MODEL QUESTION PAPER

MATHEMATICS

XII – STANDARD (CBSE)

Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions:

- This Question Paper contains - five sections A, B, C, D and E. Each section is compulsory. However,
- there are internal choices in some questions.
- Section A has 18 MCQs and 02 Assertion-Reason based questions of 1 mark each.
- Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
- Section C has 6 Short Answer (SA)-type questions of 3 marks each.
- Section D has 4 Long Answer (LA)-type questions of 5 marks each.
- Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub-parts.

SECTION A

Multiple choice questions each question carries 1 mark

Q1	The maximum number of equivalence relations on the set A = {a, b, c} are (a) 1 (b) 2 (c) 3 (d) 5	1
Q2	If set A contains 5 elements and the set B contains 6 elements, then the number of one-one and onto mappings from A to B is (a) 720 (b) 120 (c) 0 (d) none of these	1
Q3	The domain of $\sin^{-1}(2x)$ is (a) [0, 1] (b) [– 1, 1] (c) [-1/2, 1/2] (d) [–2, 2]	1
Q4	The value of $\sin(2\tan^{-1}(.75))$ is equal to (a) .75 (b) 1.5 (c) .96 (d) sin 1.5	1
Q5	If A and B are two matrices of the order 3 × m and 3 × n, respectively, and m = n, then the order of matrix (5A – 2B) is (a) m × 3 (b) 3 × 3 (c) m × n (d) 3 × n	1

Q6	If A and B are symmetric matrices of the same order, then (AB′ –BA′) is a (a) Skew symmetric matrix (b) Symmetric matrix (c) Null matrix (d) Cannot be determined	1
Q7	If A is a square matrix of order 3 and |A| = 6, then the value of |2A′| is (a) -10 (b) 10 (c) -48 (d) 48	1
Q8	The value of c in Rolle's theorem for the function, f(x) = sin 2x in [0, π/2] is (a) π/4 (b)π/6 (c) π/2 (d)π/3	1
Q9	If $y = ax^2 + b$, then dy/dx at x = 3 is equal to (a) 2a (b)3a (c) 4a (d)6a	1
Q10	If there is an error of 2% in measuring the length of a simple pendulum, then percentage error in its period is (a)1% (b) 2% (c) 3% (d) 4%	1
Q11	The line y = x + 1 is a tangent to the curve $y^2 = 4x$ at the point (a)(1, 2) (b) (2, 1) (c)(-1, 2) (d) (1, -2)	1
Q12	$\int_0^{\pi} \sin^2 x \, dx =$ (a) π/2 (b) π/4 (c) 2π (d)4π	1
Q13	If ∫ sec²(6– 3x)dx = a tan (6 – 3x) + C, then value of a is (a) $\frac{1}{3}$ (b) $-\frac{1}{3}$ (c) $-\frac{1}{7}$ (d) $\frac{1}{7}$	1
Q14	The area enclosed between the graph of $y = x^3$ and the lines x = 0, y = 1, y = 8 is (a) 7 (b)14 (c) 45/4 (d) None of these	1
Q15	The number of arbitrary constants in the particular solution of a differential equation of third order is: (a) 3 (b) 2 (c) 1 (d) 0	1
Q16	The scalar product of 3i + j – 3k and 3i – 4j + 7k is: (a)15 (b) -15 (c) 16 (d) -16	1

Q17	A set of values of decision variables that satisfies the linear constraints and non-negativity conditions of an L.P.P. is called its: (a) Unbounded solution (b) Optimum solution (c) Feasible solution (d) None of these	1
Q18	An urn contains 8 black and 5 white balls. Two balls are drawn from the urn one after the other without replacement. What is the probability that both drawn balls are black? (a) $-\frac{12}{35}$ (b) $\frac{12}{35}$ (c) $\frac{2}{35}$ (d) $-\frac{2}{35}$	1

<u>ASSERTION-REASON BASED QUESTIONS</u>

In the following questions, a statement of Assertion (A) is followed by a statement of Reason(R). Choose the correct answer out of the following choices.
(a) Both (A) and (R) are true and (R) is the correct explanation of (A).
(b) Both (A) and (R) are true but (R) is not the correct explanation of (A). (c) (A) is true but (R) is false. (d) (A) is false but (R) is true.

Q19	Assertion(A) :The function f(x) = cosecx decrease on the interval $\left(0, \frac{\pi}{2}\right)$ Reason (R) :The function f(x) = secx decrease on the interval $\left(0, \frac{\pi}{2}\right)$ (a) Both (A) and (R) are true and (R) correct explanation of (A). (b) Both (A) and (R) are true but (R) is not a correct explanation of (A). (c) A is true but R is false. (d) A is false but R is true.	1
Q20	Assertion: $x^2 + x$ has only one real zero. Reason: A polynomial of nth degree must have n real zeroes a) Both assertion and reason are true and reason is the correct explanation of assertion b) Both assertion and reason are true but reason is not the correct explanation of assertion C) Assertion is true but reason is false. d) both Assertion and reason are false	1

SECTION – B

[This section comprises of very short answer type questions (VSA) of 2 marks each]

Q21	Given an example of a relation. Which is Reflexive and symmetric but not transitive.	2
Q22	Find the Principal value of $\cos ec^{-1}(2)$.	2
Q23	Find the value of a, b, c and d from the equation: $\begin{bmatrix} a-b & 2a+c \\ 2a-b & 3c+d \end{bmatrix} = \begin{bmatrix} -1 & 5 \\ 0 & 13 \end{bmatrix}$ As the two matrices are equal, their corresponding elements are also equal.	2
Q24	Find the projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$.	2
Q25	Maximise Z = x + y subject to $x + 4y \leq 8$, $2x + 3y \leq 12$, $3x + y \leq 9$, $x \geq 0$, $y \geq 0$.	2

SECTION – C

[This section comprises of short answer type questions (SA) of 3 marks each]

Q26	Evaluate $\int_{-2}^{2} \lvert x \rvert \, e^x dx$	3
Q27	Solve the differential equation: $ydx + (x - y^2)dy = 0$ OR Solve the differential equation: $xdy - ydx = \sqrt{x^2 + y^2}\,dx$	3
Q28	Express the vector $\vec{a} = 6\hat{i} - 3\hat{j} + 2\hat{k}$ as the sum of two vectors such that one is parallel to the vector $\vec{b} = 3\hat{i} + 2\hat{k}$ and other is perpendicular to $\vec{b}$. OR Find μ when the projection of $\vec{b} = \mu\hat{i} + 2\hat{j} + 3\hat{k}$ on $\vec{a} = 3\hat{i} + \hat{j} + 3\hat{k}$ is 6 units.	3
Q29	Integrate: $\int \sin^3 x \cos^2 x \, dx$ OR Evaluate the integral: $\int \frac{dx}{(x^2 - 16)}$.	3

Q30	Discuss the continuity of sine function.	3
Q31	Find the area of the region bounded by the curve $y = x^2$ and the line $y = 4$.	3

SECTION –D

[This section comprises of long answer type questions (LA) of 5 marks each]

Q32	Solve the following Linear Programming Problems graphically: Minimize $Z = -3x + 4y$ subject to $x + 2y \leq 8$, $3x + 2y \leq 12$, $x \geq 0$, $y \geq 0$.	5
Q33	Relation R in the set A of human beings in a town at a particular time given by $R=\{(x,y): x \text{ is son of } y\}$enter 1-reflexive and transitive but not symmetric 2-reflexive only 3-Transitive only 4-Equivalence 5-Neither reflexive, nor symmetric, nor transitive OR Let $\boldsymbol{A}$={1,2,3}, $\boldsymbol{B}$={4,5,6,7} and let $\boldsymbol{f}$ =(1,4),(2,5),(3,6) be a function from $\boldsymbol{A}$ to $\boldsymbol{B}$. Show that $\boldsymbol{f}$ is one-one and Not onto	5
Q34	Two adjacent sides of a parallelogram are $(5\hat{i}-2\hat{j}+4\hat{k})$ *and* $(\hat{i}-2\hat{j}+3\hat{k})$ Find the unit vector parallel to its diagonal. Also, find its area. OR The scalar product of the vector $(\hat{i}-\hat{j}+2\hat{k})$ with a unit vector along the sum of vectors $(3\hat{i}-2\hat{j}+6\hat{k})$ *and* $(\mu\hat{i}-2\hat{j}+5\hat{k})$ is equal to one. Find the value of μ .	5
Q35	Show that the lines $\vec{r}=(2\hat{i}+3\hat{j}+4\hat{k})+\mu(\hat{i}+2\hat{j}+3\hat{k})$ and $\vec{r}=(5\hat{i}+2\hat{j}+\hat{k})+\mu(4\hat{i}+\hat{j}+2\hat{k})$ intersect. Also, find their point intersection. OR Find the vector equation of the line passing through(1,2,3) and parallel to the plane $\vec{r}.(2\hat{i}+\hat{j}-3\hat{k})=6$ and $\vec{r}.(4\hat{i}-\hat{j}+3\hat{k})=5$	5

SECTION –E

[This section comprises of 3 case- study/passage based questions of 4 marks each with sub Parts.
The first two case study questions have three sub parts (i), (ii), (iii) of marks 1,1,2 respectively.
The third case study question has two sub parts of 2 marks each.)

Q36	A train can carry a maximum of 300 passengers. A profit of Rs. 800 is made on each executive class and Rs. 200 is made on each economy class. The IRCTC reserves at least 40 tickets for executive class. However, atleast 3 times as many passengers prefer to travel by economy class, than by executive class. It is given that the number of executive class ticket is Rs. x and that of economy class ticket is Rs. y. Optimize the given problem. Based on the above information, answer the following questions.  1.The objective function of the LPP is: (a) Maximise Z = 800x + 200y (b) Maximise Z = 200x + 800y (c) Minimise Z = 800x + 200y (d) Minimise Z = 200x + 800y 2. Which among these is a constraint for this LPP? (a) $x+y \geq 300$ (b) $y \geq 3x$ (c) $x \leq 40$ (d) $y \leq 3x$ 3. Which among these is not a corner point for this LPP? (a) (40,120) (b) (40, 260) (c) (30, 90) (d) (75, 225) 4. The maximum profit is: (a) Rs.56000 (b) Rs. 84000 (c) Rs. 205000 (d) Rs. 105000 5. Which corner point the objective function has minimum value? (a) (40,120) (b) (40, 260) (c) (30, 90) (d) (75, 225)	4
Q37	Priya and Surya are playing monopoly in their house during COVID. While rolling the dice their mother Chandrika noted the possible outcomes of the throw every time belongs to the set {1,2,3,4,5,6 }. Let A denote the set of players and B be the set of all possible outcomes.Then A={P,S }, B={1,2,3,4,5,6 }.Then answer the below questions based on the given information.	4

	(i). Let R: $B \to B$ be defined by R={(a,b) both a and b are either odd or even } then R is a) Equivalence relation b) Not Reflexive but symmetric, transitive c) Reflexive, Symmetric and not transitive d) Reflexive, transitive but not symmetric (ii). Chandrika wants to know the number of functions m for to. How many number of functions are possible? a) 6^2 b) 2^6 c) 6! d) 2^{12} (iii). Let be a relation on defined by {(1,2), (2,2), (1,3), (3,4), (3,1),(4,3),(5,5)}. Then is a) Symmetric b) Reflexive c) Transitive d) None of these iv. Let be defined by{(1,1),(1,2),(2,2),(3,3)(3,1) (4,4) (5,5),(6,6) } then R is a) Symmetric b) Reflexive and Transitive c) Transitive and Symmetric d) Equivalence Relation v. Chandrika wants to know the number of relations for to. How many number of relations are possible? a) 6^2 b) 2^6 c) 6 d) 2^{12} 	
Q38	The monthly incomes of two brother Rakesh and Rajesh are in the ratio 3:4 and the monthly expenditures are in the ratio 5:7.Each brother saves Rs15,000 per month.Read the above instruction and answer the following questions. (i) If monthly income of Rakesh and Rajesh are 3x and4x and their expenditure are 5y and 7y respectively, then identify the system of linear equations for the above problem. (A)x – y =15000; x + y = 15000 (B) 3x – 5y =15000; 4x + 7y = 15000 (C) 3x + 5y =15000; 4x - 7y = 15000	4

(D) $5x - 3y = 15000$; $x - 4y = 15000$

(ii) Identify the matrix equation for question (i).

(A) A X = B where A= $\begin{pmatrix} 3 & -5 \\ 4 & -7 \end{pmatrix}$ X = $\begin{pmatrix} x \\ y \end{pmatrix}$ B = $\begin{pmatrix} 15000 \\ 15000 \end{pmatrix}$

(B) B X = A where A= $\begin{pmatrix} 3 & -5 \\ 4 & -7 \end{pmatrix}$ X = $\begin{pmatrix} x \\ y \end{pmatrix}$ B = $\begin{pmatrix} 15000 \\ 15000 \end{pmatrix}$

(C) A X = I where A= $\begin{pmatrix} 3 & -5 \\ 4 & -7 \end{pmatrix}$ X = $\begin{pmatrix} x \\ y \end{pmatrix}$ B = $\begin{pmatrix} 15000 \\ 15000 \end{pmatrix}$

(D) AB = X where A= $\begin{pmatrix} 3 & -5 \\ 4 & -7 \end{pmatrix}$ X = $\begin{pmatrix} x \\ y \end{pmatrix}$ B = $\begin{pmatrix} 15000 \\ 15000 \end{pmatrix}$

(iii)If Ax = B where A,B, X are the matrices then x should be

(A) X= AB (B) $X=A^{-1}B$ (C) $X=AB^{-1}$ (D) X=BA

(iv) If A= $\begin{pmatrix} 3 & -5 \\ 4 & -7 \end{pmatrix}$ then A^{-1} is (A) $\begin{pmatrix} 7 & 5 \\ 4 & 3 \end{pmatrix}$ (B) $\begin{pmatrix} -7 & 5 \\ -4 & 3 \end{pmatrix}$ (C) $\begin{pmatrix} -7 & 5 \\ 4 & -3 \end{pmatrix}$ (D) $\begin{pmatrix} 7 & -5 \\ 4 & -3 \end{pmatrix}$

(v) Monthly incomes of Rakesh and Rajesh respectively are

(A) 90,000 each

(B) 90,000, 12,000

(C) 1,20,000 , 90,000

(D)None of these