NDA I 2017_Mathematic

Total Time: 150

Total Marks: 300.0

Q.No.1: Let *S* be the set of all persons living in Delhi. We say that *x, y* in *S* are related if the *y* were born in Delhi on the same day. Which one of the following is correct?

A. The relation is an equivalent relation

B. The relation is not reflective but it is symmetric and transitive

C. The relation is not symmetric bout it is reflexive and transitive

D. The relation is not transitive but it is reflexive ands ymmetric

Marks:[2.50]

Q.No.2: Let *A* = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. Then the number of subsets of *A* containing two or three elements is

A. 45

B. 120

C. 165

D. 330

Marks:[2.50]

Q.No.3: 3. The value of $i^{2n} + i^{2n+1} + i^{2n+2} + i^{2n+3}$, where ,is $i = \sqrt{-1}$

A. 0

B. 1

C. *i*

D. –*i*

Marks:[2.50]

Q.No.4: If the difference between the roots of the equation $x^2 + kx + 1 = 0$ is strictly less than $\sqrt{5}$, where |*k*| ≥ 2, then *k* can be any element of the interval

A. $(-3,-2] \cup [2,3)$

B. (–3, 3)

C. $[-3,-2] \cup [2,3]$

D. None of these

Marks:[2.50]

Q.No.5: If the roots of the equation $x^2 + px + q = 0$ are in the same ratio as those of the equation $x^2 + lx + m = 0$, then which one of the following is correct?

A. $p^2m = l^2q$

B. $m^2p = l^2q$

C. $m^2p = q^2l$

D. $m^2p^2 = l^2q$

Marks:[2.50]

Q.No.6: The value of $\left(\frac{-1+i\sqrt{3}}{2}\right)^n + \left(\frac{-1-i\sqrt{3}}{2}\right)^n$ where *n* is not a multiple of 3 and $i = \sqrt{-1}$ is

A. 1

B. –1

C. *i*

D. –*i*

Marks:[2.50]

Q.No.7: Three-digit numbers are formed from the digits 1, 2 and 3 in such a way that the digits are not repeated. What is the sum of such 3 digit numbers?

A. 1233

B. 1322

C. 1323

D. 1332

Marks:[2.50]

Q.No.8: What is the sum of the series 0.3 + 0.33 + 0.333 +….*n* terms?

A. $\frac{1}{3}\left[n-\frac{1}{9}\left(1-\frac{1}{10^n}\right)\right]$

B. $\frac{1}{3}\left[n-\frac{2}{9}\left(1-\frac{1}{10^n}\right)\right]$

C. $\frac{1}{3}\left[n-\frac{1}{3}\left(1-\frac{1}{10^n}\right)\right]$

D. $\frac{1}{3}\left[n-\frac{1}{9}\left(1+\frac{1}{10^n}\right)\right]$

Marks:[2.50]

Q.No.9: If 1, ω, ω^2 are the cube roots of unity, then $(1+\omega)\left(1+\omega^2\right)\left(1+\omega^3\right)\left(1+\omega+\omega^2\right)$ is equal to

A. –2

B. –1

C. 0

D. 2

Marks:[2.50]

Q.No.10: If the sum of *m* terms of an AP is *n* and the sum of *n* terms is *m*, then the sum of (*m* + *n*) term is

A. *mn*

B. *m* + *n*

C. 2(*m* + *n*)

D. – (*m* + *n*)

Marks:[2.50]

Q.No.11: The modulus and the principal argument of the complex numbers $\frac{1+2i}{1-(1-i)^2}$ are respectively

A. 1, 0

B. 1, 1

C. 2, 0

D. 2, 1

Marks:[2.50]

Q.No.12: If the graph of a quadratic polynomial lies entirely above the *x*-axis, then which one of the following is correct?

A. Both the roots are real

B. One root is real and the other is complex

C. Both the roots are complex

D. Cannot say

Marks:[2.50]

Q.No.13: If $|z+4| \leq 3$, then the maximum value of |z + 1| is

A. 0

B. 4

C. 6

D. 10

Marks:[2.50]

Q.No.14: The number of roots of the equation $z^2 = 2\bar{z}$ is

A. 2

B. 3

C. 4

D. 0

Marks:[2.50]

Q.No.15: If cot *α* and cot *β* are the roots of the equation $x^2 + bx + c = 0$ with $b \neq 0$ then the value of cot (*α* + *β*) is

A. $\frac{c-1}{b}$

B. $\frac{1-c}{b}$

C. $\frac{b}{c-1}$

D. $\frac{b}{1-c}$

Marks:[2.50]

Q.No.16: The sum of the roots of the equation $x^2 + bx + c = 0$ (where *b* and *c* are non-zero) is equal to the sum of the reciprocals of their square. Then $\frac{1}{c}, b, \frac{c}{b}$ are in

A. AP

B. GP

C. HP

D. None of the above

Marks:[2.50]

Q.No.17: The sum of the roots of the equation $ax^2 + x + c = 0$ (where *a* and *c*

are non-zero) is equal to the sum of the reciprocals of their squares. Then a, ca^2, c^2 are in

A. AP

B. GP

C. HP

D. None of the above

Marks:[2.50]

Q.No.18: The value of $[C(7, 0) + C(7, 1)] + [C(7, 1) + C(7, 2)] + \ldots\ldots + [C(7, 6) + C(7, 7)]$ is

A. 254

B. 255

C. 256

D. 257

Marks:[2.50]

Q.No.19: The number of different words (eight-letter words) ending and beginning with a consonant which can be made out of the letters of the word 'EQUATION' is

A. 5200

B. 4320

C. 3000

D. 2160

Marks:[2.50]

Q.No.20: The fifth term of an AP of n terms, whose sum is $n^2 - 2n$, is

A. 5

B. 7

C. 8

D. 15

Marks:[2.50]

Q.No.21: The sum of all the two-digit odd numbers is

A. 2475

B. 2530

C. 4905

D. 5049

Marks:[2.50]

Q.No.22: The sum of the first *n* terms of the series $\frac{1}{2}+\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+\ldots$ is equal to

A. 2^n-n-1

B. $1-2^{-n}$

C. $2^{-n}+n-1$

D. 2^n-1

Marks:[2.50]

Q.No.23: Consider the following in respect of sets *A* and *B*:

1. $(A-B)\cup B=A$
2. $(A-B)\cup A=A$
3. $(A-B)\cap B=\phi$
4. $A\subseteq B\Rightarrow A\cup B=B$

Which of the above are correct?

A. 1, 2 and 3

B. 2, 3 and 4

C. 1, 3 and 4

D. 1, 2 and 4

Marks:[2.50]

Q.No.24: In the binary equation $(1p101)_2+(10q1)_2=(100r00)_2$ where *p, q* and *r* are binary digits, what are the possible value of *p, q* and *r*, respectively?

A. 0, 1, 0

B. 1, 1, 0

C. 0, 0, 1

D. 1, 0, 1

Marks:[2.50]

Q.No.25: If $S=\{x\ :x^2+1=0,\ x\ \text{is real}\}$, then *S* is

A. {– 1}

B. {0}

C. {1}

D. An empty set

Marks:[2.50]

Q.No.26: The expansion of $(x-y)^n,\ n\geq 5$ is done in the descending powers of *x*. If the sum of the fifth and sixth terms is zero, then $\frac{x}{y}$ is equal to

A. $\frac{n-5}{6}$

B. $\frac{n-4}{5}$

C. $\frac{5}{n-4}$

D. $\frac{6}{n-5}$

Marks:[2.50]

Q.No.27: If $A = \begin{bmatrix} \alpha & 2 \\ 2 & \alpha \end{bmatrix}$ and $\det\left(A^3\right) = 125$ then α is equal to

A. ± 1

B. ± 2

C. ± 3

D. ± 5

Marks:[2.50]

Q.No.28: If *B* is a non-singular matrix and *A* is a square matrix, then the value of $\det\left(B^{-1}AB\right)$ is equal to

A. det(*B*)

B. det(*A*)

C. det(B^{-1})

D. det(A^{-1})

Marks:[2.50]

Q.No.29: If $a \neq b \neq c$, then one value of *x* which satisfies the equation $\begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix} = 0$ is given by ;

A. *a*

B. *b*

C. *c*

D. 0

Marks:[2.50]

Q.No.30: $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$ then what is AA^T equal to (where A^T is the transpose of A)?

A. Null matrix

B. Identity matrix

C. A

D. $-A$

Marks:[2.50]

Q.No.31: The equations

$x + 2y + 3z = 1$

$2x + y + 3z = 2$

$5x + 5y + 9z = 4$

A. have the unique solution

B. have Infinitely many solutions

C. are in inconsistent

D. None of these

Marks:[2.50]

Q.No.32: $A = \begin{bmatrix} x+y & y \\ x & x-y \end{bmatrix}$, $B = \begin{bmatrix} 3 \\ -2 \end{bmatrix}$ and $C = \begin{bmatrix} 4 \\ -2 \end{bmatrix}$.

If $AB = C$, then what is A^2 equal to?

A. $\begin{bmatrix} 4 & 8 \\ -4 & -16 \end{bmatrix}$

B. $\begin{bmatrix} 4 & -4 \\ 8 & -16 \end{bmatrix}$

C. $\begin{bmatrix} -4 & -8 \\ 4 & 12 \end{bmatrix}$

D. $\begin{bmatrix} -4 & -8 \\ 8 & 12 \end{bmatrix}$

Marks:[2.50]

Q.No.33: What is the value of the determinant $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+xyz & 1 \\ 1 & 1 & 1+xyz \end{vmatrix}$?

A. $1 + x + y + z$

B. $2xyz$

C. $x^2\ y^2\ z^2$

D. $2x^2\ y^2\ z^2$

Marks:[2.50]

Q.No.34: If then $\begin{vmatrix} x & y & 0 \\ 0 & x & y \\ y & 0 & x \end{vmatrix}$ = 0, then which one of the following is correct?

A. $\frac{x}{y}$ is one of the cube root of unity

B. x is one of the cube roots of Unity

C. y is one of the cube roots of unity

D. $\frac{x}{y}$ is one of the cube root of –1

Marks:[2.50]

Q.No.35: Consider the set A of all matrices of order 3 × 3 with entire 0 or 1 only. Let B be the subset of A consisting of all matrices whose determinant is 1. Let C be the subset of A consisting of all matrices whose determinant is –1. Then which one of the following is correct?

A. C is empty

B. B has as many elements as C

C. $A = B \cup C$

D. B has thrice as many elements as C

Marks:[2.50]

Q.No.36: If $A = \begin{bmatrix} \cos\ \theta & \sin\ \theta \\ -\sin\ \theta & \cos\ \theta \end{bmatrix}$; then what is A^3 equal to?

A. $\begin{bmatrix} \cos\ 3\theta & \sin\ 3\theta \\ -\sin\ 3\theta & \cos\ 3\theta \end{bmatrix}$

B. $\begin{bmatrix} \cos^3\ \theta & \sin^3\ \theta \\ -\sin^3\ \theta & \cos^3\ \theta \end{bmatrix}$

C. $\begin{bmatrix} \cos\ 3\theta & -\sin\ 3\theta \\ \sin\ 3\theta & \cos\ 3\theta \end{bmatrix}$

D. $\begin{bmatrix} \cos^3\ \theta & -\sin^3\ \theta \\ \sin^3\ \theta & \cos^3\ \theta \end{bmatrix}$

Marks:[2.50]

Q.No.37: What is the order of $\begin{bmatrix} x & y & z \end{bmatrix} \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$?

A. 3 × 1
B. 1 × 1
C. 1 × 3
D. 3 × 3

Marks:[2.50]

Q.No.38: If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, then the value of A^4 is

A. $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
B. $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$
C. $\begin{bmatrix} 0 & 0 \\ 1 & 1 \end{bmatrix}$
D. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

Marks:[2.50]

Q.No.39: If
$\sin\ A = \frac{3}{5},\ \text{where}\ 450^\circ < A < 540^\circ$

, then $\cos\ \frac{A}{2}$ is equal to

A. $\frac{1}{\sqrt{10}}$
B. $-\sqrt{\frac{3}{10}}$
C. $\frac{\sqrt{3}}{\sqrt{10}}$
D. None of these

Marks:[2.50]

Q.No.40: What is $\frac{1}{\sin\ 10^\circ} - \frac{\sqrt{3}}{\cos\ 10^\circ}$ equal to?

A. 0

B. 1
C. 2
D. 4

Marks:[2.50]

Q.No.41: From the top of a lighthouse, 100 m high, the angle of depression of a boat is $\tan^{-1}\left(\frac{5}{12}\right)$. What is the distance between the boat and the lighthouse?

A. 120 m
B. 180 m
C. 240 m
D. 360 m

Marks:[2.50]

Q.No.42: The maximum value of $\sin\left(x+\frac{\pi}{6}\right)+\cos\left(x+\frac{\pi}{6}\right)$ in the interval $\left(0,\ \frac{\pi}{2}\right)$ is attained at

A. $\frac{\pi}{12}$
B. $\frac{\pi}{6}$
C. $\frac{\pi}{3}$
D. $\frac{\pi}{2}$

Marks:[2.50]

Q.No.43: If $K=\sin\left(\frac{\pi}{18}\right)\sin\left(\frac{5\pi}{18}\right)\sin\left(\frac{7\pi}{18}\right)$, then what is the value of *K*?

A. $\frac{1}{2}$
B. $\frac{1}{4}$
C. $\frac{1}{8}$
D. $\frac{1}{16}$

Marks:[2.50]

Q.No.44: The expression $\frac{\sin\alpha+\sin\beta}{\cos\alpha+\cos\beta}$ is equal to

A. $\tan\left(\frac{\alpha+\beta}{2}\right)$
B. $\cot\left(\frac{\alpha+\beta}{2}\right)$

C. $\sin\left(\frac{\alpha+\beta}{2}\right)$

D. $\cos\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha+\beta}{2}\right)$

Marks:[2.50]

Q.No.45: If sin θ = 3sin (θ + 2α), then the value of tan(θ + α) + 2 tanα is equal to

A. −1

B. 0

C. 1

D. 2

Marks:[2.50]

Q.No.46: What is the value of tan18°?

A. $\frac{\sqrt{5}-1}{\sqrt{10+2\sqrt{5}}}$

B. $\frac{\sqrt{5}-1}{\sqrt{10+\sqrt{5}}}$

C. $\frac{\sqrt{10+2\sqrt{5}}}{\sqrt{5-1}}$

D. $\frac{\sqrt{10+\sqrt{5}}}{\sqrt{5-1}}$

Marks:[2.50]

Q.No.47: Let *x, y, z* be positive real numbers such that *x, y, z* are in GP and $\tan^{-1} x,\ \tan^{-1} y \text{ and } \tan^{-1} z$ are in AP. Then which one of the following is correct?

A. $x = y = z$

B. $xz = 1$

C. $x \neq y$ and $y = z$

D. $x = y$ and $y \neq z$

Marks:[2.50]

Q.No.48: If tan(α + β) = 2 and tan (α – β) = 1, then tan (2α) is equal to

A. –3

B. –2

C. $-\frac{1}{3}$

D. 1

Marks:[2.50]

Q.No.49: Consider the following of triangle *ABC*:

(a) $\sin\left(\frac{B+C}{2}\right) = \cos\left(\frac{A}{2}\right)$

(b) $\tan\left(\frac{B+C}{2}\right) = \cot\left(\frac{A}{2}\right)$

(c) sin (*B* + *C*) = cos *A*

(d) tan (*B* + *C*) = –cot *A*

Which of the above are correct?

A. a and c

B. a and b

C. a and d

D. b and c

Marks:[2.50]

Q.No.50: If sec θ – cosec θ = $\frac{4}{3}$, then what is (sin θ – cos θ) equal to?

A. –2 only

B. $\frac{1}{2}$ only

C. Both –2 and $\frac{1}{2}$

D. Neither $\frac{1}{2}$ nor – 2

Marks:[2.50]

Q.No.51: If a vertex of a triangle is (1, 1) and the midpoints of two sides of the triangle through this vertex are (–1, 2) and (–3, 2), then the centroid of the triangle is

A. $\left(-\frac{1}{3}, \frac{7}{3}\right)$

B. $\left(-1, \frac{7}{3}\right)$

C. $\left(\frac{1}{3}, \frac{7}{3}\right)$

D. $\left(1, \frac{7}{3}\right)$

Marks:[2.50]

Q.No.52: The incentre of a triangle with vertices $A(1, \sqrt{3})$, $B(0, 0)$, and $C(2, 0)$ is

A. $\left(1, \frac{\sqrt{3}}{2}\right)$

B. $\left(\frac{2}{3}, \frac{1}{\sqrt{3}}\right)$

C. $\left(\frac{2}{3}, \frac{\sqrt{3}}{2}\right)$

D. $\left(1, \frac{1}{\sqrt{3}}\right)$

Marks:[2.50]

Q.No.53: If the three consecutive vertices of a parallelogram are (–2, –1), (1, 0) and (4, 3), then what are the coordinates of the fourth vertex?

A. (1, 2)

B. (1, 0)

C. (0, 0)

D. (1, –1)

Marks:[2.50]

Q.No.54: The two circles $x^2 + y^2 = r^2$ and $x^2 + y^2 - 10x + 16 = 0$ intersect at two distinct points. Then which one of the following is correct?

A. $2 < r < 8$

B. $r = 2$ or $r = 8$

C. $r < 2$

D. $r > 2$

Marks:[2.50]

Q.No.55: What is the equation of the circle which passes through the points (3, –2) and (–2, 0) and having its centre on the line $2x - y - 3 = 0$?

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. $x^2 + y^2 = 5$

Marks:[2.50]

Q.No.56: What is the ratio in which the point $C\left(-\frac{2}{7}, -\frac{20}{7}\right)$ divides the line joining the points $A(-2, -2)$ and $B(2, -4)$?

A. 1 : 3

B. 3 : 4

C. 1 : 2

D. 2 : 3

Marks:[2.50]

Q.No.57: What is the equation of the ellipse having foci (±2, 0) and the eccentricity $\frac{1}{4}$?

A. $\frac{x^2}{64} + \frac{y^2}{60} = 1$

B. $\frac{x^2}{60} + \frac{y^2}{64} = 1$

C. $\frac{x^2}{20} + \frac{y^2}{24} = 1$

D. $\frac{x^2}{24} + \frac{y^2}{20} = 1$

Marks:[2.50]

Q.No.58: What is the equation of the straight line parallel to $2x + 3y + 1 = 0$ and passes through the point (–1, 2)?

A. $2x + 3y - 4 = 0$

B. $2x + 3y - 5 = 0$

C. $x + y - 1 = 0$

D. $3x - 2y + 7 = 0$

Marks:[2.50]

Q.No.59: What is the acute angle between the pair of straight lines $\sqrt{2}x + \sqrt{3}y = 1$ and $\sqrt{3}x + \sqrt{2}y = 2$?

A. $\tan^{-1}\left(\frac{1}{2\sqrt{6}}\right)$

B. $\tan^{-1}\left(\frac{1}{\sqrt{2}}\right)$

C. $\tan^{-1}(3)$

D. $4\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Marks:[2.50]

Q.No.60: If the centroid of a triangle formed by (7, *x*), (*y*, –6) and (9, 10) is (6, 3), then the values of *x* and *y* are respectively

A. 5, 2

B. 2, 5

C. 1, 0

D. 0, 0

Marks:[2.50]

Q.No.61: A straight line with direction cosines $< 0,\ 1,\ 0>$ is

A. parallel to *x*-axis

B. parallel to *y*-axis

C. parallel to *z*-axis

D. equally inclined to all the axes

Marks:[2.50]

Q.No.62: (0, 0 , 0), (a, 0, 0), (0, b, 0) and (0, 0, c) are four distinct points. What are the coordinates of the point, which is equidistant from the four points?

A. $\left(\frac{a+b+c}{3},\ \frac{a+b+c}{3},\ \frac{a+b+c}{3}\right)$

B. *(a, b, c)*

C. $\left(\frac{a}{2},\ \frac{b}{2},\ \frac{c}{2}\right)$

D. $\left(\frac{a}{3},\ \frac{b}{3},\ \frac{c}{3}\right)$

Marks:[2.50]

Q.No.63: The point *P*(3, 2, 4), Q(4, 5, 2), *R*(5, 8, 0) and S(2, –1, 6) are

A. vertices of a rhombus which is not a square

B. non-coplanar

C. collinear

D. coplanar but not collinear

Marks:[2.50]

Q.No.64: The line passing through the points (1, 2, –1) and (3, –1, 2) meets the *yz*-plane at which one of the following points?

A. $\left(0, -\frac{7}{2}, \frac{5}{2}\right)$

B. $\left(0, \frac{7}{2}, \frac{1}{2}\right)$

C. $\left(0, -\frac{7}{2}, -\frac{5}{2}\right)$

D. $\left(0, \frac{7}{2}, -\frac{5}{2}\right)$

Marks:[2.50]

Q.No.65: Under which one of the following conditions, are the lines $x = ay + b$; $z = cy + d$ and $x = ey + f$; $z = gy + h$ perpendicular?

A. $ae + cg - 1 = 0$

B. $ae + bf - 1 = 0$

C. $ae + cg + 1 = 0$

D. $ag + ce - 1 = 0$

Marks:[2.50]

Q.No.66: If $\overrightarrow{a} = \hat{i} - \hat{j} + \hat{k}, \quad \overrightarrow{b} = 2\hat{i} + 3\hat{j} + 2\hat{k} \quad \text{and} \quad \overrightarrow{c} = \hat{i} + m\hat{j} + n\hat{k}$, are three coplanar vectors and $\left|\overrightarrow{c}\right| = \sqrt{6}$, then which one of the following is correct?

A. $m = 2$ and $n = \pm 1$

B. $m = \pm 2$ and $n = -1$

C. $m = 2$ and $n = -1$

D. $m = \pm 2$ and $n = 1$

Marks:[2.50]

Q.No.67:

Let *ABCD* be a parallelogram whose diagonals intersect at *P* and let *O* be the origin. What is $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC} + \overrightarrow{OD}$ equal to?

A. $2\overrightarrow{OP}$

B. $4\overrightarrow{OP}$

C. $6\overrightarrow{OP}$

D. $8\overrightarrow{OP}$

Marks:[2.50]

Q.No.68: *ABCD* is a quadrilateral whose diagonals are *AC* and *BD*. Which one of the following is correct?

A. $\overrightarrow{BA} + \overrightarrow{CD} = \overrightarrow{AC} + \overrightarrow{DB}$

B. $\overrightarrow{BA} + \overrightarrow{CD} = \overrightarrow{BD} + \overrightarrow{CA}$

C. $\overrightarrow{BA} + \overrightarrow{CD} = \overrightarrow{AC} + \overrightarrow{BD}$

D. $\overrightarrow{BA} + \overrightarrow{CD} = \overrightarrow{BC} + \overrightarrow{AD}$

Marks:[2.50]

Q.No.69: If $\vec{a} \times \vec{b} = \vec{c}$ and $\vec{b} \times \vec{c} = \vec{a}$, then which one of the following is correct?

A. $\vec{a}, \vec{b}, \vec{c}$ are orthogonal in pairs and $\left|\vec{a}\right| = \left|\vec{c}\right|$ and $\left|\vec{b}\right| = 1$

B. $\vec{a}, \vec{b}, \vec{c}$ are non-orthogonal to each other

C. $\vec{a}, \vec{b}, \vec{c}$ are orthogonal in pairs but $\left|\vec{a}\right| \neq \left|\vec{c}\right|$

D. $\vec{a}, \vec{b}, \vec{c}$ are orthogonal in pairs but $\left|\vec{b}\right| \neq 1$

Marks:[2.50]

Q.No.70: If $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{b} = 3\hat{i} + 2\hat{j} - \lambda\hat{k}$ are perpendicular, then what is the value of λ?

A. 2

B. 3

C. 4

D. 5

Marks:[2.50]

Q.No.71: What is $\lim_{x \to 0} \frac{e^x - (1+x)}{x^2}$ equal to?

A. 0

B. $\frac{1}{2}$

C. 1

D. 2

Marks:[2.50]

Q.No.72: What is $\int_0^{\frac{\pi}{2}} \frac{d\theta}{1+\cos\theta}$ equal to?

A. $\frac{1}{2}$

B. 1

C. $\sqrt{3}$

D. None of these

Marks:[2.50]

Q.No.73: What is $\int \frac{dx}{x(x^7+1)}$ equal to?

A. $\frac{1}{2}\text{In}\left|\frac{x^7-1}{x^7+1}\right|+c$

B. $\frac{1}{7}\text{In}\left|\frac{x^7+1}{x^7}\right|+c$

C. $\text{In}\left|\frac{x^7-1}{7x}\right|+c$

D. $\frac{1}{7}\text{In}\left|\frac{x^7}{x^7+1}\right|+c$

Marks:[2.50]

Q.No.74: The function *f* : *X* → *Y* defined by *f*(*x*) = cos *x*, where *x* ∈ *X*, is one-one and onto if *X* and *Y* are respectively equal to

A. [0, π] and [–1, 1]

B. $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ and [–1, 1]

C. [0, π] and [–1, 1]

D. [0, π] and [0, 1]

Marks:[2.50]

Q.No.75: If (*x*) = $\frac{x}{x-1}$, then what is $\frac{f(a)}{f(a+1)}$ equal to?

A. $f\left(-\frac{a}{a+1}\right)$

B. $f\left(a^2\right)$

C. $f\left(\frac{1}{a}\right)$

D. *f*(–*a*)

Marks:[2.50]

Q.No.76: What is $\int \frac{\left(x^{e-1}+e^{x-1}\right)dx}{x^e+e^x}$ equal to?

A. $\frac{x^2}{2}+c$

B. In $(x + e) + c$

C. $\ln\ \left(x^e+e^x\right)+c$

D. $\frac{1}{e}\ \ln\ \left(x^e+e^x\right)+c$

Marks:[2.50]

Q.No.77: Let $f:[-6,6]\to\mathbb{R}$ be defined by $f\left(x\right)=x^2-3$. Consider the following:

1. $\left(f\circ f\circ f\right)\ \left(-1\right)=\left(f\circ f\circ f\right)\ \left(1\right)$

2. $\left(f\circ f\circ f\right)\ \left(-1\right)-4\ \left(f\circ f\circ f\right)\ \left(1\right)=\left(f\circ f\right)\ \left(0\right)$

Which of the above is/are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Marks:[2.50]

Q.No.78: Let $f(x) = px + q$ and $g(x) = mx + n$. Then $f(g(x)) = g(f(x))$ is equivalent to

A. $f(p) = g(m)$

B. $f(q) = g(n)$

C. $f(n) = g(q)$

D. $f(m) = g(p)$

Marks:[2.50]

Q.No.79: If $F\left(x\right)=\sqrt{9-x^2}$ = then what is $\lim_{x\to1}\frac{F(x)-F(1)}{x-1}$ equal to?

A. $-\frac{1}{4\sqrt{2}}$

B. $\frac{1}{8}$

C. $-\frac{1}{2\sqrt{2}}$

D. $\frac{1}{2\sqrt{2}}$

Marks:[2.50]

Q.No.80: What is $\frac{d^2x}{dy^2}$ equal to?

A. $-\left(\frac{d^2y}{dx^2}\right)^{-1}\left(\frac{dy}{dx}\right)^{-3}$

B. $\left(\frac{d^2y}{dx^2}\right)^{-1}\left(\frac{dy}{dx}\right)^{-2}$

C. $-\left(\frac{d^2y}{dx^2}\right)\left(\frac{dy}{dx}\right)^{-3}$

D. $\left(\frac{d^2y}{dx^2}\right)^{-1}$

Marks:[2.50]

Q.No.81: Let $F(x) : \begin{cases} x, & x \text{ is rational} \\ 0, & x \text{ is irrational} \end{cases}$ and $g(x) : \begin{cases} 0, & x \text{ is rational} \\ x, & x \text{ is irrational} \end{cases}$

If $f : \mathbb{R} \to \mathbb{R}$ and $g : \mathbb{R} \to \mathbb{R}$, then $(f - g)$ is

A. one-one and into

B. neither one-one nor onto

C. many one and onto

D. one-one and onto

Marks:[2.50]

Q.No.82: What is the length of the longest interval in which the function $f(x) = 3 \sin x - 4 \sin^3 x$ is increasing?

A. $\frac{\pi}{3}$

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{2}$

D. π

Marks:[2.50]

Q.No.83: If $x\,dy = y(dx + y\,dy)$; $y(1) = 1$ and $y(x) > 0$, then what is $y(-3)$ equal to?

A. 3

B. 2

C. 1

D. 0

Marks:[2.50]

Q.No.84: What is the maximum value of the function $f(x) = 4 \sin^2 x + 1$?

A. 5

B. 3

C. 2

D. 1

Marks:[2.50]

Q.No.85: Let $f(x)$ be an indefinite integral of $\sin^2 x$.
Consider the following statements:
Statement 1: The function $f(x)$ satisfies $f(x + \pi) = f(x)$ for all real x.
Statement 2: $\sin^2(x + \pi) = \sin^2 x$ for all real x.
Which one of the following is correct with respect to the above statements?

A. Both the statements are true and Statement 2 is the correct explanation of Statement 1

B. Both the statements are true but Statement 2 is not the correct explanation of Statement 1

C. Statement 1 is true but Statement 2 is false

D. Statement 1 is false but Statement 2 is true

Marks:[2.50]

Q.No.86: What are the degree and order respectively of the differential equation $y = x\left(\frac{dy}{dx}\right)^2 + \left(\frac{dx}{dy}\right)^2$?

A. 1, 2

B. 2, 1

C. 1, 4

D. 4, 1

Marks:[2.50]

Q.No.87: What is the differential equation corresponding to $y^2 - 2ay + x^2 = a^2$ by eliminating a?

A. $\left(x^2 - 2y^2\right)p^2 - 4\,pxy - x^2 = 0$

B. $\left(x^2 - 2y^2\right)p^2 + 4\,pxy - x^2 = 0$

C. $\left(x^2 + 2y^2\right)p^2 - 4\,pxy - x^2 = 0$

D. $\left(x^2 + 2y^2\right)p^2 - 4\,pxy + x^2 = 0$

Where $p = \frac{dy}{dx}$

Marks:[2.50]

Q.No.88: What is the general solution of the differential equation $ydx - \left(x + 2y^2\right) dy = 0$?

A. $x = y^2 + cy$

B. $x = 2cy^2$

C. $x = 2y^2 + cy$

D. None of these

Marks:[2.50]

Q.No.89: Let $f(x + y) = f(x)\, f(y)$ for all x and y. Then what is $f'(5)$ equal to [where $f'(x)$ is the derivative of $f(x)$]?

A. $f(5)\, f'(0)$

B. $f(5) - f'(0)$

C. $f(5)\, f(0)$

D. $f(5) + f'(0)$

Marks:[2.50]

Q.No.90: If $f(x)$ and $g(x)$ are continuous functions satisfying $f(x) = f(a - x)$ and $g(x) + g(a - x) = 2$, then what is $\int_0^a f(x)\, g(x)\, dx$ equal to?

A. $\int_0^a g(x)\, dx$

B. $\int_0^a f(x)\, dx$

C. $2\int_0^a f(x)\, dx$

D. 0

Marks:[2.50]

Q.No.91: What is the solution of the differential equation $\ln\left(\frac{dy}{dx}\right) - a = 0$?

A. $y = xe^a + c$

B. $x = ye^a + c$

C. $y = \ln x + c$

D. $x = \ln y + c$

Marks:[2.50]

Q.No.92: Let $f(x)$ be defined as follows:

$$f(x) = \begin{cases} 2x + 1, & -3 < x < -2 \\ x - 1, & -2 \le x < 0 \\ x + 2, & 0 \le x < 1 \end{cases}$$

Which one of the following statements is correct with respect to the above function?

A. It is discontinuous at $x = -2$ but continuous at every other point.

B. It is continuous only in the interval (−3, −2).

C. It is discontinuous at $x = 0$ but continuous at every other point.

D. It is discontinuous at every point

Marks:[2.50]

Q.No.93: Consider the following statements

1. If $\lim_{x \to a} f(x)$ and $\lim_{x \to a} g(x)$ both exist, then $\lim_{x \to a} \{f(x)\, g(x)\}$ exists.
2. If $\lim_{x \to a} \{f(x)\, g(x)\}$ exists, then both $\lim_{x \to a} f(x)$ and $\lim_{x \to a} g(x)$ and must exist.

Which of the above statement is/are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Marks:[2.50]

Q.No.94: Which one of the following functions is neither even nor odd?

A. $x^2 - 1$

B. $x + \frac{3}{x}$

C. $|x|$

D. $x^2 (x - 3)$

Marks:[2.50]

Q.No.95: What is the derivative of $\log_{10} (5x^2 + 3)$ with respect to x?

A. $\frac{x \log_{10} e}{5x^2+3}$

B. $\frac{2x \log_{10} e}{5x^2+3}$

C. $\frac{10x \log_{10} e}{5x^2+3}$

D. $\frac{10x \log_{10} 10}{5x^2+3}$

Marks:[2.50]

Q.No.96: Let $f(a) = \frac{a-1}{a+1}$.

Consider the following:

1. $f(2a) = f(a) + 1$
2. $f\left(\frac{1}{a}\right) = -f(a)$

Which of the above is/are correct?

A. 1 only
B. 2 only
C. Both 1 and 2
D. Neither 1 nor 2

Marks:[2.50]

Q.No.97: What is the maximum area of a triangle that can be inscribed in a circle of radius *a*?

A. $\frac{3a^2}{4}$
B. $\frac{a^2}{2}$
C. $\frac{3\sqrt{3}a^2}{4}$
D. $\frac{\sqrt{3}a^2}{4}$

Marks:[2.50]

Q.No.98: Let $f(x) = x + \frac{1}{x},\ \text{where}\ x \in\ (0,\ 1)$. Which one of the following is correct?

A. *f*(*x*) fluctuates in the interval
B. *f*(*x*) increases in the interval
C. *f*(*x*) decreases in the interval
D. None of these

Marks:[2.50]

Q.No.99: Suppose the function $f(x) = x^n,\ n \neq 0$ is differentiable for all *x*. Then *n* can be any element of the interval

A. [1, ∞)
B. (0, ∞)
C. $\left(\frac{1}{2},\ \infty\right)$
D. None of these

Marks:[2.50]

Q.No.100: What is $\int_{e^{-1}}^{e^2} \left|\frac{\ln x}{x}\right| dx$ equal to?

A. $\frac{3}{2}$

B. $\frac{5}{2}$

C. 3

D. 4

Marks:[2.50]

Q.No.101: The variance of 20 observations is 5. If each observation is multiplied by 3, then what is the new variance of the resulting observations?

A. 5

B. 10

C. 15

D. 45

Marks:[2.50]

Q.No.102: The mean of a group of 100 observations was found to be 20. Later it was found that four observations were incorrect, which were recorded as 21, 21, 18 and 20. What is the mean if the incorrect observations are omitted?

A. 18

B. 20

C. 21

D. 22

Marks:[2.50]

Q.No.103: A committee of two persons is constituted from two men and two women. What is the probability that the committee will have only women?

A. $\frac{1}{6}$

B. $\frac{1}{3}$

C. $\frac{1}{2}$

D. $\frac{2}{3}$

Marks:[2.50]

Q.No.104: A question is given to three students *A, B* and *C* whose chance of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. What is the probability that the question will be solved?

A. $\frac{1}{24}$

B. $\frac{1}{4}$

C. $\frac{3}{4}$

D. $\frac{23}{24}$

Marks:[2.50]

Q.No.105: The mean weight of 150 students in a certain class is 60 kg. The mean weight of boys in the class is 70 kg and that of girls is 55 kg. What is the number of boys in the class?

A. 50

B. 55

C. 60

D. 100

Marks:[2.50]

Q.No.106: For two dependent events, *A* and *E*, it is given that *P*(*A*) = 0.2 and *P*(*B*) = 0.5. If $A \subseteq B$, then the value of conditional probabilities $P(A|B)$ and $P(B|A)$ are respectively

A. $\frac{2}{3}, \frac{3}{5}$

B. $\frac{2}{5}, 1$

C. $1, \frac{2}{5}$

D. Information is insufficient

Marks:[2.50]

Q.No.107: A point is chosen at random inside a circle. What is the probability that the point is closer to the centre of the circle then to its boundary?

A. $\frac{1}{5}$

B. $\frac{1}{4}$

C. $\frac{1}{3}$

D. $\frac{1}{2}$

Marks:[2.50]

Q.No.108: If two regression lines between height (*x*) and weight (*y*) are 4*y* – 15*x* + 410 = 0 and 30 *x* – 2*y* – 825 = 0, then what will be the correlation coefficient between height and weight?

A. $\frac{1}{3}$

B. $\frac{1}{2}$

C. $\frac{2}{3}$

D. $\frac{3}{4}$

Marks:[2.50]

Q.No.109: In an examination, 40% of candidates get second class. When the data are represented by a pie chart, what is the angle corresponding to the second class?

A. 40°

B. 90°

C. 144°

D. 320°

Marks:[2.50]

Q.No.110: Consider the following statements:
Statement 1: Range is not a good measure of dispersion
Statement 2: Range is highly affected by the existence of extreme values

Which one of the following is correct in respect of the above statements?

A. Both Statement 1 and Statement 2 are correct and Statement 2 is the correct explanation of Statement 1

B. Both Statement 1 and Statement 2 are correct but Statement 2 is not the correct explanation of Statement 1

C. Statement 1 is correct but Statement 2 is not correct

D. Statement 2 is correct but Statement 1 is not correct

Marks:[2.50]

Q.No.111: A card is drawn from a well shuffled ordinary deck of 52 cards. What is the probability that it is an ace?

A. $\frac{1}{13}$

B. $\frac{2}{13}$

C. $\frac{3}{13}$

D. $\frac{1}{52}$

Marks:[2.50]

Q.No.112: If the data is moderately non-symmetrical then which one of the following empirical relationships is correct?

A. 2 × Standard deviation = 5 × Mean deviation

B. 5 × Standard deviation = 2 × Mean deviation

C. 4 × Standard deviation = 5 × Mean deviation

D. 5 × Standard deviation = 4 × Mean deviation

Marks:[2.50]

Q.No.113: Data can be represented in which of the following forms
I. Textual form
II. Tabular form
III Graphical form
Select the correct answer using the code given below.

A. 1 and 2 only

B. 2 and 3 only

C. 1 and 3 only

D. 1, 2 and 3

Marks:[2.50]

Q.No.114: For given statistical data, the graphs for less than ogive and more than ogive are drawn. If the point at which the two curves intersect is *P*, then abscissa of point *P* gives the value of which one of the following measures of central tendency?

A. Median

B. Mean

C. Mode

D. Geometric mean

Marks:[2.50]

Q.No.115: Consider the following statements:
1. Two events are mutually exclusive if the occurrence of one event prevents the occurrence of the other.
2. The probability of the union of two mutually exclusive events is the sum of their individual probabilities
Which of the above statements is/are correct?

A. 1 only

B. 2 only

C. Both 1 and 2

D. Neither 1 nor 2

Marks:[2.50]

Q.No.116: If the regression coefficient of *x* on *y* and *y* on *x* are $-\frac{1}{2}$ and $-\frac{1}{8}$ respectively, then what is the correlation coefficient between *x* and *y*?

A. $-\frac{1}{4}$

B. $-\frac{1}{16}$

C. $\frac{1}{16}$

D. $\frac{1}{4}$

Marks:[2.50]

Q.No.117: A sample of 5 observations has mean 32 and median 33. Later it is found that an observation was recorded incorrectly as 40 instead of 35. If we correct the data, then which one of the following is correct?

A. The mean and median remain the same

B. The median remains the same but the mean will decrease

C. The mean and median both will decrease

D. The mean remains the same but median will decrease

Marks:[2.50]

Q.No.118: If two fair dice are thrown, then what is the probability that the sum is neither 8 nor 9?

A. $\frac{1}{6}$

B. $\frac{1}{4}$

C. $\frac{3}{4}$

D. $\frac{5}{6}$

Marks:[2.50]

Q.No.119: Let *A* and *B* are two mutually exclusive events with *P*(*A*) = $\frac{1}{3}$ and *P*(*B*) = $\frac{1}{4}$. What is the value of $P\left(\overline{A} \cap \overline{B}\right)$

A. $\frac{1}{6}$

B. $\frac{1}{4}$

C. $\frac{1}{3}$

D. $\frac{5}{12}$

Marks:[2.50]

Q.No.120: The mean and standard deviation of a binomial distribution are 12 and 2 respectively. What is the number of trials?

A. 2

B. 12

C. 18

D. 24

Marks:[2.50]