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	How many onto functions from set A to set A can be formed for the set A = {1, 2, 3, 4, 5, ……n}? (a) n^2 (b) n (c) n! (d) 2n	1
Q2	Let R be a relation on N (set of natural numbers) such that (m, n) R (p, q) mq(n + p) = np(m + q). Then, R is (a) An Equivalence Relation (b) Only Reflexive (c) Symmetric and reflexive (d) Only Transitive	1
Q3	The function f : N → N defined by f(x) = 7x is _____. (a). one-one and onto (b). not one-one but onto (c). one-one and into (d). bijective function	1
Q4	The principal value of cos –1 (cos 5) is (a) 5 (b) π – 5 (c) 5 – π (d) 2π – 5	1
Q5	If ab + bc + ca = 0, then find $1/a^2$ -bc + $1/b^2$ – ca + $1/c^2$ - ab (a) π (b) 0 (c) -1 (d) 2	1
Q6	Rank of a non-zero matrix is always (a) ⩾1 (b) 0 (c) greater than 1 (d) equal to 1	1
Q7	If A = diag [5 -2 7] ; B = diag [7 8 5], then 3A - 2B is ____. (a). diag [1 -22 -11] (b). diag [-1 -22 11] (c). diag [-1 22 -11] (d). diag [1 -22 11]	1

Q8	Inverse of a square matrix, if it exists, is _____. (a) unique (b) defined (c) singular (d) non-singular	1
Q9	Which of the following is a correct statement? a) Determinant is a square matrix. b) Determinant is a number associated to a matrix. c) Determinant is a number associated with the order of the matrix. d) Determinant is a number associated to a square	1
Q10	If A is a square matrix of order 4 such that |adj A| = 125, then |A| is ____. (a) 25 (b) 5 (c) 15 (d) 625	1
Q11	If for matrix A, |A| = 3, where matrix A is of order 2 × 2, then |5 A| is ___. (a) 9 (b) 75 (c) 15 (d) 25	1
Q12	If volume of a cylindrical container of radius R and height H is V, then the second derivative of V with respect to R is ____ H. a) $2/\pi$ b) -2π c) 2π d) $-\pi$	1
Q13	A polynomial function is differentiable at ____. a) $[-\infty, \infty]$ b) $(-\infty, 0)$ c) $(0, \infty)$ d) $(-\infty, \infty)$	1
Q14	The equation of the tangent to the curve $y = 2x^3 - x^2 + 3$ at (1, 4) is _____. (a). $4y - 4x = 0$ (b). $y - 4x = 0$ (c). $4y - x = 0$ (d). $y - x = 0$	1
Q15	The nature of the function $f(x) = (1/2)\,x$ on R is _____. a) increasing b) decreasing c) neither increasing nor decreasing d) constant	1
Q16	The degree of the differential equation $4y' - y/y' = \sin x$ is _____. a) 1 b) 2 c) 3 d) 4	1
Q17	A solution of differential equation which contains arbitrary constants is called the _____ of the differential equation a) solution b) optimal solution c) general solution d) particular solution	1
Q18	Maximise the function $Z = 11x + 7y$, subject to the constraints: $x \leq 3$, $y \leq 2$, $x \geq 0$, $y \geq 0$. (a) 49 (b) 50 (c) 47 (d) 48	1

ASSERTION-REASON BASED QUESTIONS

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) All trigonometric function have their inverses over their respective domains Reason(R) The inverses of $\tan^{-1}x$ exists for some $x \in R$ (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 (E)Both A and R are false	1
Q20	Assertion (A) : The principal value of $\cos^{-1}\left(\cos\frac{5\pi}{3}\right)=\frac{\pi}{3}$ Reason (R) : The range of $\cos^{-1}x$ is $[0,\pi]$ (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. (E). Both A and R are false.	1

SECTION – B

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

Q21	Show that the relation R defined in the set A of all polygons as R = {(P1, P2): P1 and P2 have same number of sides}, is an equivalence relation. What is the set of all elements in A related to the right angle triangle T with sides 3, 4 and 5?	2
Q22	If a Matrix has 24 elements, what are the possible orders it can have? What, if it has 13 elements?	2
Q23	Solve the differential equation$(1 + y^2) \tan^{-1}x\, dx + 2y\,(1 + x^2)\, dy = 0$	2
Q24	Find the projection of the vector $\hat{i}+3\hat{j}+7\hat{k}$ on the vector $7\hat{i}-\hat{j}+8\hat{k}$.	2
Q25	Prove that if E and F are independent event then the event E and $F^{/}$ are also independent.	2

SECTION – C

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

Q26	If $f : R \to R$ and $g:R \to R$ are given by $f(x) = \cos x$ and $g(x) = 7x^2$, then find gof(x).	3

Q27	If P (A)=0.8, P (B)=0.5 and P(B/A)=0.4, Find (i) P(A∩B) (ii) P(A/B) (iii)P(A∪B) OR If P(A) = 611,P(B) =511 and P(A∪B) = 711, Find (i) P(A∩B) (ii) P(A|B) (iii) P(B|A)	3
Q28	Using the property of determinants and without expanding prove that $\begin{vmatrix} x & a & x+a \\ y & b & y+b \\ z & c & z+c \end{vmatrix} = 0$	3
Q29	Find the area of the region bounded by $y^2 = 9x$, x=2,x=4 and the x-axis in the first quadrant.	3
Q30	Show that the line through the point (4,7,8) ,(2,3,4) is parallel to the through point (-1,-2,1), (1,2,5).	3
Q31	The radius of the circle is increasing at the rate of 0.7cm/s. what is the rate increase of its circumference.	3

SECTION –D

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

Q32	A balloon, which always remains spherical on inflation , is being inflated by pumping in 900 cubic centimeters of the gas per second. Find the rate at which the radius of the balloon increase when the radius is 15cm.	5
Q33	Find the shortest distance between the line $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$	5
Q34	Find the Area bounded by the curve $(x - 1)^2 + y^2 = 1$ and $x^2 + y^2 = 1$.	5
Q35	Determine P(E/F) in question 6 to 9: A coin is tossed three times, where (i) E: head on third toss F: heads on first two tosses. (ii) E: at least two heads F : at most two heads (iii) E: at most two tails F: at least one tail OR A Mack and a red die are rolled. (a) Find the conditional probability of obtaining a sum greater than 9, given that the black die resulted in a 5. (b) Find the conditional probability of obtaining the sum 8, given that the red die resulted in a number less than 4.	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	Students of Grade 9, planned to plant saplings along straight lines, parallel to each other to one side of the playground ensuring that they had enough play area. Let us assume that they planted one of the rows of the saplings along the line $y = x - 4$. Let L be the set of all lines which are parallel on the ground and R be a relation on L. 1. Let relation R be defined by R = {(L_1, L_2): $L_1 \parallel L_2$ where L_1, $L_2 \in$ L} then R is_____ relation a. Equivalence b. Only reflexive c. Not reflexive d. Symmetric but not transitive 2. Let R = { (L_1, L_2) : $L_1 \perp L_2$ where L_1, $L_2 \in$ L } which of the following is true? a. R is Symmetric but neither reflexive nor transitive b. R is Reflexive and transitive but not symmetric c. R is Reflexive but neither symmetric nor transitive d. R is an Equivalence relation  3. The function f: R→R defined by $f(x) = x - 4$ is_____ a. Bijective b. Surjective but not injective c. Injective but not Surjective d. Neither Surjective nor Injective 4. Let $f: R \to R$ be defined by $f(x) = x - 4$. Then the range of $f(x)$ is _____ a. R b. Z c. W d. Q 5. Let R = {(L_1 , L_2) : L_1 is parallel to L_2 and L_1 : y = x – 4} then which of the following can be taken as L_2? a. 2x-2y+5=0 b. 2x+y=5 c. 2x + 2y + 7 =0 d. x+y=7	4
Q37	A manufacture produces three stationery products Pencil, Eraser and Sharpener which he sells in two markets. Annual sales are indicated below Market | Products (in numbers) | Pencil | Eraser | Sharpener A | 10,000 | 2000 | 18,000 B | 6000 | 20,000 | 8,000 If the unit Sale price of Pencil, Eraser and Sharpener are Rs. 2.50, Rs. 1.50 and Rs. 1.00 respectively, and unit cost of the above three commodities are Rs. 2.00, Rs. 1.00 and Rs. 0.50 respectively, then,  	4

	Based on the above information answer the following: 1. Total revenue of market A a. Rs. 64,000 b. Rs. 60,400 c. Rs. 46,000 d. Rs. 40600 2. Total revenue of market B a. Rs. 35,000 b. Rs. 53,000 c. Rs. 50,300 d. Rs. 30,500 3. Cost incurred in market A a. Rs. 13,000 b. Rs.30,100 c. Rs. 10,300 d. Rs. 31,000 4. Profit in market A and B respectively are a.(Rs.15,000, Rs.17,000) b.(Rs.17,000, Rs.15,000) c.(Rs.51,000,Rs.71,000) d.(Rs.10,000,Rs. 20,000) 5. Gross profit in both market a. Rs.23,000 b. Rs. 20,300 c. Rs. 32,000 d. Rs. 30,200	
Q38	Three schools DPS, CVC and KVS decided to organize a fair for collecting money for helping the flood victims. They sold handmade fans, mats and plates from recycled material at a cost of Rs. 25, Rs.100 and Rs. 50 each respectively.	4

School /Article	DPS	CVC	KVS
Handmade fans	40	25	35
Mats	50	40	50
Plates	20	30	40

The numbers of articles sold are given as
Based on the information given above, answer the following questions:
1. What is the total money (in Rupees) collected by the school DPS?
a. 700 b. 7,000 c. 6;125 d. 7875
2. What is the total amount of money (in Rs.) collected by schools CVC and KVS?
a. 14,000 b. 15,725 c. 21,000 d. 13,125
3. What is the total amount of money collected by all three schools DPS, CVC and KVS?
a. Rs. 15,775 b. Rs. 14,000 c. Rs. 21,000 d. Rs. 17,125
4. If the number of handmade fans and plates are interchanged for all the schools, then what is the total money collected by all schools?
a. Rs. 18,000 b. Rs. 6,750 c. Rs. 5,000 d. Rs. 21,250
5. How many articles (in total) are sold by three schools?
a. 230 b. 130 c. 430 d. 330