Roll Number		

SET A

INDIAN SCHOOL MUSCAT
SECOND PRE-BOARD EXAMINATION
SUBJECT : MATHEMATICS

CLASS: XII — Sub. Code: 041 — Time Allotted: 3 Hrs.

10.02.2020 — Max. Marks: 80

General Instructions:

1. All questions are compulsory.
2. Section A contains 20 questions of 1 mark each, Section B contains 6 question of 2 marks each, Section C contains 6 questions of 4 marks each and Section D contains 4 questions of 6 marks each.
3. Wherever internal choices are given, students are expected to attempt any one of the two choices.
4. ***In case of MCQ's write answer along with the correct options.***

SECTION – A

1. The domain of $\sin^{-1} 2x$ is

   a. $[-1, 1]$ b. $[-\frac{\pi}{2}, \frac{\pi}{2}]$ c. $[-\frac{1}{2}, \frac{1}{2}]$ d. $[-2, 2]$

2. $\int_{-\pi}^{\pi} sin^3x\, cos^2x\, dx =$

   a. 1 b. $\frac{\pi}{2}$ c. -1 d. 0.

3. The number of points in the domain of f(x) where it is not continuous in $(-1,7)$, where $f(x) = \frac{1}{x-[x]}$ are

   a) 8 b) 2 c) 7 d) 0

4. Let A be a non-singular square matrix of order 3 x 3 , then $|adj\ A| =$

   a) $|A|$ b) $|A|^2$ c) $|A|^3$ d) $9|A|$

5. $\int_0^{2a} f(x)\, dx = 2\int_0^{a} f(x)dx$, if

   a) f(x) is even function b) $f(2a - x) = -f(x)$ c) $f(2a - x) = f(x)$ d) $f(2a - x) = 2f(x)$.

6. If , $A = \begin{bmatrix} 0 & p & -3 \\ 2 & 0 & -1 \\ q & 1 & 0 \end{bmatrix}$ is a skew symmetric matrix then

   a) $p = 2, q = 3$ b) $p = -2, q = 3$ c) $p = 2, q = -3$ d) $p = -2, q = -3$
   e)

7. If the vectors $2\hat{\imath} + 6\hat{\jmath} + 14\hat{k}$ and $\hat{\imath} - y\hat{\jmath} + 7\hat{k}$ are parallel to each other then value of y is

   a) 3 b) $\frac{-1}{3}$ c) $\frac{1}{3}$ d) -3

8. The solution set of the inequation $3x + 2y > 3$ is

a) half plane not containing the origin.
b) half plane containing the origin.
c) the origin as it lies on the line $3x + 2y = 3$
d) data is insufficient to reach at any logical conclusion.

9. If A and B are events such that P(A/B) =P(B/A) then
a) $A \subset B$ but $A \neq B$
b) A = B
c) P(A) = P(B)
d) A and B are mutually disjoint events

10. The cosine of angle made by the plane $2x - 3y + 6z - 11 = 0$ with x – axis is
a) ½
b) $\frac{2}{7}$
c) $\frac{\sqrt{3}}{2}$
d) $\frac{1}{\sqrt{3}}$

11. If $f : R \rightarrow R$ is defined by $f(x) = (3 - x^3)^{\frac{1}{3}}$, find fof (x)

12. If $\begin{bmatrix} 5 & x & 1 \end{bmatrix} \begin{bmatrix} 4 \\ 2 \\ 7 \end{bmatrix} = [35]$, find the value of x.

13. If A is a square matrix of finite order and $|A| = 0$ then matrix A is called a ______________ matrix.

14. Write the interval in which the function $f(x) = 2x^2 - 3x$ is strictly increasing
OR
The length of a rectangle is decreasing at the rate of 3 cm / min and breadth is increasing at the rate of 2 cm/min. at what rate the perimeter of the rectangle decreases?

15. Evaluate $\int x \log x \, dx$

16. Evaluate $\int \frac{1+2x}{\sqrt{1+x^2}} dx$ **OR** Evaluate $\int_{-2}^{1} |x| dx$

17. Show that the differential equation which represents the family of curves $y = ae^{bx}$ where a and b are arbitrary constants is $y \frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$

18. If $\vec{a} = 2\hat{\imath} - \hat{\jmath} + \hat{k}$ and $\vec{b} = -2\hat{\imath} + \hat{\jmath} + 2\hat{k}$, then find the unit vector in the direction of $(\vec{a} - \vec{b})$.

19. Find the value of p if the plane $\vec{r}.(p\hat{\imath} - \hat{\jmath} + 4\hat{k}) = 0$ and the line $\frac{x+3}{1} = \frac{4-y}{p} = \frac{z-3}{1}$ are parallel to each other.

20. Let A and B be two events. If P(A) = 0.3, P(B) = 0.4 and $P(A \cup B) = 0.6$, then Find P(A/B).

SECTION – B

21. Find the value of $\cot(\frac{\pi}{4} - 2\cot^{-1} 3)$.
OR
Solve for x ; $2\tan^{-1}(\cos x) = \tan^{-1}(2\operatorname{cosec} x)$

22. If y = cosec x + cot x , then show that $\sin x \frac{d^2y}{dx^2} = y^2$

23. Show that tangents to the curve $y = 2x^3 - 4$ at x = 2 and x = −2 are parallel to each other ?

24. Find the value of , if the vectors $\vec{a} = \hat{\imath} + 3\hat{\jmath} + \hat{k}$, $\vec{b} = 2\hat{\imath} - \hat{\jmath} - \hat{k}$ and $\vec{c} = \beta\hat{\jmath} + 3\hat{k}$ are coplanar.

OR

If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$, then show that $(\vec{r} \times \hat{\imath}).(\vec{r} \times \hat{\jmath}) + xy = 0$

25. Write the cartesian equation of a plane, bisecting the line segment joining the points A(2, 3, 5) and B(4, 5, 7) at right angles.

26. A speaks truth in 60 % of the cases and B in 90 % of the cases. In what percentage of the cases are they are likely to contradict each other in stating the same fact ?

SECTION – C

27. Let N denotes the set of natural numbers and R be the relation on N x N defined by (a,b) R (c,d) iff ad (b + c) = bc (a + d). Show that R is an equivalence relation.

OR

Consider the function f : $R - \left\{\frac{7}{5}\right\} \rightarrow R - \left\{\frac{3}{5}\right\}$ defined as $f(x) = \frac{3x+4}{5x-7}$. Show that f is invertible and hence find its inverse.

28. Find $\frac{dy}{dx}$ where $y = x^{\tan x} + \log(x + \sqrt{1+x^2})$

29. Evalute : $\int (x+3)\sqrt{3-4x-x^2}\, dx$

30. A diet is to contain at least 80 units of Vitamin A and 100 units of minerals. Two foods P and Q are available. Food P costs Rs. 4 per unit and Q costs Rs. 6 per unit. One unit of food P contains 3 units of Vitamin A and 4 units of minerals. One unit of food Q contains 6 units of Vitamin A and 3 units of minerals. Formulate this as a linear programming problem and find graphically the minimum cost for diet that consists of mixture of these two foods and also meets the minimal nutritional requirements.

31. Suppose 5% of men and 0.25% of women have grey hair. A grey haired person is selected at random. What is the probability of this person being male? Assume that there are equal number of males and females.

OR

A random variable X has the following probability distribution:

X	0	1	2	3	4	5	6	7
P(X)	0	K	2K	2K	3K	K^2	$2K^2$	$7K^2 + K$

Determine: (i) K (ii) P (X < 3) (iii) P (X > 6) (iv) P (0 < X < 3)

32. Find the particular solution of the differential equation $x\frac{dy}{dx} - y + x\sin(\frac{y}{x}) = 0$ when x = 2 and y = π.

SECTION –D

33. Find the equation of the plane passing through the line of intersection of the planes $\vec{r}.(\hat{\imath} + 3\hat{\jmath}) - 6 = 0$ and $\vec{r}.\left(3\hat{\imath} - \hat{\jmath} + 4\hat{k}\right) = 0$ whose perpendicular distance from origin is unity.

34. Prove that the volume of the largest cone, that can be inscribed in a sphere of given radius is $\frac{8}{27}$ times the volume of the sphere.

35. Using the method of integration find the area of the region bounded by the lines

    $2x + y = 4$, $3x - 2y = 6$ and $x - 3y + 5 = 0$

    OR

    Using the method of integration find the area of the region

    $\{(x, y) : 0 \le y \le x^2 + 1, 0 \le y \le x + 1, 0 \le x \le 2\}$

36. If $A = \begin{bmatrix} 4 & -5 & -11 \\ 1 & -3 & 1 \\ 2 & 3 & -7 \end{bmatrix}$, find A^{-1} . Hence solve the following system of linear equations;

    $4x - 5y - 11z = 12,\ \ x - 3y + z = 1,\ \ 2x + 3y - 7z = 2.$

    OR

    If $\Delta = \begin{vmatrix} x & x^2 & 1+px^3 \\ y & y^2 & 1+py^3 \\ z & z^2 & 1+pz^3 \end{vmatrix}$ *then prove that* $\Delta = (1 + pxyz)\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$.

    Hence show that $\Delta = (1 + pxyz)(x - y)(y - z)(z - x)$

End of the Question Paper