S R SAMPLE PAPER 1

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. If A is a skew-symmetric matrix of order 3, then the value of |A| is: **[1]**

   a) 3   b) 0

   c) 27   d) 9

2. For testing the significance of difference between the means of two independent samples, the degree of freedom   **[1]**
   (v) is taken as:

   a) $n_1 - n_2 + 2$ b) $n_1 - n_2 - 2$

   c) $n_1 + n_2 - 1$ d) $n_1 + n_2 - 2$

3. The present value of a sequence of payment of ₹1000 made at the end of every 6 months and continuing forever,   **[1]**
   if money is worth 8% per annum compounded semi-annually is

   a) 2500   b) 15,000

   c) 1000   d) 25,000

4. Any feasible solution which maximizes or minimizes the objective function is called: **[1]**

   a) An objective feasible solution   b) None of these

c) An optimal feasible solution   d) A regional feasible solution

5. If d is the determinant of a square matrix A of order n, then the determinant of its adjoint is **[1]**

    a) d^n

    b) d

    c) d^{n+1}

    d) d^{n-1}

6. If X follows a binomial distribution with parameters n = 8 and p = $\frac{1}{2}$, then P ($|X - 4| \leq 2$) equals **[1]**

    a) $\frac{117}{128}$

    b) $\frac{118}{128}$

    c) $\frac{119}{128}$

    d) none of these

7. A fair coin is tossed 99 times. If X is the number of times heads occur, then P (X = r) is maximum when r is **[1]**

    a) none of these

    b) 51, 52

    c) 50, 51

    d) 49, 50

8. The integrating factor of the differential equation $x\frac{dy}{dx} - y = 2x^2$ **[1]**

    a) e^{-x}

    b) x

    c) $\frac{1}{x}$

    d) e^{-y}

9. If a man goes 18 km downstream in 4 hours and returns against the stream in 12 hours, then the speed of the stream in km/hr is **[1]**

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

    b) 3

    c) 1

    d) $\frac{7}{4}$

10. . Let A be a square matrix of order 2×2, then |KA| is equal to: **[1]**

    a) K^3 |A|

    b) K |A|

    c) K^2 |A|

    d) 2K |A|

11. (-6×5) (mod 7) is **[1]**

    a) 2

    b) -5

    c) -2

    d) 5

12. If $x \in R, |x| \geq -7$, then **[1]**

    a) $x \in [-7, 7]$

    b) $x \in (-\infty, -7) \cup [7, \infty)$

    c) $x \in R$

    d) $x \in (-\infty, -7) \cup (7, \infty)$

13. A man rows d km upstream and back again in t hours. If he can row in still water at u km/hr and the rate of stream is v km/hr, then t = **[1]**

    a) $\frac{u^2 - v^2}{d}$

    b) $\frac{2ud}{u^2 + v^2}$

    c) $\frac{2ud}{u^2 - v^2}$

    d) $\frac{uv}{d}$

14. The corner points of the feasible region determined by the system of linear constraints are (0, 0), (0, 40), (20, 40), (60, 20), (60, 0). The objective function is z = 4x + 3y. **[1]**

Compare the quantity in Column A and Column B

Column A	Column B

Maximum of z	325

a) The relationship can not be determined on the basis of information supplied

b) The two quantities are equal

c) The quantity in column A is greater

d) The quantity in Column B is greater

15. If the objective function for an L.P.P. is Z = 3x - 4y and the comer points for the bounded feasible region are (0, 0), (5, 0), (6, 5), (6, 8), (4, 10) and (0, 8), then the minimum value of Z occurs at **[1]**

    a) (4, 10)   b) (6, 8)

    c) (6, 5)   d) (0, 0)

16. Since α = probability of Type-I error, then $1 - \alpha$ **[1]**

    a) Probability of not rejecting H_0 when H_0 is true.

    b) Probability of rejecting H_0 when H_0 is true.

    c) Probability of rejecting H_0 when H_a is true.

    d) Probability of not rejecting H_0 when H_0 is true.

17. $\int \frac{2}{\left(e^x + e^{-x}\right)^2} dx$ **[1]**

    a) $-\frac{1}{e^x + e^{-x}} + C$ b) $\frac{-1}{\left(e^x + 1\right)^2} + C$

    c) $\frac{-e^{-x}}{e^x + e^{-x}} + C$ d) $\frac{1}{e^x - e^{-x}} + C$

18. The best-fitted trend line is one for which sum of squares of residuals or errors is: **[1]**

    a) Maximum   b) Minimum

    c) Positive   d) Negative

19. **Assertion (A):** A matrix A = [1 2 0 3] is a row matrix of order 1×4. **[1]**

    Reason R: A matrix having one row and any number of column is called a row matrix.

    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 function f(x) = sin x decreases on the interval $(0, \frac{\pi}{2})$. **[1]**

    Reason (R): The function f(x) = cos x decreases on the interval $(0, \frac{\pi}{2})$.

    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. From the following data compute 4-yearly moving averages and determine the trend values. Also, find the short-term fluctuations. **[2]**

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Value:	50	36.5	43.0	44.5	38.9	38.1	32.6	41.7	41.1	33.8

22. Suppose a person invested ₹15,000 in a mutual fund and the value of the investment at the time of redemption was ₹25000. If CAGR for this investment is 8.88%. Calculate the number of years for which he has invested the **[2]**

amount.

OR

Mr. Mohan took a car loan of ₹10 lakhs at an 11% interest for a 15 years loan tenure. What would be his EMI? Given $(1.0091)^{180}$ = 5.1069

23. Evaluate the definite integral: **[2]**

$$\int_4^5 |x - 5| dx$$

24. If the matrix A = $\begin{bmatrix} 6 & x & 2 \\ 2 & -1 & 2 \\ -10 & 5 & 2 \end{bmatrix}$ is a singular matrix, find the value of x. **[2]**

OR

Evaluate: $\begin{vmatrix} 2 & 3 & 7 \\ 13 & 17 & 5 \\ 15 & 20 & 12 \end{vmatrix}^2$

25. Find the unit digit in $183! + 3^{183}$. **[2]**

Section C

26. Solve the initial value problem: $x\frac{dy}{dx} + y = x \log x$, $y(1) = \frac{1}{4}$ **[3]**

OR

It is given that radium decomposes at a rate proportional to the amount present. If p % of the original amount of radium disappears in 1 year. What percentage of it will remain after 2l years?

27. A ₹2,000, 8% bond is redeemable at the end of 10 years at ₹105. Find the purchase price to yield 10% effective rate. **[3]**

28. Suppose that the demand function for a certain commodity is $p = 20 - 4x^2$ and the marginal cost is MC = 2x + 6, where x is the number of units produced. Find the consumer's surplus at the sales level x_0 where profit is maximized. **[3]**

29. A coin is tossed 5 times. What is the probability that tail appears an odd number of times? **[3]**

OR

Students of a class were given a mechanical aptitude test. Their marks were found to be normally distributed wth mean 60 and standard deviation 5. What percent of students scored

 i. more than 60 marks?

 ii. less than 56 marks?

 iii. between 45 and 65 marks?

30. From the following time series obtain trent value by 3 yearly moving averages. **[3]**

Year	Sales (in ₹ 000)	Year	Sales (in ₹ 000)
2008	8	2014	16
2009	12	2015	17
2010	10	2016	14
2011	13	2017	17
2012	15		
2013	12		

31. A group of 5 patients treated with medicine A weigh 10, 8, 12, 6, 4 kg. A second group of 7 patients treated with **[3]** medicine B weigh 14, 12, 8, 10, 6, 2, 11 kg. Comment on the rejection of hypothesis with 5% level of significance.

[Given: $t_{(10,0.05)} = 1.812$]

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Section D

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32. A factory makes tennis rackets and cricket bats. A tennis racket takes 1.5 hours of machine time and 3 hours of **[5]** craftsman's time in its making while a cricket bat takes 3 hours of machine time and 1 hour of craftsman's time. In a day, the factory has the availability of not more than 42 hours of machine time and 24 hours of craftsman's time. If the profit on a racket and on a bat is ₹20 and ₹10 respectively, find the number of tennis rackets and cricket bats that the factory must manufacture to earn the maximum profit. Make it as an LPP and solve it graphically.

<div align="center">OR</div>

There are two types of fertilisers F_1 and F_2. F_1 consists of 10% nitrogen and 6% phosphoric acid and F_2 consists of 5% nitrogen and 10% phosphoric acid. After testing the soil conditions, a farmer finds that she needs atleast 14 kg of nitrogen and 14 kg of phosphoric acid for her crop. If F_1 costs ₹6/kg and F_2 costs ₹5/kg, determine how much of each type of fertiliser should be used so that nutrient requirements are met at a minimum cost. What is the minimum cost?

33. Solve the following system of inequalities graphically: **[5]**

$3y - 2x < 4$, $x + 3y > 3$ and $x + y \leq 5$.

34. Let X denote the number of vowels in word selected at random from this sentence. Find the expected value and **[5]** standard deviation of the random variable X. (Consider X as a word with one letter).

<div align="center">OR</div>

Find the probability distribution of the number of green balls drawn when 3 balls are awn, one by one, without replacement from a bag containing 3 green and 5 white balls.

35. The cost of a car purchased 2 years ago, depreciates at the rate of 20 % every year. If its present worth is ₹ **[5]** 315600, find:

  i. its purchase price

 ii. its value after 3 years.

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Section E

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36. **Read the text carefully and answer the questions:** **[4]**

Rohit's father wants to construct a rectangular garden using a brick wall on one side of the garden and wire fencing for the other three sides as shown in the figure. He has 200 ft of wire fencing.
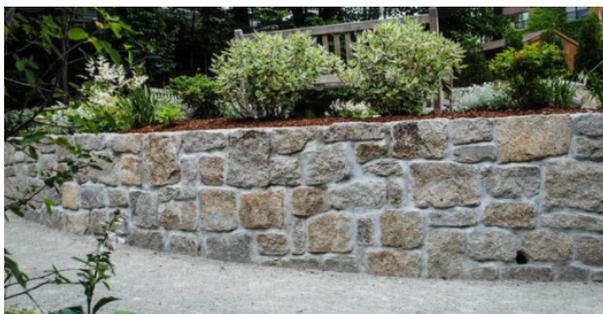
    (i)   To construct a garden using 200 ft of fencing, what should we need to maximize?

    (ii)   If x denotes the length of the side of the garden perpendicular to a brick wall and y denotes the length of the side parallel to a brick wall, then find the relation representing the total amount of fencing wire?

(iii) Area of the garden as a function of x, say A(x), how it can be represented?

OR

At what value of x, Maximum value of A(x) occurs?

37. **Read the text carefully and answer the questions:** **[4]**

What Is a Sinking Fund?

A sinking fund contains money set aside or saved to pay off a debt or bond. A company that issues debt will need to pay that debt off in the future, and the sinking fund helps to soften the hardship of a large outlay of revenue. A sinking fund allows companies that have floated debt in the form of bonds gradually save money and avoid a large lump-sum payment at maturity.

Example:

- Cost of Machine: ₹2,00,000/-
- Effective Life: 7 Years
- Scrap Value: ₹30,000/-
- Sinking Fund Earning Rate: 5%
- The Expected Cost of New Machine: ₹3,00,000/-

(i) What is the money required for a new machine after 7 years?

(ii) What is the value of A, i and n here?

(iii) What formula will you use to get the requisite amount?

OR

What amount should the company put into a sinking fund earning 5% per annum to replace the machine after its useful life?

38. Three shopkeepers A, B and C go to a store to buy stationery. A purchases 12 dozen notebooks, 5 dozen pens and 6 dozen pencils. B purchases 10 dozen notebooks, 6 dozen pens and 7 dozen pencils. C purchases 11 dozen notebooks, 13 dozen pens and 8 dozen pencils. A notebook costs 40 paise, a pen costs ₹1.25 and a pencil costs 35 paise. Use matrix multiplication to calculate each individual's bill. **[4]**

OR

An automobile company uses three types of steel S_1, S_2 and S_3 for producing three types of cars C_1, C_2 and C_3. Steel requirements (in tons) for each type of cars are given below:

	Cars		
Steel	C_1	C_2	C_3
S_1	2	3	4
S_2	1	1	2
S_3	3	2	1

Using Cramer's rule, find the number of cars of each type which can be produced using 29, 13 and 16 tonnes of steel of three types respectively.

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