ROLL NUMBER				

SET	1

QP.Code:241/01/1

INDIAN SCHOOL MUSCAT
FIRST PREBOARD EXAMINATION (2022-2023)
APPLIED MATHEMATICS (241)

CLASS : XII
DATE: 15.01.2023

TIME ALLOTED : 3 HRS.
MAXIMUM MARKS: 80

GENERAL INSTRUCTIONS:

(a) This question paper consists of 38 questions divided into five sections A, B, C, D and E.
(b) Section-A has18 MCQs and 2 Assertion-Reason based questions of **one mark** each (Q1 to Q 20).
(c) Section-B has 5 questions of **two marks** each (Q 21 to Q 25).
(d) Section-C has 6 questions of **three marks** each (Q 26 to Q 31).
(e) Section-D has 4 questions of **five marks** each (Q 32 to Q 35).
(f) Section- E comprises of 3 Case-study questions of **four marks** each (Q 36 to Q 38).
(g) There is no overall choice. However, internal choice has been provided in some questions.

SECTION – A (Questions 1 to 20 carry 1 mark each)

MULTIPLE CHOICE QUESTIONS:

1. If A is 3x3 matrix such that $|A|=8$, then $|3A|$ is equals:
   (a) 24 (b) 72 (c)216 (d) 8

2. The tangent to the curve $x = t^2 - 1$ and $y = t^2 - t$ is parallel to x axis at
   (a) $t = 0$ (b) $t = 2$ (c) $t = \frac{1}{2}$ (d) $t = \frac{-1}{2}$

3. For a random variable X, E(X) = 3 and $E(X^2) = 11$. Then the variance of X is
   a) 2 b) 8 c) 6 d) information not sufficient.

4. In a best fit trend the sum of squares of the deviations must be
   (a) maximum (b) zero (c) minimal (d) no fixed criteria.

5. The present value of a sequence of payments of ₹ 60 made at the beginning of each 6 months and continuing forever, if money is worth 4% compounded semi-annually is
   (a) ₹3000 (b) ₹3060 (c) ₹4060 (d) ₹2500

6. The graph of the inequality $2x + 3x > 6$ is
   (a) the half plane that contains the origin.
   (b) the half plane that neither contains origin nor the points of the line $2x+ 3y = 6$.

(c) the whole XOY plane excluding the points on the line $2x + 3y = 6$.

(d) the entire XOY plane.

7. A person can swim at 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?
(a) 1 hour (b) 2 hours (c) 4 hours (d) 6 hours

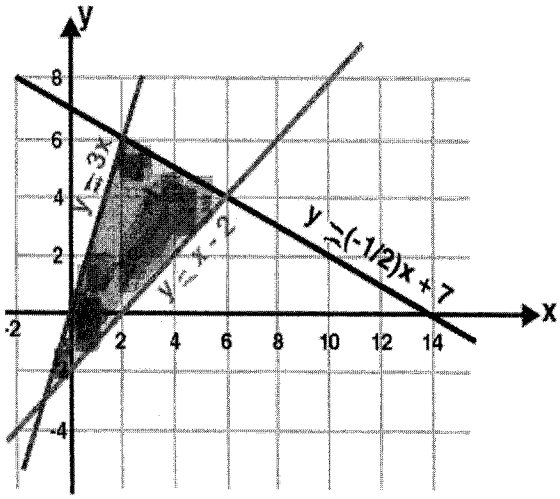
8. For any square matrix A, $A - A^T$ is a
(a) unit matrix (b) symmetric matrix (c) skew-symmetric matrix (d) diagonal matrix

9. If the critical region is evenly distributed, then the test is referred as
(a) zero tailed (b) one tailed (c) two tailed (d) three tailed

10. A fire in a factory delaying production for some weeks is a
(a) secular trend (b) irregular trend (c) cyclical trend (d) seasonal trend

11. A machine costing ₹ C would reduce to ₹10000 in 7 years. If annual depreciation charge is ₹10,000 then the value of C is
(a) 100000 (b) 90000 (c) 70000 (d) 80000

12. The adjoining graph encloses a shaded region(**feasible region**) by the lines $y = 3x$, $y = x - 2$ and $x + 2y = 14$.
Which of the constraints satisfies the solution region:
(a) $y \leq 3x$, $y \leq x - 2$ and $x + 2y \leq 14$
(b) $y \geq 3x$, $y \geq x - 2$ and $x + 2y \leq 14$
(c) $y \geq 3x$, $y \geq x - 2$, $x + 2y < 14$, $x \geq 0$, $y \geq 0$
(d) $y \leq 3x$, $y \geq x - 2$ and $x + 2y \leq 14$



13. If $0 < x < 1$ then which of the following is greatest?
(a) x (b) x^2 (c) $\frac{1}{x}$ (d) $\frac{1}{x^2}$

14. $\int \frac{(logx)^3}{x}\, dx$ is equal to
(a) $\frac{3(logx)^2}{x} + c$ (b) $\frac{(logx)^4}{4} + c$ (c) $\frac{(logx)^4}{4x} + c$ (d) $\frac{1}{x^3}$

15. A statement made about population for testing purpose is called
(a) testing statistics (b) level of significance (c) statistics (d) hypothesis

16. If the probability distribution of X is

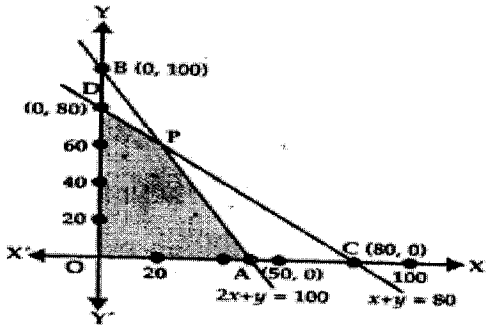
X	0	1	2	3	4
P(X)	0.2	3K	2K	2K	K

Then K =

(a) 1.5 (b) 0.10 (c) 0.05 (d) 0.15

17. The general pattern of increase or decrease of economic or social phenomena follows:
(a) irregular trend (b) secular trend (c) seasonal trend (d) cyclic trend

18. While solving a question in LPP by graphical method what is the shaded region is known as.....



(a) Feasible region
(b)Feasible solution
(c) Optimal region
(d)Objective region

19. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A : A box contains 12 bulbs of which 3 are defective. A sample of 4 bulbs is selected from the box. Let X denotes the number of defective bulbs in the sample. Then the random variable X cannot take the value 4.
Reason R : The sample contains 4 elements so X can take any of the values out of 0, 1, 2, 3 and 4.

In the light of the above statements, choose the most appropriate answer from the options given below.
(a) Both **A** and **R** are correct and **R** is the correct explanation of **A.**
(b) Both **A** and **R**are correct but **R** is NOT the correct explanation of **A.**
(c) **A** is correct but **R** is not correct.
(d) **A** is not correct but **R** is correct.

20. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R.**

Assertion A : The effective rate which is equivalent to nominal rate of 6% compounded semi-annually is 6.09%

Reason R : Effective rate is calculated as $\left(1+\frac{r}{100m}\right)^{m}-1$

In the light of the above statements, choose the most appropriate answer from the options given below.
(a) Both **A** and **R**are correct and **R** is the correct explanation of **A.**
(b) Both **A** and **R**are correct but **R** is NOT the correct explanation of **A.**
(c) **A** is correct but **R** is not correct.
(d) **A** is not correct but **R** is correct.

SECTION – B (Questions 21 to 25 carry 2 marks each)

21. If 200 misprints are distributed randomly throughout a book containing 500 pages, find the probability, using Poisson distribution, that a given page contains 2 or more misprints. (Given $e^{-0.4} = 0.670$)

22. Find the points of local maxima and minima for the function $f(x) = 2x^3 - 24x + 107$

23. Using the z table extract given on the last page find the following in reference to standard normal variate z.:
a) P (z > 0.84) b) P(z < – 0.13)

24. Find the quantity of water that must be added to 30 litres of milk at ₹60 per litre, so as to have a mixture worth ₹50 per litre.

OR

In a race of 600 m A can beat B by 60m and in a race of 500 m B can beat C by 50 m. By how much metres will A beat C in a race of 400 metre?

25. Paras invested ₹ 3,50,000 in a fund. At the end of the year the value of the fund is ₹ 4,37,500. What is the nominal rate of interest, if the market price is same at the end of the year?

OR

Rs. 250000 cash is equivalent to a perpetuity of Rs. 7500 payable at the end of the each quarter. What is the rate of interest convertible quarterly ?

SECTION – C (Questions 26 to 31 carry 3 marks each)

26. Let $A = \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} 5 & 2 \\ 7 & 4 \end{bmatrix}, and\ C = \begin{bmatrix} 2 & 5 \\ 3 & 8 \end{bmatrix}$. Find a matrix D such that CD – AB = O

27. Pipes A and B can fill a tank in 15 and 12 minutes respectively. Pipe C empties the tank at the rate of 2 litre per minute. If all the pipes are opened at the same time, the tank is filled in $8\frac{4}{7}$ minute. Find the capacity of the tank.

28. Mr. Om Parkash has invested ₹1,50,000 in a financial plan whose compound annual growth rate is 8.5% and he received a final value of ₹3,00,000. Find the period (completed) for which he has invested the amount. Given : (log 2 = 0.3010 and log 1.09 = 0.0374)

29. Calculate the quarterly trend values by the method of least square for quarterly data for last 5 years given below:

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1964	50	70	82	58
1965	78	114	110	98
1966	90	126	118	76
1967	98	132	126	144
1968	140	164	182	184

OR

Using the following data find out 4 quarterly centred moving average:

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1964	50	70	82	58
1965	78	114	110	98

30. A random sample of 12 families in one city showed an average weekly food expenditure of ₹1380 standard deviation of ₹100 and the random sample of 15 families in another city should an average weekly food expenditure of ₹1320 with the standard deviation of ₹120. Test whether the difference between the two means is significant at the level of significance of 0.01. Given: ($t_{25,\ 0.01} = 2.485$)

OR

A group of 10 foot surgery patients had a mean weight of 240 pounds. The sample standard deviation was 25 pounds. Find a confidence interval for a sample for the true mean weight of all foot surgery patients at 95% confidence interval. Given: ($t_{9,\ 0.05} = 2.2622$)

31. A machine cost a company ₹52,000 and its effective life is estimated to be 25 years. A sinking fund is created for replacing the machine by a new model at the end of its lifetime when its scrap releases a sum of Rs 2500 only. The price of the new model is estimated to be 25% more than the price of the present

one. Find what amount should be set aside at the end of each year out of the profit for the sinking fund, if it accumulates at 3.5% compounded annually. Given: $(1.035)^{25} = 2.3632$

SECTION – D (Questions 32 to 35 carry 5 marks each)

32. Find the adjoint of matrix $A = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ and hence show that A(Adj A) = |A|I where I is an identity matrix.

33. The demand and supply functions for a commodity are $p = x^2 - 6x + 16$ and $p = \frac{x^2}{3} + \frac{4x}{3} + 4$ respectively. Find the consumer's surplus at the equilibrium point when $x < 7$.

OR

The amount of oil pumped from one of the wells decreases at the continuous rate of 10% per year. After how many years will the wells output fall to one-fourth of its present value. (Given: **$\log_e 2 = 0.693$**)

34. For 6 trials of an experiment, let X be a binomial variate which satisfies a relation: 9P(x = 4) = P(X = 2). Find the probability of success.

OR

If the heights of 1000 students are normally distributed with mean 173 cm and standard deviation of 7.5 cm then

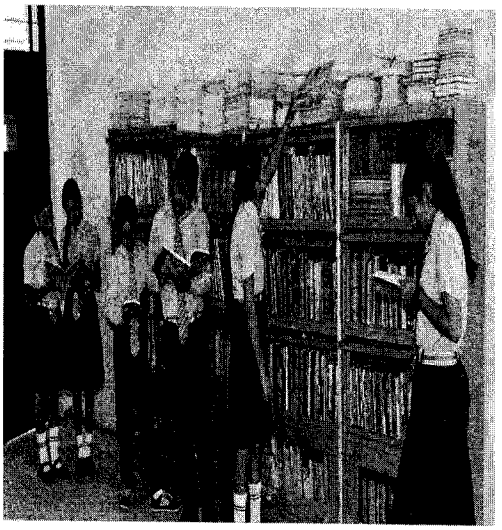
a) how many students have heights (i) greater than 183 cm (ii) less than 162.5 cm

b) 75% of the students have heights less than **h** cm. Find **h**. **(refer z-table on the last page)**

35. A dietician wishes to mix two types of foods in such a way that the vitamin contents of mixture contains atleast 8 units of vitamin A and 10 units of vitamin C. Food I contains 2 units per kg of vitamin A and 1 unit per kg of vitamin C, while food II contains 1 unit per kg of vitamin A an 2 units per kg of vitamin C. It costs Rs. 5 per kg to purchase food I and Rs. 7 per kg to purchase food II. Find the minimum cost of such a mixture. Formulate above as an LPP and solve it graphically.

SECTION – E- CASE STUDY (Questions 36 to 38 carry 4 marks each)

36. To enhance the reading skills of class 12 students the school nominates you and your friend to set a class library. There are 3 sections section A, B & C of class 12 having 32, 36 and 40 students respectively.



Based on the above information and using the concept of modular arithmetic only, answer the following questions

a. Find the remainder when sum of number of students of all the three sections is divided by 7.

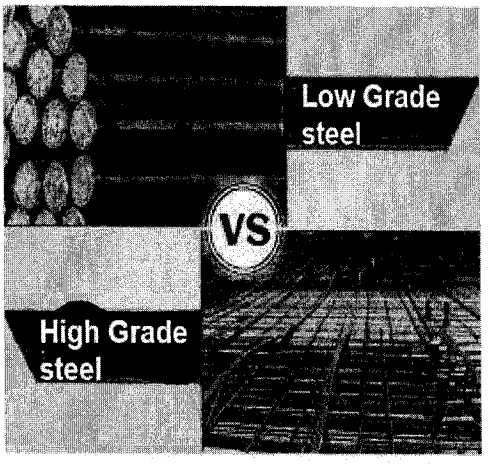
b. Find the unit digit of 3^n, where n is total number of students in the three sections.

c. Find $x \in \{1, 2, 3, 4\}$ such that $m \equiv x \bmod 7$ where m is the total number of students in section A and B only.

OR

If all the students were arranged in 15 rows and each row have equal number of students, then find how many students are left out of the last row.

37. A steel plant can produce x tons of a low-grade steel per day and 'y' tons of a high-grade steel per day, where $y = \frac{42-5x}{10-x}$. Let the fixed market price of low-grade steel be ₹ p per ton and the fixed market price of high grade is double of the low-grade steel.



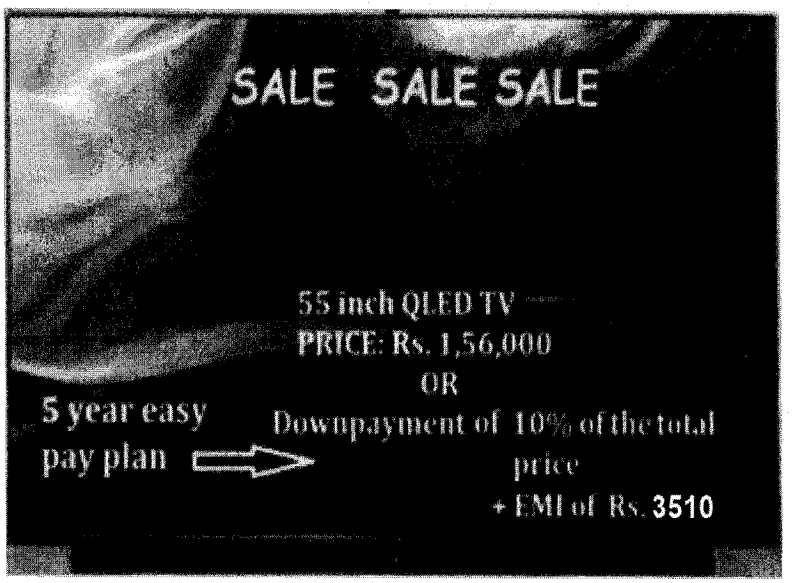
a) Show that the total revenue $R = px + 2p(\frac{42-5x}{10-x})$.

b) Show that 6 tons of low-grade steel are produced per day for the maximum total revenue.

OR

Show that 14 tons of low-grade steel are produced per day for the minimum total revenue.

38. Two close friends Sankar and Siraj found the adjoining advertisement in a local newspaper. Both always wished to have QLED TV at their homes but the exorbitant price of these TVs was out of their reach.



After going through the advertisement Siraj chose the 5 year easy plan paying out Rs. 3510 every month at flat interest rate of 10%.

a) Calculate the interest paid by Siraj?

Sankar discussed his interest of buying the QLED under the plan with his father who was a bank manager. He suggested Sankar to pay the down payment from his pocket and get the loan for the remaining amount from his bank at 12% reducing interest rate.

b) Calculate the EMI Sankar is going to pay to the bank if he goes with his father's idea.

c) Who out of Sankar and Siraj had a better deal? Given: $(1.01)^{-60} = 0.5504$

An extract of Z - Distribution Table

$P(z < a)$

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441

******END OF THE QUESTION PAPER******