

Section 4: Mathematics / Biology

Students will have to attempt either Mathematics/Biology as per the eligibility of the program applied.

Mathematics

66. The solution of the equation. $\log\left(\log_5\left(\sqrt{x+5} + \sqrt{x}\right)\right) = 0$ is
(a) 2 (b) 4 (c) 3 (d) 8
67. Let $\frac{1}{q+r}, \frac{1}{r+p}$ and $\frac{1}{p+q}$ are in A.P. where $p, q, r, \neq 0$, then
(a) p, q, r are in A.P. (b) p^2, q^2, r^2 are in A.P.
(c) $\frac{1}{p} \cdot \frac{1}{q} \cdot \frac{1}{r}$ in A.P. (d) none of these
68. If $b \in \mathbb{R}^+$ then the roots of the equation $(2+b)x^2 + (3+b)x + (4+b) = 0$ is
(a) real and distinct (b) real and equal (c) imaginary (d) cannot predicted
69. Solve for integral solutions $x_1 + x_2 + x_3 + \dots + x_6 \leq 17$, where $1 \leq x_i \leq 6, i = 1, 2, \dots, 6$.
Number of solutions will be
(a) ${}^{17}C_6 - 6{}^{11}C_5$ (b) ${}^{17}C_{11} - 6{}^{11}C_5$ (c) ${}^{17}C_5 - 6{}^{11}C_5$ (d) ${}^{17}C_{11} - 5{}^{11}C_6$
70. The probability that a certain beginner at golf gets a good shot if he uses the correct club is $\frac{1}{3}$,
and the probability of a good shot with an incorrect club is $\frac{1}{4}$. In his bag there are 5 different
clubs, only one of which is correct for the shot in question. If he chooses a club at random and
take a stroke, the probability that he gets a good shot is
(a) $\frac{1}{3}$ (b) $\frac{1}{12}$ (c) $\frac{4}{15}$ (d) $\frac{7}{12}$

71. OPQR is a square and M, N are the middle points of the side PQ and QR respectively. Then the ratio of the area of the square and the triangle OMN is

- (a) 4 : 1 (b) 2 : 1 (c) 4 : 3 (d) 8 : 3

72. Two vertices of an equilateral triangle are $(-1, 0)$ and $(1, 0)$ and its circumcircle is

- (a) $x^2 + \left(y - \frac{1}{\sqrt{3}}\right)^2 = \frac{4}{3}$ (b) $x^2 - \left(y + \frac{1}{\sqrt{3}}\right)^2 = \frac{4}{3}$
(c) $x^2 + \left(y - \frac{1}{\sqrt{3}}\right)^2 = -\frac{4}{3}$ (d) none of these

73. If in a ΔABC , $\sin^2 A + \sin^2 B + \sin^2 C = 2$, then the triangle is always

- (a) isosceles triangle (b) right angled (c) acute angled (d) obtuse angled

74. If the vertex and the focus of a parabola are $(-1, 1)$ and $(2, 3)$ respectively, then the equation of the directrix is

- (a) $3x + 2y - 25 = 0$ (b) $x + 2y + 7 = 0$ (c) $2x - 3y + 10 = 0$ (d) $3x + 2y + 14 = 0$.

75. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and having its centre at $(0, 3)$ is

- (a) 4 (b) 3 (c) $\sqrt{12}$ (d) $7/2$

76. If $P(x_1, y_1)$, $Q(x_2, y_2)$, $R(x_3, y_3)$ and $S(x_4, y_4)$ are four concyclic points on the rectangular hyperbola $xy = c^2$, then the co-ordinates of the orthocentre of ΔPQR are

- (a) $(x_4, -y_4)$ (b) (x_4, y_4) (c) $(-x_4, -y_4)$ (d) $(-x_4, y_4)$

77. The coefficient of $x^n y^n$ in the expansion of $[(1+x)(1+y)(x+y)]^n$ is

- (a) $\sum_{r=0}^n C_r$ (b) $\sum_{r=0}^n C_r^2$ (c) $\sum_{r=0}^n C_r^3$ (d) none of these

78. z_0 is one of the roots of the equation $z^n \cos \theta_0 + z^{n-1} \cos \theta_1 + \dots + \cos \theta_n = 2$, where $\theta_i \in \mathbb{R}$, then
- (a) $|z_0| < \frac{1}{2}$ (b) $|z_0| > \frac{1}{2}$ (c) $|z_0| = \frac{1}{2}$ (d) none of these
79. The second order differential equation is
- (a) $y'^2 + x + y^2$ (b) $y'y'' + y = \sin x$ (c) $y''' + y'' + y = 0$ (d) $y' = 0$
80. $\int e^{3x} \left(\frac{1+3\sin x}{1+\cos x} \right) dx$ is equal to
- (a) $e^{3x} \cot x + c$ (b) $e^{3x} \tan \frac{x}{2} + c$ (c) $e^{3x} \sin x + c$ (d) $e^{3x} \cos x + c$
81. If m and n are positive integers and $f(x) = \int_1^x (t-a)^{2n} (t-b)^{2m+1} dt$, $a \neq b$, then
- (a) $x = b$ is a point of local minimum (b) $x = b$ is a point of local maximum
(c) $x = a$ is a point of local minimum (d) $x = a$ is a point of local maximum
82. If in a triangle ABC $\frac{2 \cos A}{a} + \frac{\cos B}{b} + \frac{2 \cos C}{c} = \frac{a}{bc} + \frac{b}{ca}$, then the value of the angle A is
- (a) 45° (b) 90° (c) 135° (d) 60°
83. The general solution of the equation $2^{\cos 2x} + 1 = 3 \cdot 2^{-\sin^2 x}$ is
- (a) $n\pi$ (b) $\left(n + \frac{1}{2}\right)\pi$ (c) $\left(n - \frac{1}{2}\right)\pi$ (d) all of the above.
84. Total number of positive real values of x satisfying $2[x] = x + \{x\}$, where $[.]$ and $\{.\}$ denote the greatest integer function and fractional part respectively is equal to
- (a) 2 (b) 1 (c) 0 (d) 3
85. If $\lim_{x \rightarrow 0} \frac{((a-n)nx - \tan x) \sin nx}{x^2} = 0$, where n is nonzero real number, then a is equal to
- (a) 0 (b) $\frac{n+1}{n}$ (c) n (d) $n + \frac{1}{n}$
86. $f(x) = \begin{cases} 4x - x^3 + \ln(a^2 - 3a + 3), & 0 \leq x < 3 \\ x - 18, & x \geq 3 \end{cases}$. Find the complete set of values of a such that $f(x)$ has a local minima at $x = 3$ is
- (a) $[-1, 2]$ (b) $(-\infty, 1) \cup (2, \infty)$ (c) $[1, 2]$ (d) $(-\infty, -1) \cup (2, \infty)$

87. The number of values of k for the system of equations $(k + 1)x + 8y = 4k$ and $kx + (k + 3)y = 3k - 1$ has infinitely many solutions

(a) 0 (b) 1 (c) 2 (d) infinite

88. The matrix $\begin{bmatrix} \frac{1+i}{2} & \frac{-1+i}{2} \\ \frac{1+i}{2} & \frac{1-i}{2} \end{bmatrix}$ is

(a) unitary (b) null matrix (c) symmetric (d) none of these

89. The area between the curves $y = xe^x$ and $y = xe^{-x}$ and the line $x = 1$ is

(a) $2e$ (b) e (c) $2/e$ (d) $1/e$

90. If the unit vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle 2θ and $|\vec{a} - \vec{b}| < 1$ then θ lies in the interval

(a) $\left[0, \frac{\pi}{6}\right)$ (b) $\left(\frac{5\pi}{6}, 2\pi\right]$ (c) $\left[\frac{\pi}{6}, \frac{\pi}{2}\right]$ (d) $\left[\frac{\pi}{2}, \frac{5\pi}{6}\right]$