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Belur Math, Howrah - 711202

B. Sc ADMISSION TEST - 2025

MATHEMATICS

Date : 23/06/2025 **Full marks : 100** Time : 12:30 pm − 2:30 pm

SET: A

Instructions for the candidates

- Answer all questions.
- Each question has 4 options out of which only one is correct.
- Tick (✓) the correct option on Answer Sheet.
- The tick (✓) must be very clear − if it is smudgy or not clear, no marks will be awarded.
- Each correct answer carries **2 marks** and for each incorrect answer **1 mark** will be deducted.
- Unanswered questions will not be awarded.
- Multiple answers will be considered as wrong answer.
- Calculator, smartwatch are **not** allowed.

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1. If the lines $x + 2ay + a = 0$, $x + 3by + b = 0$ and $x + 4cy + c = 0$ are concurrent then a, b, c are
(a) in AP **(b)** in GP **(c)** in HP **(d)** None of (a), (b) and (c)

2. If the point $(3, 4)$ lies inside and the point $(-3, -4)$ lies outside the circle $x^2+y^2-7x+5y-p = 0$, then the set of all possible values of p is
(a) $(23, 25)$ **(b)** $(24, 26)$ **(c)** $(24, 25)$ **(d)** $(0, 25)$

3. An equilateral triangle is inscribed in the parabola $y^2 = 4x$, one of whose vertex is at vertex of the parabola, the length of each side of the triangle is
(a) $8\sqrt{3}$ **(b)** $4\sqrt{3}$ **(c)** $\frac{\sqrt{3}}{2}$ **(d)** $\sqrt{\frac{3}{2}}$

4. The reflection point of the point $(0, 3, -2)$ in the line $\frac{1-x}{2} = 2 - y = 1 + z$ is
(a) $(2, 1, 0)$ **(b)** $(2, 1, 4)$ **(c)** $(1, 2, -1)$ **(d)** $(0, 0, 1)$

5. The equation of a plane passing through the line of intersection of the planes $x + 2y + 3z = 2$ and $x - y + z = 3$ and at a distance $\frac{2}{\sqrt{3}}$ from the point $(3, 1, -1)$ is
(a) $5x - 11y + z = 17$ **(b)** $x + y + z = \sqrt{3}$
(c) $\sqrt{2}x + y = \sqrt{3}z - 1$ **(d)** $x + \sqrt{2}y = 1 - \sqrt{2}z$

6. If $y = x$ and $3y + 2x = 0$ are the equations of a pair of conjugate diameters of an ellipse, then the eccentricity of the ellipse is
(a) $2\sqrt{3}$ **(b)** $\frac{1}{\sqrt{3}}$ **(c)** $\frac{1}{3}$ **(d)** $\frac{1}{\sqrt{2}}$

7. The nonzero vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are related as $\vec{b} = 5\vec{a}$ and $\vec{c} = -2\vec{b}$. The angle between $\vec{a}$ and $\vec{c}$ is

(a) $\frac{\pi}{2}$ **(b)** $\frac{\pi}{3}$ **(c)** $\frac{\pi}{4}$ **(d)** π

8. Let $f(x) = \begin{cases} 1 + \dfrac{x^3 + x^2 - 16x + 20}{(x-2)^2}, & x \neq 2 \\ p &, x = 2. \end{cases}$

If $f(x)$ is continuous for all $x \in \mathbb{R}$, then p equals

(a) 8 **(b)** ± 8 **(c)** $\frac{1}{8}$ **(d)** -8 .

9. $\displaystyle\lim_{x \to 0} \frac{\sin(\pi \cos^2 x)}{2x^2}$ is equal to

(a) $\frac{\pi}{2}$ **(b)** 2 **(c)** $-\pi$ **(d)** π .

10. For $x \in \mathbb{R}$, $f(x) = |\log 3 - \sin x|$ and $g(x) = f(f(x))$. Then $g'(0)$ equals

(a) $\log 3$ **(b)** $\sin(\log 3)$ **(c)** $\cos(\log 3)$ **(d)** $-\sin(\log 3)$.

11. Let $f(x) = \begin{cases} e^{\frac{1}{x}}, & x \neq 0 \\ 0 &, x = 0. \end{cases}$

Then

(a) $f(x)$ is discontinuous at $x = 0$.

(b) $\displaystyle\lim_{x \to 0+} f(x) = 0$

(c) $\displaystyle\lim_{x \to 0-} f(x) = 1$

(d) $\displaystyle\lim_{x \to 0+} f(x) = e$

12. Let $f : \mathbb{R} \to \mathbb{R}$ be a positive increasing function with $\displaystyle\lim_{x \to \infty} \frac{f(4x)}{f(x)} = 1$. Then $\displaystyle\lim_{x \to \infty} \frac{f(3x)}{f(x)}$ is equal to

(a) $\frac{1}{2}$ **(b)** $\frac{3}{4}$ **(c)** $\frac{4}{3}$ **(d)** 1 .

13. $\displaystyle\lim_{x \to 2} \frac{3^x + 3^{3-x} - 12}{3^{-x/2} - 3^{1-x}}$ is equal to

(a) 36 **(b)** 3 **(c)** 1 **(d)** -12 .

14. The set of points of continuity of the function $f(x) = \begin{cases} \dfrac{x}{|x|}, & x < 0 \\ -1, & x \geq 0 \end{cases}$ is

(a) $\mathbb{R}$ **(b)** $\mathbb{R} \backslash \{0\}$ **(c)** $\{0\}$ **(d)** $\mathbb{R} \backslash \{1, -1\}$.

15. If $A = \begin{bmatrix} 1 & 0 \\ -1 & 7 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ satisfy $A^2 = 8A + kI$, then k is

(a) 6 **(b)** 7 **(c)** -6 **(d)** -7

16. For $x,\ y > 0$, $\begin{vmatrix} \log_x y & 1 \\ 1 & \log_y x \end{vmatrix} =$

(a) 2 **(b)** 1 **(c)** -1 **(d)** 0

17. If $3^x + 2^y = 7$ and $4^y - 9^x = 7$, then
(a) $x = 1,\ y = 2$ **(b)** $x = 2,\ y = 1$ **(c)** $x = 1,\ y = 3$ **(d)** $x = 3,\ y = 2$

18. The 7th term in the expansion of $(3x + \frac{2}{x})^{11}$ is
(a) $3849120x^3$ **(b)** $10777536x$ **(c)** $\frac{7185024}{x}$ **(d)** $\frac{3421440}{x^3}$

19. The sum of the numbers divisible by 13 between 500 and 1000 is
(a) 28305 **(b)** 28405 **(c)** 27417 **(d)** 28505

20. Sum of the first 20 terms of the series $\frac{1^3}{1} + \frac{1^3+2^3}{1+3} + \frac{1^3+2^3+3^3}{1+3+5} + \ldots$ is
(a) 829.5 **(b)** 839.5 **(c)** 827.5 **(d)** 827.75

21. The smallest n, for which the sum of the first n terms of the series $1 + 3 + 3^2 + \ldots$ is greater than 7000, is
(a) 10 **(b)** 9 **(c)** 11 **(d)** 8

22. If A, B are two sets and A× B contains 7 elements, then
(a) Both A and B contain more than 1 element.
(b) One of the sets A, B contains 3 elements and the other contains 4 elements.
(c) One of the sets A, B contains 1 element and the other contains 7 elements.
(d) Both A, B contain less than 7 elements.

23. If a set A contains 5 elements and B contains 3 elements and if B is not a subset of A then the number of elements in A∪B is
(a) ≥ 7 **(b)** ≥ 6 **(c)** $= 8$ **(d)** $= 6$

24. A relation ρ on the set $\mathbb{Z}$ of all integers is defined by '$a\ \rho\ b$ iff $ab \geq 0$' $(a, b \in \mathbb{Z})$. Then
(a) ρ is not reflexive **(b)** ρ is not symmetric
(c) ρ is not transitive **(d)** ρ is an equivalence relation.

25. A relation ρ on the set $\mathbb{N}$ of all positive integers is defined by '$a\ \rho\ b$ iff a^2+b^2 is even' $(a, b \in \mathbb{N})$. Then
(a) ρ is not reflexive **(b)** ρ is not symmetric
(c) ρ is not transitive **(d)** ρ is an equivalence relation.

26. If n is the total number of maps from A to B where A has 2 elements and B has 4 elements, then
(a) $n = 8$ **(b)** $n = 12$ **(c)** $n = 16$ **(d)** $n = 20$

27. If n is the total number of surjective maps from A to B where A has 3 elements and B has 2 elements then
(a) $n = 6$ **(b)** $n = 4$ **(c)** $n = 8$ **(d)** $n = 9$

28. Suppose $\mathbb{N}$ is the set of all positive integers and A=$\{1, 2, 3\}$. Then
(a) No map from $\mathbb{N}$ to $\mathbb{N}\backslash$A is injective.
(b) No map from $\mathbb{N}$ to $\mathbb{N}\backslash$A is bijective.
(c) there are only three bijective maps from $\mathbb{N}$ to $\mathbb{N}\backslash$A.
(d) there are more than three bijective maps from $\mathbb{N}$ to $\mathbb{N}\backslash$A.

29. Let z_1 and z_2 be two complex numbers. Which of the following statement is false for z_1 and z_2?
(a) $z_1 + z_2 \leq z_1 + z_2$.
(b) $|z_1 + z_2| \leq |z_1| + |z_2|$.
(c) $|z_1 - z_2| \leq |z_1| + |z_2|$.
(d) $\overline{z_1 + z_2} = \overline{z_1} + \overline{z_2}$.

30. If a fourth degree polynomial $P(x)$ can be written as $(a_1x^2 + b_1x + c_1)(a_2x^2 + b_2x + c_2)$ and $P(x) = 0$ has only non-real complex roots then which of the following statements is definitely true?
(a) $(b_1^2 - 4a_1c_1)(b_2^2 - 4a_2c_2) \geq 0$.
(b) $(b_1^2 - 4a_1c_1) + (b_2^2 - 4a_2c_2) \geq 0$.
(c) $(b_1^2 - 4a_1c_1) \geq 0$, $(b_2^2 - 4a_2c_2) \leq 0$.
(d) $(b_1^2 - 4a_1c_1) < 0$, $(b_2^2 - 4a_2c_2) < 0$.

31. The modulus of $\frac{7+i}{12+5i}$ is
(a) $\frac{\sqrt{50}}{13}$ **(b)** $\frac{50}{13}$ **(c)** $\sqrt{\frac{48}{119}}$ **(d)** $\frac{8}{17}$.

32. If $x \sin^3\theta + y \cos^3\theta = \sin\theta\cos\theta$; $x \sin\theta - y\cos\theta = 0$ and $\sin\theta\cos\theta \neq 0$, then which of the following statement is true?
(a) $x^2 - y^2 = 1$ **(b)** $x^2 + y^2 = 1$ **(c)** $x^3 + y^3 = 1$ **(d)** $x^3 - y^3 = 1$.

33. If n is a non-zero integer and α is a real number, then $\sin[n\pi + (-1)^n\alpha]$ is equal to
(a) $\sin\alpha$ **(b)** $-\sin\alpha$ **(c)** $\frac{n}{|n|}\sin\alpha$ **(d)** $(-1)^n\sin\alpha$.

34. Let z_1, z_2 be two complex numbers such that $|z_1 + z_2| = |z_1 - z_2|$, then which of the following statement is definitely true?
(a) $z_1 = z_2$.
(b) $z_2 = 0$.
(c) Either $Re(z_1)Re(z_2) = 0$ or $Im(z_1)Im(z_2) = 0$.
(d) $Re(z_1)Re(z_2) + Im(z_1)Im(z_2) = 0$.
(Here, $Re(z)$ and $Im(z)$ stands for real and imaginary parts respectively.)

35. From a certain point P on the ground, the angle of elevation of the top of the tree is α. After moving x meters towards the tree the angle of elevation becomes β. Then, the height h of the tower is given by
(a) $h = \frac{x\tan\alpha\tan\beta}{\tan\beta+\tan\alpha}$ **(b)** $h = \frac{x\tan\alpha\tan\beta}{\tan\beta-\tan\alpha}$ **(c)** $h = \frac{\tan\alpha\tan\beta}{x(\tan\beta\tan\alpha)}$ **(d)** $h = \frac{-\tan\alpha\tan\beta}{x(\tan\beta+\tan\alpha)}$

36. A particle moves along a straight line and its distance x from a fixed point on the line at time t is given by $t = Ax^2 + Bx + C$, where A, B, C are positive constants. If v is the velocity of the particle at time t, then the particle is moving with retardation

(a) Av^2 **(b)** $2Av^2$ **(c)** Av^3 **(d)** $2Av^3$

37. The area (in square unit) bounded by the parabola $y = x^2–6x + 10$ and the straight lines $x = 6$ and $y = 2$ is

(a) $\frac{16}{3}$ **(b)** $\frac{20}{3}$ **(c)** 8 **(d)** $\frac{32}{3}$

38. The angle between the curves $y = \sin x$ and $y = \cos x$ is

(a) $\tan^{-1}(5\sqrt{2})$ **(b)** $\tan^{-1}(2\sqrt{2})$ **(c)** $\tan^{-1}(3\sqrt{2})$ **(d)** $\tan^{-1}(3\sqrt{3})$

39. A land in the form of a circular sector has been fenced by wire 40 metre length. The area of the land will be maximum when the radius of the circular sector (in metre) is

(a) 25 **(b)** 20 **(c)** 10 **(d)** 15

40. A stone falling from the top of a vertical tower has descended x feet when another is let fall from a point y feet below the top. If they fall from rest and reach the ground together, then the height of the tower in feet is

(a) $\frac{(x+y)^2}{2x}$ **(b)** $\frac{(x+y)^2}{2y}$ **(c)** $\frac{(x+y)^2}{4x}$ **(d)** $\frac{(x+y)^2}{4y}$

41. Value of $\int_1^2 [x^2]dx$ is (where $[x]$ is the greatest integer function of x)

(a) $5 + \sqrt{3} - \sqrt{2}$ **(b)** $5 - \sqrt{3} + \sqrt{2}$ **(c)** $5 - \sqrt{3} - \sqrt{2}$ **(d)** $5 + \sqrt{3} + \sqrt{2}$

42. The minimum value of $f(x) = |3–x| + |2 + x| + |5–x|$ is

(a) 0 **(b)** 8 **(c)** 7 **(d)** 10

43. Two numbers a and b are chosen at random from the set of first 30 natural numbers. The probability that $(a^2–b^2)$ is divisible by 3 is

(a) $\frac{47}{87}$ **(b)** $\frac{44}{87}$ **(c)** $\frac{46}{87}$ **(d)** $\frac{15}{29}$

44. Among all possible arrangements of the letters of the word **NUMBER**, where the position of each of the vowels remains unchanged, the dictionary order of 'NUMBER' is

(a) 16 **(b)** 15 **(c)** 14 **(d)** 13.

45. The number of integral solutions of $x + y + z = 0$ with $x, y, z \geq -4$ is

(a) less than 90 **(b)** 90 **(c)** 91 **(d)** more than 91.

46. The number of four-digit odd numbers that contain 1 exactly once is

(a) 648 **(b)** 324 **(c)** 2916 **(d)** 1548

47. Let ABC be a triangle and we fix 3, 4 and 5 points on the sides AB, BC and CA, respectively. The number of triangles that can be formed using these points is

(a) 60 **(b)** 205 **(c)** 220 **(d)** 105

48. If $P(A) = P(B) = P(C) = 0.6$ and $P(A \cap B) = P(B \cap C) = P(C \cap A) = 0.3$, then
(a) $P(A \cap B \cap C) \leq 0.1$ **(b)** $P(A \cap B \cap C) = 0.15$
(c) $P(A \cap B \cap C) < 0.1$ **(d)** $P(A \cap B \cap C) > 0$.

49. In an experiment of rolling an unbiased die twice, the probability that sum of the faces is divisible by 3, is
(a) $\frac{1}{3}$ **(b)** $\frac{1}{2}$ **(c)** $\frac{1}{6}$ **(d)** $\frac{1}{4}$.

50. From an urn containing 5 distinguishable black balls and 6 distinguishable white balls, two balls are selected at random. The probability that the selected balls are of different colour, is
(a)$\frac{2}{11}$ **(b)** $\frac{5}{11}$ **(c)** $\frac{6}{11}$ **(d)** $\frac{1}{11}$.

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