SATISH SCIENCE ACADEMY
DHANORI PUNE - 411015

Maths nda
COMPETITIVE EXAMS - NDA

Time Allowed: 2 hours and 30 minutes

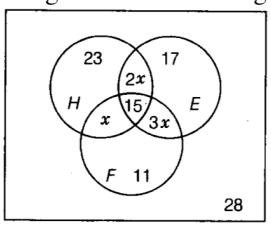
Maximum Marks : 300

General Instructions:

- All questions are compulsory and carry equal marks.
- This test has 120 questions. If you find more than one correct answer choose the best one. You can choose ONLY ONE response for each question.
- For every wrong attempt, 1/3 marks will be deducted.

Section A

1) In a class, 3 languages are offered mainly Hindi, English and French. The total number of students learning French is 46. x denotes the number of students learning Hindi and French but not English, then answer the following using below Venn diagram.



What is the total strength of the class? **[2.5]**

a) 100 b) 124
c) 66 d) 96

2) Two finite sets having m and n elements. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. Find the values of m and n. **[2.5]**

a) 6 and 3 b) 6 and 5
c) 6 and 6 d) 5 and 4

3) If A = 1, 2, 3, then how many elements are there in the power set of A? **[2.5]**

a) 1 b) 4
c) 2 d) 8

4) The inverse of the function$y = 5^{\ln x}$ is **[2.5]**

a) $x = y^{\frac{1}{\ln 5}}, y0$
b) $x = y^{\ln 5}, y0$
c) $x = 5 \ln y, y0$
d) $x = y^{\frac{1}{\ln 5}}, y0$

5) If R is a relation from set A = 2, 4, 5 to set B = 1, 2, 3, 4, 6, 8 defined by xRy⇔ x divides y, then the domain and the range of R are **[2.5]**

a) Domain (R) = 4 and Range (R) = 2, 4, 6, 8
b) Domain (R) = 4 and Range (R) = 2, 4, 6
c) Domain (R) = 2, 4 and Range (R) = 2, 4, 6, 8
d) Domain (R) = 2 and Range (R) = 2, 4, 6

6) If$f(x)y = 2x - x^2$, then what is the value of f(x+2) + f(x - 2) when x = 0 **[2.5]**

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

7) What is the minimum value of$|x - 1|$, where $x \in R$? **[2.5]**

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

8) Let a, b and c be in an AP. Consider the following statements
   i. $\frac{1}{ab}, \frac{1}{ca}$ and $\frac{1}{bc}$ are in an AP.
   ii. $\frac{1}{\sqrt{b}+\sqrt{c}}, \frac{1}{\sqrt{c}+\sqrt{a}}$ and $\frac{1}{\sqrt{a}+\sqrt{b}}$ are in AP.

Which of the above statement(s) is/are correct? **[2.5]**

a) Neither I nor II b) Only II
c) Only I d) Both I and II

9) If a, b, c are in AP or GP or HP, then$\frac{a-b}{b-c}$ is equal to **[2.5]**

a) $\frac{b}{a}$ or 1 or $\frac{b}{c}$
b) 1 or$\frac{a}{b}$ or $\frac{c}{a}$
c) $\frac{c}{a}$ or $\frac{c}{b}$ or 1
d) 1 or$\frac{a}{b}$ or $\frac{a}{c}$

10) The sum of (p + q)th and (p - q)th terms of an AP is equal to **[2.5]**

a) Twice the qth term b) (2p)th term
c) (2q)th term d) Twice the pth term

11) What is the fourth term of an AP of n terms whose sum is n(n + 1)? **[2.5]**

a) 20 b) 12
c) 6 d) 8

12) What is the sum of the series 0.3 + 0.33 + 0.333 + ... n terms? **[2.5]**

a) $\frac{1}{3}\left[n - \frac{1}{3}\left(1 - \frac{1}{10^n}\right)\right]$
b) $\frac{1}{3}\left[n - \frac{1}{9}\left(1 + \frac{1}{10^n}\right)\right]$
c) $\frac{1}{3}\left[n - \frac{1}{9}\left(1 - \frac{1}{10^n}\right)\right]$
d) $\frac{1}{3}\left[n - \frac{2}{9}\left(1 - \frac{1}{10^n}\right)\right]$

13) If z = 1 +$i\sqrt{3}$, then |arg (z)| + |arg $(\bar{z})$ | is equal to **[2.5]**

a) $\frac{\pi}{2}$ b) $\frac{\pi}{3}$
c) 0 d) $\frac{2\pi}{3}$

14) The modulus of the complex number$z = \frac{(1-i\sqrt{3})(\cos\theta+i\sin\theta)}{2(1-i)(\cos\theta-i\sin\theta)}$ is **[2.5]**

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

15) The value of i^{2n} + i^{2n+1} + i^{2n+2} + i^{2n+3}, where i = $\sqrt{-1}$, is **[2.5]**

a) - i b) I
c) 0 d) 1

16) Let z_1, z_2 and z_3 be non - zero complex numbers satisfying $z^2 = i\bar{z}$, where i = $\sqrt{-1}$.
Consider the following statements
   i. $Z_1z_2z_3$ is purely imaginary.
   ii. $Z_1z_2 + z_2z_3 + z_3z_1$ is purely real.

Which of the above statement(s) is/are correct? **[2.5]**
a) Only II b) Neither I nor II
c) Both I and II d) Only I

17) If x^2 - ax + b = 0 and x^2 - px + q = 0 have a root in common and the second equation has equal roots, then **[2.5]**
a) B + q = $\frac{ap}{4}$ b) B + q = ap
c) B + q = 2ap d) B + q = $\frac{ap}{2}$

18) Consider the following statements in respect of the quadratic equation 4(x - p)(x - q) - r^2 = 0, where p, q and r are real numbers.
i. The roots are real.
ii. The roots are equal, if p = q and r = 0.
Which of the above statements is/are correct? **[2.5]**
a) Only II b) Both I and II
c) Only I d) Neither I nor II

19) The set of real values of x satisfying the inequality |x^2 + x - 6| < 6 is **[2.5]**
a) $(-4,-1)\cup(0,3)$ b) $(-4,-3)\cup(2,3)$
c) (- 4, 3) d) (- 3, 2)

20) If one of the roots of the equation a(b - c) x^2 + b(c - a) x + c(a - b) = 0 is 1, then what is the second root? **[2.5]**
a) $-\frac{b(c-a)}{a(b-c)}$
b) $\frac{b(c-a)}{a(b-c)}$
c) $-\frac{c(a-b)}{a(b-c)}$
d) $\frac{c(a-b)}{a(b-c)}$

21) 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? **[2.5]**
a) 3382 b) 4444
c) 4044 d) 2664

22) What is the number of triangles that can be formed by choosing the vertices from a set of 12 points in a plane, seven of which lie on the same straight line? **[2.5]**
a) 185 b) 115
c) 175 d) 105

23) What is the number of 6 - digit numbers that can be formed only by using 0, 1, 2, 3, 4 and 5 (each one), and divisible by 6? **[2.5]**
a) 96 b) 312
c) 192 d) 120

24) There are 20 persons among whom two are brothers. Find the number of ways in which we can arrange them around a circle, so that there is exactly one person between the two brothers. **[2.5]**
a) 18! b) $18\times17!$
c) $2\times18!$ d) 17!

25) In the expansion of $\left(x+\frac{1}{x}\right)^{2n}$, what is the (n + 1)th term from the end (when arranged in descending powers of x)? **[2.5]**
a) C(2n, n)x b) C(2n, n)
c) C(2n, n - 1)x d) C(2n, n - 1)

26) Consider the binomial expansion of $(p+qx)^9$.
What is the ratio of the coefficients of middle terms in the expansion (when expanded in ascending powers of x? **[2.5]**
a) $\frac{p}{q}$ b) Pq
c) $\frac{4p}{5q}$ d) $\frac{1}{(pq)}$

27) If $\left(1+x-2x^2\right)^6 = 1+a_1x+a_2x^2+\ldots+a_{12}x^{12}$, then consider the following statements.
i. $a_2+a_4+a_6+\ldots+a_{12}=31$
$endmatha_1+a_3+a_5+\ldots+a_{11}=-31$
Which of the above statement(s) is/are correct? **[2.5]**
a) Only II b) Neither I nor II
c) Only I d) Both I and II

28) The domain of the function f defined by f(x) = $\log_x 10$ is **[2.5]**
a) X > 0 excluding x = 10
b) X≥ 10
c) X > 0 excluding x = 1
d) X > 10

29) What is $\frac{1}{\log_2 N}+\frac{1}{\log_3 N}+\frac{1}{\log_4 N}+\ldots+\frac{1}{\log_{100} N}$ equal to $(N\neq1)$? **[2.5]**
a) $\frac{99}{\log_{100!} N}$
b) $\frac{99}{\log_{99!} N}$
c) $\frac{1}{\log_{99!} N}$
d) $\frac{1}{\log_{100!} N}$

30) If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ then x is equal to **[2.5]**
a) 0 b) 6
c) ± 6 d) - 6

31) Let the points A (1, 3) and B (0, 0) D(k, 0) form a triangle, using determinants find the value of k such that area of△ ABD is 3 sq. units. **[2.5]**
a) ± 2 b) - 2
c) 4 d) 2

32) If A = $\begin{bmatrix} 1 & 2 & x \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and B = $\begin{bmatrix} 1 & -2 & y \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ and AB = I_3, then x + y equals **[2.5]**
a) - 1 b) 0
c) 1 d) 2

33) If B is non - singular matrix and A is a square matrix, then det (B^{-1}AB) is equal to **[2.5]**
a) Det (A) b) Det (B)
c) Det(A^{-1}) d) Det (B^{-1})

34) The transformation due to reflection of (x, y) through the origin is described by the matrix. **[2.5]**
a) $\begin{vmatrix} -1 & 0 \\ 0 & -1 \end{vmatrix}$
b) $\begin{vmatrix} 0 & -1 \\ -1 & 0 \end{vmatrix}$
c) $\begin{vmatrix} 1 & 0 \\ 0 & -1 \end{vmatrix}$
d) $\begin{vmatrix} -1 & 0 \\ 0 & 1 \end{vmatrix}$

35) If $A=\begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ and $A^{-1}=\begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$ then x = ?. **[2.5]**
a) 1 b) - 2
c) $\frac{1}{2}$ d) 2

36) If A is a 3× 3 matrix and |A| = - 2, then value of |A (adj A)| is **[2.5]**
a) - 2 b) 8
c) 2 d) - 8

37) If $A = \begin{vmatrix} -1 & 2 & 4 \\ 3 & 1 & 0 \\ -2 & 4 & 2 \end{vmatrix}$ and $B = \begin{vmatrix} -2 & 4 & 2 \\ 6 & 2 & 0 \\ -2 & 4 & 8 \end{vmatrix}$, then B is given by **[2.5]**
a) B = 4A
b) B = –4A
c) B = 6A
d) B = – A

38) What is the binary equivalent of the decimal number 18.5625? **[2.5]**
a) $(10010.1001)_2$
b) $(10010.10011)_2$
c) $(10011.10001)_2$
d) $(10001.10011)_2$

39) A binary number is represented by $(xxyxxyyyx)_2$, where x >y. What is its decimal equivalent? **[2.5]**
a) $(426)_{10}$
b) $(430)_{10}$
c) $(432)_{10}$
d) $(433)_{10}$

40) What is the binary number equivalent to decimal number 1011? **[2.5]**
a) 1111110011
b) 11111001
c) 1011
d) 111011

41) In a$\triangle ABC$, if sin A - cos B = cos C, then what is B equal to? **[2.5]**
a) $\frac{\pi}{3}$
b) π
c) $\frac{\pi}{4}$
d) $\frac{\pi}{2}$

42) If$A = \sin^2\theta + \cos^4\theta$, then for all real θ , which one of the following is correct? **[2.5]**
a) $\frac{3}{4} \leq A \leq 1$
b) $1 \leq A \leq 2$
c) $\frac{3}{4} \leq A \leq \frac{13}{16}$
d) $\frac{13}{16} \leq A \leq 1$

43) What is cos 80º + cos 40º - cos 20º equal to? **[2.5]**
a) 1
b) - 19
c) 0
d) 2

44) Determine the value of cos 20º cos 40º cos 60º cos 80º. **[2.5]**
a) $\frac{1}{16}$
b) $\frac{1}{4}$
c) $\frac{1}{2}$
d) $\frac{1}{8}$

45) If$p = X\cos\theta - Y\sin\theta, q = X\sin\theta + Y\cos\theta$ and $p^2 + 4pq + q^2 = AX^2 + BY^2$, $0 \leq \theta \leq \frac{\pi}{2}$. What is the value of B? **[2.5]**
a) - 1
b) 2
c) 0
d) 1

46) What will be the value of cos 12º + cos 84º + cos 156º + cos 132º? **[2.5]**
a) $-2\sqrt{3}$
b) $\frac{-1}{2}$
c) $\frac{3}{4}$
d) $2(\sqrt{5})$

47) Let$A = \cos^{-1}x, B = \cos^{-1}y$ and $C = \cos^{-1}z$
If $A + B = \frac{2\pi}{3}$, then $\sin^{-1}x + \sin^{-1}y$ is equal to **[2.5]**
a) π
b) $\frac{\pi}{6}$
c) $\frac{2\pi}{3}$
d) $\frac{\pi}{3}$

48) The value of$\tan\left(2\tan^{-1}\frac{1}{5} - \frac{\pi}{4}\right)$ is **[2.5]**
a) $\frac{5}{4}$
b) $\frac{5}{16}$
c) $-\frac{7}{17}$
d) $\frac{7}{17}$

49) What is$\tan^{-1}\cot\left(\text{cosec}^{-1}2\right)$ equal to? **[2.5]**
a) $\frac{\pi}{4}$
b) $\frac{\pi}{6}$
c) $\frac{\pi}{3}$
d) $\frac{\pi}{8}$

50) Let$A = \cos^{-1}x, B = \cos^{-1}y$ and $C = \cos^{-1}z$
If $A + B + C = \pi$, then $x^2 + y^2 + z^2$ is equal to **[2.5]**
a) 0
b) $1 - 2xyz$
c) 1
d) $2xyz$

51) The shadow of a tower is found to be$x$ m longer, when the angle of elevation of the Sun changes from $60°$ to $45°$. If the height of the tower is $5(3+\sqrt{3})$m , then what is x equal to? **[2.5]**
a) 15 m
b) 8 m
c) 12 m
d) 10 m

52) A flagstaff 20 m long standing on a pillar 10 m high subtends an angle$\tan^{-1}(0.5)$ at a point P on the ground. Let θ be the angle subtended by the pillar at this point P .
If x is the distance of P from bottom of the pillar, then consider the following statements
i. X can take two values which are in the ratio$1:3$.
ii. X can be equal to height of the flagstaff.
Which of the statements given above is/are correct? **[2.5]**
a) Both 1 and 2
b) Neither 1 nor 2
c) Only 2
d) Only 1

53) The angles of a triangle are in the ratio 1 : 5 : 6. The ratio of its sides is **[2.5]**
a) $(\sqrt{3}-1):(\sqrt{3}+1):2\sqrt{2}$
b) $(\sqrt{3}+1):(\sqrt{3}+1):2\sqrt{2}$
c) $(\sqrt{3}-1):2\sqrt{2}:(\sqrt{3}+1)$
d) $2\sqrt{2}:(\sqrt{3}-1):(\sqrt{3}+1)$

54) In a$\triangle ABC, (a+b+c)\left(\tan\frac{A}{2} + \tan\frac{B}{2}\right)$ is equal to **[2.5]**
a) $2c\cot\frac{A}{2}$
b) $2\cot\frac{C}{2}$
c) $2a\cot\frac{A}{2}$
d) $2b\cot\frac{B}{2}$

55) A 24 cm long wire is bent to form a triangle with one of the angles as$60°$. What is the altitude of the triangle having the greatest possible area? **[2.5]**
a) $4\sqrt{3}$ cm
b) $2\sqrt{3}$ cm
c) 3 cm
d) 6 cm

56) The area of the$\triangle ABC$, in which a = 1, b = 2 and $\angle C$ = 60º, is **[2.5]**
a) $\frac{\sqrt{3}}{2}$ sq unit
b) $\frac{1}{2}$ sq units
c) $\sqrt{3}$ sq units
d) 4 sq units

57) Consider the points$A(2,4,6), B(-2,-4,-2)$, $C(4,6,4)$ and $D(8,14,12)$.
Which of the following statements is/are correct?
i. The points are the vertices of a rectangle ABCD.
ii. The mid - point of AC is the same as that of BD.
Select the correct answer using the code given below **[2.5]**
a) Only 1
b) Only 2
c) Both 1 and 2
d) Neither 1 nor 2

58) What is the equation of the right bisector of the line segment joining$(1,1)$ and $(2,3)$? **[2.5]**
a) $2x - 4y - 5 = 0$
b) $x - y + 1 = 0$
c) $2x + 4y - 11 = 0$
d) $2x - 4y - 11 = 0$

59) What is the angle between the lines$x\cos\alpha + y\sin\alpha = a$ and $x\sin\beta - y\cos\beta = a$? **[2.5]**
a) $\frac{(\pi - 2\beta + 2\alpha)}{2}$
b) $\boldsymbol{\beta - \alpha}$
c) $\pi + \beta - \alpha$
d) $\frac{(\pi + 2\beta + 2\alpha)}{2}$

60) The intercepts of a straight line upon the coordinate axesare a and b. If the length of the perpendicular on this line from the origin be 1 unit, then which one of the following relations is correct? **[2.5]**

a) $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{\sqrt{2}}$
b) $\frac{1}{a^2}+\frac{1}{b^2}=\frac{1}{2}$
c) $\frac{1}{a^2}+\frac{1}{b^2}=1$
d) $\frac{1}{a^2}+\frac{1}{b^2}=2$

61) The line$x+y=4$ cuts the line joining $P(-1,1)$ and $Q(5,7)$ at R. What is PR : RQ equal to? **[2.5]**

a) 2 : 1 b) 1 : 1
c) 1 : 3 d) 1 : 2

62) The centre of the circle passing through origin and making positive intercepts 4 and 6 on the coordinate axes, lies on the line. **[2.5]**

a) $3x-2y-1=0$ b) $2x+3y-26=0$
c) $3x-4y+6=0$ d) $2x-y+1=0$

63) Consider the following statements.

i. Number of circles touching the given three non - concurrent lines is 4.
ii. Number of circles passing through$(1,2),(4,8)$ and $(0,0)$ is one.

Which of the above statement(s) is/are correct? **[2.5]**

a) Both I and II b) Only II
c) Only I d) None of these

64) Locus of the centre of the circle which always passes through the fixed points$(a,0)$ and $(-a,0)$ is **[2.5]**

a) $x=1$ b) $x=0$
c) $x+y=6$ d) $x+y=2a$

65) If the ellipse$25x^2+4y^2=100$ intercepts the line $5x+2y=10$, then length of the chord is **[2.5]**

a) $\sqrt{25}$ units b) $\sqrt{23}$ units
c) $\sqrt{29}$ units d) $\sqrt{21}$ units

66) The curve represented by$x=3(\cos t+\sin t)$ and $y=4(\cos t-\sin t)$ is **[2.5]**

a) A parabola b) A circle
c) A hyperbola d) An ellipse

67) What is the equation of the hyperbola having latusrectum and eccentricity 8 and$\frac{3}{\sqrt{5}}$ respectively? **[2.5]**

a) $\frac{x^2}{30}-\frac{y^2}{25}=1$
b) $\frac{x^2}{25}-\frac{y^2}{20}=1$
c) $\frac{x^2}{40}-\frac{y^2}{20}=1$
d) $\frac{x^2}{40}-\frac{y^2}{30}=1$

68) Consider the following statements

i. The angle between the planes$2x-y+z=1$ and $x+y+2z=3$ is $\frac{\pi}{3}$
ii. The distance between the planes$6x-3y+6z+2=0$ and $2x-y+2z+4=0$ is $\frac{10}{9}$

Which of the above statement is/are correct? **[2.5]**

a) Both I and II b) I only
c) Neither I nor II d) II only

69) What is the equation of the plane passing through the points$(-2,6,-6),(-3,10,-9)$ and $(-5,0,-6)$? **[2.5]**

a) $2x-y-2z=2$ b) $x+y+z=6$
c) $x-y-z=3$ d) $2x+y+3z=3$

70) Equation of the plane that passes through the point $(2,-3,1)$ and is perpendicular to the line joining the points $(3,4,-1)$ and $(2,-1,5)$ is given by **[2.5]**

a) $x+5y-6z=-23$ b) $x+5y-6z+19=0$
c) $x+5y-6z=19$ d) $x-5y+6z-23=0$

71) Consider two lines whose direction ratios are (2, - 1, 2) and (k, 3, 5). They are inclined at an angle$\frac{\pi}{4}$.
What are the direction ratios of a line which is perpendicular to both the lines? **[2.5]**

a) $(1,2,10)$ b) $(11,2,-10)$
c) $(11,12,-10)$ d) $(-1,-2,10)$

72) If the points$A(x,y,-3),B(2,0,-1)$ and $C(4,2,3)$ lie on a straight line, then what are the values of x and y respectively? **[2.5]**

a) 0 and 2 b) - 1 and 1
c) 3 and 4 d) 1 and - 1

73) The values of x for which the angle between$\vec{a}=2x^2\hat{i}+4x\hat{j}+\hat{k},\vec{b}=7\hat{i}-2\hat{j}+x\hat{k}$ is obtuse and the angle between $\vec{b}$ and the z - axis is a cute and less than $\frac{\pi}{6}$ are **[2.5]**

a) $\frac{1}{2}<x<15$
b) $x>\frac{1}{2}$ or $x<0$
c) ϕ
d) $0<x<\frac{1}{2}$

74) If the vertices A, B, C of a triangle ABC are (1, 2, 3), (– 1, 0, 0), (0, 1, 2), respectively, then find$\angle ABC$. [$\angle ABC$ is the angle between the vectors $\overrightarrow{BA}\,and\,\overrightarrow{BC}$]**[2.5]**

a) $\cos^{-1}\left(\frac{13}{\sqrt{102}}\right)$
b) $\cos^{-1}\left(\frac{11}{\sqrt{102}}\right)$
c) $\cos^{-1}\left(\frac{15}{\sqrt{102}}\right)$
d) $\cos^{-1}\left(\frac{10}{\sqrt{102}}\right)$

75) The value ofλ for which the angle between the lines $\vec{r}$ = $\hat{i}+\hat{j}+\hat{k}$ + p$(2\hat{i}+\hat{j}+2\hat{k})$ and $\vec{r}$ = (1 + q)$\vec{i}$ + (1 + q)$\vec{j}$ + (1 + q)$\vec{k}$ is $\frac{\pi}{2}$ is: **[2.5]**

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

76) ABCD is a parallelogram with AC and BD as diagonals. Then,$\overrightarrow{AC}-\overrightarrow{BD}=$ **[2.5]**

a) $3\overrightarrow{AB}$
b) $\overrightarrow{AB}$
c) $4\overrightarrow{AB}$
d) $2\overrightarrow{AB}$

77) The vector$\overrightarrow{a}$ and $\overrightarrow{b}$ satisfy the equation $2\overrightarrow{a}+\overrightarrow{b}=\overrightarrow{p}$ and $\overrightarrow{a}+2\overrightarrow{b}=\overrightarrow{q}$, where $\vec{p}=\hat{i}+\hat{j}$ and $\overrightarrow{q}=\hat{i}-\hat{j}$. If □ is the angle between$\overrightarrow{a}$ and $\overrightarrow{b}$, then $cos\theta\ is$ **[2.5]**

a) $\sin\theta=\frac{1}{\sqrt{2}}$
b) $\cos\theta=\frac{4}{5}$
c) $\cos\theta=-\frac{3}{5}$
d) $\cos\theta=-\frac{4}{5}$

78) If$\vec{a}=(\hat{i}+2\hat{j}-3\hat{k})$ and $\vec{b}=(3\hat{i}-\hat{j}+2\hat{k})$ then the angle between $(\vec{a}+\vec{b})$ and $(\vec{a}-\vec{b})$ is **[2.5]**

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

79) If two vectors have their corresponding direction cosines equal then the two vectors **[2.5]**

a) Are at an angle of 55°
b) Are at an angle of 45°
c) Are parallel
d) Are perpendicular

80) If two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 2, |\vec{b}| = 3$ and $\vec{a} \cdot \vec{b} = 4$, then $|\vec{a} - 2\vec{b}|$ is equal to **[2.5]**
a) $2\sqrt{6}$ b) 24
c) $2\sqrt{2}$ d) $\sqrt{2}$

81) If $f(x) = \frac{[x]}{|x|}, x \neq 0$, where []denotes the greatest integer function, then what is the right - hand limit of f(x) at x = 1? **[2.5]**
a) - 1
b) Right - hand limit of f(x) at x = 1does not exist
c) 1
d) 0

82) Consider the following in respect of the function f(x) = 10^x
i. Its domain is$(-\infty, \infty)$
ii. It is a continuous function
iii. It is differentiable at x = 0
Which of the above statements are correct? **[2.5]**
a) 1, 2 and 3 b) Only 1 and 3
c) Only 1 and 2 d) Only 2 and 3

83) What is$\lim_{n\to\infty} \frac{a^n+b^n}{a^n-b^n}$, where a > b > 1, equal to? **[2.5]**
a) - 1 b) 1
c) 0 d) Limit does not exist

84) What is$\lim_{\theta\to 0} \frac{\sqrt{1-\cos\theta}}{\theta}$ equal to? **[2.5]**
a) $-\frac{1}{2\sqrt{2}}$
b) $\sqrt{2}$
c) $2\sqrt{2}$
d) $\frac{1}{\sqrt{2}}$

85) If$y = \frac{x\sqrt{x^2-16}}{2} - 8\ln\left|x + \sqrt{x^2-16}\right|$, then what is $\frac{dy}{dx}$ equal to? **[2.5]**
a) $x - \sqrt{x^2-16}$ b) $x\sqrt{x^2-16}$
c) $\sqrt{x^2-16}$ d) $4\sqrt{x^2-16}$

86) If$y = x + \sqrt{(1+x^2)}^m$, then $\left(1+x^2\right)y_2 + xy_1 - m^2y$ is equal to **[2.5]**
a) 2 b) - 1
c) 0 d) 1

87) If$y = \cos x \cdot \cos 4x \cdot \cos 8x$, then what is $\frac{1}{y}\frac{dy}{dx}$ at $x = \frac{\pi}{4}$ equal to? **[2.5]**
a) 0 b) 3
c) 1 d) - 1

88) If$y = (x^x)^x$, then which one of the following is correct? **[2.5]**
a) $\frac{dy}{dx} - 2xy(1 + \ln x) = 0$
b) $\frac{dy}{dx} + 2xy(1 + \ln x) = 0$
c) $\frac{dy}{dx} + xy(1 + 2\ln x) = 0$
d) $\frac{dy}{dx} - xy(1 + 2\ln x) = 0$

89) If$y = \tan^{-1}\left(\frac{5-2\tan\sqrt{x}}{2+5\tan\sqrt{x}}\right)$, then what is $\frac{dy}{dx}$ equal to? **[2.5]**
a) $-\frac{1}{2\sqrt{x}}$
b) 1
c) - 1
d) $\frac{1}{2\sqrt{x}}$

90) Consider the following statements
i. $f(x) = \ln x$ is an increasing function on ($0, \infty$).
ii. $f(x) = e^x - x(\ln x)$ is an increasing function on $(1, \infty)$
Which of the above statement(s) is/are correct? **[2.5]**
a) Neither I nor II b) Only I
c) Only II d) Both I and II

91) A function$f : A \to R$ is defined by the equation $f(x) = x^2 - 4x + 5$, where $A = (1, 4)$. What is the range of the function? **[2.5]**
a) $[1, 5)$ b) $(1, 5)$
c) $[1, 5]$ d) $(2, 5)$

92) What is the slope of the tangent to the curve x = t^2 + 3t - 8, y = $2t^2$ - 2t - 5 at t = 2? **[2.5]**
a) 1 b) $\frac{6}{7}$
c) $\frac{5}{6}$ d) $\frac{7}{6}$

93) What is$\int \frac{dx}{\sec^2(\tan^{-1}x)}$ equal to? **[2.5]**
a) $\sin^{-1}x + C$ b) $\cos^{-1}x + C$
c) $\sec^{-1}x + C$ d) $\tan^{-1}x + C$

94) What is$\int \ln\left(x^2\right)dx$ equal to? **[2.5]**
a) $\frac{2\ln(x)}{x} - 2x + C$
b) $\frac{2}{x} + C$
c) $2x\ln(x) + C$
d) $2x\ln(x) - 2x + C$

95) Evaluate$\int \frac{x+1}{\sqrt{9-4x^2}}dx$ **[2.5]**
a) $-\frac{1}{4}\sqrt{9-4x^2} - \frac{1}{2}\sin^{-1}\left(\frac{2}{3}x\right) + C$
b) $\frac{1}{4}\sqrt{9-4x^2} + \frac{1}{2}\sin^{-1}\left(\frac{2}{3}x\right) + C$
c) $\frac{1}{4}\sqrt{9-4x^2} - \frac{1}{2}\sin^{-1}\left(\frac{2}{3}x\right) + C$
d) $-\frac{1}{4}\sqrt{9-4x^2} + \frac{1}{2}\sin^{-1}\left(\frac{2}{3}x\right) + C$

96) What is$\int_0^a \frac{f(a-x)}{f(x)+f(a-x)}dx$ equal to? **[2.5]**
a) a b) $\frac{a}{2}$
c) $2a$ d) 0

97) $\lim_{n\to\infty} \frac{1^{99}+2^{99}+3^{99}+\ldots+n^{99}}{n^{100}}$ is equal to **[2.5]**
a) $\frac{1}{100}$ b) $\frac{9}{100}$
c) $\frac{1}{101}$ d) $\frac{1}{99}$

98) If$\int_0^a [f(x) + f(-x)]dx = \int_0^a g(x)dx$, then what is g(x) equal to? **[2.5]**
a) $-f(x)$ b) $f(-x) - f(x)$
c) $f(x)$ d) $f(-x) + f(x)$

99) What is the area of the region bounded by$x - |y| = 0$ and $x - 2 = 0$? **[2.5]**
a) 1 b) 2
c) 4 d) 8

100) What is the area between the curve$f(x) = x|x|$ and x - axis for $x \in [-1, 1]$? **[2.5]**
a) $\frac{1}{4}$ b) $\frac{2}{3}$
c) $\frac{1}{2}$ d) $\frac{1}{3}$

101) General solution of$\frac{dy}{dx} + 2y = \sin x$ is **[2.5]**
a) $y = \frac{1}{5}(2\sin x + \cos x) - Ce^{-2x}$
b) $y = \frac{1}{5}(2\sin x + \cos x) + Ce^{-2x}$
c) $y = \frac{1}{5}(2\sin x - \cos x) - Ce^{-2x}$
d) $y = \frac{1}{5}(2\sin x - \cos x) + Ce^{-2x}$

102) The solution of$\frac{dy}{dx} = \sqrt{1 - x^2 - y^2 + x^2y^2}$ is, where, C is an arbitrary constant. **[2.5]**
a) $2\sin^{-1} y = x\sqrt{1-x^2} + \cos^{-1} x + C$
b) $2\sin^{-1} y = \sqrt{1-x^2} + \sin^{-1} x + C$
c) $2\sin^{-1} y = x\sqrt{1-x^2} + \sin^{-1} x + C$
d) $\sin^{-1} y = \sin^{-1} x + C$

103) The Integrating Factor of the differential equation$\left(1-y^2\right)\frac{dx}{dy} + yx = ay \ (-1 < y < 1)$ is **[2.5]**
a) $\frac{1}{1-y^2}$
b) $\frac{1}{y^2-1}$
c) $\frac{1}{\sqrt{y^2-1}}$

d) $\frac{1}{\sqrt{1-y^2}}$

104) The solution of the DE $\frac{dy}{dx} = \frac{1-\cos x}{1+\cos x}$ is **[2.5]**

a) Y = tan x + x + C
b) $y = \tan\frac{x}{2} - 2x + C$
c) $y = 2\tan\frac{x}{2} - x + C$
d) Y = tan x - x + C

105) The general solution of the differential equation (x^2 + x + 1) dy + (y^2 + y +1) dx = 0 is (x + y + 1) = A(1 + Bx + Cy + Dxy), where B, C and D are constants and A is parameter. What is D equal to? **[2.5]**

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

106) A first order linear differential equation, Is a differential equation of the form **[2.5]**

a) $\frac{dy}{dx} = Q$
b) $\frac{dy}{dx} + Py = Q$
c) $\frac{dy}{dx} + Py = 0$
d) $\frac{dy}{dx} + Px = Q$

107) The number of telephone calls received in 245 successive, one - minute intervals at an exchange is given below in the following frequency distribution.

Number	0	1	2	3	4	5	6	7
Frequency	14	21	25	43	51	40	39	12

What is the median of the distribution? **[2.5]**

a) 3.5 b) 5
c) 4 d) 4.5

108) For any collection of n items, $(\sum x) - \overline{x}$ = **[2.5]**

a) (n - 1)$\overline{x}$ b) 0
c) N$\overline{x}$ d) (n + 1)$\overline{x}$

109) The numbers 3, 5, 7 and 9 have their respective frequencies x - 2, x + 2, x - 3 and x + 3. If the mean is 6.5, then the value of x is **[2.5]**

a) 6 b) 3
c) 4 d) 5

110) The most frequent value in the data is known as **[2.5]**

a) Mean b) Mode
c) All the three d) Median

111) The arithmetic mean of a set of 40 values is 65. If each of the 40 values is increased by 5, what will be the mean of the set of new values: **[2.5]**

a) 65 b) 60
c) 70 d) 50

112) The variance of 2, 4, 6, 8, 10 is **[2.5]**

a) 7 b) 8
c) 4 d) 6

113) If the mean and the median of a data are 12 and 15 respectively, then its mode is: **[2.5]**

a) 6 b) 14
c) 21 d) 13.5

114) Suppose n($\geq$ 3) persons are sitting in a row. Two of them are selected at random. The probability that they are not together is **[2.5]**

a) $\frac{2}{n} - 1$ b) $n - \frac{1}{n}$
c) N! d) $1 - \frac{2}{n}$

115) The probability of getting a number from 1 to 100, which is divisible by 7 is **[2.5]**

a) $\frac{7}{100}$ b) $\frac{23}{98}$
c) $\frac{1}{7}$ d) $\frac{14}{100}$

116) Three numbers are chosen at random from 1 to 20. The probability that they are consecutive is **[2.5]**

a) $\frac{1}{60}$ b) $\frac{3}{190}$
c) $\frac{1}{47}$ d) $\frac{1}{57}$

117) If E is an event, then P$(\bar{E})$ is equal to **[2.5]**

a) - P (E) b) P (E)
c) 1 – P (E) d) 1 + P (E)

118) A coin is tossed 6 times. The probability of getting a head three times is **[2.5]**

a) $\frac{3}{64}$ b) $\frac{1}{2}$
c) $\frac{1}{8}$ d) $\frac{5}{16}$

119) If the probability of an event is p, the probability of its complementary event will be: **[2.5]**

a) 1 – p b) 1 - $\frac{1}{p}$
c) P - 1 d) P

120) Number X is randomly selected from the set of odd numbers and Y is randomly selected from the set of even numbers of the set 1, 2, 3, 4, 5, 6, 7. Let Z = (X + Y).
What is P (Z > 11) equal to? **[2.5]**

a) $\frac{1}{12}$ b) 0
c) $\frac{1}{4}$ d) $\frac{1}{6}$