Aakash
Medical | IIT-JEE | Foundations
(Divisions of Aakash Educational Services Ltd.)
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MM : 120 **Time : 1½ Hr.**

Sample Paper : Campus Recruitment Test
Mathematics (Engineering)

Complete Syllabus of Class XI & XII

Instructions:

(i) Use ball point pen only to darken the appropriate circle.
(ii) Mark should be dark and should completely fill the circle.
(iii) Dark only one circle for each entry.
(iv) Dark the circle in the space provided only.
(v) Rough work must not be done on the Answer sheet and do not use **white-fluid** or any other **rubbing material** on Answer sheet.
(vi) Each question carries 3 marks. For every wrong response 1 mark shall be deducted from the total score.

Choose the correct answer :

1. Let $f : R \longrightarrow A$ defined by $f(x) = [x - 4] + [6 - x]$, [.] denotes the greatest integer function. Then

(1) f is many one and even function

(2) f is onto if $A = I$ (set of integers)

(3) f is many one and odd function

(4) f is one-one and odd function

2. If for a function $f(x)$, $f(3) = 4$, $f'(3) = 5$, then $\lim\limits_{x \to 3} [f(x)]$,

([.] denotes the greatest integer function)

(1) Is equal to 3

(2) Is equal to 4

(3) Is equal to 5

(4) Does not exist

3. Let $a_1, a_2, \ldots, a_{10}$ be 10 non-negative real number such that $a_1 + a_2 + \ldots + a_{10} = 12$ and $S = a_1a_2 + a_2a_3 + a_3a_4 + \ldots + a_9a_{10}$. Then

(1) $S \le 36$ (2) $S > 144$

(3) $S < 18$ (4) $S > 72$

4. If the sine of angles of a triangle ABC satisfy the equation $c^3x^3 - c^2(a + b + c)x^2 + \lambda x + \mu = 0$ (where a, b, c are the sides of a triangle ABC), then the triangle ABC is

(1) Always right angled for any real value of λ, μ

(2) Right angled only when $\lambda = c(ab + bc + ca)$, $\mu = -abc$

(3) Right angled only when $\lambda = \dfrac{c(ab+bc+ca)}{4}$, $\mu = \dfrac{-abc}{8}$

(4) Never right angled

5. If α and β are non-real, then the condition for $x^2 + \alpha x + \beta = 0$ to have a real root is

(1) $(\alpha - \bar{\alpha})(\beta - \bar{\beta}) = (\alpha\bar{\beta} - \bar{\alpha}\beta)^2$

(2) $(\bar{\alpha} - \alpha)(\alpha\bar{\beta} - \bar{\alpha}\beta) = (\beta - \bar{\beta})^2$

(3) $(\beta - \bar{\beta})(\alpha\bar{\beta} - \bar{\alpha}\beta) = (\alpha - \bar{\alpha})^2$

(4) $(\alpha - \bar{\alpha})(\beta - \bar{\beta}) = (\alpha\bar{\beta} + \bar{\alpha}\beta)^2$

6. If $f(x)=\frac{x-1}{x+1}, f^2(x)=f(f(x)), f^{k+1}(x)=f(f^k(x))$

k = 1, 2, 3, ..., and $g(x)=f^{1922}(x)$, then

$\int_{\frac{1}{e}}^{1} g(x)dx$ is equal to

(1) 0 (2) 1

(3) e (4) –1

7. If $(1 + x + x^2)^n = a_0 + a_1x + a_2x^2 + ... + a_{2n}x^{2n}$; $n \geq 14$, then the value of the determinant

$$\begin{vmatrix} a_{n-3} & a_{n-1} & a_{n+1} \\ a_{n-6} & a_{n-3} & a_{n+3} \\ a_{n-14} & a_{n-7} & a_{n+7} \end{vmatrix}$$

(1) Is always positive (2) Is always negative

(3) Is zero (4) Can't be predicted

8. Let P_n denotes the product of all the coefficients of $(1 + x)^n$ and $10!\, P_{n+1} = 11^n . P_n$, then n is equal to

(1) 9 (2) 10

(3) 11 (4) 13

9. If $\dfrac{\sum_{r=0}^{k-1} x^{2r}}{\sum_{r=0}^{k-1} x^{r}}$ is a polynomial in x; p and q are any two values of k, then the roots of the equation $3x^2 + px + 5q = 0$ cannot be

(1) Real (2) Imaginary

(3) Rational (4) Irrational

10. Let z be a non-zero complex number. If $|z - 3 - 2i| = |z|\sin\left(\frac{\pi}{4}-\arg z\right)$, then the locus of z is

(1) A pair of straight lines

(2) Circle

(3) Parabola

(4) Ellipse

11. Let N be any five digit number say $x_1x_2x_3x_4x_5$. Then the maximum value of $\dfrac{N}{x_1+x_2+x_3+x_4+x_5}$ is equal to

(1) 10000 (2) $\frac{11111}{5}$

(3) 8000 (4) 11111

12. Let $\vec{a}=\hat{i}+\hat{j}+\hat{k}, \vec{b}=x_1\hat{i}+x_2\hat{j}+x_3\hat{k}$,

where $x_1, x_2, x_3 \in \{-3, -2, -1, 0, 1, 2\}$. Number of possible vector $\vec{b}$ such that $\vec{a}$ and $\vec{b}$ are mutually perpendicular, is

(1) 22 (2) 24

(3) 25 (4) 30

13. For the series 21, 22, 23, ..., k – 1, k, the A.M. and G.M. of the first and the last number exists in the given series. If k is a three digit number, the number of possible values of k is

(1) 5 (2) 6

(3) 2 (4) 4

14. The number of solutions of the equation $m\cos^{-1}x+\cos^{-1}(1-x)=\frac{n\pi}{2}$, where $m > 0$, $n \leq 0$, is

(1) 0 (2) 1

(3) 2 (4) 3

15. Let $f(x) = \sin 2\pi x + x - [x]$ ([.] denotes the greatest integer function). Then the number of points in [0, 10] at which $f(x)$ assumes its local maximum value is

(1) 0 (2) 10

(3) 9 (4) 20

16. Five different digits from the set of numbers {1, 2, 3, 4, 5, 6, 7} are written in random order. The probability that 5 digit number thus formed is divisible by 9, is

(1) $\frac{2}{21}$ (2) $\frac{4}{21}$

(3) $\frac{8}{21}$ (4) $\frac{10}{21}$

17. The reflection of the point $(2t + 1, t)$ in a line is $(t - 1, 2t + 2)$. Then the equation of the line can be

(1) $x = y + 1$ (2) $x = y - 1$

(3) $x = 2y + 1$ (4) $x = 2y - 1$

18. The area bounded between the tangents, drawn to the circle $x^2 + y^2 = 4$ at its points of intersection with the curve $y=\sqrt{3|x|}$ is $\left(\frac{A}{C}-B\pi\right)$ sq. units. Then the value of $(A + C^2 - 3B)$ is equal to

(1) 9 (2) 6

(3) 7 (4) 8

19. Suppose the number of elements in set A is p, the number of elements in set B is q, and the number of elements in set $(A \times B)$ is 13. Then $p^2 + q^2$ is equal to

(1) 170 (2) 130

(3) 120 (4) 140

20. For each of two data sets, each of size 4, the variance are given to be 3 and 4 and corresponding means are given to be 2 and 3 respectively. The variance of the combined data is equal to

(1) $\frac{11}{4}$ (2) $\frac{15}{4}$

(3) 5 (4) $\frac{13}{4}$

21. If $\text{cosec}x\sqrt{1-\cos^2 x} + \sec x\sqrt{1-\sin^2 x} = 0$ and $x \in (0, 2\pi)$, then the number of integral values of 'x' is

(1) 4 (2) 5

(3) 6 (4) 7

22. The minimum value of $y = \sec x + \text{cosec}x$ in (0, 1] is

(1) $\sqrt{2}$ (2) $2\sqrt{2}$

(3) $3\sqrt{2}$ (4) $4\sqrt{2}$

23. The product of roots of the equation

$(\log_2 x)^2 - 3\sqrt{(\log_2 x)^2} + 2 = 0$ is

(1) 1 (2) 4

(3) 8 (4) 2

24. Let $|z^4 - 1| = |z|^4 + 1$, where z is a complex number then argument of z may be

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{3}$

(3) $\frac{\pi}{2}$ (4) $\frac{\pi}{4}$

25. Let $f(x) = \sqrt{(3x - x^2 - 2)}$ is a real valued function and [ ] and { } represents greatest integer function and fractional function respectively then the number of integers in the domain of $f([x]^2 + 2x - 2\{x\} + 6)$ is

(1) 5 (2) 1

(3) 0 (4) 3

26. Consider A, B, C, D are four collinear points on a horizontal plane. The angle of elevation of a tower situated at point D from A, B, C is $\alpha-\beta$, $\alpha+\beta$ and 2α respectively. If $AB = BC = CD = 1$, then the height of the tower is

(1) 4 (2) 3

(3) 2 (4) 1

27. The number of five digit numbers using 2, 3, 4, 5 only such that the sum of digits 23, is

(1) 15 (2) 5

(3) 10 (4) 20

28. If $C_0, C_1, C_2, C_3, ...C_n$ are the binomial coefficients in the expansion of $(1+x)^n$ then the value of $2C_1 + (2.2^2)C_2 + (3.2^3)C_3 + (4.2^4)C_4 + ... + (n.(2^n)C_n)$ is

(1) $2n.5^{n-1}$ (2) 2^n

(3) $2n.3^{n-1}$ (4) $2n.4^{n-1}$

29. Two harmonic means H_1, H_2 are inserted between two numbers whose arithmetic mean is A and geometric mean is G. If the arithematic mean of H_1, H_2 is 'h' and geometric mean is 'g' then the value of $\left(\frac{hG^2}{g^2A}\right)$ is

(1) 2 (2) 1

(3) 3 (4) 4

30. The point (α, α) lies inside the triangle formed by the lines $x = 0$, $y = 0$, $x + y = 2$ then the number of integral values of 'α' is

(1) 1 (2) 2

(3) 3 (4) 0

31. The tangents from origin to the circle $x^2 + y^2 - 4x - 4y + 4 = 0$ meet the circle at A and B. The radius of the circle passing through A, B and (1, 0) is

(1) $\sqrt{\frac{3}{2}}$ (2) $\sqrt{\frac{5}{2}}$

(3) $\sqrt{\frac{7}{2}}$ (4) $\sqrt{\frac{11}{2}}$

32. Tangents PA, PB are drawn to parabola $y^2 - 4x - 2y + 5 = 0$ from $P(0, 1)$. The locus of centre of the ellipse whose major and minor axes are of constant length and which touches the tangents PA and PB, is

(1) Circle (2) Parabola

(3) Straight line (4) Hyperbola

33. The number of solution(s) of the equations

$-4x + y + z = 2$ ...(i)

$2x - 2y + z = 3$ ...(ii)

$2x + y - 2z = 1$ ...(iii)

is

(1) 0 (2) 1

(3) 2 (4) Infinite

34. Let $f : R \to R$ and $f(x+2) + f(x) = f(x+1)$ and $g(x) = f(x) - f(x+36) + x^3 + x^2 + x + 1$, where $x \in R$ then

(1) $g(x)$ is continuous only for some values of x

(2) $g(x)$ is differentiable only for some values of x

(3) $g(x)$ is continuous but not differentiable

(4) $g(x)$ is continuous and differentiable for all $x \in R$

35. The sum of x and y coordinates of all the points on the curve $y = x^2 + x + 1$ where tangent is equally inclined to the co-ordinate axes is

(1) 1 (2) 2

(3) 3 (4) 4

36. Let $\int e^x (3(\sin x - 3\cos x) + 4(3\cos^3 x - \sin^3 x))\, dx$ $= e^x f(x) + c$ then the range of $|f(x)|$ is

(1) $\left[0, \frac{1}{2}\right]$ (2) $[0, \sqrt{2}]$

(3) $[0, 1]$ (4) $[0, 2]$

37. The area bounded by $f(x) = \max\{x, \sin^{-1} x\}$ and x-axis in [0, 1] is

(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{2} - 1$

(3) $\frac{\pi}{2} + 1$ (4) $\frac{\pi}{2} + 2$

38. The solution of differential equation $\frac{dy}{dx} + (\sec x)(y-1) + \tan x = 0$ is $y = (x+c)f(x)$, where 'c' is the arbitrary constant then the value of $f(0)$ is

(1) 0 (2) 3

(3) 1 (4) 2

39. Four students A, B, C, D apply for admission in four centres of Aakash Institute named C_1, C_2, C_3, C_4. The probability that A, B, C, D never get the admission in C_1, C_2, C_3, C_4 respectively such that no two gets admission at the same centre and all gets admission, is p then the value of (256 p) is

(1) 9 (2) 8

(3) 7 (4) 5

40. Let $\vec{a}, \vec{b}, \vec{c}$ are vectors having magntidues 1, 1 and $\frac{\sqrt{13}}{2}$ respectively and $(\vec{a} \cdot \vec{b})\, \vec{a} + \vec{b} = \vec{c}$ then the angle between $\vec{a}$ and $\vec{b}$ is

(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{4}$

(3) $\frac{\pi}{3}$ (4) $\frac{\pi}{6}$

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1.	(1)	11.	(1)	21.	(1)	31.	(2)
2.	(4)	12.	(2)	22.	(2)	32.	(1)
3.	(1)	13.	(3)	23.	(1)	33.	(1)
4.	(2)	14.	(1)	24.	(4)	34.	(4)
5.	(2)	15.	(2)	25.	(3)	35.	(1)
6.	(4)	16.	(1)	26.	(4)	36.	(3)
7.	(3)	17.	(2)	27.	(1)	37.	(2)
8.	(2)	18.	(1)	28.	(3)	38.	(3)
9.	(3)	19.	(1)	29.	(2)	39.	(1)
10.	(3)	20.	(2)	30.	(4)	40.	(4)