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	If f: R → R, g: R → R and h: R → R is such that $f(x)= x^2$, g(x)= tanx and h(x)= logx, then the value of [ho(gof)](x), if $x = \frac{\pi}{\sqrt{2}}$ will be (a) 0 (b) 1 (c) -1 (d) 10	1
Q2	Let * be a binary operation on set Q – {1} defind by a * b = a + b – ab : a, b ∈ Q – {1}. Then * is (a) Commutative (b) Associative (c) Both (a) and (b) (d) None of these	1
Q3	The equation $\sin^{-1} x - \cos^{-1} x = \cos^{-1}\left(\frac{3}{\sqrt{2}}\right)$ has (a) unique solution (b) no solution (c) infinitely many solution (d) none of these	1
Q4	The equation $2\cos^{-1} x + \sin^{-1} x = \frac{11\pi}{6}$ has (a) no solution (b) only one solution (c) two solutions (d) three solutions	1
Q5	If $A = \begin{bmatrix} 1 & 3 \\ 3 & 4 \end{bmatrix}$ and $A^2 - KA - 5I = 0$, then K = (a) 5 (b) 3 (c) 7 (d) None of these	1

Q6	If A=$\begin{bmatrix} 0 & -1 & 2 \\ 1 & 0 & 3 \\ -2 & -3 & 0 \end{bmatrix}$,then $A + 2A^T$ equals (a) A (b) $-A^T$ (c) A^T (d) $2A^2$	1
Q7	If $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, then $A^2 - 5A$ is equal to (a) 2I (b) 3I (c) -2I (d) null matrix	1
Q8	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
Q9	The maximum value of f (x) = sin x in the interval [π,2π] is (a) 6 (b) 0 (c) -2 (d) -4	1
Q10	The number of stationary points of f (x) = sin x in [0,2π] are (a) 0 (b) 1 (c) 2 (d) 3	1
Q11	The point on the curve $y = x^3 - 11x + 8$, at which the tangent has the equation y = x - 8, is ______. a) (2, 2) b) (2, -2) c) (2, -6) d) (-6, 2	1
Q12	The function f(x) = cos 2x in (0, π/2) is ____________________. a) increasing b) decreasing c) neither increasing nor decreasing d) constant	1
Q13	If $I_1 = \int_0^1 \frac{1}{\|x\|} dx$ and $I_2 = \int_0^1 \frac{1}{\left\|\sqrt{1+x^2}\right\|} dx$ then (a) $I_1 = I_2$ (b) $I_1 < I_2$ (c) $I_1 > I_2$ (d) Cannot say	1
Q14	The area bounded by the curve y = x log x and $y = 2x - 2x^2$ is (a) 1/2 sq. units (b) 7/12 sq. units (c) 3/12 sq. units (d) none of these	1
Q15	The area of the region bounded between the line x=9 and the parabola $y^2=16x$ is (a) 144 sq units (b) 27 sq units (c) 104 sq units (d) 54 sq units	1
Q16	Q6 The direction of zero vector is ____. a) towards the origin b) away from origin c) indefinite d) definite	1
Q17	An urn contains five balls. Two balls are drawn and found to be white. The probability that all the balls are white is: (a) 1/2 (b) 3/10 (c) 1/10 (d) 3/5	1

Q18	Sachin can hit 2 sixes in 10 balls. The probability that Sachin can hit 2 sixes in an over is _____. a) 0.35 b) 0.25 c) 0.15 d) 0.05	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) The value of x for which $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & \\ 4 & 1 \end{vmatrix}$ is ± 2√ Reason(R) The determinant of a matrix A order 2x2, A= $\begin{vmatrix} a & b \\ c & d \end{vmatrix}$ is = ad – bc (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	The equation of the tangent at (2, 3) on the curve $y^2 = ax^3 + b$ is $y = 4x – 5$. Assertion (A) : The value of a is ±2 Reason (R) : The value of b is ±7. (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	The two vectors $\hat{j} + \hat{k}$ and $3\hat{i} – \hat{j} + 4\hat{k}$ represent the two sides $\overrightarrow{AB}$ and $\overrightarrow{AC}$ respectively of triangle ABC. Find the length of the median through A.	2
Q22	Write the differential equation obtained by eliminating the arbitrary constant C in the equation representing the family of curves xy = C cos x.	2
Q23	Find the vector equation of the line which passes through the point (2, 4, 6) and is parallel to the vector $2\hat{i} + 2\hat{j} – 3\hat{k}$.	2
Q24	If P(not A) = 0.8, P(B) = 0.9 and P(B/A) = 0.4, then find P(A/B).	2

Q25	Write the value of $\cos^{-1}(-1/2) + 2\sin^{-1}(1/2)$.	2

SECTION – C

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

Q26	If f : R → R and g:R → R are given by f(x) = sin x and g(x) = $5x^2$, then find gof(x).	3
Q27	If $\begin{bmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{bmatrix}$ = 10, write the value of x.	3
Q28	The equations of a line is 5x – 3 = 15y + 7 = 3 – 10z. Write the direction cosines of the line. OR Write the value of $\int \frac{x+\cos 6x}{3x^2+\sin 6x}$ dx	3
Q29	Write the integrating factor of the following differential equation. $(1 + y^2) + (2xy - \cot y)\frac{dy}{dx} = 0$ OR What are the direction cosines of a line which makes equal angles with the coordinate axes?	3
Q30	If the function R → R is given by f(x) = $x^2 + 2$ and g:R → R is given by g(x) = xx−1, then find fog and gof, and hence find fog (2) and gof(- 3).	3
Q31	A and B throw a pair of dice alternately. A wins the game, if he gets a total of 7 and B wins the game, if he gets a total of 10. If A starts the game, then find the probability that B wins.	3

SECTION –D

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

Q32	There are two types of fertilisers A and B’. A’ consists of 12% nitrogen and 5% phosphoric acid whereas B’ consists of 4% nitrogen and 5% phospheric acid. After testing the soil conditions, farmer finds that he needs at least 12 kg of nitrogen and 12 kg of phosphoric acid for his crops. If‘A’ costs 110 per kg and B’ costs ? 8 per kg , then graphically determine how much of each type of fertiliser should be used so that the nutrient requirements are met at a minimum cost?	5
Q33	A couple has 2 children. Find the probability that both are boys, if it is known that (i) one of them is a boy. (ii) the older child is a boy. OR Assume that each born child is equally likely to be a boy or a girl. If a family has two children, then what is the conditional probability that both are girls? Given that (i) the youngest is a girl? (ii) atleast one is a girl?	5

Q34	Find the value of λ, so that the lines $\frac{1-x}{3}=\frac{7y-14}{\lambda}=\frac{z-3}{2}$ *and* $\frac{7-7x}{3\lambda}=\frac{y-5}{1}=\frac{6-z}{5}$ are at right angles. Also, find whether the lines are intersecting or not. OR Find the shortest distance between the lines $\vec{r} = (4\hat{i} - \hat{j}) + \lambda(\hat{i} + 2\hat{j} - 3\hat{k})$ and $\vec{r} = (\hat{i} - \hat{j} + 2\hat{k}) + \mu(2\hat{i} + 4\hat{j} - 5\hat{k})$.	5
Q35	Solve the differential equation $\frac{dy}{dx}=-\left[\frac{x+y\cos x}{1+\sin x}\right]$ OR Find the particular solution of the differential equation $e^x \tan y\, dx + (2 - e^x) \sec^2 y\, dy = 0$, given that $y = \pi4$ when $x = 0$.	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	The shape of a toy is given as f(x) = $6(2x^4 - x^2)$. To make the toy beautiful 2 sticks which are perpendicular to each other were placed at a point (2,3), above the toy.  1. Which value from the following may be abscissa of critical point? a. $\pm\frac{1}{4}$ b. $\pm\frac{1}{2}$ c. ± 1 d. None 2. Find the slope of the normal based on the position of the stick. a. 360 b. -360 c. $\frac{1}{360}$ d. $\frac{-1}{360}$ 3. What will be the equation of the tangent at the critical point if it passes through (2,3)? a. x + 360 y = 1082 b. y = 360 x – 717 c. x = 717 y + 360 d. None 4. Find the second order derivative of the function at x = 5. a. 598 b. 1176 c. 3588 d. 3312 5. At which of the following intervals will f(x) be increasing? a. $\left(-\infty,\frac{1}{2}\right)\cup\left(\frac{1}{2},\infty\right)$ b. $\left(-\frac{1}{2},0\right)\cup\left(\frac{1}{2},\infty\right)$ c. $\left(0,\frac{1}{2}\right)\cup\left(\frac{1}{2},\infty\right)$ d. $\left(-\infty,-\frac{1}{2}\right)\cup\left(0,\frac{1}{2}\right)$	4

Q37	A manufacturing company makes two models X and Y of a product. Each piece of model X requires 9 labour hours for fabricating and 1 labour hour for finishing. Each piece of model Y requires 12 labour hours of fabricating and 3 labour hours for finishing, the maximum labour hours available for fabricating and finishing are 180 and 30 respectively. The company makes a profit of Rs. 8000 on each piece of model X and Rs. 12000 on each piece of model Y. Assume x is the number of pieces of model X and y is the number of pieces of model Y.  (1) Which among these is not a constraint for this LPP? (a) $9x+12y \geq 180$ (b) $3x+4y \leq 60$ (c) $x+3y \leq 30$ (d) None of these (2) The shape formed by the common feasible region is: (a) Triangle (b) Quadrilateral (c) Pentagon (d) hexagon (3) Which among these is a corner point for this LPP? (a) (0,20) (b) (6,12) (c) (12,6) (d) (10,0) (4) Maximum of Z occurs at (a) (0,20) (b) (0,10) (c) (20,10) (d) (12,6) (5) The sum of maximum value of Z is: (a) 168000 (b) 160000 (c) 120000 (d) 180000	4
Q38	A function f(x) is said to be continuous at x = c ,if the function is defined at x = c and if the value of the function at x = c equals the limit of the function at x = c . (= f(c) .If the function f(x) is not continuous at x = c , we say that f is discontinuous at c, and c is called the point of discontinuity of f. (1) The number of points of discontinuity of f(x) = in [3,7] is (a) 4 (b) 5 (c) 6 (d) 8 (2) Suppose f and g are two real functions continuous at a real number c then : (a) f + g is continuous at x = c (b) f + g is discontinuous at x = c. (c) f + g may or may not be continuous at x = c (d) None of these (3) Find the value of k, so that the given function f(x) is continuous at x = 5. $f(x) = \begin{cases} kx+1, & x \leq 5 \\ 3x-5, & x > 5 \end{cases}$ (a) 3/5 (b) 1/5 (c) 4/5 (d) 9/5 (4) If f(x) = |x | is continuous and g(x) = sinx is continuous , then: (a) sin|x | is continuous. (b) sin|x | is discontinuous. (c) sin |x | may or may not be continuous. (d) None of these. (5) Find the value of k, so that the given function f(x) is continuous at x = 2. $f(x) = \begin{cases} kx^2, & x \leq 2 \\ 3, & x > 2 \end{cases}$ (a) 1 (b) ¼ (c) 3/4 (d) 11/4	4