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) Consider the following statements
   i. The null set is a subset of every set.
   ii. Every set is a subset of itself.
   iii. If a set has 10 elements, then its power set will have 1024 elements.
   Which of the above statements are correct? **[2.5]**
   a) Ii and iii b) I and ii
   c) I and iii d) I, ii and iii

2) If A = x : x is a multiple of 2, B = x : x is a multiple of 5 and C = x : x is a multiple of 10, then$A\cap(B\cap C)$ is equal to **[2.5]**
   a) B
   b) C
   c) x : x is a multiple of 100
   d) A

3) Consider the following statements in respect of two non - empty sets A and B
   i. $x\notin(A\cup B)\Rightarrow x\notin A$ or $x\notin B$
   ii. $x\notin(A\cap B)\Rightarrow x\notin A$ and $x\notin B$
   Which of the above statements is/are correct? **[2.5]**
   a) Neither i nor ii b) Only i
   c) Both i and ii d) Only ii

4) Let P = 1, 2, 3 and a relation on set P is given by the set R = (1, 2), (1, 3), (2, 1), (1, 1), (2, 2), (3, 3), (2, 3). Then, R is **[2.5]**
   a) Symmetric and transitive but not reflexive
   b) Reflexive but not transitive and not symmetric
   c) Reflexive and transitive but not symmetric
   d) Symmetric and reflexive but not transitive

5) Let$A=[x\in R:-1\le x\le 1]$, $B=[y\in R:-1\le y\le 1]$ and S be the subset of $A\times B$, defined by $S=\left[(x,y)\in A\times B:x^2+y^2=1\right]$.
   Which one of the following is correct? **[2.5]**
   a) S is a many - one function from A into B
   b) S is a bijective mapping from A into B
   c) S is not a function
   d) S is a one - one function from A into B

6) If$f(x)=\log_{10}(1+x)$, then what is 4f(4) + 5 f(1) $-\log_{10}2$ equal to? **[2.5]**
   a) 4 b) 0
   c) 1 d) 2

7) Let f be a function with domain [- 3, 5]and let g(x) = |3x + 4|, then the domain of fog(x) is **[2.5]**
   a) $\left[-3,\frac{1}{3}\right)$
   b) $\left[-3,\frac{1}{3}\right]$
   c) $\left(-3,\frac{1}{3}\right]$
   d) $\left(-3,\frac{1}{3}\right)$

8) If x = 1 - y + y^2 - y^3 ... up to infinite terms, where |y| < 1, then which one of the following is correct? **[2.5]**
   a) $x=\frac{y}{1+y}$ b) $x=\frac{1}{1+y}$
   c) $x=\frac{y}{1-y}$ d) $x=\frac{1}{1-y}$

9) If$\frac{1}{4}$, $\frac{1}{x}$ and $\frac{1}{10}$ are in HP, then what is the value of x? **[2.5]**
   a) 7 b) 5
   c) 6 d) 8

10) What is the sum of all two - digit numbers, which when divided by 3 leave 2 as the remainder? **[2.5]**
   a) 1635 b) 1585
   c) 1565 d) 1655

11) If$2^{\frac{1}{c}},2^{\frac{b}{ac}},2^{\frac{1}{a}}$ are in GP, then which one of the following is correct? **[2.5]**
   a) A, b and c are in AP
   b) A, b and c are in GP
   c) A, b and c are in HP
   d) Ab, bc and ca are in AP

12) Letsinβ be the GM of $\sin\alpha$ and $\cos\alpha$; $\tan\gamma$ be the AM of $\sin\alpha$ and $\cos\alpha$.
   What is the value of $\sec 2\gamma$? **[2.5]**
   a) $\frac{5+\sin 2\alpha}{3-\sin 2\alpha}$
   b) $\frac{3-\sin 2\alpha}{5+2\sin 2\alpha}$
   c) $\frac{3-\sin 2\alpha}{4+3\sin 2\alpha}$
   d) $\frac{3-2\sin 2\alpha}{4+\sin 2\alpha}$

13) What is the value of the sum$\sum_{n=2}^{11}\left(i^n+i^{n+1}\right)$, where i = $\sqrt{-1}$? **[2.5]**
   a) 2i b) 1 + i
   c) - 2i d) I

14) If z =$-\bar{z}$, then which one of the following is correct? **[2.5]**
   a) The real part of z is equal to imaginary part of z
   b) The sum of real and imaginary parts of z is z
   c) The imaginary part of z is zero
   d) The real part of z is zero

15) Supposeω and ω^2 are the complex cube roots of unity which are given as
   $\omega^2=\frac{-1+\sqrt{3}i}{2}$ and $\omega^2=\frac{-1-\sqrt{3}i}{2}$.
   Also, 1 + ω + ω^2 = 0 and ω^3 = 1.

The value of expression $4+5\left(-\frac{1}{2}+\frac{i\sqrt{3}}{2}\right)^{334}+3\left(-\frac{1}{2}+\frac{i\sqrt{3}}{2}\right)^{365}$ is equal to **[2.5]**

a) $-1+i\sqrt{3}$ b) $1-i\sqrt{3}$
c) $-i\sqrt{3}$ d) $i\sqrt{3}$

16) If z = x + iy, where i =$\sqrt{-1}$, then what does the equation z$\bar{z}$ + |z|^2 + 4(z + $\bar{z}$) - 48 = 0 represent? **[2.5]**

a) Pair of straight lines
b) Straight line
c) Parabola
d) Circle

17) If the quadratic equations$ax^2+2cx+b=0$ and $ax^2+2bx+c=0 (b\neq c)$ have a common root, then $a+4b+4c$ is equal to **[2.5]**

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

18) Ifα and β are the roots of $x^2+x+1=0$, then what is $\sum_{j=0}^{3}\left(\alpha^j+\beta^j\right)$ equal to? **[2.5]**

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

19) Letα and β be the roots of the equation x^2 - ax - bx + ab - c = 0. What is the quadratic equation whose roots are a and b? **[2.5]**

a) $x^2-\alpha x-\beta x+\alpha\beta+c=0$
b) $x^2-\alpha x-\beta x+\alpha\beta-c=0$
c) $x^2+\alpha x+\beta x+\alpha\beta-c=0$
d) $x^2+\alpha x+\beta x+\alpha\beta+c=0$

20) Find the roots of the equation x^2 - 3|x| + 2 = 0 **[2.5]**

a) 2, 1 b) $\pm2,\pm1$
c) ±2 d) ±1

21) Four - letter words are to be formed using the letters of the wordFAILURE.
Consider the following statements

i. Number of words of F is included in each word is$^6C_3$ × 4!
ii. Number of words, if it contains two different vowels and two different consonants is$^3C_2$ × $^4C_2$ × 4!

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

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

22) There are 17 cricket players, out of which 5 players can bowl. In how many ways can a team of 11 players be selected so as to include 3 bowlers? **[2.5]**

a) C(17, 11)
b) C(12, 8)
c) C(5, 3)× C(12, 8)
d) C(17, 5)× C(5, 3)

23) How many numbers between 400 and 1000 can be made with the digits 2, 3, 4, 5, 6 and 0, when repetition of digits is not allowed? **[2.5]**

a) 55 b) 60
c) 50 d) 40

24) Consider the wordQUESTION.
How many 4 - letter words each of two vowels and two consonants with or without meaning, can be formed? **[2.5]**

a) 36 b) 144
c) 864 d) 576

25) If the coefficients ofa^m and a^n in the expansion of $(1+a)^{m+n}$ are α and β , then which one of the following is correct? **[2.5]**

a) $\alpha=2\beta$ b) $\alpha=(m+n)\beta$
c) $2\alpha=\beta$ d) $\alpha=\beta$

26) The greatest coefficient in the expansion of$\left(x+\frac{1}{x}\right)^{2n}$ is **[2.5]**

a) $\frac{2!}{[(n!)]^2}$
b) $\frac{2!}{(n!)}$
c) $\frac{1\cdot3\cdot5\ldots(2n-1)\cdot2^n}{n!}$
d) $\frac{n!}{\left[\left(\frac{n}{2}\right)!\right]^2}$

27) The value of (C(9, 0) + C(9, 1)]+ (C(9, 1) + C(9, 2)]+ ... + (C(9, 8) + C(9, 9)]is **[2.5]**

a) 1022 b) 1020
c) 1026 d) 1024

28) What is the value of$\frac{1}{10}\log_5 1024-\log_5 10+\frac{1}{5}\log_5 3125$? **[2.5]**

a) 0 b) 1
c) 3 d) 2

29) What is the value of$\log_y x^5\log_x y^2\log_z z^3$? **[2.5]**

a) 60 b) 20
c) 10 d) 30

30) If A =$\begin{bmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{bmatrix}$, then A^T + A = I$_2$, if **[2.5]**

a) $\theta=n\pi, n\in Z$
b) $\theta=4n\pi+\frac{\pi}{4}, n\in Z$
c) $\theta=(2n+1)\frac{\pi}{2}, n\in Z$
d) $\theta=2n\pi+\frac{\pi}{3}, n\in Z$

31) The value of$\begin{vmatrix}\cos 20^\circ & \sin 20^\circ\\ \sin 70^\circ & \cos 70^\circ\end{vmatrix}$ is **[2.5]**

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

32) If a matrix A is such that 3A^3 + 2A^2 + 5A + I = 0, then A^{-1} is equal to **[2.5]**

a) 3A^2 - 2A - 5 b) None of these
c) 3A^2 + 2A + 5 d) - (3A^2 + 2A + 5)

33) If A is a non singular matrix of order 3 , then |adj(A^3)|= **[2.5]**

a) |A|^7 b) |A|^8
c) |A|^6 d) |A|^9

34) $\begin{vmatrix}0 & a-b & a-c\\ b-a & 0 & b-c\\ c-a & c-b & 0\end{vmatrix}$ = **[2.5]**

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

35) If AB = A and BA = B, where A and B are square matrices, thenA^2 and B^2 are? **[2.5]**

a) B^2 ≠ B and A^2 = A b) A^2 ≠ A, B^2 ≠ B
c) A^2 ≠ A, B^2 = B d) B^2 = B and A^2 =A

36) $\begin{vmatrix}a^2+2a & 2a+1 & 1\\ 2a+1 & a+2 & 1\\ 3 & 3 & 1\end{vmatrix}$ =? **[2.5]**

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

37) The inverse of the matrix$\begin{vmatrix}2 & -1\\ 3 & 4\end{vmatrix}$ is **[2.5]**

a) $\begin{vmatrix}2 & 1\\ 0 & 3\end{vmatrix}$

b) $\begin{vmatrix} 0 & 0 \\ 0 & 0 \end{vmatrix}$
c) $\begin{vmatrix} 4/11 & 1/11 \\ -3/11 & 2/11 \end{vmatrix}$
d) $\begin{vmatrix} 4 & 1 \\ -3 & 2 \end{vmatrix}$

38) Conversion of 0.638 to binary form is [2.5]
a) $(0.1010001101)_2$ b) $(11010001101)_2$
c) $(1111000011)_2$ d) $(0.1010101110)_2$

39) What is$(1111)_2 + (1001)_2 - (1010)_2$ equal to? [2.5]
a) $(1010)_2$ b) $(111)_2$
c) $(1100)_2$ d) $(1110)_2$

40) If $(11101011)_2$ is converted to decimal system, then the resulting number is [2.5]
a) 160 b) 235
c) 175 d) 126

41) The sum of all angles in a regular decagon whose each side is 4 cm, is [2.5]
a) 1460° b) 1450°
c) 1470° d) 1440°

42) If tan A - tan B = x and cot B - cot A = y, then what is the value of cot (A - B)? [2.5]
a) $1 + \frac{1}{xy}$
b) $\frac{xy}{x+y}$
c) $\frac{1}{y} - \frac{1}{x}$
d) $\frac{1}{x} + \frac{1}{y}$

43) What is the value of $\tan^2$ 165° + $\cot^2$ 165°? [2.5]
a) $8\sqrt{3}$ b) $4\sqrt{3}$
c) 14 d) 7

44) Ifα, β are acute angles and $\cos 2\alpha = \frac{3\cos 2\beta - 1}{3 - \cos 2\beta}$, then the value of $(\tan\alpha \cdot \cot\beta)$ is [2.5]
a) $\sqrt{3}$ b) 2
c) 1 d) $\sqrt{2}$

45) If tanθ + sec θ = 4, then what is the value of sin θ ? [2.5]
a) $\frac{23}{32}$ b) $\frac{8}{17}$
c) $\frac{8}{15}$ d) $\frac{15}{17}$

46) Let f(x) = sin$[\pi^2]$ x + cos $\left(-\pi^2 x\right)$, where [.]is a greatest integer function. What is $f\left(\frac{\pi}{2}\right)$ equal to? [2.5]
a) - 1 b) 1
c) 0 d) 2

47) What is$2\cot\left(\frac{1}{2}\cos^{-1}\frac{\sqrt{5}}{3}\right)$ equal to? [2.5]
a) 1 b) $3 - \sqrt{5}$
c) - 1 d) $3 + \sqrt{5}$

48) Consider the following values of x
i. 8
ii. - 4
iii. $\frac{1}{6}$
iv. $-\frac{1}{4}$
Which of the above values of x is/are the solution (s) of the equation$\tan^{-1}(2x) + \tan^{-1}(3x) = \frac{\pi}{4}$? [2.5]
a) II and III b) ! and IV
c) Only IV d) Only III

49) If$\sin^{-1}\frac{2p}{1+p^2} - \cos^{-1}\frac{1-q^2}{1+q^2} = \tan^{-1}\frac{2x}{1-x^2}$, then what is x equal to? [2.5]
a) $\frac{p-q}{1+pq}$ b) $\frac{p+q}{1+pq}$
c) $\frac{pq}{1+pq}$ d) $\frac{p+q}{1-pq}$

50) $\sin\left[\frac{\pi}{3} - \sin^{-1}\left(-\frac{1}{2}\right)\right]$ is equal to [2.5]
a) 1 b) $\frac{1}{3}$
c) $\frac{1}{4}$ d) $\frac{1}{2}$

51) The angle of elevation of a tower of height h from a point A due South of it is x and from a point B due East of A is y. If AB = z, then which one of the following is correct? [2.5]
a) $z^2\left(\cot^2 y - \cot^2 x\right) = h^2$
b) $z^2\left(\tan^2 y - \tan^2 x\right) = h^2$
c) $h^2\left(\tan^2 y - \tan^2 x\right) = z^2$
d) $h^2\left(\cot^2 y - \cot^2 x\right) = z^2$

52) A man standing on the bank of a river observes that the angle of elevation of the top of a tree just on the opposite bank is$60°$. The angle of elevation is $30°$ from a point at a distance y m from the bank. What is the height of the tree? [2.5]
a) Y m
b) $\frac{y}{2}m$
c) $\frac{\sqrt{3}y}{2}m$
d) 2y m

53) The sides of a triangle are m, n and$\sqrt{m^2 + n^2 + mn}$. What is the sum of the acute angles of the triangle? [2.5]
a) 60° b) 75°
c) 45° d) 90°

54) If$\angle C$ of a $\triangle ABC$ is a right angle, then what is tan A + tan B equal to? [2.5]
a) $\frac{a^2}{bc}$ b) $\frac{a^2-b^2}{ab}$
c) $\frac{c^2}{ab}$ d) $\frac{b^2}{ca}$

55) What is the maximum area of a triangle that can be inscribed in a circle of radius a? [2.5]
a) $\frac{\sqrt{3}a^2}{4}$ sq units
b) $\frac{a^2}{2}$ sq units
c) $\frac{3\sqrt{3}a^2}{4}$ sq units
d) $\frac{3a^2}{4}$ sq units

56) In a triangle, the greatest angle is 120°, when sides of triangle are
i. X, y and$\sqrt{x^2 + xy + y^2}$, (x, y > 0)
ii. A - b, a + b and$\sqrt{3a^2 + b^2}$, (a, b > 0)
iii. 2, $\sqrt{6}$ and $\sqrt{3} - 1$
Which of the above statement(s) is/are correct? [2.5]
a) All of these b) Only I
c) Only III d) Only II

57) If a line is perpendicular to the line$5x - y = 0$ and forms a triangle of area 5 sq units with coordinate axes, then its equation is [2.5]
a) $x + 5y \mp 5\sqrt{2} = 0$
b) $5x - y \pm 5\sqrt{2} = 0$
c) $5x + y \pm 5\sqrt{2} = 0$
d) $x - 5y \pm 5\sqrt{2} = 0$

58) The equation of straight line passing through the point of intersection of the straight line$3x - y + 2 = 0$ and $5x - 2y + 7 = 0$ and having infinite slope is [2.5]
a) $x = 4$ b) $x + y = 3$
c) $x = 3$ d) $x = 2$

59) If$(-5, 4)$ divides the line segment between the coordinate axes in the ratio $1 : 2$, then what is its equation? [2.5]
a) $5x - 8y + 57 = 0$ b) $8x + 5y + 20 = 0$
c) $5x + 8y - 7 = 0$ d) $8x - 5y + 60 = 0$

60) If the three consecutive vertices of a parallelogram are$(-2,-1),(1,0)$ and $(4,3)$, then what are the co-ordinates of the fourth vertex? **[2.5]**
   a) $(1,-1)$ b) $(1,2)$
   c) $(0,0)$ d) $(1,0)$

61) The area of the figure formed by the lines ax + by + c = 0, ax - by + c = 0, ax + by - c = 0 and ax - by - c = 0 is **[2.5]**
   a) $\frac{c^2}{4ab}$ sq units
   b) $\frac{2c^2}{ab}$ sq units
   c) $\frac{c^2}{2ab}$ sq units
   d) $\frac{c^2}{ab}$ sq units

62) Consider the two circles$S_1 \equiv x^2+y^2-6x+4y+11=0$ and $S_2 \equiv x^2+y^2-4x+6y+9=0$.
   The equation of common chord is **[2.5]**
   a) $y-x=1$ b) $x+y=1$
   c) $x-y=1$ d) $x+y-1=0$

63) Consider the two circles$S_1 \equiv x^2+y^2-6x+4y+11=0$ and $S_2 \equiv x^2+y^2-4x+6y+9=0$.
   The angle of intersection of the two circle is **[2.5]**
   a) $60°$ b) $90°$
   c) $45°$ d) $30°$

64) Consider the circle$S \equiv x^2+y^2-6x+12y+15=0$.
   The equation of circle which is concentric with circle S and has area double of its area is **[2.5]**
   a) $x^2+y^2-6x+12y-15=0$
   b) $x^2+y^2-6x+12y+40=0$
   c) $x^2+y^2-6x+12y+45=0$
   d) $x^2-y^2-6x+12y+45=0$

65) Consider the parabola$y=x^2+7x+2$ and the straight line $y=3x-3$.
   What are the coordinates of the point on the parabola which is closest to the straight line? **[2.5]**
   a) $(-2,-8)$ b) $(0,2)$
   c) $(1,10)$ d) $(-7,2)$

66) What is the eccentricity of rectangular hyperbola? **[2.5]**
   a) $\sqrt{6}$ b) $\sqrt{2}$
   c) $\sqrt{5}$ d) $\sqrt{3}$

67) Let P(2, 2) is a point on the parabola y^2 = 2x and A is its vertex. If 0 is another point on the parabola such that PO is perpendicular to AP, then what is the length of PO? **[2.5]**
   a) $\sqrt{2}$ units
   b) $6\sqrt{2}$ units
   c) $2\sqrt{2}$ units
   d) $4\sqrt{2}$ units

68) The locus of a point$P(x,y,z)$ which moves in such a way that $z=7$ is a **[2.5]**
   a) Plane parallel to xy - plane
   b) Line parallel to Z - axis
   c) Line parallel to Y - axis
   d) Line parallel to X - axis

69) The equation of the plane passing through the intersection of the planes$2x+y+2z=9$, $4x-5y-4z=1$ and the point $(3,2,1)$ is **[2.5]**
   a) $10x-2y+2z=28$ b) $10x+2y+2z=28$
   c) $10x-2y-2z=24$ d) $10x+2y-2z=28$

70) A plane cuts intercepts$2,2,1$ on the coordinate axes. What are the direction cosines of the normal to the plane? **[2.5]**
   a) $\langle\frac{1}{3},\frac{2}{3},\frac{2}{3}\rangle$
   b) $\langle\frac{1}{\sqrt{6}},\frac{1}{\sqrt{6}},\frac{2}{\sqrt{6}}\rangle$
   c) $\langle\frac{2}{3},\frac{2}{3},\frac{1}{3}\rangle$
   d) $\langle\frac{2}{\sqrt{6}},\frac{1}{\sqrt{6}},\frac{1}{\sqrt{6}}\rangle$

71) A straight line with direction cosines$\langle 0,1,0\rangle$ is **[2.5]**
   a) Parallel to Z - axis
   b) Equally inclined to all the axes
   c) Parallel to Y - axis
   d) Parallel to X - axis

72) Ifl,m,n are the direction cosines of the line $x-1=2(y+3)=1-z$, then what is $l^4+m^4+n^4$ equal to? **[2.5]**
   a) 4 b) 1
   c) $\frac{13}{27}$ d) $\frac{11}{27}$

73) Ifθ is the angle between two vectors$\vec{a}$ and $\vec{b}$, then $\vec{a}.\vec{b}$≥0 only when **[2.5]**
   a) $0<\theta<\frac{\pi}{2}$
   b) 0≤$slant\theta$≤$slant\pi$
   c) $0<\theta<\pi$
   d) 0≤$slant\theta$≤$slant\frac{\pi}{2}$

74) Vectors$\vec{a}$ and $\vec{b}$ are inclined at angle. $\theta=120°$. If $|\vec{a}|=1,|\vec{b}|=2$, then $[(\vec{a}+3\vec{b})\times(3\vec{a}-\vec{b})]^2$ is equal to **[2.5]**
   a) 325 b) 225
   c) 300 d) 275

75) Two vectors$\vec{a}$ = $a_1\hat{i}$ + $a_2\hat{j}$ + $a_3\hat{k}$ and $\vec{b}$ = $b_1\hat{i}$ + $b_2\hat{j}$ + $b_3\hat{k}$ are collinear if **[2.5]**
   a) A_1 = b_1, a_2 = b_2, a_3 = b_3
   b) $\frac{a_1}{b_1}=\frac{a_2}{b_2}=\frac{a_3}{b_3}$
   c) A_1b_1 + a_2b_2 + a_3b_3 = 0
   d) A_1 + a_2 + a_3 = b_1 + b_2 + b_3

76) If$\vec{a}$ and $\vec{b}$ are unit vectors, then which of the following values of $\vec{a}\cdot\vec{b}$
   $endmath\ isnotpossible?$**[2.5]**
   a) $\sqrt{3}$ b) $\sqrt{3}/2$
   c) $-1/\sqrt{2}$ d) $1/\sqrt{2}$

77) The value of$(\vec{a}\times\vec{b})^2$ is **[2.5]**
   a) $|\vec{a}|^2|\vec{b}|^2-(\vec{a}\cdot\vec{b})^2$
   b) $|\vec{a}|^2+|\vec{b}|^2-2(\vec{a}\cdot\vec{b})$
   c) $|\vec{a}|^2+|\vec{b}|^2-(\vec{a}\cdot\vec{b})^2$
   d) $|\vec{a}|^2+|\vec{b}|^2-\vec{a}\cdot\vec{b}$

78) If the volume of a parallelepiped having$\vec{a}=(5\hat{i}-4\hat{j}+\hat{k})$, $\vec{b}=(4\hat{i}+3\hat{j}+\lambda\hat{k})$ and $\vec{c}=(\hat{i}-2\hat{j}+7\hat{k})$ as coterminous edges, is $\frac{648}{3}$ cubic units then value of λ is **[2.5]**
   a) $\frac{2}{3}$ b) $\frac{4}{3}$
   c) 5 d) $\frac{1}{3}$

79) If the vectors$\vec{a}=3\hat{i}+\hat{j}-2\hat{k}$ and $\vec{b}=\hat{i}+\lambda\hat{j}-3\hat{k}$ are perpendicular to each other then $\lambda=?$ **[2.5]**
   a) - 6 b) - 3
   c) - 1 d) - 9

80) If$\vec{a},\vec{b}$ and $\vec{c}$ are unit vector such that $\vec{a}+\vec{b}+\vec{c}=\overrightarrow{0}$
   Then $(\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a})=$ **[2.5]**
   a) $\frac{1}{2}$ b) $\frac{3}{2}$
   c) $\frac{-3}{2}$ d) $\frac{-1}{2}$

81) Consider the following statement
   i. F(x) = |x| is continuous$\forall x\in R$
   ii. $f(x)=x^3+x^2-1$ is not continuous $\forall x\in R$

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

82) $\lim_{x\to 0}\left[\frac{\sin(x+a)+\sin(a-x)-2\sin a}{x\sin x}\right]$ is equal to [2.5]
a) Cos a b) - sin a
c) $\frac{1}{2}$ cos a d) Sin a

83) Let f(x) = (|x| - |x - 1|)^2
What is f'(x) equal to, when 0 < x < 1? [2.5]
a) 4x - 2 b) 8x - 4
c) 2x - 1 d) 0

84) Let f(x) = [x], where [.]is the greatest integer function and g(x) = sin x be two real valued functions over R.
Which one of the following statements is correct? [2.5]

a) $\lim_{x\to 0}$ (gof)(x) exists
b) $\lim_{x\to 0^-}(fog)(x) = \lim_{x\to 0^-}(gof)(x)$
c) $\lim_{x\to 0}$ (fog)(x) exists
d) $\lim_{x\to 0^+}(fog)(x) = \lim_{x\to 0^+}(gof)(x)$

85) Let f(x) = |ln x|, x≠ 1
What is the derivative of $f(x)$ at $x = 2$? [2.5]
a) - 1 b) $-\frac{1}{2}$
c) 2 d) $\frac{1}{2}$

86) If$y = \ln\left(e^{mx}+e^{-mx}\right)$, then what is the value of $\frac{dy}{dx}$ at $x = 0$? [2.5]
a) 2 b) 1
c) - 1 d) 0

87) Suppose f(x) is such a quadratic expression that it is positive for all real x.
If $g(x) = f(x) + f'(x) + f''(x)$, then for any real x. [2.5]
a) $g(x) = 0$ b) $g(x)0$
c) $g(x)≥0$ d) $g(x)0$

88) Let f(x) = e^x, g(x) = sin^{-1} x and h(x) = f[g(x)]
Find the value of $[f(x)\cdot g(x)]'$. [2.5]

a) None of these
b) $e^x \frac{1}{\sqrt{1-x^2}}$
c) $e^x\left(\frac{1}{\sqrt{1-x^2}}+\sin^{-1}x\right)$
d) $e^x\cdot\sin^{-1}x$

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

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

90) Under which one of the following conditions does the function$f(x) = (p\sec x)^2 + (q\,\text{cosec}\,x)^2$ attain minimum value? [2.5]

a) $\tan^2 x = pq$
b) $\cot^2 x = \frac{q}{p}$
c) $\cot^2 x = pq$
d) $\tan^2 x = \frac{q}{p}$

91) Let the slope of the curve$y = \cos^{-1}(\sin x)$ be $\tan\theta$. Then, the value of θ in the interval $(0,\pi)$ is [2.5]
a) $\frac{\pi}{6}$ b) $\frac{\pi}{4}$
c) $\frac{3\pi}{4}$ d) $\frac{\pi}{2}$

92) The curve$y = -x^3+3x^2+2x-27$ has the maximum slope at [2.5]
a) $x = 0$ b) $x = -1$
c) $x = 1$ d) $x = 2$

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

a) $\ln\left(\frac{x^2}{x^2+1}\right)+C$
b) $\frac{1}{2}\ln\left(\frac{x^2}{x^2+1}\right)+C$
c) $\frac{1}{2}\ln\left(\frac{x^2+1}{x^2}\right)+C$
d) $\frac{3}{2}\ln\left(\frac{x^2}{x^2+1}\right)+C$

94) If$p(x) = (4e)^{2x}$, then what is $\int p(x)dx$ equal to? [2.5]

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

95) What is$\int\frac{dx}{\sec x+\tan x}$ equal to? [2.5]

a) $\ln(\sec x) - \ln|\sec x+\tan x| + C$
b) $\sec x\tan x - \ln|\sec x-\tan x| + C$
c) $\ln|\sec x+\tan x| - \ln|\sec x| + C$
d) $\ln(\sec x) + \ln|\sec x+\tan x| + C$

96) 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? [2.5]

a) $\int_0^a f(x)dx$
b) 0
c) $2\int_0^a f(x)dx$
d) $\int_0^a g(x)dx$

97) Let$I = \int_{-2\pi}^{2\pi}\frac{\sin^4 x+\cos^4 x}{1+3^x}dx$
What is I equal to? [2.5]
a) $\frac{3\pi}{2}$ b) $\frac{3\pi}{4}$
c) 0 d) 3π

98) Let$I = \int_{-2\pi}^{2\pi}\frac{\sin^4 x+\cos^4 x}{1+3^x}dx$
$\int_0^{2\pi}\sin^5\left(\frac{x}{4}\right)dx$ is equal to [2.5]
a) $\frac{16}{15}$ b) $\frac{8}{15}$
c) 0 d) $\frac{32}{15}$

99) Consider the lines$x = \sqrt{3}y$ and the circle x^2 + y^2 = 4.
What is the area of the region in the first quadrant enclosed by the X - axis, the line $x = \sqrt{3}$ and the circle? [2.5]

a) $\left(\frac{\pi}{2}-\frac{2}{1}\right)$ sq units
b) $\left(\frac{\pi}{3}-\frac{\sqrt{3}}{2}\right)$ sq units
c) $\left(\frac{\pi}{2}-\frac{\sqrt{3}}{2}\right)$ sq units
d) $\left(\frac{\pi}{3}-\frac{1}{2}\right)$ sq units

100) What is the area included in the first quadrant between the curves y = x and$y = x^3$? [2.5]
a) 1 sq units b) $\frac{1}{4}$ sq units
c) $\frac{1}{2}$ sq units d) $\frac{1}{8}$ sq units

101) The differential equation of the family of curves x^2 + y^2 - 2ay = 0, where a is arbitrary constant, is: [2.5]

a) (x^2 - y^2)$\frac{dy}{dx}$ = 2xy
b) (x^2 + y^2)$\frac{dy}{dx}$ = 2xy
c) 2 (x^2 - y^2)$\frac{dy}{dx}$ = xy
d) 2 (x^2 + y^2)$\frac{dy}{dx}$ = xy

102) The differential equation representing the family of curves y = a sin (λ x + α) is [2.5]

a) $\frac{d^2y}{dx^2} - \lambda y = 0$
b) $\frac{d^2y}{dx^2} + \lambda y = 0$
c) $\frac{d^2y}{dx^2} - \lambda^2 y = 0$
d) $\frac{d^2y}{dx^2} + \lambda^2 y = 0$

103) What is the solution of the differential equation $\frac{ydx-xdy}{y^2} = 0$? [2.5]
a) X + y = C b) X - y = C
c) Xy = C d) Y = Cx

104) 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 B equal to? [2.5]
a) 2 b) - 1
c) 1 d) - 2

105) In a bank, principal increases continuously at the rate of 5% per year. An amount of Rs1000 is deposited with this bank, how much will it worth after 10 years$\left(e^{0.5} = 1.648\right)$. [2.5]
a) Rs 1848 b) Rs 1648
c) Rs 1748 d) Rs 1948

106) The degree of the differential equation $x^2\frac{d^2y}{dx^2} = \left(x\frac{dy}{dx} - y\right)^3$ is: [2.5]
a) 6 b) 2
c) 3 d) 1

107) Find the median for the following distribution of workers.

Daily wages (in ₹)	No. of workers	Daily wages (in ₹)	No. of workers
1 - 3	6	9 - 11	21
3 - 5	53	11 - 13	16
5 - 7	85	13 - 15	4
7 - 9	86	15 - 17	4

[2.5]
a) 5.57 b) 6.85
c) 5.92 d) 7.14

108) If the mean of the following distribution is 2.6, then the value of y is

Variable (x)	1	2	3	4	5
Frequency	4	5	Y	1	2

[2.5]
a) 24 b) 8
c) 3 d) 13

109) Mode is: [2.5]
a) Least frequent value b) Less frequent value
c) Middle most value d) Most frequent value

110) The arithmetic mean of the squares of the first n natural numbers is: [2.5]
a) $\frac{n(n+1)(2n+1)}{6}$
b) $\frac{(n+1)(2n+1)}{3}$
c) $\frac{(n+1)(2n+1)}{6}$
d) $\frac{n(n+1)(2n+1)}{2}$

111) Which one of the following measures is determined only after the construction of cumulative frequency distribution? [2.5]
a) Arithmetic mean b) Mode
c) Geometric mean d) Median

112) If $\bar{x}$ is the mean of $x_1, x_2, ..., x_n$ then for a $\neq$ 0, the mean of $ax_1, ax_2, ..., ax_n, \frac{x_1}{a}, \frac{x_2}{a}, \ldots, \frac{x_n}{a}$ is [2.5]
a) $\frac{\left(a+\frac{1}{a}\right)\bar{x}}{2n}$
b) $\left(a+\frac{1}{a}\right)\frac{\bar{x}}{2}$
c) $\left(a+\frac{1}{a}\right)\frac{\bar{x}}{n}$
d) $\left(a+\frac{1}{a}\right)\bar{x}$

113) The geometric mean of the observations $x_1, x_2, x_3, ..., x_n$ is G_1. The geometric mean of the observation $y_1, y_2, y_3, ..., y_n$ is G_2. The geometric mean of observations $\frac{x_1}{y_1}, \frac{x_2}{y_2}, \frac{x_3}{y_3}, \ldots, \frac{x_n}{y_n}$ is: [2.5]
a) (G_1G_2)
b) $\frac{G_1}{G_2}$
c) $(\frac{G_1}{G_2})$
d) G_1G_2

114) A person writes 4 letters and addresses 4 envelopes. If the letters are placed in the envelopes at random, then the probability that all letters are not placed in the right envelopes is [2.5]
a) $\frac{15}{24}$ b) $\frac{11}{24}$
c) $\frac{23}{24}$ d) $\frac{1}{4}$

115) The probability that a teacher will give an unannounced test during any class is $\frac{1}{5}$. If a student is absent twice, then the probability that he misses atleast one test is [2.5]
a) $\frac{2}{5}$ b) $\frac{7}{25}$
c) $\frac{9}{25}$ d) $\frac{4}{5}$

116) A bag contains 3 red, 4 white and 5 blue balls. All balls are different. Two balls are drawn at random. The probability that they are of different colour is [2.5]
a) $\frac{47}{66}$ b) 1
c) $\frac{10}{33}$ d) $\frac{1}{3}$

117) A bag contains 3 red balls, 5 white balls and 7 black balls. What is the probability that a ball drawn from the bag at random will be neither red nor black? [2.5]
a) $\frac{1}{3}$ b) $\frac{8}{15}$
c) $\frac{7}{15}$ d) $\frac{1}{5}$

118) One ticket is drawn at random from a bag containing tickets numbered 1 to 40. The probability that the selected ticket has a number which is a multiple of 5, is [2.5]
a) $\frac{1}{5}$ b) $\frac{3}{5}$
c) $\frac{1}{3}$ d) $\frac{4}{5}$

119) If A and B are independent events such that P(A) =$\frac{1}{5}$, P(A ∪ B) = $\frac{7}{10}$, then what is P($\bar{B}$) equal to? [2.5]
a) $\frac{3}{8}$ b) $\frac{7}{9}$
c) $\frac{3}{7}$ d) $\frac{2}{7}$

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