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) If A is a subset of B, then which one of the following is correct? **[2.5]**
   a) $B^C \subseteq A^C$ b) $A \subseteq A \cap B$
   c) $A^C \subseteq B^C$ d) $A^C = B^C$

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 received medals in at least two of three sports? **[2.5]**
   a) 30 - 6x b) 40 - 5x
   c) 40 - 6x d) 35 - 6x

3) Consider the following statements non - empty sets A and B.
   i. $(A \cap B) \cup (A \cap \bar{B}) \cup (\bar{A} \cap B) = A \cup B$
   ii. $(A \cup (\bar{A} \cap \bar{B})) = A \cup B$
   Which of the above statements is/are correct? **[2.5]**
   a) Only ii b) Only i
   c) Both i and ii d) Neither i nor ii

4) Let$f(x) = \sqrt{2-x} + \sqrt{2+x}$
   What is the domain of the function? **[2.5]**
   a) [- 2, 2] b) R - [- 2, 2]
   c) R - (- 2, 2) d) (- 2, 2)

5) Consider the following statements in respect of relations and functions.
   i. All relations are functions but all functions are not relations.
   ii. A relation from A to B is a subset of Cartesian product$A \times B$.
   iii. A relation in A is a subset of Cartesian product$A \times A$.
   Which of the above statements are correct? **[2.5]**
   a) I and II b) I and III
   c) I, II and III d) II and III

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 f(x)? **[2.5]**
   a) 20π b) 80π
   c) 10π d) 40π

7) If$g(x) = \frac{1}{f(x)}$ and $f(x) = x, x \neq 0$, then which one of the following is correct? **[2.5]**
   a) $f(f(f(g(g(f(x))))))) = f(f(f(g(f(x)))))$
   b) $f(g(f(g(g(f(g(x))))))) = g(g(f(g(f(x)))))$
   c) $f(f(g(g(g(f(x))))))) = g(g(f(g(f(x)))))$
   d) $f(f(f(g(g(f(x))))))) = g(g(f(g(f(x)))))$

8) How many arithmetic progressions is/are possible containing 13, 5, 9 as three of its/their terms? **[2.5]**
   a) 5 b) Infinite many
   c) 2 d) 1

9) Consider the following for the next two items that follow.
   Let a_1, a_2, a_3 ... be in AP such that
   a_1, + a_5 + a_{10} + a_{15} + a_{20} + a_{25} + a_{30} + a_{34} = 300.
   What is $\sum_{n=1}^{34} a_n$ equal to? **[2.5]**
   a) 1200 b) 1275
   c) 900 d) 1025

10) The numbers 1, 5 and 25 can be three terms (not necessarily consecutive) of **[2.5]**
   a) Infinite number of APs
   b) Finite number of GPs
   c) More than one but finite numbers of APs
   d) Only one AP

11) If an infinite GP has the first term x and the sum 5, then which one of the following is correct? **[2.5]**
   a) X < - 10 b) 0 < x < 10
   c) - 10 < x < 0 d) X > 10

12) Let P be the sum of first n positive terms of an increasing arithmetic progression A.
   Let Q be the sum of first n positive terms of another increasing arithmetic progression B.
   Let P : Q = (5n + 4) : (9n + 6)
   What is the ratio of their 10^{th} terms? **[2.5]**
   a) $\frac{44}{69}$ b) $\frac{33}{59}$
   c) $\frac{11}{29}$ d) $\frac{22}{49}$

13) If i =$\sqrt{-1}$, then how many values does i^{-2n} have for different $n \in C$? **[2.5]**
   a) Infinite b) Four
   c) Two d) One

14) The common roots of the equations $z^3 + 2z^2 + 2z + 1 = 0$ and $z^{2017} + z^{2018} + 1 = 0$ are **[2.5]**
   a) - 1,ω^2 b) 1,ω^2
   c) - 1,ω d) ω, ω^2

15) Consider equation - I $z^3 + 2z^2 + 2z + 1 = 0$ and equation - II $z^{1985} + z^{100} + 1 = 0$. What are the roots of equation - I? **[2.5]**
   a) $-1, \omega, \omega^2$ b) $1, \omega, \omega^2$
   c) $1, -\omega, \omega^2$ d) $-1, -\omega, -\omega^2$

16) Which one of the following is a square root of$2a + 2\sqrt{a^2+b^2}$, where a, b $\in$ R? **[2.5]**
   a) 2a + ib

b) $\sqrt{a+ib}+\sqrt{a-ib}$
c) 2a - ib, where i $=\sqrt{-1}$
d) $\sqrt{a+ib}-\sqrt{a-ib}$

17) If the equations$x^2+2x+3\lambda=0$ and $2x^2+3x+5\lambda=0$ have a non - zero common root, then λ is equal to **[2.5]**
a) - 1 b) 1
c) 2 d) 3

18) Ifα and β are the roots of the equation $3x^2 + 2x + 1 = 0$, then the equation whose roots are $\alpha+\beta^{-1}$ and $\beta+\alpha^{-1}$ is **[2.5]**
a) $X^2 + 8x + 16 = 0$ b) $3x^2 + 8x + 16 = 0$
c) $3x^2 + 8x - 16 = 0$ d) $3x^2 - 8x - 16 = 0$

19) How many real roots does the equation $x^2 + 3|x| + 2 = 0$ have? **[2.5]**
a) 1 b) 0
c) 4 d) 2

20) Let f(x) = x^2 + 2x - 5 and g(x) = 5x + 30
What are the roots of the equation g[(f(x)]= 0? **[2.5]**
a) 0, 1 b) 1, - 1
c) - 1, - 1 d) 1, 1

21) If C(20, n + 2) = C(20, n - 2), then what is n equal to? **[2.5]**
a) 10 b) 8
c) 16 d) 12

22) Consider the following statements
i. $\frac{n!}{3!}$ is divisible by 6, where n > 3
ii. $\frac{n!}{3!}+3$ is divisible by 7, where n > 3
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

23) The number of 5 digit telephone numbers having atleast one of their digits repeated is **[2.5]**
a) 10000 b) 30240
c) 90000 d) 69760

24) How many four - digit numbers divisible by 10 can be formed using 1, 5, 0, 6, 7 without repetition of digits? **[2.5]**
a) 64 b) 36
c) 44 d) 24

25) Consider the expansion of$(1+x)^n$. Let p, q, r and s be the coefficients of first, second, nth and (n + 1)th terms respectively. What is (ps + qr) equal to? **[2.5]**
a) $1+n^2$ b) $1+2n^2$
c) $1+4n$ d) 1 + 2n

26) If the sum of the coefficients in the expansion of$\left(\alpha^2x^2-2\alpha x+1\right)^{51}$ vanishes, then the value of α is **[2.5]**
a) 2 b) - 1
c) 1 d) - 2

27) The expansions of$(x-y)^n, n\geq5$ is done in the descending powers of x. If the sum of the fifth and sixth terms is zero, then $\frac{x}{y}$ is equal to **[2.5]**
a) $\frac{n-5}{6}$ b) $\frac{5}{n-4}$
c) $\frac{6}{n-5}$ d) $\frac{n-4}{5}$

28) If$n=\frac{1}{100!}$, then the value of $\frac{1}{\log_{\frac{1}{2}}n}+\frac{1}{\log_{\frac{1}{3}}n}+\ldots+\frac{1}{\log_{\frac{1}{100}}n}$ is **[2.5]**
a) $\frac{1}{100!}$ b) 2
c) 0 d) 1

29) What is the value of$\frac{\log_{13}625}{\log_{169}25}$? **[2.5]**
a) $\frac{1}{4}$ b) 1
c) 4 d) 2

30) Let $\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix}$ = $ax^4 + bx^3 + cx^2 + dx + e$. Then, the value of 5a + 4b + 3c + 2d + e is equal to **[2.5]**
a) None of these b) - 16
c) 16 d) 0

31) If A =$[a_{ij}]_{m\times n}$, then A' is equal to **[2.5]**
a) $[a_{ji}]_{n\times m}$
b) $[a_{ij}]_{n\times m}$
c) $[a_{ij}]_{m\times n}$
d) $[a_{ji}]_{m\times n}$

32) The product$\begin{bmatrix} a & b \\ -b & a \end{bmatrix}\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$ is equal to: **[2.5]**
a) $\begin{bmatrix} a^2+b^2 & 0 \\ 0 & a^2+b^2 \end{bmatrix}$
b) $\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$
c) $\begin{bmatrix} a^2+b^2 & 0 \\ a^2+b^2 & 0 \end{bmatrix}$
d) $\begin{bmatrix} (a+b)^2 & 0 \\ (a+b)^2 & 0 \end{bmatrix}$

33) If A is a matrix of order 3× 3, then |3A| is equal to **[2.5]**
a) 81 IAI b) 27 IAI
c) 9 IAI d) 3 IAI

34) If A =$\begin{bmatrix} 0 & 2 \\ 3 & -4 \end{bmatrix}$ and kA = $\begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$, then the values of k, a, b, are respectively **[2.5]**
a) - 6, - 12, - 18 b) - 6, 12, 18
c) - 6, 4, 9 d) - 6, - 4, - 9

35) If |A|$\neq$ 0 which of the following is not true? **[2.5]**
a) $A^1=|A|^1$
b) $(A')^{-1}=(A^{-1})'$
c) $A^{-1}=|A|^{-1}$
d) $(A^2)^{-1} = (A^{-1})^2$

36) If A and B are two matrices such that A + B and AB are both defined, then **[2.5]**
a) Number of columns of A$\neq$ number of rows of B.
b) A, B are square matrices not necessarily of same order
c) A and B can be any matrices
d) A and B are square matrices of same order

37) The matrix A satisfying the equation$\begin{vmatrix} 2 & 1 \\ 3 & 2 \end{vmatrix}$ A$\begin{vmatrix} -3 & 2 \\ 5 & -3 \end{vmatrix}$ = $\begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}$ is **[2.5]**
a) Zero matrix
b) $\begin{vmatrix} 1 & 4 \\ 1 & 0 \end{vmatrix}$
c) $\begin{vmatrix} 4 & 1 \\ 1 & 0 \end{vmatrix}$
d) $\begin{vmatrix} 1 & 1 \\ 1 & 0 \end{vmatrix}$

38) Find the decimal equivalent to $(0.1101)_2$ **[2.5]**
a) $(81.25)_{10}$ b) $(8.125)_{10}$
c) $(0.8125)_{10}$ d) $(81.25)_{10}$

39) The sum of the binary numbers$(11011)_2, (10110110)_2$ and $(10011x0y)_2$ is the binary numbers $(101101101)_2$. What are the values of x and y? **[2.5]**
a) X = 0, y = 0 b) X = 1, y = 0
c) X = 0, y = 1 d) X = 1, y = 1

40) The remainder and the quotient of the binary division$(101110)_2 \div (110)_2$ are respectively **[2.5]**
a) $(100)_2$ and $(100)_2$
b) $(100)_2$ and $(111)_2$
c) $(111)_2$ and $(100)_2$
d) $(101)_2$ and $(101)_2$

41) If$\sin\alpha + \cos\alpha = p$, then what is $\cos^2(2\alpha)$ equal to? **[2.5]**
a) $P^2(2 - p^2)$ b) $P^2 - 1$
c) $P^2 + 1$ d) P^2

42) $\frac{1+\sin A-\cos A}{1+\sin A+\cos A}$ is equal to **[2.5]**
a) $-\tan\frac{A}{2}$ b) $\tan\frac{A}{2}$
c) $\cot\frac{A}{2}$ d) Tan A

43) What is the maximum value of sin x cos x? **[2.5]**
a) 1 b) 2
c) $2\sqrt{2}$ d) $\frac{1}{2}$

44) If$\sin\theta + 2\cos\theta = 1$, then what is $2\sin\theta - \cos\theta$ equal to? **[2.5]**
a) 1 b) 4
c) 2 d) 0

45) Let$\frac{\tan 3A}{\tan A} = K$, where tan A $\neq$ 0 and $K \neq \frac{1}{3}$. For real values of tan A, K cannot lie between **[2.5]**
a) $\left(\frac{1}{5}, 5\right)$
b) $\left(\frac{1}{7}, 7\right)$
c) $\left(\frac{1}{3}, 3\right)$
d) $\left(\frac{1}{2}, 2\right)$

46) If f(x) = x($4x^2$ - 3), then what is $f(\sin\theta)$ equal to? **[2.5]**
a) $\sin 3\theta$ b) $-\sin 4\theta$
c) $-\sin 3\theta$ d) $-\cos 3\theta$

47) $\tan^{-1}x + \cot^{-1}x = \frac{\pi}{2}$ holds, when **[2.5]**
a) $x \in R$ b) $x \in R - (-1, 1)$ only
c) $x \in R - 0$ only d) $x \in R - [-1, 1]$ only

48) The domain of $\cos^{-1}(2x - 3)$ is given by **[2.5]**
a) [1, 2] b) [- 1, 1]
c) (1, 3) d) (1, 2)

49) If$\sin^{-1}\left(\frac{2a}{1+a^2}\right) + \sin^{-1}\left(\frac{2b}{1+b^2}\right) = 2\tan^{-1}x$, then x is equal to **[2.5]**
a) $\frac{2ab}{a+b}$ b) $\frac{a-b}{1-ab}$
c) $\frac{a-b}{1+ab}$ d) $\frac{a+b}{1-ab}$

50) If$\left(\tan^{-1}x\right)^2 + \left(\cot^{-1}x\right)^2 = \frac{5\pi^2}{8}$, then x is equal to **[2.5]**
a) - 1 b) 1
c) 2 d) 0

51) If a flagstaff of 6 m height placed on the top of a tower throws a shadow of$2\sqrt{3}$ m along the ground, then what is the angle that the Sun makes with the ground? **[2.5]**
a) 45° b) 30°
c) 15° d) 60°

52) A chimney 20 m high standing on the top of a building subtends an angle whose tangent is$\frac{1}{6}$ at a distance 70 m from the foot of the building. The height of the building is **[2.5]**
a) 50 m b) 20 m
c) 60 m d) 40 m

53) 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 $\frac{d-a}{b-d}$ equal to? **[2.5]**
a) Sin^2y b) Cos^2y
c) Tan^2y d) Cot^2y

54) In a$\triangle ABC$, $\frac{2\cos A}{a} + \frac{\cos B}{b} + \frac{2\cos C}{c} = \frac{a}{bc} + \frac{b}{ac}$. Then, $\triangle ABC$ is **[2.5]**
a) An equilateral triangle
b) An isosceles triangle
c) A right angled triangle
d) Cannot be determined

55) If x, x - y and x + y are the angles of a triangle (not an equilateral triangle) such that tan(x - y), tan x and tan(x + y) are in GP, then what is x equal to? **[2.5]**
a) $\frac{\pi}{6}$ b) $\frac{\pi}{3}$
c) $\frac{\pi}{2}$ d) $\frac{\pi}{4}$

56) In any$\triangle ABC$, $\frac{b^2+c^2-a^2}{4\cot A}$ equals **[2.5]**
a) 2Δ b) Δ
c) $\frac{1}{\Delta}$ d) 3Δ

57) A straight line cuts off an intercept of 2 units on the positive direction of X - axis and passes through the point$(-3, 5)$. What is the foot of the perpendicular drawn from the point $(3, 3)$ on this line? **[2.5]**
a) $(2, 0)$ b) $(1, 3)$
c) $(1, 1)$ d) $(0, 2)$

58) The coordinates of the point dividing internally the lines joining the points (4, - 2) and (8, 6) in the ratio 7 : 5 will be **[2.5]**
a) $\left(\frac{8}{3}, \frac{19}{3}\right)$
b) (16, 18)
c) $\left(\frac{19}{3}, \frac{8}{3}\right)$
d) (18, 16)

59) Foot of perpendicular drawn from$(0, 5)$ to the line $3x - 4y - 5 = 0$ is **[2.5]**
a) $(1, 3)$ b) $(3, 2)$
c) $(2, 3)$ d) $(3, 1)$

60) What is the sum of the intercepts of the line whose perpendicular distance from origin is 4 units and the angle which the normal makes with positive direction of x - axis is15° ? **[2.5]**
a) 16 b) 8
c) $8\sqrt{6}$ d) $4\sqrt{6}$

61) The diagonals of a quadrilateral ABCD are along the lines$x + 3y = 4$ and $6x - 2y = 7$. Then, ABCD must be a **[2.5]**
a) Rectangle b) Rhombus
c) Parallelogram d) Cyclic quadriateral

62) What is the equation of the circle which touches both the axes in the first quadrant and the line$y - 2 = 0$? **[2.5]**
a) $x^2 + y^2 + 2x + 2y + 1 = 0$
b) $x^2 + y^2 - 2x - 2y - 1 = 0$
c) $x^2 + y^2 - 2x - 2y + 1 = 0$
d) $x^2 + y^2 - 4x - 4y + 4 = 0$

63) Consider the following in respect of the circle$4x^2 + 4y^2 - 4ax - 4ay + a^2 = 0$
i. The circle touches both the axes.
ii. The diameter of the circle is$2a$.
iii. The centre of the circle lies on the line$x + y = a$.
How many of the statements given above are correct? **[2.5]**

a) Only 2 b) 1 and 3
c) Only 1 d) Only 3

64) A square is inscribed in a circle $x^2+y^2-2x+4y+3=0$. Its sides are parallel to the coordinate axes. Then, one of the vertex of the square is **[2.5]**
a) $(1,+2+\sqrt{2})$ b) $(1-\sqrt{2},-2)$
c) $(1,-2+\sqrt{2})$ d) $(1+\sqrt{2},-2)$

65) Consider any point P on the ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$, in the first quadrant. Let r and s represent its distances from $(4,0)$ and $(-4,0)$ respectively, then $(r+s)$ is equal to **[2.5]**
a) 6 units b) 10 units
c) 9 units d) 8 units

66) What is the equation of the parabola with focus $(-3,0)$ and directrix $x-3=0$? **[2.5]**
a) $y^2=12x$ b) $y^2=3x$
c) $y^2=-12x$ d) $x^2=12y$

67) Given that, $4x^2+y^2=9$. What is the maximum value of xy ? **[2.5]**
a) $\frac{4}{9}$ b) $\frac{2}{3}$
c) $\frac{3}{2}$ d) $\frac{9}{4}$

68) What is the number of possible values of k for which the line joining the points $(k,1,3)$ and $(1,-2,k+1)$ also passes through the point $(15,2,-4)$? **[2.5]**
a) Zero b) Two
c) Infinite d) One

69) Consider the following statements
i. The direction ratios of Y - axis can be $0,4,0$
ii. The direction ratios of a line perpendicular to Z - axis can be <5, 6, 0>
Which of the statements given above is/are correct? **[2.5]**
a) Only 2 b) Neither 1 nor 2
c) Only 1 d) Both 1 and 2

70) Under what condition do the planes $bx-ay=n$, $cy-bz=l$ and $az-cx=m$ intersect in a line? **[2.5]**
a) $a+b+c=0$ b) $1+m+n=0$
c) $al+bm+cn=0$ d) $a=b=c$

71) Equation of the plane perpendicular to the plane $x-2y+5z+1=0$ which passes through the points $(2,-3,1)$ and $(-1,1,-7)$ is given by **[2.5]**
a) $4x-4y+z+7=0$ b) $2x+y-z=0$
c) $2x-y+z=0$ d) $4x+7y+2z+11=0$

72) The xy - plane divides the line segment joining the points $(-1,3,4)$ and $(2,-5,6)$. **[2.5]**
a) Externally in the ratio $2:1$
b) Internally in the ratio $2:3$
c) Internally in the ratio $3:2$
d) Externally in the ratio $2:3$

73) A unit vector $\hat{a}$ makes equal but acute angles on the co - ordinate axes. The projection of the vector $\hat{a}$ on the vector $\vec{b}=5\hat{i}+7\hat{j}-\hat{k}$ is **[2.5]**
a) $\frac{3}{5\sqrt{3}}$
b) $\frac{11}{15}$
c) $\frac{4}{5}$
d) $\frac{11}{5\sqrt{3}}$

74) If $\hat{i},\hat{j},\hat{k}$ are unit vectors, then **[2.5]**
a) $\hat{i}\times(\hat{j}\times\hat{k})=1$
b) $\hat{i}\cdot\hat{j}=1$
c) $\hat{i}.\hat{i}=1$
d) $\hat{i}\times\hat{j}=1$

75) Let a vector $\vec{r}$ make angles 60°, 30° with X and Y - axes, respectively. What are the direction cosines of $\vec{r}$? **[2.5]**
a) $<\frac{1}{\sqrt{2}},\frac{1}{\sqrt{2}},0>$
b) $<\frac{1}{2},\frac{\sqrt{3}}{2},0>$
c) $<-\frac{1}{2},\frac{\sqrt{3}}{2},0>$
d) $<\frac{1}{2},-\frac{\sqrt{3}}{2},0>$

76) The position vectors of three consecutive vertices of a parallelogram ABCD are A $(4\hat{i}+2\hat{j}-6\hat{k})$, B $(5\hat{i}-3\hat{j}+\hat{k})$ and C $(12\hat{i}+4\hat{j}+5\hat{k})$. The position vector of D is given by **[2.5]**
a) $21\hat{i}+3\hat{j}$
b) $-3\hat{i}-5\hat{j}-10\hat{k}$
c) $11\hat{i}+9\hat{j}-2\hat{k}$
d) $-11\hat{i}-9\hat{j}+2\hat{k}$

77) $(\vec{a}+\vec{b})\cdot(\vec{b}+\vec{c})\times(\vec{a}+\vec{b}+\vec{c})=$ **[2.5]**
a) 0
b) $-[\vec{a}\vec{b}\vec{c}]$
c) $2[\vec{a}\vec{b}\vec{c}]$
d) $\begin{bmatrix}\vec{a} & \vec{b} & \vec{c}\end{bmatrix}$

78) If $\vec{a}$ and $\vec{b}$ are unit vectors, then the greatest value of $\sqrt{3}|\vec{a}+\vec{b}|+|\vec{a}-\vec{b}|$ is **[2.5]**
a) 4 b) $2\sqrt{2}$
c) $3\sqrt{2}$ d) 2

79) If $|\vec{a}|=4$ and $-3\leq\lambda\leq2$, then the range of $|\lambda\vec{a}|$ is **[2.5]**
a) [0, 12] b) [0, 8]
c) [8, 12] d) [- 12, 8]

80) The area of a triangle formed by vertices O, A, and B, where $\overrightarrow{OA}=\hat{i}+2\hat{j}+3\hat{k}$ and $\overrightarrow{OB}=-3\hat{i}-2\hat{j}+\hat{k}$ is **[2.5]**
a) $3\sqrt{5}$ sq. units
b) 4 sq. units
c) $6\sqrt{5}$ sq. units
d) $5\sqrt{5}$ sq. units

81) What is $\lim_{x\to0}\frac{3^x+3^{-x}-2}{x}$ equal to? **[2.5]**
a) 1 b) - 1
c) 0 d) Limit does not exist

82) Let $f:A\to R$, where $A=\frac{R}{0}$ is such that $f(x)=\frac{x+|x|}{x}$. On which one of the following sets f(x) is continuous? **[2.5]**
a) $B=x\in R:x\geq0$
b) $C=x\in R:x\leq0$
c) A
d) D = R

83) Let $f(x)=\begin{vmatrix}\cos x & x & 1\\ 2\sin x & x^2 & 2x\\ \tan x & x & 1\end{vmatrix}$
What is $\lim_{x\to0}\frac{f(x)}{x^2}$ equal to? **[2.5]**
a) 0 b) 2
c) - 1 d) 1

84) If $f:R\to R$ be defined as f(x) = sin (|x|), then which one of the following is correct? **[2.5]**
a) F is differentiable everywhere except at x = 0
b) F is differentiable only at 0
c) F is non - differentiable at many points
d) F is not differentiable only at 0

85) The derivative of the functioncot$^{-1}\left[(\cos 2x)^{1/2}\right]$ at $x = \frac{\pi}{6}$ is **[2.5]**
a) $6^{1/2}$ b) $(2/3)^{1/2}$
c) $(1/3)^{1/2}$ d) $3^{1/2}$

86) If$y = a\sin x + b\cos x$, then $y^2 + \left(\frac{dy}{dx}\right)^2$ is a
i. Function of x
ii. Function of y
iii. Constant
Select the correct answer using the codes given below. **[2.5]**
a) Only III b) None of these
c) Only I d) Only II

87) Let$f : R \to R$ be a function, such that, $f(x) = x^3 + x^2 f'(1) + xf''(2) + f'''(3)$, for $x \in R$.
What is f(1) equal to? **[2.5]**
a) - 1 b) 0
c) 4 d) - 2

88) If$y = \tan^{-1}\left[\frac{\sqrt{(1+x^2)}-1}{x}\right]$, then **[2.5]**
a) $y'(0) = 0$
b) $y'(0) = \frac{1}{2}$
c) $y'(0) = -1$
d) $y'(0) = 1$

89) If$y = \frac{1}{\log_{10} x}$, then what is $\frac{dy}{dx}$ equal to? **[2.5]**
a) $x\log_{10} e$
b) $x\log_e 10$
c) x
d) $-\frac{(\log_x 10)^2(\log_{10} e)}{x}$

90) What is the maximum area of a rectangle that can be inscribed in a circle of radius 2 units? **[2.5]**
a) 6 sq. units b) 16 sq. units
c) 8 sq. units d) 4 sq. units

91) In the mean value theorem$\frac{f(b)-f(a)}{b-a} = f'(c)$, a = 0, $b = \frac{1}{2}$ and f(x) = x(x - 1)(x - 2), then value of c is **[2.5]**
a) $1 - \frac{\sqrt{15}}{6}$
b) $1 + \sqrt{15}$
c) $1 - \frac{\sqrt{21}}{6}$
d) $1 + \sqrt{21}$

92) Consider the function f(x) = $3x^4$ - $20x^3$ - $12x^2$ + 288x + 1.
In which one of the following intervals is the function increasing? **[2.5]**
a) $(-3, -2)$ b) $(-2, 3)$
c) $(3, 4)$ d) $(-4, -3)$

93) What is$\int \frac{dx}{x(1+\ln x)^n}$ equal to $(n \neq 1)$? **[2.5]**
a) $-\frac{1}{(n-1)(1+\ln x)^{n-1}} + C$
b) $\frac{1-n}{(1+\ln x)^{1-n}} + C$
c) $\frac{1}{(n-1)(1+\ln x)^{n-1}} + C$
d) $\frac{n+1}{(1+\ln x)^{n+1}} + C$

94) What is$\int (\sin x)^{-1/2}(\cos x)^{-3/2}dx$ equal to? **[2.5]**
a) $2\sqrt{\tan x} + C$ b) $\sqrt{2\tan x} + C$
c) $\sqrt{\tan x} + C$ d) $\sqrt{\cot x} + C$

95) If$\int \frac{dx}{(x-2)^2(x-3)} = \frac{C_1}{x-2} + C_2\log\left(\frac{x-2}{x-3}\right) + C_3$ where C_3 is constant of integration, then **[2.5]**
a) $C_1 = 1$ and $C_2 = 1$
b) $C_1 = 1$ and $C_2 = -1$
c) $C_1 = -1$ and $C_2 = -1$
d) $C_1 = -1$ and $C_2 = 1$

96) If$\int_0^{\frac{\pi}{2}} \left(\sin^4 x + \cos^4 x\right) dx = k$, then what is the value of $\int_0^{20\pi} \left(\sin^4 x + \cos^4 x\right) dx$? **[2.5]**
a) $10k$ b) $20k$
c) k d) $40k$

97) What is$\int_0^{\pi/2} \frac{dx}{a^2\cos^2 x + b^2\sin^2 x}$ equal to? **[2.5]**
a) 2 ab b) $\frac{\pi}{2ab}$
c) $\frac{\pi}{ab}$ d) $2\pi ab$

98) What is$\int_0^2 \frac{dx}{x^2+4}$ equal to? **[2.5]**
a) $\frac{\pi}{8}$ b) $\frac{\pi}{4}$
c) $\frac{\pi}{2}$ d) $\frac{\pi}{3}$

99) Consider the curves y = sin x and y = cos x.
What is the area of the region bounded by the above two curves and the lines x = 0 and $x = \frac{\pi}{4}$? **[2.5]**
a) $(\sqrt{2} - 1)$ sq units
b) $(\sqrt{2} + 1)$ sq units
c) 2 sq units
d) $\sqrt{2}$ sq units

100) The area of the region bounded by the parabola$y^2 = 4kx$, where $k0$ and its latusrectum is 24 square units. What is the value of k? **[2.5]**
a) 2 b) 1
c) 4 d) 3

101) Find the particular solution of the differential equationlog$\left(\frac{dy}{dx}\right) = 3x + 4y$, given that y = 0 and x = 0. **[2.5]**
a) $4e^{3x} + 3e^{-4y} + 7 = 0$
b) $4e^{3x} - 3e^{-4y} - 7 = 0$
c) $4e^{3x} + 3e^{-4y} - 7 = 1$
d) $4e^{3x} + 3e^{-4y} - 7 = 0$

102) The differential equation of the curve y = sin x is **[2.5]**
a) $\frac{d^2y}{dx^2}$ + y = 0
b) $\frac{d^2y}{dx^2}$ + x = 0
c) $\frac{d^2y}{dx^2}$ - y = 0
d) $\frac{d^2y}{dx^2} + y\frac{dy}{dx}$ + x = 0

103) Forming a differential equation representing the given family of curves by eliminating arbitrary constants a and b from$y = e^{2x}(a + bx)$ yields the differential equation **[2.5]**
a) Y – 4y ′ + 4y = 0 b) Y + 4y ′ + 4y = 0
c) Y – 4y ′ - 4y = 0 d) Y + 4y ′ - 4y = 0

104) The integrating factor of the differential equation ($3x^2$ + y) $\frac{dx}{dy}$ = x is **[2.5]**
a) $\frac{2}{x}$ b) $-\frac{1}{x}$
c) $\frac{1}{x}$ d) $\frac{1}{x^2}$

105) The solution of the differential equation$\frac{dy}{dx} = \frac{1}{\log y}$ is: **[2.5]**
a) Y log y - y = x + c b) Log y = x + c
c) Y log y + y = x + c d) Log y - y = x + c

106) General solution of$x\frac{dy}{dx} + y - x + xycot\, x = 0\,(x \neq 0)$ is **[2.5]**
a) $y = \frac{1}{x} + \cot x + \frac{C}{x\sin x}$
b) $y = \frac{1}{x} - \cot x + \frac{C}{x\sin x}$
c) $y = \frac{1}{x} - \cot x - \frac{C}{x\sin x}$
d) $y = \frac{1}{x} + \cot x - \frac{C}{x\sin x}$

107) Consider the following statements
i. Both the regression coefficients have same sign.
ii. If one of the regression coefficients is greater than unity, the other must be less than unity.
Which of the above statement(s) is/are correct? **[2.5]**
a) Only i
b) Neither i nor ii
c) Both i and ii
d) Only ii

108) Ram spends equal amounts on purchasing three kinds of pens being sold at ₹5, ₹10 and ₹15 per piece. Average cost of each pen is **[2.5]**
a) ₹12
b) ₹10
c) ₹$\frac{90}{11}$
d) ₹9

109) The median of first 8 prime numbers is **[2.5]**
a) 9
b) 11
c) 13
d) 7

110) If the difference of mode and median of a data is 24, then the difference of median and mean of the same data is: **[2.5]**
a) 8
b) 12
c) 34
d) 24

111) If the mode of the data: 64, 60, 48, x, 43, 48, 43, 34 is 43, then x + 3 = **[2.5]**
a) 45
b) 48
c) 44
d) 46

112) The mean and the variance of 10 observations are given to be 4 and 2 respectively. If every observation is multiplied by 2, the mean and the variance of the new series will be respectively. **[2.5]**
a) 8 and 4
b) 8 and 20
c) 8 and 8
d) 80 and 40

113) The difference between the upper and the lower class limits is called **[2.5]**
a) Mean
b) Class size
c) Frequency
d) Mid - points

114) Consider the following statements
i. If A and B are exhaustive events, then their union is the sample space.
ii. If A and B are exhaustive events, then their intersection must be an empty event.
Which of the above statement(s) is/are correct? **[2.5]**
a) Neither i nor ii
b) Both i and ii
c) Only ii
d) Only i

115) The probability of the safe arrival of one ship out of 5 is$\frac{1}{5}$. What is the probability of the safe arrival of at least 3 ships? **[2.5]**
a) $\frac{181}{3125}$
b) $\frac{1}{31}$
c) $\frac{3}{52}$
d) $\frac{184}{3125}$

116) Two men hit at a target with probabilities$\frac{1}{2}$ and $\frac{1}{3}$, respectively. What is the probability that exactly one of them hits the target? **[2.5]**
a) $\frac{1}{6}$
b) $\frac{1}{2}$
c) $\frac{1}{3}$
d) $\frac{2}{3}$

117) Two dice are rolled together. The probability of getting a doublet is: **[2.5]**
a) $\frac{1}{6}$
b) $\frac{1}{36}$
c) $\frac{5}{6}$
d) $\frac{2}{36}$

118) Find the probability of getting 5 exactly twice in 7 throws of a die. **[2.5]**
a) $\frac{5}{12}\left(\frac{5}{6}\right)^5$
b) $\frac{7}{12}\left(\frac{5}{6}\right)^4$
c) $\frac{7}{12}\left(\frac{1}{6}\right)^5$
d) $\frac{7}{12}\left(\frac{5}{6}\right)^5$

119) The probability that a leap year selected at random will have 53 Fridays is **[2.5]**
a) $\frac{1}{7}$
b) $\frac{2}{7}$
c) $\frac{4}{7}$
d) $\frac{6}{7}$

120) If E_1, E_2,.....,E_n are mutually exclusive and exhaustive events associated with a samplespace, and A is any event of non zero probability, then **[2.5]**
a) $P(E_i|A) = \frac{P(E_i)P(A|E_i)}{\sum_{i=1}^{n} P(E_i)P(A|E_i)}$
b) $P(E_i|A) = \frac{P(E_i)P(A|E_i)}{\sum_{i=1}^{n} P(E_{i-1})P(A|E_i)}$
c) $P(E_i|A) = \frac{P(E_i)P(E_i|A)}{\sum_{i=1}^{n} P(E_i)P(A|E_i)}$
d) $P(E_i|A) = \frac{P(E_i)P(A|E_i)}{\sum_{i=1}^{n} P(E_i)P(A|E_{i-2})}$