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PG-EE-2019

SUBJECT: Mathematics Hons. (Five Year)-(SET-X)

A			St. N	1076
Time : 11/4 Hours (75 minutes)	Total	Questions : 100		Max. Marks : 100
Roll No. (in figures)	(in w	vords)		
Name			Date of Birth	
Father's Name		Mother's Name	/	
Date of Exam		- //		
(Signature of the Candidate)			(Signat	ure of the Invigilator)

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1. All questions are compulsory and carry equal marks. The candidates are required to attempt all questions.

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3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to

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6. Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.

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P. T. O.

1.	The set A has 3 elements and the Set elements in the set $A \cup B$ is: (1) 21 (2) 10	B has 7 elements. (3) 7	The minimum number of (4) Can not say
2.	If A and B are two sets, then $A \cap (A \cup to:$	B) ^C (where 'C' den	notes complement) is equal
	(1) \(\phi \)	(3) B	(4) A-B
3.	Let $A = \{0, 1, 2, 3, 4, 5\}$ and a relation R^{-1} is:	R is defined by xRy	such that $2x + y = 10$. Then
	(1) {(4, 3), (2, 4), (5, 0)} (3) {(3, 4), (4, 2), (5, 0)}	(2) {(4, 3), (2, 4), (4) {(3, 4), (4, 2), (4)}	
4.	If $A + C = B$, then tan A tan B tan $C =$		
	(1) $\tan A + \tan B + \tan C$	$(2) \tan A + \tan B -$	
	(3) $\tan B - \tan C - \tan A$	(4) tan B + tan C -	-tan A
5.	If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2 \cos^6$	$x + \cos^4 x = $ $(3) -1$	(4) 2
	(1) 0 (2) 1	(3) —1	(4) 2
6.	If $4 \sin^2 x = 1$, then the values of x are:		
	$(1) n\pi \pm \frac{\pi}{3}$	$(2) n\pi \pm \frac{\pi}{4}$	
	$(3) 2n\pi \pm \frac{\pi}{6}$	$(4) n\pi \pm \frac{\pi}{6}$	
7.	If $n \in \mathbb{N}$, then $3^{3n} - 26n - 1$ is divisible	by:	
	(1) 4 (2) 3	(3) 9	(4) 15
8.	If $z = (K+3) + i \sqrt{5-k^2}$, then the locu	as of z is:	
	(1) a straight line	(2) a parabola	
	(3) an ellipse	(4) a circle	
9.	If 1, w and w^2 are the three cube $(x-1)^3 - 8 = 0$ are:	roots of unity, then	the roots of the equation
	(1) $2, 2w, 2w^2$	(2) $3, 2w, 2w^2$	
	(3) $3, 1 + 2w, 1 + 2w^2$	(4) 2, $1-2w$, $1-$	$2w^2$

10.	The smallest positiv	ve integer <i>n</i> for which	$\ln\left(\frac{1+i}{1-i}\right)^n = 1, \text{ is :}$	
	(1) 4	(2) 3	(3) 2	(4) 1
11.	roots of $x^2 - x + K =$			= 0 is double of one of the (4) 1

12. The interior angles of a regular polygon measure 160° each. The number of diagonals of the polygon are:

(1) 105 (2) 135 (3) 145 (4) 147

13. The number of ways in which 9 identical balls can be placed in three identical boxes, is:

(1) 9 (2) 12 (3) 55 (4) 27

14. In the expansion of $\left(x^2 - \frac{1}{3x}\right)^9$, the term independent of x is :

(1) 5th (2) 6th (3) 7th (4) 4th

15. If the coefficients of rth and (r + 1)th terms in the expansion of $(3 + 7x)^{29}$ are equal, then r =

(1) 14 (2) 15 (3) 18 (4) 21

16. Three numbers forms an increasing G.P. If the middle number is doubled, then the new numbers are in A. P. The common ratio of the G. P. is:

numbers are in A. P. The common ratio of the G. P. is:

(1) $2 + \sqrt{3}$ (2) $3 + \sqrt{2}$

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

17. If $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$ to $\infty = \frac{\pi^2}{6}$, then $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{6}$

(1) $\frac{\pi^2}{3}$ (2) $\frac{\pi^2}{4}$ (3) $\frac{\pi^2}{8}$ (4) $\frac{\pi^2}{12}$

18. If a, b, c are in A.P. as well as G.P., then which of the following is *true*?

 $(1) a = b = c (2) a = b \neq c$

 $(3) a \neq b = c$ $(4) a \neq b \neq c$

value of K is:

(1) 1/4

19.	If the AM of the quadratic equation (1) $x^2 - Ax + G$ (3) $x^2 - 2Ax + G$	ion is: $x^2 = 0$	ratic equation in x is A and their GM is G, then the $(2) x^2 - Ax + G = 0$ $(4) x^2 - 2Ax + G^2 = 0$
20.	A line passes the y-intercept is:	arough the point (2,	2) and is perpendicular to the line $3x + y = 3$, then its
	(1) 2/3	(2) 4/3	(3) 4/5 (4) 3/4
21.	The line $x + y$	= 4 divides the line	joining $(-1, 1)$ and $(5, 7)$ in the ratio $K: 1$, then the

22. If the foot of the perpendicular from the origin to a straight line is at the point (3, -4). Then the equation of the line is:

(3) 1/2

(4) 2

(1)
$$3x - 4y = 25$$

(2) $4x - 3y = 25$
(3) $4x + 3y = 25$
(4) $3x + 4y = 25$

23. The distance between the parallel lines 6x - 3y - 5 = 0 and 2x - y + 4 = 0 is :

(1)
$$3/\sqrt{5}$$
 (2) $\sqrt{5}/3$ (3) $17/3\sqrt{5}$ (4) $17/\sqrt{3}$

(2) 4/3

24. The points (K + 1, 1), (2K + 1, 3) and (2K + 2, 2K) are collinear, then K =

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

25. The equation of the circle of radius 5 whose centre lies on x-axis and passing through (2, 3) is:

(1)
$$x^2 + y^2 - 4x - 21 = 0$$

(2) $x^2 + y^2 + 4x - 21 = 0$
(3) $x^2 + y^2 + 4x - 17 = 0$
(4) $x^2 + y^2 - 4x + 21 = 0$

26. If the parabola $y^2 = 4$ ax passes through (3, 2), then the length of its latus-rectum is :

- (1) 2/3 (2) 3/4 (3) 4 (4) 4/3
- 27. The eccentricity of the hyperbola $16x^2 3y^2 32x + 12y 44 = 0$ is:

(1)
$$\sqrt{13}$$
 (2) $\sqrt{7}$ (3) $\sqrt{\frac{17}{3}}$ (4) $\sqrt{\frac{19}{3}}$

28. The eccentricity of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ whose latus-rectum is half of its major axis,

- $(1) \frac{\sqrt{3}}{2}$
- (2) $\frac{\sqrt{3}}{4}$ (3) $\frac{1}{\sqrt{2}}$
- $(4) \frac{1}{2}$
- The ratio in which the yz-plane divides the segment joining the points (-2, 4, 7) and (3, -5, 8) is:
 - (1) 7:8
- (2) -7:8
- (3) 2:3
- (4) -3:2
- If α , β , γ are the angles which a directed line makes with the positive directions of the co-ordinate axes, then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma =$
- (2) 1
- (4) 3

- **31.** $\lim_{x \to 1} (1-x) \tan \left(\frac{\pi x}{2} \right) =$
 - $(1) \frac{\pi}{2}$
- (2) $\frac{2}{-}$
- (3) $\frac{\pi}{4}$
- (4) 1

- $\lim_{n\to\infty} \frac{(1-2+3-4+5-6....-2n)}{\sqrt{n^2+1}+\sqrt{4n^2-1}} =$
- (2) $\frac{1}{2}$
- (3) $\frac{1}{2}$
- $(4) -\frac{1}{3}$

- 33. $\lim_{x\to 0} \frac{\sin(\pi\cos^2 x)}{x^2} =$
- (2) $\pi/2$
- $(3) -\pi$
- (4) 1

34. If $f(x) = \begin{cases} \frac{x-1}{2x^2 - 7x + 5}, & x \neq 1 \\ -\frac{1}{2}, & x = 1 \end{cases}$

then the derivative of f(x) at x = 1, is:

- $(1) \frac{9}{2}$
- $(2) \frac{-9}{2}$
- $(3)^{2} \frac{2}{9}$
- $(4) \frac{2}{9}$
- The mean of n terms is \bar{x} . If the first term is increased by 1, second by 2 and so on, then the new mean is:
 - $(1) \ \overline{x} + \frac{n+1}{2} \qquad (2) \ \overline{x} + \frac{n}{2}$

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

36.	The standard deviation of 25 numbers in than the standard deviation, is increased (1) 45 (2) 40	by 5, then the new st	numbers which is greater and ard deviation will be: (4) 40.75				
37.	The sum of 10 items is 12 and the s	The sum of 10 items is 12 and the sum of their squares is 18, then the standard					
	deviation is: (1) 3/5 (2) 4/5	(3) 3/10	(4) 2/5				
38.	There are n persons sitting in a row probability that two selected persons are	. Two of them are not sitting together,	selected at random. The is:				
	(1) $\frac{2}{n-2}$ (2) $\frac{n}{n+2}$						
39.	Seven digits from the digits 1, 2, 3, 4, probability that this seven digit number	5, 6, 7, 8, 9 are write is divisible by 9, is:	ten in a random order. The				
	(1) $\frac{1}{3}$ (2) $\frac{2}{7}$	(3) $\frac{1}{9}$	$(4) \frac{2}{9}$				
40.	The coefficients of a quadratic equation first three prime numbers, the probability (1) 2/3 (2) 1/3	ty that roots of the ec	uation are real, is:				
41.		symmetrical about th	the line $x = a$, then which of				
	the following is <i>true</i> ? (1) $f(x+a) = f(x-a)$ (3) $f(a+x) = f(a-x)$	(2) $f(x) = f(-x)$ (4) $f(x) = -f(-x)$					
42.	Let $f: R \to R$ be a function defined by	$f(x) = \frac{x^2 + 2x + 5}{x^2 + x + 1},$	then f is:				
	(1) one-one and onto(3) many one and onto	(2) one-one and in(4) many one and					
43.	$\sin \lambda x + \cos \lambda x$ and $ \sin x + \cos x $ are	periodic of same fun	damental period, if $\lambda =$				
,	(1) 4 (2) 0	(3) 2	(4) 1				
44.	Let R be a relation on the set N of natu (i.e. n/m). Then R is :	ral numbers defined	by $nRm \Leftrightarrow n$ is a factor of m				
	(1) equivalence(3) reflexive and symmetric	(2) transitive and(4) reflexive, trans	symmetric nsitive but not symmetric				
DC I	FF_2019/(Mathematics Hons.)(Five Yr.)-(SET-X)/(A)	o je i voja s den ide vari de P. T. O				

45. If
$$\sin^{-1}\left(\frac{x}{5}\right) + \csc^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$$
, then $x = \frac{\pi}{2}$

- (3) 5
- (4) 2

$$\tan^{-1}(1+x) + \tan^{-1}(1-x) = \frac{\pi}{2}$$
, is:

- (1) x = 0 (2) x = 1
- (3) x = -1 (4) $x = \pi$

47. The value of
$$\tan\left(\frac{1}{2}\cos^{-1}\left(\frac{\sqrt{5}}{3}\right)\right)$$
 is:

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

48. Solution of
$$\sin^{-1} x - \cos^{-1} x = \cos^{-1} \frac{\sqrt{3}}{2}$$
 is :

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

49. If
$$A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$$
 and $A^2 = 8A + KI_2$, then the value of K is:

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

50. If 1,
$$w$$
, w^2 are cube roots of unity, inverse of which of the following matrices exists?

- (1) $\begin{bmatrix} w & w^2 \\ w^2 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} 1 & w \\ w & w^2 \end{bmatrix}$ (3) $\begin{bmatrix} w^2 & 1 \\ 1 & w \end{bmatrix}$ (4) None of these

If A an orthogonal matrix, then which of the following is *true*?

- (1) |A| = 0
- (2) $|A| = \pm 1$ (3) $|A| = \pm 2$ (4) $|A| = \pi/2$

52. If
$$A(\alpha) = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$$
, then $A(\alpha) A(\beta) = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$

(1) $A(\alpha) + A(\beta)$

(2) $A(\alpha) - A(\beta)$

(3) $A(\alpha + \beta)$

(4) $A(\alpha - \beta)$

- **53.** If A and B are two matrices such that AB = B and BA = A, then $A^2 + B^2 = A$
 - (1) A + B
- (2) AB
- (3) 2AB
- If K is a real cube root of -2, then the value of $\begin{vmatrix} 1 & 2K & 1 \\ K^2 & 1 & 3K^2 \\ 2 & 2K & 1 \end{vmatrix}$ is equal to:
 - (1) -10
- (2) -12
- (3) -13 (4) -15
- The equations Kx y = 2, 2x 3y = -K, 3x 2y = -1 are consistent if K = -K
 - (1) 2, -3
- (2) -2, 3
- (3) 1, -4
- (4) -1, 4
- **56.** If $f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$, then $f(2x) f(x) = \begin{bmatrix} a & -1 & 0 \\ ax^2 & ax & a \end{bmatrix}$
 - (1) ax(3a + 2x) (2) ax(2a + 3x) (3) a(2a + 3x) (4) x(3a + 2x)

- **57.** Let $f(x) = \frac{1 \tan x}{4x \pi}$, $x \neq \pi/4$ and $x \in [0, \pi/2] = a$, $x = \pi/4$
 - If f(x) is continuous in $[0, \pi/2]$, then a =
 - (1) 1/2
- (2) -1/2
- (3) 1
- (4) 0
- **58.** Let $f(x) = 1 + x (\sin x) [\cos x]$, $0 < x \le \pi/2$, where [.] denotes the greatest integer function. Then which of the following is true?
 - (1) f(x) is continuous in $(0, \pi/2)$
- (2) f(x) is strictly increasing in $(0, \pi/2)$
- (3) f(x) is strictly decreasing in $(0, \pi/2)$ (4) f(x) has global maximum value 2
- **59.** If $y = \tan^{-1} \sqrt{\frac{1 + \sin x}{1 \sin x}}$, $\pi/2 < x < \pi$, then $\frac{dy}{dx} = \frac{1 + \sin x}{1 \sin x}$
 - (1) -1
- (3) 1/2
- (4) -1/2

- **60.** If $x = e^{y + e^{y} + e^{y} + \dots + \infty}$, then $\frac{dy}{dx} = \frac{dy}{dx}$
 - (1) $\frac{1-x}{x}$ (2) $\frac{x}{1-x}$ (3) $\frac{1+x}{x}$
- (4) $\frac{x}{1+x}$

61. If
$$x = a \cos^3 \theta$$
, $y = a \sin^3 \theta$, then $\sqrt{1 + \left(\frac{dy}{dx}\right)^2} =$

- (1) $\sec^2\theta$
- (2) $tan^2\theta$
- (3) $|\sec \theta|$
- (4) $|\cot \theta|$

62. If
$$e^y + xy = e$$
, then the value of $\frac{d^2y}{dx^2}$ for $x = 0$, is:

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

63. If
$$x^y$$
. $y^x = 16$, then $\frac{dy}{dx}$ at (2, 2) is:

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

- (1) 5.01
- (2) 5.02
- (3) 5.03
- (4) 5.04

65. The tangent at
$$(1, 1)$$
 on the curve $y^2 = x(2-x)^2$ meets it again at the point :

- (1) (-3, 7)
- (2) (4, 4)
- $(3) \left(\frac{3}{8}, \frac{9}{4}\right)$
- $(4) \left(\frac{9}{4}, \frac{3}{8}\right)$

66. The distance between the origin and the normal to the curve
$$y = e^{2x} + x^2$$
 at $x = 0$ is :

- (1) $4/\sqrt{5}$
- (2) $3/\sqrt{5}$
- (3) $2/\sqrt{5}$

67. The length of longest interval in which Rolle's theorem can be applied for the function
$$f(x) = |x^2 - a^2|$$
, $(a > 0)$, is:

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

68. If the function
$$f(x) = \sqrt{3} \sin x - \cos x - 2ax + b$$
 decreases for all real values of x, then the value of a is given by :

- (1) a < 1
- (2) $a < \sqrt{2}$
- (3) $a \ge \sqrt{2}$
- (4) $a \ge 1$

69. The condition that
$$x^3 + ax^2 + bx + c$$
 may have no extremum, is:
 (1) $a^2 > 3b$ (2) $a^2 < 3b$ (3) $a^2 > 2b$ (4) $a^2 < 2b$

70.
$$\int \frac{3 + 2\cos x}{(2 + 3\cos x)^2} dx =$$

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

$$(2) \frac{\cos x}{2 + 3\cos x} + c$$

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

$$(4) \quad \frac{2\cos x}{2 + 3\cos x} + c$$

71. $\int x^x (1 + \log x) dx =$

(1)
$$x^{x} + c$$

(2)
$$x^x \log x + c$$

(3)
$$x \log x + c$$

(2) $x^x \log x + c$ (3) $x \log x + c$ (4) none of these

72. $\int \sin \sqrt{x} dx =$

$$(1) (\cos \sqrt{x} - \sin \sqrt{x}) + c$$

(2)
$$(\sqrt{x}\cos\sqrt{x} - \sin\sqrt{x}) + c$$

$$(3) -2(\sqrt{x}\cos\sqrt{x}-\sin\sqrt{x})+c$$

$$(3) -2(\sqrt{x}\cos\sqrt{x} - \sin\sqrt{x}) + c \qquad (4) 2(\sqrt{x}\cos\sqrt{x} - \sin\sqrt{x}) + c$$

73. $\int \frac{1}{\sqrt{\sin^3 x \cos x}} dx =$

(1)
$$2(\tan x)^{-\frac{1}{2}} + c$$

(2)
$$(\tan x)^{1/2} + c$$

(3)
$$(\tan x)^{-1/2} + c$$

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

74. If $I_n = \int_0^1 x^n e^{-x} dx$ for $n \in \mathbb{N}$, then $I_n - n I_{n-1} =$

- (1) 1/e
- (2) -1/e
- (4) -2/e

75. If $\int_{\pi/2}^{\theta} \sin x \, dx = \sin 2\theta$, then the value of θ satisfying $0 < \theta < \pi$, is:

- (1) $\pi/6$
- (2) $\pi/4$
- (3) $\pi/2$
- (4) $5\pi/6$

76. $\int_0^{[x]} (x - [x]) dx =$

- (1) $\frac{1}{2}[x]$ (2) [x]
- $(3) \ 2[x]$
- (4) -2[x]

77. $\int_0^{\pi/4} \log(1 + \tan x) dx =$

- (1) $\frac{\pi}{4} \log 2$ (2) $\frac{\pi}{8} \log 2$ (3) $\frac{\pi}{2} \log 2$ (4) $\pi \log 2$

The area bounded by the curve $y = x \sin x$ and x-axis between x = 0 and $x = 2\pi$, is:

(1) π sq. units

(2) $\frac{\pi}{2}$ sq. units

(3) 2π sq. units

(4) 4π sq. units

79. If the area bounded by the curves $y^2 = 4ax$ and y = mx is $a^2/3$ sq. units, then the value of m is:

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

- **80.** Solution of $\frac{dy}{dx} = \cos(x+y)$ is:
 - (1) $\sin(x+y) = x + c$

(2) $\tan\left(\frac{x+y}{2}\right) + x = c$

(3) $\cot\left(\frac{x+y}{2}\right) = x+c$

- (4) $\tan\left(\frac{x+y}{2}\right) = x+c$
- Solution of $ydx + (x y^3) dy = 0$ is :
 - (1) $xy + \frac{y^2}{2} = c$

(2) $xy = \frac{y^2}{2} + c$

(3) $xy = \frac{y^2}{4} + c$

- (4) $xy = \frac{x^2}{4} + c$
- The differential equation $y \frac{dy}{dx} = x + a$ (a being constant) represents a set of:
 - (1) circles having centre on the x-axis
- (2) circles having centre on the y-axis

(3) ellipses

- (4) hyperbolas
- From a bag containing 2 white, 3 red and 4 black balls, two balls are drawn one by one without replacement. The probability that at least ones ball is red, is:
 - $(1) \frac{5}{12}$
- (2) $\frac{7}{12}$ (3) $\frac{5}{8}$
- $(4) \frac{3}{7}$
- A box contains 15 items in which 4 items are defective. The items are selected at random, one by one, and examined. The ones examined are not put back. The probability that 9th one examined is the last defective, is:
 - $(1) \frac{7}{105}$
- $(2) \frac{8}{105}$
- (3) $\frac{16}{255}$
- $(4) \frac{14}{255}$
- A person is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. The probability that it is actually a six, is:
 - (1) $\frac{7}{36}$ (2) $\frac{11}{36}$
- (3) $\frac{3}{8}$
- $(4) \frac{5}{8}$

- Four numbers are multiplied together. The probability that the product will be divisible by 5 or 10, is:
 - $(1) \frac{123}{625}$
- (2) $\frac{133}{625}$ (3) $\frac{357}{625}$ (4) $\frac{369}{625}$
- The least number of times a fair coin must be tossed so that the probability of getting at least one head is at lest 0.8, is:
 - (1) 3
- (2) 5
- (4) 8
- **88.** If $P(A \cup B) = \frac{3}{4}$ and $P(\overline{A}) = 2/3$, then $P(\overline{A} \cap B) =$
- (1) $\frac{7}{12}$ (2) $\frac{5}{12}$ (3) $\frac{1}{12}$
- $(4) \frac{1}{6}$
- If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$, then the angle between \vec{a} and \vec{b} is:
 - (1) $\pi/3$
- $(2) 2\pi/3$
- (3) $\pi/6$
- (4) $5\pi/3$
- Let \vec{a} and \vec{b} be two unit vectors and α be the angle between them, then $\vec{a} + \vec{b}$ is a unit vector if $\alpha =$
 - (1) $\pi/2$
- (2) $\pi/3$
- (3) $2\pi/3$
- (4) $\pi/4$
- The unit vector perpendicular to the vectors $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$ is/are:
 - (1) $\pm \frac{1}{\sqrt{3}}(\hat{i} \hat{j} \hat{k})$

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

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

- (4) $\frac{1}{\sqrt{2}}(\hat{i} + \hat{k})$
- The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$. The value of x is:
 - $(1) \frac{1}{3}$
- (2) -3
- (3) $\frac{2}{3}$
- $(4) -\frac{2}{3}$
- **93.** The vectors $\overrightarrow{AB} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\overrightarrow{BC} = -\hat{i} 2\hat{k}$ are the adjacent sides of a parallelogram. The angle between its diagonals is:
 - (1) $\pi/6$
- (2) $\pi/3$
- (3) $\pi/2$
- $(4) \pi/4$

- **94.** Consider a LPP: $\min Z = 6x + 10y$ subjected to $x \ge 6$, $y \ge 2$, $2x + y \ge 10$; $x, y \ge 0$. Redundand constraints in this LPP are:
 - (1) $x \ge 0, y \ge 0$

(2) $2x + y \ge 10$

(3) $x \ge 6$, $2x + y \ge 10$

- (4) None of these
- The angle between the lines having direction ratios 4, -3, 5 and 3, 4, 5 is:
 - (1) $\pi/3$
- (2) $\pi/4$
- (3) $\pi/6$
- $(4) 2\pi/3$
- If a plane meets the coordinate axes at A, B and C in such a way that the centroid of triangle ABC it at the point (1, 2, 3), then the equation of the plane is:
 - (1) $\frac{x}{1} + \frac{y}{2} + \frac{z}{3} = 1$

(2) $\frac{x}{2} + \frac{y}{6} + \frac{z}{9} = 1$

(3) $\frac{x}{1} + \frac{y}{2} + \frac{z}{3} = \frac{1}{3}$

- (4) $\frac{x}{3} + \frac{y}{6} + \frac{z}{0} = 3$
- The image of the point (1, 3, 4) in the plane 2x y + z + 3 = 0 is :
 - (1) (3, 5, 2)

(2) (3, 5, -2)

(3) (-3, 5, 2)

- (4) (3, -5, 2)
- The lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and $\frac{x-1}{-2} = \frac{y-2}{-4} = \frac{z-3}{-6}$ are:
 - (1) intersecting

(2) parallel

(3) coincidental

- (4) skew
- The distance between the line $\vec{r} = 2\hat{i} 2\hat{j} + 3\hat{k} + \lambda(\hat{i} \hat{j} + 4\hat{k})$ and the plane $\vec{r} \cdot (\hat{i} + 5\hat{j} + \hat{k}) = 5$ is:

- (1) $\frac{10}{3\sqrt{3}}$ (2) $\frac{10}{\sqrt{2}}$ (3) $\frac{10}{3}$ (4) $\frac{5}{3\sqrt{2}}$
- 100. The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if $k = \frac{z-4}{1}$
 - (1) 4
- (2) 3
- (3) -1
- (4) -3

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PG-EE-2019

SUBJECT: Mathematics Hons. (Five Year)-(SET-X)

В		Sr. No. 10762
Time: 11/4 Hours (75 minutes)	Total Questions: 100	Max. Marks : 100
Roll No. (in figures)	(in words)	
Name		Date of Birth
Father's Name	Mother's Name	
Date of Exam		
(Signature of the Candidate)		(Signature of the Invigilator)
	THE FOLLOWING INFORM	NATION/INSTRUCTIONS BEFORE PAPER.
1. All questions are compulso	ory and carry equal marks. T	he candidates are required to attempt

all questions.

- 2. The candidate must return this question booklet and the OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfairmeans / 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. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMA Sheet may be kept by the candidate.
- 4. Question Booklet along-with answer key of all the A, B, C and D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University website. The complaint be sent by the students to the Controller of Examinations/by hand or through email. Thereafter, no complaint in any case will be considered.
- 5. 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.
- 6. Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.
- 7. There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect
- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete question booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

- 1. $\int x^x (1 + \log x) dx =$
- $(2) x^{x} \log x + c \qquad (3) x \log x + c$
- (4) none of these

- $\int \sin \sqrt{x} dx =$
 - (1) $(\cos\sqrt{x} \sin\sqrt{x}) + c$
- (2) $(\sqrt{x}\cos\sqrt{x} \sin\sqrt{x}) + c$
- $(3) -2(\sqrt{x}\cos\sqrt{x} \sin\sqrt{x}) + c \qquad (4) 2(\sqrt{x}\cos\sqrt{x} \sin\sqrt{x}) + c$

- 3. $\int \frac{1}{\sqrt{\sin^3 x \cos x}} dx =$

- (1) $2(\tan x)^{-\frac{1}{2}} + c$ (2) $(\tan x)^{\frac{1}{2}} + c$ (3) $(\tan x)^{-\frac{1}{2}} + c$ (4) $2(\tan x)^{\frac{1}{2}} + c$
- **4.** If $I_n = \int_0^1 x^n e^{-x} dx$ for $n \in \mathbb{N}$, then $I_n n I_{n-1} =$
 - (1) 1/e
- (2) -1/e
- (3) e
- (4) -2/e
- **5.** If $\int_{\pi/2}^{\theta} \sin x \, dx = \sin 2\theta$, then the value of θ satisfying $0 < \theta < \pi$, is:
 - (1) $\pi/6$
- (2) $\pi/4$
- (3) $\pi/2$
- (4) $5\pi/6$

- **6.** $\int_0^{[x]} (x [x]) dx =$
 - (1) $\frac{1}{2}[x]$
- (2) [x]
- (3) 2[x]
- (4) -2[x]

- 7. $\int_0^{\pi/4} \log(1 + \tan x) dx =$

 - (1) $\frac{\pi}{4} \log 2$ (2) $\frac{\pi}{8} \log 2$ (3) $\frac{\pi}{2} \log 2$
- (4) $\pi \log 2$
- The area bounded by the curve $y = x \sin x$ and x-axis between x = 0 and $x = 2\pi$, is :
 - (1) π sq. units

(2) $\frac{\pi}{2}$ sq. units

(3) 2π sq. units

- (4) 4π sq. units
- **9.** If the area bounded by the curves $y^2 = 4ax$ and y = mx is $a^2/3$ sq. units, then the value of m is:
 - (1) 2
- (2) -2
- (3) 1/2
- (4) 3/2

- **10.** Solution of $\frac{dy}{dx} = \cos(x+y)$ is:
 - (1) $\sin(x+y) = x + c$

(2) $\tan\left(\frac{x+y}{2}\right) + x = c$

(3) $\cot\left(\frac{x+y}{2}\right) = x+c$

- (4) $\tan\left(\frac{x+y}{2}\right) = x+c$
- 11. If A an orthogonal matrix, then which of the following is *true*?
 - (1) |A| = 0
- (2) $|A| = \pm 1$
- (3) $|A| = \pm 2$
- 12. If $A(\alpha) = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$, then $A(\alpha) A(\beta) = -\sin \alpha$
 - (1) $A(\alpha) + A(\beta)$ (2) $A(\alpha) A(\beta)$ (3) $A(\alpha + \beta)$ (4) $A(\alpha \beta)$

- **13.** If A and B are two matrices such that AB = B and BA = A, then $A^2 + B^2 = A$
 - (1) A + B
- (2) AB
- (3) 2AB
- (4) I
- If K is a real cube root of -2, then the value of $\begin{bmatrix} K^2 & 1 & 3K^2 \\ 2 & 2K & 1 \end{bmatrix}$ is equal to:
 - (1) -10
- (2) -12
- (3) -13
- (4) -15
- **15.** The equations Kx y = 2, 2x 3y = -K, 3x 2y = -1 are consistent if K = -K
 - (1) 2, -3
- (2) -2, 3 (3) 1, -4
- (4) -1, 4
- **16.** If $f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$, then f(2x) f(x) =

- (1) ax(3a+2x) (2) ax(2a+3x) (3) a(2a+3x) (4) x(3a+2x)
- 17. Let $f(x) = \frac{1 \tan x}{4x \pi}$, $x \neq \pi/4$ and $x \in [0, \pi/2] = a$, $x = \pi/4$

If f(x) is continuous in $[0, \pi/2]$, then a =

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

- **18.** Let $f(x) = 1 + x (\sin x) [\cos x]$, $0 < x \le \pi/2$, where [.] denotes the greatest integer function. Then which of the following is true?
 - (1) f(x) is continuous in $(0, \pi/2)$
- (2) f(x) is strictly increasing in $(0, \pi/2)$
- (3) f(x) is strictly decreasing in $(0, \pi/2)$ (4) f(x) has global maximum value 2
- **19.** If $y = \tan^{-1} \sqrt{\frac{1 + \sin x}{1 \sin x}}$, $\pi/2 < x < \pi$, then $\frac{dy}{dx} = \frac{1}{2}$
 - (1) -1
- (2) 1
- (3) 1/2
- (4) -1/2

- **20.** If $x = e^{y+e^{y}+e^{y}+\dots \infty}$, then $\frac{dy}{dx} = \frac{dy}{dx}$
 - (1) $\frac{1-x}{x}$ (2) $\frac{x}{1-x}$ (3) $\frac{1+x}{x}$

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

- **21.** Solution of $ydx + (x y^3) dy = 0$ is :
 - (1) $xy + \frac{y^2}{2} = c$

(2) $xy = \frac{y^2}{2} + c$

(3) $xy = \frac{y^2}{4} + c$

- (4) $xy = \frac{x^2}{4} + c$
- 22. The differential equation $y \frac{dy}{dx} = x + a$ (a being constant) represents a set of:
 - (1) circles having centre on the x-axis
- (2) circles having centre on the y-axis

(3) ellipses

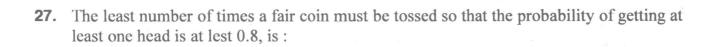
- (4) hyperbolas
- 23. From a bag containing 2 white, 3 red and 4 black balls, two balls are drawn one by one without replacement. The probability that at least ones ball is red, is:
 - $(1) \frac{5}{12}$
- (2) $\frac{7}{12}$ (3) $\frac{5}{8}$ (4) $\frac{3}{7}$

- 24. A box contains 15 items in which 4 items are defective. The items are selected at random, one by one, and examined. The ones examined are not put back. The probability that 9th one examined is the last defective, is:
 - $(1) \frac{7}{105}$

- (2) $\frac{8}{195}$ (3) $\frac{16}{255}$ (4) $\frac{14}{255}$

(1) 3

25.	A person is known a six. The probabil				throws a die	e and report	s that it is
	(1) $\frac{7}{36}$	(2) $\frac{11}{36}$		(3) $\frac{3}{8}$	(4)	<u>5</u> 8	
26.	Four numbers are by 5 or 10, is:	multiplied tog	gether. Th	e probability	that the pro	duct will be	divisible
	(1) $\frac{123}{625}$	(2) $\frac{133}{625}$		$(3) \frac{357}{625}$	(4)	$\frac{369}{625}$	



(3) 6

(4) 8

28. If $P(A \cup B) = \frac{3}{A}$ and $P(\overline{A}) = 2/3$, then $P(\overline{A} \cap B) = 2/3$

(2) 5

- (1) $\frac{7}{12}$ (2) $\frac{5}{12}$ (3) $\frac{1}{12}$ (4) $\frac{1}{6}$
- **29.** If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$, then the angle between \vec{a} and \vec{b} is:
 - (1) $\pi/3$ (2) $2\pi/3$ (3) $\pi/6$ (4) $5\pi/3$
- 30. Let \vec{a} and \vec{b} be two unit vectors and α be the angle between them, then $\vec{a} + \vec{b}$ is a unit vector if $\alpha =$
- (1) $\pi/2$ (2) $\pi/3$ (3) $2\pi/3$ (4) $\pi/4$
- 31. The value of K for which one of the roots of $x^2 3x + 2K = 0$ is double of one of the roots of $x^2 x + K = 0$, is:
 - (1) 2 (2) -2 (3) -1 (4) 1
- 32. The interior angles of a regular polygon measure 160° each. The number of diagonals of the polygon are:
 - (1) 105 (2) 135 (3) 145 (4) 147
- **33.** The number of ways in which 9 identical balls can be placed in three identical boxes, is:
 - (1) 9 (2) 12 (3) 55 (4) 27

- In the expansion of $\left(x^2 \frac{1}{3x}\right)^9$, the term independent of x is:
 - (1) 5th
- (2) 6th
- (3) 7th
- (4) 4th
- If the coefficients of rth and (r + 1)th terms in the expansion of $(3 + 7x)^{29}$ are equal, then r =
 - (1) 14
- (2) 15
- (3) 18
- (4) 21
- Three numbers forms an increasing G.P. If the middle number is doubled, then the new numbers are in A. P. The common ratio of the G. P. is:
 - (1) $2 + \sqrt{3}$

(2) $3 + \sqrt{2}$

(3) $\sqrt{3} + 1$

- (4) $3 \sqrt{2}$
- 37. If $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$ to $\infty = \frac{\pi^2}{6}$, then $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{6}$
 - (1) $\frac{\pi^2}{2}$

- (2) $\frac{\pi^2}{4}$ (3) $\frac{\pi^2}{9}$ (4) $\frac{\pi^2}{12}$
- If a, b, c are in A.P. as well as G.P., then which of the following is true?
 - (1) a = b = c

(2) $a = b \neq c$

(3) $a \neq b = e$

- (4) $a \neq b \neq c$
- 39. If the AM of the roots of a quadratic equation in x is A and their GM is G, then the quadratic equation is:
 - (1) $x^2 Ax + G^2 = 0$

(3) $x^2 - 2Ax + G = 0$

- (2) $x^2 Ax + G = 0$ (4) $x^2 2Ax + G^2 = 0$
- **40.** A line passes through the point (2, 2) and is perpendicular to the line 3x + y = 3, then its y-intercept is:
 - (1) 2/3
- (2) 4/3
- (3) 4/5
- (4) 3/4
- The unit vector perpendicular to the vectors $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$ is/are:
 - (1) $\pm \frac{1}{\sqrt{3}}(\hat{i} \hat{j} \hat{k})$

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

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

(4) $\frac{1}{\sqrt{2}}(\hat{i} + \hat{k})$

- The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i} + (4x-2)\hat{j} + 2\hat{k}$. The value of x is:
 - (1) $\frac{1}{3}$
- (2) -3
- (3) $\frac{2}{3}$ (4) $-\frac{2}{3}$
- **43.** The vectors $\overrightarrow{AB} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\overrightarrow{BC} = -\hat{i} 2\hat{k}$ are the adjacent sides of a parallelogram. The angle between its diagonals is:
 - (1) $\pi/6$
- (2) $\pi/3$
- (3) $\pi/2$
- $(4) \pi/4$

- **44.** Consider a LPP: $\min Z = 6x + 10y$ subjected to $x \ge 6$, $y \ge 2$, $2x + y \ge 10$; $x, y \ge 0$. Redundand constraints in this LPP are:
 - (1) $x \ge 0, y \ge 0$

(2) $2x + y \ge 10$

(3) $x \ge 6$, $2x + y \ge 10$

- (4) None of these
- The angle between the lines having direction ratios 4, -3, 5 and 3, 4, 5 is:
 - (1) $\pi/3$
- (2) $\pi/4$
- (3) $\pi/6$
- $(4) \cdot 2\pi/3$
- **46.** If a plane meets the coordinate axes at A, B and C in such a way that the centroid of triangle ABC it at the point (1, 2, 3), then the equation of the plane is:
 - (1) $\frac{x}{1} + \frac{y}{2} + \frac{z}{3} = 1$

(2) $\frac{x}{3} + \frac{y}{6} + \frac{z}{9} = 1$

(3) $\frac{x}{1} + \frac{y}{2} + \frac{z}{3} = \frac{1}{3}$

- (4) $\frac{x}{3} + \frac{y}{6} + \frac{z}{9} = 3$
- The image of the point (1, 3, 4) in the plane 2x y + z + 3 = 0 is:
 - (1) (3, 5, 2)

(2) (3, 5, -2)

(3) (-3, 5, 2)

- (4) (3, -5, 2)
- **48.** The lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and $\frac{x-1}{2} = \frac{y-2}{2} = \frac{z-3}{2}$ are :
 - (1) intersecting

(2) parallel

(3) coincidental

(4) skew

- **49.** The distance between the line $\vec{r} = 2\hat{i} 2\hat{j} + 3\hat{k} + \lambda(\hat{i} \hat{j} + 4\hat{k})$ and the plane $\vec{r} \cdot (\hat{i} + 5\hat{j} + \hat{k}) = 5$ is:
 - (1) $\frac{10}{3\sqrt{3}}$ (2) $\frac{10}{\sqrt{2}}$ (3) $\frac{10}{3}$

- **50.** The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if $k = \frac{z-4}{1} = \frac{z-5}{1}$
 - (1).4

- (4) -3
- **51.** If $x = a \cos^3 \theta$, $y = a \sin^3 \theta$, then $\sqrt{1 + \left(\frac{dy}{dx}\right)^2} =$
 - (1) $\sec^2\theta$
- (2) $tan^2\theta$
- (3) $|\sec \theta|$
- (4) $|\cot \theta|$
- **52.** If $e^y + xy = e$, then the value of $\frac{d^2y}{dx^2}$ for x = 0, is:
 - (1) e^2
- (2) $\frac{1}{a^2}$ (3) $\frac{1}{a}$
- $(4) \frac{1}{e^3}$

- **53.** If x^y . $y^x = 16$, then $\frac{dy}{dx}$ at (2, 2) is:
- (2) 1
- (3) -1
- (4) -4
- The approximate value of square root of 25.2 is:
 - (1) 5.01
- (2) 5.02
- (3) 5.03
- (4) 5.04
- The tangent at (1, 1) on the curve $y^2 = x(2-x)^2$ meets it again at the point :
 - (1) (-3, 7)
- (2) (4, 4)
- (3) $\left(\frac{3}{8}, \frac{9}{4}\right)$
- $(4) \left(\frac{9}{4}, \frac{3}{8}\right)$
- The distance between the origin and the normal to the curve $y = e^{2x} + x^2$ at x = 0 is:
 - (1) $4/\sqrt{5}$
- (2) $3/\sqrt{5}$
- (3) $2/\sqrt{5}$
- 57. The length of longest interval in which Rolle's theorem can be applied for the function $f(x) = |x^2 - a^2|, (a > 0), \text{ is } :$
 - (1) 2a
- (2) 3a
- (3) 4a
- (4) $a\sqrt{2}$

- If the function $f(x) = \sqrt{3} \sin x \cos x 2ax + b$ decreases for all real values of x, then the value of a is given by:
 - (1) a < 1
- (2) $a < \sqrt{2}$
- (3) $a > \sqrt{2}$
- (4) $a \ge 1$
- **59.** The condition that $x^3 + ax^2 + bx + c$ may have no extremum, is :
- (2) $a^2 < 3b$
- (3) $a^2 > 2b$ (4) $a^2 < 2b$
- **60.** $\int \frac{3 + 2\cos x}{(2 + 3\cos x)^2} dx =$

- (1) $\frac{\sin x}{2+3\cos x} + c$ (2) $\frac{\cos x}{2+3\cos x} + c$ (3) $\frac{2\sin x}{2+3\cos x} + c$ (4) $\frac{2\cos x}{2+3\cos x} + c$
- **61.** $\lim_{x \to 1} (1-x) \tan \left(\frac{\pi x}{2} \right) =$
 - (1) $\frac{\pi}{2}$ (2) $\frac{2}{\pi}$
- (3) $\frac{\pi}{4}$
- (4) 1

- **62.** $\lim_{n\to\infty} \frac{(1-2+3-4+5-6....-2n)}{\sqrt{n^2+1}+\sqrt{4n^2-1}} =$

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

- $\lim_{x\to 0}\frac{\sin(\pi\cos^2 x)}{x^2}=$
 - (1) π
- (2) $\pi/2$
- $(3) -\pi$
- (4) 1

64. If $f(x) = \begin{cases} \frac{x-1}{2x^2 - 7x + 5}, & x \neq 1 \\ -\frac{1}{3}, & x = 1 \end{cases}$

then the derivative of f(x) at x = 1, is:

- (2) $\frac{-9}{2}$ (3) $\frac{-2}{9}$
- $(4) \frac{2}{9}$
- The mean of n terms is \bar{x} . If the first term is increased by 1, second by 2 and so on, then the new mean is:
 - (1) $\bar{x} + \frac{n+1}{2}$ (2) $\bar{x} + \frac{n}{2}$ (3) $\bar{x} + n$
- (4) $\bar{x} + \frac{n-1}{2}$

66.	The standard deviation of 25 numbers is 4 than the standard deviation, is increased by (1) 45 (2) 40 (3)	5, then the new stand	ard deviation will be:			
67.	The sum of 10 items is 12 and the sum deviation is:	of their squares is	18, then the standard			
		(4)	2/5			
68.	There are n persons sitting in a row. T probability that two selected persons are no		ected at random. The			
	(1) $\frac{2}{n-2}$ (2) $\frac{n}{n+2}$	$\frac{2}{n} \tag{4}$	$1-\frac{2}{n}$			
69.	Seven digits from the digits 1, 2, 3, 4, 5, 6 probability that this seven digit number is 6		in a random order. The			
	(1) $\frac{1}{3}$ (2) $\frac{2}{7}$		$\frac{2}{9}$			
_, 70.	The coefficients of a quadratic equation a first three prime numbers, the probability to (1) 2/3 (2) 1/3 (3)	hat roots of the equati	$b \neq c$) are chosen from on are real, is:			
71.	The graph of the function $y = f(x)$ is symthe following is <i>true</i> ?					
	(1) $f(x+a) = f(x-a)$ (3) $f(a+x) = f(a-x)$	2) $f(x) = f(-x)$ 4) $f(x) = -f(-x)$				
72.	Let $f: R \to R$ be a function defined by $f(x)$	$(x) = \frac{x^2 + 2x + 5}{x^2 + x + 1}$, then	fis:			
	(1) one-one and onto	2) one-one and into4) many one and into				
73.	$\sin \lambda x + \cos \lambda x \text{ and } \sin x + \cos x \text{ are period}$ (1) 4 (2) 0		ental period, if $\lambda =$ 4) 1			
74.	Let R be a relation on the set N of natural (i.e. n/m). Then R is:	numbers defined by n	$Rm \Leftrightarrow n \text{ is a factor of } m$			
	(1) equivalence	(2) transitive and sym(4) reflexive, transitive				
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75. If
$$\sin^{-1}\left(\frac{x}{5}\right) + \csc^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$$
, then $x = \frac{\pi}{2}$

- (3) 5
- (4) 2

$$\tan^{-1}(1+x) + \tan^{-1}(1-x) = \frac{\pi}{2}$$
, is:

- (1) x = 0
- (2) x = 1
- (3) x = -1

77. The value of
$$\tan\left(\frac{1}{2}\cos^{-1}\left(\frac{\sqrt{5}}{3}\right)\right)$$
 is:

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

78. Solution of
$$\sin^{-1} x - \cos^{-1} x = \cos^{-1} \frac{\sqrt{3}}{2}$$
 is :

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

79. If
$$A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$$
 and $A^2 = 8A + KI_2$, then the value of K is:

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

80. If
$$1, w, w^2$$
 are cube roots of unity, inverse of which of the following matrices exists?

- (1) $\begin{bmatrix} w & w^2 \\ w^2 & 1 \end{bmatrix}$ (2) $\begin{bmatrix} 1 & w \\ w & w^2 \end{bmatrix}$ (3) $\begin{bmatrix} w^2 & 1 \\ 1 & w \end{bmatrix}$ (4) None of these

81. The line
$$x + y = 4$$
 divides the line joining $(-1, 1)$ and $(5, 7)$ in the ratio $K : 1$, then the value of K is :

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

If the foot of the perpendicular from the origin to a straight line is at the point (3, -4). Then the equation of the line is:

(1) 3x - 4y = 25

(2) 4x - 3y = 25

(3) 4x + 3y = 25

(4) 3x + 4y = 25

(1) $3/\sqrt{5}$

(1) -1

(3) $17/3\sqrt{5}$

85.	The equation of the circle of radius 5 whose centre lies on x -axis and passing through $(2, 3)$ is:				
	(1) $x^2 + y^2 - 4x - 2$	1 = 0	(2) $x^2 + y^2 + 4x - 2$	1 = 0	
	$(3) x^2 + y^2 + 4x - 1$	7 = 0	$(4) x^2 + y^2 - 4x + 2$	1 = 0	
86.	If the parabola $y^2 =$	4 ax passes through	(3, 2), then the length	n of its latus-rectum is:	
	(1) 2/3	(2) 3/4	(3) 4	(4) 4/3	
87.	The eccentricity of	the hyperbola $16x^2$ –	$-3y^2 - 32x + 12y - 44$	I = 0 is:	
	(1) $\sqrt{13}$	(2) $\sqrt{7}$	(3) $\sqrt{\frac{17}{3}}$	(4) $\sqrt{\frac{19}{3}}$	
88.		The ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2}$	= 1 whose latus-rectu	um is half of its major axis,	
	is:	<u> </u>	1	1	
	(1) $\frac{\sqrt{3}}{2}$	(2) $\frac{\sqrt{3}}{4}$	(3) $\frac{1}{\sqrt{2}}$	$(4) \frac{1}{2}$	
89.	The ratio in which $(3, -5, 8)$ is:	the yz-plane divide	s the segment joinin	g the points (-2, 4, 7) and	
		(2) -7:8	(3) 2:3	(4) -3:2	
90.	If α , β , γ are the a co-ordinate axes, t	ngles which a directe hen $\sin^2 \alpha + \sin^2 \beta +$	ed line makes with the $\sin^2 \gamma =$	ne positive directions of the	
	(1) 0	(2) 1	(3) 2	(4) 3	
91.	The set A has 3 elements in the set		et B has 7 elements.	. The minimum number of	
	(1) 21	(2) 10	(3) 7	(4) Can not say	
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The distance between the parallel lines 6x - 3y - 5 = 0 and 2x - y + 4 = 0 is :

The points (K+1, 1), (2K+1, 3) and (2K+2, 2K) are collinear, then K=

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

(2) $\sqrt{5}/3$

(4) $17/\sqrt{3}$

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

92.	If A and B are two sets, then $A \cap (A \cup to :$	B) ^C (where 'C' den	
	(1) \(\phi \) (2) A	(3) B	(4) A - B
93.	Let $A = \{0, 1, 2, 3, 4, 5\}$ and a relation R^{-1} is:	R is defined by xRy s	such that $2x + y = 10$. Then
	(1) {(4, 3), (2, 4), (5, 0)} (3) {(3, 4), (4, 2), (5, 0)}	(2) {(4, 3), (2, 4), ((4) {(3, 4), (4, 2), (
94.	If $A + C = B$, then tan A tan B tan $C =$		
0 11	(1) $\tan A + \tan B + \tan C$	(2) tan A + tan B -	tan C
	(3) $\tan B - \tan C - \tan A$	$(4) \tan B + \tan C -$	
95.	If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2 \cos^6$		(4) 2
	(1) 0 (2) 1	(3) -1	(4) 2
96.	If $4 \sin^2 x = 1$, then the values of x are:		
	$(1) n\pi \pm \frac{\pi}{3}$	$(2) n\pi \pm \frac{\pi}{4}$	
	$(3) 2n\pi \pm \frac{\pi}{6}$	$(4) n\pi \pm \frac{\pi}{6}$	
97.	If $n \in \mathbb{N}$, then $3^{3n} - 26n - 1$ is divisible	ov:	
	(1) 4 (2) 3	(3) 9	(4) 15
	(1) 4		(1)
98.	If $z = (K+3) + i \sqrt{5-k^2}$, then the locu	s of z is:	
	(1) a straight line	(2) a parabola	
	(3) an ellipse	(4) a circle	
99.	If 1, w and w^2 are the three cube r $(x-1)^3 - 8 = 0$ are:	oots of unity, then	the roots of the equation
	$(1) 2, 2w, 2w^2$	(2) 3, 2w, 2w ²	
	(3) $3, 1 + 2w, 1 + 2w^2$	(4) 2, 1-2w, 1-3	$2w^2$
100.	The smallest positive integer n for which	$\operatorname{ch}\left(\frac{1+i}{1-i}\right)^n = 1, \text{ is : }$	
	(1) 4 (2) 3	(3) 2	(4) 1
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PG-EE-2019

SUBJECT: Mathematics Hons. (Five Year)-(SET-X)

C		Sr. No.	10763
Time: 11/4 Hours (75 minutes)	Total Questions: 100		Max. Marks: 100
Roll No. (in figures)	(in words)	_//	
Name	Da	e 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 candidate *must return* this question booklet and the OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfairmeans / 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. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
- 4. Question Booklet along-with answer key of all the A, B, C and D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case will be considered.
- 5. 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.
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- 1. The graph of the function y = f(x) is symmetrical about the line x = a, then which of the following is true?
 - (1) f(x+a) = f(x-a)

(2) f(x) = f(-x)

(3) f(a+x) = f(a-x)

- (4) f(x) = -f(-x)
- **2.** Let $f: R \to R$ be a function defined by $f(x) = \frac{x^2 + 2x + 5}{x^2 + x + 1}$, then f is:
 - (1) one-one and onto

(2) one-one and into

(3) many one and onto

- (4) many one and into
- 3. $\sin \lambda x + \cos \lambda x$ and $|\sin x| + |\cos x|$ are periodic of same fundamental period, if $\lambda =$
 - (1) 4
- (2) 0
- (3) 2
- (4) 1
- **4.** Let R be a relation on the set N of natural numbers defined by $nRm \Leftrightarrow n$ is a factor of m (i.e. n/m). Then R is:
 - (1) equivalence

- (2) transitive and symmetric
- (3) reflexive and symmetric
- (4) reflexive, transitive but not symmetric
- 5. If $\sin^{-1}\left(\frac{x}{5}\right) + \csc^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$, then $x = \frac{\pi}{2}$
 - (1) 4
- (2) 3
- (3) 5
- (4) 2

6. A solution of the equation :

$$\tan^{-1}(1+x) + \tan^{-1}(1-x) = \frac{\pi}{2}$$
, is:

- (1) x = 0 (2) x = 1
- (3) x = -1

- 7. The value of $\tan\left(\frac{1}{2}\cos^{-1}\left(\frac{\sqrt{5}}{3}\right)\right)$ is:

- (1) $3+\sqrt{5}$ (2) $3-\sqrt{5}$ (3) $\frac{1}{2}(3-\sqrt{5})$ (4) $\frac{1}{2}(\sqrt{5}+3)$
- **8.** Solution of $\sin^{-1} x \cos^{-1} x = \cos^{-1} \frac{\sqrt{3}}{2}$ is :
- (1) $x = \frac{1}{2}$ (2) $x = \frac{1}{\sqrt{2}}$ (3) $x = \frac{\sqrt{3}}{2}$
- (4) x = 1

(4) -7

	(1) -1	(2) 1	(3) 7	(4) -7
10.	If $1, w, w^2$ are cube	roots of unity, invers	se of which of the fol	lowing matrices exists?
	$(1) \begin{bmatrix} w & w^2 \\ w^2 & 1 \end{bmatrix}.$	$(2) \begin{bmatrix} 1 & w \\ w & w^2 \end{bmatrix}$	$(3) \begin{bmatrix} w^2 & 1 \\ 1 & w \end{bmatrix}$	(4) None of these
11.	The line $x + y = 4$ value of K is:	divides the line joining	ng (-1, 1) and (5, 7)	in the ratio $K: 1$, then the
	(1) 1/4	(2) 4/3	(3) 1/2	(4) 2
12.	If the foot of the portion (1) $3x - 4y = 25$ (3) $4x + 3y = 25$	erpendicular from the of the line is:	e origin to a straight (2) $4x - 3y = 25$ (4) $3x + 4y = 25$	line is at the point $(3, -4)$.
13.	The distance between	een the parallel lines	6x - 3y - 5 = 0 and 2	2x - y + 4 = 0 is:
	(1) $3/\sqrt{5}$		(2) $\sqrt{5}/3$	
	(3) $17/3\sqrt{5}$; · · · · · · · ·	(4) $17/\sqrt{3}$	•
14.	The points $(K+1,$	1), $(2K+1, 3)$ and $(2K+1, 3)$	2K + 2, $2K$) are colling	near, then $K =$
	(1) -1	(2) $\frac{1}{3}$	(3) $\frac{1}{2}$	$(4) -\frac{1}{2}$
15.	The equation of the	ne circle of radius 5	whose centre lies on	x-axis and passing through
	(2, 3) is: (1) $x^2 + y^2 - 4x - 2$ (3) $x^2 + y^2 + 4x - 2$		(2) $x^2 + y^2 + 4x - 4x$	
16.	If the parabola y^2	= 4 ax passes through	(3, 2), then the leng	th of its latus-rectum is:
	(1) 2/3	(2) 3/4	(3) 4	(4) 4/3
17.	The eccentricity o	f the hyperbola $16x^2$	$-3y^2 - 32x + 12y - 4$	44 = 0 is:
	(1) $\sqrt{13}$	(2) $\sqrt{7}$	(3) $\sqrt{\frac{17}{3}}$	(4) $\sqrt{\frac{19}{3}}$
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9. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ and $A^2 = 8A + KI_2$, then the value of K is:

18.	The eccentricity	of the ellipse	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	whose latus-rectum	is half of its major	or axis,
	1S:					

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

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

19. The ratio in which the yz-plane divides the segment joining the points (-2, 4, 7) and (3, -5, 8) is:

(1) 7:8

(2) -7:8

(3) 2:3

(4) -3:2

20. If α , β , γ are the angles which a directed line makes with the positive directions of the co-ordinate axes, then $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma =$

(1) 0

(2) 1

(4) 3

The set A has 3 elements and the Set B has 7 elements. The minimum number of elements in the set $A \cup B$ is :

(1) 21

(2) 10

(3) 7

(4) Can not say

22. If A and B are two sets, then $A \cap (A \cup B)^C$ (where 'C' denotes complement) is equal to:

 $(1) \phi$

(2) A

(3) B

(4) A - B

23. Let $A = \{0, 1, 2, 3, 4, 5\}$ and a relation R is defined by xRy such that 2x + y = 10. Then R^{-1} is:

 $(1) \{(4,3),(2,4),(5,0)\}$

(2) {(4, 3), (2, 4), (0, 5)}

(3) {(3, 4), (4, 2), (5, 0)}

(4) {(3, 4), (4, 2), (0, 5)}

24. If A + C = B, then tan A tan B tan C =

(1) $\tan A + \tan B + \tan C$

(2) $\tan A + \tan B - \tan C$

(3) $\tan B - \tan C - \tan A$

(4) $\tan B + \tan C - \tan A$

If $\sin x + \sin^2 x = 1$, then $\cos^8 x + 2 \cos^6 x + \cos^4 x =$

(2) 1

(3) -1

(4) 2

If $4 \sin^2 x = 1$, then the values of x are:

(1) $n\pi \pm \frac{\pi}{3}$

(2) $n\pi \pm \frac{\pi}{4}$

(3) $2n\pi \pm \frac{\pi}{6}$

(4) $n\pi \pm \frac{\pi}{6}$

(4) 15

27. If $n \in N$, then $3^{3n} - 26n - 1$ is divisible by : (1) 4 (2) 3 (3) 9

28.	If $z = (K+3) + i \sqrt{5-k^2}$, then the locus (1) a straight line (2) a parabola	s of z is: (3) an ellipse (4) a ci	rcle				
29.	If 1, w and w^2 are the three cube roots of unity, then the roots of the equation $(x-1)^3 - 8 = 0$ are:						
	$(1) 2, 2w, 2w^2$	(2) $3, 2w, 2w^2$					
	(3) $3, 1+2w, 1+2w^2$	$(4) 2, 1-2w, 1-2w^2$					
30.	The smallest positive integer n for whice	$h\left(\frac{1+i}{1-i}\right)^n = 1, \text{ is :}$					
		(3) 2 (4) 1					
31.	The unit vector perpendicular to the vectors $\hat{i} + \hat{j}$ and $\hat{j} + \hat{k}$ is/are:						
	$\pm \frac{1}{\sqrt{3}}(\hat{i} - \hat{j} - \hat{k})$	(2) $\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}-\hat{k})$					
	(3) $\pm \frac{1}{\sqrt{3}}(\hat{i} - \hat{j} + \hat{k})$	$(4) \ \frac{1}{\sqrt{2}}(\hat{i}+\hat{k})$					
32.	The vector $\hat{i} + x\hat{j} + 3\hat{k}$ is rotated through an angle θ and doubled in magnitude, then it becomes $4\hat{i} + (4x - 2)\hat{j} + 2\hat{k}$. The value of x is:						
	(1) $\frac{1}{3}$ (2) -3	(3) $\frac{2}{3}$ (4) $-\frac{2}{3}$	23				
33.	The vectors $\overrightarrow{AB} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\overrightarrow{BC} = -\hat{i} - 2\hat{k}$ are the adjacent sides of a parallelogram. The angle between its diagonals is:						
(*)	(1) $\pi/6$ (2) $\pi/3$	(3) $\pi/2$ (4) $\pi/2$	4				
34.	Consider a LPP: $\min Z = 6x + 10y$ subjected to $x \ge 6$, $y \ge 2$, $2x + y \ge 10$; $x, y \ge 0$. Redundand constraints in this LPP are:						
	(1) $x \ge 0, y \ge 0$	(2) $2x + y \ge 10$					
	$(3) \ \ x \ge 6, \ 2x + y \ge 10$	(4) None of these					

- The angle between the lines having direction ratios 4, -3, 5 and 3, 4, 5 is:
 - (1) $\pi/3$
- (2) $\pi/4$
- (3) $\pi/6$
- $(4) 2\pi/3$
- 36. If a plane meets the coordinate axes at A, B and C in such a way that the centroid of triangle ABC it at the point (1, 2, 3), then the equation of the plane is:
 - (1) $\frac{x}{1} + \frac{y}{2} + \frac{z}{2} = 1$

(2) $\frac{x}{3} + \frac{y}{6} + \frac{z}{9} = 1$

(3) $\frac{x}{1} + \frac{y}{2} + \frac{z}{2} = \frac{1}{2}$

- (4) $\frac{x}{3} + \frac{y}{6} + \frac{z}{9} = 3$
- The image of the point (1, 3, 4) in the plane 2x y + z + 3 = 0 is :
 - (1) (3, 5, 2)

(2) (3, 5, -2)

(3) (-3, 5, 2)

- (4) (3, -5, 2)
- The lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and $\frac{x-1}{-2} = \frac{y-2}{-4} = \frac{z-3}{-6}$ are:
 - (1) intersecting

(2) parallel

(3) coincidental

- (4) skew
- The distance between the line $\vec{r} = 2\hat{i} 2\hat{j} + 3\hat{k} + \lambda(\hat{i} \hat{j} + 4\hat{k})$ and the plane $\vec{r} \cdot (\hat{i} + 5\hat{j} + \hat{k}) = 5$ is:
 - (1) $\frac{10}{3\sqrt{3}}$ (2) $\frac{10}{\sqrt{3}}$ (3) $\frac{10}{3}$
- $(4) \frac{5}{3\sqrt{3}}$
- **40.** The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if $k = \frac{y-4}{2} = \frac{z-5}{1}$

- (4) -3
- (1) 4 (2) 3 (3) **41.** If $x = a \cos^3 \theta$, $y = a \sin^3 \theta$, then $\sqrt{1 + \left(\frac{dy}{dx}\right)^2} =$
 - (1) $\sec^2\theta$
- (2) $tan^2\theta$
- (3) $|\sec \theta|$
- (4) $|\cot \theta|$
- **42.** If $e^y + xy = e$, then the value of $\frac{d^2y}{dx^2}$ for x = 0, is:
 - (1) e^2
- (2) $\frac{1}{a^2}$ (3) $\frac{1}{a}$
- $(4) \frac{1}{3}$

43.	If x^{y} . $y^{x} = 16$, then $\frac{\partial}{\partial x}$	$\frac{dy}{dx}$ at (2, 2) is:					
	(1) 0	(2) 1	(3) -1	(4) -4			
44.	(1) 5.01	alue of square root of (2) 5.02	(3) 5.03	* * *			
45.	The tangent at $(1, 1)$ on the curve $y^2 = x(2-x)^2$ meets it again at the point :						
	(1) (-3, 7)	(2) (4, 4)	$(3) \left(\frac{3}{8}, \frac{9}{4}\right)$	$(4) \left(\frac{9}{4}, \frac{3}{8}\right)$			
46.	The distance between (1) $4/\sqrt{5}$	ten the origin and the (2) $3/\sqrt{5}$	normal to the curve (3) $2/\sqrt{5}$	$y = e^{2x} + x^2$ at $x = 0$ is: (4) $2/\sqrt{7}$			
47.	The length of longest interval in which Rolle's theorem can be applied for the function						
	$f(x) = x^2 - a^2 , (a > 0), \text{ is } :$						
	(1) 2 <i>a</i>	(2) 3 <i>a</i>	(3) 4 <i>a</i>	(4) $a\sqrt{2}$			
48.	If the function $f(x) = \sqrt{3} \sin x - \cos x - 2ax + b$ decreases for all real values of x, then the value of a is given by:						
	(1) $a < 1$	(2) $a < \sqrt{2}$	$(3) \ a \ge \sqrt{2}$	$(4) \ a \ge 1$			
49.	The condition that (1) $a^2 > 3b$	$x^3 + ax^2 + bx + c$ may (2) $a^2 < 3b$	y have no extremum, (3) $a^2 > 2b$	is: $(4) a^2 < 2b$			
50.	$\int \frac{3 + 2\cos x}{(2 + 3\cos x)^2} dx =$	=					
	$(1) \frac{\sin x}{2 + 3\cos x} + c$	$(2) \frac{\cos x}{2 + 3\cos x} + c$	$(3) \frac{2\sin x}{2 + 3\cos x} + c$	$(4) \frac{2\cos x}{2 + 3\cos x} + c$			
51.	$\lim_{x \to 1} (1 - x) \tan \left(\frac{\pi x}{2}\right)$						
	$(1) \ \frac{\pi}{2}$	$(2) \frac{2}{\pi}$	$(3) \frac{\pi}{4}$	(4) 1			
52.	$\lim_{n \to \infty} \frac{(1 - 2 + 3 - 4 + 4)}{\sqrt{n^2 + 4}}$	$\frac{5-62n)}{1+\sqrt{4n^2-1}} =$					
	(1) -2	$(2) \frac{1}{2}$	$(3) \frac{1}{3}$	$(4) -\frac{1}{3}$			

53.
$$\lim_{x \to 0} \frac{\sin(\pi \cos^2 x)}{x^2} =$$

 $(3) -\pi$

(4) 1

54. If
$$f(x) = \begin{cases} \frac{x-1}{2x^2 - 7x + 5}, & x \neq 1 \\ -\frac{1}{3}, & x = 1 \end{cases}$$

then the derivative of f(x) at x = 1, is:

 $(1) \frac{9}{2}$

(2) $\frac{-9}{2}$ (3) $\frac{-2}{9}$

 $(4) \frac{2}{0}$

The mean of n terms is \overline{x} . If the first term is increased by 1, second by 2 and so on, then the new mean is:

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

The standard deviation of 25 numbers is 40. If each of the numbers which is greater than the standard deviation, is increased by 5, then the new standard deviation will be:

(2) 40

(3) 65

(4) 40.75

57. The sum of 10 items is 12 and the sum of their squares is 18, then the standard deviation is:

(1) 3/5

(2) 4/5

(3) 3/10

(4) 2/5

There are n persons sitting in a row. Two of them are selected at random. The probability that two selected persons are not sitting together, is:

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

(2) $\frac{n}{n+2}$ (3) $\frac{2}{n}$

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

59. Seven digits from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9 are written in a random order. The probability that this seven digit number is divisible by 9, is:

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

(3) $\frac{1}{9}$

 $(4) \frac{2}{0}$

The coefficients of a quadratic equation $ax^2 + bx + c = 0$ ($a \ne b \ne c$) are chosen from first three prime numbers, the probability that roots of the equation are real, is:

(1) 2/3

(2) 1/3

(3) 1/4

 $(4) \ 3/4$

61. $\int x^x (1 + \log x) dx =$

(1) $x^{x} + c$

(2) $x^x \log x + c$ (3) $x \log x + c$ (4) none of these

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P. T. O.

- **62.** $\int \sin \sqrt{x} dx =$
 - (1) $(\cos\sqrt{x} \sin\sqrt{x}) + c$
- (2) $(\sqrt{x}\cos\sqrt{x} \sin\sqrt{x}) + c$
- (3) $-2(\sqrt{x}\cos\sqrt{x}-\sin\sqrt{x})+c$
- (4) $2(\sqrt{x}\cos\sqrt{x}-\sin\sqrt{x})+c$

- **63.** $\int \frac{1}{\sqrt{\sin^3 x \cos x}} dx =$
 - (1) $2(\tan x)^{-\frac{1}{2}} + c$

(2) $(\tan x)^{\frac{1}{2}} + c$

(3) $(\tan x)^{-\frac{1}{2}} + c$

- (4) $2(\tan x)^{1/2} + c$
- **64.** If $I_n = \int_0^1 x^n e^{-x} dx$ for $n \in \mathbb{N}$, then $I_n n I_{n-1} =$
 - (1) 1/e
- (2) -1/e
- (3) e
- (4) -2/e
- **65.** If $\int_{\pi/2}^{\theta} \sin x \, dx = \sin 2\theta$, then the value of θ satisfying $0 < \theta < \pi$, is:
 - (1) $\pi/6$
- (2) $\pi/4$
- (3) $\pi/2$
- (4) $5\pi/6$

- **66.** $\int_{0}^{[x]} (x [x]) dx =$
 - $(1) \frac{1}{2}[x]$
- (2) [x]
- (3) 2[x]
- (4) -2[x]

- **67.** $\int_0^{\pi/4} \log(1 + \tan x) dx =$
 - (1) $\frac{\pi}{4} \log 2$ (2) $\frac{\pi}{8} \log 2$ (3) $\frac{\pi}{2} \log 2$
- (4) $\pi \log 2$
- The area bounded by the curve $y = x \sin x$ and x-axis between x = 0 and $x = 2\pi$, is:
 - (1) π sq. units

(2) $\frac{\pi}{2}$ sq. units

(3) 2π sq. units

- (4) 4π sq. units
- If the area bounded by the curves $y^2 = 4ax$ and y = mx is $a^2/3$ sq. units, then the value of
 - (1) 2
- (2) -2
- (3) 1/2
- (4) 3/2

- **70.** Solution of $\frac{dy}{dx} = \cos(x+y)$ is:
 - (1) $\sin(x+y) = x + c$

(2) $\tan\left(\frac{x+y}{2}\right) + x = c$

(3) $\cot\left(\frac{x+y}{2}\right) = x+c$

- (4) $\tan\left(\frac{x+y}{2}\right) = x+c$
- **71.** Solution of $ydx + (x y^3) dy = 0$ is:
 - (1) $xy + \frac{y^2}{2} = c$

(2) $xy = \frac{y^2}{2} + c$

(3) $xy = \frac{y^2}{4} + c$

- (4) $xy = \frac{x^2}{4} + c$
- The differential equation $y \frac{dy}{dx} = x + a$ (a being constant) represents a set of:
 - (1) circles having centre on the x-axis
- (2) circles having centre on the y-axis

(3) ellipses

- (4) hyperbolas
- 73. From a bag containing 2 white, 3 red and 4 black balls, two balls are drawn one by one without replacement. The probability that at least ones ball is red, is:
 - $(1) \frac{5}{12}$
- (2) $\frac{7}{12}$ (3) $\frac{5}{8}$ (4) $\frac{3}{7}$

- 74. A box contains 15 items in which 4 items are defective. The items are selected at random, one by one, and examined. The ones examined are not put back. The probability that 9th one examined is the last defective, is:
 - $(1) \frac{7}{105}$
- (2) $\frac{8}{105}$ (3) $\frac{16}{255}$
- $(4) \frac{14}{255}$
- 75. A person is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. The probability that it is actually a six, is:

 - (1) $\frac{7}{26}$ (2) $\frac{11}{26}$
- (3) $\frac{3}{8}$
- $(4) \frac{5}{9}$

76.	Four numbers are m	ultiplied together. Tl	ne probability that the	ne product will be divisible
	by 5 or 10, is: $(1) \frac{123}{625}$	$(2) \ \frac{133}{625}$	$(3) \ \frac{357}{625}$	$(4) \ \frac{369}{625}$
77.	The least number of least one head is at	f times a fair coin mulest 0.8, is:	ast be tossed so that	the probability of getting at
	,(1) 3	(2) 5	(3) 6	(4) 8
78.	If $P(A \cup B) = \frac{3}{4}$ and	and $P(\overline{A}) = 2/3$, then	$P(\overline{A} \cap B) =$	
	$(1) \frac{7}{12}$	(2) $\frac{5}{12}$	$(3) \frac{1}{12}$	(4) $\frac{1}{6}$
79.	If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, $ \vec{a} $	$=3, \vec{b} =5, \vec{c} =7, \text{ th}$	en the angle between	\vec{a} and \vec{b} is:
	(1) $\pi/3$		(2) $2\pi/3$	
	(3) $\pi/6$		(4) $5\pi/3$	
80.	Let \vec{a} and \vec{b} be two vector if $\alpha =$	vo unit vectors and o	be the angle between	en them, then $\vec{a} + \vec{b}$ is a unit
	(1) $\pi/2$	(2) $\pi/3$	$(3) 2\pi/3$	
81	The value of K for	r which one of the r	oots of $x^2 - 3x + 2I$	X = 0 is double of one of the
	roots of $x^2 - x + K$ (1) 2	= 0, 1s : (2) -2	(3) -1	(4) 1
82	The interior angle	es of a regular polyg	on measure 160° ea	ch. The number of diagonals
	of the polygon are (1) 105	(2) 135	(3) 145	(4) 147
83	3. The number of w	rays in which 9 iden	tical balls can be pl	aced in three identical boxes,
	is: (1) 9	(2) 12	(3) 55	(4) 27
8	4. In the expansion	of $\left(x^2 - \frac{1}{3x}\right)^9$, the to	erm independent of	c is:
	(1) 5th	(2) 6th	(3) 7th	(4) 4th

- If the coefficients of rth and (r + 1)th terms in the expansion of $(3 + 7x)^{29}$ are equal, then r =
 - (1) 14
- (2) 15
- (3) 18
- (4) 21
- 86. Three numbers forms an increasing G.P. If the middle number is doubled, then the new numbers are in A. P. The common ratio of the G. P. is:
 - (1) $2 + \sqrt{3}$

(2) $3 + \sqrt{2}$

(3) $\sqrt{3} + 1$

- (4) $3 \sqrt{2}$
- 87. If $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \dots$ to $\infty = \frac{\pi^2}{6}$, then $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{6}$
- (2) $\frac{\pi^2}{4}$ (3) $\frac{\pi^2}{8}$
- (4) $\frac{\pi^2}{12}$
- If a, b, c are in A.P. as well as G.P., then which of the following is true?
 - (1) a = b = c

(2) $a = b \neq c$

(3) $a \neq b = c$

- (4) $a \neq b \neq c$
- 89. If the AM of the roots of a quadratic equation in x is A and their GM is G, then the quadratic equation is:
 - (1) $x^2 Ax + G^2 = 0$

(2) $x^2 - Ax + G = 0$

(3) $x^2 - 2Ax + G = 0$

- (4) $r^2 2Ar + G^2 = 0$
- **90.** A line passes through the point (2, 2) and is perpendicular to the line 3x + y = 3, then its y-intercept is:
 - (1) 2/3
- (2) 4/3
- (3) 4/5
- (4) 3/4
- If A an orthogonal matrix, then which of the following is true?
 - (1) |A| = 0

(2) $|A| = \pm 1$

(3) $|A| = \pm 2$

- (4) $|A| = \pi/2$
- **92.** If $A(\alpha) = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$, then $A(\alpha) A(\beta) = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$
 - (1) $A(\alpha) + A(\beta)$

(2) $A(\alpha) - A(\beta)$

(3) $A(\alpha + \beta)$

(4) $A(\alpha - \beta)$

- If A and B are two matrices such that AB = B and BA = A, then $A^2 + B^2 = A$
 - (1) A + B
- (2) AB
- (3) 2AB
- If K is a real cube root of -2, then the value of $\begin{vmatrix} 1 & 2K & 1 \\ K^2 & 1 & 3K^2 \\ 2 & 2K & 1 \end{vmatrix}$ is equal to:
 - (1) -10
- (2) -12
- (3) -13
- (4) -15
- The equations Kx y = 2, 2x 3y = -K, 3x 2y = -1 are consistent if K = -K

- (4) -1, 4
- **96.** If $f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$, then f(2x) f(x) =
 - (1) ax(3a+2x) (2) ax(2a+3x) (3) a(2a+3x) (4) x(3a+2x)

- **97.** Let $f(x) = \frac{1 \tan x}{4x \pi}$, $x \neq \pi/4$ and $x \in [0, \pi/2] = a$, $x = \pi/4$

If f(x) is continuous in $[0, \pi/2]$, then a =

- (1) 1/2
- (2) -1/2
- (3) 1
- (4) 0
- Let $f(x) = 1 + x (\sin x) [\cos x]$, $0 < x \le \pi/2$, where [.] denotes the greatest integer function. Then which of the following is true?
 - (1) f(x) is continuous in $(0, \pi/2)$
- (2) f(x) is strictly increasing in $(0, \pi/2)$
- (3) f(x) is strictly decreasing in $(0, \pi/2)$ (4) f(x) has global maximum value 2
- **99.** If $y = \tan^{-1} \sqrt{\frac{1 + \sin x}{1 \sin x}}$, $\pi/2 < x < \pi$, then $\frac{dy}{dx} = \frac{1}{2}$
 - (1) -1
- (2) 1
- (3) 1/2
- (4) -1/2

- **100.** If $x = e^{y + e^{y} + e^{y} + \dots + \infty}$, then $\frac{dy}{dx} = \frac{dy}{dx} = \frac{dy}{dx}$
 - (1) $\frac{1-x}{x}$ (2) $\frac{x}{1-x}$ (3) $\frac{1+x}{x}$ (4) $\frac{x}{1+x}$

Openedat 01:45 pm for evaluation

Total Nø. of Printed Pages: 13

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PG-EE-2019

SUBJECT: Mathematics Hons. (Five Year)-(SET-X)

D		Sr. No.	10760
Time : 11/4 Hours (75 minutes)	Total Questions: 100		Max. Marks: 100
Roll No. (in figures)	(in words)		
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 candidate *must return* this question booklet and the OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfairmeans / 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. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
- 4. Question Booklet along-with answer key of all the A, B, C and D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case will be considered.
- 5. 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.
- 6. Use only black or blue ball point pen of good quality in the OMR Answer-Sheet.
- 7. There will be **no negative** marking. Each correct answer will be awarded **one** full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.
- 8. Before answering the questions, the candidates should ensure that they have been supplied correct and complete question booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.

PG-EE-2019/(Mathematics Hons.)(Five Yr.)-(SET-X)/(D)

Murau Epa J

1.	The value of K for roots of $x^2 - x + K =$		ots of $x^2 - 3x + 2K =$	= 0 is double of one of the
	(1) 2	(2) -2	(3) -1	(4) 1
2.	The interior angles of the polygon are		n measure 160° each	. The number of diagonals
	(1) 105	(2) 135	(3) 145	(4) 147
3.		ys in which 9 identic	cal balls can be place	ed in three identical boxes,
	is: (1) 9	(2) 12	(3) 55	(4) 27
4.	In the expansion of	$f\left(x^2 - \frac{1}{3x}\right)^9$, the term	m independent of x is	::
	(1) 5th	(2) 6th	(3) 7th	(4) 4th
5.		of r th and $(r+1)$ th	terms in the expans	ion of $(3 + 7x)^{29}$ are equal,
	then $r = (1) 14$	(2) 15	(3) 18	(4) 21
6.	Three numbers for numbers are in A.	rms an increasing G.F P. The common ratio	P. If the middle number of the G. P. is:	per is doubled, then the new
	(1) $2 + \sqrt{3}$		(2) $3 + \sqrt{2}$	
	(3) $\sqrt{3} + 1$		(4) $3 - \sqrt{2}$	
7.	If $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{3^2}$	$\frac{1}{4^2} + \dots$ to $\infty = \frac{\pi^2}{6}$	-, then $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2}$	+=
	(1) $\frac{\pi^2}{3}$	(2) $\frac{\pi^2}{4}$	(3) $\frac{\pi^2}{8}$	(4) $\frac{\pi^2}{12}$
8.	If a, b, c are in A.I	P. as well as G.P., the	en which of the follow	wing is true?
		$(2) \ a=b\neq c$		
9.	If the AM of the quadratic equation		equation in x is A	and their GM is G, then the
	$(1) x^2 - Ax + G^2 =$		(2) $x^2 - Ax + G =$	
	(3) $x^2 - 2Ax + G =$	=0	(4) $x^2 - 2Ax + G^2$	$\dot{r} = 0$

D

10	 A line passes t y-intercept is : 	hrough the point (2,	2) and is perpendicu	lar to the line $3x + y =$	3, then its
	(1) 2/3	(2) 4/3	(3) 4/5	(4) 3/4	
- 11	. The unit vecto	r perpendicular to th	ne vectors $\hat{i} + \hat{j}$ and	$\hat{j} + \hat{k}$ is/are:	
	(1) $\pm \frac{1}{\sqrt{3}}(\hat{i} - 1)$	$(\hat{j} - \hat{k})$	$(2) \ \frac{1}{\sqrt{3}}(\hat{i}+\hat{j}$	$-\hat{k}$)	
	(3) $\pm \frac{1}{\sqrt{3}}(\hat{i} - \hat{j})$	$\hat{j} + \hat{k}$)	$(4) \ \frac{1}{\sqrt{2}}(\hat{i} + \hat{k})$		
12		$+x\hat{j} + 3\hat{k}$ is rotated t $(4x-2)\hat{j} + 2\hat{k}$. The		nd doubled in magnitu	de, then it
	(1) $\frac{1}{3}$	(2) -3	(3) $\frac{2}{3}$	$(4) -\frac{2}{3}$	
1		$\overrightarrow{AB} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ a. The angle between (2) $\pi/3$		are the adjacent si $(4) \pi/4$	des of a
1	subjected to x		10; $x, y \ge 0$.		
1	5. The angle beto $(1) \pi/3$	tween the lines havi $(2) \pi/4$	ng direction ratios 4, (3) $\pi/6$	-3 , 5 and 3, 4, 5 is: (4) $2\pi/3$	
1	16. If a plane mo	eets the coordinate it at the point (1, 2,	axes at A, B and C i, 3), then the equation	n such a way that the of the plane is:	centroid o
	(1) $\frac{x}{1} + \frac{y}{2} + \cdots$	$\frac{z}{3} = 1$ (2) $\frac{x}{3} + \frac{y}{6} + \frac{z}{6}$	$\frac{z}{9} = 1$ (3) $\frac{x}{1} + \frac{y}{2} + \frac{z}{2}$	$\frac{z}{3} = \frac{1}{3}$ (4) $\frac{x}{3} + \frac{y}{6} + \frac{z}{9}$	= 3
	17. The image of (1) (3, 5, 2)	f the point (1, 3, 4) i	n the plane $2x - y + z$ (2) (3, 5, -2		
	(3) $(-3, 5, 2)$)	(4) (3, -5, 2)	2)	

- **18.** The lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and $\frac{x-1}{-2} = \frac{y-2}{-4} = \frac{z-3}{-6}$ are:
 - (1) intersecting
- (2) parallel (3) coincidental (4) skew
- **19.** The distance between the line $\vec{r} = 2\hat{i} 2\hat{j} + 3\hat{k} + \lambda(\hat{i} \hat{j} + 4\hat{k})$ and the plane $\vec{r} \cdot (\hat{i} + 5\hat{j} + \hat{k}) = 5$ is:
 - (1) $\frac{10}{3\sqrt{3}}$ (2) $\frac{10}{\sqrt{3}}$
- (3) $\frac{10}{3}$
- $(4) \frac{5}{3\sqrt{3}}$
- **20.** The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if $k = \frac{z-4}{1} = \frac{z-4}{1}$
 - (1) 4
- (2) 3
- (3) -1
- (4) -3

- **21.** $\int x^x (1 + \log x) dx =$
 - (1) $x^{x} + c$

- (2) $x^x \log x + c$ (3) $x \log x + c$ (4) none of these
- 22. $\int \sin \sqrt{x} dx =$
 - (1) $(\cos\sqrt{x} \sin\sqrt{x}) + c$
- (2) $(\sqrt{x}\cos\sqrt{x} \sin\sqrt{x}) + c$
- $(3) -2(\sqrt{x}\cos\sqrt{x}-\sin\sqrt{x})+c \qquad (4) 2(\sqrt{x}\cos\sqrt{x}-\sin\sqrt{x})+c$

- 23. $\int \frac{1}{\sqrt{\sin^3 x \cos x}} dx =$

- (1) $2(\tan x)^{-\frac{1}{2}} + c$ (2) $(\tan x)^{\frac{1}{2}} + c$ (3) $(\tan x)^{-\frac{1}{2}} + c$ (4) $2(\tan x)^{\frac{1}{2}} + c$
- **24.** If $I_n = \int_0^1 x^n e^{-x} dx$ for $n \in \mathbb{N}$, then $I_n n I_{n-1} =$
 - (1) 1/e
- (2) -1/e
- (4) -2/e
- **25.** If $\int_{\pi/2}^{0} \sin x \, dx = \sin 2\theta$, then the value of θ satisfying $0 < \theta < \pi$, is:
 - (1) $\pi/6$
- (2) $\pi/4$
- (3) $\pi/2$
- $(4) 5\pi/6$

- **26.** $\int_{0}^{[x]} (x [x]) dx =$
 - $(1) \frac{1}{2}[x]$
- (2) [x]
- (3) 2[x]
- (4) -2[x]

27.
$$\int_0^{\pi/4} \log(1 + \tan x) dx =$$

- (1) $\frac{\pi}{4} \log 2$ (2) $\frac{\pi}{8} \log 2$ (3) $\frac{\pi}{2} \log 2$
- (4) $\pi \log 2$

28. The area bounded by the curve
$$y = x \sin x$$
 and x-axis between $x = 0$ and $x = 2\pi$, is :

- (1) π sq. units
- (2) $\frac{\pi}{2}$ sq. units (3) 2π sq. units
- (4) 4π sq. units

29. If the area bounded by the curves
$$y^2 = 4ax$$
 and $y = mx$ is $a^2/3$ sq. units, then the value of m is :

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

30. Solution of
$$\frac{dy}{dx} = \cos(x+y)$$
 is:

(1)
$$\sin(x+y) = x + c$$

(2)
$$\tan\left(\frac{x+y}{2}\right) + x = c$$

(3)
$$\cot\left(\frac{x+y}{2}\right) = x+c$$

$$(4) \tan\left(\frac{x+y}{2}\right) = x+c$$

- (1) |A| = 0
- (2) $|A| = \pm 1$
- (3) $|A| = \pm 2$ (4) $|A| = \pi/2$

32. If
$$A(\alpha) = \begin{bmatrix} \cos \alpha & \sin \alpha \\ -\sin \alpha & \cos \alpha \end{bmatrix}$$
, then $A(\alpha) A(\beta) = (-\sin \alpha) + (-\sin \alpha) = (-\cos \alpha)$

(1) $A(\alpha) + A(\beta)$

(2) $A(\alpha) - A(\beta)$

(3) $A(\alpha + \beta)$

(4) $A(\alpha - \beta)$

33. If A and B are two matrices such that
$$AB = B$$
 and $BA = A$, then $A^2 + B^2 = A$

- (1) A + B
- (2) AB
- (3) 2AB

34. If K is a real cube root of
$$-2$$
, then the value of $\begin{vmatrix} 1 & 2K & 1 \\ K^2 & 1 & 3K^2 \\ 2 & 2K & 1 \end{vmatrix}$ is equal to:

- (1) -10
- (2) -12
- (3) -13 (4) -15

35. The equations
$$Kx - y = 2$$
, $2x - 3y = -K$, $3x - 2y = -1$ are consistent if $K = -K$

- (1) 2, -3
- (2) -2, 3

36. If
$$f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$$
, then $f(2x) - f(x) = -1$

- (1) ax(3a+2x) (2) ax(2a+3x) (3) a(2a+3x) (4) x(3a+2x)

37. Let
$$f(x) = \frac{1 - \tan x}{4x - \pi}$$
, $x \neq \pi/4$ and $x \in [0, \pi/2] = a$, $x = \pi/4$

If f(x) is continuous in $[0, \pi/2]$, then a =

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

38. Let
$$f(x) = 1 + x (\sin x) [\cos x]$$
, $0 < x \le \pi/2$, where [.] denotes the greatest integer function. Then which of the following is *true*?

- (1) f(x) is continuous in $(0, \pi/2)$
- (2) f(x) is strictly increasing in $(0, \pi/2)$
- (3) f(x) is strictly decreasing in $(0, \pi/2)$ (4) f(x) has global maximum value 2

39. If
$$y = \tan^{-1} \sqrt{\frac{1 + \sin x}{1 - \sin x}}$$
, $\pi/2 < x < \pi$, then $\frac{dy}{dx} = \frac{1}{2}$

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

40. If
$$x = e^{y + e^y + e^y + \dots \infty}$$
, then $\frac{dy}{dx} = \frac{dy}{dx}$

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

41.
$$\lim_{x \to 1} (1-x) \tan \left(\frac{\pi x}{2} \right) =$$

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

42.
$$\lim_{n\to\infty} \frac{(1-2+3-4+5-6....-2n)}{\sqrt{n^2+1}+\sqrt{4n^2-1}} =$$

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

43.
$$\lim_{x\to 0} \frac{\sin(\pi\cos^2 x)}{x^2} =$$

(1) π

(2) $\pi/2$

 $(3) -\pi$

(4) 1

44. If
$$f(x) = \begin{cases} \frac{x-1}{2x^2 - 7x + 5}, & x \neq 1 \\ -\frac{1}{3}, & x = 1 \end{cases}$$

then the derivative of f(x) at x = 1, is:

(2) $\frac{-9}{2}$ (3) $\frac{-2}{9}$

 $(4) \frac{2}{0}$

The mean of n terms is \bar{x} . If the first term is increased by 1, second by 2 and so on, then the new mean is:

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

The standard deviation of 25 numbers is 40. If each of the numbers which is greater than the standard deviation, is increased by 5, then the new standard deviation will be:

(1) 45

(2) 40

(3) 65

(4) 40.75

47. The sum of 10 items is 12 and the sum of their squares is 18, then the standard deviation is:

(1) 3/5

(2) 4/5

(3) 3/10

(4) 2/5

48. There are n persons sitting in a row. Two of them are selected at random. The probability that two selected persons are not sitting together, is:

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

Seven digits from the digits 1, 2, 3, 4, 5, 6, 7, 8, 9 are written in a random order. The probability that this seven digit number is divisible by 9, is:

(2) $\frac{2}{7}$ (3) $\frac{1}{9}$

(4) $\frac{2}{9}$

The coefficients of a quadratic equation $ax^2 + bx + c = 0$ ($a \ne b \ne c$) are chosen from first three prime numbers, the probability that roots of the equation are real, is:

(1) 2/3

(2) 1/3

(3) 1/4

(4) 3/4

51.	The line $x + y = 4$ value of K is:	divides the line join	ing (-1, 1) and (5, 7)	in the ratio $K: 1$, then the
	(1) 1/4	(2) 4/3	(3) 1/2	(4) 2
52.	Then the equation of	•		line is at the point $(3, -4)$.
	(1) $3x - 4y = 25$		(2) $4x - 3y = 25$	



53. The distance between the parallel lines
$$6x - 3y - 5 = 0$$
 and $2x - y + 4 = 0$ is :

(1) $3/\sqrt{5}$ (2) $\sqrt{5}/3$

(3)
$$17/3\sqrt{5}$$
 (4) $17/\sqrt{3}$

54. The points
$$(K + 1, 1)$$
, $(2K + 1, 3)$ and $(2K + 2, 2K)$ are collinear, then $K = (1) -1$ $(2) \frac{1}{3}$ $(3) \frac{1}{2}$ $(4) -\frac{1}{2}$

55. The equation of the circle of radius 5 whose centre lies on
$$x$$
-axis and passing through

(2, 3) is:
(1)
$$x^2 + y^2 - 4x - 21 = 0$$

(2) $x^2 + y^2 + 4x - 21 = 0$

(3)
$$x^2 + y^2 + 4x - 17 = 0$$
 (4) $x^2 + y^2 - 4x + 21 = 0$

56. If the parabola
$$y^2 = 4$$
 ax passes through (3, 2), then the length of its latus-rectum is:

(1) $2/3$ (2) $3/4$ (3) 4 (4) $4/3$

- 57. The eccentricity of the hyperbola $16x^2 3y^2 32x + 12y 44 = 0$ is:
 - (1) $\sqrt{13}$ (2) $\sqrt{7}$ (3) $\sqrt{\frac{17}{3}}$ (4) $\sqrt{\frac{19}{3}}$

58. The eccentricity of the ellipse
$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$
 whose latus-rectum is half of its major axis,

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

59. The ratio in which the yz-plane divides the segment joining the points (-2, 4, 7) and (3, -5, 8) is:

(1)
$$7:8$$
 (2) $-7:8$ (3) $2:3$ (4) $-3:2$

	(1) 0 (2) 1	(3) 2 (4)	3		
61.	The graph of the function $y = f(x)$ is sy the following is <i>true</i> ?	mmetrical about the line	e x = a, then which of		
	(1) f(x+a) = f(x-a)	(2) f(x) = f(-x)			
	(3) $f(a+x) = f(a-x)$	(4) $f(x) = -f(-x)$			
62.	Let $f: R \to R$ be a function defined by f	$f(x) = \frac{x^2 + 2x + 5}{x^2 + x + 1}$, then f	is:		
	(1) one-one and onto	(2) one-one and into			
	(3) many one and onto	(4) many one and into			
			(A) - (A) - (A)		
63.	$\sin \lambda x + \cos \lambda x$ and $ \sin x + \cos x $ are p	eriodic of same fundamental (3) 2 (4)			
	(1) 4 (2) 0	(3) 2	, 1		
64.	64. Let R be a relation on the set N of natural numbers defined by $nRm \Leftrightarrow n$ is a factor of (i.e. n/m). Then R is:				
	(1) equivalence	(2) transitive and symm	metric		
	(3) reflexive and symmetric	(4) reflexive, transitive	e but not symmetric		
65.	If $\sin^{-1}\left(\frac{x}{5}\right) + \csc^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$, then $x = \frac{\pi}{2}$				
	(1) 4 (2) 3	(3) 5 (4)) 2		
66.	A solution of the equation:				
	$\tan^{-1}(1+x) + \tan^{-1}(1-x) = \frac{\pi}{2}$, is:				
	(1) $x = 0$ (2) $x = 1$	(3) $x = -1$ (4	$x = \pi$		
		(5) 2 1			
67.	The value of $\tan\left(\frac{1}{2}\cos^{-1}\left(\frac{\sqrt{5}}{3}\right)\right)$ is:				
	(1) $3+\sqrt{5}$ (2) $3-\sqrt{5}$	$(3) \ \frac{1}{2}(3-\sqrt{5}) \qquad (4)$	$\frac{1}{2}(\sqrt{5}+3)$		

60. If α , β , γ are the angles which a directed line makes with the positive directions of the co-ordinate axes, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

68. Solution of $\sin^{-1} x - \cos^{-1} x = \cos^{-1} \frac{\sqrt{3}}{2}$ is :

(1)
$$x = \frac{1}{2}$$

(2)
$$x = \frac{1}{\sqrt{3}}$$

(1)
$$x = \frac{1}{2}$$
 (2) $x = \frac{1}{\sqrt{3}}$ (3) $x = \frac{\sqrt{3}}{2}$

(4)
$$x = 1$$

69. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ and $A^2 = 8A + KI_2$, then the value of K is:

$$(1) -1$$

$$(4) -7$$

70. If 1, w, w^2 are cube roots of unity, inverse of which of the following matrices exists?

$$(1) \begin{bmatrix} w & w^2 \\ w^2 & 1 \end{bmatrix}$$

$$(2) \begin{bmatrix} 1 & w \\ w & w^2 \end{bmatrix}$$

$$(3) \begin{bmatrix} w^2 & 1 \\ 1 & w \end{bmatrix}$$

(4) None of these

71. If $x = a \cos^3 \theta$, $y = a \sin^3 \theta$, then $\sqrt{1 + \left(\frac{dy}{dx}\right)^2} =$

- (1) $\sec^2\theta$
- (2) $tan^2\theta$
- (3) $|\sec \theta|$
- (4) $|\cot \theta|$

72. If $e^y + xy = e$, then the value of $\frac{d^2y}{dx^2}$ for x = 0, is:

(1)
$$e^2$$

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

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

(4)
$$\frac{1}{e^3}$$

73. If x^y . $y^x = 16$, then $\frac{dy}{dx}$ at (2, 2) is:

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

The approximate value of square root of 25.2 is:

- (2) 5.02
- (3) 5.03
- (4) 5.04

The tangent at (1, 1) on the curve $y^2 = x(2-x)^2$ meets it again at the point :

(1) (-3, 7)

(2) (4,4)

 $(3) \left(\frac{3}{8}, \frac{9}{4}\right)$

(4) $\left(\frac{9}{4},\frac{3}{8}\right)$

_				
76.	The distance between (1) $4/\sqrt{5}$	en the origin and the second (2) $3/\sqrt{5}$	normal to the curve y (3) $2/\sqrt{5}$	$e = e^{2x} + x^2$ at $x = 0$ is: (4) $2/\sqrt{7}$
77.	The length of longe	est interval in which	Rolle's theorem can b	be applied for the function
	$f(x) = x^2 - a^2 , (a > a^2)$			
	(1) 2 <i>a</i>	(2) 3 <i>a</i>	(3) 4 <i>a</i>	(4) $a\sqrt{2}$
78.	If the function $f(x)$	$= \sqrt{3} \sin x - \cos x -$	-2ax + b decreases for	for all real values of x , then
	the value of a is given (1) $a < 1$	$(2) \ a < \sqrt{2}$	$(3) \ a \ge \sqrt{2}$	(4) $a \ge 1$
79.	The condition that (1) $a^2 > 3b$	$a^{3} + ax^{2} + bx + c$ may (2) $a^{2} < 3b$	have no extremum, (3) $a^2 > 2b$	is: (4) $a^2 < 2b$
80.	$\int \frac{3 + 2\cos x}{(2 + 3\cos x)^2} dx =$	=		
	$(1) \frac{\sin x}{2 + 3\cos x} + c$	$(2) \frac{\cos x}{2 + 3\cos x} + c$	$(3) \frac{2\sin x}{2 + 3\cos x} + c$	$(4) \frac{2\cos x}{2 + 3\cos x} + c$
81.	The set A has 3	elements and the Se	t B has 7 elements.	The minimum number of
	elements in the set (1) 21	$A \cup B \text{ is :}$ (2) 10	(3) 7	(4) Can not say
82.	If A and B are tw	o sets, then $A \cap (A$	\cup B) ^C (where 'C' de	notes complement) is equal
	to: (1) φ	(2) A	(3) B	(4) A – B
83	Let $A = \{0, 1, 2, 3\}$	3, 4, 5} and a relation	R is defined by xRy	such that $2x + y = 10$. Then
	R^{-1} is:		(2) {(4, 3), (2, 4),	
	(1) {(4, 3), (2, 4), (3) {(3, 4), (4, 2),		$(4) \ \{(3,4),(4,2),$	
84	If $A + C = B$, then	n tan A tan B tan C =		
	(1) tan A + tan B(3) tan B - tan C		(2) tan A + tan B(4) tan B + tan C	
		1, then $\cos^8 x + 2 \cos^8 x$		8.4
85	11 $\sin x + \sin^{-} x =$ (1) 0	(2) 1	(3) -1	(4) 2

- **86.** If $4 \sin^2 x = 1$, then the values of x are :
 - (1) $n\pi \pm \frac{\pi}{3}$

 $(2) \quad n\pi \pm \frac{\pi}{4}$

(3) $2n\pi \pm \frac{\pi}{6}$

- $(4) \quad n\pi \pm \frac{\pi}{6}$
- **87.** If $n \in N$, then $3^{3n} 26n 1$ is divisible by :
 - (1) 4
- (2) 3
- (3) 9
- (4) 15
- **88.** If $z = (K+3) + i \sqrt{5-k^2}$, then the locus of z is :
 - (1) a straight line

(2) a parabola

(3) an ellipse

- (4) a circle
- 89. If 1, w and w^2 are the three cube roots of unity, then the roots of the equation $(x-1)^3 8 = 0$ are:
 - (1) $2, 2w, 2w^2$

(2) $3, 2w, 2w^2$

(3) $3, 1 + 2w, 1 + 2w^2$

- (4) 2, 1-2w, $1-2w^2$
- **90.** The smallest positive integer *n* for which $\left(\frac{1+i}{1-i}\right)^n = 1$, is:
 - (1) 4
- (2) 3
- (3) 2
- (4) 1

- **91.** Solution of $ydx + (x y^3) dy = 0$ is :
 - (1) $xy + \frac{y^2}{2} = c$

(2) $xy = \frac{y^2}{2} + c$

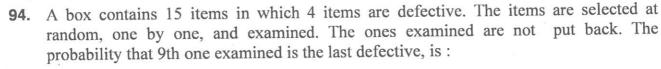
(3) $xy = \frac{y^2}{4} + c$

- (4) $xy = \frac{x^2}{4} + c$
- **92.** The differential equation $y \frac{dy}{dx} = x + a$ (a being constant) represents a set of:
 - (1) circles having centre on the x-axis
- (2) circles having centre on the y-axis

(3) ellipses

(4) hyperbolas

93.	From a bag contain without replacemen	ing 2 white, 3 red an	d 4 black ball at at least ones	s, two balls ball is red,	are drawn is:	one by one
	$(1) \frac{5}{12}$	(2) $\frac{7}{12}$	(3) $\frac{5}{8}$. (4)	$\frac{3}{7}$	
94.	A box contains 15 random, one by co	titems in which 4 in the one, and examined.	The ones ex	amined are	items are not put	selected at back. The



- (2) $\frac{8}{195}$ (3) $\frac{16}{255}$ (4) $\frac{14}{255}$ $(1) \frac{7}{195}$
- A person is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. The probability that it is actually a six, is:
 - (2) $\frac{11}{36}$ (3) $\frac{3}{9}$ (4) $\frac{5}{9}$ $(1) \frac{7}{36}$
- Four numbers are multiplied together. The probability that the product will be divisible by 5 or 10, is:
 - (2) $\frac{133}{625}$ (3) $\frac{357}{625}$ (4) $\frac{369}{625}$ (1) $\frac{123}{625}$
- The least number of times a fair coin must be tossed so that the probability of getting at least one head is at lest 0.8, is:
- (4) 8(2) 5(3) 6(1) 3
- **98.** If $P(A \cup B) = \frac{3}{4}$ and $P(\overline{A}) = 2/3$, then $P(\overline{A} \cap B) = 2/3$
 - (1) $\frac{7}{12}$ (2) $\frac{5}{12}$ (3) $\frac{1}{12}$ $(4) \frac{1}{6}$
- **99.** If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, $|\vec{a}| = 3$, $|\vec{b}| = 5$, $|\vec{c}| = 7$, then the angle between \vec{a} and \vec{b} is:
 - $(4) 5\pi/3$ (3) $\pi/6$ (1) $\pi/3$ (2) $2\pi/3$
- 100. Let \vec{a} and \vec{b} be two unit vectors and α be the angle between them, then $\vec{a} + \vec{b}$ is a unit vector if $\alpha =$
 - (4) $\pi/4$ (3) $2\pi/3$ (2) $\pi/3$ (1) $\pi/2$

Answer Key: Mathematics (Hons) Five Year Integrated Course

Answer Key: Mathematics (Hons) Five Year Integrated Course				
Sr. No.	Code A	Code B	Code C	Code D
1	3	1	3	2
2	1	3	4	2
3	2	4	. 1	2
4	3	2	4	3
5	2	3	2	4
6	4	1	1	
7	1	2	3	3
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38	4	1	3	2
39	3	4	1	1
40	2	2	4	4
41	3	3		1
42	4	4	3	2
43	1	4	2	4
44	4	2	3	1
45	2		2	3
46	1	1	4	1
47	3	2	3	2
48	3	3	1	1
49		3	4	4
	4	1	2	3
50	4	4	1	2

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51	2	3	2	3
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97	3	1	2	1
98	3	4	1	2
99	1	3	4	1
100	4	1	1	3
		_	1	3

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