# KENDRIYA VIDYALAYA SANGHTHAN LUCKNOW REGION

## SECOND PRE-BOARD EXAMINATION:2020-21

## CLASS:XII

## SUBJECT:-MATHEMATICS

**Max Marks:-80** **Time: - 3 hours**

### General instructions:

(i)This question paper consists of two parts A and B. Each part is compulsory. Part A carries 24 marks and part B carries 56 marks.
(ii) Part A has objective type questions and part B has descriptive type questions.
(iii) There is no overall choice. However, internal choices have been provided in both the parts AandB.

### PART–A:

1. This part 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 multiple choice questions. An examinee is to attempt any 4 out of 5 multiple choice questions.

### PART- B:

1. This part consists of three sections- III, IV and V.
2 Section III contains 10 questions of 2 marks each.
3 Section IV contains 7 questions of 3 marks each.
4 Section V contains 3 questions of 5 marks each
5 Internal choice is provided in 3 questions of section- III, 2questions 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

1. Find the value of $\sin^{-1}(\frac{\sqrt{3}}{2}) + \cot^{-1}(-\sqrt{3})$ .

**OR**

Find the value of $\sin(2cos^{-1}0.6)$

2. If f: $\mathbf{R} \rightarrow \boldsymbol{R}$ be a function defined by f(x) = |x|, Check whether f is one one and onto?

3. If A is a square matrix of order 3 such that |A|=5 , find |adj A|

4. If $X_{m\times 3}.Y_{p\times 4} = Z_{2\times b}$ for three matrices X,Y and Z then find the values of m+p+b

5. Solve for x if $\begin{bmatrix} 1 & x \end{bmatrix}\begin{bmatrix} 2 & -1 \\ 1 & 2 \end{bmatrix}\begin{bmatrix} 1 \\ 3 \end{bmatrix} = 0$

6. If $\left|\vec{a}\right| = 5, \left|\vec{b}\right| = 13$ and $\left|\vec{a} \times \vec{b}\right| = 25$ then find the value of $\vec{a}.\vec{b}$

7. Find the area of the region bounded by $x^2=4y$, y=2, y=4 and the y axis in the first quadrant.

8. *Evaluate* $\int e^{3\log x} x^4 dx$

**OR**

Evaluate $\int_0^{\frac{\pi}{2}} \log(\tan x)dx$

9. If a be the order and b be the degree of differential equation $(\frac{d^3y}{dx^3})^2 + 4x(\frac{dy}{dx})^3 + 4y = 0$, find the value of a-2b.

**OR**

Find what value of n is the following a homogeneous differential equation: $\frac{dy}{dx} = \frac{x^2y-3yx^2}{x^n+4y^n}$

10. If $\vec{a} = \hat{i} + 2\hat{j} - 3\hat{k}$ and $\vec{b} = 2\hat{i} + 4\hat{j} + 9\hat{k}$ find a unit vector parallel to $\vec{a} + \vec{b}$

**OR**

Find the area of the triangle whose two sides are given by the vectors $\vec{a}=\hat{i}+\hat{j}+4\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$.

11. IF $\vec{a}=\hat{i}+3\hat{j}+2\hat{k}$ Find the angle between $\vec{a}$ and Z axis.

12. Find the direction cosines of vector whose initial and terminal points are (2, -5,-2) and (-3,7,4).

13. Find the distance of point (1,-2,3) from the plane $\vec{r}.(\hat{i} + 2\hat{j} + 3\hat{k}) - 4 = 0$

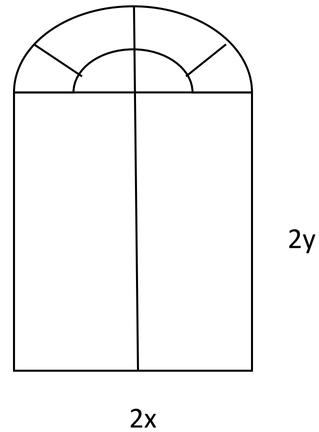
14. Evaluate P(A∪B), if 2P(A) = P(B) = 5/13and P(A|B) = 2/5

15. If A and B are independent events, Find P (B) if P (A∪B) = 0.60 and P (A) = 0.35.

16. The relation R in the set R of real numbers, defined as R = $\{(a, b) : a \leq b^2\}$ . Check whether relation R is symmetric.

## SECTION-II

17. The shape of the window of a house as given in the diagram consists of a rectangle with semicircle. The dimensions of rectangular part of window is shown in the diagram.




**On the situation, answer the following questions:**

(a) The perimeter of the window is:

i) 2x +4y+$\pi$x

ii) 4x + 4y + $\pi$ x

iii) 2x +2y + $\pi$ x

iv) None of these

(b) The Area of window is

i) 2xy+$\frac{\pi x^2}{2}$

ii) 4xy+$\frac{\pi x^2}{2}$

iii) 4xy+$\pi x^2$

iv) 4xy+$2\pi x^2$

(c) If perimeter of window is P then the Area of window in terms of x is

i)$Px - 2x^2 - \frac{\pi x^2}{2}$

ii) $Px - x^2 - \frac{\pi x^2}{2}$

iii) $Px - 2x^2 - \frac{\pi x^2}{4}$

iv) $Px - x^2 - \frac{\pi x^2}{2}$

(d) If area in above part is denoted by A then value of $\frac{dA}{dx}$

i) $P - 2x - \pi x$

ii) $P - 2x - \frac{\pi x}{2}$

iii) $P - 4x - \pi x$

iv) $P - 4x - \frac{\pi x}{2}$

(e) The value of x for which area of window is minimum

i) $2P/(\pi+4)$

ii) $P/2(\pi+4)$

iii) $P/(\pi+4)$

iv) $P/(\pi+2)$

18. Of the students in a college, it is known that 1200 students reside in hostel and 800 students are day scholars (not residing in hostel). Previous year results report that 40% of all students who reside in hostel attain A grade and 30% of day scholars attain A grade in their annual examination. At the end of the year, one student is chosen at random.

**On the situation, answer the following questions:**

(a) The probability that he resides in hostel

(i) $\frac{2}{5}$

(ii) $\frac{1}{5}$

(iii) $\frac{3}{5}$

(iv) None of these

(b)The probability that he attains A grade if he was day scholar

(i) 3/10

(ii) 12/100

(iii) 4/10

(iv) 24/100

(c) The probability he attains A grade

(i) $27/25$

(ii) 17/25

(iii) 31/50

(iv) 9/25

(d)The probability that he resides in hostel given that he attains A grade

(i) 2/3

(ii) 1/3

(iii) 2/5

(iv) 3/5

(e) The probability that he is day scholar given that he he attains A grade

(i) 2/3

(ii) 1/3

(iii) 2/5

(iv) 3/5

## PART-B
### SECTION-III

19. If A= $\begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$, show that $A^2 - 6A + 17I = 0$, Hence find $A^{-1}$.

20. Write the simplest form of $\tan^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right]$

21. Find $\frac{dy}{dx}$ if $sin^2x + cos^2y = a^2$

**OR**

Find $\frac{dy}{dx}$ if x= a(1+cos t) and y= b(t+sin t)

22. Find the points on the curve $y=4x^3-3x+5$ at which tangents are parallel to the line 9x-y+5=0

23. Evaluate $\int e^x \frac{(x-3)}{(x-1)^3}\, dx$

24. Evaluate $\int_2^5 \frac{\sqrt{x}}{\sqrt{7-x}+\sqrt{x}}dx$

**OR**

Evaluate $\int_{-3}^{3}(sin^7x + x^2)\, dx$

25. Solve the differential equation $\frac{dy}{dx} = y\ tanx; y = 1\ when\ x = 0.$

**OR**

Find the general solution of $\frac{dy}{dx} = \frac{x+y}{x}$

26. Find the coordinated of the foot of perpendicular drawn from the origin to the plane $\vec{r}.(2\hat{i}+\hat{j}-\hat{k})+5=0$

27. If the projection of the vectors $\lambda\hat{\imath} + \hat{\jmath} - 4\hat{k}$ and $2\hat{\imath} + 6\hat{\jmath} + 3\hat{k}$ is $\frac{8}{7}$, find the value of $\lambda$ .

28. A die is thrown twice and the sum of the numbers appearing is observed to be 6. What is the conditional probability that the number 3 has appeared at least once?

## SECTION-IV

29. If $x^{2y} + y^{2x} = a^{2b}$, find dy/dx

**OR**

If y = $(\tan^{-1} x)^2$, show that $(x^2 + 1)^2 y_2 + 2x (x^2 + 1) y_1 = 2$.

30. Find the intervals in which the function $f(x) = - 2x^3 – 9 x^2 – 12x + 1$ is increasing or decreasing.

31. Find the values of a and b such that the function is defined by

$$f(x) \to \begin{cases} 7\ , if\ x \le 3 \\ a + bx\ , if\ 3 < x < 10 \\ 21, if\ x \ge 10 \end{cases}$$ , is a continuous function.

32. Evaluate: $\int \frac{4x-5}{\sqrt{(x-5)(x-4)}}$ dx

33. The area between $y^2 = 2x$ and $x = 8$ is divided into two equal parts by the line $x = a$, find the value of $a$.

34. Solve the differential equation $3e^x \tan y\ dx + (2 - e^x)sec^2\ y\ dy = 0$

**OR**

Find the general solution of the differential equation $cos^2 x\ \frac{dy}{dx}$ + y = tan x

35. Check whether the function $f: \boldsymbol{R} - \left\{\frac{7}{5}\right\} \to \boldsymbol{R} - \{\frac{3}{5}\}$ $defined\ as\ f(x) = \frac{3\ x+4}{5x-7}$ is one one and onto. Also find the value of x for which f(x) =2.

## SECTION-V

36. Using matrices solve the system $2x-3y+5z=11;\ 3x+2y-4z=-5;\ x+y-2z=-3$

OR

Given two matrices A = $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and B= $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ verify that BA=6I.

Use the result to solve the system x-y = 3, 2x + 3y + 4z = 17, y + 2z =7

37. Find the distance of the point (1, -2, 3) from the plane x – y + z = 5, measured parallel to the line $\frac{x}{2} = \frac{y}{3} = \frac{z}{-6}$.

**OR**

Find the point on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance $3\sqrt{2}$ from the point A (1,2,3) .Also find the equation of line of this point from given point A.

38. A manufacturer produces two types of steel trunks. He has two machines A and B. The first type requires 3 hours on machine A and 3 hours on machine B. The second type requires 3 hours on machine A and 2 hours on machine B. Machines A and B can work at the most for 18 hours and 15 hours per day respectively. He earns a profit of Rs.30 and Rs.25 per trunk of the first type and second type respectively. How many trunks of each type must he make each day to make maximum profit?

**OR**

Maximize Z = 5x + 3y Subject to
$2x+3y \leq 12$,

$x+2y \leq 7$,

$y-3x \leq 0$,

$x \geq 0, y \geq 0$