PRUDENCE SCHOOL
PREBOARD I EXAMINATION
SESSION: 2025-26

SUBJECT: APPLIED MATHEMATICS
Class: XII (SET A)

Name of the Student: _____ **Max. Marks 80**
Day & Date: Friday, 21st November 2025 **Duration: 3 hrs.**

General Instructions:

1. This Question Paper has 5 Sections A-E.
*2. Section **A** has 20 MCQs carrying 1 mark each.*
*3. Section **B** has 5 questions carrying 02 marks each.*
*4. Section **C** has 6 questions carrying 03 marks each.*
*5. Section **D** has 4 questions carrying 05 marks each.*
*6. Section **E** has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1 mark each.*
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided.

SECTION A

Q.1 What is the least value of 'x' that satisfies $x \equiv 27 (\text{mod } 4)$, when $27 < x \leq 36$? **1**

(a) 27 (b) 31
(c) 30 (d) 35

Q.2 A certain tank can be filled by pipe A in 12 minutes. pipe B can empty the tank in 18 minutes. If both pipes are open, then the time it takes to fill the tank : **1**

(a) 6.4 minutes (b) 7.2 minutes
(c) 5 minutes (d) 8.5 minutes

Q.3 A person can swim 8km/h in still water. if the speed of the stream is 4km/h, then find the time taken by the person to cover the distance of 24 km downstream? **1**

(a) 1hour (b) 4 hours
(c) 2hours (d) 6 hours

Q.4 Let A be a nonsingular square matrix of order 4 × 4. Then |adj A| is equal to: **1**

(a) | A | (b) | A | 4
(c) | A | 3 (d) 4|A|

Q.5 Integrate: **1**

$$\int (x^2 - e^x)dx$$

(a) $x^3/3 - e^x + C$ (b) $2x^2 - e^x + C$
(c) $x^2 - e^x + C$ (d) none

Q.6 The probability distribution of X is **1**

X	0	1	2	3	4
P(X)	0.2	3K	2K	2K	K

Find K

(a)1.5 (b) 0.15

(c)0.05 (d)0.10

Q.7 If random variable X represents the number of heads when a coin is tossed twice then mathematical expectation of X is : **1**

(a)0 (b)1

(c)1/4 (d)1/2

Q.8 The supply of finished good was delayed for a month due to landslide in hilly terrain. Under which trend oscillation does this situation fall : **1**

(a)Seasonal (b) Secular

(c) Cyclical (d) Irregular

Q.9 A newspaper printing machine costs ₹ 4,80,000 and estimated scrap value of ₹ 25,000 at the end of its useful life of 10 years. What is its annual depreciation as per linear method? **1**

(a) ₹4,550 (b) ₹50,500

(c) ₹ 45,500 (d) ₹61,500

Q.10 At what rate of interest will the present value of a perpetuity of Rs. 500 payable at the end of every 6 months be Rs. 10000? **1**

(a) 6 (b) 5

(c) 8 (d) 10

Q.11 A machine costing Rs40,000 is expected to have a useful life of 4 years and a final scrap value of Rs8000. Find the annual depreciation charge using the straight-line method. **1**

(a) 8000 (b) 5000

(c) 10,000 (d) 4000

Q.12 Assume an investment's starting value is Rs2,00,000 and it grows to Rs12,00,000 in 4 years. Calculate CAGR: **1**

(a)56.5% (b)60%

(c)50.5% (d)60.5%

Q.13 For the given five values 35, 70, 36, 59, 64, the three years moving averages are given by **1**

(a)47,53,55 (b)53,47,45

(c)47,55,53 (d)45,55,57

Q.14 The shape of normal distribution curve is: **1**

(a)parallel to x axis (b) bell shaped

(c) oval shaped (d)none of the above

Q.15 The moving average method is used to find: **1**

(a)Seasonal variation (b) Irregular variation

(c) Secular trend (d) Cyclical variation

Q.16 The order of differential equation d/dx(dy/dx)=0 is: **1**

(a)0 (b)1

(c)2 (d)3

Q.17 Region represented by $x>0, y>0$ lies in 1

(a) 1st quadrant (b) 2nd quadrant

(c) 3rd quadrant (d) 4th quadrant

Q.18 A fair coin is tossed 6 times, let the number of heads obtained, if $P(X=k)=P(X=k+2)$ then the value of k is 1

(a) 4 (b) 3

(c) 2 (d) 1

For Q 19 & 20

(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.

Q.19 Assertion (A): The probability of getting 6 heads when a unbiased coin is tossed 10 times is $C(10,6)(1/2)^{10}$ 1

Reason (R) : In a Binomial distribution the probability is given by

$P(X=r) = C(n,r)(p)^r(q)^{n-r}$

Q.20 Assertion (A): If a LPP admits two optimal solutions then it has infinitely many optimal solutions. 1

Reason (R): If the value of the objective function of a LPP is same at two corner then it is same at every point on the line joining two corner points.

SECTION B **(2 X 5 = 10 marks)**

Q.21 In a flat race, A beats B by 15 m and C by 29 m. When B and C run over the course together B wins by 15 m. Find the length of the race course. 2

Q.22 If $A=\begin{bmatrix}2 & 3 & -1\\ 4 & 1 & 0\\ 3 & 3 & 2\end{bmatrix}$, find M_{12} □ M_{21} □ C_{21} □ C_{12} when M_{ij} is called minor and C_{ij} is called cofactors of A. 2

Q.23 Find local maximum and local minimum values of the function f given by $f(x) = 3x^4 + 4x^3 - 12x^2 + 12$. 2

Or

Find the last digit of 11^{102}

Q.24 Solve 2

$-4<3x+2<11$

Q.25 A firm is engaged in breeding pigs. The pigs are fed on various products grown on the farm. In view of the need to ensure certain nutrients constituents (call them X, Y and Z), It is necessary to buy two additional products, say A and B. One unit of product A contains 36 units of nutrient X, 3 units of nutrient Y and 20 units of nutrient Z. One unit of product B contains 6 units of nutrient X, 12 units of nutrient Y and 10 units of nutrient Z. The minimum requirement of nutrients X, Y and Z is 108 units, 36 units and 100 units respectively. Product A costs Rs. 20 per unit and product B costs Rs. 40 per unit. Formulate the above as a linear programming problem to minimize total cost. 2

Q.26 The demand and supply functions under the pure market competition are $p_d = 16 - x^2$ and $p_s = 2x^2 + 4$ respectively, where p is the price and x is the quantity of the commodity. Using integrals find Consumer's surplus. 3

Q.27 Solve the following system of equations by cramer's rule. 3

$3x - 2y + 3z = 8$; $2x + y - z = 1$; $4x - 3y + 2z = 4$

Q.28 Integrate: $(x^2 + 1) \log x$. 3

Q.29 The supply function of a commodity is $100p=(x+20)^2$,find the producer surplus when the market price is ₹25 . 3

Q.30 Surjeet purchased a mobile phone for which he makes a down payment of ₹5000.The balance is to be paid in 3 years by monthly instalments of ₹ 1673 each,the interest rate charged by the financer is 6% p.a.find the actual price of the mobile phone. (Use $(201/200)^{-36}=0.835644$) 3

Q.31 10 years ago, Mr Mehra set up a sinking fund to save for his daughter's higher studies. At the end of 10 years, he has received an amount of ₹ 10,21,760. What amount did he put in the sinking fund at the end of every 6 months for the tenure, which paid him 5% p.a. compounded semi-annually? [Use $(1.025)^{20} = 1.6386$] 3

SECTION D

Q.32 A school plans to award Rs. 6000 in total to its students to reward for certain values - honesty, regularity and hard work. When three times the award money for hard work is added to the award money given for honesty amounts to Rs. 11000. The award money for honesty and hard work together is double the award money for regularity. Use matrix method to find the prize money for each category of award. 5

Q.33 It is known that 3% of plastic buckets manufactured in a factory are defective. Using the Poisson distribution on a sample of 100 buckets, find the probability of: 5

(i) Zero defective buckets

(ii) At most one bucket is defective [Use $e^{-3} \approx 0.049$]

Q.34 Rohan has completed his M.B.A. and now he wants to start a new business. So, he approaches to many banks. One bank is agreed to give loan to Rohan. So, Rohan has borrowed Rs. 5 lakhs from a bank on the interest rate of 12% for 10 years. 5

(i) Calculate monthly installment using $(1.01)^{120} = 3.300$

(ii) Find the amount of interest paid by Rohan.

Q.35 A farmer has a supply of chemical fertilizer of type A which contains 10% nitrogen and 6% phosphoric acid and of type B which contains 5% nitrogen and 10% phosphoric acid. After soil test, it is found that atleast 7 kg of nitrogen and same quantity of phosphoric acid is required for a good crop. The fertilizer of type A costs Rs. 5 per kg and the type B cost Rs.18 per kg. Using linear programming, find how many kilograms of each type of the fertilizer should be bought to meet the requirement and for the cost to be minimum. Find the feasible region in the graph. 5

SECTION E

(Case Study Based)

Q.36 An overhead water tank has three pipes A, B and C attached to it. The inlet pipes A and B can fill the empty tank independently in 15 hours and 12 hours respectively. The outlet pipe C alone can empty a full tank in 20 hours. 4

Based on the above information, answer the following questions. Show steps to support your answers.

(a) For a routine cleaning of the tank, the tank needs to be emptied. If pipes A and B are closed at the time when the tank is filled to two-fifth of its total capacity, how long will pipe C take to empty the tank completely?

(b) How long will it take for the empty tank to fill completely, if all the three pipes are opened simultaneously?

On a given day, pipes A, B and C are opened (in order) at 5 am, 8 am and 9 am respectively, to fill the empty tank. In how many hours will the tank be filled completely?

Q37 When observed over a long period of time, a time series data can predict trend that can forecast increase or decrease or stagnation of a variable under consideration. Such analytical studies can benefit a business for forecasting or prediction of future estimated sales or production. **4**

The table below shows the welfare expenses(in lakh) of Steel Industry during 2001-2005. Fit a straight line trend by the method of least squares and estimate the trend for the year 2008.

Year	2001	2002	2003	2004	2005
Welfare expenses	160	185	220	300	510

Q38 The mathematics score of group of 500 students follow a normal distribution with mean of 75 and standard deviation of 8,based on this data answer the following questions: **4**

i) What percentage of students scored below 75 marks

ii) Find number of student who scored more than 82 marks.

(Use $P(Z<0.875)=0.8092$)