DAV PUBLIC SCHOOL, CHANDRASEKHARPUR, BHUBANESWAR-21

MTHE 2019

SENIOR (XI & XII)

1. If sets A and B are defined as

$A = \{(x, y) : y = \frac{1}{x},\ x \neq 0 \in R\}$

$B = \{(x, y) : y = -x,\ x \in R\}$, then :

(a) $A \cap B = A$ b) $A \cap B = \phi$ (c) $A \cap B = B$ (d) None of these

2. If $A = \{x : f(x) = 0\}$ and $B = \{x : g(x) = 0\}$, then

(a) $[f(x)]^2 + [g(x)]^2 = 0$ (b) $\frac{f(x)}{g(x)}$

(c) $\frac{g(x)}{f(x)}$ (d) none of these

3. Solution set of $x \equiv 3(\text{mod}7)$, $p \in I$ is given by

(a) $\{3\}$ (b) $\{7p - 3 : p \in I\}$ (d) $\{7p + 3 : p \in I\}$ (d) None of these

4. If $|z + 4| \leq 3$, then the greatest and least value of $|z + 1|$ are

(a) 6, –6 (b) 6, 0 (c) 7, 2 (d) 0, –1

5. The points represented by complex numbers $1 + i, -2 + 3i, \frac{5}{3}i$; on the Argard plane are :

(a) vertices of an equilateral triangles b) Vertices of an isosceles triangle
(c) collinear (d) none of these

(SPACE FOR ROUGH WORK)

6. The equation $z^2 = \bar{z}$ has

(a) no solution
(b) two solutions
(c) four solutions
(d) an infinite number of solutions

7. If α and β $(\alpha < \beta)$ are the roots of the equation $x^2 + bx + c = 0$, where $c < 0 < b$, then

(a) $0 < \alpha < \beta$
(b) $\alpha < 0 < \beta < |\alpha|$
(c) $\alpha < \beta < 0$
(d) $\alpha < 0 < |\alpha| < \beta$

8. If $a + 2b + 3c = 12$, a, b, c $\in R^+$, then ab^2c^3 is

(a) $>2^3$
(b) $\geq 2^6$
(c) $\leq 2^6$
(d) None of these

9. Let a_1, a_2, a_3............... cannot be terms of an AP, if

$$\frac{a_1 + a_2 + ... + a_p}{a_1 + a_2 + ... + a_q} = \frac{p^2}{q^2}, p \neq q \text{ then } \frac{a_6}{a_{21}} =$$

(a) $\frac{7}{2}$
(b) $\frac{2}{7}$
(c) $\frac{11}{41}$
(d) $\frac{41}{11}$

10. The number 111 .... 1 (91 times) is :

(a) prime number
(b) even number
(c) not prime
(d) none of these

11. The coefficient of x^{20} in the expansion of $(1 + 3x + 3x^2 + x^3)^{20}$ is

(a) ${}^{60}C_{40}$
(b) ${}^{30}C_{20}$
(c) ${}^{15}C_2$
(d) None of these

12. The number of integral terms in the expansion of $\left(\sqrt{3} + \sqrt[8]{5}\right)^{256}$ is

(a) 32
(b) 33
(c) 34
(d) 35

(SPACE FOR ROUGH WORK)

13. If $\left(\frac{1+a}{3}\right)$ and $\left(\frac{1-a}{4}\right)$ are probability of two mutually exclusive events, then set of all values of a is :

(a) $-1 \le a \le 1$ (b) $-7 \le a \le 5$ (c) $-1 \le a \le 2$ (d) $-4 \le a \le 1$

14. Suppose $f(x) = x^3 + ax^2 + bx + c$, where a, b, c are chosen respectively by throwing a die three fimes. Then the probability that f(x) is an increasing function is :

(a) $\frac{4}{9}$ (b) $\frac{3}{8}$ (c) $\frac{2}{5}$ (d) $\frac{16}{34}$

15. The equation $\sin^4 x + \cos^4 x = a$ has a real solution if

(a) $0 < a < 1$ (b) $\frac{1}{2} \le a \le 1$ (c) $\frac{1}{4} \le a \le \frac{1}{2}$ (d) $-1 \le a \le 1$

16. If $\frac{x}{\cos\theta} = \frac{y}{\cos\left(\theta - \frac{2\pi}{3}\right)} = \frac{z}{\cos\left(\theta + \frac{2\pi}{3}\right)}$, then x + y + z is equal to

(a) 1 (b) 0 (c) –1 (d) none of these

17. The equation sinx + siny + sinz = –3 for $0 \le x \le 2\pi, 0 \le y \le 2\pi, 0 \le z \le 2\pi$ has :

(a) one solution (b) two sets of solutions

(c) four sets of solutions (d) no solution

18. If a, b, c are the sides of a Δ ABC in A.P and a is the smallest side, then cosA equals

(a) $\frac{3c-4b}{2c}$ (b) $\frac{3c-4b}{2b}$ (c) $\frac{4c-3b}{2c}$ (d) none of these

(SPACE FOR ROUGH WORK)

19. Three vertical towers standing at A, B, C subtends the angle $\theta_A, \theta_B, \theta_C$ respectively at the circumcentre of the triangle ABC, then $\tan\theta_A, \tan\theta_B$ and $\tan\theta_C$ are in :

(a) AP (b) GP (c) HP (d) None of these

20. The area (in sq. unit) of the quadrilateral formed by two pairs of lines $l^2x^2 - m^2y^2 - n(lx + my) = 0$ and $l^2x^2 - m^2y^2 + n(lx - my) = 0$ is :

(a) $\frac{n^2}{2|lm|}$ (b) $\frac{n^2}{|lm|}$ (c) $\frac{n}{2|lm|}$ (d) $\frac{n^2}{4|lm|}$

21. If $(a\cos\theta_i, a\sin\theta_i), i = 1,2,3$ represent the vertices of an equilateral triangle inscribed in a circle, then :

(a) $\cos\theta_1 + \cos\theta_2 + \cos\theta_3 = 0$ (b) $\sec\theta_1 + \sec\theta_2 + \sec\theta_3 = 0$

(c) $\tan\theta_1 + \tan\theta_2 + \tan\theta_3 = 0$ (d) $\cot\theta_1 + \cot\theta_2 + \cot\theta_3 = 0$

22. The angle made by a double ordinate of length 8a at the vertex of the parabola $y^2 = 4ax$ is

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

23. If the angle between the line joining the end points of minor axis of an ellipse with its foci is $\frac{\pi}{2}$, then the eccentricity of the ellipse is :

(a) $\frac{1}{2}$ (b) $\frac{1}{\sqrt{2}}$ (c) $\frac{\sqrt{3}}{2}$ (d) $\frac{1}{2\sqrt{2}}$

24. The equation of the common tangent to the curve $y^2 = 8x$ and $xy = -1$ is :

(a) $3y = 9x + 2$ (b) $y = 2x + 1$ (c) $2y = x + 8$ (d) $y = x + 2$

(SPACE FOR ROUGH WORK)

25. The range of the function $f(x)=\frac{\sin(\pi[x])}{x^2+1}$ where [*] denotes greatest integer function is

(a) 0 (b) R (c) (0, 1) (d) none of these

26. The period of the function $f(x) = \sin^4 x + \cos^4 x$ is

(a) π (b) $\frac{\pi}{2}$ (c) 2π (d) none of these

27. If a variable x takes value x_i such that $a \le x_i < b$, for i = 1, 2, 3...........n then :

(a) $a \le \text{var}(x) \le b$ (b) $a^2 \le \text{var}(x) \le b^2$

(c) $\frac{a^2}{4} \le \text{var}(x)$ (d) $(b-a)^2 \ge \text{var}(x)$

28. If the point (a, a) falls between the lines $|x + y| = 2$ then :

(a) $|a| = 2$ (b) $|a| = 1$ (c) $|a| < 1$ (d) $|a| < \frac{1}{2}$

29. Area of triangle formed by the lines $x + y = 3$ and angle bisector of the pair of straight lines $x^2 - y^2 + 2y = 1$ is :

(a) 2 sq unit (b) 4 sq unit (c) 6 sq unit (d) 8 sq unit

30. The greatest value of $\cos\theta$ for which $\cos 5\theta = 0$ is :

(a) 0 (b) $\frac{1+\sqrt{5}}{4}$ (c) $\sqrt{\frac{5+\sqrt{5}}{8}}$ (d) $\sqrt{\frac{\sqrt{5}+1}{4}}$

(SPACE FOR ROUGH WORK)

31. Arithmetic mean of the series 1, 2, 4, 8, 16, ..., 2^n is

(a) $\frac{2^n-1}{n}$ (b) $\frac{2^{n+1}-1}{n+1}$ (c) $\frac{2^n+1}{n}$ (d) none of these

32. If standard deviation of X is S, then standard deviation of the varriable $\mu = \frac{aX+b}{c}$ (where a, b, c are constants) is

(a) $\left|\frac{c}{a}\right|S$ (b) $\left|\frac{a}{c}\right|S$ (c) $\left|\frac{b}{c}\right|S$ (d) none of these

33. The varriance of first n natural numbers is

(a) $\frac{n^2-1}{12}$ (b) $\frac{n(n^2-1)}{12}$ (c) $\frac{n^2+1}{2}$ (d) none of these

34. An aeroplane flies around a square, the sides of which measure 100 miles each. The aeroplane covers at a speed of 100 mph the first side, at 200 mph the second side at 300 mph the third side and 400 mph the fourth side. The average speed of the aeroplane arround the square is

(a) 190 mph (b) 195 mph (c) 192 mph (d) none of these

35. In a series of 2n observations, half of them equal to 'a' and remaining half equal to –a. If the standard deviation of the observations is 2, then |a| equal to

(a) $\frac{1}{n}$ (b) $\sqrt{2}$ (c) 2 (d) $\frac{\sqrt{2}}{n}$

(SPACE FOR ROUGH WORK)

36. $\lim_{\alpha \to \beta} \left(\frac{\sin^2 \alpha - \sin^2 \beta}{\alpha^2 - \beta^2} \right)$ is equal to :

(a) 0 (b) 1 (c) $\frac{\sin \beta}{\beta}$ (d) $\frac{\sin 2\beta}{2\beta}$

37. $\lim_{x \to \infty} \frac{\sin x}{x}$ is equal to ;

(a) ∞ (b) 1 (c) 0 (d) doesn't exist

38. $\lim_{x \to 0} \left(\frac{\log_e (1+x)}{3^x - 1} \right)$ is equal to :

(a) $\log_e 3$ (b) 0 (c) 1 (d) $\log_3 e$

39. The value of $\lim_{x \to 7} \left(\frac{2 - \sqrt{x-3}}{x^2 - 49} \right)$ is :

(a) $\frac{2}{9}$ (b) $-\frac{2}{49}$ (c) $\frac{-1}{56}$ (d) $\frac{-1}{59}$

40. If $f(x) = \begin{cases} \frac{x^2 - 9}{x - 3} & x \neq 3 \\ 2x + K & \text{otherwise} \end{cases}$ is continous at x= 3 then K is

(a) 3 (b) 0 (c) –6 (d) $\frac{1}{6}$

41. $\lim_{n \to \infty} \frac{1}{n} + \frac{1}{\sqrt{n(n+1)}} + \frac{1}{\sqrt{n(n+2)}} + \dots\dots\dots\dots + \frac{1}{\sqrt{n^2 + (n-1)n}}$ is equal to

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

(SPACE FOR ROUGH WORK)

42. If $f(x)=\frac{x}{1+|x|}$ for $x \in R$, then $f'(0)$ is equal to

(a) 0 (b) 1 (c) 2 (d) 3

43. $\lim_{x\to\infty}\frac{\log x^n-[x]}{[x]}, n \in N$ (where [x] is the greatest integer function)

(a) has value −1 (b) has value 0 (c) has value 1 (d) doesn't exist

44. If $\lim_{x\to 0}\frac{[(a-n)nx-\tan x]\sin nx}{x^2}=0$, where n is nonzero real number, then a equal to :

(a) 0 (b) $\frac{n+1}{n}$ (c) n (d) $n+\frac{1}{n}$

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

(a) $-\pi$ (b) π (c) $\frac{\pi}{2}$ (d) 1

46. The greatest positive integer, which divides (n + 2)(n + 3)(n + 4)(n + 5)(n + 6) for all $n \in N$, is :

(a) 4 (b) 120 (c) 240 (d) 24

47. For all $n \in N$, $(2.4^{2n+1} + 3^{3n+1})$ is divisible by

(a) 2 (b) 9 (c) 3 (d) 11

48. In how many ways 3 letters can be posted in 4 letter boxes, if all the letters are not posted in the same letter box ?

(a) 63 (b) 60 (c) 77 (d) 81

(SPACE FOR ROUGH WORK)

49. The number of times the digit 3 will be written when listing the integers from 1 to 1000 is
(a) 269 (b) 300 (c) 271 (d) none of these

50. Six X's have to be placed in the square of the figure such that each row contains at least one X. In how many different ways can this be done ?
(a) 28 (b) 27 (c) 26 (d) none of these

51. The greatest possible number of points of intersection of 8 straight lines and 4 circles is:
(a) 32 (b) 64 (c) 76 (d) none of these

52. A student is to answer 10 out of 13 questions in an examination such that he must choose at least 4 from the first 5 questions. The number of choices available to him is :
(a) 140 (b) 196 (c) 280 (d) none of these

53. The number of arrangements of the letters of the word BANANA in which the two N's do not appear adjcently is :
(a) 40 (b) 60 (c) 80 (d) none of these

54. The number of integral solutions of $x^2 + y^2 = x^2y^2$ is
(a) 0 (c) 1 (c) infinite (d) none of these

55. The number of divisors of the number 38808 (excluding 1 and the number itself) is :
(a) 70 (b) 72 (c) 71 (d) none of these

56. The number of ways in which 20 one rupee coins can be distributed among 5 people such that each person, gets at least 3 rupees, is :
(a) 26 (b) 63 (c) 125 (d) none of these

(SPACE FOR ROUGH WORK)

57. Probabilities of teams A, B and C winning are $\frac{1}{4}, \frac{1}{6}$ and $\frac{1}{8}$ respectively. Probability that one of these teams will win, is :

(a) $\frac{13}{24}$ (b) $\frac{11}{24}$ (c) $\frac{23}{24}$ (d) none of these

58. Let $f(x)=\frac{1}{2}-tan\left(\frac{\pi x}{2}\right), -1<x<1$ and $g(x)=\sqrt{3+4x-4x^2}$ then dom(f + g) is

(a) $\left[\frac{1}{2}, 1\right]$ (b) $\left[\frac{-3}{2}, -1\right)$ (c) $\left[\frac{-1}{2}, 1\right)$ (d) none of these

59. A pair of 12-sided fair dice with faces numbered 1, 2, 3, ..., 12 is rolled. The probability that the sum of the numbers appearing has remainder 2 when divided by 9 is :

(a) $\frac{7}{72}$ (b) $\frac{5}{48}$ (c) $\frac{11}{144}$ (d) none of these

60. A spherical ball is kept at the corner of a rectangular room such that the ball touches two (perpendicular) walls and lies on the floor. If a point on the sphere is at a distance of 9, 16, 25 from the two walls and the floor, then sum of lengths of possible radius of the sphere is

(a) 13 (b) 15 (c) 50 (d) none of these

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(SPACE FOR ROUGH WORK)

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