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Maths nda
COMPETITIVE EXAMS - NDA

Time Allowed: 2 hours and 30 minutes

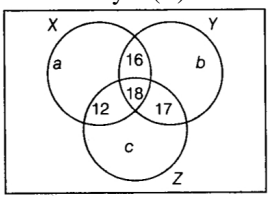
Maximum Marks : 300

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) 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.



What is the value of $n(X) + n(Y) + n(Z) - n(X \cap Y) - n(Y \cap Z) - n(X \cap Z) + n(X \cap Y \cap Z)$? **[2.5]**

a) A + b + 43 b) A + b + 106
c) A + b + 96 d) A + b + 63

2) A university awarded medals in basket ball, football and volleyball. Only x students (x < 6) got medal in all the three sports and the medals went to a total of 15x students. It awarded 5x medals in basketball, (4x + 15) medals in football and (x + 25) medals in volleyball. How many students received medals in exactly two of the three sports? **[2.5]**

a) 40 - 7x b) 45 - 5x
c) 30 - 4x d) 35 - 7x

3) Consider the following statements

i. The set of all irrational numbers between $\sqrt{2}$ and $\sqrt{5}$ is an infinite set.
ii. The set of all odd integers less than 100 is a finite set.

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

a) Neither i nor ii b) Only ii
c) Only i d) Both i and ii

4) A function is defined by $f(x) = \pi + \sin^2 x$. What is the range of the function? **[2.5]**

a) $[0, 1]$ b) $[\pi - 1, \pi + 1]$
c) $[\pi, \pi + 1]$ d) $[\pi - 1, \pi - 1]$

5) A function is defined by $f(x) = \pi + \sin^2 x$. What is the period of the function? **[2.5]**

a) 2π
b) The function is non - periodic
c) π
d) $\frac{\pi}{2}$

6) The period of the function f(x) = sin x cos x is **[2.5]**

a) $\frac{\pi}{2}$ b) 3π
c) 2π d) π

7) Let z = [y]and y = [x]- x where [.]is the greatest integer function. If x is not an integer but positive, then what is the value of z? **[2.5]**

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

8) 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) terms is **[2.5]**

a) Mn b) M + n
c) 2(m + n) d) - (m + n)

9) The sum of the series $\frac{1}{2} + \frac{3}{4} + \frac{7}{8} + \frac{15}{16}$ is **[2.5]**

a) $\frac{16}{49}$ b) 49
c) $\frac{59}{16}$ d) $\frac{49}{16}$

10) What is the greatest value of the positive integer n satisfying the condition? $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots + \frac{1}{2^{n-1}} < 2 - \frac{1}{1000}$ **[2.5]**

a) 9 b) 10
c) 11 d) 8

11) If p = (1111 ... up to n digits), then what is the value of $9p^2$ + p? **[2.5]**

a) 10^n p b) 10^n p + 1
c) 10^n p - 1 d) $2p10^n$

12) How many geometric progressions is/are possible containing 27, 8 and 12 as three of its/their terms? **[2.5]**

a) Infinitely many b) Two
c) One d) Four

13) What is the value of $\left(\frac{i+\sqrt{3}}{-i+\sqrt{3}}\right)^{200} + \left(\frac{i-\sqrt{3}}{i+\sqrt{3}}\right)^{200} + 1 = ?$ **[2.5]**

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

14) If the cube roots of unity are $1, \omega, \omega^2$, then the roots of equation $(x - 1)^3 + 8 = 0$ are **[2.5]**

a) - 1, - 2, - 1
b) - 1, 1 - 2ω , 1 - $2\omega^2$
c) - 1, - 1, - 1
d) - 1, 1 + 2ω , 1 + $2\omega^2$

15) The smallest positive integer n for which $\left(\frac{1-i}{1+i}\right)^{n^2} = 1$ where i = $\sqrt{-1}$, is **[2.5]**

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

16) Consider the following statements in respect of the roots of the equation $x^3 - 8 = 0$

i. The roots are non - collinear.
ii. The roots lie on a circle of unit radius.

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

a) Both i and ii b) I only
c) I only d) Neither i nor ii

17) Let α and $\beta(\alpha < \beta)$ be the roots of the equation $x^2 + bx + c = 0$, where b > 0 and c < 0.
Consider the following
i. $\alpha + \beta + \alpha\beta > 0$
ii. $\alpha^2\beta + \beta^2\alpha > 0$
Which of the above statement(s) is/are correct? **[2.5]**
a) Both I and II b) Only I
c) Neither I nor II d) Only II

18) If the roots of the equation $\frac{1}{x+p} + \frac{1}{x+q} = \frac{1}{r}$ are equal in magnitude but opposite in sign, then p + q is equal to **[2.5]**
a) R^2 b) 2r
c) R d) $\frac{2}{r}$

19) If α and β are the roots of the equation $ax^2 + bx + c = 0$, then the equation whose roots are $\frac{1}{\alpha+\beta}, \frac{1}{\alpha} + \frac{1}{\beta}$ is equal to **[2.5]**
a) Ab x^2 + (c^2 + ab) x + ca = 0
b) Ab x^2 - (c^2 - ab) x - ca = 0
c) Ac x^2 + (a^2+ bc)x + bc = 0
d) Bc x^2 + (b^2+ bc)x + ab = 0

20) 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? **[2.5]**
a) $P^2m = l^2q$ b) $M^2p = q^2l$
c) $M^2p = l^2q$ d) $M^2p^2 = l^2q$

21) The number of ways in which a cricket team of 11 players be chosen out of a batch of 15 players. So that the captain of the team is always included, is **[2.5]**
a) 1001 b) 165
c) 364 d) 1365

22) A polygon has 44 diagonals. The number of its sides is **[2.5]**
a) 10 b) 7
c) 11 d) 8

23) If C(3n, 2n) = C(3n, 2n - 7), then what value of C(n, n - 5)? **[2.5]**
a) 21 b) 35
c) 42 d) 28

24) The sides AB, BC, CA of a$\triangle$ ABC have 3, 5 and 6 points, respectively on them. The number of triangles that can be constructed using these points as vertices is given by **[2.5]**
a) 240 b) 333
c) 415 d) 364

25) Let $(1+x)^n = 1 + T_1x + T_2x^2 + T_3x^3 + \ldots + T_nx^n$ then what is $T_1 + T_2 + T_3 + \ldots + T_n$ equal to? **[2.5]**
a) $2^n + 1$ b) 2^n
c) $2^n - 1$ d) 2^{n-1}

26) In the expansion of $\left(\sqrt{x} + \frac{1}{3x^2}\right)^{10}$, the value of constant term (independent of x) is **[2.5]**
a) 45 b) 5
c) 90 d) 8

27) Find the coefficient of x^4 in the expansion of $(4 - 3x)^{-3/2}$. **[2.5]**
a) $\frac{76544}{786423}$ b) $\frac{76542}{786432}$
c) $\frac{76445}{786423}$ d) $\frac{76545}{786432}$

28) The value of $81^{1/\log_5 3} + 27^{\log_9 36} + 3^{4/\log_7 9}$ is equal to **[2.5]**
a) 625 b) 49
c) 890 d) 216

29) $\frac{\log x + \log x^4 + \log x^9 + \ldots + \log x^{n^2}}{\log x + \log x^2 + \log x^3 + \ldots + \log x^n}$ is equal to **[2.5]**
a) $\frac{3(n+2)}{2}$ b) $\frac{2n-1}{3}$
c) $\frac{2n+1}{3}$ d) $\frac{3(n-1)}{2}$

30) The system of linear equations
5x + ky = 5,
3x + 3y = 5;
will be consistent if: **[2.5]**
a) K = 5 b) K = - 5
c) K≠ - 3 d) K≠ 5

31) If 1,ω , ω^2 are the cube roots of unity, then the value of $\begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^n & \omega^{2n} & 1 \\ \omega^{2n} & 1 & \omega^n \end{vmatrix}$ is equal to **[2.5]**
a) - z b) 1
c) - 1 d) ω

32) If $A_r = \begin{vmatrix} 1 & r & 2^r \\ 2 & n & n^2 \\ n & \frac{n(n+1)}{2} & 2^{n+1} \end{vmatrix}$ then the value of $\sum_{r=1}^{n} A_r$ is **[2.5]**
a) N^2 b) - 2n
c) N d) 2n

33) Given $A = \begin{bmatrix} \sqrt{3} & 1 & -1 \\ 2 & 3 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & \sqrt{5} & 1 \\ -2 & 3 & \frac{1}{2} \end{bmatrix}$, then find A + B. **[2.5]**
a) $\begin{bmatrix} 2+\sqrt{3} & 1+\sqrt{5} & 0 \\ 0 & 6 & \frac{1}{2} \end{bmatrix}$
b) $\begin{bmatrix} \sqrt{3}+\sqrt{2} & 1+\sqrt{2} & 3 \\ 0 & 6 & 0 \end{bmatrix}$
c) $\begin{bmatrix} \sqrt{3}+\sqrt{2} & 1+\sqrt{3} & 4 \\ 0 & 1 & \frac{1}{2} \end{bmatrix}$
d) $\begin{bmatrix} \sqrt{3}+2 & 1 & 0 \\ 0 & 6 & 1 \end{bmatrix}$

34) The value of $\begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix}$ is **[2.5]**
a) 1 b) X + y + z
c) 2(x + y + z) d) 0

35) If A and B are invertible matrices, then which of the following is not correct? **[2.5]**
a) $(AB)^{-1} = B^{-1} A^{-1}$
b) $(A + B)^{-1} = B^{-1} + A^{-1}$
c) Det $(A)^{-1}$ = [det (A)]$^{-1}$
d) Adj A = |A|· A^{-1}

36) If A = $\begin{bmatrix} 1 & 2 \\ 6 & 12 \end{bmatrix}$, then A is **[2.5]**
a) Non - singular b) Singular
c) Scalar matrix d) Diagonal matrix

37) If the area of a$\triangle$ ABD is 3 sq. units with vertices A(1, 3), B(0, 0) and D(k, 0), then k is equal to **[2.5]**
a) 3 b) 2
c) ± 2 d) ± 3

38) What is $(1110011)_2 \div (10111)_2$ equal to? **[2.5]**
a) $(111)_2$ b) $(101)_2$
c) $(1011)_2$ d) $(1001)_2$

39) A binary number is represented by $(cdccddcccddd)_2$, where cd . What is its decimal equivalent? **[2.5]**
a) 1848 b) 2842
c) 2048 d) 2872

40) What is the value of X, if $(1010)_2 \times (111)_2 = (X)_{10}$? **[2.5]**

a) 60 b) 70
c) 80 d) 75

41) What is the value of $\left(\sin^4\theta - \cos^4\theta + 1\right)\ \text{cosec}^2\theta$? **[2.5]**
a) - 2 b) 1
c) 2 d) 0

42) What is the angle (in circular measure) between the hour hand and the minute hand of a clock when the time is half past 4? **[2.5]**
a) $\frac{\pi}{3}$ b) $\frac{\pi}{6}$
c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

43) What is sin 3x + cos 3x + 4 $\sin^3$ x - 3 sin x + 3 cos x - 4 $\cos^3$ x equal to? **[2.5]**
a) 0 b) 1
c) 4 cos 4x d) 2 sin 2x

44) What is the value of $\frac{\sin 34^\circ \cos 236^\circ - \sin 56^\circ \sin 124^\circ}{\cos 28^\circ \cos 88^\circ + \cos 178^\circ \sin 208^\circ}$? **[2.5]**
a) - 1 b) - 2
c) 1 d) 2

45) If $p = X\cos\theta - Y\sin\theta, q = X\sin\theta + Y\cos\theta$ and $p^2 + 4pq + q^2 = AX^2 + BY^2$, $0 \le \theta \le \frac{\pi}{2}$. What is the value of θ ? **[2.5]**
a) $\frac{\pi}{6}$ b) $\frac{\pi}{2}$
c) $\frac{\pi}{4}$ d) $\frac{\pi}{3}$

46) If $p = X\cos\theta - Y\sin\theta, q = X\sin\theta + Y\cos\theta$ and $p^2 + 4pq + q^2 = AX^2 + BY^2$, $0 \le \theta \le \frac{\pi}{2}$. What is the value of A? **[2.5]**
a) 3 b) 2
c) 1 d) 4

47) What is the value of $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$? **[2.5]**
a) $-\frac{\pi}{6}$ b) $\frac{5\pi}{6}$
c) $\frac{\pi}{6}$ d) $\frac{7\pi}{6}$

48) Consider the following statements
i. The value of $\tan^{-1}\left(\frac{1}{4}\right) + \tan^{-1}\left(\frac{2}{9}\right)$ is equal to $\sin^{-1}\left(\frac{1}{\sqrt{5}}\right)$
ii. $\sin^{-1}\left(\frac{8}{17}\right) + \sin^{-1}\left(\frac{3}{5}\right) = \sin^{-1}\left(\frac{77}{85}\right)$
Which of the above statement(s) is/are correct? **[2.5]**
a) Only II b) Both I and II
c) Only I d) Neither I nor II

49) What is the value of $\sin^{-1}\frac{4}{5} + \sec^{-1}\frac{5}{4} - \frac{\pi}{2}$? **[2.5]**
a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$
c) π d) 0

50) Consider the following statements
i. $\tan^{-1}x + \tan^{-1}\left(\frac{1}{x}\right) = \pi$
ii. Their exist, $x, y \in [-1, 1]$, where $x \neq y$ such that $\sin^{-1}x + \cos^{-1}y = \frac{\pi}{2}$
Which of the above statement(s) is/are correct? **[2.5]**
a) Both I and II b) Only I
c) Only II d) Neither I nor II

51) What should be the height of a flag, where a 20 ft long ladder reaches 20 ft below the flag. The angle of elevation of the top of the flag at the foot of the ladder is 60º? **[2.5]**
a) 30 ft b) $20\sqrt{2}$ ft
c) 40 ft d) 20 ft

52) 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? **[2.5]**
a) 180 m b) 360 m
c) 240 m d) 120 m

53) Consider the following statements
i. If in a$\triangle ABC, A = 2B$ and b = c, then it must be an obtuse angled triangle.
ii. There exists no$\triangle ABC$ with $\angle A = 40^\circ, \angle B = 65^\circ$ and $\frac{a}{c} = \sin 40^\circ \operatorname{cosec} 15^\circ$.
Which of the above statements is/are correct? **[2.5]**
a) Only I b) Only II
c) Neither I nor II d) Both I and II

54) In a$\triangle ABC$, if the angles A, B and C are in AP, then which one of the following is correct? **[2.5]**
a) $B^2 = a^2 + c^2 - ac$ b) $C^2 = a^2 + b^2 - ab$
c) C = a + b d) $A^2 = b^2 + c^2 - bc$

55) Two straight roads intersect at an angle of 60º. A bus on one road is 2 km away from the intersection and a car on the other road is 3 km away from the intersection. Then, the direct distance between the two vehicles is **[2.5]**
a) $\sqrt{7}$ km b) 1 km
c) $\sqrt{2}$ km d) 4 km

56) If the angles of a triangle are 30º and 45º and the included side is $(\sqrt{3}+1)$cm , then what is the area of the triangle? **[2.5]**
a) $\frac{\sqrt{3}+1}{3}$ cm^2
b) $\frac{\sqrt{3}+1}{2}$ cm^2
c) $2(\sqrt{3}+1)\text{cm}^2$
d) $\frac{\sqrt{3}-1}{2}$ cm^2

57) The base AB of an equilateral triangle ABC with side 8 cm lies along the Y - axis such that the mid - point of AB is at the origin and B lies above the origin. What is the equation of line passing through$(8, 0)$ and parallel to the side AC? **[2.5]**
a) $\sqrt{3}x - y - 8\sqrt{3} = 0$
b) $\sqrt{3}x + y - 8\sqrt{3} = 0$
c) $x + \sqrt{3}y - 8 = 0$
d) $x - \sqrt{3}y - 8 = 0$

58) If$P(3, 4)$ is the mid - point of a line segment between the axes, then what is the equation of the line? **[2.5]**
a) $4x + 3y - 24 = 0$ b) $3x - 4y + 7 = 0$
c) $4x - 3y = 0$ d) $3x + 4y - 25 = 0$

59) The angle between the lines$x + y - 3 = 0$ and $x - y + 3 = 0$ is α and the acute angle between the lines $x - \sqrt{3}y + 2\sqrt{3} = 0$ and $\sqrt{3}x - y + 1 = 0$ is β .
Which one of the following is correct? **[2.5]**
a) $\alpha\beta$ b) $\alpha = \beta$
c) $\alpha = 2\beta$ d) $\alpha\beta$

60) What is the angle between the straight lines $\left(m^2 - mn\right)y = \left(mn + n^2\right)x + n^3$ and $\left(mn + m^2\right)y = \left(mn - n^2\right)x + m^3$, where mn ? **[2.5]**
a) 45°
b) $\tan^{-1}\left(\frac{4m^2n^2}{m^2 - n^2}\right)$
c) $\tan^{-1}\left(\frac{2mn}{m^2 + n^2}\right)$
d) $\tan^{-1}\left(\frac{4m^2n^2}{m^4 - n^4}\right)$

61) If A, B and C are in AP, then the straight line$Ax + 2By + C = 0$ will always pass through a fixed point. The fixed point is **[2.5]**
a) $(0, 0)$ b) $(1, -1)$
c) $(-1, 1)$ d) $(1, -2)$

62) What is the diameter of a circle inscribed in a regular polygon of 12 sides, each of length 1 cm? **[2.5]**

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

63) The equation of the circle which touches X - axis at (3, 0) and passes through (1,4) is given by **[2.5]**
a) $x^2+y^2+6x+.5y-9=0$ b) $x^2+y^2-6x-5y+9=0$
c) $x^2+y^2+6x-5y+9=0$ d) $x^2+y^2-6x+5y-9=0$

64) A circle is passing through the points$(5,-8),(-2,9)$ and $(2,1)$.
What are the coordinates of the centre of the circle? **[2.5]**
a) $(-24,-58)$ b) $(-2,-50)$
c) $(-50,-20)$ d) $(-58,-24)$

65) Consider the parabola$y=x^2+7x+2$ and the straight line $y=3x-3$.
What is the shortest distance from the above point on the parabola to the line? **[2.5]**

a) $\frac{\sqrt{10}}{5}$ units
b) $\frac{\sqrt{5}}{4}$ units
c) $\frac{\sqrt{10}}{2}$ units
d) $\frac{1}{\sqrt{10}}$ units

66) The equation$y^2-2x-2y+5=0$ represents **[2.5]**

a) Parabola with focus at$(1,2)$
b) Parabola with directrix at$x=\frac{3}{2}$
c) Parabola with directrix at$x=-\frac{1}{2}$
d) Circle centred at$(1,1)$

67) The curve $5x^2$ + 12xy - 22x - 12y - 19 = 0 is a/an **[2.5]**

a) Pair of straight line
b) Parabola
c) Hyperbola
d) Ellipse

68) The angle between the lines with direction ratios$(1,0,\pm\cos\alpha)$ is $60°$. What is the value of α ? **[2.5]**

a) $\cos^{-1}\left(\frac{1}{3}\right)$
b) $\cos^{-1}\left(\frac{1}{2}\right)$
c) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$
d) $\cos^{-1}\left(\frac{1}{\sqrt{2}}\right)$

69) Find the equation of the sphere having the centre (- 2, 2, 3) and passing through the point (3, 4, - 1). **[2.5]**

a) $X^2 + y^2 + z^2 + 4x + 4y + 6z - 28 = 0$
b) $X^2 + y^2 + z^2 + 4x - 4y - 6z + 28 = 0$
c) $X^2 + y^2 + z^2 + 4x + 4y + 6z + 28 = 0$
d) None of these

70) A straight line passes through the point$(1,1,1)$ makes an angle $60°$ with the positive direction of Z - axis, and the cosine of the angles made by it with the positive directions of the Y - axis and the X - axis are in the ratio $\sqrt{3}:1$. What is the acute angle between the two possible positions of the line? **[2.5]**
a) $30°$ b) $90°$
c) $60°$ d) $45°$

71) The foot of the perpendicular from$(0,2,3)$ to the line $\frac{x+3}{5}=\frac{y-1}{2}=\frac{z+4}{3}$ is **[2.5]**
a) $(2,3,-1)$ b) $(2,-1,3)$
c) $(3,2,-1)$ d) $(-2,3,4)$

72) The angle between the line 6x = 4y = 3z and the plane$\frac{x}{4}+\frac{y}{6}-\frac{z}{4}=\frac{1}{3}$ is **[2.5]**

a) $\tan^{-1}\left(\frac{32}{\sqrt{29}\sqrt{22}}\right)$
b) 90°
c) 45°
d) 0°

73) The projection of vector$\hat{i}$ on the vector $\hat{i}+\hat{j}+2\hat{k}$ is: **[2.5]**
a) $\sqrt{6}$ b) $\frac{2}{\sqrt{6}}$
c) $\frac{3}{\sqrt{6}}$ d) $\frac{1}{\sqrt{6}}$

74) What is a vector of unit length orthogonal to both the vectors$\hat{i}+\hat{j}+\hat{k}$ and $2i+3\hat{j}-\hat{k}$? **[2.5]**

a) $\frac{-4\hat{i}+3\hat{j}-\hat{k}}{\sqrt{26}}$
b) $\frac{-4\hat{i}+3\hat{j}+\hat{k}}{\sqrt{26}}$
c) $\frac{-3\hat{i}+2\hat{j}-\hat{k}}{\sqrt{14}}$
d) $\frac{-3\hat{i}+2\hat{j}+\hat{k}}{\sqrt{14}}$

75) If O and O' are circumcentre and orthocentre of$\triangle$ ABC, then $\overrightarrow{OA}+\overrightarrow{OB}+\overrightarrow{OC}$ equals. **[2.5]**

a) $2\overrightarrow{OO'}$
b) OO'
c) $\overrightarrow{OO'}$
d) $2\overrightarrow{O'O}$

76) Given that the vectorα and β are non - collinear. The values of x and y for which $\vec{u}-\vec{v}=\vec{w}$ holds true, if $\vec{u}=2x\alpha+y\beta$, $\vec{v}=2y\alpha+3x\beta$ and $\vec{w}=2\alpha-5\beta$, are **[2.5]**
a) X = 2, y = 1 b) X = - 2, y = 1
c) X = 1, y = 2 d) X = - 2, y = - 1

77) If the vectors$\hat{i}-2x\hat{j}+3y\hat{k}$ and $\hat{i}+2x\hat{j}-3y\hat{k}$ are perpendicular to each other, then the locus of (x, y) is **[2.5]**
a) An ellipse b) A circle
c) A parabola d) A hyperbola

78) In a hexagon ABCDEF$\vec{AB}=a, \vec{BC}=\vec{b}$ and $\overrightarrow{CD}=\vec{c}$. Then $\overrightarrow{AE}=$ **[2.5]**

a) $\vec{a}+2\vec{b}+2\vec{c}$
b) $2\vec{a}+\vec{b}+\vec{c}$
c) $\vec{a}+\vec{b}+\vec{c}$
d) $\vec{b}+\vec{c}$

79) Which one of the following is the unit vector perpendicular to both$\vec{a}=-\hat{i}+\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-\hat{j}+\hat{k}$? **[2.5]**

a) $\frac{\hat{j}+\hat{k}}{\sqrt{2}}$
b) $\hat{k}$
c) $\pm\frac{\hat{i}+\hat{j}}{\sqrt{2}}$
d) $\frac{\hat{i}-\hat{j}}{\sqrt{2}}$

80) Ifθ is the angle between the vectors $2\hat{i}-2\hat{j}+4\hat{k}$ and $3\hat{i}+\hat{j}+2\hat{k}$, then sin θ = **[2.5]**
a) $\frac{\sqrt{2}}{7}$ b) $\frac{2}{3}$
c) $\frac{2}{\sqrt{7}}$ d) $\sqrt{\frac{2}{7}}$

81) For the function f(x) = |x - 3|, which one of the following is not correct? **[2.5]**

a) The function is differentiable at x = - 3
b) The function is not continuous at x = - 3
c) The function is differentiable at x = 0
d) The function is continuous at x = 3

82) Let f(x) = $\begin{matrix}-2, -3 \le x \le 0 \\ x-2, 0 < x \le 3\end{matrix}$ and g(x) = f(|x|) + |f(x)|. What is the value of the differential coefficient of g(x) at x = - 2? **[2.5]**

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

83) Let f(x) = (|x| - |x - 1|)^2
What is f'(x) equal to, when x > 1? **[2.5]**

a) 4x - 2 b) 0
c) 8x - 4 d) 2x - 1

84) If $f(x) = \begin{matrix}\frac{\sin 2x}{\sin 3x}, & \text{when } x \neq 0 \\ 2, & \text{when } x = 0\end{matrix}$, then at x = 0, function is **[2.5]**

a) Not continuous, since$\lim_{x\to 0} f(x)$ is not defined
b) Continuous
c) None of these
d) Not continuous, since$\lim_{x\to 0} f(x) \neq f(0)$

85) If$y = (1+x)\left(1+x^2\right)\left(1+x^4\right)\left(1+x^8\right)\left(1+x^{16}\right)$, then what is $\frac{dy}{dx}$ at $x = 0$ equal to? **[2.5]**

a) 0 b) 4
c) 2 d) 1

86) If$u = e^{ax}\sin bx$ and $v = e^{ax}\cos bx$, then what is $u\frac{du}{dx} + v\frac{dv}{dx}$ equal to? **[2.5]**

a) $(a+b)e^{ax}$
b) $ab\ e^{2ax}$
c) ae^{2ax}
d) $\left(a^2+b^2\right)e^{ax}$

87) If$x = \cos(2t)$ and $y = \sin^2 t$, then what is $\frac{d^2y}{dx^2}$ equal to? **[2.5]**

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

88) What is$\frac{d\sqrt{1-\sin 2x}}{dx}$ equal to, where $\frac{\pi}{4} x \frac{\pi}{2}$? **[2.5]**

a) $-(\cos x + \sin x)$ b) $\pm(\cos x + \sin x)$
c) None of these d) $\cos x + \sin x$

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

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

90) Consider the following statements in respect of the function$f(x) = x^2 + 1$ in the interval $(1, 2)$.
i. The maximum value of the function is 5 .
ii. The minimum value of the function is 2.
Which of the above statements is/are correct? **[2.5]**

a) Neither 1 nor 2 b) Both 1 and 2
c) 2 only d) 1 only

91) The radius of a circle is increasing at the rate of 0.7 cm/s. What is the rate of increase of its circumference? **[2.5]**

a) 4.4 cm/s
b) 8.4 cm/s
c) 8.8 cm/s
d) 15.4 cm/s

92) If the derivative of the function$f(x) = \frac{m}{x} + 2nx + 1$ vanishes at x = 2, then what is the value of m + 8n? **[2.5]**

a) Cannot be determined due to insufficient data
b) 0
c) - 2
d) 2

93) Evaluate the integral$\int \frac{dx}{x\cos^2(1+\log x)}$ **[2.5]**

a) Tan (1 + log x) + C b) Tan(1 - log x) + C
c) $\log|1-\tan x| + C$ d) $\log|1+\tan x| + C$

94) What is$\int \tan^{-1}(\sec x + \tan x)dx$ equal to? Where, C is the constant of integration. **[2.5]**

a) $\frac{\pi x}{4} + \frac{\pi x^2}{4} + C$
b) $\frac{\pi x}{4} - \frac{x^2}{4} + C$
c) $\frac{\pi x}{2} + \frac{x^2}{4} + C$
d) $\frac{\pi x}{4} + \frac{x^2}{4} + C$

95) What is$\int \frac{dx}{2x^2-2x+1}$ equal to? **[2.5]**

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

96) What is$\int_1^3 \left|1-x^4\right| dx$ equal to? **[2.5]**

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

97) The value of$\int_{-\pi/2}^{\pi/2} \frac{dx}{e^{\sin x}+1}$ is equal to **[2.5]**

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

98) $\int_0^a \frac{dx}{x+\sqrt{(a^2-x^2)}}$ is equal to **[2.5]**

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

99) What is the area of one of the loops between the curve y = c sin x and X - axis? **[2.5]**

a) 2c sq units b) 3c sq units
c) 4c sq units d) C sq unit

100) What is the area bounded by y = [x], where [.]is the greatest integer function, the X - axis and the lines x = - 1.5 and x = - 1.8? **[2.5]**

a) 0.4 sq unit b) 0.8 sq unit
c) 0.6 sq unit d) 0.3 sq unit

101) Variable separation method can be used to solve First Order, First Degree Differential Equations in which y' is of the form. **[2.5]**

a) $y^2 = cos\ (g(y))$
b) $y^2 = sin\ (h(x))$
c) Y' = h(x)g(y)
d) $y^3 = g(y)$

102) The integrating factor of the differential equation$\left(1-x^2\right)\frac{dy}{dx} + xy = ax\ -1 < x < 1$ is: **[2.5]**

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

103) The number of solutions of$\frac{dy}{dx} = \frac{y+1}{x-1}$ when y(1) = 2 is : **[2.5]**

a) Infinite b) Three
c) One d) Two

104) General solution of $\frac{dy}{dx}$ + y tan x = sec x is: **[2.5]**
a) Y tan x = sec x + c b) Y sec x = tan x + c
c) Tan x = y tan x + c d) X sec x = tan y + c

105) What is the degree of the differential equation $\frac{d^3y}{dx^3} + 2\left(\frac{d^2y}{dx^2}\right)^2 - \frac{dy}{dx}$ + y = 0? **[2.5]**
a) 3 b) 2
c) 1 d) 6

106) The integrating factor of the differential equation (1 - y^2)$\frac{dx}{dy}$ + yx = ay, (- 1 < y < 1) is **[2.5]**
a) $\frac{1}{y^2-1}$
b) $\frac{1}{1-y^2}$
c) $\frac{1}{\sqrt{1-y^2}}$
d) $\frac{1}{\sqrt{y^2-1}}$

107) Consider the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. If 1 is added to each number, the variance of the numbers so obtained is **[2.5]**
a) 3.87 b) 8.25
c) 2.87 d) 6.5

108) If the median of the data 4, 7, x - 1, x - 3, 16, 25, written in ascending order, is 13 then x is equal to **[2.5]**
a) 15 b) 14
c) 13 d) 16

109) If $x_i's$ are the midpoints of the class intervals of grouped data, $f_i's$ are the corresponding frequencies and $\overline{x}$ is the mean, then $\sum(f_ix_i - \overline{x})$ is equal to **[2.5]**
a) 2 b) 0
c) – 1 d) 1

110) If the median of the data: 6, 7, x - 2, x, 17, 20, written in ascending order, is 16. Then x = **[2.5]**
a) 18 b) 16
c) 15 d) 17

111) The width of each of nine classes in a frequency distribution is 2.5 and the lower class boundary of the lowest class 10.6. Then the upper class boundary of the highest class is **[2.5]**
a) 28.1 b) 30.6
c) 33.1 d) 35.6

112) The difference between the maximum and the minimum observation in the data is called _____. **[2.5]**
a) Range b) Frequency
c) Class interval d) Cumulative frequency

113) For some data x_1, x_2, ... x_n with respective frequencies f_1, f_2, ... f_n, the value of $\sum_1^n f_i(x_i - \bar{x})$ is equal to: **[2.5]**
a) $n\bar{x}$ b) 1
c) $\sum f_i$ d) 0

114) Three squares of chess board are selected at random. The probability of getting 2 squares of one colour and other of a different colour is **[2.5]**
a) $\frac{3}{32}$ b) $\frac{16}{21}$
c) $\frac{8}{21}$ d) $\frac{3}{8}$

115) A number is selected at random from the first 20 numbers, then the probability that the number is a multiple of 3 is : - **[2.5]**
a) $\frac{3}{18}$ b) $\frac{3}{10}$
c) $\frac{5}{18}$ d) $\frac{4}{18}$

116) The probability that a person is not a swimmer is 0.3. The probability that out of 5 persons 4 are swimmers is **[2.5]**
a) ${}^5C_1(0.7)(0.3)^4$
b) $(0.7)^4(0.3)$
c) ${}^5C_4(0.7)(0.3)^4$
d) ${}^5C_4(0.7)^4(0.3)$

117) 8 coins are tossed at a time. The probability of getting atleast 6 heads up is **[2.5]**
a) $\frac{57}{64}$ b) $\frac{229}{256}$
c) $\frac{37}{256}$ d) $\frac{1}{64}$

118) A card is selected at random from a well shuffled deck of 52 playing cards. The probability of its being a face card is **[2.5]**
a) $\frac{3}{26}$ b) $\frac{3}{13}$
c) $\frac{1}{26}$ d) $\frac{4}{13}$

119) An integer is chosen at random from the first 100 integers. Then, the probability that this number will not be divisible by 5 or 8 is **[2.5]**
a) $\frac{9}{10}$ b) $\frac{7}{10}$
c) $\frac{1}{10}$ d) $\frac{3}{10}$

120) One of the two events must occur. If the chance of one is $\frac{2}{3}$ of the other, then odds in favour of the other are **[2.5]**
a) 2 : 3 b) 3 : 1
c) 1 : 3 d) 3 : 2