

**PRACTICE PAPER**

**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. What is x if  $\begin{bmatrix} 1 & 4 \\ 2 & x \end{bmatrix}$  is a singular matrix? [1]
  - a) 7
  - b) 8
  - c) 5
  - d) 6
2. A sample of 50 bulbs is taken at random. Out of 50 we found 15 bulbs are of Bajaj, 17 are of Surya and 18 are of Crompton. What is the point estimate of population proportion of Surya? [1]
  - a) 0.3
  - b) 0.34
  - c) 0.36
  - d) 0.4

OR

A population consists of four observations 1, 3, 5, 7. What is the variance?

  - a) 6
  - b) 4
  - c) 5
  - d) 2
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

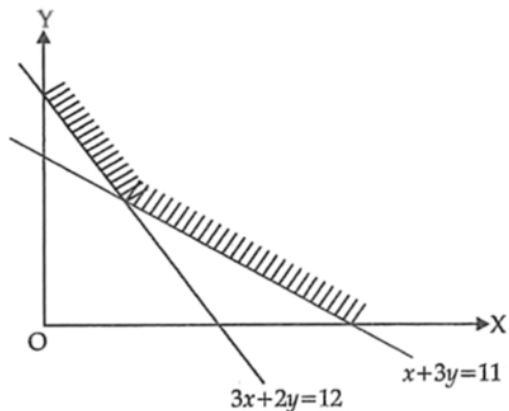
b) ₹60000

c) ₹40000

d) ₹20000

4. For the following feasible region, the linear constraints are:

[1]



a) None of these

b)  $x \geq 0, y \geq 0, 3x + 2y \leq 12, x + 3y \leq 11$

c)  $x \geq 0, y \geq 0, 3x + 2y \leq 12, x + 3y \geq 11$

d)  $x \geq 0, y \geq 0, 3x + 2y \geq 12, x + 3y \geq 11$

5. If  $\begin{bmatrix} a & b \\ c & d \\ e & f \end{bmatrix} A = \begin{bmatrix} g & h & i \\ j & k & l \\ m & n & o \end{bmatrix}$  then order of matrix A is:

[1]

a)  $2 \times 3$

b)  $3 \times 3$

c)  $3 \times 2$

d)  $2 \times 2$

6. The probability distribution of a discrete random variable X is given below:

[1]

X	2	3	4	5
P(X)	$\frac{5}{k}$	$\frac{7}{k}$	$\frac{9}{k}$	$\frac{11}{k}$

The value of E(X) is:

a) 48

b) 32

c) 16

d) 8

7. The area under the standard normal curve which lies to the right of  $z = -0.66$  is

[1]

a)  $F(-0.66)$

b)  $1 - F(0.66)$

c)  $F(0.66)$

d)  $F(0.66) - 1$

8. The solution of the differential equation  $\frac{dy}{dx} = \frac{2y}{x} = 0$  with  $y(1) = 1$  is given by:

[1]

a)  $x = \frac{1}{y}$

b)  $y = \frac{1}{x^2}$

c)  $x = \frac{1}{y^2}$

d)  $y = \frac{1}{x}$

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. The value of  $\begin{vmatrix} 2^2 & 2^3 & 2^4 \\ 2^3 & 2^4 & 2^5 \\ 2^4 & 2^5 & 2^6 \end{vmatrix}$  is

[1]

a)  $2^9$

b)  $2^6$

c)  $2^{13}$

d) 0

11. In what ratio must a grocer mix two varieties of pulses costing ₹ 85 per kg and ₹ 100 per kg respectively so as to get a mixture worth ₹ 92 per kg? [1]

a) 8 : 7

b) 5 : 7

c) 7 : 8

d) 7 : 5

12. If  $\frac{1}{2}\left(\frac{3}{5}x + 4\right) \geq \frac{1}{3}(x - 6)$ ,  $x \in \mathbb{R}$ , then [1]

a)  $x \in (-\infty, 120)$

b)  $x \in (-\infty, 120]$

c)  $x \in [120, \infty)$

d)  $x \in (120, \infty)$

13. In a race of 200 m, B can give a start of 10 m to A and C can give a start of 20 m to B. The start that C can give to A in the same race is: [1]

a) 30 m

b) 25 m

c) 29 m

d) 27 m

14. The optimal value of the objective function is attained at the points [1]

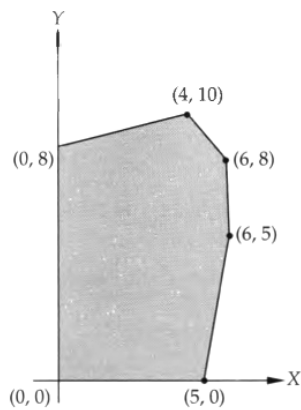
a) given by corner points of the feasible region

b) given by intersection of inequations with x-axis only

c) none of these

d) given by intersection of inequations with the axes only

15. The feasible region of a LPP is shown in Figure. Let  $z = 3x - 4y$  be the objective function. Minimum of  $z$  occurs at [1]



a) (0, 0)

b) (4, 10)

c) (0, 8)

d) (5, 0)

16. A \_\_\_\_\_ is a statistical test used to compare the means of two groups. [1]

a) h-test

b) g-test

c) t-test

d) p-test

17.  $\int \frac{x^9}{(4x^2+1)^6} dx$  is equal to [1]

a)  $\frac{1}{5x} \left(4 + \frac{1}{x^2}\right)^{-5} + C$

b)  $\frac{1}{10} \left(\frac{1}{x^2} + 4\right)^{-5} + C$

c)

d)



Determine the values of  $x$  for which the matrix  $A = \begin{bmatrix} x+1 & -3 & 4 \\ -5 & x+2 & 2 \\ 4 & 1 & x-6 \end{bmatrix}$  is singular.

25. How many litres of water should be added to a 30 litre mixture of milk and water containing milk and water in the ratio 7 : 3 such that the resultant mixture has 40% of water in it? [2]

### Section C

26. A machine costing ₹ 30,000 is expected to have a useful life of 4 years and a final scrap value of ₹ 4000. Find the annual depreciation charge using the straight-line method. Prepare the depreciation schedule. [3]
27. The marginal cost of production of  $x$  units of a commodity is  $30 + 2x$ . It is known that fixed costs are ₹ 120. Find [3]

- i. the total cost of producing 100 units
- ii. the cost of increasing output from 100 to 200 units.

28. Solve:  $(x^2 + 1)\frac{dy}{dx} + 2xy - 4x^2 = 0$  subject to the initial condition  $y(0) = 0$ . [3]

OR

Obtain the differential equation of all circles of radius  $r$ .

29. From a lot of 10 items containing 3 defectives, a sample of 4 items is drawn at random. Let the random variable  $X$  denote the number of defective items in the sample. If the sample is drawn randomly, find: [3]
- i. the probability distribution of  $X$
  - ii.  $P(X \leq 1)$
  - iii.  $P(X < 1)$
  - iv.  $P(0 < X < 2)$

OR

In a distribution exactly normal, 7% of the items are under 35 and 89% are under 63. What are the mean and standard deviation of the distribution?

30. Given below are the consumer price index numbers (CPI) of the industrial workers. [3]

Year	2014	2015	2016	2017	2018	2019	2020
Index number	145	140	150	190	200	220	230

Find the best fitted trend line by the method of least squares and tabulate the trend values.

31. Ten individuals are chosen at random from the population and their heights are found to be in inches 63, 63, 64, 65, 66, 69, 69, 70, 70, 71. Discuss the freedom value of Student's  $t$  and 5% level of significance is 2.62. [3]

### Section D

32. A diet is to contain at least 80 units of vitamin A and 100 units of minerals. Two foods  $F_1$  and  $F_2$  are available. Food  $F_1$  costs ₹4 per unit and  $F_2$  costs ₹6 per unit one unit of food  $F_1$  contains 3 units of vitamin A and 4 units of minerals. One unit of food  $F_2$  contains 6 units of vitamin A and 3 units of minerals. Formulate this as a linear programming problem and find graphically the minimum cost for a diet that consists of a mixture of these foods and also meets the mineral nutritional requirements. [5]

OR

A small firm manufactures gold rings and chains. The total number of rings and chains manufactured per day is at most 24. It takes 1 hour to make a ring and 30 minutes to make a chain. The maximum number of hours available per day is 16. If the profit on a ring is ₹300 and that on a chain is ₹190, find the number of rings and chains that should be manufactured per day, so as to earn the maximum profit. Make it as an LPP and solve it graphically.

33. Find the probability distribution of the number of sixes in three tosses of a die. Find also the mean and variance of the distribution. [5]

OR

If  $X$  is a Poisson variate such that  $3P(X = 2) = 2P(X = 1)$ . Find

- i.  $P(X = 0)$ ,
- ii.  $P(X = 3)$ .

(Given  $e^{-\frac{4}{3}} = 0.264$ )

34. Exhibit graphically the solution set of the linear inequations: [5]

$$x + y \leq 5, 4x + y \geq 4, x + 5y \geq 5, x \leq 4, y \leq 3$$

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 real estate company is going to build a new residential complex. The land they have purchased can hold at most 4500 apartments. Also, if they make  $x$  apartments, then the monthly maintenance cost for the whole complex would be as follows: Fixed cost = ₹50,00,000. Variable cost = ₹ $(160x - 0.04x^2)$



- (i) What will be the maintenance cost as a function of  $x$ ?
- (ii) If  $C(x)$  denote the maintenance cost function, then at what value of  $x$  the maximum value of  $C(x)$  occur ?
- (iii) What is the maximum value of  $C(x)$ ?

OR

What should be the number of apartments, that the complex should have in order to minimize the maintenance cost?

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

Arun is a service man. He lives in a joint family. There are 6 members in his family. He is planning to purchase a car so he is searching for a bank for a loan. He take a loan of ₹ 250000 at the interest rate of 6% p.a. compounded monthly is to be amortized by equal payment at the end of each month for 5 years. Given that

$$(1.005)^{60} = 1.3489, (1.005)^{21} = 1.1104.$$



- (i) What is the value of monthly payment?

**OR**

How much principal amount paid on 40<sup>th</sup> payment?

- (ii) What is the principal outstanding at beginning of 40th month?  
 (iii) How much interest paid on 40<sup>th</sup> payment?

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

**[4]**

A trust fund has ₹ 35000 that must be invested in two different types of bonds, say X and Y. The first bond pays 10% interest p.a. which will be given to an old age home and second one pays 8% interest p.a. which will be given to WWA (Women Welfare Association). Let A be a  $1 \times 2$  matrix and B be a  $2 \times 1$  matrix, representing the investment and interest rate on each bond respectively.



- (i) If ₹ 15000 is invested in bond X, then find investment and interest rate in matrix form?  
 (ii) If ₹ 15000 is invested in bond X, then find the total amount of interest received on both bonds?  
 (iii) If the trust fund obtains an annual total interest of ₹ 3200, then find the investment in two bonds?

**OR**

What will be the total amount of interest received on both bonds?