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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 proper subsets of 1, 2, 3, 4. How many of these proper subsets are superset of the set 3? [2.5]
a) 5 b) 6
c) 7 d) 8

2) Let X be a non - empty set and let A, B, C be subsets of X. Consider the following statements.
i. $A \subset C \Rightarrow (A \cap B) \subset (C \cap B), (A \cup B) \subset (C \cup B)$
ii. $(A \cap B) \subset (C \cap B)$ for all sets $B \Rightarrow A \subset C$
iii. $(A \cup B) \subset (C \cup B)$ for all sets $B \Rightarrow A \subset C$
Which of the above statements are correct? [2.5]
a) I and ii b) Ii and iii
c) I and iii d) I, ii and iii

3) Let A and B be subsets of X and$C = (A \cap B) \cup (A' \cap B)$, where A' and B are complements of A and B, respectively in X. What is C equal to? [2.5]
a) $(A \cup B') - (A \cap B')$
b) $(A' \cup B') - (A' \cap B')$
c) $(A \cup B) - (A \cap B)$
d) $(A' \cup B) - (A' \cap B)$

4) Let R be a relation from N to N defined by$R = (x, y) : x, y \in N$ and $x^2 = y^3$. Which of the following are not correct?
i. $(x, x) \in N$ for all $x \in N$
ii. $(x, y) \in R \Rightarrow (y, x) \in R$
iii. $(x, y) \in R$ and $(y, z) \in R \Rightarrow (x, z) \in R$
Select the correct answer using the code given below. [2.5]
a) Only ii and iii b) Only i and ii
c) Only i and iii d) I, ii and iii

5) Let A be the set of all real numbers. Then, the relation R =(a, b) : 1 + ab > 0 on A is [2.5]
a) Reflexive and symmetric but not transitive
b) Only relfexive
c) Symmetric and transitive but not reflexive
d) Reflexive and transitive but not symmetric

6) Consider the function
f(x) = g(x) + h(x)
where, $g(x) = \sin\left(\frac{x}{4}\right)$ and $h(x) = \cos\left(\frac{4x}{5}\right)$
What is the period of the function h(x)? [2.5]
a) $\frac{5\pi}{2}$ b) $\frac{4\pi}{5}$
c) π d) $\frac{3\pi}{2}$

7) If f(x) = 4x + 1 and g(x) = kx + 2 such that fog(x) = gof(x), then what is the value of k? [2.5]
a) 7 b) 3
c) 5 d) 4

8) In an AP, the first term is x and the sum of the first n terms is zero. What is the sum of next m terms? [2.5]
a) $\frac{mx(m+n)}{n-1}$ b) $\frac{nx(m+n)}{1-m}$
c) $\frac{mx(m+n)}{1-n}$ d) $\frac{nx(m+n)}{m-1}$

9) If p times the p^{th} term of an AP is q times the q^{th} term, then what is the $(p + q)^{th}$ term equal to? [2.5]
a) 0 b) Pq
c) P + q d) 1

10) Consider the following statements
i. 2 + 4 + 6 + ... + 2n = n^2 + n
ii. The expression n^2 + n + 41 always gives a prime number for every natural number n.
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

11) Let$t_1, t_2, t_3 \ldots$ be in GP.
What is $(t_1 t_3 \ldots t_{21})^{\frac{1}{11}}$? [2.5]
a) T_{11} b) t_{10}^2
c) T_{10} d) t_{11}^2

12) If x =$1 + a + a^2 + a^3 + \cdots \infty (|a| < 1)$ and y = $1 + b + b^2 + b^3 + \cdots \infty (|b| < 1)$, then $1 + ab + a^2b^2 + a^3b^3 + \cdots \infty$ is equal to [2.5]
a) $\frac{x-y}{x-y+1}$ b) $\frac{xy}{x-y-1}$
c) $\frac{xy}{x+y-1}$ d) $\frac{x+y}{x+y+1}$

13) What is the real part of $(\sin x + i \cos x)^3$, where i = $\sqrt{-1}$? [2.5]
a) - cos 3x b) Cos 3x
c) - sin 3x d) Sin 3x

14) $\arg(i\omega) + \arg\left(i\omega^2\right)$ is equal to [2.5]
a) π b) $\frac{\pi}{3}$
c) $\frac{\pi}{2}$ d) 0

15) If$\frac{3+2i\sin\theta}{1-2i\sin\theta}$ is purely real, then θ is equal to [2.5]
a) $n\pi \pm \frac{\pi}{3}$
b) $2n\pi \pm \frac{\pi}{4}$
c) $n\pi$
d) $\frac{n\pi}{2}$

16) If$\left|\frac{z-2}{z-3}\right|$ = 2 represents a circle, then centre and radius are [2.5]
a) $\left(\frac{10}{3}, 1\right), \frac{2}{3}$
b) $\left(\frac{-10}{3}, 0\right), \frac{2}{3}$
c) $\left(\frac{-10}{3}, 1\right), \frac{2}{3}$
d) $\left(\frac{10}{3}, 0\right), \frac{2}{3}$

17) If 4^x - 6 · 2^x + 8 = 0, then the values of x are [2.5]

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

18) If the roots of a quadratic equation $ax^2 + bx + c = 0$ are α and β , then the quadratic equation having roots α^2 and β^2 is [2.5]

a) $Ax^2 - (b^2 - 2ac)x + c^2 = 0$
b) $X^2 - (b^2 - 2ac)x + c = 0$
c) $A^2x^2 - (b^2 - 2ac)x + c = 0$
d) $A^2x^2 - (b^2 - 2ac)x + c^2 = 0$

19) If $a, b \in R$, then the equation $x^2 - abx - a^2 = 0$ has [2.5]

a) Both positive roots
b) Non - real roots
c) One positive and one negative root
d) Both negative roots

20) If $x^2 - px + 4 > 0$ for all real values of x, then which one of the following is correct? [2.5]
a) $|p| \geq 4$ b) $|p| > 4$
c) $|p| \leq 4$ d) $|p| < 4$

21) Consider a regular polygon with 10 sides. What is the number of triangles that can be formed by joining the vertices which have no common side with any.of the sides of the polygon? [2.5]
a) 100 b) 50
c) 75 d) 25

22) How many 5 - letter words with or without meaning can be formed out of letters of the wordEQUATIONS if repetition of letters is not allowed? [2.5]
a) ${}^9C_5 \times 5!$ b) 9^5
c) ${}^9C_5$ d) 5^9

23) 5 - digit numbers are formed using the digits 0, 1, 2, 4, 5 without repetition. What is the percentage of numbers which are greater than 50000? [2.5]
a) $\frac{110}{3}$ % b) 20%
c) $\frac{100}{3}$ % d) 25%

24) In how many ways can a team of 5 players be selected from 8 players so as not to include a particular player? [2.5]
a) 42 b) 21
c) 20 d) 35

25) If 1! + 3! + 5! + 7! +...+ 199! is divided by 24, what is the remainder? [2.5]
a) 3 b) 7
c) 9 d) 6

26) Find the number, which the expression $7^9 + 9^7$ is divisible [2.5]
a) 13 b) 17
c) 64 d) 25

27) How many terms are there in the expansion of$(3x - y)^4(x + 3y)^4$? [2.5]
a) 15 b) 9
c) 12 d) 17

28) If$x \in \left(0, \frac{\pi}{2}\right)$, then value of x satisfying the equation $\log_{\sin x} 2\cos x = 0$ is [2.5]
a) $\frac{\pi}{3}$ b) $\frac{\pi}{2}$
c) $\frac{\pi}{4}$ d) $\frac{\pi}{6}$

29) If n = 100!, then what is the value of the following? $\frac{1}{\log_2 n} + \frac{1}{\log_3 n} + \frac{1}{\log_4 n} + \ldots + \frac{1}{\log_{100}} n$ [2.5]
a) 0 b) 1
c) 3 d) 2

30) If |A| = 3 and$A^{-1} = \begin{bmatrix} 3 & -1 \\ \frac{-5}{3} & \frac{2}{3} \end{bmatrix}$ then adj A =? [2.5]

a) $\begin{bmatrix} -9 & 3 \\ 5 & -2 \end{bmatrix}$
b) $\begin{bmatrix} 9 & 3 \\ -5 & -2 \end{bmatrix}$
c) $\begin{bmatrix} 9 & -3 \\ -5 & 2 \end{bmatrix}$
d) $\begin{bmatrix} 9 & -3 \\ 5 & -2 \end{bmatrix}$

31) Three points P(2x, x + 3), Q(0, x) and R(x + 3, x + 6) are collinear, then x is equal to: [2.5]
a) 2 b) 0
c) 3 d) 1

32) The value of the determinant$\begin{vmatrix} 0 & a & -b \\ -a & 0 & -c \\ b & c & 0 \end{vmatrix}$ is [2.5]
a) 0 b) A
c) - a d) B

33) If A is a square matrix of order 3 such that |adj A| = 36, find |A| [2.5]
a) ± 6 b) ± 5
c) - 6 d) 6

34) If$\begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ 3 \\ 2 \end{bmatrix}$, then the value of (2x + y - z) is: [2.5]
a) 3 b) 5
c) 1 d) 2

35) If the matrix AB is zero, then [2.5]

a) A = 1 and B = 1
b) It is necessary that either A = 0 or, B = 0
c) It is not necessary that either A = 0 or, B = 0
d) A = 0 or B = 0

36) If A and B are two matrices such that AB = A and BA = B, then B^2 is equal to [2.5]
a) 0 b) A
c) B d) 1

37) Matrices A and B will be inverse of each other only if [2.5]
a) AB = 0, BA = I b) AB = BA = I
c) AB = BA = 0 d) AB = BA

38) Divide $(1111)_2$ by $(11)_2$. [2.5]
a) $(11)_2$ b) $(101)_2$
c) $(102)_2$ d) $(10)_2$

39) If the number 235 in decimal system is converted into binary system, then what is the resulting number? [2.5]
a) $(11011011)_2$ b) $(11110101)_2$
c) $(11101011)_2$ d) $(11110011)_2$

40) A binary number is represented by (II mm I mm II m)$_2$, where **mI** . What is its decimal equivalent? [2.5]
a) $(213)_{10}$ b) $(215)_{10}$
c) $(210)_{10}$ d) $(217)_{10}$

41) What is value of $\cot^2 15^o + \tan^2 15^o$? [2.5]
a) 12 b) 14
c) $8\sqrt{3}$ d) 4

42) What will be the value of$\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos 8\theta}}}$? [2.5]

a) 2cosθ b) 2sinθ
c) Cos 2θ d) Sin 2θ

43) It is given that$\cos(\theta-\alpha)=a, \cos(\theta-\beta)=b$. What is $\sin^2(\alpha-\beta)+2ab\cos(\alpha-\beta)$ equal to? [2.5]
a) A^2 - b^2 b) B^2 - a^2
c) A^2 + b^2 d) - (a^2 + b^2)

44) The number of integer values of k, for which the equation 2 sin x = 2k + 1 has a solution, is [2.5]
a) 1 b) 4
c) 0 d) 2

45) If$\tan\theta=-\frac{5}{12}$, then what can be the value of $\sin\theta$? [2.5]

a) $\frac{5}{13}$ but cannot be $-\frac{5}{13}$
b) $\frac{5}{13}$ or $-\frac{5}{13}$
c) $-\frac{5}{13}$ but cannot be $\frac{5}{13}$
d) $-\frac{5}{13}$ or $-\frac{5}{13}$

46) What is the maximum value of 3 cos x + 4 sin x + 5? [2.5]
a) 7 b) 10
c) 5 d) 12

47) If$\sin^{-1}x+\cot^{-1}(\frac{1}{2})=\frac{\pi}{2}$, then what is the value of x? [2.5]
a) 0 b) $\frac{\sqrt{3}}{2}$
c) $\frac{1}{\sqrt{5}}$ d) $\frac{2}{\sqrt{5}}$

48) The principal value of$\sin^{-1}\frac{1}{\sqrt{17}}+\cos^{-1}\frac{5}{\sqrt{34}}$ is [2.5]

a) $\frac{\pi}{2}$
b) $\cos^{-1}\left(\frac{23}{17\sqrt{2}}\right)$
c) $\frac{\pi}{4}$
d) $\sin^{-1}\left(\frac{23}{17\sqrt{2}}\right)$

49) What is the principal value of$\operatorname{cosec}^{-1}(-\sqrt{2})$? [2.5]
a) $\frac{\pi}{4}$ b) $\frac{\pi}{2}$
c) $-\frac{\pi}{4}$ d) 0

50) If$3\sin^{-1}x+\cos^{-1}x=\pi$, then what is x equal to? [2.5]
a) 0 b) $\frac{1}{\sqrt{2}}$
c) $\frac{1}{2}$ d) $\frac{1}{\sqrt{3}}$

51) There are two points P and Q due South of a leaning tower, which leans towards North. P is at a distance x and Q is at a distance y from the foot of the tower(xy) . The angles of elevation of the top of the tower from P and Q are 15° and 75° , respectively.
If θ is the inclination of the tower to the horizontal, then what is $\cot\theta$ equal to? [2.5]

a) $2-\frac{\sqrt{3}(x-y)}{x+y}$
b) $2-\frac{\sqrt{3}(x+y)}{x-y}$
c) $2+\frac{\sqrt{3}(x+y)}{x-y}$
d) $2+\frac{\sqrt{3}(x-y)}{x+y}$

52) AB is a vertical pole. The end A is on the ground, C is the middle point of AB and P is a point on the level ground. The portion BC subtends an angleα at P. If $AP=n.AB$, then $\tan\alpha$ is [2.5]

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

53) In a$\triangle ABC$, if $\cos B=\frac{(\sin A)}{(2\sin C)}$, then the triangle is [2.5]

a) Scalene triangle
b) Right angled triangle
c) Equilateral triangle
d) Isosceles triangle

54) The perimeter of a triangle ABC is 6 times the AM of sine of angles of the triangle. Further BC =$\sqrt{1}$ and CA = $\sqrt{3}$.
Consider the following statements
i. ABC is right angle triangle.
ii. The angles of the triangle are in AP.
Which of the statements given above is/are correct? [2.5]
a) Neither 1 nor 2 b) Both 1 and 2
c) Only 1 d) Only 2

55) In any$\triangle ABC$, a = 18, b = 24 and c = 30, then what is sin C equal to? [2.5]
a) 1 b) $\frac{1}{3}$
c) $\frac{1}{4}$ d) $\frac{1}{2}$

56) 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.
What is $\frac{p^2}{q^2}$ equal to? [2.5]

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

57) The line$3x+4y-24=0$ intersects the X - axis at A and Y - axis at B. Then, the circumcentre of the $\triangle OAB$, where O is the origin, is [2.5]
a) $(3,3)$ b) $(2,3)$
c) $(4,3)$ d) None of these

58) Consider the following statements in respect of the points$(p,p-3),(q+3,q)$ and $(6,3)$
i. The points lie on a straight line.
ii. The points always lie in the first quadrant only for any value of p and q.
Which of the above statements is/are correct? [2.5]
a) Only I b) Neither I nor II
c) Only II d) Both I and II

59) The vertices of a triangle are A(5, - 1), 8(- 1, 5) and C(6, 6). Find the coordinates of the circumcentre. [2.5]

a) $\left(\frac{23}{8},\frac{23}{8}\right)$
b) $\left(\frac{28}{3},\frac{28}{3}\right)$
c) $\left(\frac{10}{3},\frac{10}{3}\right)$
d) $\left(\frac{33}{3},\frac{33}{3}\right)$

60) The points$(a,b),(0,0),(-a,-b)$ and $\left(ab,b^2\right)$ are [2.5]

a) The vertices of a square
b) Collinear
c) The vertices of a rectangle
d) The vertices of a parallelogram

61) What is the distance between the straight lines$3x+4y=9$ and $6x+8y=15$? [2.5]
a) 6 units b) $\frac{3}{10}$ units
c) 5 units d) $\frac{3}{2}$ units

62) If the centre of the circle passing through the origin is (3, 4), then the intercepts cut - off by the circle on X - axisand Y - axis,respectively are [2.5]

a) 6 units and 8 units b) 6 units and 4 units c) 3 units and 4 units d) 3 units and 8 units

63) The circle $x^2+y^2+4x-7y+12=0$, cuts an intercept on Y - axis equal to [2.5]
a) 1 b) 4 c) 3 d) 7

64) In a circle of diameter 44 cm, the length of a chord is 22 cm. What is the length of minor arc of the chord? [2.5]
a) $\frac{121}{21}$ cm
b) $\frac{242}{21}$ cm
c) $\frac{44}{7}$ cm
d) $\frac{484}{21}$ cm

65) $P(x,y)$ is any point on the ellipse $x^2+4y^2=1$ Let E,F be the foci of the ellipse.
Consider the following points.
i. $\left(\frac{\sqrt{3}}{2},0\right)$
ii. $\left(\frac{\sqrt{3}}{2},\frac{1}{4}\right)$
iii. $\left(\frac{\sqrt{3}}{2},-\frac{1}{4}\right)$
Which of the above points lie on latus rectum of ellipse? [2.5]
a) 2 and 3 b) 1 and 3 c) 1,2 and 3 d) 1 and 2

66) What is the distance between the foci of the ellipse $x^2+2y^2=1$? [2.5]
a) 2 b) 1 c) $\sqrt{2}$ d) $2\sqrt{2}$

67) The centre of an ellipse is at $(0,0)$, major - axis is on the Y - axis. If the ellipse passes through (3, 2) and (1, 6), then what is its eccentricity? [2.5]
a) $\sqrt{5}$ b) $\sqrt{3}$ c) $\frac{\sqrt{3}}{2}$ d) $\frac{\sqrt{5}}{2}$

68) What is the radius of the sphere $x^2+y^2+z^2-6x+8y-10z+1=0$? [2.5]
a) 3 units b) 2 units c) 7 units d) 5 units

69) A point P lies on the line joining $A(1,2,3)$ and $B(2,10,1)$. If z - coordinate of P is 7, what is the sum of other two coordinates? [2.5]
a) - 15 b) - 11 c) $-13°$ d) $\ddot{-}9$

70) If y - coordinate of a point P on the join of Q(1, 1, 3) and R(2, - 3, 5) is - 4, then find its z - coordinate. [2.5]
a) $\frac{11}{2}$ b) $\frac{2}{11}$ c) $\frac{-11}{2}$ d) $\frac{-2}{11}$

71) What is the angle between the lines $\frac{x-2}{1}=\frac{y+1}{-2}=\frac{z+2}{1}$ and $\frac{x-1}{1}=\frac{2y+3}{3}=\frac{z+5}{2}$? [2.5]
a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$ c) $\frac{\pi}{2}$ d) $\frac{\pi}{3}$

72) The foot of the perpendicular drawn from the origin to the plane $x+y+z=3$ is [2.5]
a) $(-1,1,3)$ b) $(0,0,3)$ c) $(0,1,2)$ d) $(1,1,1)$

73) If $|\vec{a}|=|\vec{b}|$, then $(\vec{a}+\vec{b})\cdot(\vec{a}-\vec{b})$ [2.5]
a) Positive b) Negative c) 0 d) 1

74) The vectors $\hat{i}-2x\hat{j}-3y\hat{k}$ and $\hat{i}+3x\hat{j}+2y\hat{k}$ are orthogonal to each other. Then, the locus of the point (x, y) is [2.5]
a) Parabola b) Hyperbola c) Circle d) Ellipse

75) If $\vec{a}=a_1\hat{i}+a_2\hat{j}+a_3\hat{k}$ and $\vec{b}=b_1\hat{i}+b_2\hat{j}+b_3\hat{k}$ then the dot product $\vec{a}.\vec{b}=$ [2.5]
a) $a_1b_1-a_2b_2+a_3b_3$
b) $a_1b_1+a_2b_2+a_3b_3$
c) $a_1b_1-a_2b_2-a_3b_3$
d) $a_1b_1+a_2b_2-a_3b_3$

76) If $\vec{a},\vec{b}$ represent the diagonals of a rhombus, then [2.5]
a) $\vec{a}\times\vec{b}=\vec{0}$
b) $\vec{a}+\vec{b}=1$
c) $\vec{a}\times\vec{b}=\vec{a}$
d) $\vec{a}\cdot\vec{b}=0$

77) If $\vec{a}\cdot\vec{b}=\vec{a}\cdot\vec{c}$ and $\vec{a}\times\vec{b}=\vec{a}\times\vec{c},\vec{a}=0$, then [2.5]
a) $\vec{b}+\vec{c}=\vec{0}$
b) $\vec{b}+\vec{a}=\vec{0}$
c) $\vec{b}=\vec{c}$
d) $\vec{b}=\vec{0}$

78) If $\vec{a}=(2\hat{i}-3\hat{j}+4\hat{k})$, $\vec{b}=(\hat{i}+2\hat{j}-\hat{k})$ and $\vec{c}=(3\hat{i}-\hat{j}-2\hat{k})$ be the co - terminous edges of a parallelepiped then its volume is [2.5]
a) 25 cubic unit b) 21 cubic unit c) 35 cubic unit d) 14 cubic unit

79) Find the value of x for which $x\left(\hat{i}+\hat{j}+\hat{k}\right)$ is a unit vector. [2.5]
a) $\pm\frac{1}{\sqrt{2}}$
b) $\pm\frac{1}{\sqrt{3}}$
c) $\pm\frac{1}{\sqrt{7}}$
d) $\pm\frac{1}{\sqrt{5}}$

80) The scalar projection of the vector $3\hat{i}-\hat{j}-2\hat{k}$ on the vectors $\hat{i}-2\hat{j}-3\hat{k}$ is [2.5]
a) $\frac{7}{2}$ b) $\frac{7}{\sqrt{14}}$ c) $\frac{6}{13}$ d) $\frac{7}{14}$

81) Evaluatelim$_{x\to\frac{\pi}{2}}$ (secx - tanx). [2.5]
a) 0 b) 1 c) - 1 d) $\frac{1}{2}$

82) $\lim_{x\to 0}\frac{1-\cos^3 4x}{x^2}$ is equal to [2.5]
a) 0 b) 36 c) 12 d) 24

83) Let $f(x)=\begin{matrix} 1+\frac{x}{2k}, & 0<x<2 \\ kx, & 2\leq x<4 \end{matrix}$
If $\lim_{x\to 2}f(x)$ exists, then what is the value of k? [2.5]
a) 0 b) 1 c) - 2 d) - 1

84) The function $f(x)=\frac{1-\sin x+\cos x}{1+\sin x+\cos x}$ is not defined at $x=\pi$. The value of $f(\pi)$, so that f(x) is continuous at $x=\pi$, is [2.5]
a) $-\frac{1}{2}$ b) 1 c) $\frac{1}{2}$ d) - 1

85) What is the derivative of $\sin(\ln x)+\cos(\ln x)$ with respect to x at $x=e$? [2.5]
a) $\frac{\cos 1+\sin 1}{e}$
b) 0
c) $\frac{\sin 1-\cos 1}{e}$
d) $\frac{\cos 1-\sin 1}{e}$

86) If y = x + e^x, then what is $\frac{d^2x}{dy^2}$ equal to? [2.5]

a) E^x
b) $-\frac{e^x}{(1+e^x)^3}$
c) $-\frac{e^x}{(1+e^x)}$
d) $-\frac{e^x}{(1+e^x)^2}$

87) If $y = e^{x+e^{x+e^{x...\infty}}}$, then $\frac{dy}{dx}$ is equal to [2.5]
a) $\frac{y}{y-1}$ b) $\frac{1}{1-y}$
c) $\frac{y}{1-y}$ d) $\frac{1}{y-1}$

88) Find $\frac{dy}{dx}$, when $x = \frac{3at}{1+t^3}$ and $y = \frac{3at^2}{1+t^3}$. [2.5]
a) $\frac{t(2-t^3)}{1-2t^3}$
b) $\frac{t^3-4}{1-2t^3}$
c) $\frac{t(2+t^3)}{1+2t^3}$
d) $\frac{t^3+4}{1+2t^3}$

89) Consider the following statements
i. Derivative of f(x) may not exist at some point.
ii. Derivative of f(x) may exist finitely at some point.
iii. Derivative of f(x) may be infinite (geometrically) at some point.
Which of the above statements are correct? [2.5]
a) II and III b) All are correct
c) I and III d) I and II

90) Three sides of a trapezium are each equal to 6 cm. Let $\alpha \in \left(0, \frac{\pi}{2}\right)$ be the angle between a pair of adjacent sides. If the area of the trapezium is the maximum possible, then what is α equal to? [2.5]
a) $\frac{\pi}{3}$ b) $\frac{\pi}{4}$
c) $\frac{2\pi}{5}$ d) $\frac{\pi}{6}$

91) Find interval(s) in which the function f(x) = sinx + cosx, where $x \in \left(0, \frac{\pi}{2}\right)$ is strictly increasing or decreasing. [2.5]
a) $\left(0, \frac{\pi}{3}\right)$ or $\left(\frac{\pi}{3}, \frac{\pi}{2}\right)$
b) $\left(0, \frac{\pi}{4}\right)$ or $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$
c) $\left(0, \frac{\pi}{5}\right)$ or $\left(\frac{\pi}{5}, \frac{\pi}{2}\right)$
d) $\left(0, \frac{\pi}{6}\right)$ or $\left(\frac{\pi}{6}, \frac{\pi}{2}\right)$

92) In which one of the following intervals is the function $f(x) = x^2 - 5x + 6$ decreasing? [2.5]
a) $[3, \infty)$ b) $(2, 3)$
c) $(-\infty, \infty)$ d) $(-\infty, 2]$

93) Evaluate the integral $\int \sin^3 x\sqrt{\cos x}dx$ [2.5]
a) $\frac{1}{3}\sin^3 x + \frac{1}{5}\sin^5 x + C$
b) $-\frac{2}{3}\cos^{3/2} x + \frac{2}{7}\cos^{7/2} x + C$
c) $\frac{1}{3}\sin^3 x - \frac{1}{5}\sin^5 x + C$
d) $\frac{2}{3}\cos^{3/2} x + \frac{2}{7}\cos^{7/2} x + C$

94) What is the value of $\int \left(x^2+1\right)^{5/2} xdx$? [2.5]
a) $\left(x^2-1\right)^{\frac{7}{2}} + C$
b) $\frac{2}{7}\left(x^2+1\right)^{\frac{7}{2}} + C$
c) $\frac{1}{7}\left(x^2+1\right)^{\frac{7}{2}} + C$
d) $\left(x^2+1\right)^{\frac{7}{2}} + C$

95) Consider $f'(x) = \frac{x^2}{2} - kx + 1$ such that f(0) = 0 and f(3) =15
$f''\left(-\frac{2}{3}\right)$ is equal to [2.5]
a) - 1 b) 1
c) $\frac{1}{2}$ d) $\frac{1}{3}$

96) $\int_0^{\frac{\pi}{2}} |\sin x - \cos x|dx$ is equal to [2.5]
a) $2(\sqrt{2}-1)$ b) 0
c) $2\sqrt{2}$ d) $2(\sqrt{2}+1)$

97) Let $f(x) = Pe^x + Qe^{2x} + Re^{3x}$, where P, Q and R are real numbers. Further $f(0) = 6, f'(\ln 3) = 282$ and $\int_0^{\ln 2} f(x)dx = 11$.
What is the value of Q? [2.5]
a) 1 b) 3
c) 2 d) 4

98) What is $\int_0^{\pi} \ln\left(\tan\frac{x}{2}\right)dx$ equal to? [2.5]
a) 2 b) $\frac{1}{2}$
c) 1 d) 0

99) Find the area of the region, bounded by the curve (x, y) :$y = \sqrt{4-x^2}$ and X - axis. [2.5]
a) 3π sq units b) 5π sq units
c) π sq units d) 2π sq units

100) What is the area of the region enclosed in the first quadrant by $x^2 + y^2 = \pi^2$, y = sin x and x = 0? [2.5]
a) $\frac{\pi^3}{2} - 1$ b) $\frac{\pi^2}{4} - 2$
c) $\frac{\pi^3}{4} - 1$ d) $\frac{\pi^3}{4} - 2$

101) The equation of the curve satisfying the differential equation y (x + y^3) dx = x (y^3 - x)dy and passing through the point (1, 1) is , [2.5]
a) $y^3 - 2x + 4x^2y = 0$
b) $Y^3 + 2x + 3x^2y = 0$
c) $y^3 + 2x - 3x^2y = 0$
d) $Y^3 - 2x + 3x^2 y = 0$

102) Tan^{-1} x + $\tan^{-1}$ y = c is the general solution of the differential equation: [2.5]
a) $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$
b) $\frac{dy}{dx} = \frac{1+x^2}{1+y^2}$
c) $(1 + x^2)$ dy + $(1 + y^2)$ dx = 0
d) $(1 + x^2)$ dx + $(1 + y^2)$ dy = 0

103) The number of arbitrary constants in the particular solution of a differential equation of third order are: [2.5]
a) 1 b) 3
c) 2 d) 0

104) What is the general solution of the differential equation e^x tan ydx + (1 - e^x) $\sec^2$ ydy = 0? [2.5]
a) Cos y = C(1 - e^x) b) Sin y = C(1 - e^x)
c) Cot y = C(1 - e^x) d) None of these

105) The general solution of the differential equation (e^x + 1) ydy = (y + 1) e^x dx is: [2.5]
a) Y + 1 = e^x + 1 + k
b) (y + 1) = k (e^x + 1)
c) Y =log $\frac{e^x+1}{y+1} + k$
d) Y = log k (y + 1) (e^x + 1)

106) The differential equation obtained on eliminating A and B from y = A cosω t + B sin ω t, is [2.5]
a) $y'' - \omega^2 y = 0$
b) Y'' + y = 0
c) Y'' =$-\omega^2 y$
d) Y'' + y' = 0

107) The mean of 'n' observations is $\overline{x}$. If the first item is increased by 1, second by 2 and so on, then the new mean is: [2.5]
a) $\overline{x} - \frac{n-1}{2}$
b) $\overline{x} - \frac{n+1}{2}$

c) $\overline{x}+\frac{n+1}{2}$
d) $\overline{x}$

108) If the mean of 3, 4, x, 7, 10 is 6, then the value of x is [2.5]
a) 5 b) 4
c) 7 d) 6

109) Median and Mode of a distribution are 25 and 21 respectively. Mean of the data using empirical relationship is: [2.5]
a) 29 b) 27
c) $\frac{29}{3}$ d) 18

110) The H.M. of the numbers 2, 3, 4 is [2.5]
a) $\frac{36}{13}$ b) 13
c) $\frac{13}{36}$ d) 3

111) The mean of 20 observations is 15. On checking, it was found that two observations were wrongly copied as 3 and 6. If wrong observations are replaced by correct values 8 and 4, then the correct mean is: [2.5]
a) 16 b) 15.15
c) 15.35 d) 15

112) In a frequency distribution, ogives are graphical representation of [2.5]
a) Cumulative frequency b) Frequency
c) Relative frequency d) Raw data

113) $\frac{\text{Upper class limit + Lower class limit}}{2}$ = [2.5]
a) Frequency b) Class mark
c) Class interval d) Class size

114) Two events E and F are independent. If P(E) = 0.3, P(E∪ F)=0.5 then P(E|F) - P(F|E) equals [2.5]
a) $\frac{3}{35}$ b) $\frac{2}{7}$
c) $\frac{1}{7}$ d) $\frac{1}{70}$

115) Two dice are thrown simultaneously. The probability that the sum of two numbers appearing on the top of the dice is less than 12, is [2.5]
a) 1 b) $\frac{1}{36}$
c) $\frac{35}{36}$ d) 0

116) If M and N are any two events, the probability that at least one of them occurs is [2.5]

a) P (M) + P (N) − P (M∩ N)
b) P (M) + P (N) − 2 P (M∩ N)
c) P (M) + P (N) + 2P (M∩ N)
d) P (M) + P (N) + P (M∩ N)

117) The least number of times a fair coin must be tossed so that the probability of getting at least one head is at least 0.8 , is [2.5]
a) 5 b) 7
c) 6 d) 3

118) The probability of getting a rotten egg in a lot of 400 is 0.035. The number of rotten eggs in the lot is [2.5]
a) 21 b) 14
c) 28 d) 7

119) Two numbers are successively drawn from the set U = 1, 2, 3, 4, 5, 6, 7, 8, the second being drawn without replacing the first. The number of elementary events in the sample is [2.5]
a) 56 b) 32
c) 14 d) 64

120) Fifteen coupons are numbered 1 to 15. Seven coupons are selected at random, one at a time with replacement. The probability that the largest number appearing on a selected coupon is 9, is [2.5]

a) $\left(\frac{3}{5}\right)^7$
b) $\left(\frac{1}{15}\right)^7$
c) None of these
d) $\left(\frac{8}{15}\right)^7$