

# INDIAN SCHOOL AL WADI AL KABIR

#### Assessment - I (2023-24)

#### **SUB: Applied Mathematics (241)**

Date: 26/09/2023

Set I

Time Allowed :3 hours

Grade: XII

Maximum Marks: 80

General Instructions:

- 1. This question paper contains five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
- 2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
- 3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
- 4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
- 5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
- 6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

Q. No					SECTIO	ON A (	MCQ)				Mar	ks
1.	If a m	atrix has 1	6 ele	ements, t	hen whic	ch of th	e follow	ing can	not be i	ts order?		1
	А	2 × 8	В	4 × 4	4	С	1 × 16		D	15 × 1		
2.	$\begin{vmatrix} 2x & 4 \\ -3 & x \end{vmatrix} = \begin{vmatrix} 5 & 0 \\ -1 & 6 \end{vmatrix}$ then value of x.											1
	Α	<u>±</u> 3	<u>+</u> 3 <b>B</b>		$2\sqrt{6}$	С	<u>±</u> 5		D	$\pm 2\sqrt{7}$		
3.	$If A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 3 \\ -1 & 0 & 3 \end{pmatrix},  adjA  = \_\_$										1	
	А	3	B	9		С	27		D	81		
4.	Writ	e the sun	i of	order at	nd degr	ree of	differn	tial eq	luation			
	$\left(\frac{dy}{dx}\right)^{\frac{1}{2}}$	$\frac{d^2y}{dx^2} = \left(\frac{d^2y}{dx^2}\right)$	$\overline{)}^{\overline{3}}$									1
	Α	5		В	4		C	3	D	Not define	d	

5.	If A =	[3]	5 4] t	then	A <sup>-1</sup>										1
	A	[4 [2	5] 3]	В	$\begin{bmatrix} -2 \\ 1 \end{bmatrix}$	$\begin{bmatrix} 2 & 2 \\ -3 \end{bmatrix}$	C		$\begin{bmatrix} 2 & -1 \\ -1 & \frac{1}{2} \end{bmatrix}$	$\left[\frac{5}{2}\right]$	I	)	$\begin{bmatrix} 2 & \frac{5}{2} \\ 1 & \frac{3}{2} \end{bmatrix}$		
6.	If the the pr	mea obat	n and oility o	the v	varian o suc	nce of a cesses i	binoı s	nial d	istribution	n are 4	and 2	res	pectiv	ely, then	1
	A		$\frac{1}{2}$			B	7 64	ŀ	С	$\frac{219}{256}$ <b>D</b> $\frac{37}{56}$			37 56		
7.	The value of x if A is a singular matrix, where $A = \begin{pmatrix} 1 & 0 & 3 \\ 0 & 1 & -3 \\ x & 3 & 0 \end{pmatrix}$												1		
	Α		3	В		2		С	1		D			0	
8.	If x is a Poisson variable and $P(x = 1) = 2p(x = 2)$ , then $P(x = 0) = $											1			
	Α	e	-1	B		е		С	1	D			<i>e</i> <sup>2</sup>		
9.	If $x = logt$ and $y = \frac{1}{t}$ then $\frac{dy}{dx} =$												1		
	Α		$-t^{3}$	3		B	-	$-\frac{1}{t}$	$\frac{1}{t}$ C $-t$			D		e <sup>t</sup>	
10.	Given Z-sco	that ore o	t mear f data	n of a poin	norr t 20 i	nal vari is equal	able 2 to	X is 1	2 and star	ndard d	leviati	on i	s 4. Tł	nen	1
	A		1	B		2		С	3		D			4	
11.	Whicl	n of	the fo	llowi	ng is	the sol	ution	of xd	y = ydx	?					1
	Α	<i>x</i> –	y = a	c   1	B 2	xy = c		С	$\frac{y}{x} = 0$	с	D		x + y	v = c	
12.	The d $y^2 =$	iffer 4 <i>ax</i>	ential <i>is</i>	equa	tion	of fami	ly of j	parabo	olas whos	e equa	tion is	5			1
	A x	$\frac{dy}{dx}$	= 2y		B	$\frac{dy}{dx} =$	· y	C	$y\frac{dy}{dx} =$	= 2x	D		$x\frac{dy}{dx}$	$= 2y^{2}$	
13.	In wh	ich o	of the	follo	wing	interva	1y =	<i>x</i> <sup>3</sup> –	3x is str	ictly (	decre	asir	ıg?		1
	Α	(-0	∘,−1)		B	(-1, 1)		С	(1, 0	0)	D		(-	1,∞)	

												1
14.	$\int_{-1}^{1} \log\left(\frac{2+x}{2-x}\right) dx = \underline{\qquad}.$											
	Α	0	В		1		С	2		D	3	
15.	A stor second enclos	ne is dropp d. At the i sed area in	ped in nstan Icreas	ito a t, wl sing?	quiet lak hen the ra	e an dius	d wa of t	aves move the circular	in circl wave i	es at a s s 10 cm	peed of 4cm per , how fast is the	1
	A	80π	В	2	400π		С	100π		D	$40\pi$	
16.	$f(x) = x^x$ has a stationary point at											
	Ax=eBx=1C $x = \frac{1}{e}$ D $x = 0$									x = 0		
17.	$\int 3^{3^x} 3^x dx = \underline{\qquad}.$											
	<b>A</b> $\frac{3^{3^{x}}}{(log3)^{2}}$ +C <b>B</b> $3^{3^{x}}$ +C <b>C</b> $3^{3^{x}}log3$ +c <b>D</b> $3^{3^{x}}3^{x}$ +C								$3^{3^x}3^x + C$			
18.	$\int_0^1 e^x \left(\frac{x}{(x+1)^2}\right) dx$											1
	A	e <sup>2</sup>	В		<u>е</u> 2	C		1	D		$\frac{e-2}{2}$	
	ASSERTION-REASON BASED QUESTIONS In the following questions (19 and 20), a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. A) Both A and R are true and R is the correct explanation of A. B) Both A and R are true but R is not the correct explanation of A. C) A is true but R is false. D) A is false but R is true.											
19.	(A) If (R) T	$\begin{bmatrix} 5 & y \\ 2 & 1 \end{bmatrix} =$ wo square	$= \begin{bmatrix} 3x \\ z \end{bmatrix}$	-y x	$\begin{array}{c} x - y \\ 2x - 3 \\ \hline A \text{ and } B \end{array}$	], <i>th</i> are	nen eau	x = 2 and al if $ A  =$	y = 1 $ B .$			1
		A		E	3		- 74	C			D	
	1											

(A) $f(x) = e^{2x}$ is increasing in R, where R is the set of real numbers.										
(R) f(x) is increasing if $f'(x) \ge 0, x \in R$ , where R is the set of real numbers.										
А	В		С		]	D				
SECTION B										
							2			
The probability	distribution of X	is given b	у				2			
X	0	1	2	3		4				
$\begin{array}{ c c } P(X) \\ \hline Find the value \end{array}$	0.1 ok and hence eval	k uate $P(x)$	2k < 2).	2k	2	k				
			2				2			
Find the equation	on of tangent to a	curve y =: O	$x^{3} + 3x + 0$ R	1 at (1, 5)			2			
The cost function	on $C(x)$ of a comm	nodity is g	given by c(	$(x) = \frac{2x^2 + 3}{2x^2 + 3}$	$\frac{x}{x}$ .					
Prove that marginal cost increases as the output x increases.										
			1							
Evaluate: $\int_{0}^{9}$	$\frac{\sqrt{x}}{\sqrt{x}} dx$						2			
$\int 3 \sqrt{\chi}$	$x + \sqrt{12} - x$	0	R							
The marginal re	evenue of a compa	ny is give	en by MR -	- 80±20x±3	$3x^2$					
where x is the n	umber of units so	ld for a pe	eriod. Find	the total re	venue	e function $R(x)$				
if at $x=2$ , $R(x) = 240$										
(	3 4 0 \						2			
Express $A = \begin{pmatrix} -1 & 2 & 3 \\ 1 & 2 & -1 \end{pmatrix}$ as a sum of symmetric and a skew symmetric matrix.										
							2			
$I_{f \Delta} = \begin{bmatrix} 1 & 2 \end{bmatrix}$	-3] and $B = ($	12 31	$1 \\ 0 $ then find	nd the prod	uct A	B				
$\prod_{n=1}^{n} \prod_{i=1}^{n} 0 -1$	3 ], and $D = ($	-1 0	4) then m	id the prod	uct A	D				
		SECT	ION C							
A fair coin is to	esed Q times Find	the prob	ability of a	otting						
i) exac	tly 5tails;	t the proba	aonity of g	etting			3			
ii) at lea	ast 5tails;									
iii) at m	ost 5 tails.									
	. г1	2 31	r—7 —8	-91			3			
Find the matr	$ix X$ , if $X \cdot \begin{bmatrix} 1 \\ 4 \end{bmatrix}$	$\begin{bmatrix} 2 & 6 \\ 5 & 6 \end{bmatrix} =$	$\begin{bmatrix} 1 \\ 2 \end{bmatrix} \begin{bmatrix} 1 \\ 4 \end{bmatrix}$	6						
							3			
Solve the follow	ving aquations usi	ng Crame	er's rule				5			
Solve the follow	vilig equations usi	ing Craine	<i>i</i> 5 fuic.							
	(A) $f(x) = e^{2x}$ (R) $f(x)$ is increased (R) $f(x)$ is increased A The probability X P(X) Find the value Find the equation The cost function Prove that marged Evaluate: $\int_{3}^{9} \frac{1}{\sqrt{x}}$ The marginal results where x is the noise of the second if $A = \begin{bmatrix} 1 & 2 \\ 0 & -1 \end{bmatrix}$ A fair coin is toon i) exact ii) at leased Find the matreased Find the matreased Find the matreased Find the matreased (A) $f(x) = e^{2x}$	(A) $f(x) = e^{2x}$ is increasing in (R) $f(x)$ is increasing if $f'(x) \ge$ A B The probability distribution of X X 0 P(X) 0.1 Find the value ok and hence eval Find the equation of tangent to a find the matrix $X$ if $X = \begin{bmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ .	(A) $f(x) = e^{2x}$ is increasing in R, where (R) $f(x)$ is increasing if $f'(x) \ge 0, x \in R$ , A B SECTION The probability distribution of X is given by X 0 1 P(X) 0.1 k Find the value ok and hence evaluate $P(x)$ Find the equation of tangent to a curve $y = CO$ The cost function C(x) of a commodity is generated by Prove that marginal cost increases as the or Evaluate: $\int_{3}^{9} \frac{\sqrt{x}}{\sqrt{x} + \sqrt{12 - x}} dx$ The marginal revenue of a company is given where x is the number of units sold for a prise if at x=2, R(x) = 240 Express $A = \begin{pmatrix} 3 & 4 & 0 \\ -1 & 2 & 3 \\ 1 & 2 & -1 \end{pmatrix}$ as a sum of If $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 \\ 3 & 1 \\ -1 & 0 \end{pmatrix}$ SECT A fair coin is tossed 9 times. Find the probening exactly 5 tails; ii) at least 5 tails. Find the matrix X, if $X \cdot \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} =$	(A) $f(x) = e^{2x}$ is increasing in R, where R is the set (R) $f(x)$ is increasing if $f'(x) \ge 0, x \in R$ , where R is A B C SECTION B The probability distribution of X is given by X 0 1 2 P(X) 0.1 k 2k Find the value ok and hence evaluate $P(x < 2)$ . Find the equation of tangent to a curve $y = x^3 + 3x + OR$ The cost function C(x) of a commodity is given by $c(x)$ Prove that marginal cost increases as the output x incr	(A) $f(x) = e^{2x}$ is increasing in $R$ , where R is the set of real nu (R) f(x) is increasing if $f'(x) \ge 0, x \in R$ , where R is the set of rABCSECTION BThe probability distribution of X is given by $X$ X012Y3P(X)0.1k2kPind the value ok and hence evaluate $P(x < 2)$ .Find the equation of tangent to a curve $y = x^3 + 3x + 1$ at (1, 5) ORThe cost function $C(x)$ of a commodity is given by $c(x) = \frac{2x^2+3}{x+2}$ Prove that marginal cost increases as the output x increases.Evaluate: $\int_3^9 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{12-x}} dx$ ORORThe marginal revenue of a company is given by $MR = 80+20x+3$ where x is the number of units sold for a period. Find the total re if at $x=2$ , $R(x) = 240$ Express $A = \begin{pmatrix} 3 & 4 & 0 \\ -1 & 2 & 3 \\ 1 & 2 & -1 \end{pmatrix}$ as a sum of symmetric and a skewIf $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & 1 \\ 3 & 1 & 0 \\ -1 & 0 & 4 \end{pmatrix}$ then find the prodIf $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & 1 \\ 3 & 1 & 0 \\ -1 & 0 & 4 \end{pmatrix}$ then find the prodSECTION CA fair coin is tossed 9 times. Find the probability of getting i) exactly Stails; iii) at least Stails; iii) at most 5 tails.Find the matrix X, if X. $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{bmatrix}$	(A) $f(x) = e^{2x}$ is increasing in R, where R is the set of real number(R) $f(x)$ is increasing if $f'(x) \ge 0, x \in R$ , where R is the set of real numberABCSECTION BThe probability distribution of X is given by $X$ 012 $X$ 012 $P(X)$ 0.1k2k $P(X)$ 0.1k1.1 (1, 5) $OR$ $OR$ $C(x) = \frac{2x^2 + 3x}{x^2 + 2x}$ Prove that marginal cost increases as the output x increases. $Evaluate: \int_3^9 \frac{\sqrt{x}}{\sqrt{x + \sqrt{12 - x}}} dxORORThe marginal revenue of a company is given by MR = 80 + 20x + 3x^2,where x is the number of units sold for a period. Find the total revenue(f a 1 \ 2 \ 3 \ 1 \ 2 \ -1 \ $	(A) $f(x) = e^{2x}$ is increasing in R, where R is the set of real numbers. (R) $f(x)$ is increasing if $f'(x) \ge 0, x \in R$ , where R is the set of real numbers. A B C D SECTION B The probability distribution of X is given by X 0 1 2 3 4 P(X) 0.1 k 2k 2k k Find the value ok and hence evaluate $P(x < 2)$ . Find the equation of tangent to a curve $y = x^3 + 3x + 1$ at (1, 5) OR The cost function C(x) of a commodity is given by $c(x) = \frac{2x^2 + 3x}{x + 2}$ . Prove that marginal cost increases as the output x increases. Evaluate: $\int_3^9 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{12 - x}} dx$ OR The marginal revenue of a company is given by MR = 80+20x+3x^2, where x is the number of units sold for a period. Find the total revenue function R(x) if at x=2, R(x) = 240 Express $A = \begin{pmatrix} 3 & 4 & 0 \\ -1 & 2 & 3 \\ 1 & 2 & -1 \end{pmatrix}$ as a sum of symmetric and a skew symmetric matrix. If $A = \begin{bmatrix} 1 & 2 & -3 \\ 0 & -1 & 3 \end{bmatrix}$ , and $B = \begin{pmatrix} 1 & 2 & 1 \\ 3 & 1 & 0 \\ -1 & 0 & 4 \end{pmatrix}$ then find the product AB SECTION C A fair coin is tossed 9 times. Find the probability of getting i) exactly Stalls; ii) at least Stalls. Find the matrix X, if X . $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{bmatrix}$			

29.	Find the consumers' surplus for the demand function	3
	$p = 25 - x - x^2$ when $p_0 = 19$ .	_
	OR	
	Find the producers' surplus for the demand function	
	$p = 4 - 5x + x^2$ when $p_0 = 18$ .	
30.	Evaluate: $\int_{-1}^{1} \frac{x^3 +  x  + 1}{x^2 + 2 x  + 1} dx$ OR Evaluate: $\int_{0}^{3}  x - 1  +  x - 2  dx$	3
31.	Find the particular solution of the differential equation $xy\frac{dy}{dx} = (x + 2)(y + 2)$ when $x = 1$ and $y = -1$	3
	SECTION D	
32.	In a district, exam scores of 500 student of class XII are recorded at the end of the session.	5
	<ul> <li>a) Tom scored 640 marks in total out of 800. The average score for the batch was 520 and the standard deviation was calculated to be 80. Find out how has Tom scored compared to his batch mates in the whole district.</li> </ul>	
	b) Jerry scored 400 marks in the same batch. What can you say about her	
	performance as compared to the batch of 500 students?	
	batchmates?	
	(Given: $P(z < 1.5) = 0.9332$ , $P(z < -0.12) = 0.4522$ )	
33.	If $x^m y^n = (x + y)^{m+n}$ then prove that $\frac{dy}{dx} = \frac{y}{x}$ and $\frac{d^2y}{dx^2} = 0$ <b>OR</b>	5
	A firm has the following total cost and demand functions:	
	$C(x) = \frac{x^3}{3} - 7x^2 + 111x + 50 \text{ and } x = 100 - p$	
	<ul> <li>(i) Find the total revenue function in terms of x.</li> <li>(ii) Find the total profit function P in terms of x.</li> </ul>	
	(iii) Find the profit maximum level of output of x.	
	What is the maximum profit, taking rupee as a unit of money?	
34.	Solve the following equations using matrices: x + y + z = 35, $2x - y + z = 35$ , $x - z = 15$	5
35.	Evaluate: $\int \frac{2x-3}{x^3-x^2-x+1} dx$ OR $\int \frac{x^2}{x^2-2x-3} dx$	5
	SECTION-E	
36.	Ms. Rajni deposited Rs.10,000 in a bank that pays 4% interest compounded continuously.	4
	Based on the above information	
	i) formulate a differential equation and find its particular solution.	
	ii) How much amount will she get after 10 years?	
	iii) How long it will take to double the amount?	
	(Given: $e^{0.4} = 1.4918$ and $log 2 = 0.6931$ )	

37.	Profit function of a company is given by	4									
	$p(x) = 41 + 72x - 18x^2$										
	i) Find the profit when $x = 1$ .										
	ii) In which interval $p(x)$ is strictly										
	increasing?										
	iii) (a) Find the maximum profit?										
	OR										
	iii) (b)Find the absolute minimum										
	value of $p(x)$ in [0, 3]										
	Jan Feb Mar Apr Nay Jan										
38.	A factory produces bulbs, of which 6% are defective bulbs in a large bulk of	4									
	bulbs.										
	Based on the above information, answer the following questions:										
	i) Find the probability that in a sample of 100 bulbs selected at random,										
	none of the bulbs is defective. (Use: $e^{-6} = 0.0024$ )	none of the bulbs is defective. (Use: $e^{-6} = 0.0024$ )									
	ii) Find the probability that the sample of 100 bulbs has exactly two										
	defective bulbs.										
	iii) (a) Find the probability that the sample of 100 bulbs will include not										
	more than one defective bulb.										
	UK (iii) (b) Find the mean and the variance of the distribution of number of										
	(iii) (b) Find the mean and the variance of the distribution of indinder of defective bulbs in a sample of 100 bulbs										
	derective builds in a sample of 100 builds.										



# INDIAN SCHOOL AL WADI AL KABIR

## Assessment - I (2023-24)

Marking scheme

### **SUB: Applied Mathematics (241)**

Date: 26/09/2023

Set I

Time Allowed :3 hours

Grade: XII Maximum Marks: 80

Q. SECTION A (MCQ) Marks No 1. If a matrix has 16 elements, then which of the following cannot be its order? 1 D  $15 \times 1$ 2.  $\begin{vmatrix} 2x & 4 \\ -3 & x \end{vmatrix} = \begin{vmatrix} 5 & 0 \\ -1 & 6 \end{vmatrix}$  then value of x. 1 Α <u>+</u>3 3.  $If A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 3 \\ -1 & 0 & 3 \end{pmatrix}, |adjA| = \_\_\_$ 1 B 9 Write the sum of order and degree of differntial equation 4.  $\left(\frac{dy}{dx}\right)^{\frac{1}{2}}$  $\frac{d^2y}{dx^2} = \left(\frac{d^2y}{dx^2}\right)$ 1 5 A 5. If  $A = \begin{bmatrix} 3 & 5 \\ 2 & 4 \end{bmatrix}$  then  $A^{-1}$ 1  $\frac{5}{2}$ С 3 6. If the mean and the variance of a binomial distribution are 4 and 2 respectively, 1 then the probability of two successes is

					В	$\frac{7}{64}$									
7.	The va	alue of x i	f A i:	s a si	ingular	matrix	, whe	re A =	$=\begin{pmatrix}1\\0\\x\end{pmatrix}$	0 1 3	3 -3 0	)		1	
	Α	3													
8.	If x is	a Poisson	vari	able a	and $P(x$	= 1) =	2 <i>p</i> ( <i>x</i>	= 2)	, then i	P(x =	= 0)	) = _		1	
	А	$e^{-1}$													
9.	If $x =$	logt and	<i>l</i> y =	$=\frac{1}{t}th$	nen $\frac{dy}{dx} =$									1	
					B	$-\frac{1}{t}$									
10.	Given that mean of a normal variable X is 12 and standard deviation is 4. Then Z-score of data point 20 is equal to												1		
			В		2										
11.	Which	n of the fo	llowi	ng is	the solu	ition of <i>x</i>	dy =	ydx	?					1	
						C		$\frac{y}{r} = 0$	c						
12.	The di $y^2 = -$	ifferential 4ax is	equa	tion	of famil	y of para	bolas	whose	e equa	tion i	s			1	
	A x	$\frac{dy}{dx} = 2y$													
13.	In whi	ich of the	follo	wing	interval	$y = x^3$	-3x	is str	ictly o	decre	easi	ing?			1
				B	(-1, 1)										
14.	$\int_{-1}^{1} lo_{\lambda}$	$g\left(\frac{2+x}{2-x}\right)dx$	x = _	·		1				<u>I</u>				1	
	A	0													
15.	A stor per see fast is	ne is dropp cond. At t the enclose	bed in he in sed a	nto a stant rea ir	quiet lal , when t hcreasin	ke and w he radius g?	aves 1 s of th	nove i e circi	in circl ular wa	les at ave is	a sp 10	cm, l	of 4cm now	1	
	Α	80π													

16.	$f(x) = x^x$ has a stationary point at										
	C $x = \frac{1}{e}$										
17.	$\int 3^{3^x} 3^x dx = \underline{\qquad}.$	1									
	$\mathbf{A}  \frac{3^{3^{x}}}{(log_{3})^{2}} + \mathbf{C}$										
18.	$\int_0^1 e^x \left(\frac{x}{(x+1)^2}\right) dx$										
	$\mathbf{D} \qquad \frac{e-2}{2}$										
	ASSERTION-REASON BASED QUESTIONS In the following questions (19 and 20), a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. A) Both A and R are true and R is the correct explanation of A. B) Both A and R are true but R is not the correct explanation of A. C) A is true but R is false. D) A is false but R is true.										
19.	(A) If $\begin{bmatrix} 5 & y \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 3x - y & x - y \\ x & 2x - 3 \end{bmatrix}$ , then $x = 2$ and $y = 1$ (R) Two square matrices A and B are equal if $ A  =  B $ .	1									
20.	(A) $f(x) = e^{2x}$ is increasing in R, where R is the set of real numbers. (R) $f(x)$ is increasing if $f'(x) \ge 0, x \in R$ , where R is the set of real numbers.	1									
	A										
21	SECTION B										
21.	The probability distribution of X is given byX01234P(X)0.1k2k2kkK=0.15P(x<2) =0.25	1									

22.	Find the equation of tangent to a curve $y = x^3 + 3x + 1$ at (1, 5)	
	$y'=3x^2+3$ Slope = 6 Equation $y_{1}^{2}=6(x_{1}^{2})$	1
	Equation $y-3=0(x-1)$ 6x-y-1=0	1
	OR OR	
	The cost function C(x) of a commodity is given by $c(x) = \frac{2x^2 + 3x}{x}$ .	
	$C^{2}(x) = (x+2)(4x+3) - (2x^{2}+3)$	1
	$\frac{C(x)}{(x+3)^2}$	
	Proving $C'(x) \ge 0$	1
23.	Evaluate: $\int_{3}^{9} \frac{\sqrt{x}}{\sqrt{x} + \sqrt{12 - x}} dx = \int_{3}^{9} \frac{\sqrt{12 - x}}{\sqrt{12 - x} + \sqrt{x}} dx$	1
	$2I - \int_{-1}^{9} dx = 6$ Hence $I = 6$	1
	$\int_{-\infty}^{\infty} \frac{1}{2\pi} \int_{-\infty}^{\infty} \frac{1}{2\pi} \int_{-$	
	The marginal revenue of a company is given by $MR = 80+20x+3x^2$ ,	
	where x is the number of units sold for a period. Find the total revenue function	
	R(x) if at x=2, $R(x) = 240$	
	$1R = \int 80 + 20x + 3x^{2} dx = 80x + 10x^{2} + x^{3} + C$ $C = 32$	1
	$TR = 80x + 10x^2 + x^3 + 32$	0.5
		0.5
24.	Express $A = \begin{pmatrix} 3 & 4 & 0 \\ 1 & 2 & 2 \end{pmatrix}$ as a sum of symmetric and a show symmetric	
	Express $A = \begin{pmatrix} -1 & 2 & 3 \\ 1 & 2 & -1 \end{pmatrix}$ as a sum of symmetric and a skew symmetric	
	matrix.	1+1
	$\begin{pmatrix} 3 & \frac{3}{2} & \frac{1}{2} \end{pmatrix} \begin{pmatrix} 3 & \frac{5}{2} & -\frac{1}{2} \end{pmatrix}$	
	$\begin{pmatrix} 2 & 2 \\ 3 & 5 \end{pmatrix} \begin{pmatrix} 2 & 2 \\ 5 & 1 \end{pmatrix}$	
	$A = \begin{bmatrix} \frac{3}{2} & 2 & \frac{3}{2} \end{bmatrix} + \begin{bmatrix} -\frac{3}{2} & 0 & \frac{1}{2} \end{bmatrix}$	
	$(\overline{2} \ \overline{2} \ -1)$ $(\overline{2} \ -\overline{2} \ 0)$	
25.	If $A = \begin{bmatrix} 1 & 2 & -3 \end{bmatrix}$ and $B = \begin{pmatrix} 1 & 2 & 1 \\ 2 & 1 & 0 \end{pmatrix}$ then find the product AB	2
	$\begin{bmatrix} 1 & X - \begin{bmatrix} 0 & -1 & 3 \end{bmatrix}, & uu & D - \begin{bmatrix} 3 & 1 & 0 \\ -1 & 0 & 4 \end{bmatrix}$ then this the product AB	
	$(10 \ 4 \ -11)$	
	(-6 -1 12)	
	SECTION C	
26.	A fair coin is tossed 9 times. Find the probability of getting	
26.	SECTION CA fair coin is tossed 9 times. Find the probability of getting $n = 9$ $p = 1/2$ $q = 1/2$ $q = 1/2$	
26.	SECTION CA fair coin is tossed 9 times. Find the probability of getting $n = 9$ $p = 1/2$ $q = 1/2$ $q = 1/2$ $p(exactly 5tails) = 9C_2 \left(\frac{1}{2}\right)^9$	1
26.	SECTION C A fair coin is tossed 9 times. Find the probability of getting n = 9  p = 1/2  q = 1/2 i) P(exactly 5tails)=9C <sub>2</sub> $\left(\frac{1}{2}\right)^9$ ii) P(at least 5tails)= $\left(\frac{1}{2}\right)^9$ [9C <sub>5</sub> + 9C <sub>6</sub> + 9C <sub>7</sub> + 9C <sub>8</sub> +9C <sub>9</sub> ]	1
26.	SECTION C A fair coin is tossed 9 times. Find the probability of getting n =9 p=1/2 q=1/2 i) P(exactly 5tails)=9C <sub>2</sub> $\left(\frac{1}{2}\right)^9$ ii) P(at least 5tails)= $\left(\frac{1}{2}\right)^9$ [9C <sub>5</sub> + 9C <sub>6</sub> + 9C <sub>7</sub> + 9C <sub>8</sub> +9C <sub>9</sub> ] iii) P(at most 5 tails)= $\left(\frac{1}{2}\right)^9$ [9C <sub>6</sub> + 9C <sub>7</sub> + 9C <sub>8</sub> +9C <sub>9</sub> ]	1 1 1
26.	SECTION C A fair coin is tossed 9 times. Find the probability of getting n =9 p=1/2 q=1/2 i) P(exactly 5tails)=9 $C_2 \left(\frac{1}{2}\right)^9$ ii) P(at least 5tails)= $\left(\frac{1}{2}\right)^9 [9C_5 + 9C_6 + 9C_7 + 9C_8 + 9C_9]$ iii) P(at most 5 tails)= $\left(\frac{1}{2}\right)^9 [9C_0 + 9C_1 + 9C_2 + 9C_3 + 9C_4 + 9C_5]$	1 1 1
26. 27.	SECTION C A fair coin is tossed 9 times. Find the probability of getting n =9 p=1/2 q=1/2 i) P(exactly 5tails)=9C <sub>2</sub> $\left(\frac{1}{2}\right)^9$ ii) P(at least 5tails)= $\left(\frac{1}{2}\right)^9$ [9C <sub>5</sub> + 9C <sub>6</sub> + 9C <sub>7</sub> + 9C <sub>8</sub> +9C <sub>9</sub> ] iii) P(at most 5 tails)= $\left(\frac{1}{2}\right)^9$ [9C <sub>0</sub> + 9C <sub>1</sub> + 9C <sub>2</sub> + 9C <sub>3</sub> +9C <sub>4</sub> + 9C <sub>5</sub> ] $\begin{bmatrix} a & b \\ c & d \end{bmatrix} \cdot \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} = \begin{bmatrix} -7 & -8 & -9 \\ 2 & 4 & 6 \end{bmatrix}$ $X = \begin{bmatrix} 1 & -2 \\ 2 & 0 \end{bmatrix}$	1 1 1 1

28.	Solve the following equations using Cramer's rule:	1
	3x + 4y = 24; 4x - 3y = 7	
	$\begin{bmatrix} 3 & 4 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 24 \\ 7 \end{bmatrix} \Delta = -25$	
	A = -100 A = -75 x - 4 y - 3	1
29	$\Delta_{\chi} = 100 \Delta_{y} = 7.5 \Lambda_{} \gamma_{} \gamma_{}$	1
27.	Find the consumers surplus for the demand function $n = 25 - x - x^2$ when $n = 10$	1
	$p = 25$ $x$ $x$ when $p_0 = 17$ . When $n_0 = 19$ solving and getting $x_0 = 2$	1
	$CS = \int_{-1}^{2} 25 = x - \frac{x^2}{2} dx - \frac{19}{2} x^2$	1
	$\begin{array}{c} cs - J_0 \\ 22 \\ 22 \\ cn \\ cn \\ cn \\ cn \\ cn \\ cn$	
	$=\frac{1}{3}$ OR	
	Find the producers' surplus for the demand function	
	$p = 4 - 5x + x^2$ when $p_0 = 18$ .	1
	When $p_0 = 18$ solving and getting $x_0 = 7$	1
	$PS=126 - \int_0^{y} 4 - 5x - x^2 dx$	1
	$=\frac{2009}{6}$	
	Evolute: $\int_{-\infty}^{1} \frac{x^3 +  x  + 1}{dx} dx$	
30.	Evaluate: $\int_{-1}^{1} \frac{dx}{x^2 + 2 x  + 1} dx$	
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	$I = \int \frac{x +  x  + 1}{2} dx$	
	$\int_{-1}^{1} x^2 + 2 x  + 1$	1
	$=\int \frac{x}{2} + \frac{ x +1}{2} + \int \frac{ x +1}{2} dx$	
	$\int_{-1}^{3} x^{2} + 2 x  + 1$ $\int_{-1}^{3} x^{2} + 2 x  + 1$	
	$\int_{C}^{1}  x  + 1$	
	$= 0 + 2 \int \frac{dx}{( x +1)^2} dx$ [odd function + even function]	
	0( x +1)	
	$\int \frac{x+1}{x+1} dx = 2\int \frac{1}{x} dx$	1.1
	$=2 \int \frac{1}{(x+1)^2} dx = 2 \int \frac{1}{x+1} dx = 2  \log x+1  _0^2 = 2 \log 2.$	1 – 1
	<b>OR</b> Evaluate: $\int_{-\infty}^{3}  r - 1  +  r - 2  dr$	
	$\int_{0}^{1} dx = \int_{0}^{3} dx = \int_{0}^{1} dx = \int_{0}^{2} dx = \int_{0}^{3} dx = \int_{0$	
	$\int_{0}^{1} 1 - x  dx + \int_{1}^{1} (1 - x)  dx + \int_{0}^{1} (2 - x)  dx + \int_{2}^{1} (x - 2)  dx =$	1+1+
	5	1
31	Find the particular solution of the differential equation	
51.	$ry\frac{dy}{dx} = (r+2)(y+2)when r = 1 and y = -1$	
	dy = (x + 2)(y + 2)when x = 1	
	$y\frac{dy}{dx+2} = \frac{(x+2)}{x}dx$	
	$y + 2 \qquad x$ ( $y dy \qquad c (x + 2)$	1
	$\int \frac{y  dy}{y + 2} = \int \frac{(x + 2)}{x} dx$	
	$y + 2 \int x$ y + 2loaly + 2l = x + 2loax + c	1
	y + 2log   y + 2l = x + 2log x + c y + 2loa   y + 2l = x + 2loa x - 2	1
		-

	SECTION D	
32.	<ul> <li>In a district, exam scores of 500 student of class XII are recorded at the end of the session.</li> <li>d) Tom scored 640 marks in total out of 800. The average score for the batch was 520 and the standard deviation was calculated to be 80. Find out how has Tom scored compared to his batch mates in the whole district.</li> <li>e) Jerry scored 400 marks in the same batch. What can you say about her performance as compared to the batch of 500 students?</li> <li>f) How much has Hari scored if he has done better than 45.22% of his hot how the standard standar</li></ul>	
	(Given: $P(z < 1.5) = 0.9332$ , $P(z < -0.12) = 0.4522$ ) a) $Z = \frac{x - \mu}{\sigma} = 1.5$ $P(z < 15) = .9332$	2 2
	b) $z = -1.5$ 6.68% of 500 c) $z = -0.12$ then $x = -0.12 \times 80 + 520 = 510(Approx)$	1
33.	If $x^m y^n = (x + y)^{m+n}$ then prove that $\frac{dy}{dx} = \frac{y}{x}$ and $\frac{d^2y}{dx^2} = 0$ m log x + n log y = (m + n) log (x + y)	
	Differentiating w.r.t. x we get	1
	$\frac{m}{x} + \frac{n}{y}\frac{dy}{dx} = \frac{m+n}{x+y}\left(1 + \frac{dy}{dx}\right)$	2
	$\Rightarrow \frac{dy}{dx}\left(\frac{n}{y} - \frac{m+n}{x+y}\right) = \frac{m+n}{x+y} - \frac{m}{x}$	
	$\Rightarrow \frac{dy}{dx} \left( \frac{nx + ny - my - ny}{y(x + y)} \right) = \frac{mx + nx - mx - my}{x(x + y)}$	
	$\Rightarrow \ \frac{dy}{dx} = \left(\frac{nx - my}{nx - my}\right) \frac{y}{x} = \frac{y}{x} \ \Rightarrow \ \frac{dy}{dx} = \frac{y}{x}$	1
	$\frac{\mathrm{d}^2 \mathrm{y}}{\mathrm{d}\mathrm{x}^2} = \frac{\mathrm{x} \cdot \frac{\mathrm{d}\mathrm{y}}{\mathrm{d}\mathrm{x}} - \mathrm{y} \cdot \mathrm{1}}{\mathrm{x}^2}$	1
	$\Rightarrow \frac{x \cdot \frac{dy}{dx} - y}{x^2}$	
	=0 OR	

A firm has the following total cost and demand functions:  

$$C(x) = \frac{x^3}{3} - 7x^2 + 111x + 50 \text{ and } x = 100 - p$$
(iv) Find the total profit function P in terms of x. (1)  
(v) Find the total profit function P in terms of x. (2)  
(vii) What is the maximum level of output of x. (2)  
(vii) What is the maximum profit, taking rupee as a unit of money? (1)  
Cost function is  $C(x) = \frac{x^3}{3} - 7x^2 + 111x + 50$   
Demand function;  $x = 100 - p \Rightarrow p = 100 - x$   
Revenue function,  $R(x) = px = x(100 - x) = 100x - x^2...(1)$   
Profit function,  $P(x) = \text{Revenue} - \text{Cost}$   
 $= R(x) - C(x)$   
 $= 100x - x^2 - \frac{x^3}{3} + 7x^2 - 111x - 50$   
 $= -\frac{x^3}{3} + 6x^2 - 11x - 50...(2)$   
Differentiating of equation (2) w.r. to x, we get  
 $\frac{dP}{dx} = -x^2 + 12x - 11...(3)$   
Now,  $\frac{dP}{dx} = 0 \Rightarrow -x^2 + 12x - 11 = 0 \Rightarrow x^2 - 12x + 11 = 0$   
 $\Rightarrow x^2 - 11x - x + 11 = 0$   
 $\Rightarrow x(x - 11) - 1(x - 11) = 0$   
 $\Rightarrow (x - 1)(x - 11) = 0 \Rightarrow x = 1, 11$   
Again differentiating, we get  
 $\frac{d^2P}{dx^2} = 12 - 2x...(4)$   
at  $x = 11, \frac{d^2P}{dx^2} = -10 \Rightarrow \frac{d^2P}{dx^2} < 0$  (Maximum value)  
at  $x = 11, \frac{d^2P}{dx^2} = -10 \Rightarrow \frac{d^2P}{dx^2} < 0$  (Maximum value)

34.	Solve the following equations using matrices:	
	x + y + z = 35, $2x - y + z = 35$ , $x - z = 15$	
	$\begin{pmatrix} 1 & 1 & 1 \\ 2 & 1 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 35 \\ 25 \end{pmatrix}$	1
	$\begin{pmatrix} 2 & -1 & 1 \\ 1 & 0 & -1 \end{pmatrix} \begin{pmatrix} y \\ z \end{pmatrix} = \begin{pmatrix} 35 \\ 15 \end{pmatrix}$	1 1
	$AX=B  X=A^{-1}B$	1
	A  = 5	
	$1 \begin{pmatrix} 1 & 1 & 2 \\ 2 & 2 & -1 \end{pmatrix}$	2
	$A^{-1} = \frac{1}{5} \begin{pmatrix} 3 & -2 & -1 \\ 1 & 1 & 2 \end{pmatrix}$	
	x=20 $y=10$ $z=5$	1
	Evaluate: $\int \frac{2x-3}{3} dx = \int \frac{2x-3}{(-1)^2(-1)^2} dx = \int \frac{A}{(-1)^2} + \frac{B}{(-1)^2} + \frac{C}{(-1)^2} dx$	2+1
35.	$= \frac{5}{2} \log \left[ x + \frac{1}{2} + \frac{1}{2} + \frac{5}{2} \log \left[ x + \frac{1}{2} + \frac{1}{2} + \frac{5}{2} \log \left[ x + \frac{1}{2} + \frac{1}{2} + \frac{5}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{5}{2} + \frac{1}{2} + \frac$	2
	$= -\frac{1}{4} \log \left  x - 1 + \frac{1}{2(x-1)} - \frac{1}{4} \log \left  x + 1 \right  + c \right $	2
	$x^2$ $x^{2x+3}$ $x^{2x+3}$	
	$\int \frac{x}{x^2 - 2x - 3} dx = \int 1 + \frac{2x + 3}{x^2 - 2x - 3} dx = \int 1 - \frac{1}{4(x + 3)} + \frac{1}{4(x - 1)} dx$	1+2
	$=x-\frac{1}{4}\log x+3 +\frac{9}{4}\log x-1 +C$	
	4 4	2
	SECTION E -Case study-based questions	
36.	Ms. Rajni deposited Rs.10,000 in a bank that pays 4% interest compounded	
	continuously.	
	Based on the above information	
	iv) formulate a differential equation and find its particular solution.	
	$dP_{-kt}$	2
	$\frac{dt}{dt} = \kappa t$	2
	Solving : $P = \alpha e^{0.04t}$ and $\alpha = 10000$	
	v) How much amount will she get after 10 years? $\gtrless$ 14918	
	vi) How long it will take to double the amount?	
	(Given: $e^{0.4} = 1.4918$ and $log2 = 0.6931$ )	1
	$20000 = 10000e^{0.04t}$	1
	Then $t = 17.32$ (Approx 17 years)	
37	Profit function of a company is given by $n(r) = 41 + 72r - 18r^2$	
	iv) Find the profit when $x = 1$	
	Profit = $P(1) = 95$	1
	v) In which interval $p(x)$ is strictly increasing?	
	P'(x)=72-36x critical point=2	
	Increasing in $(-\infty, 2)$	
	vi) (a) Find the maximum profit?	1
	P''(x) = -36  Max at  x = 2	-
	P(2) = 113	2
	OR	
	vii) (b)Find the absolute minimum value of p(x) in [0, 3]	

		1
	P(0)=41 P(2)=113 P(3)=95	
	Absolute minimum value =41	
38.	A factory produces bulbs, of which 6% are defective bulbs in a large bulk of bulbs.	
	Based on the above information, answer the following questions:	
	iv) Find the probability that in a sample of 100 bulbs selected at random, none of the bulbs is defective. (Use: $e^{-6} = 0.0024$ ) P(x=0)= $e^{-6} = 0.0024$	1
	v) Find the probability that the sample of 100 bulbs has exactly two defective bulbs. P(x=2)= 0.0432	1
	vi) (a) Find the probability that the sample of 100 bulbs will include not more than one defective bulb. P(x<2)=0.0024+0.0144=0.0168 OR	2
	(iii) (b) Find the mean and the variance of the distribution of number of defective bulbs in a sample of 100 bulbs.	
	Mean = $np = variance = 6$	
		I