

Roll Number

SET C



INDIAN SCHOOL MUSCAT  
FINAL EXAMINATION 2021-21  
**MATHEMATICS**

CLASS: XII

Sub. Code: 041

Time Allotted: 3 Hrs.

24.01.2021

Max. Marks: 80

**General Instructions:**

1. This question paper contains two parts A and B. Each part is compulsory. Part A carries 24 marks and Part B carries 56 marks
2. Part-A has Objective Type Questions and Part -B has Descriptive Type Questions
3. Both Part A and Part B have choices.

Part – A:

1. It consists of two sections- I and II.
2. Section I comprises of 16 very short answer type questions.
3. Section II contains 2 case studies. Each case study comprises of 5 case-based MCQs. An examinee is to attempt any 4 out of 5 MCQs.

Part – B:

1. It consists of three sections- III, IV and V.
2. Section III comprises of 10 questions of 2 marks each.
3. Section IV comprises of 7 questions of 3 marks each.
4. Section V comprises of 3 questions of 5 marks each.
5. Internal choice is provided in 3 questions of Section –III, 2 questions of Section-IV and 3 questions of Section-V. You have to attempt only one of the alternatives in all such questions.

**PART A**

**SECTION I**

1. Find the sum of order and degree of the differential equation  $\frac{d}{dx} \left\{ \left( \frac{dy}{dx} \right)^4 \right\} = 0$

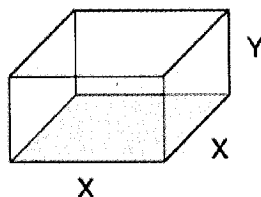
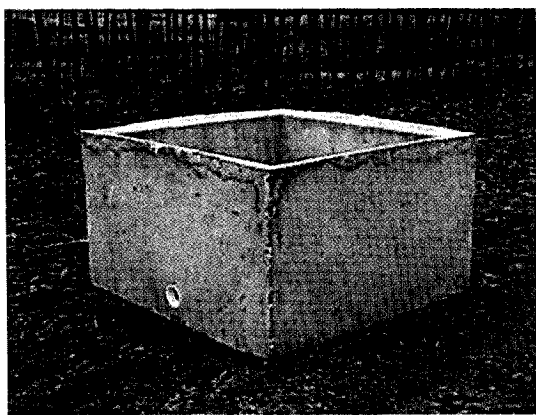
**OR**

Find the integrating factor of differential equation  $\left( \frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{x} \right) \frac{dx}{dy} = 1$

2. Find the area of the region bounded by the curve  $x = 2y + 3$ , y-axis and the line  $y = 1$ . 1
- OR**
- Find the area bounded by the curve  $y = x|x|$ , x- axis and the lines  $x = -2$  and  $x = 2$ .
3.  $\int_{-3}^1 \frac{|x|}{x} dx$  **OR**  $\int \frac{1}{\sqrt{25-16x^2}} dx = \frac{1}{4} \sin^{-1}(ax) + c$ , find the value of a. 1
4. If A and B are matrices of order 2 and  $|A| = 5$ ,  $|B| = 3$ , then find  $|3AB|$  1
5. Write the number of all possible matrices of order  $3 \times 3$  with each entry 0, 1, 2 or 3. 1
6. How many reflexive relations are possible in a set A whose  $n(A) = 2$  1
7. The relation R be defined on the set  $A = \{1, 2, 3\}$  by  $R = \{(a, b) : |a^2 - b^2| < 8\}$ , then write the relation R in roster form. 1
8. Find the value of  $\beta$  for which the vectors  $3\hat{i} + 6\hat{j} + \hat{k}$  and  $2\hat{i} - 4\hat{j} + \beta\hat{k}$  are perpendicular. 1
9. Find the reflection of the point (2, 3, 5) in the XZ plane . 1
10. What is the distance of the point (1, 4, 7) from the Y- axis? 1
11. A fair die is rolled .Consider events  $E = \{1,3,5\}$ ,  $F = \{2,3\}$  and  $G = \{2,3,4,5\}$  . Find  $P((E \cap F)/G)$  1
12. If  $P(B') = 0.65$ ,  $P(A \cup B)' = 0.15$  and A and B are independent events then find  $P(A)$ . 1
13. The two vectors  $\hat{j} + \hat{k}$  and  $3\hat{i} - \hat{j} + 4\hat{k}$  represent the two sides AB and AC, respectively of a  $\Delta ABC$ . Find the length of the median through C. 1
14. Given  $|\vec{a}|=3$ ,  $|\vec{b}| = 2$ ,  $\vec{a} \cdot \vec{b} = 6$ . Find  $|\vec{a} - \vec{b}|$  1
15. Write the adjoin of matrix  $A = \begin{pmatrix} 2 & -1 \\ 4 & 3 \end{pmatrix}$  1
16. If  $n(A) = 3$  and  $n(B) = 6$ , then find the number of bijective functions from A to B. 1

## SECTION II

17. An open tank with a square base(x units) and vertical sides(y units) is to be constructed from a metal sheet so as to hold a given quantity of water. 4

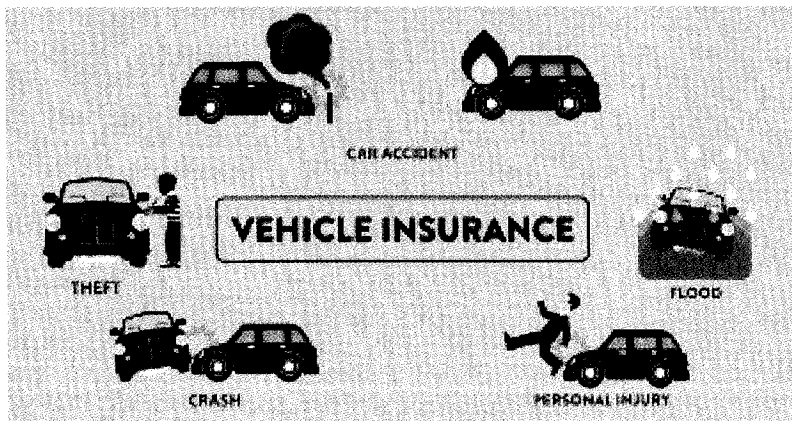


Based on the above information , answer the following:

- (i) The volume of tank V is  
 (a)  $x^2y$  (b)  $xy$  (c)  $x + y$  (d)  $xy^2$
- (ii) Total Surface Area S of tank in terms of x and volume V is  
 (a)  $x^2 + 4V$  (b)  $x^2 + \frac{4V}{x}$  (c)  $x + \frac{4V}{x}$  (d)  $x^2 - \frac{4V}{x}$
- (iii) For maximum or minimum value of surface area S,  $\frac{ds}{dx}$  is  
 (a)  $2x + \frac{4V}{x^2}$  (b)  $x - \frac{4V}{x^2}$  (c)  $x + \frac{4V}{x^2}$  (d)  $2x - \frac{4V}{x^2}$
- (iv) From  $\frac{ds}{dx} = 0$  , relation between length (x) and volume (V) is  
 (a)  $x^2 = 2V$  (b)  $x^3 = 2V$  (c)  $x = 2V$  (d)  $x = 2v^2$
- (v) For minimum surface area (S), relation between length (x) and height (y) is  
 (a)  $x = 2 + y$  (b)  $x = 2 - y$  (c)  $x = 2V$  (d)  $x = 2y$

18. An insurance company insure three type of vehicles i.e., type A, B and C. If it insured 12000 vehicles of type A, 16000 vehicles of type B and 20,000 vehicles of type C. Survey report says that the chances of their accident are 0.01, 0.03 and 0.04 respectively.

4



Based on the information given above, write the answer of following:

- (i) The probability of insured vehicle of type C is  
 (a)  $\frac{5}{12}$  (b)  $\frac{4}{12}$  (c)  $\frac{7}{12}$  (d)  $\frac{3}{12}$
- (ii) Let E be the event that insured vehicle meets with an accident then  $P(E/A)$  is  
 (a) 0.09 (b) 0.01 (c) 0.07 (d) 0.06
- (iii) Let E be the event that insured vehicle meets with an accident then P (E) is  
 (a)  $\frac{38}{1200}$  (b)  $\frac{32}{1200}$  (c)  $\frac{24}{1200}$  (d)  $\frac{35}{1200}$
- (iv) One of the insured vehicle meets with an accident , what is the probability that it is a type C vehicle  
 (a)  $\frac{2}{7}$  (b)  $\frac{3}{7}$  (c)  $\frac{5}{7}$  (d)  $\frac{4}{7}$
- (v) One of the insured vehicles meets with an accident, what is the probability that it is not of type A and C.  
 (a)  $\frac{12}{35}$  (b)  $\frac{20}{35}$  (c)  $\frac{1}{35}$  (d)  $\frac{17}{35}$

## PART B SECTION III

19. Evaluate :  $\sin^{-1}\left(\frac{\sin 25 + \cos 25}{\sqrt{2}}\right)$

2

20. If  $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$  then show that  $A^2 - 5A + 7I = 0$ . Hence find  $A^{-1}$ . 2

OR

Express the following matrices as the sum of a symmetric matrix and a skew symmetric matrix:

$$C = \begin{bmatrix} 3 & 5 \\ 1 & -1 \end{bmatrix}$$

21. Find the point on the parabola  $f(x) = (x - 3)^2$ , where the tangent is parallel to the chord joining the points (0,3) and (4,1). 2

22. Evaluate  $\int \tan^4 x \, dx$  OR Evaluate  $\int \frac{1}{\sin(x-a) \sin(x-b)} \, dx$  2

23. If the following function is differentiable at  $x = 2$ , then find the values of  $a$  and  $b$  2
- $$f(x) = \begin{cases} x^2, & \text{if } x \leq 2 \\ ax + b, & \text{if } x > 2 \end{cases}$$

OR

Find the value of  $k$  if  $f(x) = \begin{cases} k \sin \frac{\pi}{2}(x+1), & x \leq 0 \\ \frac{\tan x - \sin x}{x^3}, & x > 0 \end{cases}$  is continuous at  $x = 0$

24. Find the values of  $p$  so that the lines 2
- $$\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2} \text{ and } \frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$$
- are at right angles to each other.

25. A problem in mathematics is given to 3 students whose chance of solving it are  $1/3$ ,  $1/4$ , and  $1/5$ . What is probability that the problem is solved? 2

OR

A box of oranges is inspected by examining three randomly selected orange drawn without replacement. If all the three oranges are good, the box is approved for sale, otherwise it is rejected. Find the probability that a box containing 16 oranges out of which 12 are good and 4 are bad ones will be approved for sale.

26. Find the area bounded by the curve  $y = \cos x$  and the  $x$  axis between  $x = 0$  and  $x = \pi$ , using the method of integration. 2
27. Find the area of the parallelogram whose diagonals are represented by the vectors  $3\hat{i} + \hat{j} - 2\hat{k}$  and  $\hat{i} - 3\hat{j} + 4\hat{k}$ . 2
28. Find the general solution of the following differential equation:  $\log \left( \frac{dy}{dx} \right) = ax + by$ . 2

#### SECTION IV

29. Show that the relation  $R$  in the set  $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$  given by  $R = \{(a, b) : |a - b| \text{ is a multiple of } 4\}$  is an equivalence relation. Write equivalence class  $[1]$  3

30. Find  $\frac{dy}{dx}$ ,  $y = (\sin x)^x + \sin(x^x)$  3

**OR**

For a positive constant  $a$ , find  $\frac{dy}{dx}$  if  $x = \left(t + \frac{1}{t}\right)^a$ ,  $y = a\left(t + \frac{1}{t}\right)$

31. If  $x^{28}y^{17} = (x+y)^{45}$ , then Prove that  $\frac{dy}{dx} = \frac{y}{x}$  3

32. Solve the differential equation  $\cos^3 x \frac{dy}{dx} + y \cos x = \sin x$  ( $0 \leq x < \frac{\pi}{2}$ ) 3

33. Find the area of the region bounded by the curve  $y = \sqrt{25 - x^2}$  and x-axis using integrals. 3

**OR**

Find the area of the region bounded by the curve  $y + 4 = x^2$  and x-axis using integrals.

34. Evaluate  $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{9 + 16 \sin 2x} dx$  3

35. Find the Intervals in which the function  $f$  given by  $f(x) = \frac{4 \sin x - 2x - x \cos x}{2 + \cos x}$ ,  $0 \leq x \leq 2\pi$  is 3  
a) increasing b) decreasing

### SECTION V

36. Find the equation of the plane passing through the two points  $(1, 2, -1)$ ,  $(2, 0, 2)$  and parallel to the line  $\vec{r} = (2\hat{i} + \hat{j} + 2\hat{k}) + \lambda(\hat{i} + 2\hat{j} + 2\hat{k})$  5

**OR**

Find the foot of the perpendicular from  $P(1, 2, 3)$  on the line  $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$  also, obtain the equation of the plane containing the line and the point  $(1, 2, 3)$ .

37. Two schools A and B decided to award prizes to their students for three games hockey (x), cricket (y) and tennis (z). School A decided to award a total of Rs11000 for the three games to 5, 4 and 3 students respectively while school B decided to award Rs10700 for the three games to 4, 3 and 5 students respectively. Also, all the three prizes together amount to Rs. 2700. Solve for x, y and z using matrix method. 5

**OR**

If  $A = \begin{bmatrix} 5 & 0 & 4 \\ 2 & 3 & 2 \\ 1 & 2 & 1 \end{bmatrix}$  and  $B^{-1} = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$  then compute  $(AB)^{-1}$

38.. Solve the following linear programming problems graphically: 5

Minimize and Maximize  $Z = 5x + 10y$  subject to  $x + 2y \leq 120$ ,  $x + y \geq 60$ ,  $x - 2y \geq 0$ ;  $x, y \geq 0$

**OR**

Minimize  $Z = 10(x - 7y + 190)$  subject to the constraints:  $x + y \leq 8$ ,  $x \leq 5$ ,  $y \leq 5$ ,  $x + y \geq 4$ ,  $x, y \geq 0$

**End of the Question Paper**