Sample Question Paper
CLASS: XII
Session: 2021-22
Applied Mathematics (Code-241)
Term - 1

Time Allowed: 90 minutes **Maximum Marks: 40**

General Instructions:

1. **This question paper contains three sections – A, B and C. Each part is compulsory.**
2. **Section - A has 20 MCQs, attempt any 16 out of 20.**
3. **Section - B has 20 MCQs, attempt any 16 out of 20**
4. **Section - C has 10 MCQs, attempt any 8 out of 10.**
5. **There is no internal choice in any section.**
6. **All Questions carry equal Marks.**

SECTION – A

In this section, attempt any 16 questions out of Questions 1 – 20.
Each Question is of 1 mark weightage.

1.	The value of $5 \odot_8 11$, where $\odot$ is multiplication modulo is (a) -1 (b) 0 (c) 7 (d) 9	1
2.	For two distinct positive numbers x and y (a) $x + y > 2\sqrt{xy}$ (b) $\frac{x+y}{2} > xy$ (c) $\sqrt{xy} > \frac{x+y}{2}$ (d) $\frac{2xy}{x+y} > \sqrt{xy}$	1
3.	A person can row in still water at the rate of 8 km/h. If it takes him thrice as long to row upstream as to row downstream then the speed of the stream is: (a) 2 km/h (b) 3 km/h (c) 4 km/h (d) 6 km/h	1
4.	If $x \equiv -4\ (mod\ 3)$, then a solution for x is: (a) -2 (b) 12 (c)19 (d) 35	1
5.	If A is a square matrix of order 3 and $\|A\| = -2$, then $\|adj(A)\|$ is equal to (a) -8 (b) -2 (c) 0 (d) 4	1
6.	In a 3×3 matrix A, value of $a_{12}c_{13} + a_{22}c_{23} + a_{32}c_{33}$, where c_{ij} is the cofactor of a_{ij} is (a) 0 (b) -1 (c) 1 (d)$\|A\|$	1
7.	If two square matrices A and B are such that $\|AB\| = 12$ and $\|B\| = -4$, then value of $\|A\|$ is: (a) 8 (b) -8 (c) -3 (d)16	1
8.	If solving a system of linear equations in 3 variables by Cramer's rule, we get $\Delta = 0$ and at least one of $\Delta_x, \Delta_y, \Delta_z$ is non-zero then the system of linear equations has (a) no solution (b) unique solution (c) infinitely many solutions (d) trivial solution	1

9.	The total cost function is given by $C(x) = x^2 + 30x + 1500$ .The marginal cost when 10 units are produced is: (a) ₹ 20 (b) ₹ 30 (c) ₹ 50 (d)₹ 70	1
10.	The function $y = \frac{1}{x}$ is strictly decreasing in the interval(s) (a) $(0, \infty)$ only (b) $(-\infty, 0)$ only (c)$(-\infty, 0)$ as well as $(0, \infty)$ (d) **R**	1
11.	The equation of tangent to the curve $y = x^3 + x$ at the point (1, 2) is (a) $4x + y = 6$ (b) $4x - y = 2$ (c) $4x - y = 12$ (d) $4x + 3y = 7$	1
12.	A Candidate claims 70% of the people in her constituency would vote for her. If 120000 valid votes are polled, then the number of votes she expects from her constituency is (a) 100000 (b) 84000 (c) 56000 (d) 36000	1
13.	The total area under the normal distributed curve above the base line i.e., $\int_{-\infty}^{\infty} f(x)dx$ is (a) 0 (b) 0.5 (c) 0.75 (d) 1	1
14.	Let X denotes the number of hours a student devotes to self-study during a randomly selected school day. The probability that X takes the value x, where *k* is some unknown constant is $P(X = x) = \begin{cases} k & if\ x = 0 \\ kx & if\ x = 1\ or\ 2 \\ k(5 - x) & if\ x = 3\ or\ 4 \\ 0 & otherwise \end{cases}$ The probability that a student studies at least 3 hours on a particular day is (a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{3}{7}$ (d) $\frac{1}{2}$	1
15.	An automatic machine produces 20000 pins per day. On rare occasion it produces a perfect pin whose chance is $\frac{1}{10000}$. Assuming Poisson distribution, the mean and variance of the number of perfect pins are respectively (a) $\sqrt{2}$, $\sqrt{2}$ (b) 2, 2 (c) 2, 4 (d) 4, 2	1
16.	For a Poisson distribution with mean λ, $\sum_{k=0}^{\infty} \frac{e^{-\lambda}\lambda^k}{k!}$ is equal to (a) -1 (b) 0 (c) $\frac{1}{2}$ (d) 1	1
17.	A TV manufacturer tests a random sample of 6 picture tubes to determine any defect. Past experience suggests the probability of defective picture tube is 0.05. The probability that there is at least one defective picture tube in the sample is (a) $\left(\frac{19}{20}\right)^6$ (b) $1 - \left(\frac{19}{20}\right)^6$ (c) $1 - \left[\left(\frac{19}{20}\right)^6 + \frac{3}{10}\left(\frac{19}{20}\right)^5\right]$ (d) $\left(\frac{1}{20}\right)^6$	1
18.	To calculate Laspeyres price index the weights are taken as (a) Base year prices (b) Current year prices (c)Base year quantities (d) Current year quantities	1
19.	Given that $\sum p_1 q_1 = 506$, $\sum p_0 q_0 = 406$, $\sum p_1 q_0 = 456$ and $\sum p_0 q_1 = 451$, where subscript 0 and 1 are used for base year and current year respectively. The Paasche's index number is (a) 112.19 (b) 112.31 (c) 117.31 (d) 108.52	1

20.	Price index by Marshall Edgeworth method takes (a) q_0 as weights (b) q_1 as weights (c) $\frac{q_0+q_1}{2}$ as weights (d) $\sqrt{q_0 q_1}$ as weights	1

SECTION – B

In this section, attempt any 16 questions out of the Questions 21 - 40.
Each Question is of 1-mark weightage.

21.	Two athletes Vijay and Samuel finish 100 meters race in 12 secs and 16 secs respectively. By how many meters does Vijay defeat Samuel? (a) 10.2 meters (b) 15 meters (c) 25 meters (d) 33.3 meters	1
22.	If the present time is 8.40 PM, then the time after $876\frac{1}{2}$ hours will be: (a) 8.40 AM (b) 9.10 AM (c) 6.10 PM (d) 10.40 PM	1
23.	A, B and C enter into a partnership. B contributes $\frac{1}{3}rd$ of the capital, while A contributes as much as B and C together contribute. The ratio of their capitals is: (a) 1:2:3 (b) 3:2:1 (c) 3:1:1 (d) 2:1:1	1
24.	Let $m \in Z^+$ consider the relation R_m defined as $a\ R_m\ b$ iff $a \equiv b\ (mod\ m)$, then R_m is (a) reflexive but not symmetric (b) symmetric but not transitive (c) reflexive, symmetric but not transitive (d) an equivalence relation	1
25.	Three friends X, Y and Z agrees to invest for time periods in the ratio 2:3:4. If their profit sharing ratio is 6:7:8 then the ratio of their investments is (a) 4:5:6 (b) 9:7:6 (c) 8:7:6 (d) 12:21:32	1
26.	If matrix $A = \begin{pmatrix} a & b & -5 \\ c & d & 0 \\ 5 & 0 & 0 \end{pmatrix}$ is skew symmetric, then value of $2a + b + c - 3d$ is: (a) 1 (b) -1 (c) 0 (d) 2	1
27.	In which of the technology matrix, Hawkins- Simon conditions are satisfied (a) $\begin{pmatrix} 0.2 & 0.9 \\ 0.8 & 0.1 \end{pmatrix}$ (b) $\begin{pmatrix} 0.7 & 0.3 \\ 0.2 & 1.2 \end{pmatrix}$ (c) $\begin{pmatrix} 1.02 & 0.5 \\ 0.6 & 0.8 \end{pmatrix}$ (d) $\begin{pmatrix} 0.3 & 0.2 \\ 0.1 & 0.5 \end{pmatrix}$	1
28.	The function $y = \lvert x \rvert$ is (a) neither differentiable nor continuous at $x = 0$ (b) differentiable and continuous at $x = 0$ (c) continuous but not differentiable at $x = 0$ (d) differentiable but not continuous at $x = 0$	1
29.	Given that $x = at^2$ and $y = 2at$, then value of $\frac{d^2y}{dx^2}$ is (a) $-\frac{1}{2at^3}$ (b) $-\frac{1}{2at^2}$ (c) $\frac{1}{t^2}$ (d) $\frac{-2a}{t}$	1

30.	The variable cost of producing x units is $V(x) = x^2 + 2x$. If the company incurs a fixed cost of ₹10,000, then the level of output where the average cost is minimum is (a) 10 units (b) 50 units (c) 100 units (d) 200 units	1
31.	A sales promotion company sells tickets for ₹100 each to win a prize of ₹5 lakhs. If a person buys one of the 10,000 tickets sold, then his expected gain in rupees is (a) -50 (b) 0 (c) 50 (d) 100	1
32.	An insurance company has found that 50% of its claims are for damages resulting from accidents. The probability that a random sample of 10 claims will contain fewer than 2 for accidents is (a) $\frac{1}{1024}$ (b) $\frac{5}{512}$ (c) $\frac{11}{1024}$ (d) $\frac{15}{1024}$	1
33.	During a pandemic, 10% of the patients who have the disease get complications. If 100 patients of a locality get infected by the disease, then the standard deviation of the number of patient getting complications is: (a) 10 (b) 9 (c) 6 (d) 3	1
34.	An electrical supplier distributor has found the daily demand for fluorescent light bulbs is normally distributed with a mean of 432 and standard deviation of 86. Find the probability that the demand on a particular day exceeds 518 bulbs. (a) 0.1587 (b) 0.3413 (c) 0.7587 (d) 0.8413	1
35.	The value of mortgage loans made by a certain bank is normally distributed with mean of ₹36 lacs and a standard deviation of ₹12 lacs. The probability that a randomly selected mortgage loan is less than 54 lacs is (a) 85.26% (b) 93.32% (c) 97.42% (d) 98.04%	1
36.	The prices of group of commodities is given in the following table: Commodities | A | B | C | D p_0 [Price (₹) in 2019] | 40 | 28 | 120 | 112 p_1 [Price (₹) in 2020] | 50 | 35 | 135 | 120 The price index for 2020 taking 2019 as base year using simple aggregative method is: (a) 88.23% (b) 113.33% (c) 120.5% (d) 136%	1
37.	For data regarding some commodities, the price indexes using Laspeyres and Paasches method are 118.4 and 117.5 respectively. The Fishers price index for the data is (a) 115.95 (b)117.95 (c) 120.84 (d) 121.45	1
38.	The price and quantities of certain commodities are shown in the following table: | | A | B | p_0 | 1 | 1 q_0 | 10 | 5 p_1 | 2 | x q_1 | 5 | 2 If ratio of Laspeyres (L) and Paasches (P) index number i.e., L : P = 28:27, then the value of x is (a) 2 (b) 3 (c) 4 (d) 5	1

39.	To find the Index number by weighted average of price relatives, we use the formula (a) $\frac{\sum\left(\frac{p_1}{p_0}\right)(p_0\,q_0)}{\sum(p_0\,q_0)}\times 100$ (b) $\frac{\sum p_1(p_0\,q_0)}{\sum(p_0\,q_0)}\times 100$ (c) $\frac{\sum p_0(p_0\,q_0)}{\sum(p_0\,q_0)}\times 100$ (d) $\frac{\sum\left(\frac{p_1}{p_0}\right)(p_1\,q_1)}{\sum(p_1\,q_1)}\times 100$	1
40.	The Time reversal test is satisfied by (a) Laspeyres index only. (b) Paasches index only (c) Both Laspeyres and Paasches index numbers (d) Fishers ideal index	1
	SECTION – C **In this section, attempt any 8 questions out 10 Questions.** **Each question is of 1 mark weightage.** **(Questions 46-50 are based on a Case-Study).**	
41.	A retailer buys 250 kg of rice, a part of which he sells at 10% profit and the remaining at 5% loss. If the net profit made by the retailer in the whole transaction is 7%, then the quantity of rice sold at 10% profit is (a) 200 kg (b) 150 kg (c) 100 kg (d) 50 kg	1
42.	Two pipes A and B can fill a cistern in 8 hours and 12 hours respectively. The pipes when opened simultaneously takes 12 minutes more to fill the cistern due to leakage. Once the cistern is full, it will get emptied due to leakage in (a) 5 hrs. (b) 20 hrs. (c) 60 hrs. (d) 120 hrs.	1
43.	The demand function of a toy is, $x = 75 - 3p$ and its total cost function is $TC = 100 + 3x$. For maximum profit the value of x is (a) 33 (b) 31 (c) 29 (d) 24	1
44.	A river passing near a town floods it on an average twice every 10 years. Assuming Poisson distribution find the probability that the town faces flooding at least once in 10 years. (a) 0.0198 (b) 0.1353 (c) 0.5657 (d) 0.8647	1
45.	The height of certain species of plant is normally distributed with mean of 20 cm and standard deviation of 4 cm. what is the probability that the height of a plant chosen at random lies between 10 cm and 30 cm (a) 0.0062 (b) 0.5341 (c) 0.9876 (d) 0.9938	1
	CASE STUDY The economy of a state is composed of various sectors. To understand the basic concept, we consider two sectors coal mining (sector 1) and utilities (sector 2). The coal mining produces coal and utilities produces electricity. Assume that these products are measured by their rupee value. By one unit of product we mean 1 rupee worth of that product. To produce ₹1 worth of coal the coal mining sector uses ₹0.50 of coal and ₹0.10 of electricity. To produce ₹1 worth of electricity the utilities sector uses ₹0.25 of coal and ₹0.25 of electricity.	

Based on the above information, answer the following questions:

46. The technology coefficient matrix A is 1

(a) $\begin{pmatrix} 0.50 & 0.10 \\ 0.25 & 0.25 \end{pmatrix}$ (b) $\begin{pmatrix} 0.50 & 0.25 \\ 0.10 & 0.25 \end{pmatrix}$

(c) $\begin{pmatrix} 0.25 & 0.25 \\ 0.50 & 0.10 \end{pmatrix}$ (d) $\begin{pmatrix} 0.10 & 0.50 \\ 0.25 & 0.25 \end{pmatrix}$

47. 1

The matrix $(I - A)^{-1}$ is

(a) $\frac{1}{8}\begin{pmatrix} 15 & 5 \\ 2 & 10 \end{pmatrix}$ (b) $\frac{1}{7}\begin{pmatrix} 15 & 2 \\ 5 & 10 \end{pmatrix}$

(c) $\frac{1}{7}\begin{pmatrix} 15 & 5 \\ 2 & 10 \end{pmatrix}$ (d) $\frac{20}{7}\begin{pmatrix} 0.75 & 0.25 \\ 0.50 & 0.10 \end{pmatrix}$

48. 1

The system is viable because

(a) $|I - A| > 0$ and diagonal elements of $(I - A) < 0$
(b) $|I - A| > 0$ and diagonal elements of $(I - A) > 0$
(c) $|I - A| < 0$ and diagonal elements of $(I - A) > 0$
(d) $|I - A| < 0$ and diagonal elements of $(I - A) < 0$

49. 1

If there is external demand worth ₹7000 of coal and ₹14000 of electricity, then production of two sectors to meet the demand is

(a) ₹ 25000 of coal, ₹ 22000 of electricity
(b) ₹ 12000 of coal, ₹ 20000 of electricity
(c) ₹ 15000 of coal, ₹ 22000 of electricity
(d) ₹ 27000 of coal, ₹ 22000 of electricity

50. 1

How much worth of coal and electricity is used internally?

(a) ₹ 25000 of coal, ₹22000 of electricity
(b) ₹ 22000 of coal, ₹15000 of electricity
(c) ₹ 20000 of coal, ₹10000 of electricity
(d) ₹ 18000 of coal, ₹8000 of electricity
