

# NAVNEET PRACTICE PAPERS COMMERCE

# **STANDARD XII**

#### Each Subject in this book contains :

- New Format of the Question Paper
- 1 Paper with Solutions and Marking Scheme
- 5 Papers for Practice

Full Solution of Practice Papers through **QR Code** 

Economics

Updated as per Portion Omitted from the Syllabus for the Year 2020-2021

- **Organisation of Commerce & Management** 
  - Secretarial Practice

**Book-keeping & Accountancy** 

Mathematics & Statistics

English



# 2021NAVNEET PRACTICE PERS COMMERCE Updated

Based on the Board's New Textbooks and Paper Pattern

# **STANDARD XII**

★ Economics ★ Organisation of Commerce & Management \* Secretarial Practice \* Book-Keeping & Accountancy Mathematics & Statistics + \* English

#### Salient features :

- An examination-oriented book based on Board's new textbooks.
- All Question Papers/Activity Sheets prepared as per the Board's New Paper Pattern.
- One Model Activity Sheet for English and One Model Question Paper each for all other subjects with full solution and detailed marking scheme for a clear idea of writing the answers exactly as per the requirements of the Board.
- 5 Model Question Papers in each subject for practice.
- Neat, labelled and authentic diagrams, Journal and various Ledger Accounts in the solved papers.
- Helps the student to get full exposure to the new question paper pattern and secure highest marks in the forthcoming Board examination.



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Price :

₹ 300.00

as per the

portions omitted

from the syllabus

for the year

2020-21



NAVNEET EDUCATION LIMITED

# **MATHEMATICS AND STATISTICS**

#### **EVALUATION PLANS**

- 1. (a) Theory/Written Examination : 80 Marks
  - (b) Practical Examination : 20 Marks

Total

d : 100 Marks

#### 2. Question Paper Pattern for the Theory/Written Examination :

(a) For Mathematics and Statistics (Commerce) there will be one question paper divided into two sections, viz.
 Section – I and Section – II. Students should write the answers of both sections in the same answer book.
 Section I : 40 marks

Section I : 40 marks Section II : 40 marks

Total : 80 marks

(b) Each section will have three main questions as follows :

Question No.	Question Type	Marks
Q. 1. (A)	6 Multiple Choice Questions (MCQ) (1 mark each)	06
(B)	3 True/False type Questions (1 mark each)	03
(C)	3 Fill in the blanks type Questions (1 mark each)	03
Q. 2. (A)	Solve any 2 out of 3 (3 marks each)	06
(B)	Solve any 2 out of 3 (4 marks each)	08
Q. 3. (A)	Solve any 2 out of 3 (3 marks each)	06
(B)	Solve any 1 out of 2 (4 marks each)	04
(C)	Solve any 1 out of 2 (Activity) (4 marks each)	04

#### SECTION-I

#### SECTION-II

Question No.	Question Type	Marks
Q. 4. (A)	6 Multiple Choice Questions (MCQ) (1 mark each)	06
(B)	3 True/False type Questions (1 mark each)	03
(C)	3 Fill in the blanks type Questions (1 mark each)	03
Q. 5. (A)	Solve any 2 out of 3 (3 marks each)	06
(B)	Solve any 2 out of 3 (4 marks each)	08

Question No.	Question Type	Marks
Q. 6. (A)	Solve any 2 out of 3 (3 marks each)	06
(B)	Solve any 1 out of 2 (4 marks each)	04
(C)	Solve any 1 out of 2 (Activity) (4 marks each)	04

#### 3. Chapterwise distribution of marks in the Question Paper :

SECTION-I

Sr. No.	Chapters	Marks with Options
1.	Mathematical Logic	08
2.	Matrices	08
3.	Differentiation	07
4.	Applications of Derivatives	09
5.	Integration	07
6.	Definite Integration	05
7.	Application of Definite Integration	04
8.	Differential Equations and Applications	10
	Total Marks	58
	SECTION-II	

### SECTION-II

Sr. No.	Chapters	Marks with Options
1.	Commission, Brokerage and Discount	06
2.	Insurance and Annuity	04
3.	Linear Regression	08
4.	Time Series	07
5.	Index Numbers	07
6.	Linear Programming	06
7.	Assignment Problem and Sequencing	09
8.	Probability Distributions	11
	Total Marks	58

#### 4. Scheme for the conduct of Practical Examination :

There will be Practical Examination based on topics in Part I and Part II of the textbooks for 20 marks.

#### **Distribution of Marks :**

1. Journal	5 marks
<ol> <li>Problem solving (Three Problems out of four practical problems each of 5 marks)</li> </ol>	15 marks
Total	20 marks

### NON-EVALUATIVE PORTION FOR THE ACADEMIC YEAR 2020-21 AS DECLARED ON 22-07-2020

Part –	1
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#### 1. Mathematical Logic :

#### Solved Examples on page no.

4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 20, 22, 23, 24, 25, 26, 27.

Activities on page no. 2, 14, 34

#### 2. Matrices :

Solved Examples on page no.

39, 43, 44, 45, 48, 49, 50, 52, 53, 54, 55, 61, 62, 64, 65, 66, 67, 69, 70, 71, 74, 75, 76, 77, 78, 79.

Activities on page no. 86, 87, 88.

#### 3. Differentiation :

**Solved Examples on page no.** 90, 91, 92, 93, 94, 95, 96, 97, 98.

Activities on page no. 101, 102.

4. Applications of Derivatives :

Solved Examples on page no. 104, 105, 106, 108, 109, 110, 111, 112.

Activities on page no. 114, 115.

#### 5. Integration :

#### Solved Examples on page no.

117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 134, 135. Activities on page no. 135, 139, 140.

6. Definite Integration :

Solved Examples on page no. 141, 142, 143, 144, 145, 146, 147.

Activities on page no. 150, 151.

7. Applications of Definite Integration :

**Solved Examples on page no.** 154, 155, 156, 157.

Activities on page no. 158, 159.

#### 8. Differential Equations and Applications :

Solved Examples on page no. 162, 163, 164, 166, 167, 168, 169, 170. Activities on page no. 173.

#### Part – II

1.	Commission, Brokerage and Discount :
	Solved Examples on page no. 1, 2, 3, 4, 7, 8, 9, 10.
	Activities on page no. 14, 15
2.	Insurance and Annuity :
	Solved Examples on page no. 17, 18, 19, 23, 24, 25, 26, 27.
	Activities on page no. 32, 33.
3.	Linear Regression :
	Solved Examples on page no. 39, 40, 41, 44, 45, 46, 48, 49.
	Activities on page no. 54, 55, 56.
4.	Time Series :
	Solved Examples on page no. 59, 62, 64, 65, 66.
	Activities on page no. 70, 71.
5.	Index Numbers :
	Solved Examples on page no. 75, 76, 77, 79, 80, 81, 84, 85, 86.
	Activities on page no. 94.
6.	Linear Programming :
	Solved Examples on page no. 96, 97, 100, 101.
	Activities on page no. 105, 106, 107.
7.	Assignment Problem and Sequencing :
	Solved Examples on page no. 113, 114, 115, 118, 121, 122, 123, 124.
	Activities on page no. 130, 131.
8.	Probability Distribution :
	Solved Examples on page no.
	136, 137, 138, 139, 140, 142, 143, 144, 147, 149, 150, 151, 152.

(For detailed information please refer to Board's Website.)



### MODEL PRACTICE PAPER

(WITH SOLUTION AND MARKING SCHEME)

## **MATHEMATICS AND STATISTICS**

Time : 3 Hours]

[Max. Marks : 80

#### **General Instructions :**

- (1) All questions are compulsory.
- (2) Figures to the right indicate full marks.
- (3) There are 6 questions divided into two sections.
- (4) Write answers of Section I and Section II in the same answer book.
- (5) Use of logarithmic table is allowed. Use of calculator is not allowed.
- (6) For LPP, graph paper is not necessary. Only rough sketch of graph is expected.
- (7) Start answer to each question on a new page.

#### **SECTION-I**

# Q. 1. (A) Select and write the most appropriate answer from the given alternatives for each sub-question :

- (i) The statement  $(\sim p \land q) \lor \sim q$  is equivalent to (a)  $p \lor q$  (b)  $p \land q$  (c)  $\sim (p \lor q)$  (d)  $\sim (p \land q)$  (1)
- (ii) If A is a  $2 \times 2$  matrix such that

A(adj. A) = 
$$\begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$$
, then |A| = .....  
(a) 0 (b) 5 (c) 10 (d) 25 (1)

(iii) If 
$$y = \log\left(\frac{e^x}{x^2}\right)$$
, then  $\frac{dy}{dx} = \dots$   
(a)  $\frac{2-x}{x}$  (b)  $\frac{x-2}{x}$  (c)  $\frac{e-x}{ex}$  (d)  $\frac{x-e}{ex}$  (1)

(iv) The equation of tangent to the curve  $y = x^2 + 4x + 1$  at (-1, -2) is (a) 2x - y = 0 (b) 2x + y - 5 = 0 (c) 2x - y - 1 = 0 (d) x + y - 1 = 0 (1)

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**[6]** 

(v) 
$$\int \frac{dx}{x-x^2} = \dots$$
  
(a)  $\log |x| - \log |1 - x| + c$  (b)  $\log |1 - x^2| + c$  (c)  $-\log |x| + \log |1 - x| + c$  (d)  $\log |x - x^2| + c$  (l)  
(vi) 
$$\int_{2}^{3} \frac{x}{x^2 - 1} dx = \dots$$
  
(a)  $\log \left(\frac{8}{3}\right)$  (b)  $-\log \left(\frac{8}{3}\right)$  (c)  $\frac{1}{2} \log \left(\frac{8}{3}\right)$  (d)  $-\frac{1}{2} \log \left(\frac{8}{3}\right)$  (l)  
(B) State whether the following statements are *True* or *False* : [3]  
(i) If  $\int \frac{x - 1}{(x + 1)(x - 2)} dx = A \log |x + 1| + B \log |x - 2| + c$ , then  $A + B = 1$ . (l)  
(ii)  $A_1$  is the area enclosed by  $y = f(x)$ ,  $x = a$ ,  $x = b$  and X-axis,  $A_2$  is the area enclosed by  $y = f(x)$ ,  $x = c$ ,  $x = d$  and X-axis. If  $A_1 = A_2$ , then  $a = c$ ,  $b = d$ . (l)  
(iii) Order and degree of a differential equation are always positive integers. (l)  
(c) Fill in the following blanks : [3]  
(i) Truth value of : If  $x = 2$ , then  $x^2 = -4$ , is ....... (l)  
(ii) If  $f'(x) = \frac{1}{x} + x$  and  $f(1) = \frac{5}{2}$ , then  $f(x) = \log x + \frac{x^2}{2} + \dots$ .... (l)  
(iii) The order of highest derivative occurring in the differential equation is called ...... of the differential equation. (l)  
2. (A) Attempt any Two of the following statement pattern is a tautology or a contradiction or a contingency :  
 $(p \land \sim q) \rightarrow (\sim p \land \sim q)$  (3)  
(ii) Solve the following equations by the method of reduction :  
 $x + 2y + z = 8$ ,  $2x + 3y - z = 11$ ,  $3x - y - 2z = 5$ . (3)  
(iii) If  $e^x + e^x = e^{x + x}$ , then show that  $\frac{dy}{dx} = -e^{y - x}$  (3)  
(iii) Attempt any Two of the following : [8]  
(i) Find MPC, MPS, APC and APS, if the expenditure  $E_c$  of a person with income *I* is given as  $E_c = (0.0003) I^2 + (0.075)I$ , when  $I = 1000$ . (4)  
(ii) Evaluate :  $\int \frac{x}{(x - 1)^2(x + 2)} dx$ . (4)

(iii) Solve the following differential equation :  $(x^2 - y^2)$ 

$$y^2)dx + 2xy \, dy = 0. (4)$$

Q.

#### **Q. 3.** (A) Attempt any Two of the following :

(i) Write the converse, inverse and contrapositive of the following statement : "If he studies, then he will go to college." (3)

(ii) Find 
$$\frac{d^2y}{dx^2}$$
, if  $y = 2at$ ,  $x = at^2$ . (3)

(iii) Find the area between the parabolas  $y^2 = 7x$  and  $x^2 = 7y$ . (3)

#### (B) Attempt any One of the following :

(i) Find the inverse of  $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 5 \\ 2 & 4 & 7 \end{bmatrix}$  by using elementary row transformations. (4)

(ii) Evaluate : 
$$\int_{1}^{3} \frac{\sqrt[3]{x+5}}{\sqrt[3]{x+5} + \sqrt[3]{9-x}} dx.$$
 (4)

#### (C) Attempt any One of the following :

(i) The rectangle has area of 50 cm<sup>2</sup>. Find its dimensions for least perimeter.

**Solution :** Let *x* cm and *y* cm be the length and breadth of the rectangle.

Then its area is xy = 50.

$$\therefore y = \frac{50}{}$$

Perimeter of the rectangle = 2(x + y)

$$= 2\left(x + \frac{50}{2}\right)$$
Let  $f(x) = 2\left(x + \frac{50}{2}\right)$ 
Then  $f'(x) = 2\left(1 - \frac{50}{2}\right)$ 
and  $f''(x) = 2\left(0 + \frac{50}{2}\right) = \frac{200}{2}$ 
Now,  $f'(x) = 0$ , if  $1 - \frac{50}{2} = 0$ 
i.e. if  $x^2 = 2$ 
i.e. if  $x = \pm 2$ 

But x is not negative.

[4]

[4]

**[6]** 



This is the general solution.

(4)

#### **SECTION-II**

# Q. 4. (A) Select and write the most appropriate answer from the given alternatives for each sub-question : [6]

- (i) The market price is also called as
  - (a) cost price (b) selling price (c) list price (d) invoice price (1)
- (ii) The cost of living index number using weighted relative method is given by

(a) 
$$\frac{\Sigma I W}{\Sigma W}$$
 (b)  $\Sigma \left(\frac{W}{I W}\right)$  (c)  $\left(\frac{\Sigma W}{\Sigma I W}\right)$  (d)  $\Sigma \left(\frac{I W}{W}\right)$  (1)

(iii) If 
$$X \sim B\left(20, \frac{1}{10}\right)$$
, then  $E(x)$  is  
(a) 2 (b) 5 (c) 4 (d) 3 (1)

(iv) The corner points of the feasible region are (0, 0), (2, 0),  $\left(\frac{12}{7}, \frac{1}{7}\right)$  and (0, 1), then the point of maximum z = 6.5x + y = 15 is (12, 3)

(a) (0, 0) (b) (2, 0) (c)  $\left(\frac{12}{7}, \frac{3}{7}\right)$  (d) (0, 1) (1)

(v) The job A to D have processing times as 5, 6, 8, 4 on first machine and 4, 7, 9, 10 on second machine, then optimal sequence is
(a) CDAB
(b) DBCA
(c) BCDA
(d) ABCD

#### (vi) Given p.d.f. of a continuous r.v. X as

$$f(x) = \frac{x^2}{3}$$
, for  $-1 < x < 2$ 

$$= 0$$
, otherwise, then  $F(1)$  is

(a) 
$$\frac{1}{9}$$
 (b)  $\frac{2}{9}$  (c)  $\frac{3}{9}$  (d)  $\frac{4}{9}$  (1)

#### (B) State whether the following statements are *True* or *False* : [3]

- (i)  $b_{yx}$  and  $b_{xy}$  are independent of change of origin and scale. (1)
- (ii) The region represented by the inequations x ≤ 0 and y ≤ 0 lies in the first quadrant.
- (iii) If r.v. X assumes the values 1, 2, 3, ..., 9 with equal probabilities, then E(X) = 5. (1)

### (C) Fill in the following blanks : [3]

- (i) The person who receives annuity is called ...... (1)
- (iii) The value of discrete r.v. are generally obtained by ......(1)MATHEMATICS AND STATISTICS377

#### **O.** 5. (A) Attempt any Two of the following :

(i) The following are the marks obtained by the students in Economics (X) and Mathematics (Y) :

X	59	60	61	62	63
Y	78	82	82	79	81

Find the regression equation of *Y* on *X*.

(ii) Obtain trend values for the following data using 5-yearly moving averages :

Year	1974	1975	1976	1977	1978	1979	1980	1981	1982	
Production	0	4	9	9	8	5	4	8	10	

(iii) Find y, if the Price Index Number by Simple Aggregate Method is 120, taking 1995 as base year :

Commodity	А	В	С	D
Price (in ₹) in 1995	95	у	80	35
Price (in ₹) in 2003	116	74	92	42

#### (B) Attempt any Two of the following :

(i) A toy manufacturing company produces five types of toys. Each toy has to go through three machines A, B, C in the order ABC. The time required in hours for each process is given in the following table :

Туре	1	2	3	4	5
Machine A	16	20	12	14	22
Machine B	10	12	4	6	8
Machine C	8	18	16	12	10

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Solve the problem for minimizing the total elapsed time.

(ii) The following table gives the production of steel (in millions of tonnes) for years 1976 to 1986 :

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Production	0	4	4	2	6	8	5	9	4	10	10

Fit a trend line to the above data by the method of least squares. Also, obtain the trend value for the year 1990.

(4)

(4)

**[6]** 

(3)

[8]

(3)

(iii) A company manufactures two types of chemicals A and B. Each chemical requires two types of raw material P and Q. The table below shows number of units of P and Q required to manufacture one unit of A and one unit of B :

$\begin{array}{c} \text{Raw} \\ \text{Material} \rightarrow \end{array}$	A	В	Availability
Р	3	2	120
Q	2	5	160

The company gets profits of  $\gtrless$  350 and  $\gtrless$  400 by selling one unit of A and one unit of B respectively. Formulate the problem as LPP to maximize profit. (4)

#### Q. 6. (A) Attempt any Two of the following :

(i) Calculate Laspeyre's and Paasche's Price Index Number for the following data :

Commodity	Base	Year	Current Year		
Commodity	Price	Quantity	Price	Quantity	
	$p_0$	$q_0$	<i>p</i> <sub>1</sub>	$q_1$	
Ι	8	30	12	25	
П	10	42	20	16	

(3)

**[6]** 

(ii) A company has a team of four salesmen and there are four districts where the company wants to start its business. After taking into account the capabilities of salesmen and the nature of districts, the company estimates that the profit per day in rupees for each salesman in each district is as below :

Salesmen	Districts							
	1	2	3	4				
А	16	10	12	11				
В	12	13	15	15				
С	15	15	11	14				
D	13	14	14	15				

Find the assignment of salesman to various districts which will yield maximum profit.

(iii) A player tosses two coins. He wins ₹ 10 if 2 heads appear, ₹ 5 if 1 head appears and ₹ 2 if no head appears. Find the expected value and variance of winning amount.

(3)

#### (B) Attempt any One of the following :

(i) For a bivariate data :

 $\overline{x} = 53$ ,  $\overline{y} = 28$ ,  $b_{yx} = -1.2$  and  $b_{xy} = -0.3$ . Find

- (a) Correlation coefficient between X and Y.
- (b) Estimate of Y for X = 50.
- (c) Estimate of X for Y = 25.
- (ii) The number of complaints which a bank manager receives per day follows a Poisson distribution with parameter m = 4. Find the probability that the manager receives (a) only two complaints on a given day (b) at most two complaints on a given day. Use  $e^{-4} = 0.0183$ . (4)

#### (C) Attempt any One of the following :

#### (i) Complete the following activity :

Face value (SD) = ₹ 7000, r = 5%, Cash value = ₹ 6930,

$$BD = SD - = = 70$$

Date of drawing the bill = 14th April 2019

Date of discounting the bill = 6th July 2019.

$$BD = \frac{SD \times n \times 100}{100}$$

$$\therefore n = \frac{70}{350}$$
 years

 $\therefore n = \square = \square$  days.

For legal due date, 73 days are counted from due date of discounting the bill i.e. from 6th July 2019.

July 2019	Aug. 2019	Sept. 2019	Total
	31		73

Legal due date : 17th Sept. 2019.

Nominal due date is

Period of the bill is |-| = 5 months.

(4)

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(4)

[4]

#### (ii) Complete the following activity :

Present value P = ₹ 10000

Accumulated value A = ₹ 20,000 r = 12%



C = Payment of each annuity



(4)

		SECTION-I	
Q. 1.	(A)		
	(i)	(d) ~ (p∧q)	(1 mark
	(ii)	(b) 5	(1 mark
	(iii)	(b) $\frac{x-2}{x}$	(1 mark
	(iv)	(a) $2x - y = 0$	(1 mark
	(v)	(a) $\log  x  - \log  1 - x  + c$	(1 mark
	(vi)	(c) $\frac{1}{2} \log \left( \frac{8}{3} \right)$	(1 mark
		R	
Q. 1.	(B)		
	(i)	True	(1 mark
	(ii)	False	(1 mark
	(iii)	True	(1 mark
Q. 1.	(C)		
	(i)	False (F)	(1 mark
	(ii)	2	(1 mark
	(iii)	order	(1 mark

Q. 2.	(A)										
	(i)	1	2	3	4	5	6	7			
		р	q	~ p	~ q	p∧~q	$\sim p \wedge \sim q$	$(p \land \sim q) \rightarrow (\sim p \land \sim q)$			
		Т	т	F	F	F	F	Т			
		Т	F	F	т	т	F	F			
		F	т	Т	F	F	F	Т			
		F	F	т	т	F	т	т			
		<ul> <li>The entries in the last column are neither all T nor all F.</li> <li>∴ (p ∧ ~q) → (~p ∧ ~q) is a contingency.</li> <li>(Columns 5 and 6 : 1 mark; Column 7 : 1 mark; Conclusion : 1 mark</li> </ul>									
	(ii)	(ii) The given equations can be written in matrix formers									
		$(1 \ 2 \ 1) (r) (8)$									
		2	3	-1	y y	= 11		(1 mark)			
		$\begin{bmatrix} 3 & -1 & -2 \end{bmatrix} \begin{bmatrix} 2 & 5 \end{bmatrix}$									
		By $R_2 - 2R_1$ and $R_3 - 3R_1$ , we get									
		ſ	1	2	1)	[x] [	8]				
			0 -	-1- -7-	-3 -5)	$\begin{vmatrix} \mathbf{y} \\ \mathbf{z} \end{vmatrix} = \begin{vmatrix} -\mathbf{z} \\ -\mathbf{z} \end{vmatrix}$	5 19				
		$B_{\rm X} R_{\rm a} - 7 R_{\rm a}$ we get									
			1 0 - 0	2 -1 - 0	1 - 3 16 J		3) 5 5				
		··· (	( x + 0 - 0 + 0	- 2y + - y — 3 0 + 10	- z ) 3z   = 6z )	$= \begin{bmatrix} 8\\ -5\\ 16 \end{bmatrix}$		(1 mark)			
		By e	quali	ty of	mat	rices,					
		$\mathbf{x} + \mathbf{z}$	2 <b>y</b> +	z = 8			(1)				
		- <b>y</b>	— 3z	= -	5		(2)				
			16z	= 16			(3)				
		Fror	n (3)	, <b>z</b> =	1						
				1	мати	FMATICS AND	STATISTICS	383			

Substituting 
$$z = 1$$
 in (2), we get  
 $-y - 3 = -5$ ,  $\therefore y = 2$   
Substituting  $y = 2$ ,  $z = 1$  in (1), we get  
 $x + 4 + 1 = 8$   $\therefore z = 3$   
Hence,  $x = 3$ ,  $y = 2$ ,  $z = 1$  is the required solution. (1 mark)  
(iii)  $e^x + e^y = e^{x+y}$  ... (1)  
Differentiating both sides w.r.t.  $x$ , we get  
 $e^z + e^y \frac{dy}{dx} = e^{z+y} \frac{d}{dx} (x + y)$   
 $\therefore e^z + e^y \frac{dy}{dx} = e^{z+y} \frac{dy}{dx}$  (1 mark)  
 $\therefore e^z + e^y \frac{dy}{dx} = e^{z+y} - e^z$   
 $\therefore (e^y - e^{z+y}) \frac{dy}{dx} = e^{z+y} - e^z$   
 $\therefore (e^y - e^{z+y}) \frac{dy}{dx} = e^{z+y} - e^z$   
 $\therefore \frac{dy}{dx} = \frac{e^{z+y} - e^z}{e^z - e^{z-y}}$  (1 mark)  
 $= \frac{e^z + e^y - e^z}{e^z - e^z}$  (1 mark)  
 $= \frac{e^y - e^{z-y}}{-e^z}$  (1 mark)

	(D)		
Q. 2.	(B)		
	(1)	$E_c = (0.0003)I^2 + (0.075)I$	
		$dE_c = d (0.0003)T^2 + (0.075)T^1$	
		$\frac{dI}{dI} = \frac{dI}{dI} $	
		= (0.0003)(2T) + (0.075)(1)	
		= (0.0006)I + 0.075	
		When $I = 1000$ , then	
		MPC = (0.0006)(1000) + 0.075	
		= 0.6 + 0.075 = 0.675.	(1 mark)
		$\therefore$ MPC + MPS = 1	
		: $0.675 + MPS = 1$	
		$\therefore$ MPS = 1 - 0.675 = 0.325	(1 mark)
		Now, $APC = \frac{E_c}{T} = \frac{(0.0003)I^2 + (0.075)I}{T}$	
		= (0.0003)I + (0.075)	
		When $I = 1000$ , then	
		APC = (0.0003)(1000) + 0.075	
		= 0.3 + 0.075 = 0.375	(1 mark)
		$\therefore$ APC + APS = 1	
		$\therefore$ 0.375 + APS = 1	
		$\therefore$ APS = 1 - 0.375 = 0.625	(1 mark)
		Hence, $MPC = 0.675$ ,	
		MPS = 0.325	
		APC = 0.375,	
		APS = 0.625.	
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(ii) Let 
$$I = \int \frac{x}{(x-1)^2(x+2)} dx$$
  
Let  $\frac{x}{(x-1)^2(x+2)} = \frac{A}{x-1} + \frac{B}{(x-1)^2} + \frac{C}{x+2}$   
 $\therefore x = A(x-1)(x+2) + B(x+2) + C(x-1)^2$   
Put  $x - 1 = 0$ , i.e.  $x = 1$ , we get  
 $1 = A(0)(3) + B(3) + C(0) \qquad \therefore B = \frac{1}{3}$   
Put  $x + 2 = 0$ , i.e.  $x = -2$ , we get  
 $-2 = A(-3)(0) + B(0) + C(9) \qquad \therefore C = -\frac{2}{9}$  (1 mark)  
Put  $x = -1$ , we get,  
 $-1 = A(-2)(1) + B(1) + C(4)$   
But  $B = \frac{1}{3}$  and  $C = -\frac{2}{9}$   
 $\therefore -1 = -2A + \frac{1}{3} - \frac{8}{9}$   
 $\therefore 2A = -\frac{5}{9} + 1 = \frac{4}{9} \qquad \therefore A = \frac{2}{9}$  (1 mark)  
 $\therefore x = \frac{(2/9)}{(x-1)^2(x+2)} = \frac{(1/3)}{x-1} + \frac{(-2/9)}{(x-1)^2} + \frac{(x-2)^2}{x+2}$   
 $\therefore I = \int \left[ \frac{(2/9)}{x-1} + \frac{(1/3)}{(x-1)^2} + \frac{(-2/9)}{x+2} \right] dx$   
 $= \frac{2}{9} \left[ \frac{1}{x-1} dx + \frac{1}{3} \int (x-1)^{-2} dx - \frac{2}{9} \int \frac{1}{x+2} dx$  (1 mark)  
 $= \frac{2}{-\frac{2}{9}} \log |x-1| + \frac{1}{3} \frac{(x-1)^{-1}}{-1} - \frac{2}{9} \log |x+2| + c$   
 $= \frac{2}{-\frac{2}{9}} \log |\frac{x-1}{x+2}| - \frac{1}{-3(x-1)} + c$ . (1 mark)

$$\begin{array}{|c|c|c|c|} \hline (iii) & (x^2 - y^2)dx + 2xy dy = 0 \\ \hline (iii) & (x^2 - y^2)dx = (x^2 - x^2) dx = (y^2 - x^2) dx \\ \hline dy = (x^2 - x^2) & ... (1) \\ \hline dy = (x^$$

		1	
0.3	(4)		
પ્ર. ગ.	(i)	Let p : He studies	
		a : He will go to college	
		Then the symbolic form of the given statement is $p \rightarrow q$ .	
		Converse : $a \rightarrow p$ is the converse of $p \rightarrow a$ .	
		i.e. If he will go to college, then he studies.	(1 mark)
		Inverse : $\sim p \rightarrow \sim q$ is the inverse of $p \rightarrow q$ .	
		i.e. If he does not study, then he will not go to college.	(1 mark)
		Contrapositive : $\sim q \rightarrow \sim p$ is the contrapositive of $p \rightarrow q$ .	
		i.e. If he will not go to college, then he does not study.	(1 mark)
	(ii)	$x = at^2$ , $y = 2at$	
		Differentiating x and y w.r.t. t, we get	
		dr d d	
		$\frac{du}{dt} = \frac{d}{dt}(at^2) = a\frac{d}{dt}(t^2)$	
		$= a \times 2t = 2at$ (1)	
		and $\frac{dy}{dt} = \frac{d}{dt}(2at) = 2a\frac{d}{dt}(t)$	
		$= 2a \times 1 = 2a$	(1 mark)
		$\therefore \frac{dy}{dx} = \frac{(dy/dt)}{(dx/dt)} = \frac{2a}{2at} = \frac{1}{t}$	
		$\therefore \frac{d^2 y}{dt^2} = \frac{d}{dt} \left(\frac{1}{t}\right) = \frac{d}{dt} \left(\frac{1}{t}\right) \cdot \frac{dt}{dt}$	(1 mark)
		$\frac{dx^2 - dx (t)}{dt (t)} dx$	
		$= -\frac{1}{12} \times \frac{1}{12} = -\frac{1}{12} \times \frac{1}{221} \qquad \dots  [By (1)]$	
		$\frac{t^2}{\left(\frac{dx}{dt}\right)}$ $t^2 - 2dt$	
		$=-\frac{1}{2z^{+3}}$	(1 mark)
		1	



$$\begin{array}{c} \begin{array}{c} & = \frac{1}{6} \frac{2}{7} \frac{x^2}{3} dx = \frac{1}{7} \left[ \frac{x^3}{3} \right]_0^2 = \frac{1}{7} \left[ \frac{7^3}{3} - 0 \right] \\ & = \frac{7^2}{3} = \frac{49}{3} \\ & & = \frac{7^2}{3} = \frac{49}{3} = \frac{49}{3} = \frac{49}{3} \text{ sq units.} \qquad (1 \text{ mark}) \\ & & & \\ \hline & & \\$$

Q. 3.	)	
	Let $x$ cm and y cm be the length and breadth of a rectangle.	
	Then its area is $xy = 50$ .	
	$\therefore y = \frac{50}{2}$	
	Perimeter of the rectangle = 2 $(x + y)$	
	$= 2\left(\begin{array}{c} x + \frac{50}{x} \end{array}\right) $ (1 mark)	
	$(1 - 1)^{-1}$	
	$\frac{\operatorname{Let} f(x) = 2 \left( \begin{array}{c} x + \frac{1}{2} \right) \\ x \end{array} \right)$	
	Then $f'(x) = 2 \left( 1 - \frac{50}{x^2} \right)$	
	and $f''(r) = 2(0, 100) = 200$ (1 mark)	
	$\frac{1}{x^3} = \frac{1}{x^3} = \frac{1}{x^3}$	
	Now, $f'(x) = 0$ , if $1 - \frac{50}{x^2} = 0$	
	$1.e. \text{ If } \mathcal{L}^{-} = 50$	
	$1.e. \text{ if } x = \pm 5\sqrt{2}$	
	$\therefore x = 5\sqrt{2}$ and f'' $5\sqrt{2} = \frac{200}{5\sqrt{2}} > 0$ (1 mark)	
	<u>(5√2)</u> <sup>3</sup>	
	$\therefore$ by the second derivative test, f is minimum at $x = 5\sqrt{2}$	
	When $\mathfrak{x} = \left\lfloor 5\sqrt{2} \right\rfloor$ , $\mathfrak{y} = \frac{50}{5\sqrt{2}} = \left\lfloor 5\sqrt{2} \right\rfloor$	
	$\therefore x = 5\sqrt{2}$ cm, $y = 5\sqrt{2}$ cm	
	Hence, the rectangle is a square of side $5\sqrt{2}$ cm. (1 mark)	
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 (ii)	$\frac{dy}{dr} + 2xy = x \qquad \dots (1)$	
	This is the linear differential equation of the form $\frac{dy}{dx} + P \cdot y$	v = Q,
	where $P = 2x$ , $Q = x$	
	$\therefore I.F. = e^{\int P dx} = e^{\int \left[ 2x \right] dx} = e^{\left[ x^2 \right]}$	(1 mark)
	: the solution of (1) is given by	
	$\mathbf{y} \cdot (\mathbf{I}.\mathbf{F}.) = \int \mathbf{Q} \cdot (\mathbf{I}.\mathbf{F}.) d\mathbf{x} + \mathbf{c}.$	
	$\therefore \mathbf{y} \cdot \left[ \mathbf{e}^{\mathbf{x}^2} \right] = \int \left[ \mathbf{x} \cdot \mathbf{e}^{\left[ \mathbf{x}^2 \right]} d\mathbf{x} + \mathbf{c} \right] \dots (2)$	(1 mark)
	Put $\mathbf{x}^2 = \mathbf{t}$	
	$\therefore 2x dx = dt$	
	$\therefore x dx = \frac{1}{2} dt$	
	$\therefore$ (2) becomes	
	$\mathbf{y} \cdot \mathbf{e}^{\mathbf{x}^{t}} = \frac{1}{2} \int \mathbf{e}^{t} d\mathbf{t} + \mathbf{c}$	(1 mark)
	$\therefore \mathbf{y} \cdot \mathbf{e}^{\mathbf{z}} = \frac{1}{2} \mathbf{e}^{\mathbf{z}} + \mathbf{c}$	
	<b>1 1 1</b>	(1
	$\therefore \mathbf{y} \cdot \mathbf{e}^{\mathbf{z}} = \frac{1}{2} \mathbf{e}^{\mathbf{z}} + \mathbf{c}$	(I mark)
	This is the general solution.	
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		SECTION-II	
Q. 4.	(A)		
	(i)	(c) list price	(1 mark)
	(ii)	(a) $\frac{21W}{\Sigma W}$	(1 mark)
	(iii)	(a) 2	(1 mark)
	(iv)	(b) (2, 0)	(1 mark)
	(v)	(b) DBCA	(1 mark)
	(vi)	(b) $\frac{2}{9}$	(1 mark)
		B	
Q. 4.	(B)		
	(i)	False	(1 mark)
		NAVICEI	
	(ii)	False	(1 mark)
	(iii)	True	(1 mark)
Q. 4.	(C)		
	(i)	Annuitant	(1 mark)
	(ii)	y > x	(1 mark)
	(iii)	counting	(1 mark)

Q. 5.	(A)										
	(i)	X = marks	s in Eco	nomics, Y =	= Marks in	mathematics.					
		We prepo	are the t	following t	able for c	alculation :					
		x	У	$\frac{(x-\overline{x})}{\overline{x}=61}$	$\frac{(y-\overline{y})}{y=80.4}$	$(x-\overline{x})\cdot(y-\overline{y})$	$(\mathbf{x} - \overline{\mathbf{x}})^2$				
		59	78	<b>- 2</b>	- 2.4	4.8	4				
		60	82	-1	1.6	- 1.6	1				
		61	82	0	1.6	0	0				
		62	79	1	-1.4	- 1.4	1				
		63	81	2	0.6	1.2	4				
							_				
		Σχ	Σγ	$\Sigma(\mathbf{x} - \mathbf{x})$	$\Sigma(y-y)$	6.0	$\Sigma(\mathbf{x}-\mathbf{x})^2$				
		= 305	= 402	= 0	=0	- 3.0	= 10				
						$\Sigma(\mathbf{x}-\mathbf{x})(\mathbf{y}-\mathbf{y})=3$					
							(1				
						FT	(1 mark)				
		Here, $n = -\Sigma x$	= 5 305	$-\Sigma y$	402 00						
		x ==	= <u></u> = (	$\frac{51; y = \frac{1}{n}}{n}$	=	).4					
		Regressi	on equa	tion of Y o	on X :						
		y = a + b $\Sigma(x)$	$x \cdot x$	$-\overline{v}$ 3			(4 1)				
		$b_{yx} = \frac{-cx}{2}$	$\frac{\Sigma(\mathbf{x} - \mathbf{x})}{\Sigma(\mathbf{x} - \mathbf{x})}$	$\frac{77}{10^2} = \frac{10}{10} =$	= 0.3		(I mark)				
		a = y - b	$\nabla_{\mathbf{x}} \cdot \overline{\mathbf{x}}$								
		Putting y	$\overline{i} = 80.4$	$b_{vx} = 0.3$	and $\overline{\mathbf{x}} = 61$	, we get					
		a = 80.4	-0.3(6	1)							
		= 80.4	- 18.3 =	= 62.1							
		∴ a=62	2.1.								
		Putting o	a = 62.1	and $b_{yx} =$	0.3 in y=	$a + b_{yx} \cdot x$ , we get th	e regression				
		equation	of Y on	X as follo	WS.						
		y = 62	2.1+0.3	x							
		$\therefore y = 0.3x + 62.1.$ (1 mark)									
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(ii)	We constr	uct the follow	ving table to ob	tain 5-yearly mov	ing averages for		
	the given o	data :	5		5 5		
	Year	Production	5-yearly	5-yearly			
	t	x <sub>t</sub>	moving tota	I moving avera	iges		
				Trend valu	e		
	1974	0	-	-			
	1975	4	-	-			
	1976	9	30	6.0			
	1977	9	35	7.0			
	1978	8	35	7.0			
	1979	5	34	6.8			
	1980	4	35	7.0			
	1981	8	-				
	1982	10	-	_			
		(Column 2	: 1 mark; Colu	nn 3 : 1 mark; Co	lumn 4 : 1 mark)		
		1005	-				
(111)	Here, base year = 1995						
(111)	$\therefore \mathbf{p}_0 = \mathbf{Pri}$	e year = 1995 ce in 1995 ai	nd				
	$\begin{array}{c} \text{Here, base} \\ \therefore  \mathbf{p}_0 = \text{Pri} \\ \\ \mathbf{p}_1 = \text{Pri} \end{array}$	e year = 1995 ce in 1995 ai ce in 2003.	nd				
	$p_0 = Pri$ $p_1 = Pri$ Given : P_01	e year = 1995 ce in 1995 a ce in 2003. = 120, y = ?	nd				
	$p_0 = Pri$ $p_1 = Pri$ Given : P_01	e year = 1995 ce in 1995 a ce in 2003. = 120, y = ?	nd Price (in 3	٤)			
	$\begin{array}{c} \text{Here, base} \\ \therefore  p_0 = \text{Pri} \\ \hline p_1 = \text{Pri} \\ \hline \text{Given} : P_{01} \\ \hline \hline \\ \hline $	e year = 1995 ce in 1995 a ce in 2003. = 120, y = ? odity	nd Price (in t	<u>۶)</u>			
	$\begin{array}{c} \text{Here, base} \\ \therefore  p_0 = \text{Pri} \\ \hline p_1 = \text{Pri} \\ \hline \text{Given} : P_{01} \\ \hline \hline \\ \hline $	e year = 1995 ce in 1995 a ce in 2003. = 120, y = ? odity	Price (in Price (in Po	۶)			
	$\begin{array}{c} \text{Here, base} \\ \text{Image: } p_0 = \text{Pri} \\ \hline p_1 = \text{Pri} \\ \hline \text{Given} : P_{01} \\ \hline \hline \\ \hline $	e year = 1995 ce in 1995 a ce in 2003. = 120, y = ? odity	p nd Price (in Po 95	r) p <sub>1</sub> 116			
	$\begin{array}{c} \text{Here, base} \\ \therefore  p_0 = \text{Pri} \\ \hline p_1 = \text{Pri} \\ \hline \text{Given} : P_{01} \\ \hline \hline \\ \hline $	e year = 1995 ce in 1995 a ce in 2003. = 120, y = ? odity	Price (in Price (in Po 95 y	P1 116 74			
	Piere, base	year = 1995 ce in 1995 a ce in 2003. = 120, y = ? odity	Price (in Price (in Po 95 y 80	P <sub>1</sub> P <sub>1</sub> 116       74       92			
	$\begin{array}{c} \text{Here, base} \\ \therefore \ \mathbf{p}_0 = \mathbf{Pri} \\ \hline \mathbf{p}_1 = \mathbf{Pri} \\ \hline \mathbf{Given} : \mathbf{P}_{01} \\ \hline \mathbf{Comm} \\ \hline \mathbf{Comm} \\ \hline \mathbf{C} \\ \hline \mathbf{C}$	year = 1995 ce in 1995 a ce in 2003. = 120, y = ? odity	Price (in Price (in Po 95 y 80 35	<ul> <li>P1</li> <li>P1</li> <li>116</li> <li>74</li> <li>92</li> <li>42</li> </ul>			

Now, Price Index Number $P_{o_1} = \frac{\Sigma p_1}{2 p_0} \times 100$ $\therefore 120 = \frac{324}{210 + y} \times 100$ (1 mark) $\therefore 120 = \frac{32400}{1200}$ $\therefore 210 + y = \frac{32400}{120}$ $\therefore 210 + y = 270$ $\therefore y = 270 - 210$ $\therefore y = 60$ Hence, the value of y is ₹ 60.		
Now, Price Index Number $P_{01} = \frac{5\mu}{2\mu} \times 100$ $\therefore 120 = \frac{324}{210 + \gamma} \times 100$ $\therefore 120(210 + \gamma) = 32400$ $\therefore 210 + \gamma = \frac{32400}{1200}$ $\therefore 210 + \gamma = 32400$ $\therefore 210 + \gamma = 700$ $\therefore \gamma = 60$ Hence, the value of y is ₹ 60.         (1 mark)		
$P_{01} = \frac{\Sigma \mu_{1}}{\Sigma \rho_{0}} \times 100$ (1 mork) $\therefore 120 = \frac{324}{210 + y} \times 100$ (1 mork) $\therefore 120(210 + y) = 32400$ $\therefore 210 + y = \frac{32400}{120}$ $\therefore 210 + y = 270$ $\therefore y = 60$ Hence, the value of y is ₹ 60. (1 mork) Hence, the value of y is ₹ 60. (1 mork) Hence = 100 + 100	 Now, Price Index Number	
$P_{01} = \frac{324}{210 + y} \times 100$ (1 mark) $\therefore 120 = \frac{324}{210 + y} \times 100$ (1 mark) $\therefore 120(210 + y) = 32400$ $\therefore 210 + y = \frac{32400}{120}$ $\therefore 210 + y = 270$ $\therefore y = 270 - 210$ $\therefore y = 60$ Hence, the value of y is ₹ 60. (1 mark)	 $\Sigma p_1 \dots 100$	
$\begin{array}{c} \therefore 120 = \frac{324}{210 + y} \times 100 \qquad (1 \text{ mark}) \\ \therefore 120(210 + y) = 32400 \\ \hline \\ \therefore 120 + y = \frac{32400}{120} \\ \hline \\ \therefore 210 + y = 270 \\ \hline \\ \therefore y = 270 - 210 \\ \hline \\ \therefore y = 60 \\ \hline \\ Hence, the value of y is ₹ 60. (1 \text{ mark}) \\ \hline \\ $	 $P_{01} = \frac{1}{\Sigma p_0} \times 100$	
$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c}$	 $120 = \frac{324}{2} \times 100$	(1 mark)
Image: State of the second state of	 $210 + y^{-100} = 32400$	(2 112 1)
$\therefore 210 + y = \frac{32400}{120}$ $\therefore 210 + y = 270$ $\therefore y = 60$ Hence, the value of y is ₹ 60.         (1 mark)		
210 + y = 270          y = 270 - 210          y = 60         Hence, the value of y is ₹ 60.       (1 mark)	$\therefore 210 + y = \frac{32400}{120}$	
y = 270 - 210         y = 60         Hence, the value of y is ₹ 60.	 $\therefore 210 + y = 270$	
y = 60         Hence, the value of y is ₹ 60. </th <th> <math>\therefore y = 270 - 210</math></th> <th></th>	 $\therefore y = 270 - 210$	
Hence, the value of y is ₹ 60.       (1 mark)         Image: I	 $\therefore y = 60$	
	 Hence, the value of y is ₹ 60.	(1 mark)
Image:	 (R)	
Image: Sector of the sector		
Image: Second statistics       Image: Second statistics		
Image:		
Image: Second statistics       Image: Second statistics         Image: Second statistics       Image: Second statistics		
Image: Second statistics		
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Q. (5)	(B)										
	(i)	Here Min. (A)	= 12, Min. (C) =	= 8 and Max. (1	8) = 12.						
		Since, Min.(A)	)≥Max.(B) is	satisfied, the	problem can	be converted					
		into 5 types o	f toys. 2 mach	ines problem o	and two fictiti	ous machines					
		are, $G = A + B$	re, $G = A + B$ and $H = B + C$								
		The problem n	ow can be writ	ten as follows	:						
		Types	Processing ti	me (in hours)							
		of									
		toys	$\Theta = \mathbf{A} + \mathbf{B}$	H=R+C							
		1	26	18							
		2	32	30							
		3	16	20	R						
		4	20	18							
		5	30	18		(1 mark)					
		Here, Min. (G	, H) = 16, whic	h corresponds	to G.						
		Therefore, ty	pe 3 toy is pro	ocessed at firs	st.						
		3									
		The problem	now reduces to	type 1, 2, 4, !	5 toys.						
		Here, Min (G,	H) = 18, which	o corresponds	to H.						
		Therefore, ty	vpe 1 toy is pro	cessed in the l	ast, type 4 toy	is processed					
		at the last ne	xt to type 1 toy	and type 5 toy	v is processed c	at last next to					
		type 4 toy.									
			<b></b>								
		3 5	4 1								
		Now, type 2 t	oy is processed	l at last next t	o type 5 toy ar	nd the optimal					
		sequence is o	btained as foll	ows :							
		3 2 5	4 1								

 Total ela	psed ti	me is ob <sup>.</sup>	tained as	s follows	::				
 Sequence	Mach	nine A	Mach	nine B	Mack	nine C	Idle		
 of type	Time	Time	Time	Time	Time	Time	time for Machine		
 of toy	in	out	in	out	in	out	С		
 3	0	12	12	16	16	32	16		
 2	12	32	32	44	44	62	12		
 5	32	54	54	62	62	72	0		
 4	54	68	68	74	74	86	2		
 1	68	84	84	94	94	102	8		
			Total i	dle time	for mac	hine C	38	]	
							(2 mar	'ks)	
 Total ela	Total elapsed time T = 102 hours								
 Idle time	e for mo	achine A							
 = T – Si	= T $-$ Sum of processing time for all jobs on machine A								
 = 102 -	= 102 - 84 = 18 hours								
 Idle time	e for mo	achine B							
 = T - SL	im of pr	rocessing	g time fo	or all job	os on ma	chine B			
 = 102 -	40 = 62	hours							
 Idle time	e for ma	achine C	= 38 hoi	urs			(1 mo	ırk)	
				DIGTICC				300	
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(ii)	Here, n=	11. We transf	orm year t to	u by takin	g	
	u = t - 198	31.				
	We constr	ruct the follov	ving table for	calculatio	n :	
						]
	Year	Production	u = t - 1981	<b>u</b> <sup>2</sup>	ux <sub>t</sub>	
	t	$\mathbf{x}_{t}$				_
	1976	0	- 5	25	0	
	1977	4	- 4	16	<b>— 16</b>	
	1978	4	- 3	9	<b>— 12</b>	
	1979	2	- 2	4	- 04	
	1980	6	-1	1	- 06	
	1981	8	0	0	0	
	1982	5	1	1	<b>B</b> 5	
	1983	9	2	4	18	
	1984	4	3	9	12	
	1985	10 7	4	16	40	
	1986	10	5	25	50	
					125	
	Total	$\Sigma x_{t} = 62$	$\Sigma u = 0$	$\Sigma u^2 = 110$	- 38	
		•			$\overline{\Sigma  ux_t = 87}$	(1 mark)
	The equa	tion of trend	line is			
	$x_t = a' + b$	o′u				
	The norm	al equations a	re			
	$\Sigma \mathbf{x}_{t} = na'$	$+ b' \Sigma u$			(1)	
	$\Sigma u x_t = a'$	$\Sigma u + b' \Sigma u^2$			(2)	
	Here, n =	11, $\Sigma x_{t} = 62$ ,	$\Sigma \mathbf{u} = 0, \ \Sigma \mathbf{u}^2 =$	= 110,		
	$\Sigma \mathbf{u} \mathbf{x}_{t} = 8$	7				
	Putting tl	nese values in	normal equat	ions, we ge	et	
	62 = 11a'	+ b′ <b>(0)</b>			(3)	
	87 = a'(0)	) + b′(110)			(4)	
	From equ	ation (3), we <u>c</u>	get			

	$a' = \frac{62}{11} = 5.6364$										
	From equation (4), we get	$b' = \frac{8}{11}$	$\frac{7}{0} = 0.79$	09	(2 marks)						
	Putting $a' = 5.6364$ and $b'$	= 0.790	9 in the	equation							
	$x_t = a' + b'u$ , we get the ed	quation o	of trend	line as							
	$x_t = 5.6364 + 0.7909  \text{u}$	$x_t = 5.6364 + 0.7909  \mathrm{u}$									
	Trend for the year 1990 :	Trend for the year 1990 : For t = 1990, u = 1990 - 1981 = 9									
	Putting $u = 9$ in $x_t = 5.636$	Putting u = 9 in $x_t = 5.6364 + 0.7909 u$ , we get									
	$\mathtt{x}_{1990} {=} 5.6364 {+} 0.7909 {\times}$	$x_{1990} = 5.6364 + 0.7909 \times 9$									
	$\therefore$ $x_{1990} = 5.6364 + 7.1181$	$\therefore \ \mathfrak{x}_{1990} = 5.6364 + 7.1181 \qquad \therefore \ \mathfrak{x}_{1990} = 12.7545$									
	Hence, trend value for th	e year 1	990 is 17	2.7545.	(1 mark)						
				R							
 (iii)	Let the company manufact	tures x	units of	chemical A and	l y units of						
	chemical B. Then the total p	profit to	the com	pany is p =₹ (35	0x+400y).						
	This is a linear function w	vhich is	to be m	naximized. Henc	e, it is the						
	objective function.				(1 mark)						
	The constraints are as per	the fol	lowing ta	ble :							
					]						
	Raw Chemical →	A	В								
	Material↓	(x)	(y)	Availability							
	Р	3	2	120							
	Q	2	5	160	(1 mark)						
	The raw material P requir	ed for s	c units o	f chemical A and	d y units of						
	chemical B is $3x + 2y$ . Sin	ce, the	maximun	n availability of l	° is 120, we						
	have the first constraint	as 3x+	2y ≤ 120	).							
	Similarly, considering the raw material Q, we have $2 \mathtt{x} + 5 \mathtt{y} \leqslant 160$ .										
	(1 mark)										
	Since, x and y cannot be r	negative	, we have	$\mathfrak{x} \ge 0,  \gamma \ge 0.$							
	Hence, the given LPP can	be form	ulated as	3:							
	Maximize $p = 350x + 400y$	y, subje	ct to 3x	+ 2γ ≤ 120,							
	$2x + 5y \leqslant 160, x \geqslant 0, y \geqslant$	0.			(1 mark)						

0.6	(A)									
<b>Q</b> . U.	(i)									
	(1)	Commodity	Base Year Current Year			<b>D</b> 1 <b>0</b> 0	ם מ	D101	p <sub>o</sub> g <sub>1</sub>	
			<b>p</b> o	$\mathbf{q}_0$	<b>p</b> <sub>1</sub>	$\mathbf{q}_1$	<b>F</b> 1 <b>1</b> 0	<b>F</b> 0 <b>1</b> 0	F 1 71	F011
		I	8	30	12	25	360	240	300	200
		II	10	42	20	16	840	420	320	160
		Total	-	-	-	-	$\frac{\Sigma p_1 q_0}{= 1200}$	$\frac{\Sigma \mathbf{p}_0 \mathbf{q}_0}{= 660}$	$\Sigma p_1 q_1 = 620$	$\frac{\Sigma p_0 q_1}{= 360}$
				•					(	1 mark)
		Laspeyre's	Price I	ndex I	Number	•:				
		$P_{01}(L) = \frac{\Sigma p_1}{\Sigma p_0}$	$\frac{q_0}{q_0}  imes 10$	0						
		$=\frac{120}{660}$	$\frac{0}{0} \times 10$	0				B)		
		= 1.81	.81 × 10 .82.	00	Ŋ	B	21		(	1 mark)
		Paasche's P	rice Ir	ndex N	umber	:				
		$P_{01}(P) = \frac{\Sigma p_{1}}{\Sigma p_{0}}$	$\frac{q_1}{q_1} \times 10$	0						
		$=\frac{620}{360}$	× 100							
		= 1.72	222 × 1	.00						
		=172	.22						(	1 mark)
		Hence, Lasp	eyre's	and P	aasche'	s Price	Index N	Jumbers	s are 181	.82 and
		172.22 resp	ective	ly.						

(ii)Since, it is a maximization problem, subtract each of the elements in the matrix from the largest element of the matrix which is 16 here.SalesmenDistrictsSalesmenDistrictsAO6AOOAOOAOOC1234AOOCDistrictsSalesmen1234OO<		1						
matrix from the largest element of the matrix which is 16 here.DistrictsDistrictsIII <thi< th="">I<tr< td=""><td>(ii)</td><td>Since, it is a</td><td>maximiza</td><td>ation prob</td><td>lem, subti</td><td>ract each</td><td>of the elements in the</td></tr<></thi<>	(ii)	Since, it is a	maximiza	ation prob	lem, subti	ract each	of the elements in the	
Districts           Districts           A         0         6         4         5           B         4         3         1         1           C         1         1         5         2           D         3         2         2         1         (1 mark)           Step 1:         Subtract the minimum (smallest) element of each row from the elements of that row.         Districts         3         4           A         0         6         4         5         5         7         7           Salesmen         1         2         3         4           A         0         6         4         5         8         3         2         0         0           C         0         0         4         1         0         0         2         1         1         0           Salesmen         Districts           B         3         4           A         6         6         1         1            Sale		matrix from	the larg	est eleme	nt of the	matrix w	hich is 16 here.	
Salesmen       I       2       3       4         A       0       6       4       5         B       4       3       1       1         C       1       1       5       2         D       3       2       2       1       (1 mark)         Step 1 : Subtract the minimum (smallest) element of each row from the elements of that row.       Image: Salesment of each row from the elements of that row.         Salesment       1       2       3       4         A       0       6       4       5         B       3       2       0       0         C       0       0       4       1         D       2       1       1       0         Step 2 : Subtract the smallest element of each column from the elements of that column.       Image: Salesment of each column from the elements of that column.         Salesment       1       2       3       4         A       0       6       4       5         B       3       2       0       0         C       0       0       4       1         D       2       1       1       0         Ste				Dist	ricts			
Image: Construct of the second se		Salesmen	1	2	2	1		
A0645B4311C1152D3221Step 1: Subtract the minimum (smallest) element of each row from the elements of that row.Step 1: Subtract the minimum (smallest) element of each row from the elements of that row.Salesmen1234A0645B3200C0041D2110Step 2: Subtract the smallest element of each column from the elements of that column.5Salesmen1234A064\$B3200C044(1 mark)D2110Step 3: Since, the number of lines covering zeros is 4 equal to the order of matrix 4. The optimal solution has reached.Districts Salesmen1234A0645B3200C041D211C045B320A064B320A064B320C041B32C0			1	<u> </u>	5			
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elements of that row.DistrictsSalesmen1234AO645B32OOCO041D211OStep 2: Subtract the smallest element of each column from the elements of that column.DistrictsSalesmenDistrictsA $\phi$ 645B32 $\phi$ $\phi$ C $\phi$ $\phi$ 4 $\phi$ B32 $\phi$ $\phi$ C $\phi$ $\phi$ $\phi$ $\phi$ D211 $O$ Step 3: Since, the number of lines covering zeros is 4 equal to the order of matrix 4. The optimal solution has reached.DistrictsSalesmen123A $O$ $6$ $4$ $5$ B32 $O$ $\phi$ B32 $O$ $\phi$ C $\phi$ $\phi$ $\phi$ $\phi$ B32 $O$ $\phi$ C $\phi$ $\phi$ $\phi$ $\phi$ C $\phi$ $\phi$ $\phi$ $\phi$ C $\phi$ <th< td=""><td></td><td>Step 1 : Sub</td><td>otract the</td><td>e minimum</td><td>(smalles</td><td>t) element</td><td>of each row from the</td></th<>		Step 1 : Sub	otract the	e minimum	(smalles	t) element	of each row from the	
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Step 2 : Subtract the smallest element of each column from the elements of that column.         Districts         Salesmen         1       2       3       4         A       0       6       4       5         B       3       2       0       0         C       0       4       4       (1 mark)         D       2       1       1       0         Step 3 : Since, the number of lines covering zeros is 4 equal to the order         of matrix 4. The optimal solution has reached.         Districts         Salesmen       1       2       3       4         M       0       6       4       5       5         M       O       6       4       5       6         M       0       6       4       5       6         B       3       2       0       4       1         Q       Q       4       1		D	2	1	1	0		
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C       Q       4       1       (1 mark)         D       2       1       1       0       (1 mark)         Step 3       Since, the number of lines covering zeros is 4 equal to the order       of matrix 4. The optimal solution has reached.         D       D       C       Districts         Salesmen       1       2       3       4         A       O       6       4       5         B       3       2       0       Ø         C       Ø       0       4       1		В	3	2	φ	φ		
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Step 3 : Since, the number of lines covering zeros is 4 equal to the order         of matrix 4. The optimal solution has reached.         Districts         Salesmen       1       2       3       4         A       0       6       4       5         B       3       Q         Q       0       Q         C       Q       0       4       1		D	2	1	1	0		
of matrix 4. The optimal solution has reached.DistrictsSalesmen123AO64AO64AO64B32OAO6B32OACØO6AO6AO6AO6AO6B32OACØO6AOAOAOADØDØOAOAOADØOAD <th colspa<="" td=""><td></td><td>Step 3 : Sin</td><td>ce, the ni</td><td>Imber of I</td><td>ines cover</td><td>ring zeros</td><td>is 4 equal to the order</td></th>	<td></td> <td>Step 3 : Sin</td> <td>ce, the ni</td> <td>Imber of I</td> <td>ines cover</td> <td>ring zeros</td> <td>is 4 equal to the order</td>		Step 3 : Sin	ce, the ni	Imber of I	ines cover	ring zeros	is 4 equal to the order
DistrictsSalesmen1234AO645B32O $\emptyset$ C $\emptyset$ O41		of matrix 4.	. The opt	imal solut	ion has re	eached.		
Salesmen     1     2     3     4       A $O$ $6$ $4$ $5$ B $3$ $2$ $O$ $\emptyset$ C $\emptyset$ $O$ $4$ $1$				Dist	ricts			
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Salesmen	1	2	3	4		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		A	0	6	4	5		
		B		2	0	Ø. 1		
			2	1	4		(1 mark)	

	The foll	owing op <sup>-</sup>	timal soluti	on is obtair	ned :				
	Sala	emen	Dietri	icte P	nofit (₹)				
	Jule	л. Л	1		16				
		A R	3		10				
		с С	2		15				
			4		15				
	Total pr	ofit=₹(	61		15		(1 mark)		
							(		
 (iii)	2 fair c	oins are	tossed.	∴ S={H	<i>н,</i> нт, т	Ή, ΤΤ}			
	Let X =	et X = number of heads $\therefore$ X = {0, 1, 2}							
	Now, P(	X = 0) =	$\frac{1}{4}$ , P(X = 1)	$=\frac{2}{4}, P(X =$	$= 2) = \frac{1}{4}$		(1 mark)		
	Let $x_i =$	Let $x_i =$ the amount received corresponds to the values of X.							
	We con	struct t	he followir	ng table to	comput	e the expect	ed winning		
	amount	amount and the variance of winning amount :							
	Y	<b>7</b>	P(X-r)				]		
		w <sub>i</sub> ≠	- (x-w)	x <sub>i</sub> p <sub>i</sub>	<b>x</b> <sub>i</sub> <sup>2</sup>	$\mathbf{p}_i = \mathbf{x}_i  \mathbf{p}_i \times \mathbf{x}_i$			
		ζ	Pi				-		
	0	2	$\frac{1}{4}$	$\frac{2}{4}$		4 			
	1	5	2	10		50			
		5	4	4		4			
	2	10	$\frac{1}{4}$	$\frac{10}{4}$		$\frac{100}{4}$			
	Total	-	1	$\Sigma \mathbf{x}_i \mathbf{p}_i = \frac{2}{2}$	$\frac{2}{1}$ $\Sigma$	$x_i^2 p_i = \frac{154}{4}$	(1 mark)		
	Expecte	d winning	g amount :						
	$E(X) = \Sigma$	$\Sigma x_i p_i = \frac{2}{2}$	2 <u>1</u> =₹ 5.5						
	Variance	e of winn	+ ing amount	:					
	Var(X)=	$= \Sigma \mathbf{x}_i^2 \mathbf{p}_i$	$-(\Sigma \mathbf{x}_i \mathbf{p}_i)^2$						
		154	5 5) <sup>2</sup> _  ንይ	5 _ 30 25					
	=	$-4^{-(3)}$	₹ 8.25	5 – 50.25			(1 mark)		
		0.20 -	. 0.20						

Q. 6.	(B)		
	(i)	Given : $\bar{x} = 53$ , $\bar{y} = 28$ , $b_{yx} = -1.2$ , $b_{xy} = -0.3$	
		(a) Correlation coefficient between X and Y :	
		$r = \pm \sqrt{b_{yx} \cdot b_{xy}}$	(1 mark)
		$=\pm\sqrt{(-1.2)(-0.3)}$	
		$=\pm\sqrt{0.36}$	
		$\therefore$ r = -0.6 ( $\therefore$ b <sub>yx</sub> and b <sub>xy</sub> are negative.)	(1 mark)
		(b) Estimation of Y for X = 50 :	
		Regression equation of Y on X is,	
		$y = a + b_{yx} \cdot x$	
		$b_{yx} = -1.2$	
		$a = \overline{y} - b_{yx} \cdot \overline{x}$	
		= 28 - ( -1.2)53	
		= 28 + 63.6 = 91.6	
		$\therefore y = 91.6 - 1.2x$	
		$\therefore y = -1.2x + 91.6$	
		Put $x = 50$ $\therefore y = -1.2(50) + 91.6$	
		$\therefore y = -60 + 91.6$ $\therefore y = 31.6$	
		Hence, $y = 31.6$ , when $x = 50$	(1 mark)
		(c) Estimation of X for $V = 25$	
		Repression equation of X on Y is	
		$\mathbf{x} = \mathbf{a}' + \mathbf{b}_{\mathrm{w}} \cdot \mathbf{v} \qquad \mathbf{b}_{\mathrm{w}} = -0.3$	
		$a' = \overline{x} + b_{xy} = 0.5$	
		$u = u = b_{xy}(y)$ = 53 - (-0.3)(28)	
		= 53 + 84 = 614	
		x = 614 - 0.3v	
		$\Rightarrow x = -0.3y + 61.4$	
		Put y = 25, $\therefore x = -0.3(25) + 61.4$	
		$\therefore x = -7.5 + 61.4 \qquad \therefore x = 53.9$	
		Hence, $x = 53.9$ , when $y = 25$	(1 mark)
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(ii)	Here, X = Number of complaints a bank manager rece	eives per day
	$X \sim P(m = 4), e^{-4} = 0.0183$	
	e <sup>-m</sup> m <sup>x</sup>	
	$\therefore P[X=x] = \frac{x!}{x!}$	
	$=\frac{e^{-4}(4)^x}{4}$	
	x!	
	$= 0.0183 \times \frac{(4)^{2}}{x!}$	(1 mark)
	(a) P[Only two complaints on a given day]	
	= P[X = 2]	
	$= 0.0183 \times \frac{(4)^2}{21}$	
	$= 0.0183 \times \frac{16}{2}$	
	= 0.0183 × 8	
	= 0.1464	
	Hence, probability that only two complaints on a give	ven day is 0.1464.
		(1 mark)
	(b) P[At most two complaints on a given day]	
	$= P[X \leq 2]$	
	= P[X = 0] + P[X = 1] + P[X = 2]	
	$A^0 \qquad (A)^1 \qquad (A)^2$	
	$= 0.0183 \times \frac{4}{0!} + 0.0183 \times \frac{47}{1!} + 0.0183 \frac{47}{2!}$	(1 mark)
	= 0.0183(1 + 4 + 8)	
	$= 0.0183 \times 13 = 0.2379$	
	Hence, probability that at most two complaints of	on a given day is
	0.2379.	(1 mark)

Q. 6.	(C)				
	(i)	Face value (SD) = ₹ 7000, r = 5%, Cash value = ₹ 6930,			
		BD = SD - CV = ₹ 7000 - ₹ 6930 = ₹ 70	).	(1 mark)	
		Date of drawing the bill $=$ 14th April 2019			
		Date of discounting the bill = 6th July 2019.			
		$BD = \frac{SD \times h \times r}{100}$			
		$\therefore 70 = 7000 \times \underline{\qquad} \times 5$			
		70			
		$\frac{1}{350} \text{ years}$			
		$\therefore$ n = $\frac{70}{350} \times 365$ = 73 days. (1 mark)			
		For legal due date, 73 days are counted from due date of discounting the			
		bill i.e. from 6th July 2019.			
		July 2019 Aug. 2019 Sept. 2019 To	otal		
		25 31 17 7	73		
		Legal due date : 17th Sept. 2019.	(1 mark)		
		Nominal due date is 14th Sept. 2019			
		Period of the bill is 14th Sept. 2019 – 14th	April 2019	= 5 months.	
				(1 mark)	
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