School Of Math
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MATHEMATICS
CLASS XII

Time: 3 hours **MM: 100**

General Instructions:

1. *All questions are compulsory.*
2. *The question paper consists of **29** questions divided into three sections **A**, **B**,**C** and **D**. Section **A** comprises **4** questions of **one mark** each, Section **B** comprises **8** questions of **two marks** each , Section **C** comprises 11 questions of **four marks** each and Section **D** comprises 6 questions of **six marks** each.*
3. *All questions in Section **A** are to be answered in one word, one sentence or as per the exact requirement of the questions.*
4. *Use of calculator is not permitted. You may ask for logarithmic tables, if required.*

Section – A

Q1 If $A=\begin{bmatrix}5 & 0 & 0\\ 2 & 1 & 0\\ 7 & 6 & 1\end{bmatrix}$, Find $|4A^{-1}|$. 1

Q2 Evaluate : $\tan^{-1}\left(\frac{x}{y}\right)-\tan^{-1}\left(\frac{x-y}{x+y}\right)$. 1

Q3 Find $\vec{x}=3\hat{i}-6\hat{j}-\hat{k}, \vec{y}=\hat{i}+4\hat{j}-3\hat{k}$ and $\vec{z}=3\hat{i}-4\hat{j}-12\hat{k},$ then find the projection of $\vec{x}\times\vec{y}$ on vector $\vec{z}$. 1

Q4 Let f: $R\to R, g: R\to R,$ be two functions, such that f(x) = 2x – 3, g(x) = x^3 + 5. Find the function $(fog)^{-1}$ (x) . 1

SECTION – B

Q5 If the function $f: R\to A$ given by f(x) $f\left(x\right)=\frac{x^2}{x^2+1}$ is a surjection. Find A. 2

Q6 Given A = $\begin{bmatrix}1 & 3\\ 2 & 2\end{bmatrix}; I=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$. If $A-\lambda I$ is a singular matrix, then find λ . 2

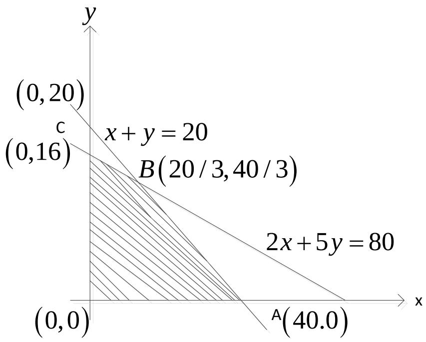
Q7 Check the differentiability of f(x) = $\sqrt{1-\sqrt{1-x^2}}$ at x = 0 2

Q8 Find the sum of order and the degree of the differential equation 2

$$\left(\frac{d^3y}{dx^3}\right)^{2/3}+4-3\frac{d^2y}{dx^2}+5\frac{dy}{dx}=0$$

Q9 The vectors $2\hat{i}+3\hat{j}, 5\hat{i}+6\hat{j}$ and $8\hat{i}+\lambda\hat{j}$, have their initial points at (1,1). Find the value of λ so that the vectors terminate on one straight line. 2

Q10 The feasible region of a L.P.P. constraints is shown in graph. 2



Find the constraints .

Q11 The probability that A can solve a question is 1/3 and B can solve it is $\frac{1}{4}$. If they try it independently, find the probability that the question is solved. 2

Q12 Find the equation of the normal to the curve $x^2+y^2=8$ at a point (2,2). 2

SECTION – C

Q13 Using properties of determinants, show that : 4

$$\Delta=\begin{vmatrix}\sin^2 A & \cos^2 A & \sin A\cos A\\ \sin^2 B & \cos^2 B & \sin B\cos B\\ \sin^2 C & \cos^2 C & \sin C\cos C\end{vmatrix}$$

$$=\sin(A-B)\sin(B-C)\sin(C-A)$$

Q14 $f(x)=ax^3+bx^2+4x+5\ on[0,2']$ satisfies Rolle's theorem with $c=\frac{2}{3}$. Find the values of a and b. 4

Q15 Find the intervals in which the function: 4

$f(x)=x^3+\frac{1}{x^3}, x\neq 0,$

i) strictly increases ii) strictly decreases

OR

Find the absolute maximum and the absolute minimum value of the function:

$f(x)=x\sqrt{32-x^2}on[-5,5].$

Q16 Evaluate using limit of a sum: $\int_1^3\left(e^{2-3x}+x^2+1\right)dx$ 4

Q17 Find the area enclosed by the parabola : y^2 = x and the line y+x = 2 and x – axis in the first quadrant. 4

Q18 Find the general solution of the differential equation: $(x^2-yx^2)dy+\left(y^2+x^2y^2\right)dx=0$. 4

OR

Can $y^2+4ax^2=\frac{b^2}{a}$ is a solution of the differential equation $y^2+yy'x+\frac{b^2}{yy^1}=0$

If no, find the solution of the given differential equation.

Q19 If three vectors $a\hat{i}+\hat{j}+\hat{k},\hat{i}+b\hat{j}+\hat{k}$ and $\hat{i}+\hat{j}+c\hat{k}$ are coplanar, find the value of : 4

$\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}$.

Q20 Three vertices of a parallelogram ABCD are A (2,1,3), B(6,7,5) and C (4,9,11). Find the fourth 4 vertex D and write the equation of the diagonal BD in vector form.

OR

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

Q21 There are two factories located on at place P and the other at place Q. From these location a certain commodity is to be delivered to each of the three depots situated at A,B and C. The weekly requirements of the depots are respectively 5,5 and 4 units of the commodity while the production capacity of the factories at P and Q are respectively 8 and 6 units. The cost of the transportation per unit is given below: 4

	Cost in rupees		
From to	A	B	C
P	160	100	150
Q	100	120	100

Formulate this problem as LPP in order that the transportation cost is minimum.

Q22 Out of a group of 30 honest people. 20 always speak truth. Two persons are selected at random from the group. Find the probability distribution of number of selected persons who speak the truth. Also, find the mean of the distribution. What values are described in this question? 4

Q23 In a hurdle race, a player has to cross 10 hurdles. The probability that he will clear each hurdle is $\frac{5}{6}$. What is the probability that he will knock down fewer than 2 hurdles? 4

SECTION-D

Q24 Evaluate $\int_0^{\pi/2} \frac{\sin^2 x}{\sin x+\cos x}dx$ 6

Q25 A binary operation $\otimes: R\times R \to R$ is defined as : $a\otimes b=\frac{ab}{5}$ show that: 6

i) $\otimes$ operation is binary ii) $\otimes$ operation is commutative iii) $\otimes$ operation is associative
iv) $\otimes$ operation has an identity element = 5 v) an element $a\in R$ has its inverse under $\otimes$ operation = $\frac{25}{a}$.

Q26 If x,y and z are different and $\Delta=\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix}=0$, then using the properties of determinants, Prove that (1+ xyz)=0. 6

Q27 If $y=(\tan x)^{\tan x}\div(\sin x)^{\sin x}$, *find* $\frac{dy}{dx}$. 6

Q28 If the line $\frac{x-1}{2}=\frac{y-1}{2}=\frac{z+1}{4}$ *and* $\frac{x-3}{1}=\frac{y-k}{2}=\frac{z}{1}$ intersect, find the value of k and hence find the equation of the plane containing the two lines. 6

Q29 P is any point on the circle $x^2+y^2-10x-12y+36=0$ Find the maximum distance of P from x – axis. 6

Ans 1 $\frac{64}{5}$ 2 $\frac{\pi}{4}$ 3 -14 4 $\left(\frac{x-7}{2}\right)^{1/3}$ 5 $[0,1)$ 6 4, -1 8 2 9 9

10 $2x+5y\le 80, x+y\le 20, x\ge 0, y\ge 0$ 11 ½ 12 Y = X + 1 14 a = 1 and b = -4

15 or 16 , -16 16 $\frac{e^{-1}-e^{-7}+32}{3}$ 17 $\frac{7}{6}$ sq. units 18 $x-\log y-\frac{1}{x}-\frac{1}{y}=C$ 19 Try yourself

20 D (0,3,9) or points (-2, -1,3)and $\left(\frac{56}{17},\frac{43}{17},\frac{111}{17}\right)$ 21 10(x-7y + 190) 22 $u=\frac{4}{3}$ 23 $\frac{5}{2}\left(\frac{5}{6}\right)^{9}$

24 $-\frac{1}{\sqrt{2}}\log\left(\sqrt{2}-1\right)$.

27 $\frac{dy}{dx}=\frac{(\tan x)^{\tan x}}{(\sin x)^{\sin x}}$ 28 k = 9/2 and 5x – 2y – z = 6 29 $\frac{11\sqrt{13}}{13}$ *units*