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Belur Math, Howrah - 711202

B. Sc ADMISSION TEST - 2024

MATHEMATICS

Date : 20/06/2024 **Full Marks : 40** Time : 11:00 am - 12 noon

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 is **not** allowed.

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1. If $\cos A = 0.75$, then the value of $16(\cos\frac{A}{2})^2 - 32\sin(\frac{A}{2})\sin(\frac{5A}{2})$ is

   (a) -4 **(b)** -3 **(c)** 3 **(d)** 4 .

2. If a and b are real numbers between 0 and 1 such that the points $z_1 = a + i,\ z_2 = 1 + ib$ and $z_3 = 0$ form an equilateral triangle then,

   (a) $a = b = 2 - \sqrt{3}$ should look like this.
   (b) $a = 2 - \sqrt{3},\ b = \sqrt{3} - 1$ should look like this.
   (c) $a = \sqrt{3} - 1,\ b = 2 - \sqrt{3}$ should look like this.
   (d) None of (a), (b) and (c) is true .

3. For each $x \in \mathbb{R}$, let $[x]$ be the greatest integer less than or equal to x. Then

$$\lim_{x\to 0+} x\Big(\Big[\frac{1}{x}\Big] + \Big[\frac{2}{x}\Big] + \Big[\frac{3}{x}\Big] + \ldots + \Big[\frac{10}{x}\Big]\Big)$$

   (a) is equal to 55 **(b)** is equal to 0 **(c)** is equal to 10 **(d)** does not exist.

4. Which of the following function has a finite number of points of discontinuity in $\mathbb{R}$?

   (a) $\sec x$ **(b)** $\dfrac{|x|}{x}$ **(c)** $[x]$ **(d)** $\tan x$

5. A differentiable function $f(x)$ is defined for all $x > 0$, and it satisfies $f(x^3) = x^4$ for all $x > 0$. Then the value of $f'(8)$

   (a) is equal to $\dfrac{2}{3}$ **(b)** is equal to $\dfrac{4}{3}$ **(c)** is equal to $\dfrac{8}{3}$ **(d)** does not exist

6. If $A = \begin{bmatrix} 0 & 3 \\ 0 & 0 \end{bmatrix}$, and $f(x) = 1 + x + \ldots + x^{10}$, then $f(A) =$

(a) $\begin{bmatrix} 0 & 3 \\ 0 & 0 \end{bmatrix}$ **(b)** $\begin{bmatrix} 0 & 3^{10} \\ 0 & 0 \end{bmatrix}$ **(c)** $\begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix}$ **(d)** $\begin{bmatrix} 1 & 3 \\ 1 & 1 \end{bmatrix}$

7. The sum of the first 19 terms of an Arithmetic Progression is 57. The 10^{th} term of the Arithmetic Progression is

(a) 1 **(b)** 2 **(c)** 3 **(d)** 4

8. The sum of the first 5 terms and first 10 terms of a Geometric Progression are 1 and 33 respectively. Then the 10^{th} term of the Geometric Progression is

(a) $\frac{1024}{37}$ **(b)** $\frac{712}{33}$ **(c)** $\frac{512}{31}$ **(d)** $\frac{350}{39}$

9. Which of the following function satisfy the ordinary differential equation $x^2\frac{dy}{dx} + y = 1$ with $y(1) = 2$, in the interval $[1, \infty)$

(a) $y = 1 + \exp(1 - x)$

(b) $y = 1 - 2\exp\left(\frac{1}{x}\right)$

(c) $y = 1 - \exp\left(\frac{1-x}{x}\right)$

(d) $y = 1 + \exp\left(\frac{1-x}{x}\right)$

10. Let f be a twice differentiable even function over $\mathbb{R}$ with $f''(x)$ being constant. Then, which of the following statements is false for the function f.

(a) $f'(0) = 0$.

(b) f has neither maxima nor minima at $x = 0$.

(c) f has maxima at $x = 0$, if $f''(0) < 0$.

(d) f has minima at $x = 0$, if $f''(0) > 0$.

11. The area of the region in the plane bounded by the curve $y = \tan x$ along with the vertical lines $x = 0$ and $x = \frac{\pi}{4}$ and the horizontal line $y = 1$ is

(a) $\frac{\pi}{4} - \frac{1}{2}\ln 2$, (b) $\frac{\pi}{4} + \frac{1}{2}\ln 2$, (c) $\frac{1}{2}\ln 2$, (d) $-\frac{1}{2}\ln 2$

12. If the chord $y = mx+1$ of the circle $x^2+y^2 = 1$ subtends an angle of $45°$ at the major segment of the circle, then the value of m is

(a) ± 1 **(b)** ± 2 **(c)** ± 3 **(d)** ± 4

13. The angle between the line $\frac{x-2}{1} = \frac{y+1}{3} = \frac{z-4}{2}$ and the plane $3x–2y + 4z = 6$ is

(a) $\cos^{-1}(\frac{5}{\sqrt{406}})$ **(b)** $\sin^{-1}(\frac{5}{\sqrt{406}})$ **(c)** $\cos^{-1}(\frac{17}{\sqrt{406}})$ **(d)** $\sin^{-1}(\frac{17}{\sqrt{406}})$

14. The eccentric angle in the first quadrant of a point on the ellipse $\frac{x^2}{10} + \frac{y^2}{8} = 1$ at a distance 3 units from the centre of the ellipse is

(a) $\frac{\pi}{2}$ **(b)** $\frac{\pi}{3}$ **(c)** $\frac{\pi}{4}$ **(d)** $\frac{\pi}{6}$

15. The value of

$$2\left({}^{10}C_2 + {}^{10}C_4 + {}^{10}C_6 + {}^{10}C_8\right)$$

is

(a) 2^{10} **(b)** $2^{10} - 1$ **(c)** $2^{10} - 2$ **(d)** $2^{10} - 4$

16. A speaks truth in 75% cases and B speaks truth in 80% cases. The probability that they will say opposite things while describing a single event is

(a) $\frac{1}{2}$ **(b)** $\frac{7}{20}$ **(c)** $\frac{1}{4}$ **(d)** $\frac{2}{5}$

17. Let A be a finite set and $1 \notin A$. If $|\mathcal{P}(A)| > 100$ then $|\mathcal{P}(A \cup \{1\})|$ is ($|\mathcal{P}(X)|$ denotes the number of elements of a finite set X)

(a) 101 **(b)**128 **(c)** 256 **(d)** 412

18. Let A= $\{1, 2, 3, \ldots\}$, B= $\{2, 4, 6, \ldots\}$. Which of the following is false?

(a) There is a one-one map from A to B.
(b) There is a surjective map from A to B.
(c) There are infinitely many bijective maps from A to B.
(d) No map from A to B is a bijection.

19. Let A= $\{1, 2, 3\}$, B= $\{1, 2\}$. The number of surjective maps from A to B is

(a) 4 **(b)** 6 **(c)** 8 **(d)** 10

20. Let $R = \{(3,3), (6,6), (9,9), (12,12), (3,9), (3,12), (3,6), (6,12)\}$ be a relation on the set $A = \{3, 6, 9, 12\}$. The relation is

(a) an equivalence relation.
(b) reflexive and symmetric only.
(c) reflexive and transitive only.
(d) reflexive only.

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