



ST. ANNE'S ACADEMY

(MATHS & PHYSICS TUITION CENTRE)

I FLOOR, JAFRO DENTAL CLINIC, HOLY CROSS COLLEGE ROAD, PUNNAI NAGAR, NAGERCOIL – 629004

Model Question Paper (2022 – 23)
CLASS – XI - MATHEMATICS

Time Allowed : 3 Hrs

Maximum Marks : 90

PART – I

I. Answer ALL questions.

20x1 = 20

1) The function $f : \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = \sin x + \cos x$ is

- (1) an odd function
- (2) neither an odd function nor an even function
- (3) an even function
- (4) both odd function and even function.

2) The value of x , for which the matrix $A = \begin{bmatrix} e^{x-2} & e^{7+x} \\ e^{2+x} & e^{2x+3} \end{bmatrix}$ is singular

- (1) 9
- (2) 8
- (3) 7
- (4) 6

3) $\lim_{x \rightarrow 0} \frac{\sqrt{1 - \cos 2x}}{x}$

- (1) 0
- (2) 1
- (3) $\sqrt{2}$
- (4) does not exist

4) $\int \frac{e^x(1+x)}{\cos^2(xe^x)} dx$ is

- (1) $\cot(xe^x) + c$
- (2) $\sec(xe^x) + c$
- (3) $\tan(xe^x) + c$
- (4) $\cos(xe^x) + c$

5) A bag contains 5 white and 3 black balls. Five balls are drawn successively without replacement. The probability that they are alternately of different colours is

- (1) $\frac{3}{14}$
- (2) $\frac{5}{14}$
- (3) $\frac{1}{14}$
- (4) $\frac{9}{14}$

6) The number of 5 digit numbers all digits of which are odd is

- (1) 25
- (2) 5^5
- (3) 5^6
- (4) 625.

7) The sum of an infinite GP is 18. If the first term is 6, the common ratio is

- (1) $\frac{1}{3}$
- (2) $\frac{2}{3}$
- (3) $\frac{1}{6}$
- (4) $\frac{3}{4}$.

8) If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} + x\hat{j} + \hat{k}$, $\vec{c} = \hat{i} - \hat{j} + 4\hat{k}$ and $\vec{a} \cdot (\vec{b} \times \vec{c}) = 70$, then x is equal to

- (1) 5
- (2) 7
- (3) 26
- (4) 10

9) If $a \neq b, b, c$ satisfy $\begin{vmatrix} a & 2b & 2c \\ 3 & b & c \\ 4 & a & b \end{vmatrix} = 0$, then $abc =$

- (1) $a+b+c$
- (2) 0
- (3) b^3
- (4) $ab+bc$



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- 10) The triangle of maximum area with constant perimeter $12m$
- (1) is an equilateral triangle with side $4m$ (2) is an isosceles triangle with sides $2m, 5m, 5m$
 (3) is a triangle with sides $3m, 4m, 5m$ (4) Does not exist.
- 11) The derivative of $f(x) = x|x|$ at $x = -3$ is
- (1) 6 (2) -6 (3) does not exist (4) 0
- 12) $\lim_{x \rightarrow 0} \frac{e^{\tan x} - e^x}{\tan x - x} =$
- (1) 1 (2) e (3) $\frac{1}{2}$ (4) 0
- 13) The number of roots of $(x + 3)^4 + (x + 5)^4 = 16$ is
- (1) 4 (2) 2 (3) 3 (4) 0
- 14) The number of ways in which a host lady invite 8 people for a party of 8 out of 12 people of whom two do not want to attend the party together is
- (1) $2 \times {}^{11}C_7 + {}^{10}C_8$ (2) ${}^{11}C_7 + {}^{10}C_8$ (3) ${}^{12}C_8 - {}^{10}C_6$ (4) ${}^{10}C_6 + 2!$.
- 15) $\int 2^{3x+5} dx$ is
- (1) $\frac{3(2^{3x+5})}{\log 2} + c$ (2) $\frac{2^{3x+5}}{2 \log(3x+5)} + c$ (3) $\frac{2^{3x+5}}{2 \log 3} + c$ (4) $\frac{2^{3x+5}}{3 \log 2} + c$
- 16) The y -intercept of the straight line passing through (1,3) and perpendicular to $2x - 3y + 1 = 0$ is
- (1) $\frac{3}{2}$ (2) $\frac{9}{2}$ (3) $\frac{2}{3}$ (4) $\frac{2}{9}$
- 17) $\lim_{n \rightarrow \infty} \left(\frac{1}{n^2} + \frac{2}{n^2} + \frac{3}{n^2} + \dots + \frac{n}{n^2} \right)$ is
- (1) $\frac{1}{2}$ (2) 0 (3) 1 (4) ∞
- 18) There are three events A, B and C of which one and only one can happen. If the odds are 7 to 4 against A and 5 to 3 against B , then odds against C is
- (1) 23: 65 (2) 65: 23 (3) 23: 88 (4) 88: 23
- 19) $\cos 1^\circ + \cos 2^\circ + \cos 3^\circ + \dots + \cos 179^\circ =$
- (1) 0 (2) 1 (3) -1 (4) 89
- 20) The range of the function $\frac{1}{1-2 \sin x}$ is
- (1) $(-\infty, -1) \cup (\frac{1}{3}, \infty)$ (2) $(-1, \frac{1}{3})$ (3) $[-1, \frac{1}{3}]$ (4) $(-\infty, -1] \cup [\frac{1}{3}, \infty)$.



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PART – II

II. Answer any SEVEN questions. Question 30 is compulsory

7x2 = 14

- 21) In the set Z of integers, define mRn if $m - n$ is divisible by 7. Prove that R is an equivalence relation.
- 22) If $(k, 2)$, $(2, 4)$ and $(3, 2)$ are vertices of the triangle of area 4 square units then determine the value of k .
- 23) Find the positive integer n so that $\lim_{x \rightarrow 3} \frac{x^n - 3^n}{x - 3} = 27$
- 24) Integrate the following with respect to x : $e^x(\tan x + \log \sec x)$
- 25) Find the general solution of $\sec \theta = -2$
- 26) Write the n^{th} term of the sequence $\frac{3}{1^2 2^2}, \frac{5}{2^2 3^2}, \frac{7}{3^2 4^2}, \dots$ as a difference of two terms.
- 27) If $x = -2$ is one root of $x^3 - x^2 - 17x = 22$, then find the other roots of equation.
- 28) Find the derivatives of the following function with respect to corresponding independent variables: $y = e^{-x} \cdot \log x$
- 29) Find the projection of the vector $\hat{i} + 3\hat{j} + 7\hat{k}$ on the vector $2\hat{i} + 6\hat{j} + 3\hat{k}$.
- 30) If for two events A and B , $P(A) = \frac{3}{4}$, $P(B) = \frac{2}{5}$ and $A \cup B = S$ (sample space), find the conditional probability $P(A / B)$.

PART – III

III. Answer any SEVEN questions. Question 40 is compulsory

7x3 = 21

- 31) Prove that $32(\sqrt{3}) \sin \frac{\pi}{48} \cos \frac{\pi}{48} \cos \frac{\pi}{24} \cos \frac{\pi}{12} \cos \frac{\pi}{6} = 3$.
- 32) If the letters of the word TABLE are permuted in all possible ways and the words thus formed are arranged in the dictionary order (alphabetical order), find the ranks of the words TABLE.
- 33) Integrate the following with respect to x : $\tan^{-1} \left(\frac{8x}{1-16x^2} \right)$
- 34) Differentiate $y = x^{\sqrt{x}}$



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- 35) Suppose the chances of hitting a target by a person X is 3 times in 4 shots, by Y is 4 times in 5 shots, and by Z is 2 times in 3 shots. They fire simultaneously exactly one time. What is the probability that the target is damaged by exactly 2 hits?
- 36) Find the range of the function $\frac{1}{2 \cos x - 1}$.
- 37) Show that the function $\begin{cases} \frac{x^3-1}{x-1}, & \text{if } x \neq 1 \\ 3, & \text{if } x = 1 \end{cases}$ is continuous on $(-\infty, \infty)$
- 38) If a, b, c are in geometric progression, and if $a^{\frac{1}{x}} = b^{\frac{1}{y}} = c^{\frac{1}{z}}$, then prove that x, y, z are in arithmetic progression.
- 39) A manufacturer has 600 litres of a 12 percent solution of acid. How many litres of a 30 percent acid solution must be added to it so that the acid content in the resulting mixture will be more than 15 percent but less than 18 percent?
- 40) If \vec{a}, \vec{b} , and \vec{c} are three unit vectors satisfying $\vec{a} - \sqrt{3} \vec{b} + \vec{c} = \vec{0}$ then find the angle between \vec{a} and \vec{c} .

PART - IV

IV. Answer ALL questions.

7x5 = 35

- 41) a) From the curve $y = x$, draw
 (i) $y = -x$ (ii) $y = 2x$ (iii) $y = x + 1$ (iv) $y = \frac{1}{2}x + 1$ (v) $2x + y + 3 = 0$.

OR

- b) The chances of A, B and C becoming manager of a certain company are $5 : 3 : 2$. The probabilities that the office canteen will be improved if A, B , and C become managers are 0.4, 0.5 and 0.3 respectively. If the office canteen has been improved, what is the probability that B was appointed as the manager?

- 42) a) Resolve into partial fractions: $\frac{2x}{(x^2 + 1)(x - 1)}$.

OR

- b) Find the derivative of $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ with respect to $\tan^{-1} x$.

- 43) a) If $\frac{\log x}{y-z} = \frac{\log y}{z-x} = \frac{\log z}{x-y}$, then prove that $xyz = 1$.

OR



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b) Solve $\cos x + \sin x = \cos 2x + \sin 2x$

44) a) Integrate the following functions with respect to x :

$$\int \frac{x+1}{(x+2)(x+3)} dx$$

OR

b) Expand $\frac{1}{(1+3x)^2}$ in powers of x . Find a condition on x for which the expansion is valid.

45) a) Find the equation of the pair of lines through the origin and perpendicular to the pair of lines $ax^2 + 2hxy + by^2 = 0$

OR

b) In a $\triangle ABC$, prove the following

$$a(\cos B + \cos C) = 2(b + c) \sin^2 \frac{A}{2}$$

46) a) By the principle of mathematical induction, prove that, for $n \geq 1$

$$1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$$

OR

b) Prove by vector method that the medians of a triangle are concurrent.

47) a) If the letters of the word IITJEE are permuted in all possible ways and the strings thus formed are arranged in the lexicographic order, find the rank of the word IITJEE

OR

b) A ball is thrown vertically upward from the ground with an initial velocity of 39.2 m/sec. If the only force considered is that attributed to the acceleration due to gravity, find

(i) how long will it take for the ball to strike the ground?

(ii) the speed with which will it strike the ground? and

(iii) how high the ball will rise?
