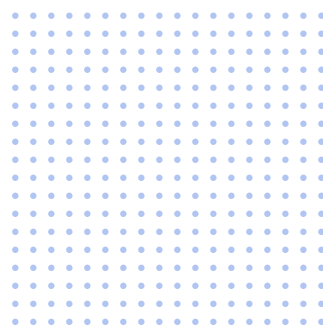




FOR CBSE CLASS 12 PREPARATION

CBSE Class 12 Sample Paper 2027 for Applied Maths

EXAM

CBSE Class 12

YEAR

2027

TYPE

Sample Paper

SUBJECT

Maths

SUBJECT: APPLIED MATHEMATICS (241)
SAMPLE QUESTION PAPER
CLASS- XII (2026-27)

Maximum Marks: 80**Time Allowed: 3 Hours****General Instructions:**Read the following instructions very carefully and strictly follow them:

1. This Question paper contains 38 questions. All questions are compulsory.
2. This Question paper is divided into five Sections - A, B, C, D and E.
3. In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Question number 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.
5. In Section C, Question number. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.
6. In Section D, Question number 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.
7. In Section E, Question number 36 to 38 are case study-based questions carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and one sub-part each in 2 questions of Section E.
9. Draw neat and clean figures wherever required. Take $\pi = \frac{22}{7}$ wherever required, if not stated
10. Use of calculators is not allowed.

SECTION – A (20 x 1 = 20)		
This section comprises of 18 multiple choice questions and two assertion and reason type questions of 1 mark each.		
Q. NO.	Question	Marks
1.	Given two integers a, b such that $a < b$ and c be any non-zero integer then which of the following always holds true: (A) $a - c > b - c$ (B) $ac < bc$ (C) $ac > bc$ (D) $a + c < b + c$	1
2.	Vessel A contains milk and water in the ratio 4 : 5. Vessel B contains milk and water in the ratio 5 : 1. In what ratio should quantities be taken from both vessels to form a mixture in which milk and water are in the ratio 5 : 4? (A) 5 : 2 (B) 5 : 3 (C) 4 : 1 (D) 1 : 4	1
3.	Number of symmetric matrices of order 3×3 with each entry 1 or -1 is (A) 512 (B) 64 (C) 8 (D) 4	1
4.	In a car race, car A beats car B by 45 km, car B beats car C by 50 km, and car A beats car C by 90 km then the length of the race course is (A) 400 km (B) 450 km (C) 500 km (D) 550 km	1

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Page 1 of 9

5.	If $x = \log t$ and $y = t^2$, then value of $\frac{d^2y}{dx^2}$ at $t = \frac{1}{\sqrt{2}}$ is (A) 4 (B) 2 (C) $2\sqrt{2}$ (D) 1	1
6.	Which of the following statements about the future value (FV) of a perpetuity is true? (A) The future value can be calculated by compounding the present value to a specific future date. (B) The future value is equal to twice the present value multiplied by number of payments. (C) The future value is always equal to the total cash flows received up to the future date. (D) The future value of perpetuity is undefined.	1
7.	The order of the differential equation whose general solution is given by $y = (a + b)\log(x + c) - de^{x+k}$ where a, b, c, d and k are arbitrary constants, is (A) 4 (B) 5 (C) 3 (D) 2	1
8.	The Marginal Revenue (MR) of a company is given by the function $MR(x) = 20e^{0.5x}$ where x is the number of units sold. The additional revenue generated when sales increase from 2 units to 4 units is: (A) $20e^2$ (B) $20(e^2 - e^1)$ (C) $40e^2$ (D) $40(e^2 - e^1)$	1
9.	In the context of standard reducing-balance EMI, over the loan period, which of the following is correct? (A) Principal and Interest components both remain constant. (B) Principal component decreases, and Interest component increases. (C) Principal component increases, and Interest component decreases. (D) Principal component remains constant, and Interest component decreases.	1
10.	If you are willing to pay ₹ 40,000 today for an investment that promises to pay ₹ 3,200 at the end of every year indefinitely, then the implied rate of return is (A) 6 % (B) 8 % (C) 10 % (D) 12.5 %	1
11.	A foreign research lab observes that the number of microscopic defects on a solar-panel surface follows a Poisson distribution with mean 2 defects per 100 cm^2 . If a scientist inspects an area of 250 cm^2 , what is the probability that exactly 1 defect is found? (A) $6e^{-5}$ (B) $5e^{-5}$ (C) $4e^{-5}$ (D) $3e^{-2}$	1
12.	Which of the following statement(s) is/are true: I: The mean of a population is denoted by $\bar{x}$. II: The population mean is a statistic. (A) I only (B) II only (C) Both I and II (D) Neither I nor II	1

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13.	Two random variables X and Y have the same mean $\mu = 50$. If $Var(X) = 100$ and $Var(Y) = 25$, which statement is TRUE? (A) X is more consistent than Y (B) Y is more consistent than X (C) Both have equal consistency (D) Cannot be determined with the given data	1
14.	A trend line is considered the best fit when the sum of squares of residuals is (A) Maximum (B) Minimum (C) Positive (D) Negative	1
15.	A sample of 100 cereal boxes has mean = 505g and SD = 15g. The 99% confidence interval for the true mean μ is (501.125, 508.875) grams. Which of the following is the correct interpretation of this interval? (A) 99% of repeated samples will have means in the interval (501.125, 508.875) grams. (B) The probability that the mean weight, μ , is between 501.125 and 508.875 grams is 0.99. (C) We are 99% confident that the calculated interval of (501.125, 508.875) grams contains the true mean weight μ . (D) Approximately 99% of all boxes have a weight between 501.125 and 508.875 grams.	1
16.	Let X be a random variable following the binomial distribution $B(6, p)$. If $2 P(X = 4) = 3 P(X = 3)$, then the value of p is: (A) $\frac{1}{3}$ (B) $\frac{1}{2}$ (C) $\frac{2}{3}$ (D) $\frac{3}{4}$	1
17.	Suppose a random variable X follows the binomial distribution with parameters n and p , where $0 < p < 1$. If $\frac{P(X=r)}{P(X=n-r)}$ is independent of n and r , then p equals (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{5}$ (D) $\frac{1}{7}$	1
18.	A firm manufacturing two types of lubricants whose non-negative production quantities, represented by decision variables x and y satisfy the following constraints: $x \geq 2, \quad y \leq 3, \quad x + y = 5$ Then the feasible region of the above LPP is: (A) A triangle (B) A quadrilateral (C) A line segment (D) unbounded	1

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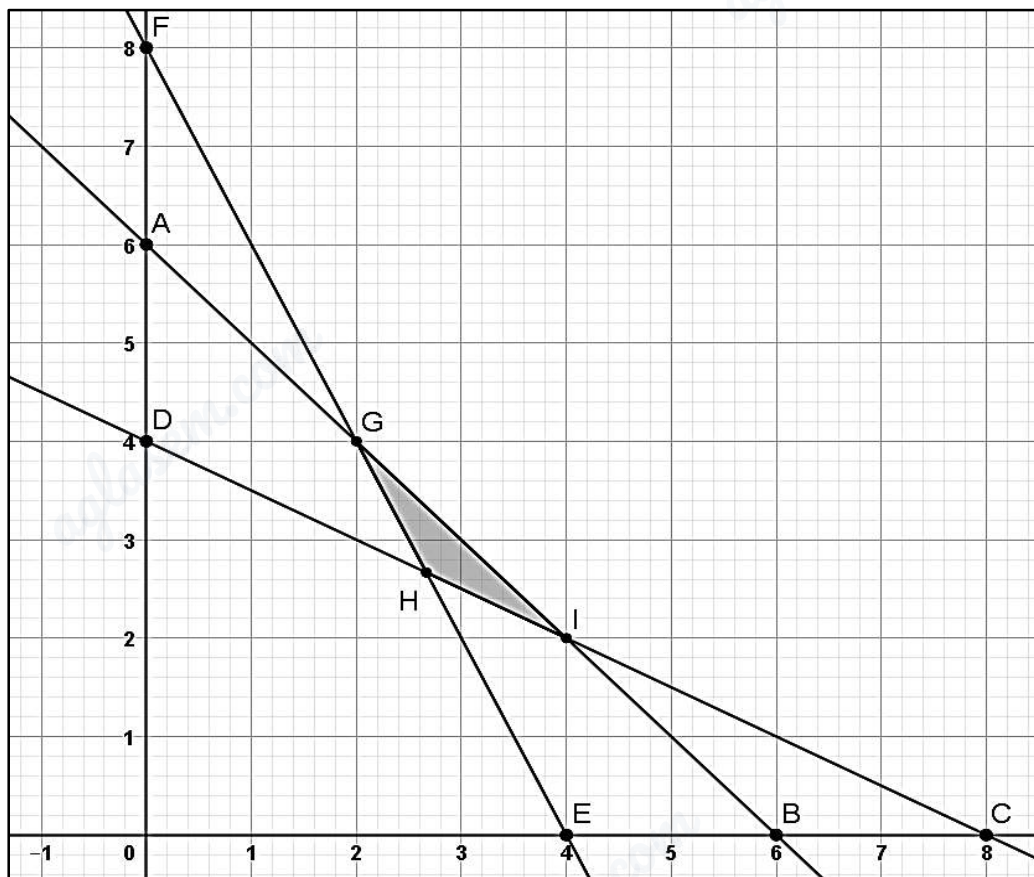
<p style="text-align: center;">Assertion-Reason Based Questions</p> <p>Directions: Question numbers 19 and 20 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the options (A), (B), (C) and (D) as given below: (A) Both Assertion (A) and Reason (R) are true and (R) is the correct explanation of Assertion (A). (B) Both Assertion (A) and Reason (R) are true but (R) is not the correct explanation of Assertion (A). (C) Assertion (A) is true but Reason (R) is false. (D) Assertion (A) is false but Reason (R) is true.</p>		
19.	<p>Assertion (A): Let A be a non-singular square matrix of order 3. If $A = 4$, then the value of $2 \cdot adj(A)$ is 128.</p> <p>Reason (R): For a matrix A, $adj(A) = A ^{n-1}$ and $kA = k^n A$</p>	1
20.	<p>Assertion (A): If two probability distributions have the same mean, they must have the same variance.</p> <p>Reason (R): Variance measures the spread of data around the mean and is calculated as $Var(X) = E(X^2) - [E(X)]^2$</p>	1
<p style="text-align: center;">SECTION – B (5 x 2 = 10)</p> <p>This section comprises of 5 very short answer (VSA) type questions of 2 marks each.</p>		
21(A).	If x is an odd integer, show that $x^2 \equiv 1 \pmod{8}$	2
	OR	
21(B).	If $3^{333} \equiv x \pmod{11}$, find x .	
22.	An asset was purchased for ₹120,000 with an expected salvage value of ₹10,000 and 10-year useful life. What is the asset's book value at the end of sixth year?	2
23.	A man rows 12 km downstream and 12 km upstream, taking 4 hours in total. If the speed of the stream is 4 km/h, find the speed of the man in still water.	2
24(A).	The number of customer complaints received by an e-commerce company follows a Poisson distribution. It is observed that the probability of receiving exactly 2 complaints in a day is equal to the probability of receiving exactly 3 complaints in a day. Find the mean and the variance of the distribution.	2
	OR	
24(B).	<p>A metro station observes that trains arrive at a particular platform at an average rate of 20 trains per hour during peak hours.</p> <p>(i) What is the expected number of trains arriving in a 6-minute interval?</p> <p>(ii) Find the probability that exactly 2 trains arrive in a 6-minute interval.</p> <p>[Use $e^{-2} = 0.1353$]</p>	

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25.

The feasible region for an LPP is shown as in the graph below:

2



Frame all the constraints of the LPP represented by the above graph.

SECTION – C**(6 x 3 = 18)****This section comprises of 6 short answer (SA) type questions of 3 marks each.**

26(A).

The price of a stock S (in dollars) t days after its IPO is modeled by $S(t) = \frac{4t^2 + 1}{t}$, $t > 0$. Show that the stock price decreased for the first half of the opening day and then started increasing thereon.

OR

26(B).

Consider a simple market where quantity demanded is $Q_d = 15 - 2P$ and quantity supplied is $Q_s = 3P - 5$. The rate of change of price i.e., $\frac{dP}{dt}$ is half of the excess demand i.e. $(Q_d - Q_s)$.

(i) Show that $\frac{dP}{dt} = \frac{1}{2} (20 - 5P)$.

(ii) If $P = 2$ when $t = 0$, then show that $P = 2(2 - e^{-2.5t})$

3

27.

A ₹1000 bond with a 4% coupon rate is 5 years until maturity and pays quarterly interest. If the annual market yield to maturity is 6%, what is the purchase price of the bond? [Given: $1.015^{-20} = 0.742$]

3

28(A).

The overall increase in a company's market share was 33.1%. Management reports the growth rate as a CAGR of 8.5%. Assuming the CAGR is accurate, how many years did it take for the market share to grow this much? [Use $\log(1.331) = 0.124$ and $\log(1.085) = 0.035$]

3

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	OR	
28(B).	A company needs to accumulate ₹ 45,000,000 in n years to replace a fleet of vehicles. They decide to make annual deposits of ₹ 5,00,000 at the end of each year into a sinking fund. If the interest rate is 15% compounded annually, then in how many years will it take to reach the target? [Use $\log(14.5) = 1.161$ and $\log(1.15) = 0.061$]	
29.	For the matrix $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, show that $A^3 - 7A - 6I = O$, where I is an identity matrix of order 2 and O is a zero matrix of order 2×2 . Hence find A^{-1} .	3
30.	In an examination, 2000 students appeared and the mean of the normal distribution of marks is 30 with standard deviation as 6.25. Find how many students are expected to score: (i) between 20 and 40 marks? (ii) less than 25 marks? [Use $P(0 \leq Z < 1.6) = 0.4452$ and $P(0 \leq Z \leq 0.8) = 0.2881$]	3
31.	A nutritionist claims that the average daily calorie intake of Indian teenagers is 2200 calories. To verify this claim, a random sample of 25 teenagers was selected, and their daily calorie intake was recorded. The sample mean was found to be 2080 calories with a sample standard deviation of 280 calories. Test at the 5% level of significance whether the nutritionist's claim is valid. Assume that the calorie intake follows a normal distribution. [Use $t_{24}(0.025) = 2.064$]	3
SECTION – D (4 x 5= 20) This section comprises of 4 long answer (LA) type questions of 5 marks each.		
32.	Under monopoly, the quantity sold and market price are determined by demand function $p = 274 - x^2$. If the marginal cost for a profit maximising monopolist is equal to $4 + 3x$, find the consumer's surplus.	5
33(A).	A textile factory manufactures three types of fabrics: Cotton (C), Silk (S), and Wool (W). These fabrics must pass through three processing units: Weaving (U_1), Dyeing (U_2), and Packaging (U_3). The per hour processing speeds of the units are as follows: <ul style="list-style-type: none"> Unit U_1 (Weaving): 20 units of Cotton, 40 units of Silk, 20 units of Wool. Unit U_2 (Dyeing): 25 units of Cotton, 50 units of Silk, 50 units of Wool. Unit U_3 (Packaging): 20 units of Cotton, 20 units of Silk, 40 units of Wool. The total available processing time for the units are 20 hours for Weaving (U_1), 12 hours for Dyeing (U_2), and 19 hours for Packaging (U_3). Using Cramer's Rule, find the number of units of Cotton, Silk, and Wool that can be produced if the available time is fully utilized.	5
	OR	

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33(B).	<p>"Cyber-Safe" has upgraded their encryption protocol. They now use a more complex Encoding Matrix (E) to encrypt the 3-letter keyword that unlocks their central server. The encryption follows the formula: $C = E \cdot P$, where P is the column matrix of the letter positions ($A = 1, B = 2, C = 3, \dots, Z = 26$).</p> <p>You are an interceptor who has received an encrypted message matrix C and you have managed to crack the Encoding Matrix E.</p> <p>The Encoding matrix E is given as $E = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 0 & 1 \\ 0 & 2 & 1 \end{bmatrix}$</p> <p>The intercepted encrypted matrix C is given as $C = \begin{bmatrix} 52 \\ 36 \\ 35 \end{bmatrix}$</p> <p>Using matrix algebra, determine the original numerical matrix P. Also decode the numbers into letters to reveal the 3-letter secret code word.</p>																					
34.	<p>A farmer can buy local goats at ₹400 each and hybrid goats at ₹600 each. A local goat produces milk worth ₹190 per week, while a hybrid goat produces milk worth ₹250 per week. The weekly maintenance cost of each goat is ₹60. The farmer has at most ₹12,000 to spend on buying goats and can maintain not more than 22 goats.</p> <p>Formulate the Linear Programming Problem and find how many local goats and hybrid goats the farmer should buy to maximize the weekly profit? Also, find the maximum profit.</p>	5																				
35(A).	<p>The following data represents the production of wheat in India (in Million Tonnes) over a period of 9 years. Due to climatic variations, the production fluctuates annually:</p> <table><tr><th>Year</th><th>Production (in Million Tonnes)</th></tr><tr><td>2015</td><td>86</td></tr><tr><td>2016</td><td>92</td></tr><tr><td>2017</td><td>98</td></tr><tr><td>2018</td><td>100</td></tr><tr><td>2019</td><td>103</td></tr><tr><td>2020</td><td>108</td></tr><tr><td>2021</td><td>109</td></tr><tr><td>2022</td><td>107</td></tr><tr><td>2023</td><td>110</td></tr></table> <p>Calculate the trend values using the 4-Year Centred Moving Average method for the given data.</p>	Year	Production (in Million Tonnes)	2015	86	2016	92	2017	98	2018	100	2019	103	2020	108	2021	109	2022	107	2023	110	5
Year	Production (in Million Tonnes)																					
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2022	107																					
2023	110																					
OR																						

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- 35(B).** The "Digital India" initiative has led to a massive surge in digital payment transactions across the country. The following data represents the volume of digital transactions (UPI, NEFT, IMPS, debit card etc.) in India (in Crores) for 6 consecutive years. The growth has been significant due to the push for a digital economy.

Year	2018	2019	2020	2021	2022	2023
Volume (in crores)	2071	3134	4572	5554	8839	13462

- (i) Fit a straight-line trend to the above data using the method of Least Squares.
- (ii) Estimate the likely volume of transactions for the year 2025, assuming the current trend continues.

SECTION – E

(3 x 4 = 12)

This section comprises of 3 case-study/passage-based questions of 4 marks each with sub parts. The first two case study questions have three sub parts (i), (ii), (iii) of marks 1, 1, 2 respectively. The third case study question has two sub parts of 2 marks each

- 36.** Three pipes A, B and C can fill a tank in 12 hours, 15 hours and 20 hours respectively. Pipe A is kept open continuously. Pipes B and C in that order are open alternately for one hour each.



Based upon the above information, answer the following questions:

- (i) Find the part of the tank filled in one hour when pipes A and C are open together.
- (ii) Find the part of the tank filled in one hour when pipes A and B are open together.
- (iii) (A) Find the part of tank filled by the three pipes in the first 6 hours.
- OR**
- (iii) (B) Find the part of the unfilled tank at the end of 7 hours.

1

1

2

- 37.** The cost of building an office block, x floors high, consists of three components:
- ₹ 80 crores for the land
 - ₹ 2 crores per floor
 - Extra structural costs ₹ $(0.08x)$ crores for each floor, where x is the total number of floors.

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	<p>Based on the above information, answer the following questions:</p> <p>(i) Find the total cost of building the office block x floors high.</p> <p>(ii) Find the average cost per floor in terms of x.</p> <p>(iii) (A) Find, how many floors the office block should have if the average cost per floor is to be minimized?</p> <p style="text-align: center;">OR</p> <p>(iii) (B) Find, for how many floors the average cost keeps decreasing?</p> <p>[Use $\sqrt{10} = 3.2$]</p>	<p>1</p> <p>1</p> <p>2</p>
38.	<p>A couple wishes to purchase a house for ₹15,00,000 with a down payment of ₹4,00,000. If they amortize the balance at an interest rate of 9% per annum compounded monthly for 10 years.</p> <p>(i) Find the monthly installment using the flat rate method.</p> <p>(ii) Find the monthly installment using the reducing balance method.</p> <p>[Use $(1.0075)^{120} = 2.451$ and $\frac{2.451}{1.451} = 1.69$]</p>	<p>2</p> <p>2</p>