Class: XII 2020-21 Mathematics

Practice Question Paper 3 (Theory)

Time Allowed: 3 Hours **Maximum 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:

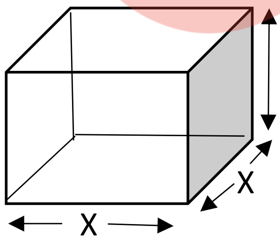
1. It consists of two sections- **I and II**
2. Section **I** comprises of 16 very short answer type questions.
3. Section **II** contains **2** case studies. Each case study comprise of 5 case-based MCQs. An examinee is to Attempt **any 4 out of 5 MCQs.**

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 question 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.

Sr. No.	Part-A	Marks
	Section I **All questions are compulsory. In case of internal choices attempt any one.**	
1.	Consider f: $R_+ \rightarrow [4, \infty]$ given by $f(x) = x^2 + 4$. Check whether the function is one-one or not.	1

	Or Let R be the relation in the set $\{1, 2, 3, 4\}$ given by $R = \{(1,2),(2,2),(1,1),(4,4),(1,3),(3,3),(3,2)\}$ Is R symmetric and Transitive?	
2.	Is the function $f: N \rightarrow N, given\ by\ f(1) = f(2) = 1\ and\ f(x) = x - 1\ for\ every\ x \geq 2\ is\ onto?$	1
3.	An equivalence relation R in A divides it into equivalence classes A_1, A_2, A_3. What is the value of $A_1 \cup A_2 \cup A_3$ and $A_1 \cap A_2 \cap A_3$. **Or** Let A $\{1, 2, 3,\}$ The number of equivalence relations containing (1, 2) is ………	1
4	If A is a matrix of order m X n and B is a matrix such that AB' and B'A are defined. The order of B is ………..	1
5	The elements of a 3x4 matrix are given by $a_{ij} = \frac{1}{2}\lvert -3i + j \rvert$. Write the value of $a_{32} - a_{14}$.	1
6	If A and B are square matrix of order 3 and $\lvert A \rvert = 5$, $\lvert B \rvert = 3$, then the value of $\lvert 3AB \rvert$ is……..	1
7	Evaluate $\int x^2 e^{x^3} dx$ **Or** Evaluate $\int_0^{\frac{\pi}{2}} \frac{\sqrt{tanx}}{\sqrt{cotx}+\sqrt{tanx}} dx.$	1
8	Find the area of the region bounded by the curve $y = x^2$ and the line $y = 4$.	1
9	Write the order and degree of the differential equation $2x^2 \frac{d^2y}{dx} - 3\left(\frac{dy}{dx}\right)^2 + y = 0$ **Or** What is the value of the constant of integration in the particular solution of the differential equation $\frac{dy}{dx} = \frac{2x}{y^2} \quad if\ f(-2) = 3$	1
10	Find the projection of $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ on $\vec{b} = \hat{\imath} + 2\hat{\jmath} + \hat{k}$	1

11	Find the area of a parallelogram whose two adjacent sides are $\hat{j}+2\hat{k}$ *and* $\hat{\imath}+2\hat{j}$.	1
12	For what value of 'k', the matrix $\begin{pmatrix} 2 & 5 \\ k & 10 \end{pmatrix}$ is a singular matrix?	1
13	If a plane has the intercepts a, b, c and is a distance of 'p' units from the origin, then $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}=$............. fill in the blank.	1
14	Find the coordinates of the point where the line $\frac{x-5}{-2}=\frac{y-1}{3}=\frac{z-6}{-5}$ crosses the ZX- plane.	1
15	Given two independent events A and B such that P(A)=0.3 and P(B)=0.6. find P(A and not B).	1
16	Whether true or false. If A and B are events such that P(A|B)=P(B|A), then $A \cap B = \emptyset$.	1
	SECTION II **Both the case study questions are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.**	
17	An open toy box with a square base is to be made out of a given quantity of metal sheet of area c^2.  Based on the above information answer following. a) If x represents the side of square base and y represents the height of the toy box then the relation between the variables a) $66xy=c^2$ b) $x^3=c^2$ c) $x^2+4xy=c^2$ d) $2xy+4x^2=c^2$	4

	b) The volume of the toy box V expressed as a function x is a) $V = xy^2$ b) $V = \frac{c^2x-x^3}{4}$ c) $V = \frac{x^3-c^2x}{4}$ d) $V = \frac{x^2(c^2x-x^2)}{4}$ c) The maximum volume of the box is. a) $\frac{c^2}{6\sqrt{3}}$ b) $\frac{6c^2}{\sqrt{3}}$ c) $\frac{\sqrt{3}c^2}{6}$ d) $\frac{c^3}{6\sqrt{3}}$ d) If the box were to be closed then the relation between x and y would be a) $2x^2 + 4xy = c^2$ b) $4x^2 + 2xy = c^2$ c) $6xy = c^2$ d) $6x^2 = c^2$ e) If the box were to be closed then the volume of the box expressed as a function of x. a) $\frac{x^2(c^2-2x^2)}{4}$ b) $V = \frac{c^2x-2x^3}{4}$ c) $V = x^3$ d) $V = \frac{2x^3-c^2x}{4}$	
18	By examining the Covid-19 test report of some laboratory, the probability that a person is diagnosed Covid-19 positive when he is actually suffering from it is 0.99. The probability that the report incorrectly diagnosed a person to be Covid-19 positive on the basis of report is 0.001. In a certain city 300 of 1000 persons suffer from Covid-19. Based on the above information answer the following. i) The conditional probability that a person is diagnosed Covid-19 positive given that he actually has Covid-19	4

a) 0.7
b) 0.99
c) 0.001
d) 0.3

ii) A person is selected at random and is diagnosed with Covid-19. What is the chance that he actually has Covid-19

a) 0.99
b) 0.91
c) 297/304
d) 304/297

iii) MCD wants to keep a check, so an officer during checking selects the report randomly. According to the report, person is diagnosed Covid-19 positive. What is the probability that the person doesn't have actually Covid-19.

a) 0.001
b) 7/297
c) 7/2977
d) 0.99

iv) Total probability of a person being diagnosed Covid-19 positive.
a) 1
b) 0.6933
c) 0.2977
d) 22%

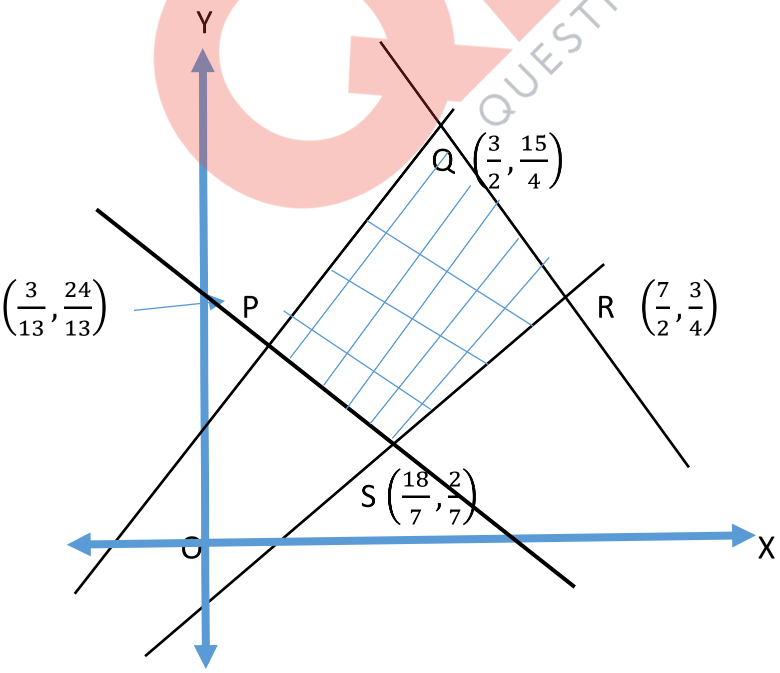
v) Let E be the event of person being diagnosed Covid-19 positive and let E_1 and E_2 be the events that he actually has Covid-19 and he actually doesn't have Covid-19 then find $\sum_{i=1}^{2} P(E_i|E)$

a) 0.991
b) 1
c) 92%
d) 0.989

	Part- B	
	Section III	
19	Find the value of $tan^{-1}(1) + cos^{-1}\left(-\frac{1}{2}\right) + sin^{-1}\left(-\frac{1}{2}\right)$	2
20	$(x \quad -5 \quad -1)\begin{pmatrix}1 & 0 & 2\\0 & 2 & 1\\2 & 0 & 3\end{pmatrix}\begin{pmatrix}x\\4\\1\end{pmatrix} = O$ Solve for 'x' **Or** $2\begin{pmatrix}3 & 4\\5 & x\end{pmatrix} + \begin{pmatrix}1 & y\\0 & 1\end{pmatrix} = \begin{pmatrix}7 & 0\\10 & 5\end{pmatrix}$ Find $(x - y)$.	2
21	Find K so that the function $f(x) = \begin{cases}kx + 1, & if\ x \leq \pi\\cosx, & if\ \ x > \pi\end{cases}$ Is continuous at $x = \pi$.	2
22	Find the slope of the normal to the curve $x = 1 - asin\theta, y = bcos^2\theta$ at $\theta = \frac{\pi}{2}$.	2
23	Find $\int e^x \frac{sin^4x - cos^4x}{sinx - cosx}\, dx$ **Or** Evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} sin^7x\, dx$	2
24	What is the area lying in the first quadrant and bounded by the circle $x^2 + y^2 = 4$ and the lines $x = 0, \ \ x = 2$.	2
25	Solve the differential equation $\frac{dy}{dx} = x^3 cosec\, y$, given that $f(0) = 0$	2

26	Find the vector equation of a plane passing through A(2, 5, -3), B(-2,-3, 5) and c(5, 3, -3).	2
27	Find the distance between lines $\vec{r} = \hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ and $\vec{r} = 3\hat{\imath} + 3\hat{\jmath} - 5\hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$.	2
28	The random variable x has a probability distribution P(x) of the following form, where k is a number, P(X=x)= $\begin{cases} k, & if\ x = 0 \\ 2k, & if x = 1 \\ 3k, & if\ x = 2 \\ 0. & other\ wise \end{cases}$ Determine the value of $p(X \le 2)$.	2
	Section IV **All questions are compulsory. In case of internal choices attempt any one.**	
29	Show that the relation R in the set A=$\{x \in Z : \ 0 \le x \le 12\}$, given by R=$\{(a, b : \ \|a - b\|\ ) \ is\ a\ multiple\ of\ 4\}$ Is an equivalence relation.	3
30	If $y = x^a + x^{sinx},\ find\ \frac{dy}{dx}$	3
31	If y=$3e^{2x} + 2e^{3x}$ Prove that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$ **Or** If $x = a(cos\theta + \theta sin\theta)$ $y = a(sin\theta - \theta cos\theta)$ Find $\frac{d^2y}{dx^2}$.	3

32	Find the intervals in which the function f given by $f(x) = 4x^3 - 6x^2 - 72x + 30$ is, (a) Strictly increasing (b) Strictly decreasing.	3
33	Find $\int \frac{x^2}{(x^2+1)(x^2+4)} dx$	3
34	Find the area of the ellipse $x^2 + 9y^2 = 36$ *using integration*	3
35	Find the general solution of the differential equation $$e^x \tan y\, dx + (1 - e^x) \sec^2 y\, dy = 0$$ **Or** Find the general solution of the differential equation $x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x$	3
	Section V **All questions are compulsory. In case of internal choices, attempt any one.**	
36	Using matrices solve the following system of equations. $$x + 2y - 3z = -4$$ $$2x + 3y + 2z = 2$$ $$3x - 3y - 4z = 11$$ **Or** Given A=$\begin{pmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{pmatrix}$, B=$\begin{pmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{pmatrix}$ Find BA and use this to solve the system of equation. $$y + 2z = 7, x - y = 3, 2x + 3y + 4z = 17$$	5
37	Find the foot of perpendicular from the point (2, 3, -8) to the line	5

	$\frac{4-x}{2}=\frac{y}{6}=\frac{1-z}{3}$ .Also find the perpendicular distance from the given point to the line. **Or** Find the equation of the plane through the intersection of the planes $\vec{r}.(i+3j)-6=0$ and $\vec{r}.(3\hat{\imath}-\hat{\jmath}-4\hat{k})=0$ whose perpendicular distance from the origin is unity.	
38	Maximize Z= $x+y$ subject to the constraints $x+4y\le 8$ $2x+3y\le 12$ $3x+y\le 9$ $x\ge 0, y\ge 0$ **Or** The corner points of the feasible region determined by the system of linear equations are as share below:  Answer each of the following	5

	i. Let Z= $x+2y$ be the objective function. Find the maximum and minimum value of Z and also the corresponding points at which the maximum and minimum values occurs. ii. Let Z= $px+qy$, where $p,q>0$ be the objective function. Find the condition on $p\ and\ q$ so that the maximum Z occurs at Q$\left(\frac{3}{2},\frac{15}{4}\right)$, R$\left(\frac{7}{2},\frac{3}{4}\right)$. Also mention the number of optimal solutions in this case.	