PRE BOARD EXAMINATION - 1(2020-21)
MATHEMATICS (041)

Time: 3 hrs

C LASS: XII **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 answers 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 3questions of Section-V.
You have to attempt **only one of** the alternatives in all such questions**.**

Part – A

Section I

All questions are compulsory. In case of internal choices attempt any one.

1.Let the relation R be defined in N by aRb if $2a + 3b = 30$, then find R. 1

2.If A = {a, b, c, d} and f = {a, b), (b, d), (c, a), (d, c)}, show that f is one- one from A nto A.

OR

For the set A = {1, 2, 3}, define a relation R in the set A as follows: 1
R = {(1, 1), (2, 2), (3, 3), (1, 3)} .Write the ordered pairs to be added to R to make it the smallest equivalence relation.

3. Let A = {0, 1, 2, 3} and define a relation R on A as follows:

R = {(0, 0), (0, 1), (0, 3), (1, 0), (1, 1), (2, 2), (3, 0), (3, 3)}.

Is R reflexive? Symmetric? Transitive? Justify. 1

4. If A is square matrix such that $A^2 = A$, show that $(I + A)^3 = 7A + I$. 1

5. The area of a triangle with vertices (–3, 0), (3, 0) and (0, k) is 9 sq. units then find the value of k. 1

6. If A is invertible matrix of order 3 × 3, then find $|A^{-1}|$.

OR

If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & 5 \\ 8 & 3 \end{vmatrix}$ find the value of x.

7. Find the value of $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} (x^3 + x\cos x + \tan^5 x + 1)\,dx$. 1

8. Give the number of arbitrary constants in the particular solution of a differential equation of third order. 1

9. Findarea of the region bounded by the curve $y^2 = 4x$, y-axis and the line y = 3. 1

10. If a and b be two unit vectors inclined to x-axis at angles 30° and 120° respectively, find the value of |a + b|. 1

11. Find a vector in the direction of $\vec{a} = \hat{\imath} - 2\hat{\jmath}$ whose magnitude is 7 unit. 1

12. Show that the vector $\hat{\imath} + \hat{\jmath} + \hat{k}$ is equally inclined to axes. 1

13. A line makes angle α, β, γ with x-axis, y-axis and z-axis respectively

then find the value of $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ 1

14. Write the Cartesian equation of the following line given in vector form:

$\vec{r} = 2\hat{i} + \hat{j} - 4\hat{k} + \lambda(\hat{i} - \hat{j} - \hat{k})$. 1

15. Three balls are drawn from a bag containing 2 red and 5 black balls, if the random

variable X represents the number of red balls drawn,

then write the values that X can take . 1

16. If A and B are two independent events such that P(A) = 17 and P(B) = 16

then find P(A′ ∩ B′). 1

Section II

Both the Case study based questions are compulsory. Attempt any 4 sub parts from each question 17 and 18. Each question carries 1 mark

17. Three schools A, B and C organized a mela for collecting funds for helping the rehabilitation of flood victims. They sold handmade fans, mats and plates from recycled material at a cost of Rs. 25, Rs. 100 and Rs. 50 each. The number of articles sold is given.

School / Article	A	B	C
Hand-fans	40	25	35
Mats	50	40	50
Plates	20	30	40

Based on the above information, answer the following questions:

(Attempt any four)

(i) Find the fund collected by school A if they sold 45 hand-fans, 40 mats and 25 plates. 1
(A) 6375 (B) 6735 (C) 5635 (D) 3635

(ii) Find the fund collected by school B and C. 1
(A) 14000 (B) 12000 (C) 10000 (D) 13000

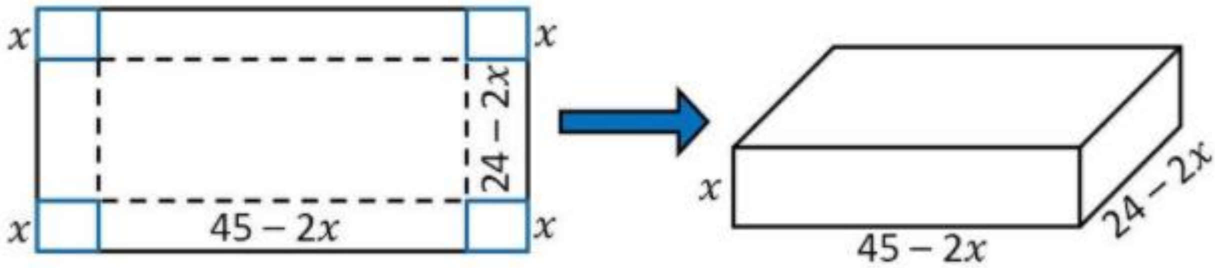
(iii) Find the total fund collected by all the schools. 1
(A) 15000 (B) 21000 (C) 18000 (D) 17000

(iv) If the number of hand-fans and mats are interchanged for all the schools, what is the total fund collected by all schools. 1

(A) 15000 (B) 16000 (C) 18000 (D) 12000

(v) Find the total number of all articles sold.
(A) 130 (B) 430 (C) 330 (D) 230

18. A rectangular sheet of tin 45 cm by 24 cm is to be made into a box without top, by cutting off square from each corner and folding up the flap as shown in the figure.



Based on the above information, answer the following questions:

(Attempt any four)

(i) The polynomial function V(x) which represents the volume of the box is given by 1

(A) $4x^3 - 138x^2 + 1080x$ (B) $4x^3 + 138x^2 + 1080x$

(C) $x^3 - 138x^2 + 1080x$ (D) none

(ii) The side of the square (x) to be cut off so that the volume of the box maximum is 1

(A) 3 (B) 5 (C) 18 (D) 5 & 18

(iii) The maximum volume of the box in cm^3 is 1

(A) 1250 (B) 4250 (C) 2000 (D) 2450

(iv) The second derivative of the volume function at the value of x for which the maximum volume occurred is 1

(A) 120 (B) -140 (C) -120 (D) none

(v) What should be the side of the square to be cut off so that the volume of the box is maximum if a square sheet of length 18 cm is given

(A) 3 (B) 4 (C) 5 (D) none

Part – B

Section III

19. Prove that: $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\frac{1}{3} = \frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$ 2

20. Express the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrix

OR

If $\begin{bmatrix} 2x & 3 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ -3 & 0 \end{bmatrix} \begin{bmatrix} x \\ 8 \end{bmatrix} = O$ find x. 2

21. Find the values of k so that the function is continuous at the indicated point 2

$$f(x) = \begin{cases} kx^2, if \quad x \le 2 \quad at \quad x = 2 \\ 3, if \quad x > 2 \quad at \quad x = 2 \end{cases}$$

22. Find points at which the tangent to the curve $y = x^3 - 3x^2 - 9x + 7$

is parallel to the x-axis . 2

23.Integrate the following

$$\frac{4x+1}{\sqrt{2x^2+x-3}}$$

OR

Evaluate $\int \frac{1-cosx}{1+cosx}dx$ 2

24. Find the area of the region in the first quadrant enclosed by the x-axis,

the line y = x, and the circle $x^2 + y^2 = 32$. 2

25. Solve

$$(x+y)\frac{dy}{dx} = 1$$

2

26. Find the equation of the plane through the intersection of the planes 3x – y + 2z – 4 = 0 and x + y + z – 2 = 0 and the point (2, 2, 1). 2

27. Find the position vector of a point which divides the join of points with

position vectors $\vec{a} + \vec{b}$ and $2\vec{a} - \vec{b}$ in the ratio 1:2 internally and externally. 2

28. Prove that if E and F are independent events, then the events E and F' are also independent.

OR

Ten cards numbered 1 to 10 are placed in a box, mixed up thoroughly and then one card is drawn randomly. If it is known that the number on the drawn card is more than 3, what is the probability that it is an even number? 2

Section IV

All questions are compulsory. In case of internal choices attempt any one

29. Let L be the set of all lines in XY plane and R be the relation in L defined as $R = \{(L_1, L_2) : L_1$ is parallel to $L_2\}$. Show that R is an equivalence relation. Find the set of all lines related to the line $y = 2x + 4$. 3

30. Prove that the curves $x = y^2$ and $xy = k$ cut at right angles if $8k^2 = 1$. 3

31. A wire of length 28 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into a circle. What should be the length of the two pieces so that the combined area of the square and the circle is minimum?

OR

Differentiate $(x \quad cosx)^x + (x \quad sinx)^{\frac{1}{x}}$ 3

32. Find the equation of all the tangents to the curve $y = \cos(x + y)$, $-2\pi \le x \le 2\pi$, that are parallel to the line $x + 2y = 0$. 3

33. Evaluate

$$\int_0^{\pi} log(1 + cosx)dx$$ 3

34. Find the area of the region included between the parabola $y = \frac{3x^2}{4}$ and line $3x - 2y + 12 = 0$.

OR

Find the area of the region bounded by the parabola $y^2 = 2x$ and the straight line $x - y = 4$. 3

35. Solve $(x^2 - 1)\frac{dy}{dx} + 2xy = \frac{1}{x^2-1}$ 3

Section V

All questions are compulsory. In case of internal choices attempt any one

36. Find the image of the point having position vector $\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$ in the plane

$$\vec{r}\cdot\left(2\hat{\imath} - \hat{\jmath} + \hat{k}\right) + 3 = 0$$

OR

Find the image of the point (1, 6, 3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$ 5

37. One kind of cake requires 300 g of flour and 15 g of fat, another kind of cake requires 150 g of flour and 30 g of fat. Find the maximum number of cakes which can be made from 7× 5 kg of flour and 600 g of fat, assuming that there is no shortage of the other ingredients used in making the cakes. Make it as an L.P.P. and solve it graphically. 5

38. Three machines E_1 , E_2 , E_3 in a certain factory produce 50%, 25% and 25%, respectively, of the total daily output of electric tubes. It is known that 4% of the tubes produced one each of machines E_1 and E_2 are defective, and that 5% of those produced on E_3 are defective. If one tube is picked up at random from a day's production, calculate the probability that it is defective. 5