MOCK EXAMINATION - I   2023 - 2024
APPLIED MATHEMATICS

Name : _____

Std / Sec : XII

Date :

Marks : 80

Time : 3hrs.

General Instructions:

1. This question paper contains five sections A, B, C, D and E and total of **38 questions**. 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.

Section – A:

3. It comprises of questions no **1-18 MCQs and 19 & 20 are Assertion-Reason based questions of 1 mark** each.

Section – B:

4. It comprises of questions no **21-25 VSA types questions of 2 marks** each.

Section – C:

5. It comprises of questions no **26-31 SA types of questions of 3 marks** each.

Section – D:

6. It comprises of questions no **32-35 LA types of questions of 5 marks** each.

Section – E:

7. It has **3 case studies** questions no **36-38**. 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.

9. **Use of Calculator not permitted.**

Section –A

(Each question (1-20) carries 1 mark each, all questions are compulsory. No internal choice in this section)

1. The least non-negative reminder when 3^{50} is dividend by 7 is

   (a) 4   (b) 3   (c) 2   (d) 1

2. The solution of $\frac{x-3}{x+5} > 0, x \neq -5, x \in R$, is

   (a) $x > 3$ (b) $x < -5$ (c) $x < -5$ or $x > 3$ (d) no solution

3. A machine makes car wheels and in a random sample of 26 wheels, the test statistic is found to be 3.07. As per t-distribution test (of 5% level of significance), what can you say about the quality of wheels produced by the machine? (Use t_{25} (0.05) = 2.06)

   (a) Superior quality   (b) Inferior quality   (c) Same quality   (d) Cannot say

4. The selection procedure of all the reality shows

   (a) Convenience Sampling   (c) Judgement Sampling

   (b) Voluntary Sampling   (d) Snowball Sampling

5. The ratio in which a grocer mixes two varieties of pulses costing ₹85 per kg and ₹100 per kg respectively so get a mixture worth ₹92 per kg is

   (a) 7:8   (b) 8:7   (c) 5:7   (d) 7:5

6. If the variance of a Poisson distribution is 2, then $P(X=2)$ is

(a) $\dfrac{2}{e^2}$ (b) $2e^2$ (c) $\dfrac{4}{e^2}$ (d) $4e^2$

7. Assume that current time is 07:00 p.m. what time (in a.m. or p.m.) will it be in 1000 hours

(a) 7 a.m. (b) 11 a.m. (c) 11 p.m. (d) 2 a.m.

8. A person invested ₹200000 in a fund for car. At the end of the year, the investment was worth ₹216000, then its rate of return is?

(a) 5% (b) 6% (c) 8% (d) 8.5%

9. $\int e^x\left(\log x + \dfrac{1}{x}\right)dx$ is

(a) $\log x + C$ (b) $e^x \log x + C$ (c) $e^x + C$ (d) $e^x\dfrac{1}{x} + C$

10. Seasonal Variations are

(a) Short term (b) Long term (c) sudden (d) None of these

11. An asset costing ₹80000 has a useful life of 8 year, if annual depreciation is ₹9000, then scrap value of asset is

(a) ₹9000 (b) ₹8000 (c) ₹10000 (d) ₹7000

12. The effective rate of interest which is equivalent to nominal rate of 8% compounded semi-annually is

(a) 8.24% (b) 8.10% (c) 8.16% (d) 8.32%

13. What amount should be deposited at the end of every 6 months to accumulate ₹50000 in 8 years, if money is worth 6% p.a. Compounded semi-annually? [Give $(1.03)^{16}=1.6047$]

(a) ₹3432.53 (b) ₹2783.08 (c) ₹2480.57 (d) ₹2149.93

14. The solution of the differential equation $\dfrac{dx}{x}+\dfrac{dy}{y}=0$ is

(a) $\dfrac{1}{x}+\dfrac{1}{y}=C$ (b) $xy=C$ (c) $\log x \log y = C$ (d) $x+y=C$

15. Let X be a discrete random variable whose probability distribution is given below:

$X = x_i$	0	1	2	3	4	5	6	7
$P(X = x_i)$	0	2k	2k	3k	k^2	$2k^2$	$2k^2$	2k

The value of k is

(a) $\dfrac{1}{10}$ (b) -1 (c) $-\dfrac{1}{10}$ (d) $\dfrac{1}{5}$

16. The general pattern of increase or decrease in economics or social phenomena is known as

(a) Irregular trend (c) Seasonal trend
(b) Secular trend (d) Cyclic trend

17. Mean of a normal variable X is 12 and standard deviation is 4, then what is the Z-Score of data point 20.

(a) 1 (c) 2 (c) 3 (d) 5

18. Graph of the inequalities $x \geq 0, y \geq 0, 2x + 3y \geq 6, 3x + 2y \geq 6$ is

(a)

(c)

(b)

(d)
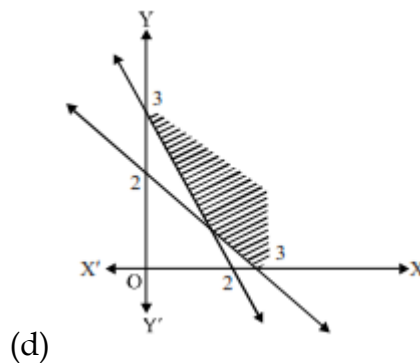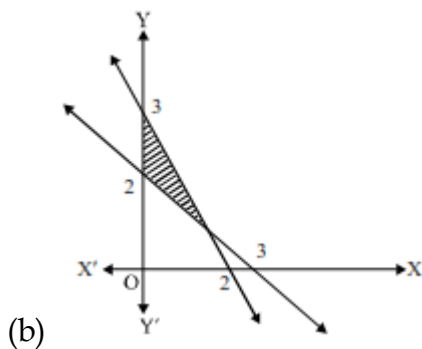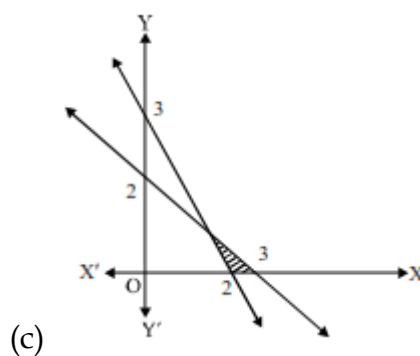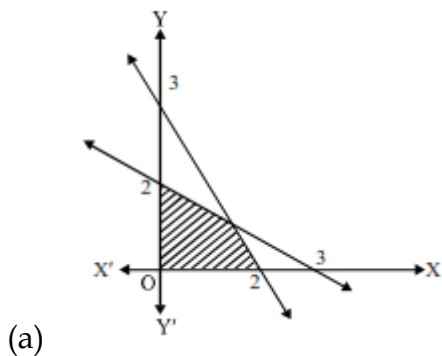
Directions (19-20) the below given questions are of the type Assertion and Reason. Each question contains Assertion and Reason. Each question has 4 choices (a), (b), (c) and (d)out of which ONLY ONE is correct. So, select the correct choice.

(a) Both the Assertion and Reason is true, and the reason is correct explanation for assertion.

(b) Both the Assertion and Reason is true, and the reason is not correct explanation for assertion.

(c) Assertion is true, reason is false

(d) Assertion is false, reason is true

19. **Assertion:** If the demand function of a product is $p = 200 - \dfrac{x^2}{3}$, then the marginal revenue (MR) of selling 10 units is ₹120.

   Reason: $MR = \dfrac{d}{dx}(R)$

20. **Assertion:** The probability of a man hitting a target is 0.25. He shoots 7 times and the probability of his hitting atleast twice is $\dfrac{4547}{8192}$.

   Reason: $P(X \geq 2)$

Section – B

(Each question (21-25) carries 2mark each, all questions are compulsory. In case of internal choice attempt only one question)

21. Find the present value of a perpetuity of ₹3,120 payable at the beginning of each year, if money is worth 6% effective.

3

22. (a) If $A = \begin{bmatrix} 2 & 1 & 0 \\ 3 & 1 & 2 \\ 0 & 4 & -1 \end{bmatrix}$, then find $|adjA|$.

(OR)

(b) If $X = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}, B = \begin{bmatrix} 5 & 2 \\ -2 & 1 \end{bmatrix}, A = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$ satisfy the equation AX=B, then find the matrix A.

23. A company produces soft drinks that have a contract which requires that a minimum of 80 units of chemical A and 60 units of the chemical B go into each bottle of the drink. The chemicals are available in prepared mix packets from two different suppliers. Supplier S had a packet of mix of 4 units of A and 2 units of B that costs 10. The supplier T has a packet of mix of 1 unit of A and 1 unit of B that costs 4. Formulate a Linear Programming Problem.

24. (a) A swimmer whose speed in swimming pool is 4km/h, swims between two points in a river and returns back to the starting point. He took 10 minutes more to cover the distance upstream than downstream. If the speed of the stream is 2km/h, find the distance between two points.

(OR)

(b) A pipe can fill a tank in 5 hours, while another pipe can empty it in 6 hours. If both the pipes are opened simultaneously, then find the time will be taken to fill the tank.

25. The mean weekly sales of mango candy in candy stores was 225.4 mango candy per store. After an advertising campaign the mean weekly sales in 25 stores for a typical week increased to 237.6 and showed a standard deviation of 21.3 was the advertising campaign successful? Level of confidence 5%.

[Given, $t_{24}(0.05) = 1.711$]

SECTION – C

(Each question (26-31) carries 3 marks each, all questions are compulsory. In case of internal choice attempt only one question)

26. (a) Evaluate: $\int_0^1 x^2 e^x dx$

(OR)

(b) Evaluate: $\int \dfrac{x^3}{x^4 + 3x^3 + 2} dx$

27. Cost of a pen and a notebook are ₹12 and ₹27 respectively. On a given day shopkeeper P sells 5 pens and 7 notebooks, whereas shopkeeper Q sells 6 pens and 4 notebooks. Find the money received by both the booksellers using matrix algebra.

28. The volume of a spherical balloon is increasing at the rate of 3 cm³/sec. Find the rate of change of its surface area when its radius is 2 cm.

29. (a) The demand and supply function of an article are $D(q) = 1000 - 0.4q^2$ and $S(q) = 42q$. Find the producer's surplus at equilibrium price.

(OR)

(b) Rakesh and Kartik are final year engineering students. Both are selected in their campus interviews and got placement in a reputed company. But both of them decide to start their own business. For this they are surveying the market. During their survey they find the demand curve for a certain item is $p = D(q) = \dfrac{20}{q+1}$ and the supply curve is $p = S(q) = q+2$. Find consumer surplus. [Given $\log_e 2 = 0.6932$]

30. Surjeet purchased a new house, costing ₹40,00,000 and made a certain amount of down payment so that he can pay the balance by taking a home loan from XYZ Bank. If his equated monthly instalment is ₹30,000, at 9% interest compounded monthly (reducing balance method) and payable for 25 years, then what is the initial down payment made by him?
    [Use $(1.0075)^{-300} = 0.1062$]

31. Sinking A company XYZ borrowed ₹1.5 lakhs for reformation. The company plans to set up a sinking fund that will pay back the loan at the end of 3 years. Assuming a rate of 9% compounded quarterly and the sinking fund of the ordinary annuity.
    [Given that $(1.0225)^{12} = 1.3060$].

SECTION – D

(Each question (32-35) carries 5 marks each, all questions are compulsory. In case of internal choice attempt only one question)

32. (a) A traffic engineer records the number of bicycle riders that use a particular cycle track. He records that an average of 3.2 bicycle riders use the cycle track every hour. Given that the number of bicycles that use cycle track follow a Poisson distribution, what is the probability that
    (i) 2 or less bicycle riders will use the cycle track within an hour?
    (ii) 3 or more bicycle riders will use the cycle track within an hour?

    Also, write the mean expectation and variance for the random variable hour X. [Given $e^{-3.2}=0.041$]

(OR)
    (b) In a game, a man wins ₹5 for getting a number greater than 4 and loses ₹1 otherwise, when a fair die is thrown. The man decided to throw a die rice but to quit as and when he gets a number greater than 4. Find the expected value of the amount he wins/loses.

33. A company manufactures two types of cardigons: Type A and Type B. It costs ₹360 to make a type A cardigan and ₹120 to make a type B cardigan. The company can make atmost 300 cardigons and spend atmost ₹72000 a day. The number of cardigons of type B cannot exceed the number of cardigons of type A by more than 200. The company makes a profit of ₹100 for each cardigan of type A and ₹50 for every cardigan of type B. Formulate this problem as a linear programming problem to maximize the profit of the company. Solve it graphically and find maximum profit.

34. (a) Divide a number 15 into two parts such that the square of one part multiplied with the cube of the other part is maximum.

(OR)

(b) The demand function is $x = \dfrac{24 - 2p}{3}$, where x is the number of units demanded and p is the price per unit. Find:

(i) the revenue function R terms of p.
(ii) the price and the number of units demanded for which demanded for which the revenue is maximum.

35. Two factories decided to award their employees for three values of (a) adaptable new techniques, (b) careful and alert in difficult situations and (c) keeping calm in tense situations, at the rate of Rs x, Rs y and Rs z per person respectively 2, 4 and 3 employees with a total prize money of ₹29,000. The second factory decided to honour respectively 5, 2 and 3 employees with the prize money of ₹30,500. If the three prizes per person together cost ₹9500; then (i) Represent the above situation by a matrix equation and form linear equations using matrix multiplication (ii) Solve these equations using matrices.

SECTION – E

(All the questions (36-38) are compulsory. In case of internal choice attempt only one question)

36. Case Study I:

Akshay and Ritesh are the neighbours. They are studying in the same school. Both are taking tuitions from the same teacher. One day they have a combined tuition class in which the teacher explains about the topic Alligation and Mixtures. Teacher said, according to alligation rule, if two ingredients at a given price are mixed to produce a mixture at given price, the ratio of quantity of cheaper ingredient and quantity of dearer ingredient must be mixed in proper ratio.

Based on the above information, answer the following questions:

(a) In what ratio must a grocer mix two varieties of pulses costing ₹15 and ₹20 per kg respectively so as to get a mixture worth ₹16.50 kg?   **[1m]**
(b) In what ratio must rice at ₹9.30 per kg be mixed with rice at ₹10.80 per kg so that the mixture be worth ₹10 per kg?   **[1m]**
(c) Five litres of water is added to a certain quantity of pure milk costing ₹60 per litre. If by selling the mixture at same price as before, a profit of 20% is made, what is the amount of pure milk in the mixture?   **[2m]**

(OR)

Two liquids one mixed in the proportion 3:2 and the mixture is sold at ₹110 per litre at 10% profit. If first liquid costs ₹20 more per litre than the second, what does it cost per litre? **[2m]**

37. Case Study II:

Two friends wanted to play a game. So, they started to play with a coin by tossing it. A fair coin is tossed and getting head is considered a success.

A coin is tossed six times,

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

(a) Find the value of n and p for this experiment.   **[1m]**
(b) Find the probability of getting exactly 4 heads   **[1m]**
(c) Find the probability of getting atleast 4 heads   **[2m]**

(OR)

In a binomial experiment, if n=5 and $P(X = 0) = \dfrac{32}{243}$, then find the value of $P(X = 3)$. **[2m]**

38. Case Study III:

The average number (in lakh) of working days lost in strikes during each year of the working period 2011-2020 was

Years	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average	1.5	1.8	1.9	2.2	2.6	3.7	2.2	6.4	3.6	5.4

Use 3 yearly moving averages.

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

(a) Determine the trend value for the year 2012.   **[1m]**
(b) Determine the trend value for the year 2015.   **[1m]**
(c) Draw moving average graph   **[2m]**

*********************All the best******************