SECTION – A (MATHEMATICS)

PART - I

SINGLE OPTION CORRECT (+ 3, - 1, 0)

1. If α, β, γ are roots of the cubic $2011x^3 + 2x^2 + 1 = 0$, then which of the following relation is (are) correct?

(A) $\alpha^{-1} + \beta^{-1} + \gamma^{-1} = -2011$ (B) $(\alpha\beta)^{-1} + (\beta\gamma)^{-1} + (\gamma\alpha)^{-1} = 2$

(C) $\alpha^2 + \beta^2 + \gamma^2 = (4/2011)$ (D) $\alpha^{-2} + \beta^{-2} + \gamma^{-2} = 4$

2. Let $A = \left\{ x : \frac{|x(x-1)|(x+1)^{\frac{3}{2}}\ln(x+2)}{(x^2-2x)^2(x-1)(e^x-2)} \geq 0 \right\}$ and $B = \left\{ a : a > 0, 2 + \sin\theta = x^2 + \frac{a}{x^2} \forall x \in R - \{0\}, \theta \in R \right\}$ are two sets, then .... (given $\log_{10} 2 = 0.3010$, $|.|$ represent modulus function.)

(A) $A \subseteq B$ (B) $B \subseteq A$ (C) $A \cap B = \phi$ (D) $A \cap B = (0, \ln 2)$

3. Suppose that $|x+y| + |x-y| = 2$. What is the maximum possible value of $x^2 - 6x + y^2$?

(A) 5 (B) 6 (C) 7 (D) 8

4. How many sequences of zeros and ones of length 20 have all zeroes consecutive, or all the ones consecutive or both?

(A) 190 (B) 192 (C) 211 (D) 382

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Paragraph for Questions Nos. 5 to 6

$A_0 = \begin{bmatrix} 2 & -2 & -4 \\ -1 & 3 & 4 \\ 1 & -2 & -3 \end{bmatrix}$ and $B_0 = \begin{bmatrix} -4 & -3 & -3 \\ 1 & 0 & 1 \\ 4 & 4 & 3 \end{bmatrix}$. If $B_n = \text{adj}(B_{n-1})$, $n \in N$ and I is an identity matrix of order 3, then answer the following question

5. Det. $\left(A_0 + A_0^2 B_0^2 + A_0^3 + A_0^4 B_0^4 + ...10 \text{ terms}\right)$ is equal to

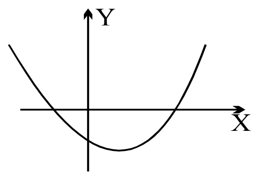
(A) 1000 (B) – 800 (C) 0 (D) – 8000

6. $B_1 + B_2 + ... + B_{49}$ is equal to

(A) B_0 (B) 7 B_0 (C) 49 I (D) 49 B_0

MULTIPLE OPTION CORRECT (+ 4, - 1, 0)

7. The graph of the quadratic polynomial; $y = ax^2 + bx + c$ is as shown in the figure. Then:



(A) $b^2 - 4ac > 0$ (B) $b < 0$

(C) $a > 0$ (D) $c < 0$

8. Let $f(x) = x^2 - (b+1)x + b$ and area of triangle formed by points $(\alpha, 0)$, $(\beta, 0)$ and $(0, f(0))$, where α and β are zeroes of f(x) is 3 units, then the value of b, is/are?

(A) 3 (B) 1 (C) - 2 (D) - 1

9. If $-3 < \frac{x^2 - \lambda x - 2}{x^2 + x + 1} < 2$ for all $x \in R$, then [λ] can be, (where [.] denotes the greatest integer function)

(A) - 1 (B) 1 (C) 0 (D) 2

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10. If α and β are the roots of $x^2 - p(x+1) - q = 0$, then

(A) $(\alpha+1)(\beta+1) = 1-q$

(B) $(\alpha+1)(\beta+1) = 1+q$

(C) $\dfrac{(\alpha+1)^2}{(\alpha+1)^2+q-1} + \dfrac{(\beta+1)^2}{(\beta+1)^2+q-1} = q$

(D) $\dfrac{\alpha^2+2\alpha+1}{\alpha^2+2\alpha+q} + \dfrac{\beta^2+2\beta+1}{\beta^2+2\beta+q} = 1$

11. If $f(x) = \cos([\pi^2]x) + \cos([-\pi^2]x)$, where [.] is Greatest integer function, then

(A) $f\left(\dfrac{\pi}{2}\right) = -1$

(B) $f(\pi) = 1$

(C) $f(-\pi) = 0$

(D) $f\left(\dfrac{\pi}{4}\right) = \dfrac{1}{\sqrt{2}}$

12. If all values of x which satisfies the inequality $\text{Log}_{1/3}(x^2+2px+p^2+1) \geq 0$ also satisfy the inequality $kx^2 + kx - k^2 \leq 0$ for all real values of k, then all possible values of p lies in the interval:

(A) [- 1, 1]

(B) [0, 1]

(C) [0, 2]

(D) [- 2, 0]

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PART – II

Integer Type (+ 4, -1, 0).

13. Let $f(x)=\left(a+\frac{1}{a}\right)x^2-2x+1$, where $a<0$ and $m(a)$ be the maximum value of f(x). As 'a' varies, then the greatest value of $2\cdot m(a)$, is?

14. If α, β, γ are such that α + β + γ = 4, $\alpha^2+\beta^2+\gamma^2=6$, $\alpha^3+\beta^3+\gamma^3=8$, then the value of $\left[\alpha^4+\beta^4+\gamma^4\right]$ must be equal to (where [.] denotes the greatest integer function)

15. The number of negative integral solutions of $x^2.2^{x+1}+2^{|x-3|+2}=x^2.2^{|x-3|+4}+2^{x-1}$ is ____

16. Let (x, y, z) be points with integer co-ordinates satisfying the system of homogeneous equation x + y + z = 0, x + 2y + 3z = 0 and 2x + 3y + 4z = 0, then the number of such points for which $x^2+y^2+z^2\le 12$.

17. Let x_1 and x_2 be real solutions of the equation $x^2 + bx + c = 0$ (b, c $\in$ R). If $x_1 - x_2 = 4$ and $x_1^2+x_2^2=40$, then the value of $b^2/8$ is ___________

18. The sum of all integral values of a in [1, 100] for which the equation $x^2-(a-5)x+\left(a-\frac{15}{4}\right)=0$ has at-least one root greater than zero, is a four digit number 501k, then k is______

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ANSWER KEY

1. B	2. B	3. D	4. D
5.	6.	7. A, B, C, D	8. A, C
9. A, B, C	11. A, C, D	12. A, B, C	13. 3
14.	15. 0	16. 3	17. 8
18. 1