INDIAN SCHOOL AL WADI AL KABIR

Sample Paper-1 (2020-2021)

Class: XII | Sub: MATHEMATICS(041) | Max Marks: 80

Date: 15.12.2020 | Time: 3 hours

General Instructions:

1. This question paper contains two parts A and B. Each part is compulsory.
2. Part A carries 24 marks and Part B carries 56 marks.
3. Part-A has Objective Type Questions and Part -B has Descriptive Type Questions,
4. 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.

Section A

Section- I (1 mark each)

Q.1. The number of all relations from set A = $\{1, 2, 3\}$ to itself is

OR

Check whether the function $f: R\ to\ R\ defined\ by\ f(x) = x^2$ is injective or not?

Q.2. Let $f: R \to R, be\ the\ function\ defined\ by\ f(x) = \frac{|x|}{x}, x \neq 0\ \ and\ f(x) = 0\ when\ x = 0$, $then\ write\ the\ range\ of\ f.$

Q.3. Let R be a relation on N defined by x+ 2y = 8 . Domain of R is

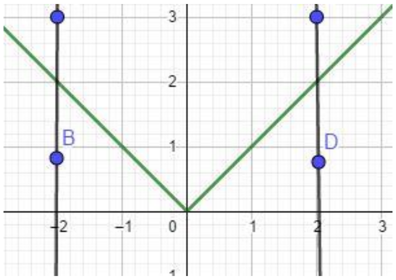
Q.4. Find x and y if $\begin{bmatrix} 2x & 4 \\ x+y & y-1 \end{bmatrix} = \begin{bmatrix} 4 & 2x \\ 5 & x \end{bmatrix}$.

Q5. If A is a 3×3 $matrix\ such\ that\ |A| = 5, then\ write\ the\ value\ of\ |adjA|$.

Q6. If A = $\begin{pmatrix} 2 & 0 & 0 \\ 0 & 1 & 1 \\ 4 & 0 & 1 \end{pmatrix}$ then write A as the sum of a symmetric and skew symmetric matrix

Q7. Evaluate: $\int \frac{1}{x^2+2x} dx$ OR Evaluate: $\int_{-1}^{1} (x^3 + x + 1)\, dx$

Q8. Find the area of region bounded by $y = |x|, x = -2,$ $x = 2\ and\ the\ X\ axis.$



Q.9. Find the general solution of the differential equation $cos^2x\ dy + cos^2y\ dx == 0$.

OR

Write the order and degree of the differential equation :$(\frac{dy}{dx}) + \frac{d^3y}{dx^3} = \left(\frac{d^2y}{dx^2}\right)^4$

Q10. Find the slope of the tangent to the curve y = x^2 at (1, 2).

Q11. $|\vec{a}|$=8, $|\vec{b}| = 3\ and\ |\vec{a} \times \vec{b}| = 12, then\ find\ \ \vec{a}.\vec{b}$

Q12. Find the equation of line passing through (1, 1, 2) and (3, 4, -1) in cartesian form.

Q13. Find the angle between unit vectors $\hat{a}\ and\ \hat{b} if\ |\hat{a} +\ \hat{b}| = \sqrt{2}$.

Q14. Evaluate $\begin{vmatrix} sin^2\theta & cos^2\theta \\ -1 & 1 \end{vmatrix}$

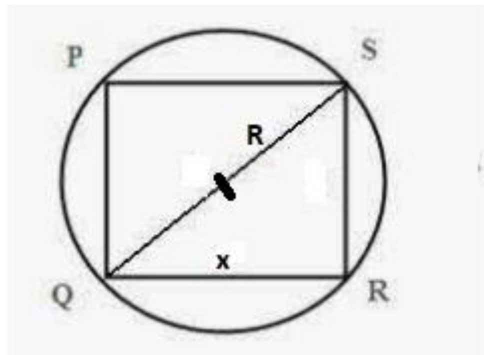
Q15. Find the probability of getting at least one odd number when 4 dice are thrown.

Q16. If P(A)= $\frac{1}{3}$ P(B) $= \frac{1}{2}$ and P$(A \cap B) = \frac{1}{4}$ find P(neither A nor B).

Section- II

Both the Case study-based questions are compulsory. Attempt any 4 sub parts from each question (17(i to v) and 18 (i to v)-26). Each question carries 1 mark

Q17. A gardener wants to construct a rectangular garden in a circular path of land. He takes the maximum perimeter of the rectangular region as possible.



Based on the above information answer the following:

(i) If QR = x and R be the radius of the land, then the perimeter of rectangle PQRS

A $2x + 2\sqrt{R^2 - x^2}$ **B** $2(x + R)$ **C** $x\sqrt{R^2 - x^2}$ **D** $2x + 2\sqrt{4R^2 - x^2}$

(ii) If A represents the area of rectangle then to find maximum area of rectangle

A $\frac{dA}{dx} = 0$ **B** $\frac{dA}{dR} = 0$ **C** $\frac{dA}{dx} \leq 0$ **D** $\frac{dR}{dx} \geq 0$

(iii) Area of the rectangle is maximum when

A $x = R$ **B** $x = \sqrt{2}R$ **C** $x = \frac{R}{\sqrt{2}}$ **D** $x = \sqrt{3}R$

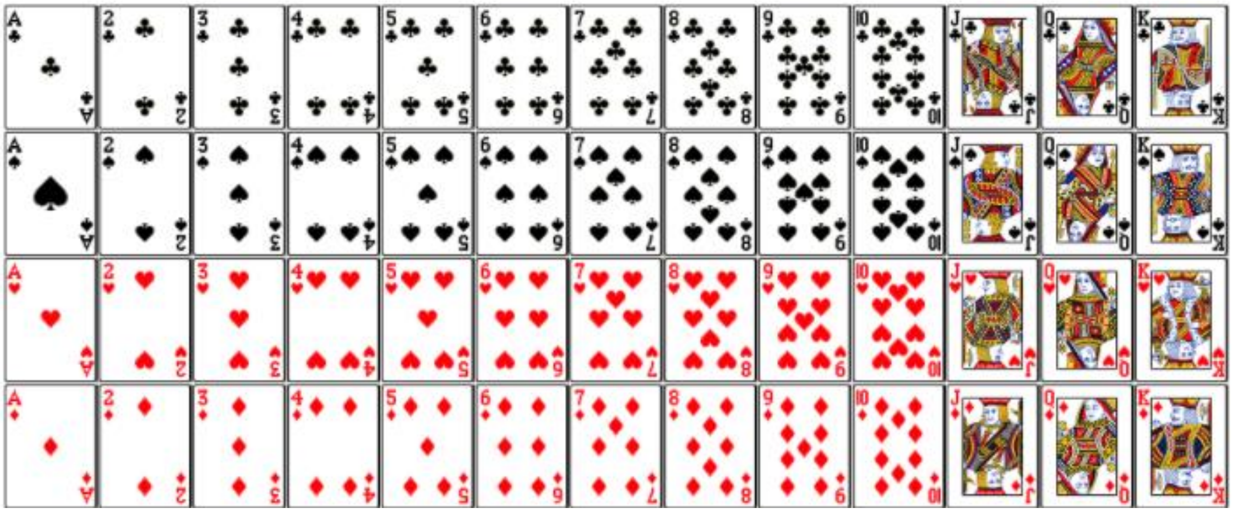
(iv) Area is maximum when the quadrilateral is

A a square **B** a parallelogram **C** a trapezium **D** a rectangle

(v) What is the maximum area of PQRS when radius is 10m?

A 100 sq. m. **B** 200 sq. m **C** 50sq.m **D** 400 sq. m

Q18



Consider the following situation:

A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be both diamonds.

Based on the above information answer the following:

Let A be the event of getting 2 diamonds from 51 cards,
E_1 and E_2 be the events that the lost card is a dimond and not a diamond respectively.

(i) $P(E_2) =$ _______

A $\frac{1}{2}$ **B** $\frac{1}{4}$ **C** $\frac{3}{4}$ **D** $\frac{13}{51}$

(ii) $P(A/E_2)$

A $\frac{12_{C_2}}{51_{C_2}}$ **B** $\frac{13_{C_2}}{51_{C_2}}$ **C** $\frac{12_{C_2}}{52_{C_2}}$ **D** $\frac{13_{C_2}}{52_{C_2}}$

(iii) $P(A/E_1) =$ ________.

A $\frac{12_{C_2}}{51_{C_2}}$ **B** $\frac{13_{C_2}}{51_{C_2}}$ **C** $\frac{12_{C_2}}{52_{C_2}}$ **D** $\frac{13_{C_2}}{52_{C_2}}$

(iv) What is the probability that the lost cards is a diamond?

A. $\frac{13}{51}$ **B.** $\frac{11}{50}$ **C.** $\frac{2}{51}$ **D.** $\frac{1}{52}$

(v) What is the probability that the lost cards is not a diamond?

A $\frac{33}{46}$ **B** $\frac{4}{5}$ **C** $\frac{13}{51}$ **D** $\frac{3}{13}$

Part- B

Section -III(2marks each)

Q19. Evaluate: $sin^{-1}\left(\frac{1}{2}\right) + cos^{-1}\left(-\frac{1}{2}\right) + tan^{-1}(-1)$.

Q20. $If\ A = \begin{bmatrix} 1 & 0 \\ -1 & 0 \end{bmatrix}\ and\ B = \begin{bmatrix} 1 & -1 \\ 2 & 2 \end{bmatrix}, then\ find\ AB$

OR

Find equation of a line passing through A(1, 2) and B(0, 3) using determinants.

Q21. Find the value k if $f(x) = \begin{cases} \frac{cos2x-1}{x^2}. x \neq 0 \\ k,\ x = 0 \end{cases}$ is continous at x= 0.

Q22. $Evaluate: \int \frac{1}{x^2 + 3x + 2} dx$

OR

Evaluate: $\int_0^{\frac{\pi}{2}} \frac{1}{\sqrt{tanx}+1} dx$

Q23. Find the area of the region bounded by $x^2 = y\ and\ the\ lines\ y = 1\ and\ y = 4$.

Q24. Solve the differential equation: $\frac{dy}{dx} + y = x$

Q25. Prove that the function $f(x) = x^3 + 4x, x \in R$ has no maximum value.

Q26. If $\vec{a}, \vec{b}$ and $\vec{c}$ are three-unit vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$, then find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{a}.\vec{c}$

Q27. If the points (1, 1, p) and (-3, 0, 1) be equidistant from the plane 3x + 4y -12z +13 =0, then find value(s) of p.

Q28. An urn contains 5 red and 5 black balls. A ball is drawn at random, its colour is noted and is returned to the urn. Moreover, 2 additional balls of the colour drawn are put in the urn and then a ball is drawn at random. What is the probability that the second ball is red?

OR

Find the probability distribution of number of doublets in three throws of a pair of dice.

Section IV

ANSWER THE FOLLOWING (3 marks each)

Q29 If $A = \{0, 1, 2, 3, ... 12\}$ and R is a relation defined on A such that

$R = \{(a, b): |a - b| \text{is divisible by } 4, a, b \in A\}$ then prove that R is an equivalence relation.

Q30. Find $\frac{dy}{dx}, if\ (x)^y + (y)^x + x^x = a^b$.

Q31. If $\sqrt{1-x^2} + \sqrt{1-y^2}$ = a (x –y), show that $\frac{dy}{dx} = \sqrt{\frac{1-y^2}{1-x^2}}$

OR

If $xcos(a+y) = cosy$, then prove $\frac{dy}{dx} = \frac{cos^2(a+y)}{sina}$.

Q32. Find the intervals in which the function $f(x) = sinx + cosx, x \in (0, 2\pi)$ is strictly increasing or decreasing.

Q33. Evaluate: $\int \frac{x^2 - 3x + 1}{\sqrt{1-x^2}} dx$

Q34. Find the area enclosed by the lines $|x| + |y| = 1$.

OR

Evaluate: $\int_0^{\frac{\pi}{4}} \log(1 + tanx)\, dx$

Q35. Solve the differential equation: $\frac{dy}{dx} = \frac{x+2y}{x-y}$.

Section V (5marks each)

Q36. If A = $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 5 & 3 \\ 0 & 2 & 1 \end{bmatrix}$ find A^{-1} and hence solve the system of equations

x – y = 1; 2x + 5y +3z = 13 and 2y + z = 3

OR

If A = $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ verify that $A^3 - 6A^2 + 9A - 4I = \mathbf{0}$ and hence find A^{-1}

Q37. Find the distance between the point P (6, 5, 9) and the plane determined by the points A (3, – 1, 2), B (5, 2, 4) and C (– 1, – 1, 6).

OR

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

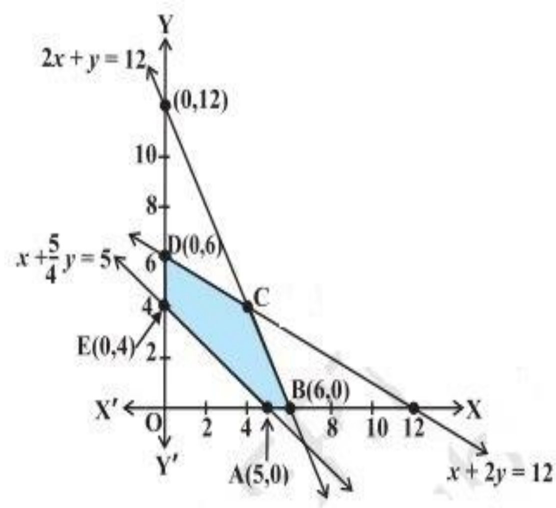
Q38. Solve the following LPP graphically:

$Maximise: Z = x + 2y$

Subject to the constrains: $x + 2y \geq 100, , 2x \leq y, x \geq 0 \; and \; 2x + y \leq 200, y \geq 0$

OR

The corner points of the feasible region determined by a system of linear constraints are given below.



Answer each of the following:

(i) Find the coordinates of the point C.

(ii) Write all the corner points of the feasible region.

(iii) If the objective function is Z= 600x+ 400y, find the maximum value of Z.

Answer									
Q1.	512	**Q2.**	$\{-1,0,1\}$	**Q3.**	$\{2,4,6\}$	**Q4.**	x=2, y=3	**Q5.**	25
Q6.	$\begin{pmatrix} 2 & 0 & 2 \\ 0 & 1 & \frac{1}{2} \\ 2 & \frac{1}{2} & 1 \end{pmatrix} + \begin{pmatrix} 0 & 0 & -2 \\ 0 & 0 & \frac{1}{2} \\ 2 & -\frac{1}{2} & 0 \end{pmatrix}$				**Q7.**	$I = \frac{1}{2} log \left\lvert \frac{x}{x+2} + C \right\rvert$ OR $I = 2$			
Q8.	4	**Q9.**	tanx +tany =c	Order3, degree 1				**Q.10.**	m=2
Q11.	$12\sqrt{3}$	**Q12.**	$\frac{x-1}{2} = \frac{y-1}{3} = \frac{z-2}{-3} = \mu$					**Q13.**	$\frac{\pi}{2}$
Q14.	1	**Q15.**	$\frac{15}{16}$		**Q16.**	$\frac{5}{12}$			
Q17(i)	D	**Q17(ii)**	A	**Q17(iii)**	**B**	**Q17(iv)**	A	**Q17(v)**	B
Q18(i)	C	**Q18(ii)**	B	**Q18(iii)**	**A**	**Q18(iv)**	B	**Q18(v)**	A
Q19.	$\frac{7\pi}{2}$	**Q20.**	$\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$	Equation of line x+y-3 =0	**Q21.**	K= -2			
Q22.	$I = log \left\lvert \frac{x+1}{x+2} \right\rvert + C$			$I = \frac{\pi}{4}$	**Q23.**	$\frac{28}{3}$			
Q24.	$y = x - 1 + ce^{-x}$			**Q26.**	$-\frac{3}{2}$	**Q27.**		$\frac{8}{3}$ $or\ 1$	
Q28.	$\frac{1}{2}$	x: 0, 1, 2, 3; P(x): $\frac{125}{216}$, $\frac{75}{216}$, $\frac{15}{216}$, $\frac{1}{216}$			**Q30.**	$\frac{dy}{dx} = \frac{-[y^x \log y + y . x^{y-1} + x^x(1+\log x)]}{x . y^{x-1} + x^y \log x}$			
Q32.	Decreasing: $\left(0, \frac{\pi}{4}\right) \cup \left(\frac{5\pi}{4}, 2\pi\right)$ Increasing: $\left(\frac{\pi}{4}, \frac{5\pi}{4}\right)$				**Q33**	$\frac{3}{2} sin^{-1}x + 3\sqrt{1-x^2} - \frac{1}{2} x\sqrt{1-x^2} + c$			
Q34.	2 OR $I = \frac{\pi}{8} log2,$				**Q35**	$\log\lvert(x^2+xy+y^2)\rvert = 2\sqrt{3}\tan^{-1}\left(\frac{x+2y}{\sqrt{3}x}\right) + C$			
Q36.	x= 3, y= 2, z= -1				**OR**	$A^{-1} = \frac{1}{4}\begin{bmatrix} 3 & 1 & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$			
Q37.	$3\sqrt{34}/17$				**OR**	(1, 0, 7)			
Q38.	Max Z= 400				**OR**	(i) (4, 4). (ii) (5, 0), B (6, 0), C (4,4), (iii) D (0,6), E (0,4) (iv) 4000.			