



S R SAMPLE PAPER 3
Class 12 - Applied Mathematics

Time Allowed: 3 hours

Maximum Marks: 80

General Instructions:

1. This question paper contains five sections A, B, C, D and E. Each section is compulsory.
2. Section - A carries 20 marks weightage, Section - B carries 10 marks weightage, Section - C carries 18 marks weightage, Section - D carries 20 marks weightage and Section - E carries 3 case-based with total weightage of 12 marks.
3. **Section – A:** It comprises of 20 MCQs of 1 mark each.
4. **Section – B:** It comprises of 5 VSA type questions of 2 marks each.
5. **Section – C:** It comprises of 6 SA type of questions of 3 marks each.
6. **Section – D:** It comprises of 4 LA type of questions of 5 marks each.
7. **Section – E:** It has 3 case studies. Each case study comprises of 3 case-based questions, where 2 VSA type questions are of 1 mark each and 1 SA type question is of 2 marks. Internal choice is provided in 2 marks question in each case-study.
8. Internal choice is provided in 2 questions in Section - B, 2 questions in Section – C, 2 questions in Section - D.
You have to attempt only one of the alternatives in all such questions.

Section A

1. For any 2×2 matrix, if $A (\text{Adj } A) = \begin{bmatrix} 10 & 0 \\ 0 & 10 \end{bmatrix}$, then $|A|$ is equal to [1]
 - a) 10
 - b) 0
 - c) 100
 - d) 20
2. A specific characteristic of a population is known as a [1]
 - a) a sample
 - b) statistic
 - c) mean
 - d) parameter
3. The present value of a sequence of payments of ₹ 800 made at the end of every 6 month and continuing forever if money is worth 4% p.a. compounded semi-annually, is: [1]
 - a) ₹80000
 - b) ₹60000
 - c) ₹40000
 - d) ₹20000
4. The feasible solution of an LPP belongs to: [1]
 - a) Second quadrant
 - b) Only first quadrant
 - c) First and third quadrants
 - d) First and second quadrants

- $\{(x, y) : 2x + 5y < 7\}$
- $\{(x, y) : x^2 + y^2 \leq 4\}$
- $\{x : |x| = 5\}$
- $\{(x, y) : 3x^2 + 2y^2 \leq 6\}$

a) $\{x : |x| = 5\}$

b) $\{(x, y) : x^2 + y^2 \leq 4\}$

c) $\{(x, y) : 2x + 5y < 7\}$

d) $\{(x, y) : 3x^2 + 2y^2 \leq 6\}$

16. A specific characteristic of a sample is known as a [1]

a) parameter

b) variance

c) statistic

d) population

17. $\int e^x \{f(x) + f'(x)\} dx =$ [1]

a) $2e^x f(x) + C$

b) $e^x - f(x) + C$

c) $e^x f(x) + C$

d) $e^x + f(x) + C$

18. The graph of time series is called: [1]

a) Ogive

b) Histogram

c) Straight line

d) Histogram

19. **Assertion (A):** If $\begin{vmatrix} x^2 - 4x & x^2 \\ x^2 & x^3 \end{vmatrix} = \begin{vmatrix} -3 & 1 \\ -x + 2 & 1 \end{vmatrix}$, then the value of $x = 1$. [1]

Reason (R): Two matrices $A = [a_{ij}]_{m \times n}$ and $B = [b_{ij}]_{m \times n}$ of same order $m \times n$ are equal, if $a_{ij} = b_{ij}$ for all $i = 1, 2, 3, \dots, m$ and $j = 1, 2, 3, \dots, n$.

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.

20. **Assertion (A):** The equation of the normal to the curve $y^2 = 4x$ at the point $(1, 2)$ is $x + y - 3 = 0$. [1]

Reason (R): Equation of normal is $y - y_1 = \frac{-1}{\left(\frac{dy}{dx}\right)_{(x_1, y_1)}} (x - x_1)$.

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.

Section B

21. Define secular trend and seasonal variations. [2]

22. A bond has a face value of ₹ 1000, matures in 4 years. Coupon rate is 4% per annum. The bond makes annual coupon payments. If the yield to maturity is 4%, find the fair value of the bond. [2]

OR

A company establishes sinking fund to provide for the payment of ₹1,00,000 debt maturing in 4 years. Contributions to the fund are to be made at the end of every year. Find the amount of each annual deposit if interest is 18% per annum.

23. Evaluate the definite integral: $\int_1^4 \frac{x^2 + x}{\sqrt{2x+1}} dx$ [2]

24. A firm produces two products P_1 and P_2 passing through two machines M_1 and M_2 before completion, M_1 can produce either 8 units of P_1 or 10 units of P_2 per hour. M_2 can produce 12 units of either product per hour. Using determinants, determine: Production of P_1 and P_2 if time available on two machines is 33 hours and 25 hours respectively. [2]

OR

Find the minors and cofactors of elements of the matrix $A = [a_{ij}] = \begin{bmatrix} 1 & 3 & -2 \\ 4 & -5 & 6 \\ 3 & 5 & 2 \end{bmatrix}$.

25. Find the set of values of x satisfying $x \equiv 12 \pmod{5}$. [2]

Section C

26. A radioactive substance disintegrates at a rate proportional to the amount of substance present. If 50% of the given amount disintegrates in 1600 years. What percentage of the substance disintegrates in 10 years? (Take $e^{\frac{-\log 2}{160}} = 0.9957$) [3]

OR

The rate of increase in the number of bacteria in a certain bacteria culture is proportional to the number present. Given the number triples in 5 hrs, find how many bacteria will be present after 10 hours. Also, find the time necessary for the number of bacteria to be 10 times the number of the initial present. [Given $\log_e 3 = 1.0986$, $e^{2.1972} = 9$]

27. Find the purchase price of a ₹600, 8% bond, dividends payable semi-annually redeemable at par in 5 years, if the yield rate is to be 8% compounded semi-annually. [3]
28. The marginal cost function of a product is given by $MC = \frac{x}{\sqrt{x^2+400}}$. Find the total cost and the average cost if the fixed cost is ₹ 1000. [3]
29. A bag contains 8 red and 5 white balls. Two successive draws of all 3 balls are made at random from the bag without replacements. Find the probability that the first draw yields 3 white balls and second draw yields 3 red balls. [3]

OR

A fair coin is tossed four times. Let X denote the number of heads occurring. Find the probability distribution, mean and variance of X .

30. Fit a straight line trend by the method of least squares to the following data: [3]

Year	Sales (in lakh ₹)
2010	65
2012	68
2013	70
2014	72
2015	75
2016	67
2019	73

31. Ten students are selected at random from a college and their heights are found to be 100, 104, 108, 110, 118, 120, 122, 124, 126 and 128 cms. In the light of these data, discuss the suggestion that the mean height of the [3]

students of the college is 110 cms. (Given $t_9(0.05) = 2.262$)

Section D

32. A fruit grower can use two types of fertilizer in his garden, brand P and Q. The amounts (in kg) of nitrogen, phosphoric acid, potash, and chlorine in a bag of each brand are given in the table. Tests indicate that the garden needs at least 240 kg of phosphoric acid, at least 270 kg of potash and at most 310 kg of chlorine. [5]

kg per bag		
	Brand P	Brand Q
Nitrogen	3	3.5
Phosphoric acid	1	2
Potash	3	1.5
Chlorine	1.5	2

If the grower wants to minimize the amount of nitrogen added to the garden, how many bags of each brand should be used? What is the minimum amount of nitrogen added in the garden?

OR

A small manufacturer has employed 5 skilled men and 10 semi-skilled men and makes an article in two qualities deluxe model and an ordinary model. The making of a deluxe model requires 2 hrs. work by a skilled man and 2 hrs. work by a semi-skilled man. The ordinary model requires 1 hr by a skilled man and 3 hrs. by a semi-skilled man. By union rules no man may work more than 8 hrs per day. The manufacturers clear profit on deluxe model is ₹15 and on an ordinary model is ₹10. How many of each type should be made in order to maximize his total daily profit.

33. Solve the system of linear inequation graphically: $x - y \leq 1$, $x + 2y \leq 8$, $2x + y \geq 2$, $x \geq 0$, $y \geq 0$ [5]

34. Suppose 220 misprints are distributed randomly throughout a book of 200 pages. Find the probability that a given page contains [5]

- i. no misprints,
- ii. one misprint,
- iii. 2 misprints,
- iv. 2 or more misprints.

(Given $e^{-1.1} = 0.33287$)

OR

A random variable X has the following probability distribution:

X	0	1	2	3	4	5	6	7
P(X)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

Find each of the following:

- i. k
 - ii. $P(X < 6)$
 - iii. $P(X \geq 6)$
 - iv. $P(0 < X < 5)$
35. Mahesh purchased a house from a company for ₹700,000 and made a down payment of ₹150,000. He repays the balance in 25 years by monthly installments at 9%. Compound monthly: [5]
- i. What are monthly payments?

ii. What is the total interest payment?

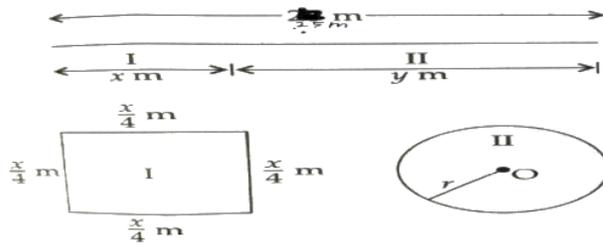
(Given $(1.0075)^{-300} = 0.1062878338$)

Section E

36. **Read the text carefully and answer the questions:**

[4]

A piece of wire of length 25 cm is to be cut into pieces one of which is to be bent into the form of a square and other into the form of a circle.



- (i) What is the total area of the square and circle?
- (ii) What is the relation between r and y ?
- (iii) If we consider total length of wire then what is the relation between x and y ?

OR

When $\frac{dA}{dy} = 0$, then find the value of y .

37. **Read the text carefully and answer the questions:**

[4]

Flexible payment arrangements, in which the borrower might pay higher sums of his or her choosing, are not the same as EMIs. Borrowers on EMI programmes are usually only allowed to make one set payment per month. Borrowers profit from an EMI since they know exactly how much money they will have to pay towards their loan each month, making personal financial planning easier. Lenders benefit from the loan interest, as it provides a consistent and predictable stream of income.

Example:

A loan of ₹400000 at the interest rate of 6.75% p.a. compounded monthly is to be amortized by equal payments at the end of each month for 10 years.

(Given $(1.005625)^{120} = 1.9603$, $(1.005625)^{60} = 1.4001$)

- (i) Find the size of each monthly payment.
- (ii) Find the principal outstanding at the beginning of 61st month.
- (iii) Find the interest paid in 61st payment.

OR

Find the principal contained in 61st payment.

38. A total amount of ₹7000 is deposited in three different savings bank accounts with annual interest rates of 5%, 8% and $8\frac{1}{2}\%$ respectively. The total annual interest from these three accounts is ₹550. Equal amounts have been deposited in the 5% and 8% savings accounts. Find the amount deposited in each of the three accounts, with the help of matrices. [4]

OR

Two farmers Ram Kishan and Gurcharan Singh cultivate only three varieties of rice namely Basmati, Permal, and Naura. The sale (in ₹) of these varieties of rice by both the farmers in the month of September and October are given by the following matrices A and B.

$$\begin{array}{c}
 \text{September Sales (in Rupees)} \\
 \begin{array}{ccc}
 \text{Basmati} & \text{Permal} & \text{Naura} \\
 \left[\begin{array}{ccc}
 10,000 & 20,000 & 30,000 \\
 50,000 & 30,000 & 10,000
 \end{array} \right] & \begin{array}{l}
 \text{Ramkishan} \\
 \text{Gurcharan Singh}
 \end{array}
 \end{array}
 \end{array}$$

$$\begin{array}{c}
 \text{October Sales (in Rupees)} \\
 \begin{array}{ccc}
 \text{Basmati} & \text{Permal} & \text{Naura} \\
 \left[\begin{array}{ccc}
 5000 & 10,000 & 6000 \\
 20,000 & 10,000 & 10,000
 \end{array} \right] & \begin{array}{l}
 \text{Ramkishan} \\
 \text{Gurcharan Singh}
 \end{array}
 \end{array}
 \end{array}$$

Find:

- i. What were the combined sales in September and October for each farmer in each variety?
- ii. What was the change in sales from September to October?
- iii. If both farmers receive 2% profit on gross rupees sales, compute the profit for each farmer and for each variety sold in October.

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