 is:

(1)
$$x^2 + 2y^2 - z^2 + 6xy + 2xz = c$$

(1)
$$x^2 + 2y^2 - z^2 + 6xy + 2xz = c$$
 (2) $x^2 + 2y^2 - z^2 - 6xy + 2xz = c$

(3)
$$x^2 + 2y^2 + z^2 + 6xy - 2xz = 0$$

(3)
$$x^2 + 2y^2 + z^2 + 6xy - 2xz = c$$
 (4) $x^2 + 2y^2 + z^2 - 6xy - 2xz = c$

56. If \vec{a} , \vec{b} , \vec{c} are unit vectors such that \vec{b} and \vec{c} are non-parallel $\overrightarrow{a} \times (\overrightarrow{b} \times \overrightarrow{c}) = \frac{1}{2} \overrightarrow{b}$, then the angles which \overrightarrow{a} makes with \overrightarrow{b} and \overrightarrow{c} are:

(1)
$$\pi/2, \pi/3$$

(2)
$$\pi/3, \pi/2$$

(3)
$$\pi/3, \pi/4$$

(4)
$$\pi/2, \pi/4$$

A particle moves along the curve given by $x = 3t^2$, $y = t^2 - 2t$, $z = t^3$. The acceleration at t = 1 in the direction of vector $\hat{i} + \hat{j} - \hat{k}$ is:

(1)
$$\frac{1}{\sqrt{2}}$$

(2)
$$\frac{3}{\sqrt{2}}$$
 (3) $\frac{4}{\sqrt{3}}$ (4) $\frac{2}{\sqrt{3}}$

(3)
$$\frac{4}{\sqrt{3}}$$

(4)
$$\frac{2}{\sqrt{3}}$$

The unit normal vector to the surface $x^4 - 3xyz + z^2 + 1 = 0$ at the point (1, 1, 1) is:

$$(1) \quad \frac{1}{\sqrt{11}} \left(\hat{i} + 3\hat{j} - \hat{k} \right)$$

(2)
$$\frac{1}{\sqrt{11}}(\hat{i}-3\hat{j}-\hat{k})$$

(3)
$$\frac{1}{\sqrt{11}}(\hat{i}-3\hat{j}+\hat{k})$$

(4)
$$\frac{1}{\sqrt{11}}(\hat{i}+3\hat{j}+\hat{k})$$

59. If ϕ is a scalar point function and \overrightarrow{f} is a vector point function, then which of the following is true in an orthogonal curvilinear system?

(1) div
$$(grad \phi) = 0$$

(2) curl
$$(curl \vec{f}) = \vec{0}$$

(3) curl
$$(div \vec{f}) = \vec{0}$$

(4) div
$$(curl \vec{f}) = 0$$

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50.	If S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$, then $\iint_S (xdydz + y dz dx + zdxdy) =$
	(1) $2\pi a^3$ (2) $\frac{4}{3}\pi a^3$ (3) $4\pi a^3$ (4) $\frac{3}{4}\pi a^3$
61.	The resultant of two forces P and Q is R. The resolved part of R in the direction of P of magnitude Q. The angle between P and Q is:
	(1) $2\cos^{-1}\sqrt{\frac{P}{2Q}}$ (2) $2\sin^{-1}\sqrt{\frac{P}{2Q}}$ (3) $\sin^{-1}\sqrt{\frac{P}{2Q}}$ (4) $\cos^{-1}\sqrt{\frac{P}{2Q}}$
62.	Any system of forces acting on a rigid body can be reduced in general to a for acting at an arbitrary chosen point of the body and a: (1) Screw (2) Wrench (3) Negative force (4) Couple
63.	The line of action of a force such that the axis of the couple is coincident with this li
	is called: (1) Null line (2) Central axis (3) Wrench (4) Screw
64.	equilibrium is categorized as: (2) Noutral (4) Perfect
	(1) Stable (2) Unstable (3) The limiting friction bears to the normal reaction is called
65	(1) Co-efficient of friction (2) Statical friction
	(3) Dynamical friction (4) Normal friction
66	The set of all limit points of a set $A \subseteq R$ is called a:
	(1) Closure of set A (2) Open cover of set A
	(3) Derived set of A (4) Limiting set of A
6	7. $\lim_{n \to \infty} \left(\frac{2}{1} \cdot \frac{3}{2} \cdot \frac{4}{3} \cdot \dots \cdot \frac{n}{n-1} \right)^{1/n} =$ (3) 1 (4) 2
	(1) 0 (2) 1/2
6	8. The series $\sum_{n=3}^{\infty} x^{\log n}$ is:
	(1) Convergent (2) Divergent
	(3) Convergent if $x < \frac{1}{e}$ (4) Convergent if $x < e$
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- The series $x + \frac{x^2}{|2|} + \frac{x^3}{|3|} + \dots$
 - (1) Converges absolutely
 - (3) Does not converge

- (2) Converges conditionally
- (4) None of these
- **70.** The infinite product $\prod_{n=1}^{\infty} \left(1 + \frac{x}{n}\right), x < 0$:
 - (1) Diverges to zero

- (2) Converges to 1
- (3) Converges absolutely
- (4) Converges to 2
- **71.** It f(x) = x + 1, $x \in [1, 3]$ and partition $P = \{1, 2, 3\}$, then L(f, P) and U(f, P) are:
 - (1) 2, 4
- (2) 3, 6
- (3) 4,7
- **72.** Value of the integral $\int_{0}^{1} ([x]-x) dx$, [x] being the greatest integer function, is:
- (2) 0
- (3), 1

- **73.** The integral $\int_{0}^{1} x^{n} e^{-mx} dx$ converges for :

- (1) n < -1 (2) n > -1 (3) n < -1, m > 1 (4) n < -2, m < 1
- 74. $\int_{1}^{\infty} \frac{\sin x}{x^{n}} dx$ converges absolutely for:
 - (1) n = 0
- (2) n < 1 (3) n = 1
- (4) n > 1
- 75. If A be any subset of a metric space (X, d) and A° denotes the interior of A, then which of the following is not true?
 - $(1) (A \cap B)^{\circ} = A^{\circ} \cap B^{\circ}$

(2) $(A \cup B)^{\circ} = A^{\circ} \cup B^{\circ}$

- (3) $(A^{\circ} \cup B^{\circ}) \subset (A \cup B)^{\circ}$
- (4) None of these
- 76. The concepts of continuity and uniform continuity are equivalent on:
 - (1) a closed set

(2) an open set

(3) a compact set

(4) a finite set

	0 11	11-0	atataments .
77.	Consider	tne	statements:

- (a) Every Cauchy sequence in a metric space is convergent.
- (b) A metric space is complete if every cauchy sequence in it has a convergent subsequence.

Which of the above is true?

(1) Both (a) and (b)

(2) Only (a)

(3) Only (b)

(4) Neither (a) nor (b)

78. Given the statements:

- (a) In a group, the order of an element and its inverse are same.
- (b) Let (G, .) be a group and $a \in G$ be of order m, then $a^n = e$ if and only if m/n.

Which of the above is true?

(1) Both (a) and (b)

(2) Only (a)

(3) Only (b)

- (4) Neither (a) nor (b)
- **79.** Let $\phi: G \to G'$ be a homomorphism. The homo-morphism ϕ is an isomorphism of Gonto G' if and only if:
 - (1) Ker $\phi = 0$
- (2) Ker $\phi = \{e\}$ (3) $\phi(a^{-1}) = [\phi(a)]^{-1}$ (4) $\phi(e) = e'$
- **80.** If $G = \{1, i, -1, -i\}$ is a multiplicative group, then order of -i is:
 - (1) 4
- (3) 2

81. If
$$A = \begin{bmatrix} x & 3 \\ 3 & x \end{bmatrix}$$
 and $|A^3| = 343$ then $x = 343$

- $(3) \pm 4$
- $(4) \pm 7$
- For two non-singular matrices of the same order, the reversal law of multiplication 82. does not hold for:
 - (1) transpose

(2) adjoint

(3) conjugate

- (4) transposed conjugate
- **83.** If α is an eigen value of a non-singular matrix A, then $\frac{|A|}{\alpha}$ is an eigen value of :
 - (1) adj A
- (2) A
- (3) A^{-1}
- (4) None of these
- **84.** If the roots of the equation $x^3 + 3px^2 + 3qx + r = 0$ are in G. P. then:
 - (1) $p^3 = r^2 q^3$

(2) $p^3r^2 = q^3$

(3) $p^3 = rq^3$

(4) $p^3r = q^3$

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- For the equation $x^8 + 5x^3 + 2x 3 = 0$, the least number of imaginary roots is:

- $\lim_{x \to 0} \frac{\tan x \sin x}{\sin^3 x} =$
 - (1) 3/4
- (2) 3/2
- (3) 1/4
- If a given curve of nth degree has n asymptotes, then the number of points at which these asymptotes cut the curve, is:
- (2) n(n-1)
- (3) n(n-2) (4) n(n-3)
- The radius of curvature for the cardioide $r = a (1 + \cos \theta)$ is given by $\rho =$
 - (1) $\frac{a}{2}\cos\frac{\theta}{2}$

(2) $\frac{3a}{4}\cos\frac{\theta}{2}$

(3) $\frac{2a}{3}\cos\frac{\theta}{2}$

- (4) $\frac{4a}{3}\cos\frac{\theta}{2}$
- The area common to the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is:
 - (1) $32\frac{a^2}{3}$ (2) $16\frac{a^2}{3}$ (3) $8\frac{a^2}{3}$ (4) $\frac{a^2}{3}$

- The point of oscul-inflexion is a: 90.
 - (1) Double cusp with change of species (2) Double cusp of first species
 - (3) Double cusp of second species
- (4) Single cusp with change of species
- **91.** If $x^2 + y^2 = v^2 u^2$ and xy = -uv, then $\frac{\partial (u, v)}{\partial (x, y)} = \frac{\partial (u, v)}{\partial (x, y)}$

 - (1) $\frac{x^2 y^2}{u^2 v^2}$ (2) $\frac{x^2 + y^2}{u^2 v^2}$ (3) $\frac{x^2 y^2}{u^2 + v^2}$ (4) $\frac{x^2 + y^2}{u^2 + v^2}$

- **92.** $\int_0^{\pi/2} \sin^3 x \cos^{5/2} x \, dx =$
 - $(1) \frac{8}{77}$
- (2) $\frac{4}{77}$
- (3) $\frac{3}{44}$
- $(4) \frac{7}{44}$

- **93.** Value of $\int_{0}^{4} \int_{0}^{2\sqrt{z}} \int_{0}^{\sqrt{4z-x^2}} dz \, dx \, dy$ is:
 - (1) 4π
- (2) 8π
- (3) 16π
- $(4) 32\pi$

-	If f and g are piecewise smooth periodic functions with fourier co-efficients c_n and d_n
94.	If f and g are piecewise smooth periodic range.
	respectively, then the result $\frac{1}{T} \int_{-T/2}^{T/2} f(t) \overline{g(t)} dt = \sum_{k=-\infty}^{\infty} c_k \overline{d}_k$, is known as:

(1) Conjugate property

(2) Parseval equality

(3) Parseval identity

(4) Dirichlet identity

The analytic function whose real part is $e^x (x \cos y - y \sin y)$, is: (1) $ze^z + c$ (2) $z\sin z + c$ (3) $ze^{-z} + c$ (4) $ze^{z+1} + c$

96. Invariant points of the bilinear transformation $w = \frac{(2+i)z-2}{z+i}$ are: (3) $2 \pm i$ (4) $1 \pm i$

 $(1) \pm i$

(2) $1 \pm 2i$

Under the transformation $w+1=\frac{4}{z^2}$, the unit circle in the w-plane corresponds to which curve of the z-plane?

(1) Circle

(2) Parabola

(3) Ellipse

(4) Hyperbola

The basis of the sub-space spanned by the vectors (-3, 1, 2), (0, 1, 3), (2, 1, 0), (1, 1, 1)is:

 $(1) \ \{(1,1,1),(0,1,0),(0,0,1)\}$

 $(2) \{(1,1,1),(0,1,3),(0,0,1)\}$

 $(3) \ \{(1,1,1),(0,1,2),(0,0,2)\} \ (4) \ \{(1,1,1),(0,2,1),(0,0,1)\}$

If W_1 and W_2 are subspaces of V and dim $W_1 = 4$, dim $W_2 = 5$, dim V = 7, then the possible values of dim $(W_1 \cap W_2)$ are :

(1) 2 or 4

(2) 1, 2 or 3

(3) 2, 3 or 4

(4) 5,6 or 7

100. Let $T: \mathbb{R}^3 \to \mathbb{R}^3$ be a linear transformation given by $T(x, y, z) = \left(\frac{x}{2}, \frac{y}{2}, 0\right)$. The rank of

T is:

(1) 3

(2) 4

(3) 1

(4) 2

Total No. of Printed Pages: 13

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

CPG-EE-2018 (Mathematics)-(SET-Y)

C	to Very Jumble Charles 30/6/18 To 1/6/18 30/06/18 To 1/6/18 30/06/18	Sr. No.	10915
Time : 11/2 Hours	Total Questions : 100		Max. Marks : 100
Roll No. (in figures)	(in words)		
Candidate's Name		Date of Birth-	
Father's Name	Mother's Name		
Date of Exam :			
(Signature of the Candidate)		(Signature	of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

- 1. All questions are *compulsory* and carry equal marks. The candidates are required to attempt all questions.
- 2. The candidates must return the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
- 4. The candidate must not do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers must not be ticked in the question booklet.
- 5. Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.
- 6. There will be negative marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Before answering the questions, the candidates should ensure that they have been supplied correct & complete question booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

CPG-EE-2018(Mathematics)-(SET-Y)/(C)

- 1. The resultant of two forces P and Q is R. The resolved part of R in the direction of P is of magnitude Q. The angle between P and Q is:
 - (1) $2\cos^{-1}\sqrt{\frac{P}{2Q}}$ (2) $2\sin^{-1}\sqrt{\frac{P}{2Q}}$ (3) $\sin^{-1}\sqrt{\frac{P}{2Q}}$ (4) $\cos^{-1}\sqrt{\frac{P}{2Q}}$

- 2. Any system of forces acting on a rigid body can be reduced in general to a force acting at an arbitrary chosen point of the body and a:
 - (1) Screw
- (2) Wrench
- (3) Negative force (4) Couple
- 3. The line of action of a force such that the axis of the couple is coincident with this line is called:
 - (1) Null line
- (2) Central axis
- (3) Wrench
- (4) Screw
- 4. If a body is slightly displaced and it remains in equilibrium in any position, then the equilibrium is categorized as:
 - (1) Stable
- (2) Unstable
- (3) Neutral
- (4) Perfect
- 5. The constant ratio which the limiting friction bears to the normal reaction is called:
 - (1) Co-efficient of friction
- (2) Statical friction

(3) Dynamical friction

- (4) Normal friction
- **6.** The set of all limit points of a set $A \subseteq R$ is called a:
 - (1) Closure of set A

(2) Open cover of set A

(3) Derived set of A

- (4) Limiting set of A
- 7. $\lim_{n \to \infty} \left(\frac{2}{1}, \frac{3}{2}, \frac{4}{3}, \dots, \frac{n}{n-1} \right)^{1/n} =$
- (2) 1/2
- (4) 2

- **8.** The series $\sum_{n=3}^{\infty} x^{\log n}$ is:
 - (1) Convergent

- (2) Divergent
- (3) Convergent if $x < \frac{1}{x}$

- (4) Convergent if x < e
- **9.** The series $x + \frac{x^2}{12} + \frac{x^3}{13} + \dots$
 - (1) Converges absolutely
- (2) Converges conditionally

(3) Does not converge

(4) None of these

10. The infinite product $\prod_{n=1}^{\infty} \left(1 + \frac{x}{n}\right)$, x < 0:

(1) Diverges to zero

- (2) Converges to 1
- (3) Converges absolutely
- (4) Converges to 2

11. Integrating factor of the differential equation $x^2y dx - (x^3 + y^3) dy = 0$ is:

- (2) $\frac{1}{v^4}$ (3) $\frac{1}{xv^3}$

12. Solution of the equation $p = \log(px - y)$ is :

 $(1) \quad y = cx - e^c$

 $(2) \quad y = cx - \log c$

(3) $y = cx + c^2$

 $(4) \quad y = cx + e^c$

13. Orthogonal trajectories of $y^2 = 4ax$ are given by:

(1) $2v^2 + x^2 = c^2$

(2) $2x^2 + y^2 = c^2$

(3) $x^2 + y^2 = c^2$

(4) $2x^2 - y^2 = c^2$

14. For the differential equation $\frac{d^2y}{dx^2} - 4y = e^x + \sin 2x$, the particular Integral (P. I.) is:

(1) $-\frac{1}{2}e^x - \frac{1}{8}\cos 2x$

(2) $\frac{1}{2}e^x - \frac{1}{8}\sin 2x$

(3) $-\frac{1}{3}e^x - \frac{1}{8}\sin 2x$

(4) $\frac{1}{2}e^x + \frac{1}{8}\sin 2x$

15. Solution of (x-3y-z) dx + (2y-3x) dy + (z-x) dz = 0 is:

- (1) $x^2 + 2y^2 z^2 + 6xy + 2xz = c$ (2) $x^2 + 2y^2 z^2 6xy + 2xz = c$
- (3) $x^2 + 2y^2 + z^2 + 6xy 2xz = c$
- (4) $x^2 + 2y^2 + z^2 6xy 2xz = c$

16. If \vec{a} , \vec{b} , \vec{c} are unit vectors such that \vec{b} and \vec{c} are non-parallel and $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{2} \vec{b}$, then the angles which \vec{a} makes with \vec{b} and \vec{c} are :

(1) $\pi/2, \pi/3$

(2) $\pi/3, \pi/2$

(3) $\pi/3, \pi/4$

(4) $\pi/2, \pi/4$

17.	A particle moves along the curve given by $x = 3t^2$, $y = t^2 - 2t$, $z = t^3$. The acceleration
	at $t = 1$ in the direction of vector $\hat{i} + \hat{j} - \hat{k}$ is:

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

18. The unit normal vector to the surface
$$x^4 - 3xyz + z^2 + 1 = 0$$
 at the point $(1, 1, 1)$ is:

- (1) $\frac{1}{\sqrt{11}} (\hat{i} + 3\hat{j} \hat{k})$ (2) $\frac{1}{\sqrt{11}} (\hat{i} 3\hat{j} \hat{k})$

(3) $\frac{1}{\sqrt{21}}(\hat{i}-3\hat{j}+\hat{k})$

(4) $\frac{1}{\sqrt{11}} (\hat{i} + 3\hat{j} + \hat{k})$

19. If
$$\phi$$
 is a scalar point function and \overrightarrow{f} is a vector point function, then which of the following is true in an orthogonal curvilinear system?

(1) div $(grad \phi) = 0$

(2) curl $(curl \vec{f}) = \vec{0}$

(3) curl $(\operatorname{div} \overline{f}) = \overline{0}$

(4) div $(curl \vec{f}) = 0$

20. If S is the surface of the sphere
$$x^2 + y^2 + z^2 = a^2$$
, then $\iint_S (xdydz + y dz dx + zdxdy) =$

- (1) $2\pi a^3$ (2) $\frac{4}{3}\pi a^3$ (3) $4\pi a^3$ (4) $\frac{3}{4}\pi a^3$

21. If
$$A = \begin{bmatrix} x & 3 \\ 3 & x \end{bmatrix}$$
 and $|A^3| = 343$ then $x = 343$

- $(1) \pm 2$
- (2) ± 3 (3) ± 4 (4) ± 7

(1) transpose

(2) adjoint

(3) conjugate

(4) transposed conjugate

23. If
$$\alpha$$
 is an eigen value of a non-singular matrix A, then $\frac{|A|}{\alpha}$ is an eigen value of :

- (1) adj A
- (2) A
- (3) A^{-1}
- (4) None of these

24. If the roots of the equation
$$x^3 + 3px^2 + 3qx + r = 0$$
 are in G. P. then:

(1) $p^3 = r^2 q^3$

(2) $p^3r^2 = q^3$

(3): $p^3 = rq^3$

(4) $p^3r = q^3$

20.	(1) 6	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	(3) 2	(4) 0			
26.	$\lim_{x\to 0} \frac{\tan x - \sin x}{\sin^3 x} =$						
	(1) 3/4	(2) 3/2	(3) 1/4	(4) 1/2			
07	If a given grows	f - 1 - 1 - 1	i i				
27.	these asymptotes	cut the curve, is:	n asymptotes, then	the number of points at	which		
	(1) n-1		(3) n (n-2)	(4) n (n - 3)			
28.	The radius of curv	vature for the card	dioide $r = a (1 + \cos \alpha)$	θ) is given by $\rho =$			
	$(1) \ \frac{a}{2} \cos \frac{\theta}{2}$		$(2) \frac{3a}{4}\cos\frac{\theta}{2}$				
	$(3) \frac{2a}{3}\cos\frac{\theta}{2}$		$(4) \frac{4a}{3}\cos\frac{\theta}{2}$	0-1876.) 24-1			
29.	The area common	to the parabolas	$y^2 = 4ax \text{ and } x^2 = 4$	ay is:			
	(1) $32\frac{a^2}{3}$	(2) $16\frac{a^2}{3}$	(3) $8\frac{a^2}{3}$	(4) $\frac{a^2}{3}$			
30.	The point of oscul	-inflexion is a :		and the first of			
	(1) Double cusp v	with change of spe	ecies (2) Double cu	sp of first species			
	(3) Double cusp of		N. S. C.	with change of species			
31.	Let $T_1: U \to V$ an	d $T_2: V \to W$ be	two linear transfe	ormations, then which	of the		
	following is income (1) $\rho(T_2T_1) = \rho(T_2$			For two non-angeler in			
	(2) $\rho(T_2T_1) \le \rho(T_2)$	120 120 120 120 120 120 120 120 120 120					
	(3) $\rho(T_2T_1) = \rho(T_2)$	The state of the s	The state of the s	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
	(4) If T_1, T_2 are invertible then T_2T_1 is also invertible						
32.	(1, 1, 1) relative to basis (1, 1, 2), (2, 2, 1), (1, 2, 2) are:						
	$(1) \left(\frac{2}{3}, \frac{1}{3}, 0\right)$	(2) $\left(\frac{2}{3}, \frac{2}{3}, 0\right)$	$(3) \left(\frac{1}{3}, \frac{2}{3}, 0\right)$	$(4) \left(\frac{1}{3}, \frac{1}{3}, 0\right)$			
33.	Select the incorrec	t one out of the fo	llowing. Dual space	is also named as:			
	(1) Algebraic dua		(2) Double Ge	nerated			
	(3) Conjugate		(4) Algebraic (Conjugate			
PG-E	E-2018/(Mathemati	(SFT - V)/(C)	W COMMITTEE				

34.	Choose	the	wrong	statement:
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- (1) Every normed linear space is an inner product space.
- (2) Every finite dimensional vector space is an inner product space.
- (3) Every inner product space is a metric space.
- (4) Every finite dimensional inner product space has an orthogonal basis.

				-			
35.	Number	of real	roots of	xo	-5x + 2 =	= 0	is:

- (1) 2
- (2) 4
- (3) 3
- (4) 5

36. The order of convergence of Newton-Raphson iteration formula is:

- (1) 2
- (2) 1.618
- (3) 1.5
- (4)

37. The convergence in Gauss-Seidal method as compared to Jacobi's method for solving the system of three non-homogeneous linear equations in three variables, is faster by :

(1) Three times

(2) Two times

(3) n times

(4) Convergence are equal

38. The fourth divided difference of the polynomial
$$3x^3 + 11x^2 + 5x + 11$$
 over the points $x = 0, 1, 4, 6$ and 7 is:

- (1) 3
- (2) 7
- (3) 11
- (4) 17

(1) $\nabla = 1 - E$

(2) $\nabla = 1 + E^{-1}$

(3) $\nabla = E^{-1} - 1$

(4) $\nabla = 1 - E^{-1}$

40. For the IVP
$$y' = -y$$
, $y(0) = y_0$ when the second order Runge-Kutta method is applied with step size h , then $y(h) =$

(1) $\frac{y_0}{2} (h^2 - 2h + 1)$

(2) $\frac{y_0}{2} (h^2 - 2h + 2)$

(3) $\frac{y_0}{2} (h^2 - 2h - 2)$

(4) $\frac{y_0}{2} \left(h - \frac{h^2}{2} + \frac{h^3}{6} \right)$

41. It
$$f(x) = x + 1$$
, $x \in [1, 3]$ and partition $P = \{1, 2, 3\}$, then $L(f, P)$ and $U(f, P)$ are:

- (1) 2, 4
- (2) 3, 6
- (3) 4,7
- (4) 5,7

42. Value of the integral
$$\int_{1}^{1} ([x]-x) dx$$
, [x] being the greatest integer function, is:

- (1) -1
- (2) (
- (3) 1
- (4) 2

a convergent

43.	The integral	$\int_{0}^{1} x^{n} e^{-mx} dx \text{ converges}$	for:					
	(1) $n < -1$	(2) $n > -1$	(3) $n < -1, m > 1$	(4) $n < -2, m < 1$				
44.	$\int_{1}^{\infty} \frac{\sin x}{x^{n}} dx$	converges absolutely for	or:					
×	(1) $n = 0$	(2) n < 1	(3) $n = 1$	(4) n > 1.				
45.	If A be any	subset of a metric spa	ce (X, d) and A° de	notes the interior of A	, then			
	which of the	following is not true?						
	(1) $(A \cap B)^{\circ}$	$=A^{\circ} \cap B^{\circ}$	$(2) (A \cup B)^{\circ} = A$	l° ∪ B°				
od.	(3) $(A^{\circ} \cup B^{\circ})$	$(A \cup B)^{\circ}$	(4) None of the	se				
46.	The concepts of continuity and uniform continuity are equivalent on:							
	(1) a closed		(2) an open set	Age - 34				
	(3) a compact set		(4) a finite set					
47.	Consider the	statements:						
	(a) Every Ca	uchy sequence in a mel	ric space is converge	nt.				
	(b) A metric	space is complete if	every cauchy seque	ence in it has a conv	ergent			

(a) In a group, the order of an element and its inverse are same.

(2) Only (a)

(2) Only (a)

(2) Ker $\phi = \{e\}$ (3) $\phi(a^{-1}) = [\phi(a)]^{-1} (4) \phi(e) = e'$

(b) Let (G, .) be a group and $a \in G$ be of order m, then $a^n = e$ if and only if m/n.

49. Let $\phi: G \to G'$ be a homomorphism. The homo-morphism ϕ is an isomorphism of G

(4) Neither (a) nor (b)

(4) Neither (a) nor (b)

subsequence.

(1) Both (a) and (b)

48. Given the statements:

(1) Both (a) and (b)

onto G' if and only if:

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(3) Only (b)

(1) Ker $\phi = 0$

(3) Only (b)

Which of the above is true?

Which of the above is true?

- If $G = \{1, i, -1, -i\}$ is a multiplicative group, then order of -i is:

- For the function $f(x) = \sin 2x$ in $\left[0, \frac{\pi}{2}\right]$, the Rolle's theorem is applicable, value of 'C'
 - is:
 - (1) $\pi/3$

- (3) $\pi/6$ (4) $3\pi/8$

- $\lim_{(x,y)\to(0,0)} \frac{x^2y}{x^4 + u^2} =$ 52.
 - (1) 1/2

(2) 1

(3) 0

- (4) limit does not exist
- **53.** If $u = \sin^{-1} \frac{x^2 + y^2}{x + y}$, then $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{\partial u}{\partial y}$
 - $(1) \sin u$
- (2) $\cos u$ (3) $\tan u$

- **54.** $\lim_{r \to 0} \left(\frac{1}{r^2} \frac{1}{\sin^2 r} \right) =$
 - $(1) -\frac{1}{2}$
- $(2) \frac{1}{2}$
- (3) $-\frac{2}{3}$ (4) $\frac{2}{3}$
- The arc-rate of rotation of the binormal at a point of the curve is known as:
 - (1) Tangent vector

(2) Principal normal

- (3) Normal vector
- (4) Torsion vector
- **56.** If $z = ae^{-b^2t}\cos bx$, then eliminating the constants a and b, the PDE obtained is:
 - (1) $\frac{\partial^2 z}{\partial t^2} + \frac{\partial z}{\partial x} = 0$ (2) $\frac{\partial^2 z}{\partial x^2} = \frac{\partial^2 z}{\partial t^2}$ (3) $\frac{\partial^2 z}{\partial x^2} + \frac{\partial z}{\partial t} = 0$ (4) $\frac{\partial^2 z}{\partial x^2} = \frac{\partial z}{\partial t}$

- Solution of the equation p + q = z is:
 - (1) $f(x-y, y + \log z) = 0$
- (2) $f(x-y, y-\log z) = 0$
- (3) $f(x+y, y-\log z) = 0$
- (4) f(x-y, y-z) = 0
- The equation $u_{xx} + 2u_{yy} + u_{zz} = 2u_{xy} + 2u_{yz}$ is:
 - (1) parabolic

(2) elliptic

- (3) hyperbolic
- (4) None of these

- A string is stretched between the fixed points (0, 0) and (1, 0) and released at rest from the position $u = A \sin \pi x$. The subsequent displacement u(x, t) is given by :
 - (1) $A \cos c \pi t \cos \pi x$

(2) $A \sin(\pi x + ct)$

(3) $A \sin c \pi t \sin \pi x$

(4) $A \cos c \pi t \sin \pi x$

Particular integral of $(D^2 - D'^2)z = \cos(x + y)$ is:

(1) $\frac{x}{4}\sin(x+y)$ (2) $x\sin(x+y)$ (3) $\frac{x}{2}\sin(x+y)$ (4) $\frac{x}{2}\cos(x+y)$

- 61. Consider the statements:
 - (a) Union of two subgroups of a group is also a subgroup of that group.
 - (b) Intersection of two subgroups of a group is also a subgroup of that group. Which of the above is true?

(1) Only (a)

(2) Only (b)

(3) Both (a) and (b)

(4) Neither (a) nor (b)

- 62. Choose the wrong statement:
 - (1) Every field is an integral domain
 - (2) Every field is a division ring
 - (3) Every division ring is a field
 - (4) Every finite non-zero integral domain is a field
- 63. If S and T are co-maximal ideals of a commutative ring R with unity then:

(1) $ST = S \cap T$

(2) $ST = S \cup T$

(3) ST = R

- Choose the incorrect statement:
 - (1) If R is a UFD, then so is R[x].
 - (2) If R is an integral domain with unity, then every irreducible element in R[x] is an irreducible polynomial.
 - (3) If F is a field, then every irreducible polynomial of F[x] is irreducible element of F[x].
 - (4) Eisenstein's criterion is necessary for the irreducibility of a polynomial.

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- The velocity of a particle moving in a straight line is given by $v^2 = 2x e^x$, then its 65. acceleration is:

 - (1) $\frac{v^2}{2}(x-1)$ (2) $\frac{v^2}{2}(x+1)$ (3) $\frac{v^2}{2x}(x+1)$ (4) $\frac{v}{2x}(x+1)$
- Let $P(r, \theta)$ be the position of a moving particle at time t, then its transverse acceleration is:
- $(1) \quad \frac{1}{r} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right) \qquad (2) \quad \frac{1}{r} \frac{d}{dt} \left(r^2 \frac{d\theta}{dt} \right) \qquad (3) \quad \frac{1}{r^2} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right) \qquad (4) \quad \frac{d}{dt} \left(r^2 \frac{d\theta}{dt} \right)$
- 67. A particle is moving with S. H. M. with amplitude a. The distance x from the centre where the velocity is half that of the maximum velocity is given by:
- (2) $\frac{1}{2}a$
- (3) $\frac{2}{\sqrt{3}}a$ (4) $\frac{\sqrt{3}}{2}a$
- If the maximum horizontal range of a projectile is R, then the greatest height attained

 - (1) $\frac{1}{2}R$ (2) $\frac{1}{2}R$ (3) $\frac{1}{4}R$ (4) $\frac{3}{4}R$
- To a man walking at the rate of 5 km/hr, rain appears to fall vertically. If its real velocity is 10 km/hr, then its real direction to the horizontal is:
- (2) $\theta = \pi/2$
- (3) $\theta = \pi/4$
- (4) $\theta = \pi/3$
- 70. A particle describes an ellipse under a central orbit, the velocity at any point of its path is:
 - (1) $v^2 = \lambda \left(\frac{2}{r} \frac{1}{a}\right)$ (2) $v^2 = \lambda \left(\frac{2}{r} \frac{1}{2a}\right)$ (3) $v^2 = \lambda \left(\frac{1}{r} \frac{2}{a}\right)$ (4) $v^2 = \lambda \left(\frac{1}{r} \frac{1}{a}\right)$
- **71.** If $x^2 + y^2 = v^2 u^2$ and xy = -uv, then $\frac{\partial (u, v)}{\partial (x, y)} = \frac{\partial (u, v)}{\partial (x, y)}$

- (1) $\frac{x^2 y^2}{u^2 v^2}$ (2) $\frac{x^2 + y^2}{u^2 v^2}$ (3) $\frac{x^2 y^2}{u^2 + v^2}$ (4) $\frac{x^2 + y^2}{u^2 + v^2}$
- 72. $\int_0^{\pi/2} \sin^3 x \cos^{5/2} x \, dx =$
 - (1) $\frac{8}{77}$
- (2) $\frac{4}{77}$
- $(3) \frac{3}{44}$
- $(4) \frac{7}{44}$

- **73.** Value of $\int_{0}^{4} \int_{0}^{2\sqrt{z}} \int_{0}^{\sqrt{4z-x^2}} dz \, dx \, dy$ is:
 - (1) 4π
- $(3) 16\pi$
- $(4) 32\pi$

(1) Conjugate property

(3) Parseval identity

(1) $ze^z + c$

76.	Invariant points of the bilinear transf	sformation $w = \frac{(2+i)z-2}{i}$ are:
	(1) $\pm i$ (2) $1 \pm 2i$	~ 1.
77.	Under the transformation $w+1=\frac{4}{z^2}$	$\frac{4}{2^2}$, the unit circle in the w-plane corresponds
	which curve of the z-plane? (1) Circle (2) Parabola	(3) Ellipse (4) Hyperbola by the vectors (-3, 1, 2), (0, 1, 3), (2, 1, 0), (1, 1,
	(1) {(1, 1, 1), (0, 1,0), (0,0,1)}	(2) {(1, 1, 1), (0, 1, 3), (0, 0, 1)}
	(3) {(1, 1, 1), (0, 1, 2), (0, 0, 2)}	
79.	possible values of dim $(W_1 \cap W_2)$ are	and dim $W_1 = 4$, dim $W_2 = 5$, dim $V = 7$, then there: (3) 2, 3 or 4 (4) 5, 6 or 7
80.	Let $T: \mathbb{R}^3 \to \mathbb{R}^3$ be a linear transform	mation given by $T(x, y, z) = \left(\frac{x}{2}, \frac{y}{2}, 0\right)$. The rank of
	T is: (1) 3 (2) 4	(3) 1 (4) 2
81.	For two given confocal conics, if the then the locus of these tangents is:	tangents drawn (one to each) are perpendicula
	(1) an ellipse	(2) a hyperbola
	(3) a circle	(4) a straight line
82.	Radius of the sphere $2x^2 + 2y^2 + 2z^2 -$	-2x+4y+2z+3=0 is:
	(1) 2 (2) 0	(3) 4 (4) 8
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74. If f and g are piecewise smooth periodic functions with fourier co-efficients c_n and d_n

(2) Parseval equality

(4) Dirichlet identity

(3) $ze^{-z} + c$ (4) $ze^{z+1} + c$

respectively, then the result $\frac{1}{T} \int_{-T/2}^{T/2} f(t) \, \overline{g(t)} \, dt = \sum_{k=-\infty}^{\infty} c_k \, \overline{d}_k$, is known as:

75. The analytic function whose real part is $e^x (x \cos y - y \sin y)$, is:

(2) $z\sin z + c$

- The condition that the plane lx + my + nz = 0 may touch the cone $4x^2 y^2 + 3z^2 = 0$,
 - (1) $4l^2 12m^2 + 3n^2 = 0$

(2) $3l^2 - 12m^2 + 4n^2 = 0$

(3) $3l^2 - 6m^2 + 4n^2 = 0$

- (4) $4l^2 6m^2 + 3n^2 = 0$
- The pole of the plane lx + my + nz = p w. r. t. the conicoid $ax^2 + by^2 + cz^2 = 1$ is:
 - (1) $\left(\frac{l}{a}, \frac{m}{h}, \frac{n}{c}\right)$

(2) $\left(\frac{a}{lp}, \frac{b}{mp}, \frac{c}{np}\right)$

(3) $\left(\frac{pl}{a}, \frac{pm}{h}, \frac{pn}{c}\right)$

- (4) $\left(\frac{l}{an}, \frac{m}{hn}, \frac{n}{cn}\right)$
- The equation of the plane which cuts the paraboloid $x^2 2y^2 z = 0$ in a conic with its 85. centre at the point $\left(2, \frac{3}{2}, 4\right)$, is:
 - (1) 4x-6y+z-5=0

(2) 4x-6y-z+5=0

(3) 4x+6y+z+5=0

- (4) 4x+6y-z-5=0
- The statement "The number of primes is infinite" is known as:
 - (1) Fundamental theorem of arithmetic (2) Euclid's first theorem
 - (3) Euclid's second theorem
- (4) Wilson's theorem
- When 2²⁰ is divided by 7, the remainder is: 87.
 - (1) 4
- (2) 3
- (3) 2
- (4) 1

- 88. $\phi(450) =$
 - (1) 90
- (2) 100
- (3) 110
- (4) 120
- If sin(u + iv) = x + iy, then which of the following is true? 89.
 - (1) $\frac{x^2}{\sin^2 u} + \frac{y^2}{\cos^2 u} = 1$

- (2) $\frac{x^2}{\sin^2 y} \frac{y^2}{\cos^2 y} = 1$
- (3) $\frac{x^2}{\cos h^2 v} \frac{y^2}{\sin h^2 v} = 1$
- (4) $\frac{x^2}{\cos^2 u} \frac{y^2}{\sin^2 u} = 1$
- **90.** If $\tan^{-1} 2x + \tan^{-1} 3x = \pi/4$, then x = 0:

 - (1) $\frac{1}{6}$ (2) $\frac{3}{4}$
- (3) $\frac{2}{3}$
- $(4) \frac{5}{6}$

91.	$J_{n-1}(x) + J_{n+1}(x) =$	net.					
	$(1) \ \frac{n}{x} J_n(x)$	(2)	$\frac{n}{x}J'_n(x)$	(3)	$\frac{x}{2n} J_n(x)$	(4)	$\frac{2n}{x}J_n(x)$
92.	$P'_{n+1}(x) - xP'_n(x) =$ (1) $n P_n(x)$	(2)	(n+1) P(x)	(2)	(m : 1) D (m)	(A)	(25 · 1) D (-)
03	$H_n(x) =$	(2)	$(n+1)T_n(x)$	(3)	$(n+1) P_{n+1}(x)$	(4)	$(2n+1) P_n(x)$
33.	$H_n(x) = $ $(1) H_{n+1}(x)$	(2)	$n H_{n-1}(x), n \ge 1$	(3)	$nH_{n+1}(x)$	(4)	$2n H_{n-1}(x), n \ge 1$
94.	$L (t e^{-4t} \sin 3t) =$						
	$(1) \frac{6(s+4)}{(s^2+8s+25)^2}$			(2)	$\frac{3(s+4)}{(s^2+8s+25)^2}$		
	(3) $\frac{6(s+4)}{(s^2+6s+25)^2}$		a Aleberta Je	(4)	$\frac{3(s+4)}{(s^2+6s+25)^2}$		
95.	Fourier transform of	of f(x) defined by f	(x) =	$= \begin{cases} 1, & x < a \\ 0, & x > a \end{cases} $ is		
	$(1) \ \frac{2}{s} \cos as$	(2)	$\frac{4}{s}\sin as$	(3)	$\frac{1}{s}\sin as$	(4)	$\frac{2}{s}\sin as$
96.	C language is availa		for which of the UNIX			(4)	All of these
97.	Which of the follow	ring i	is invalid ?	X=M		N=Z	
	(1) 'a'	(2)	'ab'	(3)	y y	(4)	ñ ñ
98.	The continue comm (1) do	nand (2)			Switch	(1)	While
99.	Which of the follow			3 12		(4)	writte
	(1)	(2)	+	(3)	%	(4)	++
00.	What should be the	exp	ression return va	lue	for a do-while to	teri	minate?
	(1) -1	(2)	1	(3)	0	(4)	NULL
- 3							

Total No. of Printed Pages: 13

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

CPG-EE-2018 (Mathematics)-(SET-Y)

D VACO	to Verily Jumber Charts Romander Charts Bolding Sr. No.	10912
Time : 1½ Hours	Total Questions: 100	Max. Marks : 100
Roll No. (in figures)	(in words)	
Candidate's Name	Date of Birth	
Father's Name	Mother's Name	
Date of Exam :		
(Signature of the Candidate)	(Signature	of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

- 1. All questions are *compulsory* and carry equal marks. The candidates are required to attempt all questions.
- 2. The candidates must return the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means/misbehaviour will be registered against him/her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
- 3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
- 4. The candidate must not do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers must not be ticked in the question booklet.
- 5. Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.
- 6. There will be negative marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 7. Before answering the questions, the candidates should ensure that they have been supplied correct & complete question booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

CPG-EE-2018(Mathematics)-(SET-Y)/(D)

- Consider the statements:
 - (a) Union of two subgroups of a group is also a subgroup of that group.
 - (b) Intersection of two subgroups of a group is also a subgroup of that group. Which of the above is true?
 - (1) Only (a)

(2) Only (b)

(3) Both (a) and (b)

- (4) Neither (a) nor (b)
- 2. Choose the wrong statement:
 - (1) Every field is an integral domain
 - (2) Every field is a division ring
 - (3) Every division ring is a field
 - (4) Every finite non-zero integral domain is a field
- 3. If S and T are co-maximal ideals of a commutative ring R with unity then:
 - (1) $ST = S \cap T$

(2) $ST = S \cup T$

(3) ST = R

- (4) $S \cap T = R$
- 4. Choose the incorrect statement:
 - (1) If R is a UFD, then so is R[x].
 - (2) If R is an integral domain with unity, then every irreducible element in R[x] is an irreducible polynomial.
 - (3) If F is a field, then every irreducible polynomial of F[x] is irreducible element of F[x].
 - (4) Eisenstein's criterion is necessary for the irreducibility of a polynomial.
- The velocity of a particle moving in a straight line is given by $v^2 = 2x e^x$, then its acceleration is:
 - (1) $\frac{v^2}{2r}(x-1)$ (2) $\frac{v^2}{2}(x+1)$ (3) $\frac{v^2}{2r}(x+1)$ (4) $\frac{v}{2r}(x+1)$

- **6.** Let $P(r, \theta)$ be the position of a moving particle at time t, then its transverse acceleration is:
 - (1) $\frac{1}{r} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right)$

(2) $\frac{1}{r} \frac{d}{dt} \left(r^2 \frac{d\theta}{dt} \right)$

(3) $\frac{1}{r^2} \frac{d}{dt} \left(r \frac{d\theta}{dt} \right)$

(4) $\frac{d}{dt} \left(r^2 \frac{d\theta}{dt} \right)$

- 7. A particle is moving with S. H. M. with amplitude a. The distance x from the centre where the velocity is half that of the maximum velocity is given by:
- (1) $\frac{2}{3}a$ (2) $\frac{1}{3}a$ (3) $\frac{2}{\sqrt{3}}a$ (4) $\frac{\sqrt{3}}{2}a$
- 8. If the maximum horizontal range of a projectile is R, then the greatest height attained
 - (1) $\frac{1}{2}R$
- (2) $\frac{1}{2}R$
- $(3) \ \frac{1}{4}R$
- (4) $\frac{3}{4}R$
- 9. To a man walking at the rate of 5 km/hr, rain appears to fall vertically. If its real velocity is 10 km/hr, then its real direction to the horizontal is:
 - (1) $\theta = \pi/6$
- (2) $\theta = \pi/2$
- (3) $\theta = \pi/4$
- 10. A particle describes an ellipse under a central orbit, the velocity at any point of its

 - (1) $v^2 = \lambda \left(\frac{2}{r} \frac{1}{a}\right)$ (2) $v^2 = \lambda \left(\frac{2}{r} \frac{1}{2a}\right)$ (3) $v^2 = \lambda \left(\frac{1}{r} \frac{2}{a}\right)$ (4) $v^2 = \lambda \left(\frac{1}{r} \frac{1}{a}\right)$

- **11.** $J_{n-1}(x) + J_{n+1}(x) =$

- (1) $\frac{n}{x} J_n(x)$ (2) $\frac{n}{x} J'_n(x)$ (3) $\frac{x}{2n} J_n(x)$ (4) $\frac{2n}{x} J_n(x)$
- **12.** $P'_{n+1}(x) xP'_n(x) =$
 - (1) $n P_n(x)$

- (2) $(n+1) P_n(x)$ (3) $(n+1) P_{n+1}(x)$ (4) $(2n+1) P_n(x)$
- 13. $H'_n(x) =$
 - (1) $H_{n+1}(x)$
- (2) $n H_{n-1}(x), n \ge 1$ (3) $n H_{n+1}(x)$ (4) $2n H_{n-1}(x), n \ge 1$

- **14.** L $(t e^{-4t} \sin 3t) =$
 - (1) $\frac{6(s+4)}{(s^2+8s+25)^2}$
- (2) $\frac{3(s+4)}{(s^2+8s+25)^2}$
- (3) $\frac{6(s+4)}{(s^2+6s+25)^2}$
- (4) $\frac{3(s+4)}{(s^2+6s+25)^2}$
- **15.** Fourier transform of f(x) defined by $f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$ is:
 - (1) $\frac{2}{3}\cos as$ (2) $\frac{4}{3}\sin as$ (3) $\frac{1}{3}\sin as$ (4) $\frac{2}{3}\sin as$

16	Classic	1.1.2			
10	(1) DOS	(2) UNIX	of the operating syste (3) Windows	ems? (4) All of these	
17	. Which of the follo	wing is invalid	?		
	(1) 'a'	(2) 'ab'	(3)	(4) ""	
18.		mand cannot be	used with:		
	(1) do	(2) for	(3) Switch	(4) While	
19.	Which of the follow	wing operator h	as lowest priority?		
	(1)	(2) +	(3) %	(4) ++	
20.	What should be the	e expression ret	urn value for a do-wh	nile to terminate?	
	(1) -1	(2) 1	(3) 0	(4) NULL	
21.	For the function f	$(x) = \sin 2x \text{ in } \int$	$0, \frac{\pi}{2}$, the Rolle's theorem	orem is applicable, value of	'C'
	is: (1) π/3		(3) π/6	(4) 3π/8	
22.	$\lim_{(x,y)\to(0,0)} \frac{x^2y}{x^4+y}$	$\frac{y^2}{y^2}$		A think of the plant of the	
	(1) 1/2		(2) 1		
	(3) 0		(4) limit does r	not exist	
23.	If $u = \sin^{-1} \frac{x^2 + y^2}{x + y}$, then $x \frac{\partial u}{\partial x} + y$			
	(1) $\sin u$		(3) tan <i>u</i>	(4) cot <i>u</i>	
24.	$\lim_{x \to 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x} \right).$				
	(1) $-\frac{1}{3}$	(2) $\frac{1}{3}$	(3) $-\frac{2}{3}$	(4) $\frac{2}{3}$	
25.	The arc-rate of rotat	ion of the binor	mal at a point of the c	urve is known as :	
	(1) Tangent vector		(2) Principal no		
	(3) Normal vector		(4) Torsion vect		

26.	If $z = ae^{-b^2t}$	cos bx.	then eliminating the constants a and b , the PDE obtained is
LU.	11 2 - 46	cos on,	their children is

(1)
$$\frac{\partial^2 \mathbf{z}}{\partial t^2} + \frac{\partial \mathbf{z}}{\partial x} = 0$$
 (2) $\frac{\partial^2 \mathbf{z}}{\partial x^2} = \frac{\partial^2 \mathbf{z}}{\partial t^2}$ (3) $\frac{\partial^2 \mathbf{z}}{\partial x^2} + \frac{\partial \mathbf{z}}{\partial t} = 0$ (4) $\frac{\partial^2 \mathbf{z}}{\partial x^2} = \frac{\partial \mathbf{z}}{\partial t}$

(3)
$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial z}{\partial t} = 0$$
 (4) $\frac{\partial^2 z}{\partial x^2} = \frac{\partial z}{\partial t}$

27. Solution of the equation p + q = z is:

(1)
$$f(x-y, y + \log z) = 0$$

(2)
$$f(x-y, y-\log z) = 0$$

(3)
$$f(x+y, y-\log z) = 0$$

(4)
$$f(x-y, y-z) = 0$$

28. The equation
$$u_{xx} + 2u_{yy} + u_{zz} = 2u_{xy} + 2u_{yz}$$
 is:

29. A string is stretched between the fixed points
$$(0, 0)$$
 and $(1, 0)$ and released at rest from the position $u = A \sin \pi x$. The subsequent displacement $u(x, t)$ is given by :

(1) A
$$\cos c \pi t \cos \pi x$$

(2)
$$A \sin(\pi x + ct)$$

(3)
$$A \sin c \pi t \sin \pi x$$

(4)
$$A \cos c \pi t \sin \pi x$$

30. Particular integral of
$$(D^2 - D'^2)z = \cos(x+y)$$
 is:

(1)
$$\frac{x}{4}\sin(x+y)$$

$$(2) x \sin(x+y)$$

(3)
$$\frac{x}{2}\sin(x+y)$$

(1)
$$\frac{x}{4}\sin(x+y)$$
 (2) $x\sin(x+y)$ (3) $\frac{x}{2}\sin(x+y)$ (4) $\frac{x}{2}\cos(x+y)$

32. Radius of the sphere
$$2x^2 + 2y^2 + 2z^2 - 2x + 4y + 2z + 3 = 0$$
 is:

33. The condition that the plane
$$lx + my + nz = 0$$
 may touch the cone $4x^2 - y^2 + 3z^2 = 0$,

(1)
$$4l^2 - 12m^2 + 3n^2 = 0$$

(2)
$$3l^2 - 12m^2 + 4n^2 = 0$$

(3)
$$3l^2 - 6m^2 + 4n^2 = 0$$

$$(4) \quad 4l^2 - 6m^2 + 3n^2 = 0$$

34. The pole of the plane
$$lx + my + nz = p$$
 w. r. t. the conicoid $ax^2 + by^2 + cz^2 = 1$ is:

(1)
$$\left(\frac{l}{a}, \frac{m}{b}, \frac{n}{c}\right)$$

(2)
$$\left(\frac{a}{lp}, \frac{b}{mp}, \frac{c}{np}\right)$$

(3)
$$\left(\frac{pl}{a}, \frac{pm}{b}, \frac{pn}{c}\right)$$

(4)
$$\left(\frac{1}{ap}, \frac{m}{bp}, \frac{n}{cp}\right)$$

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- The equation of the plane which cuts the paraboloid $x^2 2y^2 z = 0$ in a conic with its centre at the point $\left(2, \frac{3}{2}, 4\right)$, is:
 - (1) 4x-6y+z-5=0

(2) 4x-6y-z+5=0

(3) 4x + 6y + z + 5 = 0

- (4) 4x+6y-z-5=0
- The statement "The number of primes is infinite" is known as:
 - (1) Fundamental theorem of arithmetic (2) Euclid's first theorem
 - (3) Euclid's second theorem
- (4) Wilson's theorem
- When 2²⁰ is divided by 7, the remainder is:
 - (1) 4
- (2) 3
- (3) 2
- (4) 1

- 38. $\phi(450) =$
 - (1) 90
- (2) 100
- (3) 110
- (4) 120
- If sin(u + iv) = x + iy, then which of the following is true?
 - (1) $\frac{x^2}{\sin^2 y} + \frac{y^2}{\cos^2 y} = 1$
- (2) $\frac{x^2}{\sin^2 u} \frac{y^2}{\cos^2 u} = 1$
- (3) $\frac{x^2}{\cos h^2 y} \frac{y^2}{\sin h^2 y} = 1$
- (4) $\frac{x^2}{\cos^2 u} \frac{y^2}{\sin^2 u} = 1$
- **40.** If $\tan^{-1} 2x + \tan^{-1} 3x = \pi/4$, then x = 0:
 - (1) $\frac{1}{6}$ (2) $\frac{3}{4}$ (3) $\frac{2}{3}$ (4) $\frac{5}{6}$

- **41.** Let $T_1: U \to V$ and $T_2: V \to W$ be two linear transformations, then which of the following is incorrect?
 - (1) $\rho(T_2T_1) = \rho(T_2)$ if T_1 is singular
 - (2) $\rho(T_2T_1) \le \rho(T_2)$
 - (3) $\rho(T_2T_1) = \rho(T_2)$ if T_1 is invertible
 - (4) If T_1, T_2 are invertible then T_2T_1 is also invertible
- The co-ordinates of vector (1, 1, 1) relative to basis (1, 1, 2), (2, 2, 1), (1, 2, 2) are:

 - (1) $\left(\frac{2}{3}, \frac{1}{3}, 0\right)$ (2) $\left(\frac{2}{3}, \frac{2}{3}, 0\right)$ (3) $\left(\frac{1}{3}, \frac{2}{3}, 0\right)$ (4) $\left(\frac{1}{3}, \frac{1}{3}, 0\right)$

43.

(1) Algebraic dual

44. Choose the wrong statement:

(3) Conjugate

	(4) Every finite dimens	ional inner produc	ct space has an orti	hogonal basis.
45.	Number of real roots of (1) 2 (2)	$x^5 - 5x + 2 = 0$ is 3	3) 3	(4) 5
46.	The order of convergen	1.618	(3) 1.3	(1)
47.	The convergence in Ga the system of three nor	uss-Seidal method -homogeneous lir	iear equations are	acobi's method for solving nree variables, is faster by:
	(1) Three times		(2) Two times	
	(3) n times		(4) Convergence a	are equal
48.	The fourth divided di $x = 0, 1, 4, 6$ and 7 is:	fference of the po	$lynomial 3x^3 + 11$	$x^2 + 5x + 11$ over the points
) 7	(3) 11	(4) 17
49.		g is correct?		
	$(1) \nabla = 1 - E$		$(2) \nabla = 1 + E^{-1}$	
	(3) $\nabla = E^{-1} - 1$		$(4) \nabla = 1 - E^{-1}$	
	(3) $V = E - 1$	$(0) = y_0$ when the		ge-Kutta method is applied
50.	For the IVP $y = -y$, y with step size h , then	y(h) = y(h) = y(h)		
	(1) $\frac{y_0}{2} (h^2 - 2h + 1)$		(2) $\frac{y_0}{2} \left(h^2 - 2h + \right)$	
	(3) $\frac{y_0}{2}(h^2-2h-2)$		(4) $\frac{y_0}{2} \left(h - \frac{h^2}{2} + \right)$	$\left(\frac{h^3}{6}\right)$
51	. It $f(x) = x + 1, x \in [1, 3]$	and partition P	$= \{1, 2, 3\}, \text{ then } L($	f,P) and $U(f,P)$ are:
	(1) 2,4	2) 3,6	(3) 4,7	(4) 5,7
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				Partition 18 to

Select the incorrect one out of the following. Dual space is also named as:

(2) Every finite dimensional vector space is an inner product space.

(1) Every normed linear space is an inner product space.

(3) Every inner product space is a metric space.

(2) Double Generated

(4) Algebraic Conjugate

)		*
52	Value of the integral $\int_{-\infty}^{1} ([x] - x) dx$,	, $[x]$ being the greatest integer function, is:
	2000	(3) 1 (4) 2
53	The integral $\int_{0}^{1} x^{n} e^{-mx} dx$ converges	s for :
	(1) $n < -1$ (2) $n > -1$	(3) $n < -1, m > 1$ (4) $n < -2, m < 1$
54.	$\int_{1}^{\infty} \frac{\sin x}{x^{n}} dx \text{ converges absolutely f}$	for:
	(1) $n = 0$ (2) $n < 1$	(3) $n = 1$ (4) $n > 1$
55.	If A be any subset of a metric spa	ace (X, d) and A° denotes the interior of A, the
	which of the following is not true?	The state of the s
	$(1) (A \cap B)^{\circ} = A^{\circ} \cap B^{\circ}$	$(2) (A \cup B)^{\circ} = A^{\circ} \cup B^{\circ}$
	$(3) (A^{\circ} \cup B^{\circ}) \subset (A \cup B)^{\circ}$	(4) None of these
56.	The concepts of continuity and unifo	
	(1) a closed set	(2) an open set
	(3) a compact set	(4) a finite set
57.	Consider the statements:	
	(a) Every Cauchy sequence in a met	tric space is convergent.
	(b) A metric space is complete if	every cauchy sequence in it has a convergent
	subsequence. Which of the above is true?	
		(2) Only (a)
	(3) Only (b)	
8.	Given the statements:	(4) Neither (a) nor (b)
	(a) In a group, the order of an elemen	nt and its inverse and
	(b) Let (G, .) be a group and a c C b	of and any of an
	Which of the above is true?	e of order m, then $a^n = e$ if and only if m/n .
	(1) Both (a) and (b)	(2) O. 1. (3)
	(3) Only (b)	(2) Only (a)
	(2)	(4) Neither (a) nor (h)

(4) Neither (a) nor (b)

59.	Let $\phi: G \to G'$ be a homomorphism.	The homo-morphism ϕ is an isomorphism of C
	onto G' if and only if:	

- (1) Ker $\phi = 0$
- (2) Ker $\phi = \{e\}$ (3) $\phi(a^{-1}) = [\phi(a)]^{-1}$ (4) $\phi(e) = e'$
- **60.** If $G = \{1, i, -1, -i\}$ is a multiplicative group, then order of -i is :

61. If
$$x^2 + y^2 = v^2 - u^2$$
 and $xy = -uv$, then $\frac{\partial (u, v)}{\partial (x, y)} = \frac{\partial (u, v)}{\partial (x, y)}$

(1) $\frac{x^2 - y^2}{x^2 - y^2}$

(2) $\frac{x^2 + y^2}{y^2 - y^2}$

- (3) $\frac{x^2 y^2}{y^2 + v^2}$
- $(4) \quad \frac{x^2 + y^2}{u^2 + v^2}$

62.
$$\int_0^{\pi/2} \sin^3 x \cos^{5/2} x \, dx =$$

- (1) $\frac{8}{77}$ (2) $\frac{4}{77}$ (3) $\frac{3}{44}$ (4) $\frac{7}{44}$

63. Value of
$$\int_0^4 \int_0^{2\sqrt{z}} \int_0^{\sqrt{4z-x^2}} dz \, dx \, dy$$
 is:

- (1) 4π
- (2) 8π (3) 16π
- (4) 32π

64. If
$$f$$
 and g are piecewise smooth periodic functions with fourier co-efficients c_n and d_n respectively, then the result $\frac{1}{T} \int_{-T/2}^{T/2} f(t) \, \overline{g(t)} \, dt = \sum_{k=-\infty}^{\infty} c_k \, \overline{d}_k$, is known as:

(1) Conjugate property

(2) Parseval equality

(3) Parseval identity

- . (4) Dirichlet identity
- The analytic function whose real part is e^x ($x \cos y y \sin y$), is:
- (2) $z\sin z + c$ (3) $ze^{-z} + c$

66. Invariant points of the bilinear transformation
$$w = \frac{(2+i)z-2}{z+i}$$
 are:

- (1) $\pm i$
- (2) $1 \pm 2i$
- (3) $2 \pm i$

Under the transformation $w+1=\frac{4}{2^2}$, the unit circle in the w-plane corresponds to which curve of the z-plane?

- (1) Circle
- (2) Parabola
- (3) Ellipse
- (4) Hyperbola

D	
6	8. The basis of the sub-space spanned by the vectors (-3, 1, 2), (0, 1, 3), (2, 1, 0), (1, 1, 1) is:
	(1) $\{(1,1,1),(0,1,0),(0,0,1)\}$ (2) $\{(1,1,1),(0,1,3),(0,0,1)\}$
	$(3) \ \{(1,1,1),(0,1,2),(0,0,2)\} $ $(4) \ \{(1,1,1),(0,2,1),(0,0,1)\}$
6:	 9. If W₁ and W₂ are subspaces of V and dim W₁ = 4, dim W₂ = 5, dim V = 7, then the possible values of dim (W₁ ∩ W₂) are: (1) 2 or 4 (2) 1, 2 or 3 (3) 2, 3 or 4 (4) 5, 6 or 7
70	Let $T: \mathbb{R}^3 \to \mathbb{R}^3$ be a linear transformation given by $T(x, y, z) = \left(\frac{x}{2}, \frac{y}{2}, 0\right)$. The rank of T is:
71	(1) 3 (2) 4 (3) 1
	of magnitude Q. The angle between P and Q is:
	(1) $2\cos^{-1}\sqrt{\frac{P}{2Q}}$ (2) $2\sin^{-1}\sqrt{\frac{P}{2Q}}$ (3) $\sin^{-1}\sqrt{\frac{P}{2Q}}$ (4) $\cos^{-1}\sqrt{\frac{P}{2Q}}$
72.	Any system of forces acting on a rigid body can be reduced in general to a force (1) Screen (2) (2) (3) (4) (5) (6) (6) (6) (7) (7) (7) (7) (7) (7) (7) (7) (7) (7
73.	(2) Wrench (3) Negative force (4) Counts
	is called:
	(1) Null line (2) Central axis (3) Wrench (4) Screw
74.	If a body is slightly displaced and it remains in equilibrium in any position, then the
75	(1) Stable (2) Unstable (3) Neutral (4) Porfoct
75.	The constant ratio which the limiting friction bears to the normal reaction is called
	(2) Statical friction
76.	(3) Dynamical friction (4) Normal friction
70.	The set of all limit points of a set $A \subseteq R$ is called a:

(2) Open cover of set A

(4) Limiting set of A

(1) Closure of set A

(3) Derived set of A

77.
$$\lim_{n \to \infty} \left(\frac{2}{1} \cdot \frac{3}{2} \cdot \frac{4}{3} \cdot \dots \cdot \frac{n}{n-1} \right)^{1/n} =$$

- '(2) 1/2
- (3) 1
- (4) 2

78. The series
$$\sum_{n=3}^{\infty} x^{\log n}$$
 is:

- (1) Convergent
- (3) Convergent if $x < \frac{1}{e}$

- (2) Divergent
- (4) Convergent if x < e

79. The series
$$x + \frac{x^2}{2} + \frac{x^3}{3} + \dots$$

- (1) Converges absolutely
- (3) Does not converge

- (2) Converges conditionally
- (4) None of these

80. The infinite product
$$\prod_{n=1}^{\infty} \left(1 + \frac{x}{n}\right), x < 0$$
:

- (1) Diverges to zero
- (3) Converges absolutely
- (2) Converges to 1
- (4) Converges to 2
- Integrating factor of the differential equation $x^2y dx (x^3 + y^3) dy = 0$ is:
- (2) $\frac{1}{v^4}$
- (3) $\frac{1}{rv^3}$

82. Solution of the equation
$$p = \log(px - y)$$
 is:

 $(1) \quad y = cx - e^c$

 $(2) \quad y = cx - \log c$

 $(3) \quad y = cx + c^2$

- $(4) \quad y = cx + e^c$
- **83.** Orthogonal trajectories of $y^2 = 4ax$ are given by :
 - $(1) \quad 2y^2 + x^2 = c^2$

(2) $2x^2 + y^2 = c^2$

(3) $x^2 + y^2 = c^2$

- $(4) \quad 2x^2 y^2 = c^2$
- For the differential equation $\frac{d^2y}{dx^2} 4y = e^x + \sin 2x$, the particular Integral (P. I.) is:
 - (1) $-\frac{1}{2}e^x \frac{1}{8}\cos 2x$

(2) $\frac{1}{3}e^x - \frac{1}{8}\sin 2x$

(3) $-\frac{1}{3}e^x - \frac{1}{8}\sin 2x$

(4) $\frac{1}{3}e^x + \frac{1}{8}\sin 2x$

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- Solution of (x-3y-z) dx + (2y-3x) dy + (z-x) dz = 0 is:

 - (1) $x^2 + 2y^2 z^2 + 6xy + 2xz = c$ (2) $x^2 + 2y^2 z^2 6xy + 2xz = c$

 - (3) $x^2 + 2y^2 + z^2 + 6xy 2xz = c$ (4) $x^2 + 2y^2 + z^2 6xy 2xz = c$
- **86.** If \vec{a} , \vec{b} , \vec{c} are unit vectors such that \vec{b} and \vec{c} are non-parallel $\vec{a} \times (\vec{b} \times \vec{c}) = \frac{1}{2} \vec{b}$, then the angles which \vec{a} makes with \vec{b} and \vec{c} are:
 - (1) $\pi/2, \pi/3$

(2) $\pi/3, \pi/2$

(3) $\pi/3.\pi/4$

- (4) $\pi/2, \pi/4$
- A particle moves along the curve given by $x = 3t^2$, $y = t^2 2t$, $z = t^3$. The acceleration at t = 1 in the direction of vector $\hat{i} + \hat{j} - \hat{k}$ is:
- (2) $\frac{3}{\sqrt{2}}$
- (3) $\frac{4}{\sqrt{3}}$ (4) $\frac{2}{\sqrt{3}}$
- The unit normal vector to the surface $x^4 3xyz + z^2 + 1 = 0$ at the point (1, 1, 1) is:
 - (1) $\frac{1}{\sqrt{11}} (\hat{i} + 3\hat{j} \hat{k})$

(2) $\frac{1}{\sqrt{11}}(\hat{i}-3\hat{j}-\hat{k})$

(3) $\frac{1}{\sqrt{11}}(\hat{i}-3\hat{j}+\hat{k})$

- (4) $\frac{1}{\sqrt{11}} (\hat{i} + 3\hat{j} + \hat{k})$
- **89.** If ϕ is a scalar point function and \overrightarrow{f} is a vector point function, then which of the following is true in an orthogonal curvilinear system?
 - (1) div $(grad \phi) = 0$

(2) curl $(curl \vec{f}) = \vec{0}$

(3) curl $(div \vec{f}) = \vec{0}$

- (4) div $(curl \vec{f}) = 0$
- If S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$, then $\iint (xdydz + y dz dx + zdxdy) =$
 - (1) $2\pi a^3$
- (2) $\frac{4}{3}\pi a^3$ (3) $4\pi a^3$ (4) $\frac{3}{4}\pi a^3$

- **91.** If $A = \begin{bmatrix} x & 3 \\ 3 & x \end{bmatrix}$ and $|A^3| = 343$ then x = 343
 - $(1) \pm 2$
- $(2) \pm 3$
- $(3) \pm 4$
- $(4) \pm 7$

2	2. For two non-singular matrices of the same order, the reversal law of mu					
92.	does not hold for: (2) adjoint					

(1) transpose

(2) adjoint

(3) conjugate

(4) transposed conjugate

If α is an eigen value of a non-singular matrix A, then $\frac{|A|}{\alpha}$ is an eigen value of : (3) A^{-1} (4) None of these

- (1) adj A
- (2) A

94. If the roots of the equation $x^3 + 3px^2 + 3qx + r = 0$ are in G. P. then:

(1) $p^3 = r^2 q^3$

(2) $p^3r^2 = q^3$

- (3) $p^3 = ra^3$
- $(4) \quad p^3 r = q^3$

95. For the equation $x^8 + 5x^3 + 2x - 3 = 0$, the least number of imaginary roots is:

- (2) 4

 $\lim_{x \to 0} \frac{\tan x - \sin x}{\sin^3 x} =$ 96.

- (1) 3/4
- (2) 3/2
- (3) 1/4

97. If a given curve of nth degree has n asymptotes, then the number of points at which these asymptotes cut the curve, is: (4) n (n-3)(3) n(n-2)

- (2) n(n-1)

The radius of curvature for the cardioide $r = a(1 + \cos \theta)$ is given by $\rho =$ $(1) \frac{a}{2}\cos\frac{\theta}{2} \qquad (2) \frac{3a}{4}\cos\frac{\theta}{2}$

- (3) $\frac{2a}{3}\cos\frac{\theta}{2}$
- $(4) \frac{4a}{3}\cos\frac{\theta}{2}$

The area common to the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ is: (1) $32\frac{a^2}{3}$ (2) $16\frac{a^2}{3}$ (3) $8\frac{a^2}{3}$ (4) $\frac{a^2}{3}$

The point of oscul-inflexion is a:

- (1) Double cusp with change of species (2) Double cusp of first species
- (3) Double cusp of second species
- (4) Single cusp with change of species

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Q. NO.	Α	THEMATICS GF B	С	D
1	3	3	2	2
2	3	2	4	3
3	1	2	2	1
4	4	4	3	4
5	1	2	1	3
6	4	3	3	2
7	3	1	3	4
8	4	4	3	3
9	2	2 .	1	4
10	1	1	1	1
11	3	1	2	4
12	2	4	1	2
13	2	2	2	4
14	4	1	3	1
15	2	3	4	4
16	3	1	1	4
17	1	2	4	2
18	4	3	2	3
19	2	4	4	1
20	1	2	3	3
21	2	2 ·	3	2
22	1	3	3	4
23	2	1	1	3
24	3	4	4	1
25	4	3	1	4
26	1	2	4	4
27	4	4	3	2
28	2	3	4	1
29	4	4	2	4
30	3	1	1	3
31	2	4	1	3
32	4	2	4	2
33	3	4 .	2	2
34	1	1	1 2	4
35	4	4	3	2
36	4	4	1	3

37 38 39 40 41 42	A 2 1 4 3 2	B 2 3 1	2 3	1
38 39 40 41 42	1 4 3	3 1		
39 40 41 42	4 3	1		4
40 41 42	3		4	2
41 42		3	2	1
42)	2	4	1
	4	4	1	4
43	2	3	2	2
44	3	1	4	1
45	1	4	2	3
46	3	4	3	1
47	3	2	3	2
48	3	1	1	3
49	1	4	2	4
50	1	3	1	2
51	4	2	2	4
52	2	1 .	4	1
53	4	2	3	2
54	1	3	1	4
55	4	4	4	2
56	4	1	4	3
57	2	4	2	3
58	3	2	1	1
59	1	4	4	2
60	3	3	3	1
61	4	2	2	3
62	1	4	3	1
63	2	2	1	2
64	4	3	4	3
65	2	1	3	1
66	3	3	2	4
67	3	3	4	4
68	1	3	3	2
69	2	1	4	3
70	1	1	1 7	4
71	2	4	3	2

Q. NO.	Α	В	С	D
73	1	2	2	2
74	4	4	3	3
75	3	2	1	1
76	2	3	4	3
77	4	3	4	3
78	3	1	2	3
79	4	2	3	1
80	1	1	4	1
81	3	3	3	2
82	1	3	2	1
83	2 .	1 .	2	2
84	3	4	4	3
85	1	1	2	4
86	4	4	3	1
87	4	3	1	4
88	2	4	4	2
89	3	2	2	4
90	4	1	1	3
91	1	3	4	3
92	4	1	2	3
93	2	2	4	1
94	1	3	1	4
95	3	1 .	4	1
96	1	. 4	4	4
97	2	4	2	3
98	3	2	3	4
99	4	3	1	2
100	2	4	3	1