MODEL QUESTION PAPER

MATHEMATICS

XII-STANDARD (STATE BOARD)

Time : 3.00 hrs **Max Marks : 90**

PART I

i) All questions are **compulsory.** **20 X 1 = 20**

ii) Choose the most appropriate answer from the given **four** alternatives and write the answer along with the code**.**

S.No.	Questions	Marks
1	If $\lvert \text{adj}(\text{adj } A) \rvert = \lvert A \rvert^9$, then the order of the square matrix A is (a) 3 (b) 4 (c) 2 (b) 5	**1**
2	If P= $\begin{bmatrix} 1 & x & 0 \\ 1 & 3 & 0 \\ 2 & 4 & -2 \end{bmatrix}$ is the adjoint of 3×3 matrix A and $\lvert A \rvert = 4$, then x is (a) 15 (b)12 (c)14 (d)11	**1**
3	$i^n + 1^{n+1} + i^{n+2} + i^{n+3}$ is ………. (a) 0 (b) 1 (c) -1 (d) i	**1**
4	If $\lvert z - 2 + i \rvert \le 2$, then the greatest value of $\lvert z \rvert$ is (a) $\sqrt{3} - 2$ (b) $\sqrt{3} + 2$ (c) $\sqrt{5} - 2$ (d) $\sqrt{5} + 2$	**1**
5	If f and g are polynomials of degrees m and n respectively, and if $h(x) = (f \circ g)(x)$, then the degree of h is (a) mn (b)m+n (c)m^n (d)n^m	**1**
6	The polynomial $x^3 - kx^2 + 9x$ has three real zeros if and only if, k satisfies (a) $\lvert k \rvert \le 6$ (b) $k = 0$ (c) $\lvert k \rvert > 6$ (d) $\lvert k \rvert \ge 6$	**1**
7	If $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = 3\pi/2$,the value of $x^{2017}+y^{2018}+z^{2019} - [9/(x^{101} + y^{101} + z^{101})]$ is (a)0 (b)1 (c)2 (d)3	**1**
8	The domain of the function defined by $f(x) = \sin^{-1}\sqrt{x-1}$ is (a) [1,2] (b) [-1,1] (c) [0,1] (d) [-1,0]	
9	The eccentricity of the hyperbola whose latus rectum is 8 and conjugate axis is equal to half the distance between the foci is (a) 4/3 (b) $4/\sqrt{3}$ (c) $2\sqrt{3}$ (d) 3/2	**1**
10	The equation of the normal to the circle $x^2 + y^2 - 2x - 2y + 1 = 0$ which is parallel to the line $2x + 4y = 3$ is (a) $x + 2y = 3$ (b) $x + 2y + 3 = 0$ (c) $2x + 4y + 3 = 0$ (d) $x - 2y + 3 = 0$	**1**

11	If $\bar{a}.\bar{b}=\bar{b}.\bar{c}=\bar{c}.\bar{a}=0$ then the value of $[\bar{a}\ \bar{b}\ \bar{c}]$ is (a) $\lvert\bar{a}\rvert\ \lvert\bar{b}\rvert\ \lvert\bar{c}\rvert$ (b) $\frac{1}{3}\lvert\bar{a}\rvert\ \lvert\bar{b}\rvert\ \lvert\bar{c}\rvert$ (c) 1 (d) -1	1
12	The rate of change of its radius when radius is 1/2 cm (a) 3 cm/s (b) 2 cm/s (c) 1 cm/s (d) 1/2 cm/s	1
13	A balloon rises straight up at 10 m/s. An observer is 40 *m* away from the spot where the balloon left the ground. The rate of change of the balloon's angle of elevation in radian per second when the balloon is 30 metres above the ground. (a) 3/25 radians/sec (b) 4/25 radians/sec (c) 1/3 radians/sec (d) 1/5 radians/sec	1
14	A stone is thrown up vertically. The height it reaches at time t seconds is given by $x = 80t - 16t^2$. The stone reaches the maximum height in time *t* seconds is given by (a) 2 (b) 2.5 (c) 3 (d) 3.5	1
15	Angle between $y^2 = x$ and $x^2 = y$ at the origin is (a) $\tan^{-1}(3/4)$ (b) $\tan^{-1}(4/3)$ (c) $\pi/2$ (d) $\pi/4$	1
16	A circular template has a radius of 10 cm. The measurement of radius has an approximate error of 0.02 cm. Then the percentage error in calculating area of this template is (a) 0.2% (b) 0.4% (c) 0.04% (d) 0.08%	1
17	If $u(x, y) = e^{x2+y2}$, then $\partial u/\partial x$ is equal to (a) $1 / e^x + e^y$ (b) $e^x + e^y$ (c) 1 (d) 2	1
18	If $w(x, y) = x^y$, $x > 0$, then $\partial w/\partial x$ is equal to (a) $x^y \log x$ (b) $y \log x$ (c) yx^{y-1} (d) $x \log y$	1
19	The area between $y^2 = 4x$ and its latus rectum is (a) 2/3 (b) 4/3 (c) 8/3 (d) 5/3	1
20	A pair of dice numbered 1, 2, 3, 4, 5, 6 of a six-sided die and 1, 2, 3, 4 of a four-sided die is rolled and the sum is determined. Let the random variable *X* denote this sum. Then the number of elements in the inverse image of 7 is (a)1 (b) 2 (c) 3 (d)4	1

PART II .

Answer any seven questions. question number 30 is Compulsory . 7 X 2 = 14

21	Find the adjoint of the matrix $A = \begin{bmatrix} 3 & 5 \\ 1 & 2 \end{bmatrix}$ and verify the result A (adj A) = (adj A)A = A I	2
22	Show that diameter of a sphere subtends a right angle at a point on the surface by vector method.	2
23	Find the square root of (-8 -6i)	2
24	Prove that the tangent at any point to the rectangular hyperbola forms with the asymptotes a triangle of constant area.	2
25	Find two positive numbers whose product is 100 and whose sum is minimum.	2
26	Trace the curve $y = x^3 + 1$	2
27	Find the area of the region enclosed by $y^2 = x$ and $y = x - 2$	2
28	Construct the truth tables for $(p \wedge q) \vee r$	2

29	The life of army shoes is normally distributed with mean 8 months and standard deviation 2 months. If 5000 pairs are issued, how many pairs would be expected to need replacement within 12 months.	**2**
30	State and prove cancellation laws on groups.	**2**

PART III .

Answer any seven questions. question number 40 is Compulsory . **7 X 3 = 21**

31	Solve the following non-homogeneous equations of three unknowns. 2x + 2y + z = 5 ; x - y + z =1 ; 3x + y + 2z = 4	**3**
32	A force given by 3i + 2j- 4k is applied at the point (1,-1,2) . Find the moment of the force about the point (2,-1,3).	**3**
33	If arg (z -1) = $\frac{\pi}{6}$ and arg (z + 1) = $2\frac{\pi}{3}$ then prove that $\lvert z \rvert$ =1.	**3**
34	The ceiling in a hallway 20ft wide is in the shape of a semi ellipse and 18ft high at the centre. Find the height of the ceiling 4 feet from either wall if the height of the side walls is 12ft.	**3**
35	Find the intervals in which f(x)= x^3- 3x + 1 is increasing and decreasing.	**3**
36	Show that the volume of the largest right circular cone that can be inscribed in a sphere of radius ‘a’ is 27/8 (volume of the sphere).	**3**
37	Use differentials to find an approximate value for the given number $\sqrt{36.1}$	**3**
38	Derive the formula for the volume of a right circular cone with radius ‘ r ‘ and height ‘ h ‘.	**3**
39	Radium disappears at a rate proportional to the amount present. If 5% of the original amount disappears in 50 years, how much will remain at the end of 100 years. [Take A0 as the initial amount]	**3**
40	Show that $p \leftrightarrow q \equiv ((\sim p) \vee q) \vee ((\sim q) \wedge p)$	**3**

PART IV

Answer all the questions . **7 X 5 = 35**

41	Verify whether the given system of equations is consistent. If it is consistent, solve them x - y + z = 5, - x + y - z = - 5, 2x - 2y + 2z = 10 **(OR)** For what values of k, the system of equations k x + y + z = 1, x + k y +z = 1, x + y + k z = 1 have (i) unique solution (ii) more than one solution (iii) no solution	5
42	a) Find all the values of $\left(\frac{1}{2} - i\frac{\sqrt{3}}{2}\right)$ and hence prove that the product of the values is 1. **(OR)** (b) If P represents the variable complex number z. Find the locus of P, if $\arg\left(\frac{z-1}{z+3}\right) = \frac{\pi}{2}$	

43	(a) On lighting a rocket cracker it gets projected in a parabolic path and reaches a maximum height of 4mts when it is 6 mts away from the point of projection. Finally it reaches the ground 12 mts away from the starting point. Find the angle of projection. **(OR)** b)The ceiling in a hallway 20ft wide is in the shape of a semi ellipse and 18ft high at the centre. Find the height of the ceiling 4 feet from either wall if the height of the side walls is 12ft.	5
44	(a) Find the intervals of concavity and the points of inflection of the function: $y = 12x^2 - 2x^3 - x^4$ **(OR)** **b)** 10. If $u = \tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$ Prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$ by using Euler's theorem.	5
45	a) Show that the equation of the curve whose slope at any point is equal to y + 2x and which passes through the origin is $y = 2(e^x - x - 1)$ **(OR)** b) Solve : $(x+y)^2 \frac{dy}{dx} = a^2$	5
46	a). Show that the set $\{[1],[3],[4],[5],[9]\}$ forms an abelian group under multiplication modulo 11. **(OR)** b**)**.Show that the set $G = \{a + b\sqrt{2} / a, b \in Q\}$ is an infinite abelian group with respect to addition.	
47	a) An urn contains 4 white and 3 red balls. Find the probability distribution of number of red balls in three draws one by one from the urn.(i) With replacement (ii) without replacement. **(OR)** b) The mean weight of 500 male students in a certain college in 151 pounds and the standard deviation is 15 pounds. Assuming the weights are normally distributed, find how many students weigh (i) between 120 and155pounds (ii) more than 185 pounds	5