MATHS

1. The real value of α for which the expression $\frac{1-i\sin\alpha}{1+2i\sin\alpha}$ is purely real is

(A) $(n + 1)\frac{\pi}{2}$ (B) $(2n + 1)\frac{\pi}{2}$

(C) $n\pi$ (D) none of these

2. If $e^{i\theta} = \cos\theta + i\sin\theta$, then for the triangle ABC, $e^{iA}.e^{iB}.e^{iC}$ is

(A) –i (B) -1

(C) 1 (D) none of these

3 The value of $\sum_{r=1}^{16}\left(\sin\frac{2r\pi}{17}+i\cos\frac{2r\pi}{17}\right)$ is

(A) 1 (B) i

(C) –i (D) -1

4. If $z = \frac{(\cos\theta+i\sin\theta)^n(\sin\theta+i\cos\theta)^m}{(\sin\theta-i\cos\theta)^k}$, then |z| is

(A) 0 (B) 1

(C) 2 (D) none of these

5. If $x = \cos 2\alpha + i \sin 2\alpha$, $y = \cos 2\beta + i \sin 2\beta$, $z = \cos 2\gamma + i \sin 2\gamma$, then $\sqrt{xyz}+\frac{1}{\sqrt{xyz}}$ is

(A) $2\cos(\alpha + \beta + \gamma)$ (B) $2i \sin(\alpha + \beta + \gamma)$

(C) $e^{i(\alpha + \beta + \gamma)}$ (D) None of these

6. A square matrix A is invertible iff detA is equal to

(A) 0 (B) 1

(C) non zero (D) –1

7. Which of the following is not true

(A) Every skew-symmetric matrix of odd order is non-singular

(B) If determinant of a square matrix is non-zero, then it is non-singular

(C) Adjoint of a symmetric matrix is symmetric

(D) Adjoint of a diagonal matrix is diagonal

8. If for $AX=B$, $B = \begin{bmatrix} 9 \\ 52 \\ 0 \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 3 & -\frac{1}{2} & -\frac{1}{2} \\ -4 & \frac{3}{4} & \frac{5}{4} \\ 2 & -\frac{1}{4} & -\frac{3}{4} \end{bmatrix}$

the X is equal to

(A) $\begin{bmatrix} 1 \\ 3 \\ 5 \end{bmatrix}$ (B) $\begin{bmatrix} -\frac{1}{2} \\ -\frac{1}{2} \\ 2 \end{bmatrix}$ (C) $\begin{bmatrix} -4 \\ 2 \\ 3 \end{bmatrix}$ (D) $\begin{bmatrix} 3 \\ \frac{3}{4} \\ -\frac{3}{4} \end{bmatrix}$

9. $\begin{vmatrix} a+b & a+2b & a+3b \\ a+2b & a+3b & a+4b \\ a+4b & a+5b & a+6b \end{vmatrix} =$

(A) $a^2 + b^2 + c^2 - 3abc$ (B) 3ab
(C) 3a + 5b (D) 0.

10. If the system of equations kx + 3y – 4z = 0, x – ky + z = 0, 5x + 4y – 3z = 0 has a non – zero solution, then k =
(A) – 2, 6 (B) 1, -5
(C) – 1, 5 (D) none of these.

11. The value of x for which $\begin{vmatrix} x & 2 & 2 \\ 3 & x & 2 \\ 3 & 3 & x \end{vmatrix} + \begin{vmatrix} 1-x & 2 & 4 \\ 2 & 4-x & 8 \\ 4 & 8 & 16-x \end{vmatrix} > 33$ are
(A) $0 < x < 1$ (B) $-\frac{1}{2} < x < \frac{1}{2}$
(C) $x < -\frac{1}{7}$ or $x > 1$ (D) none of these.

12. If the roots of equations $ax^2 + bx + c = 0$ are of the form $\frac{\alpha}{\alpha - 1}$ and $\frac{\alpha + 1}{\alpha}$, then the value of $(a + b + c)^2$ is
(A) $b^2 - 4ac$ (B) $b^2 - 2ac$
(C) $2b^2 - ac$ (D) $4b^2 - 2ac$

13. The quadratic equation $8\sec^2 x - 6\sec x + 1 = 0$ has
(A) infinitely many roots (B) exactly two roots
(C) exactly four roots (D) no root.

14. If the equation $ax^2 + 2bx - 3c = 0$ has no real root and $\frac{3c}{4} < a + b$, then
(A) $c < 0$ (B) $c > 0$
(C) $c \geq 0$ (D) $c = 0$

15. If $\frac{x^2 - bx}{ax - c} = \frac{\lambda - 1}{\lambda + 1}$ has roots equal in magnitude and opposite in sign, then the value of λ is
(A) $\frac{a-b}{a+b}$ (B) $\frac{a+b}{a-b}$
(C) c (D) 1/c

16. If (x + 1) is a factor of $x^4 + (p - 3)x^3 - (3p - 5)x^2 + (2p - 9)x + 6$, then the value of P is
(A) -4 (B) 0
(C) 4 (D) 2

17. The number of diagonals that can be drawn by joining the vertices of an octagon is
(A) 28 (B) 48
(C) 20 (D) none

18. There are 10 roads to a village from a town. The number of different ways in which a villager can go to a town and return back is
(A) 25 (B) 20
(C) 10 (D) 100

19. The number of ways in which 8 men can use 8 pens, no pen remain unused is
(A) $^{8}P_{8}$ (B) $^{8}C_{8}$
(C) $^{8}C_{8}$ (D) 8

20. The number of ways in which four letters can be selected from the word 'APSARA'
(A) 2 (B) 7
(C) 5 (D) 10

21. Number of ways of selecting 7 players out of 12 players when 2 of them are always included
(A) $^{10}C_{6}$ (B) $^{10}C_{5}$
(C) $^{12}C_{7}$ (D) $^{10}C_{7}$

22 The coefficient of x^5 in the expansion of $(1 + x)^{21} + (1 + x)^{22} + \ldots\ldots\ldots + (1 + x)^{30}$ is
(A) $^{51}C_{5}$ (B) $^{9}C_{5}$
(C) $^{31}C_{6} - {}^{21}C_{6}$ (D) $^{30}C_{5} + {}^{20}C_{5}$.

23. If the coefficients of x^7 and x^8 in $\left(2+\frac{x}{3}\right)^{n}$ are equal then n is
(A) 56 (B) 55
(C) 45 (D) 15.

24. The sum of all the coefficients in the binomial expansion of $(x^2 + x - 3)^{319}$ is
(A) 1 (B) 2
(C) – 1 (D) 0.

25. The smallest positive integer n, for which $n! < \left(\frac{n+1}{2}\right)^{n}$ holds, is
(A) 1 (B) 3
(C) 2 (D) 4

26. If $x^a = x^{b/2}z^{b/2} = z^c$, then a, b, c are in
(A) A.P. (B) G.P.
(C) H.P. (D) none of these

27. If $x^{18} = y^{21} = z^{28}$, then 3, 3 $\log_y x$, 3$\log_z y$, 7$\log_x z$ are in
(A) A.P. (B) G.P.
(C) H.P. (D) none of these

28. The least value of 'a' for which $5^{1+x} + 5^{1-x}$, $\frac{a}{2}$, $25^{x} + 25^{-x}$ are three consecutive terms of an A.P. is

(A) 10
(B) 5
(C) 12
(D) none of these

29. If $A = 1 + r^a + r^{2a} + r^{3a} + \ldots\ldots\infty$ and $B = 1 + r^b + r^{2b} + r^{3b} + \ldots\ldots\infty$, then a/b is equal to

(A) $\log_{1-B}(1 - A)$
(B) $\log_{\frac{B-1}{B}}\left(\frac{A-1}{A}\right)$
(C) $\log_B A$
(D) none of these

30. If $a_1, a_2, a_3, \ldots\ldots$ is an A.P. such that $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$ then $a_1 + a_2 + a_3 + \ldots\ldots + a_{23} + a_{24}$ is equal to

(A) 909
(B) 75
(C) 750
(D) 900

31. The vector $\vec{a} = 3\hat{j} + 4\hat{k}$ is the sum of two vectors $\vec{a}_1$ and $\vec{a}_2$. $\vec{a}_1$ is parallel to the vector $\vec{b} = \hat{i} + \hat{j}$ and $\vec{a}_2$ is perpendicular to $\vec{b}$. Vector $\vec{a}_1$ is equal to

(A) $\frac{3}{2}(\hat{i} + \hat{j})$
(B) $\frac{1}{2}(\hat{i} + \hat{j})$
(C) $\frac{2}{3}(\hat{i} + \hat{j})$
(D) $\frac{1}{3}(\hat{i} + \hat{j})$

32. If $\vec{a} + \vec{b}$ is at right angles to $\vec{b}$ and $2\vec{b} + \vec{a}$ is at right angles to $\vec{a}$, then

(A) $a = \sqrt{2b}$
(B) a = 2b
(C) a = b
(D) 2a = b

33. A parallelogram is constructed with $\vec{a}$ and $\vec{b}$ as adjacent sides that $|\vec{a}| = a$ and $|\vec{b}| = b$. The vector which coincides with the altitude of the parallelogram and is perpendicular to vector $\vec{a}$ is

(A) $\vec{b} - \frac{(\vec{a}.\vec{b})\vec{a}}{a^2}$
(B) $\vec{a} - \frac{(\vec{a}.\vec{b})\vec{b}}{b^2}$
(C) $\vec{a} - \frac{(\vec{a}.\vec{b})\vec{b}}{a^2}$
(D) $\vec{b} - \frac{(\vec{a}.\vec{b})\vec{a}}{b^2}$

34. $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d})$ equals

(A) $[\vec{a}\vec{b}\vec{c}]\vec{d}$
(B) $[\vec{a}\vec{b}\vec{c}]\vec{d}$
(C) $[\vec{a}\vec{b}\vec{c}]\vec{d}$
(D) None of these

35. $\vec{a} \times (\vec{a} \times \vec{b})$ equals

(A) $(\vec{a}.\vec{a})(\vec{a} \times \vec{b})$
B) $(\vec{a}.\vec{a})(\vec{b} \times \vec{a})$
(C) $(\vec{b}.\vec{b})(\vec{a} \times \vec{b})$
D) $(\vec{b}.\vec{b})(\vec{b} \times \vec{a})$

36. The probability that a card drawn out of a pack of 52 cards is a spade is

(A) $\frac{1}{2}$
(B) $\frac{1}{4}$
(C) $\frac{1}{13}$
(D) $\frac{2}{13}$

37. In a class of 10 students 4 are boys and rest are girls. The probability that a student selected will be girl is

(A) $\frac{1}{5}$ (B) $\frac{2}{3}$

(C) $\frac{3}{5}$ (D) $\frac{4}{5}$

38. If P(E) denotes the probability of an event E, then

(A) $P(E) \leq 0$ (B) $P(E) \geq 1$

(C) $0 \leq P(E) \leq 1$ (D) $-1 \leq P(E) \leq 1$

39. From a group of 7 men and 7 ladies, a committee of 6 person is formed, x probability that the committee will consist of exactly 2 ladies is

(A) $\frac{4}{11}$ (B) $\frac{3}{11}$

(C) $\frac{2}{11}$ (D) $\frac{5}{11}$

40. If 6 boys and 6 girls sit in a row randomly then the probability that all the 6 girls sit together is

(A) $\frac{1}{61}$ (B) $\frac{3}{61}$

(C) $\frac{1}{132}$ (D) $\frac{3}{132}$