

Roll Number

SET A



INDIAN SCHOOL MUSCAT
FINAL EXAMINATION 2020-21
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

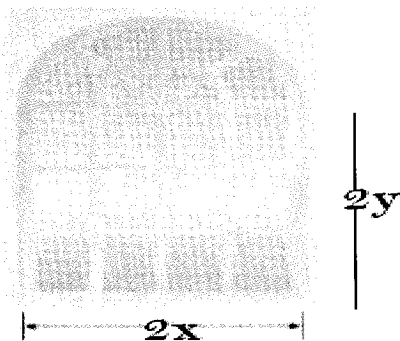
1. If $n(A) = 5$ and $n(B) = 6$, then find the number of bijective functions from A to B. 1
2. How many reflexive relations are possible in a set A whose $n(A) = 2$ 1

3. 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
4. For what value of x, the matrix $\begin{bmatrix} 5-x & x+1 \\ 2 & 4 \end{bmatrix}$ is singular? 1
5. Write the number of all possible matrices of order 2×2 with each entry 1, 2 or 3. 1
6. If A and B are matrices of order 3 and $|A| = 5$, $|B| = 3$, then find $|3AB|$ 1
7. Evaluate $\int_{-1}^2 \frac{|x|}{x} dx$ OR If $\int \frac{1}{\sqrt{4-9x^2}} dx = \frac{1}{3} \sin^{-1}(ax) + c$, then find the value of a. 1
8. Find the area of the region bounded by the curve $x = 2y + 3$, y-axis and the lines $y = 1$. 1
OR
Find the area bounded by the curve $y = x|x|$, x-axis and the lines $x = -2$ and $x = 2$
9. Find the order and degree of the differential equation $\left(\frac{d^4y}{dx^4}\right)^2 + \left(\frac{d^3y}{dx^3}\right)^5 + 4y = 7$ 1
OR
Find the integrating factor of differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$
10. Find the value of β for which the vectors $3\hat{i} - 6\hat{j} + \hat{k}$ and $2\hat{i} - 4\hat{j} + \beta\hat{k}$ are parallel. 1
11. Find the projection of \vec{a} on \vec{b} if $\vec{a} \cdot \vec{b} = 8$ and $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$. 1
12. $|\vec{a} \cdot \vec{b}| = |\vec{a} \times \vec{b}|$, then what is the angle between \vec{a} and \vec{b} . 1
13. Find the reflection of the point (2, 3, 5) in the XY plane. 1
14. What is the distance of the point (1, 4, 7) from the Z-axis? 1
15. If A and B are two events such that $P(A) + P(B) - P(A \text{ and } B) = P(A)$, then find the value of $P(A/B)$. 1
16. The probability distribution of the discrete variable X is given below, find the value of k. 1

X	1	2	3	4	5
P(X)	$\frac{2}{k}$	$\frac{3}{k}$	$\frac{5}{k}$	$\frac{7}{k}$	$\frac{3}{k}$

SECTION II

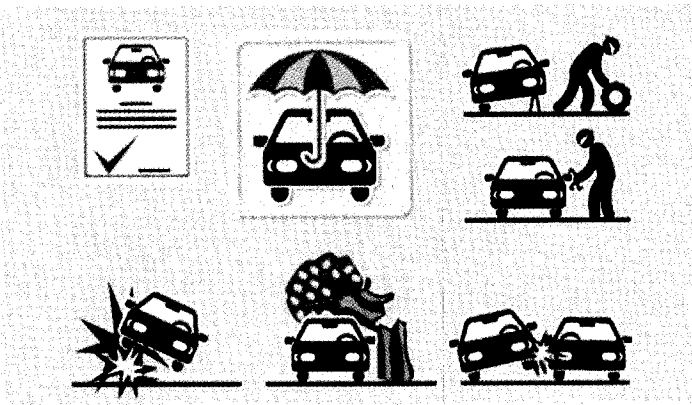
17. MR. Kumar, who is an architect, designs a building for a small company. The design of window on the ground floor is proposed to be different than other floors. The window is in the shape of a rectangle which is surmounted by a semi-circular opening. This window is having a perimeter of 10 m as shown below: 4



Based on the above information answer the following:

- (i) If $2x$ and $2y$ represents the length and breadth of the rectangular portion of the windows, then the relation between the variables is
 - (a) $4y - 2x = 10 - \pi$
 - (b) $4y = 10 - (2 - \pi)x$
 - (c) $4y = 10 - (2 + \pi)x$
 - (d) $4y - 2x = 10 + \pi$
- (ii) The combined area (A) of the rectangular region and semi-circular region of the window expressed as a function of x is
 - (a) $A = 10x + (2 + \frac{1}{2}\pi)x^2$
 - (b) $A = 10x - (2 + \frac{1}{2}\pi)x^2$
 - (c) $A = 10x - (2 - \frac{1}{2}\pi)x^2$
 - (d) $A = 4xy + \frac{1}{2}\pi x^2$
- (iii) The maximum value of area A , of the whole window is
 - (a) $A = \frac{50}{\pi - 4} m^2$
 - (b) $A = \frac{50}{\pi + 4} cm^2$
 - (c) $A = \frac{100}{\pi + 4} m^2$
 - (d) $A = \frac{50}{4 - \pi} m^2$
- (iv) The owner of this small company is interested in maximizing the area of the whole window so that maximum light input is possible. For this to happen, the length of rectangular portion of the window should be
 - (a) $\frac{20}{\pi + 4} m$
 - (b) $\frac{10}{\pi + 4} m$
 - (c) $\frac{4}{\pi + 10} m$
 - (d) $\frac{100}{\pi + 4} m$
- (v) In order to get the maximum light input through the whole window, the area (in sq. m) of only semi-circular opening of the window is
 - (a) $\frac{100\pi}{(4 + \pi)^2}$
 - (b) $\frac{50\pi}{4 + \pi}$
 - (c) $\frac{50\pi}{(4 + \pi)^2}$
 - (d) same as the area of rectangular portion of the window

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. 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, the probability that it is a type C vehicle is
 (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, the probability that it is not of type A and C is
 (a) $\frac{12}{35}$ (b) $\frac{20}{35}$ (c) $\frac{1}{35}$ (d) $\frac{17}{35}$

PART B SECTION III

19. Evaluate : $\sin^{-1} \left(\frac{(\sin 20 + \cos 20)}{\sqrt{2}} \right)$ 2
20. $A = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ Show that $A^2 - 7A - 2I = 0$. Hence find A^{-1} . 2

OR

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

$$C = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$$

21. $f(x) = \begin{cases} \frac{\sqrt{1+px} - \sqrt{1-px}}{x}, & -1 \leq x < 0 \\ \frac{2x+1}{x-2}, & 0 \leq x \leq 1 \end{cases}$ is continuous. Find the value of p 2

OR

If the following function is differentiable at $x = 2$, then find the values of a and b

$$f(x) = \begin{cases} x^2, & \text{if } x \leq 2 \\ ax + b, & \text{if } x > 2 \end{cases}$$

22. 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
23. Evaluate $\int \operatorname{cosec} x \, dx$ OR Evaluate $\int \frac{1}{1 + \cot x} \, dx$ 2
24. 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
25. Find the general solution of the following differential equation: $\log\left(\frac{dy}{dx}\right) = ax + by$. 2
26. 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
27. Find the values of p so that the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are at right angles to each other 2
28. A police man fires 4 bullet on a dacoit. The probability that the dacoit will be killed by one bullet is 0.6. What is the probability that the dacoit is still alive? 2

OR

A box of orange 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 15 oranges out of which 12 are good and 3 are bad ones will be approved for sale.

SECTION IV

29. Show that the relation R in the set $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ given by $R = \{(a, b) : |a - b| \text{ is a multiple of } 3\}$ is an equivalence relation. Write equivalence class $[1]$ 3
30. Find $\frac{dy}{dx}$, $y = (\sin x)^x + \sin(x^x)$ 3
- OR
- If $x = a[\cos t + \log(\tan \frac{t}{2})]$, $y = a \sin t$, show that $\frac{dy}{dx} = \tan t$
31. If $x^{28}y^{17} = (x + y)^{45}$, then Prove that $\frac{dy}{dx} = \frac{y}{x}$ 3
32. Show that the function f is given by $f(x) = \tan^{-1}(\sin x + \cos x)$, $x > 0$ is always a strictly increasing function in $(0, \frac{\pi}{4})$ 3
33. Evaluate $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{9 + 16 \sin 2x} \, dx$ 3
34. Find the area of the region bounded by the curve $y = \sqrt{16 - x^2}$ and x -axis. 3

OR

Find the area of the region bounded by the curve $y = 5 - x^2$ and x- axis

35. Solve the differential equation $\cos^2 x \frac{dy}{dx} + y = \tan x$ ($0 \leq x < \frac{\pi}{2}$) when $y = 1$, $x = \frac{\pi}{4}$ 3

SECTION V

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

37. Find the length and foot of perpendicular from the point (7, 14, 5) to the plane $2x + 4y - z = 2$, Also find the image of (7, 14, 5). 5

OR

Find the distance of the point (2, 3, 4) from the line $\frac{x+3}{3} = \frac{y-2}{6} = \frac{z}{2}$ measured parallel to the plane $3x + 2y + 2z + 5 = 0$

38. Solve the following linear programming problems graphically: 5

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

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