

NDA- 2020

Date: 06-09-2020

SET-A

1. If matrix $A = \begin{bmatrix} 1-i & i \\ -i & 1-i \end{bmatrix}$ where $i = \sqrt{-1}$, then which one of the following is correct?
 (a) A is hermitian (b) A is skew-hermitian
 (c) $(\bar{A})^T + A$ is hermitian (d) $(\bar{A})^T + A$ is skew-hermitian
2. The term independent of x in the binomial expansion of $\left(\frac{2}{x^2} - \sqrt{x}\right)^{10}$ is equal to
 (a) 100 (b) 120
 (c) 90 (d) 72
3. If $(1 + 2x - x^2)^6 = a_0 + a_1x + a_2x^2 + \dots + a_{12}x^{12}$, then that is $a_0 - a_1 + a_2 + a_4 - \dots + a_{12}$ equal to?
 (a) 32 (b) 64
 (c) 2048 (d) 4096
4. If $C(20, n+2) = C(20, n-2)$, then what is n equal to?
 (a) 18 (b) 25
 (c) 10 (d) 12
5. For the many values of k , is the matrix $\begin{bmatrix} 0 & k & 4 \\ -k & 0 & -5 \\ -k & k & -1 \end{bmatrix}$ singular?
 (a) only one (b) only two
 (c) only four (d) infinite
6. The number $(1101101 + 1011011)_2$ can be written in decimal system as
 (a) $(198)_{10}$ (b) $(199)_{10}$
 (c) $(200)_{10}$ (d) $(201)_{10}$
7. What is the value of $\frac{1}{10} \log_5 1024 - \log_5 10 + \frac{1}{5} \log_5 3125$?
 (a) 0 (b) 1
 (c) 2 (d) 3
8. If $x = \log_c(ab)$, $y = \log_b(bc)$, $z = \log_b(ca)$, then which of the following is correct?
 (a) $xyz = 1$
 (b) $x + y + z = 1$
 (c) $(1+x)^{-1} + (1+y)^{-1} + (1+z)^{-1} = 1$
 (d) $(1+x)^{-2} + (1+y)^{-2} + (1+z)^{-2} = 1$
9. Let $A = \begin{bmatrix} x+y & y \\ 2x & x-y \end{bmatrix}$, $B = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$ and $C = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$. If $AB = C$, then what is the value of the determinant of the matrix A?
 (a) -10 (b) -14
 (c) -24 (d) -34
10. If $1.5 \leq x \leq 4.5$, then which one of the following is correct?
 (a) $(2x-3)(2x-9) > 0$ (b) $(2x-3)(2x-9) < 0$
 (c) $(2x-3)(2x-9) \geq 0$ (d) $(2x-3)(2x-9) \leq 0$
11. Let $S = \{1, 2, 3, \dots\}$. A relation R on $S \times S$ is defined by xRy if $\log_a x > \log_a y$ when $a = \frac{1}{2}$. Then the relation is
 (a) reflexive only (b) symmetric only
 (c) transitive only (d) both symmetric and transitive
12. What is the value of the determinant $\begin{vmatrix} i & i^2 & i^3 \\ i^4 & i^6 & i^8 \\ i^9 & i^{12} & i^{15} \end{vmatrix}$ where $i = \sqrt{-1}$?
 (a) 0 (b) -2
 (c) $4i$ (d) $-4i$

13. Let $A = \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$ and $B = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$, then what is AB equal to?

(a) $\begin{bmatrix} ax + hy + gz \\ y \\ z \end{bmatrix}$

(b) $\begin{bmatrix} ax + hy + gz \\ hx + by + fz \\ z \end{bmatrix}$

(c) $\begin{bmatrix} ax + hy + gz \\ hx + by + fz \\ gx + fy + cz \end{bmatrix}$

(d) $[ax + hy + gz \quad gx + by + fz \quad gx + fy + cz]$

14. What is the number of ways in which the letter of the word 'ABLE' can be arranged so that the vowels occupy even places?

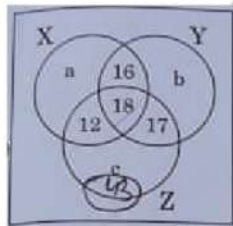
- (a) 2 (b) 4
(c) 6 (d) 8

15. What is the maximum number of points of intersection of 5 non-overlapping circles?

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

Directions for the following three (03) items:

Consider the following Venn diagram, where X, Y and Z are three sets. Let the number of elements in Z be denoted by $n(Z)$ which is equal to 90.



16. If the number of elements in Y and Z are in the ratio 4:5, then what is the value of b?

- (a) 18 (b) 19
(c) 21 (d) 23

17. What is the value of $n(X) + n(Y) + n(Z) - n(X \cap Y) - n(Y \cap Z) - n(X \cap Z) + n(X \cap Y \cap Z)$?

- (a) $a + b + 43$ (b) $a + b + 63$
(c) $a + b + 96$ (d) $a + b + 106$

18. If the number of elements belonging to neither X, nor Y, nor Z is equal to p, then what is the number of elements in the complement of X?

- (a) $p + b + 60$ (b) $p + b + 40$
(c) $p + a + 60$ (d) $p + a + 40$

Directions for the following two (02) items:

Read the following information and answer the two items that follows:

Let $\frac{\tan 3A}{\tan A} = K$, where $\tan A \neq 0$ and $K \neq \frac{1}{3}$.

19. What is $\tan^2 A$ equal to?

- (a) $\frac{K+3}{3K-1}$ (b) $\frac{K-3}{3K-1}$
(c) $\frac{3K-3}{K-3}$ (d) $\frac{K+3}{3K+1}$

20. For real values of $\tan A$, K cannot lie between

- (a) $\frac{1}{3}$ and 3 (b) $\frac{1}{2}$ and 2
(c) $\frac{1}{5}$ and 5 (d) $\frac{1}{7}$ and 7

Direction for the following two (02) items:

Read the following information and answer the two items that follow:

ABCD is a trapezium such that AB and CD are parallel and BC is perpendicular to them. Let $\angle ADB = \theta, \angle ABD = \alpha, BC = p$ and $CD = q$.

21. Consider the following:

- $AD \sin \theta = AB \sin \alpha$
- $BD \sin \theta = AB \sin(\theta + \alpha)$

Which of the above is/are correct?

- (a) 1 only (b) 2 only
(c) both 1 and 2 (d) Neither 1 nor 2

22. What is AB equal to?

- (a) $\frac{(p^2 + q^2)\sin\theta}{p\cos\theta + q\sin\theta}$ (b) $\frac{(p^2 - q^2)\cos\theta}{p\cos\theta + q\sin\theta}$
(c) $\frac{(p^2 + q^2)\sin\theta}{q\cos\theta + p\sin\theta}$ (d) $\frac{(p^2 - q^2)\cos\theta}{q\cos\theta + p\sin\theta}$

23. If $\tan\theta = \frac{\cos 17^\circ - \sin 17^\circ}{\cos 17^\circ + \sin 17^\circ}$, then what is the value of θ ?

- (a) 0° (b) 28°
(c) 38° (d) 52°

24. A and B are positive acute angles such that $\cos 2B = 3\sin^2 A$ and $3\sin 2A = 2\sin 2B$ What is the value of?

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

25. What is $\sin 3x + \cos 3x + 4\sin^3 x - 3\sin x + 3\cos x - 4\cos^2 x$ equal to?

- (a) 0 (b) 1
(c) $2\sin 2x$ (d) $2\cos 4x$

26. The value of ordinate of the graph of $y = 2 + \cos x$ lies in the interval

- (a) $[0, 1]$ (b) $[0, 3]$
(c) $[-1, 1]$ (d) $[1, 3]$

27. What is the value of $8\cos 10^\circ, \cos 20^\circ, \cos 40^\circ$?

- (a) $\tan 10^\circ$ (b) $\cot 10^\circ$
(c) $\operatorname{cosec} 10^\circ$ (d) $\sec 10^\circ$

28. What is the value of $\cos 48^\circ - \cos 12^\circ$?

- (a) $\frac{\sqrt{5}-1}{4}$ (b) $\frac{1-\sqrt{5}}{4}$

(c) $\frac{1-\sqrt{5}}{2}$

(d) $\frac{1-\sqrt{5}}{8}$

29. Consider the following statements:

1. If ABC is a right-angled triangle, right-angled at A and if

$\sin B = \frac{1}{3}$, then $\operatorname{cosec} C = 3$.

2. If $b\cos B = c\cos C$ and if the triangle ABC is not right-angled, then ABC must be isosceles.

Which of the above statements is/are correct?

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

30. Consider the following statements:

1. If in a triangle ABC, $A = 2B$ and $b = c$, then it must be an obtuse angled triangle.

2. There exists no triangle ABC with $A = 40^\circ, B = 65^\circ$ and

$\frac{a}{c} = \sin 40^\circ \operatorname{cosec} 15^\circ$.

Which of the above statements is/are correct?

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

Directions for the following tree (03) items:

Read the following information and answer the three items that follows:

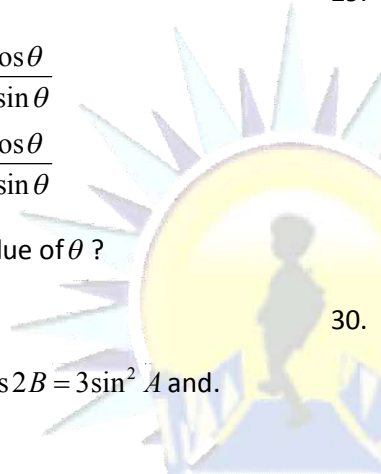
Let $a\sin^2 x + b\cos^2 x = c; b\sin^2 y + a\cos^2 y = d$ and $p\tan x = q\tan y$

31. What is $\tan^2 x$ equal to?

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

32. What is $\frac{d-a}{b-d}$ equal to?

- (a) $\sin^2 y$ (b) $\cos^2 y$
(c) $\tan^2 y$ (d) $\cot^2 y$



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33. What is $\frac{p^2}{q^2}$ equal to?

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

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

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

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

Directions for the following tree (03) items:

Read the following information and answer the three items that follows:

Let $t_n = \sin^n \theta + \cos^n \theta$

31. What is $\frac{t_3 - t_5}{t_5 - t_7}$ equal to?

(a) $\frac{t_1}{t_3}$

(b) $\frac{t_3}{t_5}$

(c) $\frac{t_5}{t_7}$

(d) $\frac{t_1}{t_7}$

35. What is $t_1^2 - t_2$ equal to?

(a) $\cos 2\theta$

(b) $\sin 2\theta$

(c) $2 \cos \theta$

(d) $2 \sin \theta$

36. What is the value of t_{10} where $\theta = 45^\circ$?

(a) 1

(b) $\frac{1}{4}$

(c) $\frac{1}{16}$

(d) $\frac{1}{32}$

Directions for the following tree (03) items:

Read the following information and answer the three items that follows:

Let $\alpha = \beta = 15^\circ$.

37. What is the value of $\sin \alpha + \cos \beta$?

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

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

(c) $\frac{\sqrt{3}}{2\sqrt{2}}$

(d) $\frac{\sqrt{3}}{\sqrt{2}}$

38. What is the value of $\sin 7\alpha - \cos 7\beta$?

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

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

(c) $\frac{\sqrt{3}}{2\sqrt{2}}$

(d) $\frac{\sqrt{3}}{\sqrt{2}}$

39. What is $\sin(\alpha + 1^\circ) + \cos(\beta + 1^\circ)$ equal to?

(a) $\sqrt{3} \cos 1^\circ + \sin 1^\circ$

(b) $\sqrt{3} \cos 1^\circ - \frac{1}{2} \sin 1^\circ$

(c) $\frac{1}{\sqrt{2}}(\sqrt{3} \cos 1^\circ - \sin 1^\circ)$

(d) $\frac{1}{2}(\sqrt{3} \cos 1^\circ + \sin 1^\circ)$

40. If $\sin x + \sin y = \cos y - \cos x$, where $0 < y < x < \frac{x}{2}$, then what is

$\tan\left(\frac{x-y}{2}\right)$ equal to?

(a) 0

(b) $\frac{1}{2}$

(c) 1

(d) 2

41. If A is a matrix of order 3×5 and B is a matrix of order 5×3 , then the order of AB and BA will respectively be

(a) 3×3 and 3×3

(b) 3×5 and 5×3

(c) 3×3 and 5×5

(d) 5×3 and 3×5

42. If p^2, q^2 and r^2 (where $p, q, r > 0$) are in GP, then which of the following is/are correct?

1. p, q and r are in GP

2. $\ln p, \ln q$ and $\ln r$ are in AP

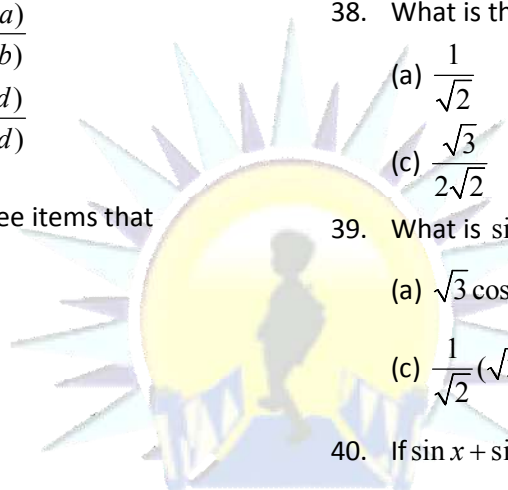
Select the correct answer using the code given below:

(a) 1 only

(b) 2 only

(c) both 1 and 2

(d) neither 1 nor 2



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43. If $\cot \alpha$ and $\cot \beta$ are the roots of the equation $x^2 - 3x + 2 = 0$, then what is $\cot(\alpha + \beta)$ equal to?

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

44. The roots α and β of a quadratic equation, satisfy the relation $\alpha + \beta = \alpha^2 + \beta^2$ and $\alpha\beta = \alpha^2\beta^2$. What is the number of such quadratic equations?

- (a) 0 (b) 2
 (c) 3 (d) 4

45. What is the argument of the complex number $\frac{1-i\sqrt{3}}{1+i\sqrt{3}}$, where

$$1 = \sqrt{-1} ?$$

- (a) 240° (b) 210°
 (c) 120° (d) 60°

46. What is the modulus of the complex number $\frac{\cos \theta + i \sin \theta}{\cos \theta - i \sin \theta}$,

$$\text{where } i = \sqrt{-1} ?$$

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

47. Consider the proper subsets of $\{1, 2, 3, 4\}$. How many of these proper subsets are superset of the set $\{3\}$?

- (a) 5 (b) 6
 (c) 7 (d) 8

48. Let p, q and r be three distinct positive real numbers. If

$$D = \begin{vmatrix} p & q & r \\ q & r & p \\ r & p & q \end{vmatrix}, \text{ then which one of the following is correct?}$$

- (a) $D < 0$ (b) $D \leq 0$
 (c) $D > 0$ (d) $D \geq 0$

49. What is the sum of the last five coefficients in the expansion of $(1 + x)^9$ when it is expanded in ascending powers of x ?

- (a) 256 (b) 512
 (c) 1024 (d) 2048

50. Consider the following in respect of a non-singular matrix of order 3.

1. $A (\text{adj } A) = (\text{adj } A) A$
2. $|\text{adj } A| = |A|$

Which of the above statements is/are correct?

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

51. The center of the circle $(x - 2a)(x - 2b) + (y - 2c)(y - 2d) = 0$ is

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

52. The point $(1, -1)$ is one of the vertices of a square. If $3x + 2y = 5$ is the equation of one diagonal of the square, then what is the equation of the other diagonal?

- (a) $3x - 2y = 5$ (b) $2x - 3y = 1$
 (c) $2x - 3y = 5$ (d) $2x + 3y = -1$

53. Let $P(x, y)$ be any point on the ellipse $25x^2 + 16y^2 = 400$. If $Q(0, 3)$ and $R(0, -3)$ are two points, then what is $(PQ + PR)$ equal to?

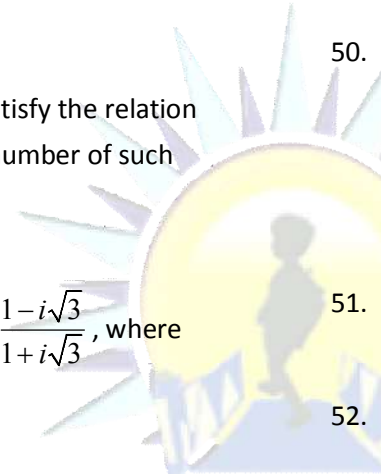
- (a) 12 (b) 10
 (c) 8 (d) 6

54. If the circumcentre of the triangle formed by the lines $x + 2 = 0, y + 2 = 0$ and $kx + y + 2 = 0$ is $(-1, -1)$, then what is the value of k ?

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

55. In the parabola, $y^2 = x$ what is the length of the chord passing through the vertex and inclined to the x -axis at an angle θ ?

- (a) $\sin \theta, \sec^2 \theta$ (b) $\cos \theta, \cos ec^2 \theta$
 (c) $\cot \theta, \sec^2 \theta$ (d) $2 \tan \theta, \cos ec^2 \theta$



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56. Under which condition, are the points (a, b), (c, d) and (a - c, b - d) collinear?
 (a) $ab = cd$ (b) $ac = bd$
 (c) $ad = bc$ (d) $abc = d$
57. Let ABC be a triangle. If D(2, 5) and E(5, 9) are the mid-points of the sides AB and AC respectively, then what is the length of the side BC?
 (a) 8 (b) 10
 (c) 12 (d) 14
58. If the foot of the perpendicular drawn from the point (0, k) to the line $3x - 4y - 5 = 0$ is (3, 1), then what is the value of k?
 (a) 3 (b) 4
 (c) 5 (d) 6
59. What is the obtuse angle between the lines whose slopes are $2 - \sqrt{3}$ and $2 + \sqrt{3}$?
 (a) 105° (b) 120°
 (c) 135° (d) 150°
60. If $3x - 4y - 5 = 0$ and $3x - 4y + 15 = 0$ are the equations of a pair of opposite sides of a square, then what is the area of the square?
 (a) 4 square units (b) 9 square units
 (c) 16 square units (d) 25 square units
61. What is the length of the diameter of the sphere whose centre is at (1, -2, 3) and which touches the plane $6x - 3y + 2z - 4 = 0$?
 (a) 1 unit (b) 2 units
 (c) 3 units (d) 4 units
62. What is the perpendicular distance from the point (2, 3, 4) to the line $\frac{x-0}{1} = \frac{y-0}{0} = \frac{z-0}{0}$?
 (a) 6 units (b) 5 units
 (c) 3 units (d) 2 units
63. If a line has direction ratios $\langle a + b, b + c, c + a \rangle$, then what is the sum of the squares of its direction cosines?
 (a) $(a + b + c)^2$ (b) $2(a + b + c)$
 (c) 3 (d) 1
64. Into how many compartments do the coordinate planes divide the space?
 (a) 2 (b) 4
 (c) 8 (d) 16
65. What is the equation of the plane which cuts an intercept 5 units on the x-axis and is parallel to xy-plane?
 (a) $x + y = 5$ (b) $x = 5$
 (c) $z = 0$ (d) $x + y + z = 5$
66. If \hat{a} is a unit vector in the xy-plane making an angle 30° with the positive x-axis, then what is \hat{a} equal to?
 (a) $\frac{\sqrt{3}\hat{i} + \hat{j}}{2}$ (b) $\frac{\sqrt{3}\hat{i} - \hat{j}}{2}$
 (c) $\frac{\hat{i} + \sqrt{3}\hat{j}}{2}$ (d) $\frac{\hat{i} - \sqrt{3}\hat{j}}{2}$
67. Let A be a point in space such that $[\overline{OA}] = 12$ where O is the origin. If \overline{OA} is inclined at angles 45° and 60° with x-axis and y-axis respectively, then what is \overline{OA} equal to?
 (a) $6\hat{i} + 6\hat{j} + \sqrt{2}\hat{k}$ (b) $6\hat{i} + 6\sqrt{2}\hat{j} + 6\hat{k}$
 (c) $6\sqrt{2}\hat{i} + 6\hat{j} + 6\hat{k}$ (d) $3\sqrt{2}\hat{i} + 3\hat{j} + 6\hat{k}$
68. Two adjacent sides of a parallelogram are $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$. What is the magnitude of dot product of vectors which represent its diagonals?
 (a) 21 (b) 25
 (c) 31 (d) 36
69. If $|\vec{a} \times \vec{b}|^2 + |\vec{a} \cdot \vec{b}|^2 = 144$ and $|\vec{a}| = 4$, then what is $|\vec{b}|$ equal to?
 (a) 3 (b) 4
 (c) 6 (d) 8
70. If the vectors $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 3\hat{k}$, and $\vec{c} = \hat{j} + p\hat{k}$ are coplanar, then what is the value of p?
 (a) 1 (b) -1
 (c) 5 (d) -5

71. What is $\lim_{x \rightarrow 1} \frac{x + x^2 + x^3 - 3}{x - 1}$ equal to?

- (a) 1 (b) 2
(c) 3 (d) 6

72. The radius of a circle is increasing at the rate of 0.7 cm/sec. What is the rate of increase of its circumference?

- (a) 4.4 cm/sec (b) 8.4 cm/sec
(c) 8.8 cm/sec (d) 15.4 cm/sec

73. If $\lim_{x \rightarrow 1} \frac{x^4 - 1}{x - 1} = \lim_{x \rightarrow k} \frac{x^3 - k^3}{x^2 - k^2}$, where $k \neq 0$, then what is the value of k ?

- (a) $\frac{2}{3}$ (b) $\frac{4}{3}$
(c) $\frac{8}{3}$ (d) 4

74. The order and degree of the differential equation

$$k \frac{dy}{dx} = \int \left[1 + \left(\frac{dy}{dx} \right)^2 \right]^{\frac{2}{3}} dx$$
 are respectively

- (a) 1 and 1 (b) 2 and 3
(c) 2 and 4 (d) 1 and 4

75. What is $\lim_{x \rightarrow 0} \frac{\sin x \log(1-x)}{x^2}$ equal to?

- (a) -1 (b) zero
(c) -e (d) $-\frac{1}{e}$

76. If $f(x) = 3x^2 - 5x + p$ and $f(0)$ and $f(1)$ are opposite in sign, then which of the following is correct?

- (a) $-2 < p < 0$ (b) $-2 < p < 2$
(c) $0 < p < 2$ (d) $3 < p < 5$

77. If $e^{\theta\phi} = c + 4\theta\phi$, where c is an arbitrary constant and ϕ is a function of θ , then what is $\phi d\theta$ equal to?

- (a) $\theta d\phi$ (b) $-\theta d\phi$

- (c) $4\theta d\phi$ (d) $-4\theta d\phi$

78. If $p(x) = (4e)^{2x}$, then what is $\int p(x) dx$ equal to?

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

79. What is the value of $\int_d^{\pi/4} (\tan^3 x + \tan x) dx$?

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

80. Let $y = 3x^2 + 2$. If x changes from 10 to 10.1, then what is the total change in y ?

- (a) 4.71 (b) 5.23
(c) 6.03 (d) 8.01

81. If $f(x) = \frac{\sin x}{x}$, where $x \in R$ is to be continuous at $x = 0$, then the value of the function at $x = 0$.

- (a) should be 0 (b) should be 1
(c) should be 2 (d) cannot be determined

82. The solution of the differential equation $dy = (1 + y^2) dx$ is

- (a) $y = \tan x + c$ (b) $y = \tan(x + c)$
(c) $\tan^{-1}(y + c) = x$ (d) $\tan^{-1}(y + c) = 2x$

83. What is $\int (e^{\log x} + \sin x) \cos x dx$ equal to?

- (a) $\sin x + x \cos x + \frac{\sin^2 x}{2} + c$ (b) $\sin x - x \cos x + \frac{\sin^2 x}{2} + c$
(c) $x \sin x + \cos x + \frac{\sin^2 x}{2} + c$ (d) $x \sin x - x \cos x + \frac{\sin^2 x}{2} + c$

84. What is the domain of the function $f(x) = \cos^{-1}(x - 2)$?

- (a) $[-1, 1]$ (b) $[1, 3]$
(c) $[0, 5]$ (d) $[-2, 1]$

85. What is the area of the region enclosed between the curve $y^2 = 2x$ and the straight line $y = x$?

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

86. If $f(x) = 2x - x^2$, then what is the value of $f(x+2) + f(x-2)$ when $x = 0$?

- (a) -8 (b) -4
(c) 8 (d) 4

87. If $x^m y^n = a^{m+n}$, then what is $\frac{dy}{dx}$ equal to?

- (a) $\frac{my}{nx}$ (b) $-\frac{my}{nx}$
(c) $\frac{mx}{ny}$ (d) $-\frac{ny}{mx}$

88. What is $\int \frac{dx}{x(x^n + 1)}$ equal to?

- (a) $\frac{1}{n} \ln \left(\frac{x^n}{x^n + 1} \right) + c$ (b) $\ln \left(\frac{x^n + 1}{x^n} \right) + c$
(c) $\ln \left(\frac{x^n}{x^n + 1} \right) + c$ (d) $\frac{1}{n} \ln \left(\frac{x^n + 1}{x^n} \right) + c$

89. What is the minimum value of $|x - 1|$, where $x \in R$?

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

90. What is the value of k such that integration of $\frac{3x^2 + 8 - 4k}{x}$ with

- respect to x , may be a rational function?
(a) 0 (b) 1
(c) 2 (d) -2

91. Consider the following statements for $f(x) = e^{-|x|}$:

1. The function is continuous at $x = 0$
2. The function is differentiable at $x = 0$
Which of the above statements is/are correct?

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

92. What is the maximum value of $\sin x \cdot \cos x$?

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

93. What is $\lim_{x \rightarrow 0} \frac{3^x + 3^{-x} - 2}{x}$ equal to?

- (a) 0 (b) -1
(c) 1 (d) limit does not exist

94. What is the derivative of $\tan^{-1} x$ with respect to $\cot^{-1} x$?

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

95. The function $u(x, y) = c$ which satisfies the differential equation $x(dx - dy) + y(dy - dx) = 0$, is

- (a) $x^2 + y^2 = xy + c$ (b) $x^2 + y^2 = 2xy + c$
(c) $x^2 - y^2 = xy + c$ (d) $x^2 - y^2 = 2xy + c$

96. What is the minimum value of $3 \cos \left(A + \frac{\pi}{3} \right)$ where $A \in R$?

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

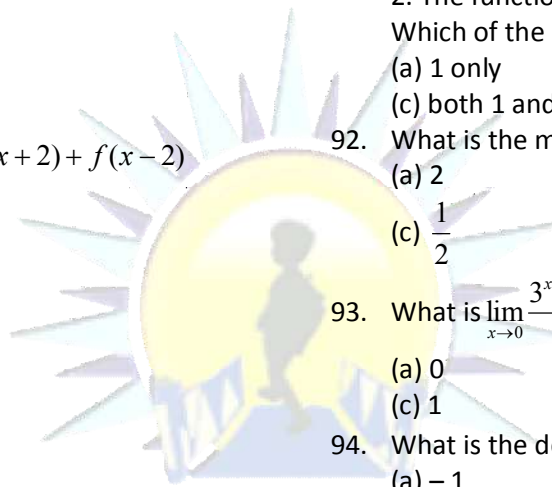
97. Consider the following statements:

1. The function $f(x) = \ln x$ increases in the interval $(0, \infty)$

2. The function $f(x) = \tan x$ increases in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2} \right)$.

Which of the above statements is/are correct?

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



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98. Which one of the following is correct in respect of the graph of

$$y = \frac{1}{x-1} ?$$

- (a) The domain is $\{x \in R \mid x \neq 1\}$ and the range is the set of reals
 (b) The domain is $\{x \in R \mid x \neq 1\}$, the range is $\{y \in R \mid y \neq 0\}$ and the graph intersects y-axis at $(0, -1)$
 (c) The domain is the set of reals and the range is the singleton set $\{0\}$.
 (d) The domain is $\{x \in R \mid x \neq 1\}$ and the range is the set of points on the y-axis

99. What is the solution of the differential equation $\ln\left(\frac{dy}{dx}\right) = x$?

- (a) $y = e^x + c$ (b) $y = e^x + c$
 (c) $y = \ln x + c$ (d) $y = 2 \ln x + c$

100. Let l be the length and b be the breadth of a rectangle such that $l + b = k$. What is the maximum area of the rectangle?

- (a) $2k^2$ (b) k^2
 (c) $\frac{k^2}{2}$ (d) $\frac{k^2}{4}$

101. The numbers 4 and 9 have frequencies x and $(x - 1)$ respectively. If their arithmetic mean is 6, then what is the value of x ?

- (a) 2 (b) 3
 (c) 4 (d) 5

102. If three dice are rolled under the condition that no two dice show the same face, then what is the probability that one of the faces is having the number 6?

- (a) $\frac{5}{6}$ (b) $\frac{5}{9}$
 (c) $\frac{1}{2}$ (d) $\frac{5}{12}$

103. If $P(A \cup B) = \frac{5}{6}$, $P(A \cap B) = \frac{1}{3}$ and $P(\text{not } A) = \frac{1}{2}$, then which one of the following is not correct?

- (a) $P(B) = \frac{2}{3}$
 (b) $P(A \cap B) = P(A)P(B)$
 (c) $P(A \cup B) > P(A) + P(B)$
 (d) $P(\text{not } A \text{ and not } B) = P(\text{not } A) P(\text{not } B)$

104. The sum of deviation of n number of observations measured from 2.5 is 50. Then sum of deviations of the same set of observations measured from 3.5 is -50 . What is the value of n ?

- (a) 50 (b) 60
 (c) 80 (d) 100

105. A data set of n observations has mean $2M$ while another data set of $2n$ observations have mean M . What is the mean of the combined data sets?

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

Directions for the following three (03) items:

Read the following information and answer the three items that follow:

Marks	Number of students	
	Physics	Mathematics
10-20	8	10
20-30	11	21
30-40	30	38
40-50	26	15
50-60	15	10
60-70	10	6

106. The difference between number of students under Physics and Mathematics is largest for the interval

- (a) 20-30 (b) 30-40
 (c) 40-50 (d) 50-60

107. Consider the following statements:
 1. Modal value of the marks in Physics lies in the interval 30- 40.
 2. Median of the marks in Physics is less than that of marks in Mathematics.

Which of the above statements is/are correct?

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

108. What is the mean of marks in Physics?

- (a) 38.4 (b) 39.4
 (c) 40.9 (d) 41.6

109. What is the standard deviation of the observations

$$-\sqrt{6}, -\sqrt{5}, -\sqrt{4}, -1, 1, \sqrt{4}, \sqrt{5}, \sqrt{6} ?$$

- (a) $\sqrt{2}$ (b) 2
 (c) $2\sqrt{2}$ (d) 4

110. If $\sum x_i = 20$, $\sum x_i^2 = 200$ and $n = 10$ for an observed variable x , then what is the coefficient of variation?

- (a) 80 (b) 100
 (c) 150 (d) 200

111. What is the probability that February of a leap year selected at random, will have five Sundays?

- (a) $\frac{1}{5}$ (b) $\frac{1}{7}$
 (c) $\frac{2}{7}$ (d) 1

112. The arithmetic mean of 100 observations is 40. Later, it was found that an observation '53' was wrongly read as '83'. What is the correct arithmetic mean?

- (a) 39.8 (b) 39.7
 (c) 39.6 (d) 39.5

113. A husband and wife appear in an interview for two vacancies for the same post. The probability of the husband's selection is $\frac{1}{7}$

and that of the wife's selection is $\frac{1}{5}$. If the events are

independent, then the probability of which one of the following is

$$\frac{11}{35} ?$$

- (a) At least one of them will be selected
 (b) Only one of them will be selected
 (c) None of them will be selected
 (d) Both of them will be selected

114. A dealer has a stock of 15 gold coins out of which 6 are counterfeits. A person randomly picks 4 of the 15 gold coins. What is the probability that all the coins picked will be counterfeits?

- (a) $\frac{1}{91}$ (b) $\frac{4}{91}$
 (c) $\frac{6}{91}$ (d) $\frac{15}{91}$

115. A committee of 3 is to be formed from a group of 2 boys and 2 girls. What is the probability that the committee consists of 2 boys and 1 girl?

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

116. In a lottery of 10 tickets numbered 1 to 10, two tickets are drawn simultaneously. What is the probability that both the tickets drawn have prime numbers?

- (a) $\frac{1}{15}$ (b) $\frac{1}{2}$
 (c) $\frac{2}{15}$ (d) $\frac{1}{5}$

117. Let X and Y represent prices (in Rs.) of a commodity in Kolkata and Mumbai respectively. It is given that $\bar{X} = 65$, $\bar{Y} = 67$, $\sigma_X = 2.5$, $\sigma_Y = 3.5$ and $r(X, Y) = 0.8$. What is the equation of regression of Y on X ?

- (a) $Y = 0.175 X - 5$ (b) $Y = 1.12 X - 5.8$

$$(c) Y = 1.12X - 5$$

$$(d) Y = 0.17X + 5.8$$

118. Consider a random variable X which follows Binomial distribution

with parameters $n = 10$ and $P = \frac{1}{5}$. Then $Y = 10 - X$ follows

Binomial distribution with parameters n and p respectively given by

$$(a) 5, \frac{1}{5}$$

$$(b) 5, \frac{2}{5}$$

$$(c) 10, \frac{3}{5}$$

$$(d) 10, \frac{4}{5}$$

119. If A and B are two events such that $P(A) = 0.6, P(B) = 0.5$ and

$P(A \cap B) = 0.4$, then consider the following statements:

1. $P(\bar{A} \cup B) = 0.9$

2. $P(\bar{B} | \bar{A}) = 0.6$

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) both 1 and 2

(d) neither 1 nor 2

120. Three cooks X, Y and Z bake a special kind of cake, and with respective probabilities $0.02, 0.03$ and 0.05 , it fails to rise. In the restaurant where they work. X bakes 50% , Y bakes 30% and Z bakes 20% of cakes. What is the proportion of failures caused by X ?

$$(a) \frac{9}{29}$$

$$(b) \frac{10}{29}$$

$$(c) \frac{19}{29}$$

$$(d) \frac{28}{29}$$



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