

CBSE

CLASS 12

2022-23

Applied Mathematics

5 AMPLE PAPERS

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Dedicated to



NIRMAN HIGH SCHOOL
(A NON NIRMA INITIATIVE)

Maheshwar Sir
PGT (Mathematics & Applied mathematics)

Sample Paper 1

Applied Mathematics

(Code241)

Time Allowed: 3 hrs.

Maximum Marks: 80

General Instructions:

1. This question paper contains five sections A, B, C, D and E. 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 **20 MCQs of 1 mark** each.

Section – B:

4. It comprises of **5 VSA type questions of 2 marks** each.

Section – C:

5. It comprises of **6 SA type of questions of 3 marks** each.

Section – D:

6. It comprises of **4 LA type of questions of 5 marks** each.

Section – E:

7. It has **3 case studies**. 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.

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.

Section A

- 1 $\Omega(32)$ is equal to 1
a) 1
b) 3
c) 5
d) 7
- 2 $(9:30 + 16:40)$ in 24 hours clock is 1
a) 03:10
b) 26:10
c) 2:10
d) 25:70
- 3 Milk and water in two vessels A and B are in the ratio 5:3 and 5:4 1
respectively . In what ratio the liquid of both the vessels be mixed to
obtain n new mixture in which ratio of milk and water is 7:5
respectively ?
a) 3:2
b) 3:5
c) 2:3
d) 2:5
- 4 A boat running downstream covers a distance of 16 km in 2 hours while 1
for covering the same distance upstream it takes 4 hours. What is the
speed of the boat in still water ?
a) 4 km/h
b) 6 km/h
c) 8 km/h
d) 10 km/h
- 5 What sum of money invested now could establish a scholarship of 1
Rs.2500 , which is to be awarded at the end of every year forever, if
money is worth 4% compounded annually ?
a) Rs.62500
b) Rs.125000
c) Rs.31250
d) None of these.
- 6 Find the effective rate that is equivalent to a nominal rate of 12% 1
compounded quarterly . Use $(1.03)^4 = 1.1255$
a) 0.1255

- b) 1.2364
c) 12.365
d) 135.7
- 7 Nisha started a business with Rs. 540000. After few months kusum joined her with an investment of Rs. 720000. If at the end of a year they shared the profit equally, then find after how many months Kusum joined Nisha ? 1
- a) 3
b) 6
c) 9
d) 10
- 8 If $\int x e^{kx^2} dx = \frac{1}{4} e^{2x^2} + c$, then the value of k is 1
- a) 4
b) -2
c) 2
d) 1
- 9 $\int \frac{1}{e^x + e^{-x} + 2} dx$ is equal to 1
- a) $\frac{1}{e^x+1} + c$
b) $\frac{1}{1+e^{-x}} + c$
c) $-\frac{1}{e^x+1} + c$
d) None of these
- 10 For the following distribution : 1
- | | | | | | |
|------|-----|-----|-----|-----|-----|
| X | -4 | -3 | -2 | -1 | 0 |
| P(X) | 0.1 | 0.2 | 0.3 | 0.2 | 0.2 |
- E(X) is equal to
- a) 6
b) 4
c) 3
d) -5
- 11 For a random variable X, $E(X) = 3$ and $E(X^2) = 11$. Then variance of X is 1
- a) 8
b) 5
c) 2
d) 1

- 12 A die is rolled thrice. If the event of getting an even number is success, 1
then the probability of getting at least two successes is
- a) $7/8$
 - b) $1/8$
 - c) $2/3$
 - d) $1/2$
- 13 A coin is tossed 10 times . the probability of getting exactly six heads is 1
 $10C_6$
- a) $511/512$
 - b) $105/512$
 - c) $21/512$
 - d) $32/512$
- 14 A bag contains 2 white and 4 black balls. A ball is drawn 5 times with 1
replacement . The probability that atleast 4 of the balls drawn are
white is
- a) $8/243$
 - b) $10/243$
 - c) $11/243$
 - d) $32/243$
- 15 In series of three trials, the probability of two successes is 9 times the 1
probability of three successes. Then, the probability of success in each
trail is
- a) $3/4$
 - b) $1/2$
 - c) $1/3$
 - d) $1/4$
- 16 A specific characteristics of a sample is known as a 1
- a) Population
 - b) Parameter
 - c) Statistics
 - d) Variance
- 17 $\int (1 + x + \sqrt{(x + x^2)})/\sqrt{x + \sqrt{(1 + x)}} dx$ is equal to 1
- a) $\frac{1}{2}\sqrt{1 + x} + c$
 - b) $\frac{2}{3}(1 + x)^{\frac{3}{2}} + c$
 - c) $2(1 + x)^{\frac{2}{3}} + c$
 - d) $\sqrt{1 + x} + C$

- 18 If $\int_0^4 \frac{1}{2x+1} dx = \log k$, then the value of k is
- 3
 - $9/2$
 - 9
 - None of these

1

For questions 19 and 20, two statements are given – one labelled Assertion(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:

- Both A and R are true and R is the correct explanation of the assertion
 - Both A and R are true but R is not the correct explanation of the assertion
 - A is true, but R is false
 - A is false, but R is true
- 19 Assertion : $A(AB)$ and $(AB)A$ are symmetric matrices . Reason : AB is symmetric matrix if matrix multiplication of A with B is commutative .
- 20 Assertion : if A is a symmetric matrix, then $B'AB$ is also symmetric. Reason : $(ABC)' = C'B'A'$

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Section B

- 21 A boatman takes half as much time in rowing his boat for a certain distance downstream than upstream. What is the ratio between his speed of rowing the boat in still water and speed of current?
- 22 Compute the indicated product : $\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix} [2 \ 3 \ 4]$
- OR**
- Find the value of $2a + 3b - c$, if $A = \begin{bmatrix} 0 & -1 & 28 \\ a-8 & 0 & 3b \\ -c+a & 2 & 0 \end{bmatrix}$ is skew-symmetric matrix.
- 23 A retired person wants to invest an amount of upto Rs.20000. his broker recommends investing in two types of bonds A and B, bond A yielding 8% return on the amount invested and bond B yielding 7% return on the amount invested . After some consideration , he decides

2

2

2

to invest at least Rs.5000 in bond A and no more than Rs.8000 in bond B. he also want to invest at least as much in bond A as in bond B. Formulate as L.P.P to maximize his return on investments.

- 24 For a Poisson distribution , find (i) $P(2)$, given $\lambda=1$,(ii) $P(3)$, given $\lambda=1/2$ 2
.(given $e^{-1} = 0.368$)
- 25 Mitul 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? 2

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

- 26 A manufacturing produces three products x,y,z which he sells in two markets. Annual sales are indicated below : 3

Market	Product		
	X	Y	Z
1	10000	2000	18000
2	6000	20000	8000

- a. If units sales price of x,y and z are Rs.2.50,Rs. 1.50 and Rs.1.00 , respectively , find the total revenue in each market with the help of matrix algebra .
- b. If the unit costs of the above three commodities are Rs.2.00 , Rs. 1.00 and 50 paisa respectively. Find the gross profit .
- 27 The demand function for a commodity is given by $p= 4-x^2$ find the consumer's surplus when the market demand is 1 . 3
- 28 The following data shows the percentage of rural ,urban and suburban Indians who have a high speed internet connection at home . 3

Year	Rural	Urban	Suburban
2001	3	9	9
2002	6	18	17
2003	9	21	23
2004	16	29	29
2005	24	38	40

1. A Straight line trend by the method of least square for the rural Indians is what ?
 2. A straight line trend by the method of least square for the urban Indians is what ?
- 29 a. A can run 22.5 m while B runs 25 m in the same time . In a 1000 m race , find by how much distance B beats A ? 3
b. In a 600 m race , A beats B by 37.5 m or by 10 seconds, find the time taken by B to finish the race .
- 30 A person has set up a sinking fund in order to have Rs. 1,00,000 after 10 years for his children's college education. How much amount should be set aside bi-annually into an account paying 5% per annum compounded half yearly ? Use : $(1.025)^{20} = 1.6386$ 3

OR

Surjeet purchased a new house , costing Rs. 4000000 and made a certain amount of down payment so that he can pay the balance by taking a home loan from IDFC bank. If his equated monthly instalment is Rs. 30000, at 9% interest compounded monthly (RBM) and payable for 25 years , then what is the initial down payment made by him ?
Use $(1.0075)^{-300} = 0.1062$

Section D

- 31 a. A can run 22.5 m while B runs 25 m in the same time . In a 1000 m race , find by how much distance B beats A ? 5
b. In a 600 m race , A beats B by 37.5 m or by 10 seconds, find the time taken by B to finish the race .
- 32 A firm has the cost function $C = \frac{x^3}{3} - 7x^2 + 11x + 50$ and demand fuction $x = 100 - p$ 5
a) write the total revenue function in term of x.
b) formulate the total profit function P in terms of x.
c) find the profit maximizing level of output x.
d) what is the maximum profit ?
- 33 The marks obtained in a certain examination follow normal distribution with mean 30 and standard deviation 10. If 1000 students appeared in the examinations , calculate the number of students scoring 5
I. less than 33 marks
II. more than 50 marks
III. between 30 and 45 marks .

OR

A diet is to contain at least 80 units of vitamin A and 100 units of minerals. Two foods F1 and F2 are available . food F1 cost Rs. 4 per kg and F2 costs Rs. 5 per kg .One kg of food F1 contains 3 units of vitamin A and 4 units of minerals. One kg of food F2 contains 6 units of vitamin A and 3 units of minerals. We wish to find the minimum cost for diet that consists of mixture of these two foods and also meets the minimum nutritional requirements . formulate this as a L.P.P.

34 The poll results of AAll for the week ending December 31,2012 are 5
follows

Bullish 208

Bearish 150

Neutral 142

- The point estimate of the population proportion of all AAll subscribes who are neutral is what ?
- A 95 % confidence interval for the population proportion of AAll subscribers who are bearish , is what value ?

The point estimate of the population proportion of all AAll subscribes who are bullish, is what ?

OR

1.Multiplicative Model is

- $O=T \times C \times S \times L$
- $O=T \times C \times S \times L$
- $O=TC \times SL$
- $O=TC \times S \times L$

2.Additive Model is

- $O=T-C+S+L$
- $O=T+C+S-L$
- $O=T+C-S+L$
- $O=T+C+S+L$

3.Irregular variations in a time series are caused by

- Lockouts and strikes
- Epidemics
- Floods
- All of above

4.For the given values 15,24,18,33,42 the three years moving average are

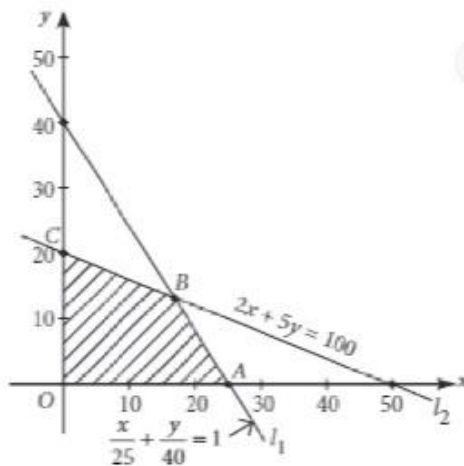
- 19,22,33
- 19,25,31
- 19,30,31
- 19,25,33

5. The rise in prices before Diwali is an example of
- Seasonal trend
 - Cyclical trend
 - Long term trend
 - Irregular trend

Section E

- 35 Rekha rides her car at 25 km/hr. She has to spend Rs. 3 per km on diesel and if she rides it at a faster speed of 40 km/hr, the diesel cost increases to Rs. 5 per km. She has Rs. 100 to spend on diesel. Let her travel x kms with speed 25 km/hr and y kms with speed 40 km/hr. The feasible region for the LPP is shown below.

Diagram:



1

1

2

- What is the point of intersection of line l_1 and l_2 .
 - $Z = x + y$ be the objective function and $\max Z = 30$. The maximum value occurs at point is what ?
 - What is the maximum value of Z if $Z = 6x - 3y$?
- OR**
- What is the minimum value of Z if $Z = 6x + 3y$?
- 36 The cost function for a certain commodity is $C(x) = 3 + 2x - \frac{1}{4}x^2$. Write the various cost components when 4 times are produced.

4

Commodity



- a). TC and TFC
 b). TVC and AC
 C). AFC and AVC **OR** verify your results.
- 37 The following data shows the percentage of rural ,urban and suburban Indians who have a high speed internet connection at home .



Year	Rural	Urban	Suburban
2001	3	9	9
2002	6	18	17
2003	9	21	23
2004	16	29	29
2005	24	38	40

1

- a) A Straight line trend by the method of least square for the rural Indians is what ?
- b) A straight line trend by the method of least square for the urban Indians is what ?
- c) What is the forecast for the year 2006 for urban group using trend line equation ?

1

2

OR

What is the forecast for the year 2006 for rural group using trend equation ?

Do Your Best

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Sample Paper 2

Applied Mathematics

(Code241)

Time Allowed: 3 hrs.

Maximum Marks: 80

General Instructions:

1. This question paper contains five sections A, B, C, D and E. 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 **20 MCQs of 1 mark** each.

Section – B:

4. It comprises of **5 VSA type questions of 2 marks** each.

Section – C:

5. It comprises of **6 SA type of questions of 3 marks** each.

Section – D:

6. It comprises of **4 LA type of questions of 5 marks** each.

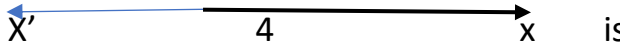
Section – E:

7. It has **3 case studies**. 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.

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.

Section A		
1	<p>If there are two values of a which makes determinant , $\Delta =$</p> $\frac{1}{2} \begin{vmatrix} 1 & -2 & 5 \\ 2 & a & -1 \\ 0 & 4 & 2a \end{vmatrix} = 86,$ <p>then the sum of these number is</p> <p>a) 4 b) 5 c) -4 d) 9</p>	1
2	<p>How much money is needed to ensure a series of lectures costing Rs. 3000 at the beginning of each year indefinitely , if the money is worth 4 % compounded annually.</p> <p>a) 78500 b) 79800 c) 78000 d) 87000</p>	1
3	<p>Centuries ago, marwadi families in the rajasthan established a fund to further welfare and education. From this fund ,only the interest revenue was allowed to be spent , in order to keep the principal unattached. Assume the fund has amounted to Rs. 2 million and market interest rate is 6 % annually .so what would be the monthly income to society ?</p> <p>a) 10500 b) 11000 c) 12000 d) 25000</p>	1
4	<p>Uses of Sinking Fund ...</p> <p>a) Future expansion of business b) To pay off debenture issue c) Repair building d) All of above</p>	1
5	<p>The beginning value of the investment is Rs. 10000 and the ending value of investment is Rs. 14000 over a period of 2 years , calculate CAGR .(Use $\sqrt{1.4} = 1.1832$)</p> <p>a) 8.32% b) 18.32% c) 183.2%</p>	1

	d) 0.1832%							
6	<p>Year end revenues of a firm over a three-year period are given by</p> <table border="1"> <thead> <tr> <th>Year end</th> <th>31.12.2019</th> <th>31.12.2022</th> </tr> </thead> <tbody> <tr> <td>Year end Revenue</td> <td>9000</td> <td>13000</td> </tr> </tbody> </table> <p>Calculate CAGR over the three-year period spanning the end of 2019 to the end of 2022. (Use $\sqrt[3]{1.4444} = 1.300$)</p> <p>a) 12.95% b) 13.10% c) 13% d) 1.30%</p>	Year end	31.12.2019	31.12.2022	Year end Revenue	9000	13000	1
Year end	31.12.2019	31.12.2022						
Year end Revenue	9000	13000						
7	<p>A money-lender charges interest at the rate of 100 rupees per 1000 rupees per half year , payable in advanced . what is the effective rate of interest per annum of lender ?</p> <p>a) 23.73% b) 23.67% c) 23.45% d) None of these</p>	1						
8	<p>For manufacturing a certain item, the fixed cost is Rs.9000 and the variable cost producing each unit is Rs. 30 . The average cost of producing 60 units is</p> <p>a) Rs. 150 b) Rs.180 c) Rs.240 d) Rs.120</p>	1						
9	<p>The function $f(x) = x(x - 3)^2$ decreases for the values of x given by</p> <p>a) $1 \leq x \leq 3$ b) $x \leq 0$ c) $x \geq 0$ d) $0 \leq x \leq \frac{3}{2}$</p>	1						
10	<p>The least value of the function $f(x) = ax + \frac{b}{x}$ ($x > 0, a > 0, b > 0$) is</p> <p>a) \sqrt{ab} b) $2\sqrt{ab}$ c) ab d) $2ab$</p>	1						
11	<p>Given that x,y and b are real numbers and $x < y, b < 0$, then</p> <p>a) $\frac{x}{b} < \frac{y}{b}$ b) $\frac{x}{b} \leq \frac{y}{b}$</p>	1						

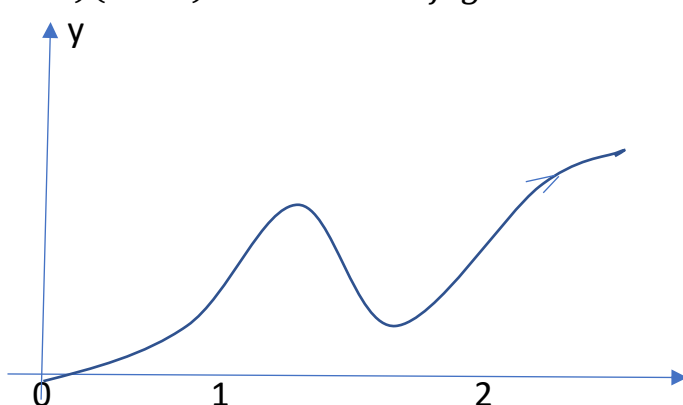
	<p>c) $\frac{x}{b} > \frac{y}{b}$ d) $\frac{x}{b} \geq \frac{y}{b}$</p>	
12	<p>The solution of the linear inequality in x represented on number line as</p>  <p>is</p> <p>a) $x \in [4, \infty)$ b) $x \in (4, \infty)$ c) $x \in (-\infty, 4)$ d) $x \in (-\infty, 4]$</p>	1
13	<p>Maximize $Z = 3x + 5y$ Subject to $x + 2y \leq 20$ $x + y \leq 15$ $y, = 5$ $x, y \geq 0$</p> <p>a) 52 b) 55 c) 25 d) 45</p>	1
14	<p>The feasible region (shaded) for a L.P.P. is shown in the figure. The maximum $Z = 5x + 7y$ is</p> <p>a) 49 b) 23 c) 43 d) 40</p>	1
15	<p>The point which does not belong to the feasible region of the LPP : Minimize : $Z = 60x + 10y$ subject to $3x + 2y \geq 18, 2x + 2y \geq 12, x = 2y \geq 10, x, y \geq 0$ is</p> <p>a) (0,8) b) (4,2) c) (6,2) d) (10,2)</p>	1
16	<p>Maximize $Z = x + 2y$, subject to the constraints $x + 2y \geq 100, 2x - y \leq 0, 2x + y \leq 200, x, y \geq 0$ by graphical method.</p> <p>a) 356 b) 659 c) 298 d) 400</p>	1

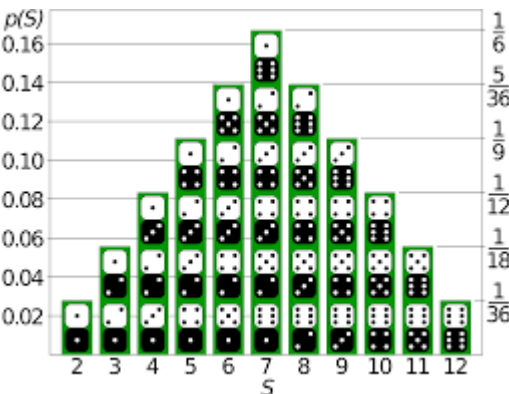
17	<p>For predicting the straight-line trend in the sales of scooters (in thousands) on the basis of 6 consecutive years data, the company makes use of 4-year moving averages method. If the sales of scooters for respective years are a, b, c, d, e and f respectively, then which of the following average will not be computed?</p> $\frac{a + b + c + d}{4}$ $\frac{e + b + c + d}{4}$ $\frac{a + e + c + d}{4}$ $\frac{f + e + c + d}{4}$	1
18	<p>Full Form of CAGR is</p> <ol style="list-style-type: none"> Common annual growth Rate Compound annual growth Rise Compound annual growth Rate Compress annual great rate 	1
	<p>For questions 19 and 20, two statements are given – one labelled Assertion(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:</p> <ol style="list-style-type: none"> Both A and R are true and R is the correct explanation of the assertion Both A and R are true but R is not the correct explanation of the assertion A is true, but R is false A is false, but R is true 	
19	<p>Assertion (A): EMI is equal to Equated Monthly Installment Reason (R) : Its is related to share market Equity .</p>	1
20	<p><u>Assertion</u> (A) : Kuhu and Beena are two equally capable badminton players. Probability that Beenawill beat Kuhu in 3 games out of 4 is 25%</p> <p><u>Reason</u> (R) : The probability of r successes in n trials, denoted by $P(X = r)$ is given by $P(X = r) = {}^n C_r p^r q^{n-r}$, $r = 0, 1, \dots, n$ where p denotes success and q denotes failure in each trial.</p>	1

Section B		
21	<p>A retired person wants to invest an amount of upto Rs.20000. his broker recommends investing in two types of bonds A and B, bond A yielding 8% return on the amount invested and bond B yielding 7% return on the amount invested . After some consideration , he decides to invest at least Rs.5000 in bond A and no more than Rs.8000 in bond B. he also want to invest at least as much in bond A as in bond B. Formulate as L.P.P to maximize his return on investments.</p> <p>OR</p> <p>A book publisher sells a hard cover edition of a book for Rs. 72 and a paperback edition for Rs.40 .In addition to a fixed weekly cost of Rs. 9600, the cost of printing hardcover and paperback editions are Rs.56 and Rs. 28 per book respectively . Each edition requires 5 minutes on the printing machine whereas hardcover binding takes 10 mins and paperback takes 2 minutes on the binding machine . The printing machine and the binding machine are available for 80 hours each week . formulate the linear programming problem to maximise the publisher's profit .</p>	2
22	<p>A furniture dealer deals in only two items tables and charis. He has Rs. 20000 to invest and a space to store at most 80 pieces . a table costs him Rs 800 and a chair costs him Rs.200. he can sell a table Rs.950 and a chair for Rs.280 . Assume that he can sell the items that he buys. Formulate this problem as an L.P.P. so that he can maximize his profit .</p>	2
23	<p>A simple random sample of 50 items from a population with $\sigma = 6$ resulted in a simple mean of 32. Provide a 95% confidence interval for the population mean .</p>	2
24	<p>Compute the indicated product : $\begin{bmatrix} 2 & 1 \\ 3 & 2 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 1 \\ -1 & 2 & 1 \end{bmatrix}$</p> <p style="text-align: center;">OR</p> <p>There are two value(s) of x , for which the value of the determinant $\Delta =$</p> $\begin{vmatrix} 1 & -2 & 5 \\ 2 & x & -1 \\ 0 & 4 & 2x \end{vmatrix} = 86.$	2
25	<p>Evaluate : $\int_{1/3}^1 \frac{(x-x^3)^{(\frac{1}{3})}}{x^4} dx$</p>	2

Section C										
26	<p>a. A can run 22.5 m while B runs 25 m in the same time . In a 1000 m race , find by how much distance B beats A ?</p> <p>b. In a 600 m race , A beats B by 37.5 m or by 10 seconds, find the time taken by B to finish the race .</p>	3								
27	<p>Find all pairs of consecutive even positive integers , both of which are larger than 5 , such that their sum is less than 23.</p> <p style="text-align: center;">OR</p> <p>10 years ago , Mr. mehta set up a sinking fund to save for his son 's higher education . at the end of 10 years he has received an amount of Rs. 1021760. What amount did he put in the sinking fund at the end of every 6 month for the tenture , which paid him 5 % p.a. compounded semi - annually ?Use $(1.025)^{20} = 1.6386$</p>	3								
28	<p>For what value of x : $[1 \quad 2 \quad 1] \begin{bmatrix} 1 & 2 & 0 \\ 2 & 0 & 1 \\ 1 & 0 & 2 \end{bmatrix} \begin{bmatrix} 0 \\ 2 \\ x \end{bmatrix} = 0$</p>	3								
29	<p>Find the value of k if area of triangle is 4 sq. units and vertices are</p> <p>i. $(k,0) ,(4,0)$ and $(0,2)$</p> <p>ii. $(-2,0) ,(0,4)$ and $(0,k)$</p>	3								
30	<p>Consider the following hypothesis test :</p> <p>$H_0 : \mu_1 - \mu_2 = 0$</p> <p>$H_a : \mu_1 - \mu_2 \neq 0$</p> <p>The following results are from independent sample taken from two population :</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Sample 1</th> <th style="width: 50%;">Sample 2</th> </tr> </thead> <tbody> <tr> <td>$n_1=35$</td> <td>$n_2=40$</td> </tr> <tr> <td>$\bar{x}_1=13.6$</td> <td>$\bar{x}_2=10.1$</td> </tr> <tr> <td>$S_1=5.2$</td> <td>$S_2=8.5$</td> </tr> </tbody> </table> <p>a. What is the value of the test statistics ?</p> <p>b. What is the p-value ?</p> <p style="text-align: center;">At $\alpha=0.05$, what is your conclusion ?</p>	Sample 1	Sample 2	$n_1=35$	$n_2=40$	$\bar{x}_1=13.6$	$\bar{x}_2=10.1$	$S_1=5.2$	$S_2=8.5$	3
Sample 1	Sample 2									
$n_1=35$	$n_2=40$									
$\bar{x}_1=13.6$	$\bar{x}_2=10.1$									
$S_1=5.2$	$S_2=8.5$									
31	<p>A person buys a house for which he agrees to pay Rs.5000 at the end of the each month for 8 years. If money is worth 12 % converted monthly , what is the cash price of the house ?(Use : $(1.01)^{-96} = 0.3847229701$</p> <p style="text-align: center;">OR</p>	3								

	Under the pure market competition scenario , the demand function $p_d = \frac{8}{x+1} - 2$ and $p_s = \frac{x+3}{2}$ respectively, where p is the price and x is the quantity of the commodity . Using integral , find the producer's surplus .																			
	Section D																			
32	A loan of Rs.250000 at the interest rate of 6% p.a. compounded monthly is to be amortized by equal payments at the end of end of each month for 5 years , find (Given $(1.005)^{60} = 1.3489$, $(1.005)^{21} = 1.1104$) i. The size of each monthly payment. ii. The principal outstanding at beginning of 40 th month . iii. Interest paid in 40 th payment. iv. Principal contained in 40 th payment Total interest paid .	4																		
33	A person amortizes a loan of Rs.1500000 for renovation of his house by 8 years mortgage at the rate of 12 % p.a. compounded monthly . find (Use $(1.01)^{96} = 2.5993$, $(1.01)^{57} = 1.7633$) i. The equated monthly installment. ii. The principal outstanding at the beginning of 40 th month . iii. The interest paid in 40 th payment . iv. The principal contained in 40 th payment . v. Total interest paid . vi. OR It is known that 3% plastics buckets manufacturing in a factory are defective . using the Poisson distribution on a sample of 100 buckets ,find the probability of a. zero defective buckets b. at most one bucket is defective Use $e^{-3} = 0.049$	5																		
34	Fit a straight line trend by the method of least squares and tabulate the trend values from the following data: <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Year</th> <th>2011</th> <th>2012</th> <th>2013</th> <th>2014</th> <th>2015</th> <th>2016</th> <th>2017</th> <th>2018</th> </tr> </thead> <tbody> <tr> <td>Sales (in Rs. Crores)</td> <td>6.7</td> <td>5.3</td> <td>4.3</td> <td>6.1</td> <td>5.6</td> <td>7.9</td> <td>5.8</td> <td>6.1</td> </tr> </tbody> </table>	Year	2011	2012	2013	2014	2015	2016	2017	2018	Sales (in Rs. Crores)	6.7	5.3	4.3	6.1	5.6	7.9	5.8	6.1	5
Year	2011	2012	2013	2014	2015	2016	2017	2018												
Sales (in Rs. Crores)	6.7	5.3	4.3	6.1	5.6	7.9	5.8	6.1												
35	In a bank , principal increase continuously at the rate of 5 % per year . In how many years Rs. 1000 double itself ? OR The equilibrium conditions for three competitive markets are describe as given below .	5																		

	$x + 2y + 3z = 85;$ $3x + 2y + 2z = 105$ $2x + 3y + 2z = 110$ <p>Use matrix method , find the value of respectively equilibrium prices.</p>	
	Section E	
36	<p>A particle is moving along the curve represented by the polynomial $f(x) = (x - 1)(x - 2)^2$ as shown in figure .</p> 	
	<p>1). The critical points of polynomial $f(x)$ are :</p> <p>a) 2, -4/3 b) 2, 4/3 c) -2, -4/3 d) -2, 4/3</p>	1
	<p>2). The interval where $f(x)$ is strictly increasing is</p> <p>a) $(-\infty, \frac{4}{3}] \cup [2, \infty)$ b) $(-\infty, -\frac{4}{3}] \cup [2, \infty)$ c) $[2, \infty)$ d) $(-\infty, \frac{4}{3}]$</p>	1
	<p>3). The interval where $f(x)$ is strictly decreasing is</p> <p>a) $[\frac{4}{3}, 2]$ b) $[-\frac{4}{3}, 2]$ c) $[0, 2]$ d) None of these</p>	1
	<p>4). What is the local minimum value of $f(x) = (x - 1)(x - 2)^2$?</p> <p>a) 1 b) 2</p>	1

	<p>c) 0 d) 3</p>	
<p>37</p>	<p>The binomial distribution with parameters n and p is the discrete probability distribution. The probability distribution function is given as $P(X = r) = {}^n C_r p^r q^{n-r}, r = 0, 1, 2, 3, 4 \dots n, p, q > 0$ such that $(p + q)^n = 1$, where $n =$ number of trials, $p =$ probability of success and $q =$ probability of failure.</p>  <p>A fair coin is tossed 6 times . based on the above information , aswer the following questions:</p> <ol style="list-style-type: none"> 1. the value of parameters of this binomial experiment are $n = ? , p = ?$ 2. The probability of getting exactly 4 heads is what ? 3. the probability of getting at least 4 heads is what ? <p style="text-align: center;">OR</p> <p>The value of $P(X=0)$ is what ?</p>	<p>1 1 2</p>
<p>38</p>	<p>Linear programming is a method for finding the optional values (maximum or minimum) of quantities subject to the constraints when relationship is expressed as liner equation or inequations.</p> <p>Base on the above information answer the following questions .</p> <ol style="list-style-type: none"> 1. Where is the optimal value of the objective function attached at the points ? 2. The graph of the inequality $3x+4y < 12$ is what ? <p>The corners points of the feasible region determined by the system of linear constraints are $(0,10), (5,5), (15,15), (0,20)$. let $Z = px + qy$, where $p, q > 0$. condition on p and q so that the maximum of z occurs at both the points $(15,15)$ and $(0,20)$. so what the relation between p and q?</p>	<p>1 3</p>
<p>Do your Best</p>		

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Sample Paper 3

Applied Mathematics

(Code241)

Time Allowed: 3 hrs.

Maximum Marks: 80

General Instructions:

1. This question paper contains five sections A, B, C, D and E. 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 **20 MCQs of 1 mark** each.

Section – B:

4. It comprises of **5 VSA type questions of 2 marks** each.

Section – C:

5. It comprises of **6 SA type of questions of 3 marks** each.

Section – D:

6. It comprises of **4 LA type of questions of 5 marks** each.

Section – E:

7. It has **3 case studies**. 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.

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.

Section A

- 1 Pipes A and B can fill a tank in 4 hours and 5 hours respectively . Another pipe C can empty the full tank in 10 hours . if all the three pipes are opened together then the tank will be filled 1
- a) $1\frac{2}{7}$ hours
b) $2\frac{6}{7}$ hours
c) $3\frac{5}{7}$ hours
d) $4\frac{6}{7}$ hours
- 2 In a 50 m race A can give a start of 5m to B and a start of 14 m to C . in the same race , how much start can B give to C ? 1
- a) 9m
b) 10m
c) 11m
d) 12m
- 3 At a game of billiards, A can give 15 points to B in 60 and A can give 20 points to C in 60. How many points can B give C in a game of 90 ? 1
- a) 10 points
b) 12 points
c) 18 points
d) 20 points
- 4 The length of rectangle is double the breadth . if the minimum perimeter of the rectangle is 120 cm , then 1
- a) Breadth $>$ 20 cm
b) Breadth $<$ 20 cm
c) Breadth \geq 20 cm
d) Breadth \leq 20 cm
- 5 If $|2x + 3| < 7, x \in R, \text{ then}$ 1
- a) $x \in [-5, 9]$
b) $x \in (-5, 9]$
c) $x \in (-\infty, -5] \cup [9, \infty)$
d) $x \in (-\infty, -5) \cup [2, \infty)$
- 6 If supply function for a commodity is $p = \sqrt{9 + x}$ and the market price $p_0 = 4$, then producer's surplus is 1

- a) 3
b) $10/3$
c) 10
d) 15
- 7 If the demand function for a commodity is $p = 20 - 2x - x^2$ and the market demand is 13 units, then consumer's surplus is 1
a) 27
b) 38
c) 42
d) 47
- 8 The number of solutions of $\frac{dy}{dx} = \frac{y+1}{x-1}$, when $y(1) = 2$ is 1
a) None
b) One
c) Two
d) Infinite
- 9 The order and degree of the differential equation $\left(3 - \left(\frac{dy}{dx}\right)^2\right)^{\left(\frac{5}{3}\right)} = \frac{x^3 d^2y}{dx^2}$, respectively are 1
a) 2,1
a) 2,2
b) 2,3
d) 2,5
- 10 If six coins are tossed 6400 times, then the approximate probability of getting 6 heads x times 1
a) $\frac{(100)^x e^{-100}}{x!}$
b) $\frac{(50)^x e^{-50}}{x!}$
c) $\frac{(200)^x e^{-200}}{x!}$
d) None of these
- 11 If Z is a standard normal variable, then $(0 < Z < 1.7)$ is equal to 1
a) $F(0) - F(1.7)$
b) $F(1.7) - F(0)$
c) $1 - F(1.7)$
d) $F(1.7) - 1$
- 12 If X is normally distributed with mean 20 and standard deviation 4, then standard normal variable Z corresponding to $X = 21$ is 1
a) 1.25

- b) -1.25
c) -0.25
d) 0.25
- 13 Suman purchased 4000 shares of Rs. 100 each at a premium of Rs. 25. If company declares a dividend of 10% then her rate of return is 1
a) 8%
b) 10%
c) 12%
d) 15%
- 14 The effective rate of return compounded semi annually which is equivalent to 10.25%, effective rate of return, is 1
a) 10.13%
b) 10.05%
c) 10%
d) 9.89%
- 15 A machine costing Rs. C would reduce to Rs. 10000 in 7 years. If annual depreciation charge is Rs. 10000, then the value of C is 1
a) 80000
b) 70000
c) 60000
d) None of these
- 16 At 6% converted quarterly, find the present value of a perpetuity of Rs. 9000 payable at the end of each quarter. 1
a) 600000
b) 700000
c) 500000
d) 450000
- 17 There are two values of β is 1
$$\begin{vmatrix} 0 & 2 & 0 \\ \beta & 3 & \beta \\ \beta & 5 & 6 \end{vmatrix} = -16$$
 then the sum of two values of β is
a) 5
b) 0
c) 3
d) 6
- 18 Which of the following is correct? 1
a) Determinant is a square matrix.
b) Determinant is a number associated to a matrix.
c) Determinant is a number associated to a square matrix.

d) None of these

For questions 19 and 20, two statements are given – one labelled Assertion(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:

- (i) Both A and R are true and R is the correct explanation of the assertion
- (ii) Both A and R are true but R is not the correct explanation of the assertion
- (iii) A is true, but R is false
- (iv) A is false, but R is true

- 19 Assertion : cyclic variations are periodic variation 1
Reason : their repeating cyclic is usually one year
- 20 Assertion : For n value is even then the middle year as the origin. 1
Reason : if n is odd ,then take middle year as the origin .

Section B

- 21 Find the particular solution of the differential equation $\frac{dy}{dx} = 1 + x + y + xy$, given that $y = 0$ when $x = 1$. 2
- 22 Evaluate : $\int \sqrt{x} e^{\sqrt{x}} dx$
- 23 A milkman has two cans. First containing 75% milk and rest water , 2
whereas second containing 50% milk and rest water . how much mixture should he mix from each can so as to get 20 litres of mixture, such that ratio of milk and water is 5:3 respectively ?

OR

A boatman takes half as much time in rowing his boat for a certain distance downstream than upstream . what is the ratio between his speed of rowing the boat in still water and speed of current ?

- 24 A started a business by investing Rs. 750000 . B joined A in the business 2
after 6 months by investing Rs. 1000000 and after another 6 months C joined A and B by investing Rs. 1200000. Find the ratio in which they should share the profit 2 years after A started the business.
- 25 A, B, and C enter into partnership in the ratio $\frac{5}{2} : \frac{4}{3} : \frac{7}{6}$. After 6 months B 2
increases his investment by 25% . if the total profit at the end of a year is Rs.62000, find A's share in the profit .

OR

Mitul invested Rs. 350000 in a fund . at the end of the year the value of the fund is Rs.437500. what is the nominal rate of interest , if the market price is the same at the end of the year ?

Section C

26 Consider the following hypothesis test : 3

$$H_0 : \mu \leq 12$$

$$H_a : \mu > 12$$

A sample of 25 provided a sample mean $\bar{x} = 14$ and a sample standard deviation $S = 4.32$

a. Use the t-distribution table to compute a range for the p-value .

b. At $\alpha = 0.05$, what is your conclusion ?

What is the rejection rule using the critical value ? what is your conclusion ?

27 Five cards are drawn successively with replacement from a well -shuffled 3
pack of 52 cards. What is the probability that

(i) all the five cards are spades

(ii) only 3 cards are spades

(iii) none is spade ?

28 If $y(t)$ is a solution of $\frac{(1+t)dy}{dt} - ty = 1$ and $y(0) =$ 3
 -1 , then show that $y(1) = -1/2$.

29 evaluate : $\int \frac{x^3}{x^4 + 3x^2 + 2} dx$ 3

OR

$$\text{Evaluate : } \int x \log(1 + x^2) dx$$

30 How many litres of water will have to be added to 1125 litres of the 45% 3
solution of acid so that the resulting mixture will contain more than 25%
but less than 30% acid content ?

OR

Find the interval(s) in which the function $f(x) = \frac{x^4}{4} - 2x^3 + \frac{11x^2}{2} - 6x$, is
strictly increasing and decreasing .

31 If $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ verify the result $A^3 - 6A^2 + 9A - 4I =$ 3
 0 and hence find A^{-1} .

Section D

- 32 The demand function for a commodity is $p = 20 e^{-\frac{x}{10}}$. Find the consumer's surplus at equilibrium price $p=2$. (Given $\log e = 0.4343$). 5

OR

In a math aptitude test, student scores are found to be normally distribution having mean as 45 and standard deviation 5. What percentage of students have scores

1. More than the mean score ?
 2. Between 30 and 50 ?
- 33 An aeroplane can carry a maximum of 200 passengers. Baggage allowed for a first class is 30 kg and for an economy class ticket is 20 kg. Maximum capacity for the baggage is 4500 kg. the profit on each first class ticket is Rs.500 and on each economy class ticket is Rs.300. Determine how many tickets of each type must be sold to maximize the profit of the airline . also find the maximum profit . 5

OR

Rahul is the whole sale market to purchase folding tables and chairs , to later sell them at his furniture shop . he has only Rs. 5760 to spend and his van has space to carry at the most 20 items. A table costs him Rs. 360 and a Chair costs Rs.240 . back at his shop , he plans to sell a table at a profit of Rs.22 and a chair at a profit of Rs.18. given that he can sell all the items that he purchases , how many tables and chairs shall he purchase in order to maximise his profit ?

- 34 Consider the following data : 5

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Production	137	140	134	137	151	121	124	159	157
	2012	2013	2014						
	169	172	150						

- 35 The origin cost of the asset is Rs. 270000. The useful life of the asset is 10 years and net residual value is estimated to be Rs. 20000. 5
- a. Construct a schedule for depression .
 - b. Find the book value at the end of 6th year .
 - c. Find the book value at the beginning of 7th year .

Section E

- 36 If there is a statement involving the natural number n such that

- a) The statement is true for $n=1$
 b) When the statement is true for $n=k$ (where k is some positive integer), then the statement is also true for $n=k+1$

Then, the statement is true for all natural numbers n .

Also if A is square matrix of order n , then A^2 is defined as AA . In general $AAA\dots A$ (m times), where m is any positive integers.

Based on the above information answer following questions.

1. If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, then for any positive integer n ,

a) $A^n = \begin{bmatrix} 3n & -4n \\ 1n & -1n \end{bmatrix}$

1

b) $A^n = \begin{bmatrix} 1 + 2n & -4n \\ 1n & 1 - 2n \end{bmatrix}$

c) $A^n = \begin{bmatrix} 3n & -8n \\ 1 & -1n \end{bmatrix}$

d) $A^n = \begin{bmatrix} 1 + 3n & -4n \\ 1n & 1 - 3n \end{bmatrix}$

2. If $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$, then $|A^n|$, where $n \in \mathbb{N}$, is equal to

a) 2^n

b) 3^n

1

c) \mathbb{N}

d) 1

3. If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$ and $A^n = [a_{ij}]_{3 \times 3}$ for some positive integer n , then

the cofactor of a_{13} is what value?

2

OR

If A is a square matrix such that $|A|=2$, then for any positive integer n , $|A^n|$ is equal to what?

- 37 Mr. Kohli manufacturing ball point pens. He sells pens in packets of 100 pieces. It is known that 6% of his products are defective. A packet of pens is selected at random and checked for number of defective pens.



Based on the above information, answer the following questions;

1

32

1. the probability that packet contains no defective pen is

- a) e^{-6}
- b) $3e^{-6}$
- c) 0
- d) e^{-6}

2. The probability that packet contains at most 4 defective pens is

- a) $93e^{-6}$
- b) $104e^{-6}$
- c) $115e^{-6}$
- d) $87e^{-6}$

1

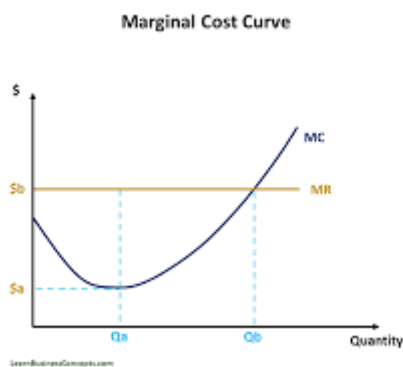
3. The probability that packet contains more than 4 defective pens is what ?

2

OR

The probability that packet contains at least 2 defective pens is what ?

38 The marginal cost (in Rs) of a product is given by $MC = \frac{300}{\sqrt{3x+25}}$ and the fixed cost is Rs. 5000. Based on the above information, answer the following questions :



1. find the cost of function ?

1

2. what is the cost of producing 25 units of the product ?

1

3. find the average cost function .

1

4. what is the average cost of producing 200 units ?

1

Do your Best

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Sample Paper 4

Applied Mathematics

(Code241)

Time Allowed: 3 hrs.

Maximum Marks: 80

General Instructions:

1. This question paper contains five sections A, B, C, D and E. 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 **20 MCQs of 1 mark** each.

Section – B:

4. It comprises of **5 VSA type questions of 2 marks** each.

Section – C:

5. It comprises of **6 SA type of questions of 3 marks** each.

Section – D:

6. It comprises of **4 LA type of questions of 5 marks** each.

Section – E:

7. It has **3 case studies**. 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.

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.

Section A

- 1 If $[x \ 1] \begin{bmatrix} 1 & 0 \\ -2 & 0 \end{bmatrix} = 0$, then x equals 1
- a) 0
b) -2
c) -1
d) 2
- 2 If $A = [2 \ -3 \ 4]$, $B = \begin{bmatrix} 3 \\ 2 \\ 2 \end{bmatrix}$, $A = [1 \ 2 \ 3]$, $y = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix}$, then $AB + XY$ equals 1
- a) [28]
b) [24]
c) 28
d) 24
- 3 If A and b are symmetric matrices of same order, then $AB - BA$ is a : 1
- a) Skew-symmetric matrix
b) Symmetric matrix
c) Zero matrix
d) Identify matrix
- 4 Assume X, Y, Z, W and P are matrices of order $22 \times n$, $3 \times k$, $2 \times p$ and $p \times k$ respectively . If $n=p$ then the order of the matrix $7X - 5Z$ is : 1
- a) $p \times 2$
b) $2 \times n$
c) $n \times 3$
d) $p \times n$
- 5 if $x = -9$ is a root of $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$, then other two roots are 1
- a) 2 & 7
b) -2 & 7
c) 1 & 7
d) None of these
- 6 If $\int x e^{kx^2} dx = \frac{1}{4} e^{2x^2} + c$, then the value of k is 1
- a) 4
b) -2
c) 2
d) 1

- 7 $\int \frac{1}{e^x + e^{-x} + 2} dx$ is equal to 1
- a) $\frac{1}{e^{x+1}} + c$
b) $\frac{1}{1+e^{-x}} + c$
c) $-\frac{1}{e^{x+1}} + c$
d) None of these
- 8 $\int (1 + x + \sqrt{x + x^2})/\sqrt{x} + \sqrt{(1 + x)} dx$ is equal to 1
- a) $\frac{1}{2}\sqrt{1+x} + c$
b) $\frac{2}{3}(1+x)^{\frac{3}{2}} + c$
c) $2(1+x)^{\frac{2}{3}} + c$
d) $\sqrt{1+x} + C$
- 9 If $\int_0^4 \frac{1}{2x+1} dx = \log k$, then the value of k is 1
- a) 3
b) 9/2
c) 9
d) None of these
- 10 A fair coin is tossed 100 times. The probability of getting head an odd number of times is 1
- a) $\frac{1}{2}$
b) $\frac{1}{3}$
c) $\frac{1}{8}$
d) $\frac{3}{8}$
- 11 If the mean and the variance of binomial distribution are 4 and 3 respectively, then the probability of six successes is 1
- a) $\frac{1}{2}$
b) $\frac{7}{64}$
c) $\frac{219}{256}$
d) $\frac{37}{256}$
- 12 If X has a Poisson variable such that $P(X=1)=2P(X=2)$, then $P(X=0)$ is 1
- a) e
b) $1/e$
c) 1
d) e^2
- 13 The present value of a perpetuity of Rs.750 payable at the beginning of each year, if money is worth 5 % p.a. , is 1



- a) Rs. 15000
b) Rs.15750
c) Rs.14250
d) Rs.none of these
- 14 What amount should be deposited at the end of every 6 months to accumulate Rs. 50000 in 8 years, if money is worth 6 % p.a. compounded semi-annually ? (Given $(1.02)^{16} = 1.6047$) 1
- a) Rs. 3432.53
b) Rs.2783.08
c) Rs. 2480.574
d) Rs.2149.93
- 15 Mr. X borrowed Rs. 500000 from a bank to purchase a house and decided to repay the loan by equal monthly payments in 10 years. If bank charges interest at 7.5% p.a. compounded monthly , then EMI is (Given $(1.00625)^{120} = 2.1121$) 1
- a) Rs.5935
b) Rs.6380
c) Rs.7340
d) Rs.8520
- 16 Rs. 100 shares of a company are selling at Rs.80. If the company is paying a divided of 12 %, then the rate of return is 1
- a) 10%
b) 12%
c) 15%
d) 18%
- 17 A specific characteristics of a sample is known as a 1
- a) Population
b) Parameter
c) Statistics
d) Variance
- 18 The assumed hypothesis which is tested for rejection considering it to be true is called 1
- a) Null hypothesis
b) Alternative hypothesis
c) Simple hypothesis
d) True hypothesis

For questions 19 and 20, two statements are given – one labelled

Assertion(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:

- (i) Both A and R are true and R is the correct explanation of the assertion
- (ii) Both A and R are true but R is not the correct explanation of the assertion
- (iii) A is true, but R is false
- (iv) A is false, but R is true

- 19 Assertion : Since α = probability of type -1 error , then $1-\alpha$ Reason : Probability of not rejecting H_0 when H_0 is true . 1
- 20 If we reject the null hypothesis , we might be making Assertion : we reject the null hypothesis Reason : Type -III error A correct decision 1

Section B

- 21 What amount is received at the end of every month forever, if Rs. 72000 kept in a bank earns 8% per annum compounded half yearly ? 2
- 22 solve differential equation : $(x^2 - 1) \left(\frac{dy}{dx}\right) + 2xy = \frac{2}{x^2-1}$ 2

OR

Evaluate : $\int_{1/3}^1 \frac{(x-x^3)^{\frac{1}{3}}}{x^4} dx$

- 23 Find the intervals in which the functions are strictly increasing or strictly decreasing $f(x) = 10 - 6x - 2x^2$ 2
- 24 A shopkeeper mixes two varieties of rice one costs Rs. 161 per kg and other costs Rs. 179 per kg in the ratio 5:4 respectively . he sells the mixed variety at Rs. 202.80 per kg . Find his profit percentage . 2

OR

A man wants to deposit a lump sum amount so that an annual scholarship of Rs.3000 is paid . Rate of interest is 5% per annum. Calculate the lump sum amount required , if the scholarship is to start at the end of this year and continue forever.

- 25 A vessel contains a mixture of two liquids X and Y in the ratio 2:5. 8 litres of mixture are drawn off from the vessel and 8 litres of liquid X is filled in the vessel . if the ratio of liquids X and Y is now becomes 7:10 , how many litres of liquids X and y were contains by the vessel initially ? 2

Section C

- 26 Calculate five yearly moving averages of the number of students who have studies in a school given below : 3

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
No. of students	442	427	467	502	512	515	520	527	515	541

- 27 Consider the following hypothesis test : 3

$$H_0 : p \geq 0.75$$

$$H_a : p < 0.75$$

A sample of 300 provided a sample proportion of 0.68.

- Compute the value of the test statistics .
 - What is the p-value ?
- 28 A company manufacturing two types of product A and B. Each unit of A requires 3 grams of nickle and 1 grams of chromium, which each unit of B requires 1 gram of nickle and 2 grams of chromium. The firm can produce A and Rs. 50 on each unit of type B. how many unit of each type should the company manufacture so as to earn maximum profit ? Use liner programming to find the solution. 3

OR

Two badminton teams A and B are staying in the same hotel .

	Calories	Protein
Male Players	2500	65g
Female Players	1900	50g
Coach	2000	54g

Use Matrix algebra to calculate the total diet requirement of calories and proteins for each team .

- 29 If $\Omega(n)$ = total numbers of prime factors of n , $n \in \mathbb{N}$, then find (i) $\Omega(39)$ (ii) $\Omega(210)$ 3
If $\omega(n)$ = Number of distinct prime factors of n , $n \in \mathbb{N}$, then find (i) $\omega(36)$ (ii) $\omega(110)$
- 30 In a certain factory turning razor blades , there is a small chance $1/500$ for any blade to be defective. The blades are in packets of 10 . Use Poisson's distribution to calculate the approximate number of packets containing no defective, once defective and two defective blades respectively in a consignment of 10000 packets . (Use $e^{-0.02} = 0.9802$) 3

31 evaluate : $\int \frac{x^3}{x^4 + 3x^2 + 2} dx$

3

OR

Evaluate : $\int 1/((1+x)(1+e^{-x})) dx$

Section D

- 32 a. A firm anticipates an expenditure of Rs. 500000 for plant modernization at end of 10 years from now . How much should the company deposit at the end of each year into a sinking fund earning interest 5 % per annum ? (Use $(1.05)^{10}=1.629$) 5
- b. A machine costing Rs. 200000 has effective life of 7 years and its scrap value is Rs.30000. what amount should the company put into a sinking fund earning per annum , so that it can replace the machine after its useful life ? assume that a new machine will cost Rs. 300000 after 7 years. Use $(1.05)^7 =1.407$

OR

Solve differential equation : $\frac{\left(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}}\right) dy}{dx} = 1$

- 33 A manufacturing makes two products ,A and b . Product A sells at Rs .200 each and takes $\frac{1}{2}$ hour to make . Product B sells at Rs.300 each take 1 hour to make. There is permanent order for 14 units of product A and 16 units of Product B. A working week consists of 40 hours production and weekly turnover must not be less than Rs.10000. if the profit on each of product A is Rs.20 and on Product B is Rs. 30 , then how many of each should be produced so that the profit is maximum ? also find the maximum profit . 5

- 34 5

If $A^{-1} \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$ and $B \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ then find $(AB)^{-1}$.

OR

Evaluate : $\frac{\int_4^9 \sqrt{x}}{(30 - (x)^{\frac{3}{2}})^2} dx$

- 35 1. seven times a two digit number is same as four times the number obtained on interchanging the digits of the given number . if one digit of the given number exceeds the other by 3 , find the number . 5

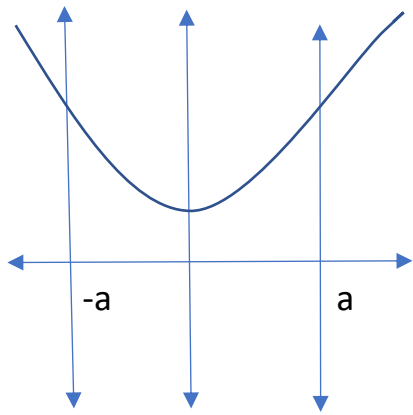
2. the age of the father is twice the sum of ages of his two children. After 20 years, his age will be equal to the sum of the ages of his two children. Find the present age of the father.

Section E

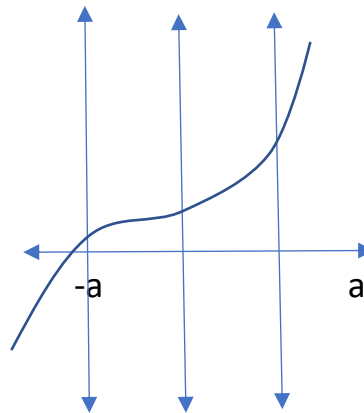
36 Consider $f(x)$ be a continuous function defined in $[-a, a]$, then

$$\int_{-a}^a f(x) dx = 2 \int_0^a f(x) dx, \text{ if } f(x) \text{ is an even function}$$

$$= 0, f \text{ is an odd function}$$



$$f(x) = x^2$$



$$f(x) = x^3$$

1). $\int_{-2}^2 x^3 dx$

1

2). $\int_{-5}^5 (8x^5 - 4x^3 + 7x) dx$

1

3). $\int_{-3}^3 \log \frac{1-x}{1+x} dx$

2

OR $\int_{-11}^1 \frac{x}{1+x^2} dx$

37 The marks obtained in a certain examination follow normal distribution with mean 30 and standard deviation 10. If 1000 students appeared in the examinations, calculate the number of students scoring
For reference only

Total students	Standard Deviation	Normal Distribution With Mean
1000	10	30

- I. less than 33 marks 1
- II. more than 50 marks 1
- III. between 30 and 45 marks . 2

38



An equated monthly installment is a fixed payment made by a borrower to a lender at a specific date every month to clear off the loan .

The EMI depends on the following :

1. Principal borrowed
2. Rate of interest
3. Tenue of the loan

Calculate of EMI

There are two methods of calculating EMI:

- i. Flat rate method
- ii. Reducing balanced method.

Now ,

Avni takes a loan of Rs.500000 from a bank at an interest rate of 6% p.a. for 10 years. She wants to pay back loan in equated monthly installments. Find her EMI by using 1

- a. Flat rate method 1
- b. Reducing Method 2
- c. Compare both method

$$\text{Use } (1.005)^{-120} = 0.5496327334$$

Do your Best

Maheshwar Sir
81410 84740



Sample Paper 5

Applied Mathematics

(Code241)

Time Allowed: 3 hrs.

Maximum Marks: 80

General Instructions:

1. This question paper contains five sections A, B, C, D and E. 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 **20 MCQs of 1 mark** each.

Section – B:

4. It comprises of **5 VSA type questions of 2 marks** each.

Section – C:

5. It comprises of **6 SA type of questions of 3 marks** each.

Section – D:

6. It comprises of **4 LA type of questions of 5 marks** each.

Section – E:

7. It has **3 case studies**. 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.

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.

Section A

- 1 $(18 \times 10) \pmod{7}$ is _____ 1
a) 5
b) 4
c) 3
d) 2
- 2 $(09:30+16:40)$ in 24 hours clock is _____ 1
a) 03:10
b) 26:10
c) 02:10
d) 25:70
- 3 In what ratio must water be mixed with milk to gain $16\frac{2}{3}\%$ on selling the mixture at cost price ? 1
a) 1:6
b) 6:1
c) 3:2
d) 2:5
- 4 Nisha started a business with Rs.540000. After few months kusum joined her with an investment of Rs.720000 . If at the end of a year they shared the profit equally , then find after how many months kusum joined Nisha ? 1
a) 3
b) 6
c) 9
d) 10
- 5 General solution of differential equation : $y \log y dx - x dy = 0$ is _____ 1
a) $y = \log |Cx|$
b) $y = e^{|Cx|}$
c) $y = e^{-Cx}$
d) $\log y = |C + x|$
- 6 An investment of 10,000 becomes Rs. 60,000 in 4 years, then the CAGR is given by 1
a) $\frac{\sqrt[4]{6}-1}{100}$
b) $\frac{\sqrt[4]{6}+1}{100}$
c) $(\sqrt[4]{6} - 1) * 100$
d) $(\sqrt[4]{6} + 1) * 100$



- 7 A population consists of four observations 1,3,5,7. What is the variance? 1
a) 2
b) 4
c) 5
d) 6
- 8 A sample of 50 bulbs is taken at random . Out of 50 we found 15 bulbs are Bajaj, 17 are of surya and 18 are of Crompton . what is the point estimate of population proportion of surya ? 1
a) 0.3
b) 0.34
c) 0.36
d) 0.4
- 9 The area under the standard normal curve which lies to the right of $z=-0.66$ is 1
a) $1-F(0.66)$
b) $F(0.66) -1$
c) $F(0.66)$
d) $F(1.7) -1$
- 10 If X is poisson variable such that $P(X=1) =2P(X=2)$ then $P(X=0)$ is 1
a) e
b) $1/e$
c) 1
d) e^2
- 11 A statement made about a population parameter for testing purpose is called 1
a) Statistic
b) Parameter
c) Hypothesis
d) Level of significance
- 12 Since α = probability of Type -I error , then $1 - \alpha$ 1
a) Probability of rejecting H_0 when H_0 is true .
b) Probability of not rejectin H_0 when H_0 is true .
c) Probability of not rejecting H_0 when H_a is true .
d) Probability of rejecting H_0 when H_a is true .
- 13 For the given five values 15,24,18,33,42 the three years moving average are 1
a) 19,22,33
b) 19,25,31
c) 19,30,31
d) 19,25,33

- 14 The present value of a sequence of payments of Rs. 800 made at the end of every 6 month and continue forever , if the money is worth 4% p.a. compounded semi annually , is 1
Rs.20,000
Rs.40,000
Rs.60,000
Rs.80,000
- 15 Mr.Chandrakant Bakshi borrow Rs. 500000 from a bank to purchase a house and decided to replay the loan by equal monthly payments in 10 years. If bank charges interest at 7.5% p.a. compounded monthly , then EMI is (Given $(1.00625)^{20} = 2.1121$) 1
a) 5935
b) 6380
c) 7340
d) 8520
- 16 Rohan invested Rs. 3000000 in a fund for two years. At the end of the two years the investment was worth 327000. Rohan's rate of return is 1
a) 6%
b) 7%
c) 8%
d) 9%
- 17 A vehicle costing Rs. 125000 has scrap value of 25000. If annual depreciation charge is 12500 then useful life of the vehicle is 1
a) 4 years
b) 6 years
c) 8 years
d) 10 years
- 18 The graph of the inequality $2x + 3y > 6$ is 1
a) Half plane that contains the origin
b) Half plane that neither contains origin nor the points of the line $2x+3y=6$
c) Whole XOY -plane excluding the points on the line $2x+3y=6$
d) Entire XOY -plane

For questions 19 and 20, two statements are given – one labelled Assertion(A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:

- (v) Both A and R are true and R is the correct explanation of the assertion
(vi) Both A and R are true but R is not the correct explanation of the

assertion

- (vii) **A is true, but R is false**
(viii) **A is false, but R is true**

19 Assertion (A): Choosing the media mix (radio, TV, news papers, hoardings, magazine, internet) to maximize the advertising effectiveness, within given publicity budget. 1

Reason(R): there are a finite number of decision variable (activities or product) and a finite number of constraints.

20 Assertion (A): $\int_{-2}^3 |x + 2| dx = 13$ 1

Reason(R): $\int_a^b f(x) dx = \int_a^c f(x) dx + \int_c^b f(x) dx$, where $a < c < b$

Section B

21 A what rate of interest will the present value of perpetuity of Rs. 500 payable at the end of every 6 months be Rs. 10000? 2

22 If the matrix $\begin{bmatrix} 1 & -1 & 2 \\ 3 & 1 & -2 \\ 1 & 0 & 3 \end{bmatrix}$, find adj A without computing adj A. 2

OR

find the matrix X for which $\begin{bmatrix} 5 & 4 \\ 1 & 1 \end{bmatrix} X = \begin{bmatrix} 1 & -2 \\ 1 & 3 \end{bmatrix}$.

23 Minimize $Z = 3x + 2y$ subject to the constraints $x + y \geq 8, 3x + 5y \leq 15, x \geq 0, y \geq 0$. 2

24 A pipe can fill a tank in 40 mins. Due to a leakage in the bottom it took 60 mins. To fill the tank. How much time will take for the leakage to empty the full tank? 2

OR

Three partners A, B and C shared the profit in a business in the ratio 8:9:10 respectively. If A, B and C invested the money for 12 months, 9 months and 6 months respectively, find the ratio of their investment respectively.

25 What sum of money invested now could be establish a scholarship of Rs. 5000 which is to be awarded at the end of the every year forever, if money is worth 8% per annum. 2

Section C

26 10 years ago, Mr. Iyer 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 Rs. 10,21,760. What amount did he put in the sinking fund at the end of every 6 month for the tenure, which paid him 5% p.a. compounded semi-annually? [Use $(1.025)^{20} = 1.6386$] 3



- 27 Find the intervals in which the following functions are strictly increasing or strictly decreasing $f(x) = 10 - 6x - 2x^2$. 3
- 28 Two schools P and Q decided to award their selected students for the values of discipline and honesty in the form of prizes at the rate of Rs. X and Rs. Y respectively . School P decided to award respectively 3,2 students a total prize money of Rs. 2300 and school Q decided to award respectively 5,3 students a total prize money of Rs. 3700. Find the inverse of matrix. 3
- 29 Solve : $\int \frac{\sqrt{3+\log x}}{x} dx$ 3

OR

- $\int \frac{3x + 5}{x^2 + 3x - 18} dx$
- 30 A company produces a commodity with Rs.24000 fixed cost. The variable cost is estimated to be 25% of the total revenue recovered on selling the product at a rate of Rs.8 per unit . Find Cost function and Revenue function . 3
- 31 Praful shah 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 HDFC bank . if his equated monthly installment Rs. 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 ? 3
Use $[(1.0075)^{-300} = 0.1062]$

Section D

- 32 Phone calls arrive at the rate of 48 per hours t the reservation desk for Indian Airlines. 5
1. Compute the probability of receiving three calls in a 5 minutes interval of time .
 2. compute the probability of receiving exactly 10 calls in 15 minutes .
 3. if no call are currently being processed , what is the probability that the agent can take 3 minutes for personal time without being interrupted by a call ?

OR

- An unbiased coin is tossed n times .Let the random variable X denote the number of times the head occurs. If $P(X = 1), P(X = 2)$ and $P(X = 3)$ are in AP, find the value of n .
- 33 The cost of manufacturing of certain items consists of Rs. 1600 as overheads, Rs. 30 per item as the cost of material and the labour cost of $X^2/100$ for items produced. How many items must be produced to have a minimum average cost ? 5

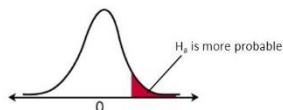
OR

- Show that the height of a cylinder of maximum volume that can be inscribed in a sphere of radius R is $2R/\sqrt{3}$. Also find the maximum volume. 5
- 34 Vansh is at the whole sale market to purchase folding tables and chairs , to later sell them at his furniture shop . he has only Rs. 5760 to spend and his van has space to carry at the most 20 items. A table costs him Rs. 360 and a chair costs Rs. 240 . Back at his shop , he plan to sell a table at a profit of Rs. 22 and a chair at a profit of Rs. 18 . Given that he can sell all the items that he purchases, how many tables and chairs shall he purchase in order to maximise his profit ? 5
- 35 Two schools P and Q want to award their selected students on the values of discipline , politeness and punctuality . the school P want to Rs. X each , Rs. Y each and Rs. Z each. For the three respective values to its 3,2 and 1 students with a total awarded money of Rs. 1000. School Q want to spend Rs. 1500 to award its 4,1 and 3 students on the respective values. The total amount of awards for one prize on each value is Rs. 600. What is the value of X , Y and Z ? 5

Section E

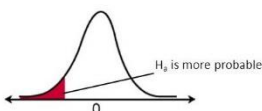
Case Study.

- 36 Consider the following hypothesis test :



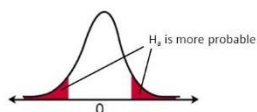
Right-tail test

$$H_a: \mu > \text{value}$$



Left-tail test

$$H_a: \mu < \text{value}$$



Two-tail test

$$H_a: \mu \neq \text{value}$$

$$H_0: p \geq 0.75$$

$$H_a: p < 0.75$$

A sample of 300 provided a sample proportion of 0.68.

a. compute the value of the test statistics .

OR

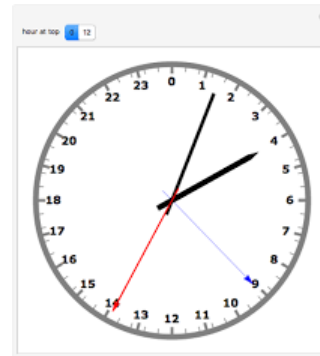
a. what is the p-value ?

b. at $\alpha = 0.05$, what is your conclusion ?

d.what is the rejection rule using critical value ? what is your conclusion ?

37 Modulo Arithmetic

There are 24 hours in a day . To know the time we use clocks . There are mainly two types of clocks. 12 hours clock and 24 hours clock. 12 hours clock repeat itself twice in a day . i.e. 24 hours of a day are divided into two periods called a.m. (ante Meridien) and p.m. (post Meridiem) . Each period consists of 12 hours numbered 12 (acting as 0) ,1,2,3,4,5,6,7,8,9,10,11. Then 24 hours per day cycle starts at 12 midnight (usually indicated at 12 a.m.) runs through 12 noon (usually indicated as 12 p.m.) and continues just before midnight at the end of the day .



1. It is currently 7:00 am in 12 hours clock . what will be The time in next 492 hours ?

OR

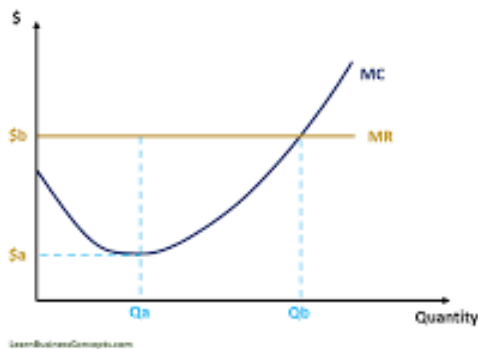
1. If the time after 6:40 hours from now will be 9:00 p.m. then What is current time ? 2

2. what time in 24 hours clock is equivalent to 2:00 p.m. in 12 hours clock ? 1

3. which of two times are same in 12 hours and 24 hours clocks respectively ? 1

38 The marginal cost (in Rs) of a product is given by $MC = \frac{300}{\sqrt{3x+25}}$ and the fixed cost is Rs. 5000. Based on the above information , answer the following questions :

Marginal Cost Curve



1. find the cost of function ?
2. what is the cost of producing 25 units of the product ?
3. find the average cost function .
4. what is the average cost of producing 200 units ?

1
1
1
1

Do your Best

Thanking you