PRE-BOARD EXAMINATION-2020-21

SUBJECT - MATHEMATICS

Class: XII (CBSE) **Total Marks: 80**

Date……………. **Time: 3 hrs.**

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

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

1. Check whether the function ƒ: N→N, given by ƒ (x) $=2x$ is one –one or onto? (1)

OR

Set A has 3 elements and the set B has 4 elements. Find the number of injective mapping that can be defined from A to B?

2. Show that the relation S in the set $A=\{x \in Z: 0 \leq x \leq 12\}$ given by $S=\{(a,b): a,b \in Z, |a-b| is divisible\ by\ 3\}$ is a transitive relation? (1)

3. Let $A = \{(x, y): x + 2y = 8\}$ is a relation on N. Find the range of R. (1)

OR

Let $f: R \to R$ be defined by $f(x) = \begin{cases} 2x, & x > 3 \\ x^2, & 1 < x \leq 3 \\ 3x, & x \leq 1 \end{cases}$. Then find the value of

$f(-1) + f(2) + f(4)$?

4. Find the number of all possible matrices of order 3×3 which each entry 0 or 1 ? (1)

5. Find the adjoint of the matrix A = $\begin{bmatrix} 2 & 1 \\ 4 & -1 \end{bmatrix}$? (1)

OR

If A is a square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to ______.

6. If A is a matrix of order 3×3, then find the number of minors in the determinants of A ? (1)

7. If $\int \left(\frac{x-1}{x^2}\right) e^x dx = f(x)e^x + C$, then write the value of $f(x)$? (1)

OR

Evaluate: $\int_2^3 \frac{1}{x} dx$?

8. Find the area of the region bounded by the curve $x = 2y + 3$ and the lines $y = 1$ and $y = -1$? (1)

9. Find the number of arbitrary constants in the general solution of a differential equation of order two? (1)

OR

Find the degree of the differential equation $\sqrt{1 + \left(\frac{dy}{dx}\right)^2} = x$?

10. For what value of 'a' the vectors $2\hat{\imath} - 3\hat{\jmath} + 4\hat{k}$ and $a\hat{\imath} + 6\hat{\jmath} - 8\hat{k}$ are collinear**?** (1)

11. Find the sum of the intercepts cut off by the plane 2x + y – z = 5 on the coordinate axes? (1)

12. Write the value of $(\hat{\imath} \times \hat{\jmath}).\hat{k} + \hat{\imath}.\hat{\jmath}$? (1)

13. For what value of p, is $(\hat{\imath} + \hat{\jmath} + \hat{k})p$ a unit vector? (1)

14. Write the equation of a plane which is at a distance of $5\sqrt{3}$ units from origin and the normal to which is equally inclined to coordinate axes? (1)

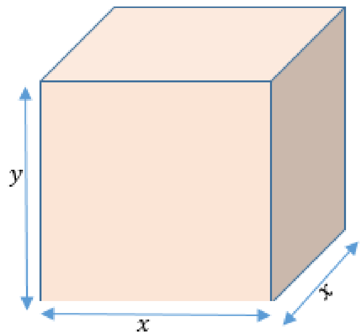
15. If A and B are two events such that P (A)= 0.2 , P (B) = 0.4 and P (A ∪ B) = 0.5 , then value of P (A|B) is ? (1)

16. A flashlight has 8 batteries out of which 3 are dead. If two batteries are selected without replacement and tested, then find the probability that both are dead? (1)

SECTION II

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

17. A butter cookies company designs a metal box as shown below. The metal box with a square base and vertical sides is to contain 1024 cm^3. The material for the top and bottom costs ₹ 5 per cm^2 and the material for the sides costs ₹ 2.50 per cm^2. (4)



Based on the above information answer the following:

(i)If x represents the side of the square base and y the length of the vertical sides , then the cost of making the top and bottom is

a) ₹ x^2

b) ₹ $2x^2$

c) ₹ $5x^2$

d) ₹ $10x^2$

(ii) Area of the four sides is

a) $4y^2\ cm^2$

b) $4x^2\ cm^2$

c) $4xy\ cm^2$

d) $4x^2y^2\ cm^2$

(iii) If x represents the side of the square base and y the length of the vertical sides, then the relation between the variables is

a) $y = \frac{1024}{x}$

b) $y = \frac{1024}{x^2}$

c) $y = 1024\,x$

d) $y = 1024\,x^2$

(iv)Cost of making the metal box C expressed as a function of x is

a) $C = 10x^2 + \frac{1024}{x}$

b) $C = 5x^2 + \frac{1024}{x}$

c) $C = 10x^2 + \frac{1024}{x^2}$

d) $C = 5x^2 + \frac{1024}{x^2}$

(v) The company decided to make the box with least cost. For this to happen the side of the square base x should be

a) 2cm

b) 5cm

c) 8cm

d) 16cm

18. Let X denotes the number of colleges where you apply after your results and $P(X = x)$ denotes your probability of getting admission in x number of colleges. It is given that (4)

$$P(X = x) = \begin{cases} kx, & if\ x = 0\ or\ 1 \\ 2kx, & if\ x = 2, \\ k(5-x), & if\ x = 3\ or\ 4 \\ 0, & if\ x > 4 \end{cases} \quad ,where\ k\ is\ a\ positive\ constant.$$

Based on the above information answer the following:

(i)The value of k is

a) 1

b) $\frac{1}{3}$

c) $\frac{1}{7}$

d) $\frac{1}{8}$

(ii) The probability that you will get admission in exactly one college is

a) $\frac{1}{2}$

b) $\frac{1}{3}$

c) $\frac{1}{8}$

d) $\frac{1}{5}$

(iii) The probability that you will get admission in at most two colleges is

a) $\frac{7}{12}$

b) $\frac{5}{8}$

c) $\frac{5}{21}$

d) $\frac{8}{17}$

(iv)What is the probability that you will get admission in at least 2 colleges?

a) $\frac{1}{3}$

b) $\frac{2}{7}$

c) $\frac{3}{8}$

d) $\frac{7}{8}$

(v)What is the probability that you will get admission in more than 4 colleges?

a) 0

b) 1

c) $\frac{1}{2}$

d) $\frac{1}{8}$

PART - B

SECTION III

19. Prove that : $3\sin^{-1}x = \sin^{-1}(3x - 4x^3),\ x \in [\frac{-1}{2}, \frac{1}{2}]$. (2)

20. Evaluate $\begin{vmatrix} \sin 30^\circ & \cos 30^\circ \\ -\sin 60^\circ & \cos 60^\circ \end{vmatrix}$? (2)

OR

If $A^T = \begin{bmatrix} 3 & 4 \\ -1 & 2 \\ 0 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 2 & 1 \\ 1 & 2 & 3 \end{bmatrix}$, then find $A^T - B^T$?

21. Find the value of k for which the function $f(x) = \begin{Bmatrix} \frac{x^2-x-6}{x+2}, x \neq -2 \\ k \quad\quad , x = -2. \end{Bmatrix}$ Is continuous at $x = -2$? (2)

22. Find the point on the curve $y = x^2$, where the slope of the tangent is 6? (2)

23. Evaluate: $\int \frac{sec^2 x}{3+\tan x} dx$? (2)

OR

If $\int_0^1 (3x^2 + 2x + k\ )dx = 0$, then find the value of k?

24. Find the area of the region bounded by the line $2y = 5x + 7, x - axis$ and the lines $x = 2\ ans\ x = 8$? (2)

25. Find the solution of the differential equation $\tan y\ \ sec^2 x\ dx + \tan x\ \ sec^2 y\ dy = 0$? (2)

26. If $\vec{a}\ , \vec{b}\ and\ \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$? (2)

27. Find the direction cosines of the line passing through two points $(-2,4,-5)$ and $(1,2,3)$? (2)

28. A die marked 1, 2, 3 in red and 4, 5, 6 in green is tossed. Let A be the event, ‘the number is even,’ and B be the event, ‘the number is red’. Are A and B independent? (2)

OR

A and B are events such that $P(A) = 0.4, P(B) = 0.3$ and $P(A \cup B) = 0.5$.

Then find $P(B' \cap A)$?

SECTION IV

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

29. Prove that the relation R on the set A = {1, 2, 3, 4, 5} given by $R = \{(a, b): |a - b| \text{ is even}\}$, is an equivalence relation. (3)

30. If $y = (x)^{\cos x} + (\cos x)^{\sin x}$, find $\frac{dy}{dx}$? (3)

31. If $x = a(\theta - sin\theta)$ and $y = a(1 - cos\theta)$, find $\frac{d^2y}{dx^2}$? (3)

OR

If $y = (cot^{-1}x)^2$,then show that $(x^2 + 1)^2 . \frac{d^2y}{dx^2} + 2x(x^2 + 1)\frac{dy}{dx} = 2$.

32. Solve the differential equation $x\frac{dy}{dx} - y + x \sin\left(\frac{y}{x}\right) = 0$? (3)

33. Find the intervals in which the function f given by $f(x) = \sin x + \cos x,\ 0 \leq x \leq 2\pi$, is strictly increasing or strictly decreasing? (3)

34. Find the area of the region bounded by the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$? (3)

OR

Find the area of bounded by the curve $y = 2\cos x$ and the x-axis from 0 to 2π?

35. Find $\int \frac{x^2}{(x^2+4)(x^2+9)}\, dx$? (3)

SECTION V

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

36. Using matrices, solve the following system of linear equations : (5)

$2x - 3y + 5z = 11$

$3x + 2y - 4z = -5$

$x + y - 2z = -3.$

OR

If $A = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$,then find BA and use this to solve the system of equations $y + 2z = 7, x - y = 3$ and $2x + 3y + 4z = 17$?

37. Find the equation of the plane through the line $\frac{x-1}{3}=\frac{y-4}{2}=\frac{z-4}{-2}$ and parallel to the line $\frac{x+1}{2}=\frac{1-y}{4}=\frac{z+2}{1}$. Hence find the shortest distance between the lines? (5)

OR

Find the equation of the plane pasing through the point $(-1,3,2)$ and perpendicular to each of the planes $x+2y+3z=5$ and $3x+3y+z=0$?

38. Solve the linear programming problem graphically. (5)

Maximise $Z=x+y$

subject to the constraints

$x+4y\leq 8$

$2x+3y\leq 12$

$3x+y\leq 9$

$x\geq 0, y\geq 0.$

OR

i. The corner points of the feasible region for an LPP are $(0,2),(3,0),(6,0),(6,8)$ *and* $(0,5)$. Let $Z=4x+6y$ be the objective function.Find the maximum and minimum value(s) of Z and also the corresponding points at which maximum and minimum value(s) occurs?

ii. Let $Z=px+qy$ *where* $p,q>0$ be the objective function. Find the condition on p *and* q so that the minimum occurs at $(3,0)$ *and* $(1,1)$?

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