SAINIK SCHOOL IMPHAL
NDA MOCK TEST
MATHEMATICS (SET-22)

Date :   TIME : 2 ½ Hrs   MAX MARK : 300

General Instruction :

(i)   All 120 questions carry 2.5 mark each.

(ii)   There will be penalty of $^1/_3$ of mark assigned to that question (i.e. 0.83) for each wrong answer marked by the candidates.

(iii)   You have to mark your response by completely blackening with black ball pen to indicate your response.

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1. Let a, b, c be in AP and $K \neq 0$ be a real number. Which of the following are correct?
    1. Ka, kb, kc are in AP.   (2019-II)
    2. $K - a, k - b, k - c$ are in AP
    3. $\frac{a}{k}, \frac{b}{k}, \frac{c}{k}$ are in AP

    Select the correct answer using the code given below.
    (a) 1&2 only   (b) 2 & 3 only   (c) 1& 3 only   (d)1, 2& 3.

2. Let x be the number of integers lying between 2999 and 8001 which have at least two digits equal. Then x is equal to.   (2018-II)
    (a) 2480   (b) 2481   (c) 2482   (d)2483

3. If α and β are the roots of $x^2 + x + 1 = 0$ then what is $\sum_{j=0}^{3}(\alpha^j + \beta^j)$ equal to?
    (a) 8   (b) 6   (c) 4   (d)2   (2019-II)

4. If $x + log_{15}(1 + 3^x) = x log_{15} 5 + log_{15} 12$ Where x is an integer, then what is x equal to?
    (a) -3 (b) 2   (c) 1   (d)3   (2018-I)

5. The equation $|1 - x| + x^2 = 5$ has   (2018-I)
    (a) A rational root and an irrational root
    (b) Two rational root
    (c) Two irrational root
    (d) No real root

6. If $\frac{sin(x+y)}{sin(x-y)} = \frac{a+b}{a-b}$, Then what is $\frac{tanx}{tany}$?   (2014-II, 2018-I)
    (a) $\frac{a}{b}$ (b) $\frac{b}{a}$ (c) $\frac{a+b}{a-b}$ (d) $\frac{a-b}{a+b}$

7. If $\vec{a} + 2\vec{b} + 3\vec{c} = \vec{0}$ and $\vec{a} \times \vec{b} + \vec{b} \times \vec{c} + \vec{c} \times \vec{a} = \lambda (\vec{b} \times \vec{c})$ then what is the value of λ ?
    (a) 2   (b) 3   (c) 4   (d)6   (2018-I)

8. For f to be a function, what is the domain of f if $(x) = \frac{1}{\sqrt{|x|-x}}$? (2015-II, 2016-II, 2018-I)
    (a) $(-\infty, 0)$ (b) $(0, \infty)$ (c) $(-\infty, \infty)$ (d)$(-\infty, 0]$

9. What is $\int_{0}^{\sqrt{2}}[x^2] \, dx$ equal to?   (2018-I)
    (a) $\sqrt{2} - 1$ (b) $1 - \sqrt{2}$ (c) $2(\sqrt{2} - 1)$ (d)$\sqrt{3} - 1$

10. The order and degree of the differential equation $y^2 = 4a(x - a)$ where 'a' is arbitrary constant, are respectively   (2018-I)
    (a) 1, 2   (b) 2, 1   (c) 2, 2   (d)1, 1

11. The ratio of roots of the equations $ax^2 + bx + c = 0$ and $px^2 + qx + r = 0$ are equal.
If D_1 and D_2 are respective discriminants, then what is $\frac{D_1}{D_2}$ equal to? (2018-II)

(a) $\frac{a^2}{p^2}$ (b) $\frac{b^2}{q^2}$ (c) $\frac{c^2}{r^2}$ (d) none of above

12. What is the maximum value of $16sin\theta - 12sin^2\theta$?(2018-I)

(a) $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{16}{3}$ (d) 4

13. What is the number of solutions of the equation $x^2 - 4x + [x] = 0$ in the interval $[0,2]$?

(a) No solution   (b) One   (c) Two   (d)Three   (2018-I)

14. A force $\vec{F} = \hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ acts on a particle to displace it from the point $A(\hat{\imath} + 2\hat{\jmath} - 3\hat{k})$ to the point $B(3\hat{\imath} - \hat{\jmath} + 5\hat{k})$. The work done by the force will be(2017-II)

(a) 5 units   (b) 7units   (c) 9 units   (d)10 units

15. The point of intersection of the line joining the points $(-3,4,-8)$ and $(5,-6,4)$ with the xy – plane is   (2017-II)

(a) $(\frac{7}{3}, \frac{-8}{3}, 0)$ (b) $(\frac{-7}{3}, \frac{-8}{3}, 0)$

(c) $(\frac{-7}{3}, \frac{8}{3}, 0)$ (d) $(\frac{7}{3}, \frac{8}{3}, 0)$

16. If we define a relation R on the set N×N as (a, b) R(c,d)⇔ a+d=b+c for all (a,b), (c,d) ∈N×N then the relation is   (2017-II)

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

17. If $\left|z - \frac{4}{z}\right| = 2$ then the maximum value of $|z|$ is equal to   (2017-II,AIEEE-2009)

(a) $1 + \sqrt{3}$ (b) $1 + \sqrt{5}$ (c) $1 - \sqrt{5}$ (d)$\sqrt{5} - 1$

18. The sum of all real roots of the equation$| x - 3|^2 + |x - 3| - 2 = 0$ is   (2017-II)

   (a) 2   (b) 3   (c) 4   (d)6

19. Which one of the following can be considered as approximate pair of values of regression coefficient of y on x and x on y?(2017-II)

(a) (1,1)   (b) (-1,1)   (c) $\left(\frac{-1}{2}, 2\right)$ (d)$\left(\frac{1}{3}, \frac{10}{3}\right)$

20. Consider the following statements:(2017-II)
     1.   Variance in unaffected by change of origin and change of scale.
     2.   Coefficient of variance is independent of the unit of observation.
Which of the given statement is/are correct?
(a) 1 only   (b) 2 only   (c) both 1& 2   (d)neither 1 nor 2

21. What is the probability that at least two persons out of a group of three persons were born in the same month (disregard year)?(2017-II)

(a) $\frac{33}{144}$ (b) $\frac{17}{72}$ (c) $\frac{1}{144}$ (d) $\frac{2}{9}$

22. In triangle ABC, if $\frac{sin^2A + sin^2B + sin^2C}{cos^2A + cos^2B + cos^2C} = 2$ then the triangle is   (2017-II)

(a) right-angled   (b) equilateral   (c) isosceles   (d)obtuse-angled

23. If $a \neq b \neq c$, then one value of x which satisfies the equation

$$\begin{vmatrix} 0 & x - a & x - b \\ x + a & 0 & x - c \\ x + b & x + c & 0 \end{vmatrix} = 0 \text{ is given by}$$ (2017-I)

(a) a   (b) b   (c) c   (d)0

24. What is the equation of the circle which passes through the points (3,-2) and (-2, 0) and having its centre on the line $2x - y - 3 = 0$?   (2017-I)

   (a)$x^2 + y^2 + 3x + 2 = 0$ (b)$x^2 + y^2 + 3x + 12y + 2 = 0$

   (c) $x^2 + y^2 + 2x = 0$ (d)$x^2 + y^2 = 5$

25. If $A = \begin{pmatrix} 1 & -1 \\ 2 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 \\ -1 & -2 \end{pmatrix}$ then which of the following is/are correct?

   1. $AB(A^{-1}B^{-1})$ is a unit matrix   (2016-II)

   2. $(AB)^{-1} = A^{-1}B^{-1}$

 Select the correct answer using the code given below.

(a) 1 only   (b) 2 only   (c) both 1& 2   (d)neither 1 nor 2

26. If the point (a, a) lies between the lines $|x + y| = 2$ then which one of the following is correct?

(a) $|a| < 2$ (b) $|a| < \sqrt{2}$ (c) $|a| < 1$ (d)$|a| < \frac{1}{\sqrt{2}}$ (2016-II)

27. If $Re\left(\frac{z-1}{z+1}\right) = 0$ where $z = x + iy$ is a complex number, then which one of the following is correct?(2016-II)

(a) $z = 1 + i$ (b) $|z| = 2$ (c) $z = 1 - i$ (d)$|z| = 1$

28. A five digit number divisible by 3 is to be formed using the digits 0, 1, 2, 3 and 4 without repetition of digits. What is the number of ways this can be done? (2016-II)

(a) 96   (b) 48   (c) 32   (d) no number can be formed

29.Three independent events A₁, A₂ and A₃ occur with probabilities $P(A_i) = \frac{1}{1+i}, i = 1, 2, 3$.What is the probability that at least one of the three events occurs?(2016-II)

(a)$\frac{1}{4}$ (b) $\frac{2}{3}$ (c) $\frac{3}{4}$ (d)$\frac{1}{24}$

30. In a series of 3 one day cricket matches between teams A and B of a college, the probability of team A winning or drawing are $\frac{1}{3}$ & $\frac{1}{6}$ respectively. If a win, loss or draw gives 2, 0 and 1 point respectively, then what is the probability that team A will score 5 points in the series?(2016-II)

(a)$\frac{17}{18}$ (b) $\frac{11}{12}$ (c) $\frac{1}{12}$ (d)$\frac{1}{18}$

31. Consider the following in respect of the function(2016-II)

$$f(x) = \begin{cases} 2 + x, & x \geq 0 \\ 2 - x, & x < 0 \end{cases}$$

   1. $Lt_{x \to 1} f(x)$ does not exist
   2. $f(x)$ is differentiable at $x = 0$
   3. $f(x)$ is continuous at $x = 0$

   Which of the above statement is/are correct?

(a) 1 only   (b) 3 only   (c) 2&3only   (d)1 & 3 only

   For the next two items that follow: (2016-I)
   Consider the function

$$f(x) = (x - 1)^2(x + 1)(x - 2)^3$$

32. What is the number of points of local minima of the function f(x)?

   (a) none   (b) one   (c) two   (d) three

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33. What is the number of points of local maxima of the function f(x)?
    (a) none   (b) one   (c) two   (d) three

For the next two items that follow: (2016-I)

Consider the function

$$f(x) = \begin{vmatrix} x^3 & sinx & cosx \\ 6 & -1 & 0 \\ p & p & p^3 \end{vmatrix}$$

Where p is a constant

34. What is the value of $f'(0)$?
    (a) p^3 (b) $3p^3$ (c) $6p^3$ (d) $-6p^3$

35. What is the value of p for which $f''(0) = 0$?
    (a) $\frac{-1}{6}$ or 0 (b) -1 or 0 (c) $\frac{-1}{6}$ or 1 (d) -1 or 1

36. If $x \in [0,5]$, then what is the probability that $x^2 - 3x + 2 \geq 0$?(2015-II)

    (a) $\frac{4}{5}$ (b) $\frac{1}{5}$ (c) $\frac{2}{5}$ (d) $\frac{3}{5}$

37. Which of the following statement is correct in respect of the function $f(x) = x^3 sinx$?
    (a) It has local maximum at x=0   (2016-II)
    (b) It has local minimum at x=0
    (c) It has neither maximum nor minimum at x=0
    (d) It has maximum value 1

38. Let A, B, C and D are four sets such that $A \cap B = C \cap D = \emptyset$. Consider the following :
                                                                              (2015-II)

    1. $A \cup C$ and $B \cup D$ are always disjoint
    2. $A \cap C$ and $B \cap D$ are always disjoint

    Which of the above statement is/are correct?

    (a) 1 only   (b) 2 only   (c) both 1& 2   (d) neither 1 nor 2

39. If the magnitude of difference of two unit vectors is $\sqrt{3}$, then the magnitude of sum of the two vectors is   (2015-II)
    (a) $\frac{1}{2}$ unit   (b) 1 unit   (c) 2 unit   (d) 3 unit

40. If $f: R \to R, g: R \to R$ be two function given by $f(x) = 2x - 3$ and $g(x) = x^3 + 5,$ then $(fog)^{-1}(x)$ is equal to (2015-II)

    (a) $\left(\frac{x+7}{2}\right)^{\frac{1}{3}}$ (b) $\left(\frac{x-7}{2}\right)^{\frac{1}{3}}$ (c) $\left(x - \frac{7}{2}\right)^{\frac{1}{3}}$ (d)$\left(x + \frac{7}{2}\right)^{\frac{1}{3}}$

41. The equation $tan^{-1}(1+x) + tan^{-1}(1-x) = \frac{\pi}{2}$ is satisfied by (2015-I)

    (a) $x = 1$ (b) $x = -1$ (c) $x = 0$ (d) $x = \frac{1}{2}$

For the next two items that follow: (2015-I)

From the point $P(3, -1, 11)$ a perpendicular is drawn on the line L given by the equation $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$. Let Q be the foot of the perpendicular.

42. What are the direction ratios of the line segment PQ is ?
    (a) $< 1, 6, 4 >$ (b) $< -1, 6, -4 >$ (c) $< -1, -6, 4 >$ (d) $< 2, -6, 4 >$

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43. What is the length of the line segment PQ?

    (a) $\sqrt{47}$ unit   (b) 7 unit   (c) $\sqrt{53}$ unit   (d) 8 unit

 For the next two items that follow: (2015-I)

 A triangular plane ABC with centroid (1, 2, 3) cuts the co-ordinate axes at A, B, C respectively.

44. What are the intercepts made by the plane ABC on the axes?

    (a) 3, 6, 9   (b) 1, 2, 3   (c) 1, 4, 9   (d) 2, 4, 6

45. What is the equation of the plane ABC?

    (a) $x + 2y + 3z = 1$ (b) $3x + 2y + z = 3$

    (c) $2x + 3y + 6z = 18$ (d) $6x + 3y + 2z = 18$

46. Consider the following statements:(2015-I)

   1. $y = \dfrac{e^x + e^{-x}}{2}$ is an increasing function on $[0, \infty)$

   2. $y = \dfrac{e^x - e^{-x}}{2}$ is an increasing function on (-∞, ∞)

 Which of the above statements is/are correct?

 (a) 1 only   (b) 2 only   (c) both 1 & 2   (d) neither 1 nor 2

 For the next two item that follow:

 A cylinder is inscribed in a sphere of radius r.   (2014-II)

47. What is the height of the cylinder of maximum volume?

    (a) $\dfrac{2}{\sqrt{3}} r$ (b) $\dfrac{r}{\sqrt{3}}$ (c) 2r   (d) $\sqrt{3}$r

48. What is the radius of the cylinder of maximum volume?

    (a) $\dfrac{2}{\sqrt{3}} r$ (b) $\sqrt{\dfrac{2}{3}} r$ (c) r   (d) $\sqrt{3}$ r

49. The probability that in a random arrangement of the letters of the word UNIVERSITY the two I[s] do not come together is (2014-II)

    (a) $\dfrac{4}{5}$ (b) $\dfrac{1}{5}$ (c) $\dfrac{1}{10}$ (d) $\dfrac{9}{10}$

50. What is $\dfrac{(1+i)^{4n+5}}{(1-i)^{4n+3}}$ equal to where n $\in N$ & $i = \sqrt{-1}$ (2014-II)

    (a) 2   (b) $2i$ (c) $-2i$ (d) i

 For the next three items that follow:

 Consider the function $f(x) = \dfrac{x-1}{x+1}$ (2014-II)

51. What is $\dfrac{f(x)+1}{f(x)-1} + x$ equal to?

    (a) 0   (b) 1   (c) $2x$ (d) $4x$

52. What is f(2x) equal to?

    (a) $\dfrac{f(x)+1}{f(x)+3}$ (b) $\dfrac{f(x)+1}{3f(x)+1}$ (c) $\dfrac{3f(x)+1}{f(x)+3}$ (d) $\dfrac{f(x)+3}{3f(x)+1}$

53. What if $f(f(x))$ equal to?

    (a) x (b) $-x$ (c) $-\dfrac{1}{x}$ (d) none of the above

54. Let A and B be two matrices such that AB=A and BA=B. Which of the following statements are correct?   (2014-II)

   1. $A^2 = A$

   2. $B^2 = B$

   3. $(AB)^2 = AB$

 Select the correct answer using the code given below:

 (a) 1 & 2 only   (b) 2 & 3 only   (c) 1 & 3 only   (d) 1, 2 & 3

55. The roots of the equation $\begin{vmatrix} 1 & t-1 & 1 \\ t-1 & 1 & 1 \\ 1 & 1 & t-1 \end{vmatrix} = 0$ are(2013-I)

   (a) 1, 2   (b) $-1, 2$ (c) $1, -2$ (d) $-1, -2$

56. If $\tan A = x + 1$ & $\tan B = x - 1$ $then$ $x^2 \tan(A - B)$ is (2013-I)

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

57. A unit vector perpendicular to each of the vectors $2\hat{\imath} - \hat{\jmath} + \hat{k}$ and $3\hat{\imath} - 4\hat{\jmath} - \hat{k}$ is

   (a) $\frac{1}{\sqrt{3}}\hat{\imath} + \frac{1}{\sqrt{3}}\hat{\jmath} - \frac{1}{\sqrt{3}}\hat{k}$ (b) $\frac{1}{\sqrt{2}}\hat{\imath} + \frac{1}{2}\hat{\jmath} + \frac{1}{2}\hat{k}$ (2018-II)

   (c) $\frac{1}{\sqrt{3}}\hat{\imath} - \frac{1}{\sqrt{3}}\hat{\jmath} - \frac{1}{\sqrt{3}}\hat{k}$ (d) $\frac{1}{\sqrt{3}}\hat{\imath} + \frac{1}{\sqrt{3}}\hat{\jmath} + \frac{1}{\sqrt{3}}\hat{k}$

58. A spacecraft located at $\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$ is subjected to a force $\lambda\hat{k}$ by firing a rocket. The spacecraft is subjected to a moment of magnitude. (2018-II)

   (a) λ (b) $\sqrt{3}\lambda$ (c) $\sqrt{5}\lambda$ (d) none of above

59. What is the sum of all three-digit numbers that can be formed using all the digits 3, 4 and 5, when repetition of digits is not allowed?(2018-II)

   (a) 2664 (b) 3882 (c) 4044 (d) 4444

60. How many real roots does the equation $x^2 + 3|x| + 2 = 0$ have?   (2019-II)

   (a) zero   (b) one   (c) two   (d) four

61. If the angle between the lines joining the end points of minor axis of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ with one of its foci is $\frac{\pi}{2}$, then what is the eccentricity of the ellipse?(2019-II)

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

62. What is the area of the region bounded by $|x| < 5, y = 0$ & $y = 8$? (2019-II)

   (a) 40 square units   (b) 80 square units

   (c) 120 square units   (d) 160 square units

63. The line $y = \sqrt{3}$ meets the graph $y = \tan x$ where $x \in (0, \frac{\pi}{2})$, is k points. What is k equal to? (2014-II)

   (a) one   (b) two   (c) three   (d) infinity

   For the next two items that follow: (2015-I)

   Consider the curves $y = \sin x$ and $y = \cos x$

64. What is the area of the region bounded by the above two curves and the lines

$$x = 0 \ \& \ x = \frac{\pi}{4}?$$

   (a) $\sqrt{2} - 1$ (b) $\sqrt{2} + 1$ (c)$\sqrt{2}$ (d) 2

65. What is the area of the region bounded by the above two curves and the lines

$$x = \frac{\pi}{4} \ \& \ x = \frac{\pi}{2}?$$

   (a) $\sqrt{2} - 1$ (b) $\sqrt{2} + 1$ (c) $2\sqrt{2}$ (d) 2

66. What is the number of four-digit decimal numbers (< 1) in which no digit is repeated?

   (a) 3024   (b) 4536   (c) 5040   (d) none   (2016-I)

67. Consider the following statements: (2013-I)

   1. $Lt_{x \to 0} \sin\frac{1}{x}$ does not exists

   2. $Lt_{x \to 0} x\sin\frac{1}{x}$ exists

   Which of the above statements is/are correct?

(a) 1 only   (b) 2 only   (c) both 1 & 2   (d) neither 1 nor 2

68. What is $Lt_{x\to 0} \frac{sinx-tanx}{x}$ equal to?   (2013-I)

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

69. Consider the following statement in respect of a function $f(x)$ (2013-I)

   1. $f(x)$ is continuous at x=a iff $Lt_{x\to a}f(x)$ esixts.

   2. If $f(x)$ is continuous at a point, then $\frac{1}{f(x)}$ is also continuous at that point

   Which of the above statements is/are correct?

   (a) 1 only   (b) 2 only   (c) both 1 & 2   (d) neither 1 nor 2

70. If α, β are the roots of $x^2 + px - q = 0$ and γ, δ are the roots of $x^2 - px + r = 0$, then what is $(\beta + \gamma)(\beta + \delta)$ equal to? (2012-II)

   (a) $p + r$ (b) $p + q$ (c) $q + r$ (d) $p - q$

71. The mean of 10 observations is 5. If 2 is added to each observation and then multiplied by 3, then what will be the new mean? (2012-II)

   (a) 5   (b) 7   (c) 15   (d) 21

72. What is $\int_0^{\frac{\pi}{2}} sin2xln(cotx)dx$ equal to?   (2012-II)

   (a) 0   (b) $\pi ln2$ (c) $-\pi ln2$ (d) $\frac{\pi ln2}{2}$

73. If the mean of few observation is 40 and standard deviation is 8, then what is the coefficient of variation?   (2012-II)

   (a) 1%   (b) 10%   (c) 20%   (d) 30%

For the next two question that follow: (2012-II)

An urn contains one black ball and one green ball. A second urn contains one white and one green ball. One ball is drawn at random from each urn.

74. What is the probability that both balls are of same color.

   (a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{5}$

75. What is the probability of getting at least one green ball?

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

76. The function $f(x) = x^3 - 3x^2 + 6$ is an increasing function for   (2012-II)

   (a) $0 < x < 2$ (b) $x < 2$ (c) $x > 2\ or\ x < 0$ (d) all x

77. Which one of the following is correct in respect of the function

   $f(x) = \frac{x^2}{|x|}\ for\ x \neq 0, \& f(0) = 0$ (2012-II)

   (a) $f(x)$ is discontinuous everywhere.

   (b) $f(x)$ is continuous everywhere.

   (c) $f(x)$ is continuous at x=0 only.

   (d) $f(x)$ is discontinuous at x=0 only.

78. In a $\Delta PQR, if\ 3sinP + 4cosQ = 6\ and\ 4sinQ + 3cosP = 1$, then the angle R is equal to

   (a) $5\frac{11}{6}$ (b) $\frac{11}{6}$ (c) $\frac{11}{4}$ (d) $3\frac{11}{4}$ (AIEEE-12)

79. What is the value of m if the vectors $2\hat{\imath} - \hat{\jmath} + \hat{k},\ \hat{\imath} + 2\hat{\jmath} - 3\hat{k}\ and\ 3\hat{\imath} + m\hat{\jmath} + 5\hat{k}$ are coplanar?

                                                                  (2012-I)

   (a) -2 (b) 2   (c) -4 (d) 4

80. There is a point inside a circle. What is the probability that this point is close to the circumference than to the centre? (2011-II)

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

81. Consider the following statements in respect of the function $f(x) = x^3 - 1, x \in [-1, 1]$

  1. $f(x)$ is increasing in $[-1, 1]$ (2011-I)

  2. $f(x)$ has no root in $(-1, 1)$

  Which of the statements given above is/are correct?

(a) 1 only   (b) 2 only   (c) both 1 & 2   (d) neither 1 nor 2

82. What is the value of k for which the following function $f(x)$ is continuous for all x?

$$f(x) = \begin{cases} \frac{x^3 - 3x + 2}{(x-1)^2} & for\ x \neq 1 \\ k & for\ x = 1 \end{cases}$$ (2011-I)

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

83. A box contains 6 distinct dolls. From this box, three dolls are randomly selected one by one with replacement. What is the probability of selecting 3 distinct dolls? (2011-I)

(a) $\frac{5}{54}$ (b) $\frac{12}{25}$ (c) $\frac{1}{20}$ (d) $\frac{5}{9}$

84. If $\sum_{i=1}^{n}(x_i - 2) = 110, \sum_{i=1}^{n}(x_i - 5) = 20$, then what is the mean? (2009-I)

(a) $\frac{11}{2}$ (b) $\frac{2}{11}$ (c) $\frac{17}{3}$ (d) $\frac{17}{9}$

85. What is the area of the triangle formed by the lines $y - x = 0, y + x = 0, x = c$? (2009-I)

(a) $\frac{c}{2}$ (b) c^2 (c) $2c^2$ (d) $\frac{c^2}{2}$

86. If $f(x) = log|x|, x \neq 0$, then what is $f'(x)$ equal to? (2009-I)

(a) $\frac{1}{|x|}$ (b) $\frac{1}{x}$ (c) $\frac{-1}{x}$ (d) none

87. What is the value of n for which the numbers 1, 2, 3,……. n have variance 2?

(a) 4   (b) 5   (c) 6   (d) 8   (2008-II)

88. If $|x^2 - 3x + 2| > x^2 - 3x + 2$, then which one of the following is correct? (2019-II)

(a) $x \leq 1\ or\ x \geq 2$ (b) $1 \leq x \leq 2$ (c) $1 < x < 2$

(d) x is any real value except 3 & 4

89. If the constant term in the expansion of $\left(\sqrt{x} - \frac{k}{x^2}\right)^{10}$ is 405, then what can be the value of k?

(2019-II)

(a) ± 2 (b) ± 3 (c) ± 5 (d) ± 9

90. If the angle of a triangle ABC are in A.P and $b:c = \sqrt{3}:\sqrt{2}$, then what is the measure of angle A?

(a) 30°   (b) 45°   (c) 60°   (d) 75°   (2019-II)

91. If $sin\alpha + cos\alpha = p$, then what is $cos^2(2\alpha)$ equal to ? (2019-I)

(a) p^2 (b) $p^2 - 1$ (c) $p^2(2 - p^2)$ (d) $p^2 + 1$

92. What is the value of $sin^{-1}\frac{4}{5} + sec^{-1}\frac{5}{4} - \frac{\pi}{2}$? (2019-I)

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) π (d) 0

93. If $sin2\theta = cos3\theta$, where $0 < \theta < \frac{\pi}{2}$ then what is $sin\theta$ equal to? (2019-I)

(a) $\frac{\sqrt{5}+1}{4}$ (b) $\frac{\sqrt{5}-1}{4}$ (c) $\frac{\sqrt{5}+1}{16}$ (d) $\frac{\sqrt{5}-1}{16}$

94. What is the nth term of the sequence $25, -125, 625, -3125\ldots\ldots$? (2019-I)

(a) $(-5)^{2n-1}$ (b) $(-1)^{2n}5^{n+1}$ (c)$(-1)^{2n-1}5^{n+1}$ (d) $(-1)^{n-1}5^{n+1}$

95. Suppose X={1, 2, 3, 4} & R is a relation on X. If R= {(1, 1), (2, 2), (3, 3), (1, 2), (2, 1), (2, 3), (3, 2)} then which one of the following is correct?
  (a) R is reflexive & symmetric, but not transitive.
  (b) R is symmetric and transitive, but not reflexive.
  (c) R is reflexive and transitive, but not symmetric.
  (d) R is neither reflexive nor transitive but symmetric.

96. Consider the following statements for the two non-empty sets A and B: (2019-I)
  1. $(A \cap B) \cup (A \cap \overline{B}) \cup (\overline{A} \cap B) = A \cup B$
  2. $(A \cup (\overline{A} \cap \overline{B}) = A \cup B$
  Which of the above statements is/are correct?
  (a) 1 only   (b) 2 only   (c) both 1 & 2   (d) neither 1 nor 2

97. The equation $px^2 + qx + r = 0$ (where p, q, r all are positive) has distinct real roots a and b, which one of the following is correct?   (2019-I)
  (a) $a > 0, b > 0$ (b) $a < 0, b < 0$
  (c) $a > 0, b < 0$ (d) $a < 0, b > 0$

98. The two parabolas $y^2 = 4ax$ and $x^2 = 4ay$ intersect   (2019-I)
  (a) At two points on the line $y = x$
  (b) Only at the origin
  (c) At three points one of which lies on $y + x = 0$
  (d) Only at (4a, 4a)

99. From 6 programmers and 4 typists, an office wants to recruit 5 people. What is the number of ways this can be done so as to recruit at least one typist? (2019-I)
  (a) 209   (b) 210   (c) 246   (d) 242

100. The number 1, 5 and 25 can be three terms (not necessarily consecutive) of   (2019-I)
  (a) Only one A.P
  (b) More than one but finite numbers of A Ps
  (c) Infinite numbers of APs
  (d) Finite number of GPs

101. The sum of $(p + q)^{th}$ and $(p - q)^{th}$ term of an A.P. is equal to   (2019-I)
  (a) $(2p)^{th}\ term$ (b) $(2q)^{th}\ term$ (c) twice the pth term   (d) twice the qth term

102. A pair of fair dice is rolled. What is the probability that the second dice lands on a higher value than does the first?   (2019-I)
  (a) $\frac{1}{4}$ (b) $\frac{1}{6}$ (c) $\frac{5}{12}$ (d) $\frac{5}{18}$

103. $Lt_{x \to 0} \frac{1 - cos^3 4x}{x^2}$ is equal to ?   (2019-I)
  (a) 0   (b) 12   (c) 24   (d) 36

104. A function f defined by $f(x) = ln(\sqrt{x^2 + 1} - x)$ is
  (a) An even function
  (b) An odd function
  (c) Both even and odd function
  (d) Neither even nor odd function

105. The mean of 100 observations is 50 and the standard deviation is 10. If 5 is subtracted from each observation and then it is divided by 4, then what will be the new mean and the new standard deviation respectively? (2019-I)
(a) 45, 5   (b) 11.25, 1.25   (c) 11.25, 2.5   (d) 12.5, 2.5

106. Two cards are chosen at random from a deck of 52 playing cards. What is the probability that both of them have the same value? (2019-I)
(a) $\frac{1}{17}$ (b) $\frac{3}{17}$ (c) $\frac{5}{17}$ (d) $\frac{7}{17}$

107. Let the correlation coefficient between X & Y be 0.6. Random variables Z and W are defined as $Z = X + 5$ and $W = \frac{Y}{3}$. What is the correlation coefficient between Z and W?
(a) 0.1   (b) 0.2   (c) 0.36   (d) 0.6   (2019-I)

108. What is the general solution of the differential equation $\frac{dy}{dx} + \frac{x}{y} = 0$?   (2019-I)
(a) $x^2 + y^2 = c$ (b) $x^2 - y^2 = c$
(c) $x^2 + y^2 = cxy$ (d) $x + y = c$

109. If $f(x) = log_{10}(1 + x)$, then what is $4f(4) + 5f(1) - log_{10}2$ equal to? (2019-I)
(a) 0   (b) 1   (c) 2   (d) 4

110. The sum of the binary number $(11011)_2$, $(10110110)_2$ and $(10011x0y)_2$ is the binary number $(101101101)_2$. What is the value of x and y? (2018-II)
(a) $x = 1, y = 1$ (b) $x = 1, y = 0$ (c) $x = 0, y = 1$ (d) $x = 0, y = 0$

111. Let T$_r$ be the rth term of an A.P. for $r = 1, 2, 3 ....$, If for some distinct positive integers m & n we have $T_m = \frac{1}{n}$ and $T_n = \frac{1}{m}$, then what is T$_{mn}$ equal to? (2018-II)
(a) $(mn)^{-1}$ (b) $m^{-1} + n^{-1}$ (c) 1   (d) 0

112. The top of a hill observed from the top and bottom of a building of height h is at angles of elevation $\frac{\pi}{6}$ & $\frac{\pi}{3}$ respectively. What is the height of the hill? (2018-II)
(a) $2h$ (b) $\frac{3h}{2}$ (c) h (d) $\frac{h}{2}$

113. What is $\int sin^3x \, cosx \, dx$ equal to?   (2018-II)
(a) $cos^4x + c$ (b) $sin^4x + c$ (c) $\frac{(1-sin^2x)^2}{4}$
(d) $\frac{(1-cos^2x)^2}{4} + c$ Where c is constant of integration.

114. What is $\int_{-1}^{1} \left\{ \frac{d}{dx}\left(tan^{-1}\frac{1}{x} \right) \right\} dx$ equal to?   (2018-II)
(a) 0   (b) $\frac{-\pi}{4}$ (c) $\frac{-\pi}{2}$ (d) $\frac{\pi}{2}$

115. What is the solution of the differential equation $ln\left(\frac{dy}{dx}\right) = ax + by$?   (2018-II)
(a) $ae^{ax} + be^{by} = c$ (b) $\frac{1}{a}e^{ax} + \frac{1}{b}e^{by} = c$
(c) $ae^{ax} + be^{-by} = c$ (d) $\frac{1}{a}e^{ax} + \frac{1}{b}e^{-by} = c$

116. Consider the following statements: (2017-1)
1. If $Lt_{x \to a} f(x)$ and $Lt_{x \to a} g(x)$ both exists then $Lt\{f(x)g(x)\}$ exists.
2. If $Lt_{x \to a}\{f(x)g(x)\}$ exists then both $Lt_{x \to a} f(x)$ and $Lt_{x \to a} g(x)$ exist.
Which of the above statements is/are correct?
(a)1 only   (b) 2 only   (c) both 1 & 2   (d) neither 1 nor 2

117. What is the equation of hyperbola having latus rectum and eccentricity 8 and $\frac{3}{\sqrt{5}}$ respectively? (2016-II)

(a) $\frac{x^2}{25} - \frac{y^2}{20} = 1$ (b) $\frac{x^2}{40} - \frac{y^2}{20} = 1$

(c) $\frac{x^2}{40} - \frac{y^2}{30} = 1$ (d) $\frac{x^2}{30} - \frac{y^2}{25} = 1$

118. If $z = \left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^{107} + \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^{107}$, then what is the imaginary part of z equal to?

(a) 0   (b) $\frac{1}{2}$ (c) $\frac{\sqrt{3}}{2}$ (d) 1   (2016-II)

119. What is $\int_1^3 |1 - x^4|\, dx$ equal to?   (2016-II)

(a) $\frac{-232}{5}$ (b) $\frac{-116}{5}$ (c) $\frac{116}{5}$ (d) $\frac{232}{5}$

120. If a circle of radius b units with center at $(0, b)$ touches the line $y = x - \sqrt{2}$, then what is the value of b?

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

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