

1. Given $f(x)$ is differentiable and $f'(4) = 5$, find

$$\lim_{x \rightarrow 2} \frac{f(4) - f(x^2)}{x - 2}$$

- (a) ∞ (b) 0
(c) 5 (d) -20

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2. $\lim_{x \rightarrow 0} \frac{1}{1 + e^{1/x}}$ is

- (a) 0 (b) 1
(c) $1/2$ (d) Does not exist

DJNU-2010

3. The fourth power of $\sqrt{1 + \sqrt{1 + \sqrt{1}}}$ is :

- (a) $3 + 2\sqrt{3}$ (b) $3 + 2\sqrt{2}$
(c) $\frac{7 + 3\sqrt{5}}{2}$ (d) None of these

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4. At what time between 3 and 4 o'clock are the hands of a clock together ?

- (a) $49\frac{1}{11}$ minutes past 3 (b) $16\frac{4}{11}$ minutes past 3
(c) $10\frac{10}{11}$ minutes past 3 (d) $43\frac{7}{11}$ minutes past 3

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5. How many numbers from 1 to 1000 are not divisible by 2, 3 and 5 ?

- (a) 268 (b) 500
(c) 333 (d) none of these

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6. Express $(4312)_3$ as a number in base 10.

- (a) 502 (b) 512
(c) 562 (d) 582

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7. A and B can reap a field in 8 days, B and C in 12 days and C and A in 16 days. How long will they take to reap the field, if they work together ?

- (a) $\frac{77}{13}$ days (b) $\frac{88}{13}$ days
(c) $\frac{96}{13}$ days (d) 11 days

JNU-2010

8. If α is a repeated root of $px^2 + qx + r = 0$, then

$$\lim_{x \rightarrow \alpha} \frac{\tan(px^2 + qx + r)}{(x - \alpha)^2}$$

- (a) 0 (b) r
(c) p (d) $\pi/2$

CJNU-2010

9. A triangle has two of its vertices at $P(1, 0)$ and $Q(0, 1)$. The third vertex $R(x, y)$ moves along the line $y = x$. Let A represent the area of the triangle.

Find $\frac{dA}{dx}$

- (a) 0 (b) 1
(c) $1/2$ (d) $1/4$

BJNU-2010

10. If $0 < st < 1$, then which of the following can be true ?

- (a) $s < -1$ and $t > 0$ (b) $s < -1$ and $t < -1$
(c) $s > 1$ and $t > 1$ (d) $s > -1$ and $t > -1$

JNU-2010

11. A certain cake recipe states that the cake should be baked in a pan of 8 cm diameter. If you want to make a cake of same depth but 12 cm in diameter, by what factor should you multiply the recipe ingredients ?

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

JNU-2010

12. X is normally distributed with mean -2 and variance 4, i.e., $X \sim N(-2, 4)$. Find $E[e^x]$.

- (a) e^{-1} (b) e^4
(c) e^2 (d) e^{-2}

JNU-2010

13. For what value of x is

$$S = (x - 1)^2 + (x - 2)^2 + (x - 5)^2 + (x - 7)^2$$
 minimum ?

- (a) 4 (b) 6
(c) 7 (d) none of these

DJNU-2010

14. The density ρ of a uniform cylinder is determined by measuring its mass m , length l and diameter d . Calculate the approximate fractional error in ρ from the following data :

$$m = 47.36 \pm 0.01 \text{ g}, l = 15.28 \pm 0.05 \text{ mm}, d = 21.37 \pm 0.04 \text{ mm}$$

- (a) 0.01% (b) 0.08%
(c) 0.50% (d) 1.50%

JNU-2010

15. X_1, X_2, \dots, X_n are independent random variables with respective means $\mu_1, \mu_2, \dots, \mu_n$, and variances $\sigma_1^2, \sigma_2^2, \dots, \sigma_n^2$. Obtain $\text{Var}(a_1 X_1 + a_2 X_2 + \dots + a_n X_n)$.

- (a) $\sigma_1^2 + \sigma_2^2 + \dots + \sigma_n^2$ (b) $\sigma_1^2 \sigma_2^2 \dots \sigma_n^2$
(c) $a_1^2 \sigma_1^2 + a_2^2 \sigma_2^2 + \dots + a_n^2 \sigma_n^2$ (d) $(a_1 a_2 \dots a_n)$

JNU-2010

16. X is a random variable with mean M and standard deviation σ . For small deviations compared to M , compute $E(\sqrt{x})$

- (a) $M^{1/2}$ (b) $M^{1/2}$
(c) $s > 1$ and $t > 1$ (d) $s > -1$ and $t > -1$

JNU-2010
17. The incomes of A and B are in the ratio 3 : 2 and the expenditures in the ratio 5 : 3. If each of them saves ₹ 1,000 find their incomes

- (a) ₹ 3,000, ₹ 2,000 (b) ₹ 6,000, ₹ 4,000
(c) ₹ 12,000, ₹ 8,000 (d) none of these

JNU-2010
18. In a singles tennis tournament that has 125 entrants, a player is eliminated whenever she loses a match. How many matches are played in the entire tournament ?
(a) 62 (b) 63
(c) 124 (d) 246

JNU-2010
19. How many four digit numbers have only even digits ?
(a) 96 (b) 128
(c) 500 (d) 625

JNU-2010
20. There are 27 students in a college debate team. Find the probability that at least 3 of them have their birthdays in the same month.
(a) 1/27 (b) (1/27)³
(c) 9/27 (d) 1

JNU-2010
21. Which of the operations is/are applicable on semaphore ?
(a) UP and DOWN (b) INTERRUPT
(c) BUSY WAITING (d) SEND and RECEIVE

JNU-2010
22. The time taken to move the arm from one track to another for R/W operation is called
(a) seek time (b) rotational time
(c) latency time (d) transmission time

JNU-2010
23. Consider a relation R(P, Q, R) with set of functional dependencies F = (P → QR, Q → PR, R → PQ). The minimal cover of F is :
(a) (P → R, Q → P, R → Q)
(b) (P → R, Q → P, R → P)
(c) (P → Q, Q → P, R → Q)
(d) (P → R, Q → R, R → Q)

JNU-2010
24. Consider a relation R(P, Q, R, S, T) with set of functional dependencies F = (P → Q, QR → T, ST → P). The highest normal form for R is :
(a) 2NF (b) 3NF
(c) BCNF (d) 4NF

JNU-2010
25. Which of following is a conflict serializable schedule ?
(a) R₁(X), R₂(X), W₁(X), R₁(Y), W₂(X), W₁(Y)
(b) R₁(X), R₂(X), W₂(X), W₁(X), R₁(Y), W₁(Y)

- (c) R₁(X), R₂(Y), W₁(X), R₁(Y), W₁(Y), W₂(Y)
(d) R₁(X), W₁(X), R₁(Y), R₂(X), W₁(Y), W₂(X)

JNU-2010
26. The address lines required for 512 K word memory are
(a) 10 (b) 19
(c) 20 (d) none of these

JNU-2010
27. Suppose the numbers a, b, c are in AP and |a|, |b|, |c| < 1. If
x = 1 + a + a² + ... ∞, y = 1 + b + b² + ... ∞,
z = 1 + c + c² + ... ∞ then x, y, z are in :
(a) AP (b) GP
(c) HP (d) none of these

JNU-2010
28. The number of rectangles that one can find on a chessboard is :
(a) 1082 (b) 1296
(c) 1128 (d) 1632

JNU-2010
29. Let A be an orthogonal matrix. Consider the following statements :
I. The transpose of A is orthogonal.
II. The inverse of A is orthogonal.
III. aA is orthogonal, where a is any non-zero number.
(a) 0 (b) 1
(c) 2 (d) 3

JNU-2010
30. The greatest value of the positive integer n so that the sum to n terms of the series 1 + 1/2 + 1/2² + is less than (2 - 1/1000), is :
(a) 5 (b) 7
(c) 8 (d) 10

JNU-2010
31. The number of solutions of the system of equations
1 + x + x² + ... + x²³ = 0
1 + x + x² + ... + x¹⁹ = 0 equals :
(a) 3 (b) 4
(c) 19 (d) 23

JNU-2010
32. A man of weight W is in an elevator of weight W. The elevator accelerates vertically up at a rate K and at a certain instant has a speed V. What is the apparent weight of the man ?
(a) W(1 - k/g) (b) W(1 + k/g)
(c) 2WV (d) zero

JNU-2010
33. Octal equivalent of the hexadecimal number B@F16 is :
(a) 2627426 (b) 2625426
(c) 2826426 (d) 5457426

JNU-2010
34. If a file of size $n = 1000$ takes on an average 4 ms for searching in item using binary search algorithm, then approximately how much time on an average would it take to search an item in a file of size $n = 1000\ 000\ 000\ 000$?

- (a) 1600 ms (b) 16000 ms
(c) 160 ms (d) 16 ms

JNU-2010

35. Assume that a lower triangular matrix $A [0 \dots n-1, 0 \dots n-1]$ is stored in a linear array $B [0 \dots \frac{1}{2} * n(n+1) - 1]$ in row by row order. For $n = 100$, if $A [0, 0]$ is stored in $B [0]$, where is $A [50, 40]$ stored ?

- (a) 1275 (b) 1300
(c) 1312 (d) 1315

JNU-2010

36. The probability that a number chosen at random from the primes between 100 and 199 is odd, is : B

- (a) 1082 (b) 1
(c) $\frac{1}{2}$ (d) 0.6

JNU-2010

37. Three identical balls fit exactly into a cylindrical can : the radius of the balls equals the radius of the can and the balls just touch the bottom and the top of the can. What fraction of the volume of can is taken up by the balls ?

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

JNU-2010

38. In quadrilateral WXYZ, the measure of angle Z is 10 more than twice the average of the measures of the other three angles. What is the measure of angle Z ?

- (a) 100 (b) 120
(c) 150 (d) 170

JNU-2010

39. What is the arithmetic mean of $3^{30}, 3^{60}, 3^{90}$? D

- (a) 3^{60} (b) 3^{177}
(c) $3^{10} + 3^{20} + 3^{30}$ (d) none of these

JNU-2010

40. If the sum of all the positive even integers less than 1000 is A, what is the sum of all the positive odd integers less than 1000 ?

- (a) $A + 500$ (b) $A + 1$
(c) $A/2$ (d) $A - 499$

JNU-2010

41. Calculate $\int_1^2 \frac{\sin(\ln x)}{x} dx$.

- (a) $1 - \sin 2$ (b) $1 - \cos(\ln 2)$
(c) $1 + \cos(\ln 2)$ (d) $1 + \ln 2$

JNU-2010

42. There are three critical points of the function $g(x, y) = x^4 + 2x^2y + 2y^2 + 4$. Identify the point which is not critical.

- (a) $(\frac{1}{\sqrt{2}}, \frac{1}{4})$ (b) $(0, -\frac{1}{4})$
(c) $(\frac{1}{\sqrt{2}}, -\frac{1}{2})$ (d) $(-\frac{1}{\sqrt{2}}, -\frac{1}{2})$

JNU-2010

43. Find the area enclosed by the lines $t = 1, t = 2, t$ -axis and the graph of the function $f(t) = e^t$.

- (a) e^{2t} (b) e
(c) $e^2 - e$ (d) e^2

JNU-2010

44. Given the function $f(x, y) = 2y^3x + 5y^4 - (y^{3/4} - 2x^{3/4})y^4 x$,

then $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y}$ equals :

- (a) xy (b) $x^4 y^4$
(c) xyf (d) $4f$

DJNU-2010

45. Suppose that $f(x) = 1/x, g(x) = x^{3/2}, h(x) = x^2 + 2x + 3$. Compute $fgh(x)$ at $x = 2$.

- (a) 11^3 (b) $11^{-3/2}$
(c) $11^{3/2}$ (d) none of these

DJNU-2010

46. Let $a_i, q_i > 0, i = 1, 2, \dots, n; \sum_{i=1}^n q_i = 1$. Then

$\lim_{x \rightarrow 0} \ln(\sum_{i=1}^n q_i a_i^x)^{1/x}$ equals :

- (a) $\ln(a_1 a_2 \dots a_n)$ (b) $(q_1 + q_2 + \dots + q_n)$
(c) $\sum_{i=1}^n q_i \ln a_i$ (d) Does not exist

CJNU-2010

47. Evaluate $\int_0^u \int_0^v \exp[\max(v^2 x^2, u^2 y^2)] dy dx$.

- (a) $\frac{e^{u^2 v^2} - 1}{uv}$ (b) $\frac{e^{u^2 v^2}}{uv}$
(c) e^{uv} (d) $\frac{uv}{e}$

JNU-2010

48. Compute $\int_0^\infty x^{-1/2} e^{-x} dx$.

- (a) e^{-1} (b) $\sqrt{\pi}$
(c) $\sqrt{\pi/e}$ (d) ∞

- JNU-2010**
49. Suppose that the lifetime X (in years) of a machine has an exponential distribution with parameter $\lambda = 1/3$. What is the probability that a three-year-old machine will still work at the end of three additional years ?
- (a) $e^{-6} + e^{-3}$ (b) $e^{-3} + e^{-6}$
(c) e^{-1} (d) $e^{-1/3}$

- JNU-2010**
50. Let X be a non-negative continuous random variable. The $E(X) = \int_0^{\infty} x f_x(x) dx$ in terms of c.d.f. $F_x(x)$ can be expressed as

- (a) $\int_0^{\infty} F_x(x) dx$ (b) $\int_0^{\infty} (1 - F_x(x)) dx$
(c) $F_x(\infty) - F_x(0)$ (d) $\int_0^{\infty} \frac{F_x(x)}{x} dx$

- JNU-2010**
51. License plates are made up of three letters followed by four digits. We assume that letters I and O are never used and that no license plates end with 0000. How many distinct license plates can there be ? D

- (a) $\left(\frac{24}{3}\right)\left(\frac{10}{4}\right) - 1$ (b) $\left(\frac{24}{3}\right)\left(\frac{10}{4}\right) - 1$
(c) $(24 \times 24 \times 24) 10^4$ (d) $(24 \times 24 \times 24) (10^4 - 1)$

- JNU-2010**
52. An amount of ₹ 1,000 is invested and attracts interest at a rate equivalent 10% per annum. Find the total after one year, if the interest is compounded monthly.
- (a) $1000(1 + 0.1)^{12}$ (b) $1000(1 + 1.2)$
(c) $1000\left(1 + \frac{0.1}{12}\right)^{12}$ (d) $1000 \times 0.1 \times 12$

- JNU-2010**
53. Determine the set $G \cap L$, where
 $G = \{(x, y) \mid y = x^2 - 5x + 6\}$
 $L = \{(x, y) \mid y = 2x - 6\}$
 $G \cap L$ consists of
- (a) (4, 2), (3, 0) (b) (2, 3)
(c) (2, 6), (3, 0) (d) (4, 2), (6, 2)

- JNU-2010**
54. The population of a country doubled every 10 years from 1960 to 1990. What was the percent increase in population during this time ?
- (a) 200% (b) 300%
(c) 60% (d) 70%

- JNU-2010**
55. 8 is $\frac{1}{3}$ % of what number ?
- (a) 24 (b) 240
(c) 2.4 (d) 2400

- JNU-2010**
56. Consider the identity

$$(1 + x + x^2)^{25} = a_0 + a_1x + a_2x^2 + \dots + a_{50}x^{50}.$$

We find $2(a_0 + a_2 + a_4 + \dots)$ equals

- (a) 3^{25} (b) $3^{25} + 1$
(c) 3^{26} (d) $3^{25} - 1$

- JNU-2010**
57. The value of $f(0)$, for which $f(x) = \frac{512(\sqrt{x+4} - 2)}{\sin 2x}$ is continuous, is :
- (a) 51 (b) 59
(c) 61 (d) none of these

- DJNU-2010**
58. If A is the area of a triangle whose vertices are (1, 2, 3), (-2, 1, -4), (3, 4, -2), then the value of $4A^2$ is
- (a) $\frac{\sqrt{1218}}{2}$ (b) 1128
(c) 1218 (d) 2418

- JNU-2010**
59. If $f(x) = (1 + x)^n$, then the value of $f(0) + f'(0) + \frac{f''(0)}{2!} + \dots + \frac{f^n(0)}{n!}$ is :
- (a) n (b) 2^{n-1}
(c) 2^{n+1} (d) 2^n

- DJNU-2010**
60. The curve which passes through the point (2, 0) and the slope of the tangent at any point (x, y) is $x^2 - 2x$ for all values of x, is :
- (a) $y = x^3$ (b) $y = \frac{x^3}{3} - x^2$
(c) $y = \frac{x^3}{3} - x^2 + \frac{4}{3}$ (d) $y = \frac{x^3}{3} - x^2 - \frac{4}{3}$

- CJNU-2010**
61. A straight line passes through (2, -6) and the point of intersection of the lines $5x - 2y + 14 = 0$ and $2y = 8 - 7x$. Any straight line concurrent with the given lines is $(5x - 2y + 14) + \lambda(2y - 8 + 7x) = 0$. The value of λ is :
- (a) 6 (b) 36
(c) 17 (d) 16

- JNU-2010**
62. The Laplace transform of a real-valued function $f(t)$ is defined as $\bar{f}(s) = \int_0^{\infty} e^{-st} f(t) dt$. If $f(t)$ is a piecewise continuous function of exponential order α (i.e., $|f(t)| < Me^{\alpha t}$) the transform $\bar{f}(s)$ is defined for $\text{Re } s > \alpha$. If $\bar{f}(s) = \frac{1}{s+1} + \frac{1}{s+2}$, then $f(t)$ is given by
- (a) $t + t^2$ (b) $e^{-t} + 2t$
(c) $e^{-t} + e^{-2t}$ (d) $\sin t + \sin 2t$

JNU-2010
63. Given a 10×10 matrix. Each element of the matrix is a Boolean variable. How many different matrices can be formed ? A

- (a) 2^{100} (b) 100^2
(c) 2^{10} (d) 10^2

JNU-2010
64. Let $S \equiv x^2 + y^2 + 2gx + 2fy + c = 0$ be the equation of a circle and $P \equiv ax + by + c' = 0$ be the equation of a straight line. Then the equation $S + \lambda P = 0$ represent

(a) circle (b) ellipse
(c) hyperbola (d) pair of straight lines

JNU-2010
65. The ratio of the outer and the inner perimeters of a circular path is $23 : 22$. If the path is 5 meters wide, the diameter of the inner circle is :

(a) 55m (b) 65 μ
(c) 215m (d) 220m

JNU-2010
66. Four circular cardboard pieces, each of a radius 7 cm, are placed in such a way that each piece touches two other pieces. The area of the space enclosed by the four pieces is :

(a) 22 cm^2 (b) 42 cm^2
(c) 84 cm^2 (d) 102 cm^2

JNU-2010
67. The value of $e^{0.001}$ correct up to one decimal place is :

(a) 1.1 (b) 2.7
(c) 1.0 (d) none of these

JNU-2010
68. Mr. A, Miss B, Mr. C and Miss D are sitting around a table and discussing their trades.

(i) Mr. A sits opposite to cook
(ii) Miss B sits right to the barber.
(iii) Miss D sits opposite to Mr. C.
(iv) The washerman is on the left of the tailor.

What are the trades of A and B ?

(a) Incomplete information (b) Tailor and cook
(c) Washerman and cook (d) Barber and cook

JNU-2010
69. It is given that $f''(x) = -f(x)$, $f'(x) = g(x)$ and $h(x) = [f(x)]^2 + [g(x)]^2$. If $h(1/2) = 8$, then $h(3/2)$ is equal to:

(a) 0 (b) 2
(c) 2 (d) 8

DJNU-2010
70. Six roads lead to a country. They may be indicated by letters X, Y, Z and digits 1, 2, 3. When there is storm, Y is blocked. When there are floods, X, 1 and 2 will be affected. When road 1 is blocked, Z also is blocked. At a time when there are floods and a storm also blows,

which road(s) can be used ?

- (a) Only Y (b) Only Z
(c) Only 3 (d) Z and 2

JNU-2010
71. Six persons A, B, C, D, E and F are standing in a circle. B is between F and C; A is between E and D; F is to the left of D. Who is between A and F ?

(a) B (b) C
(c) D (d) E

JNU-2010
72. Which one of the following diagrams correctly represents the relationship among the classes Tennis fans, Cricket players and Students ?



JNU-2010
73. If sky is called sea, sea is called water, water is called air, air is called cloud and cloud is called river, then what do the drink when thirsty ?

(a) River (b) Sky
(c) Water (d) Air

JNU-2010
74. Grain : Stock :: Stick : ?

(a) Heap (b) String
(c) Bundle (d) Collection

JNU-2010
75. What terms will fill the blank spaces ?
Z, X, V, T, R,,

(a) M, N (b) N, M
(c) P, N (d) O, K

JNU-2010
76. In a certain code, PAPER is written as SCTGW. How is MOTHER written in that code ?

(a) ORVLGW (b) PQRSXY
(c) PQVJGT (d) none of these

JNU-2010
77. A point moves in such a manner that the sum of its distances from fixed points $(-3, 0)$ and $(3, 0)$ is 6. Then the locus of the moving point must be

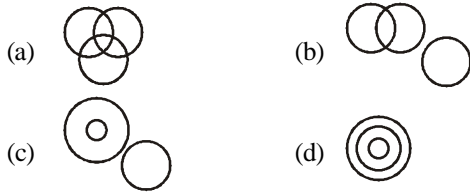
(a) an ellipse (b) a parabola
(c) a line segment joining the fixed points
(d) a circle

JNU-2010
78. Find the centre of mass for three weights located at points $(1, 3)$, $(2, -2)$ and $(3, 2)$, the weights being 5 kg, 6kg and 2 kg respectively

(a) $(23, 7)$ (b) $(23/13, 7/13)$
(c) $(6/13, 8/13)$ (d) $(6, 3)$

JNU-2010

79. Select from the given diagrams the one that illustrates the relationship among the given three classes - Judge, Thief and Criminals



JNU-2010

80. In an (8×8) matrix whose elements are $a_{ij} = (-1)^{i+j}$, how many positive terms are there ?

- (a) 64 (b) 32
(c) 48 (d) 16

JNU-2010

81. Which of these systems has no solution ?

- (a) $\begin{cases} 2x_1 - x_2 = 3 \\ x_1 + x_2 = 1 \end{cases}$ (b) $\begin{cases} 2x_1 - x_2 = 3 \\ 4x_1 - 2x_2 = 6 \end{cases}$
- (c) $\begin{cases} x_1 + x_2 = 3 \\ 2x_1 - 2x_2 = 6 \end{cases}$ (d) $\begin{cases} 2x_1 - x_2 = 3 \\ 4x_1 - 2x_2 = 5 \end{cases}$

JNU-2010

82. For what value of α is the vector $(2, 11, -3)$ in the span of the set $\{(2, 5, -3), (4, 8, \alpha)\}$?

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

JNU-2010

83. Let A be (4×3) matrix whose columns form a linearly independent set. Which conclusion is justified

- (a) The equation $AX = b$ is consistent for every b in \mathbb{R}^4
(b) The set of rows in A is linearly dependent
(c) The equation $AX = 0$ has a non trivial solution
(d) There is a matrix B such that $AB = I_4$

JNU-2010

84. Let $\frac{1}{x^2 - 1} = \frac{A}{x - 1} + \frac{B}{x + 1}$. Find A and B

- (a) $-1/2, 1/2$ (b) $1/2, -1/2$
(c) $-1, 1$ (d) $-1, -2$

JNU-2010

85. Which of these transformations is linear ? in each

- (a) $T(X) = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$ (b) $T(X) = \begin{bmatrix} x_1 - x_2 \\ x_1 / x_2 \end{bmatrix}$
- (c) $T(X) = \begin{bmatrix} x_1 & x_2 \\ x_1 + x_2 \end{bmatrix}$ (d) $T(X) = \begin{bmatrix} 3x_1^2 \\ 4x_2^2 \end{bmatrix}$

JNU-2010

86. What is the range of the function f that maps \mathbb{R} to \mathbb{R}^2

by means of the formula $f(t) = \begin{bmatrix} \sin t \\ \cos t \end{bmatrix}$?

- (a) A circle (circumference only)

(b) \mathbb{R}^2

- (c) The set of all points (x, y) satisfying $-1 \leq x \leq 1$ and $-1 \leq y \leq 1$
(d) A disk consisting of a circle together with all the points enclosed by the circle

JNU-2010

87. Given an array of n elements. Each element can take three values -1, 0, 1. How many different arrays can be formed ? C

- (a) $\binom{n}{3}$ (b) n^3
(c) 3^n (d) $\left[\binom{n}{3} \right]^3$

JNU-2010

88. The number of roots of $x^{2.1} + x^{3.01} + x^{4.001} = 1$ is

- (a) infinite (b) two
(c) 3001 (d) 4001

JNU-2010

89. The value of the sum $\sum_{n=1}^{13} (i^n + i^{n-1}), i = \sqrt{-1}$ is

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

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90. What is the area of a regular hexagon inscribed in a circle of radius of 10 cm ?

- (a) 180 cm^2 (b) $150\sqrt{3} \text{ cm}^2$
(c) $(150\sqrt{3}) \text{ cm}^2$ (d) $180\sqrt{3} \text{ cm}^2$

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91. For what value of x is

$S = |x - 1| + |x - 3| + |x - 8| + |x - 9| + |x - 20|$ minimum?

- (a) 7 (b) 6.8
(c) 8 (d) none of these

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92. The Fibonacci sequence is governed by the difference equation $y_n = y_{n-1} + y_{n-2}$ with initial condition $y_0 = 0, y_1 = 1$. The general solution is

$y_n = A \left(\frac{1 + \sqrt{5}}{2} \right)^n + B \left(\frac{1 - \sqrt{5}}{2} \right)^n$. Determine A and B.

- (a) -1, 1 (b) $\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}$
(c) $\frac{1}{\sqrt{5}}, \frac{1}{\sqrt{5}}$ (d) $\frac{1}{\sqrt{5}}, -\frac{1}{\sqrt{5}}$

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93. Find z^4 , if $z = 1 + \sqrt{3}i, i = \sqrt{-1}$.

- (a) $4 \cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3}$ (b) $4 \left(\cos \frac{4\pi}{3} + i \sin \frac{2\pi}{3} \right)$
(c) $16 \left(\cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3} \right)$ (d) $-16 \left(\cos \frac{4\pi}{3} + i \sin \frac{4\pi}{3} \right)$

94. $\sinh ix$ equals :
 (a) $\cosh x$ (b) $i \sin x$
 (c) $\cos x$ (d) 1
95. $S = 1 + 1/2^2 + 1/3^2 + \dots$ equals :
 (a) $\pi^2/6$ (b) $\pi/2$
 (c) 4 (d) ∞
96. The arc length of the parabola $y(x) = \frac{1}{2}x^2$ from $x = 0$ to $x = 1$ is given by :
 (a) $\ln(\sqrt{2}-1)$ (b) $\frac{1}{2}[\sqrt{2} + \ln(\sqrt{2}+1)]$
 (c) $\frac{\ln(\sqrt{2}+1)}{2}$ (d) $\frac{\ln(\sqrt{2})}{2}$
97. The divergence of a vector field $\underline{u} = \nabla u = \begin{vmatrix} i & j & k \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ u_1 & u_2 & u_3 \end{vmatrix}$ then $\nabla \cdot (\nabla \cdot \underline{u})$ is
 (a) $\nabla \cdot (\nabla \cdot \underline{u}) - \nabla^2 u$ (b) 0
 (c) $\nabla^2 \underline{u}$ (d) 3
98. For $-1 \leq x \leq 1$, the infinite power series $x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \frac{x^5}{5} - \dots$ converges to
 (a) e^x (b) $\sin x$
 (c) $\ln x$ (d) $\ln(1+x)$
99. For cylindrical polar coordinates (r, ϕ, z) , we have $x = r \cos \phi, y = r \sin \phi, z = z$. The Jacobian $J = \frac{\partial(x, y, z)}{\partial(r, \phi, z)}$ is :
 (a) r (b) ϕ
 (c) $r^2 \sin \phi \cos \phi$ (d) z
100. For large x , Stirling's asymptotic formula for $x!$ gives
 (a) $e^{x \ln x}$ (b) $\sqrt{2\pi x} e^{-x \ln x}$
 (c) $\sqrt{2\pi x} e^{-x \ln x - x}$ (d) $e^{x \sqrt{x}}$
101. $g(n) = O\{f(n)\}$ denotes
 (a) $g(n)$ has order at least $f(n)$
 (b) $g(n)$ has the same order as $f(n)$
 (c) $g(n)$ has order at most $f(n)$
 (d) none of these
102. The object oriented paradigm includes which of the following properties ?
 I. Encapsulation II. Inheritance III. Recursion
 (a) I only (b) I, II and III
 (c) II only (d) I and II only
103. Which of the following is the name of the data structure

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in a compiler that is responsible for managing information about variables and their attributes ?

- (a) Parse table (b) Symbol table
 (c) Attribute grammar (d) Semantic stack

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104. Which of the following statements about Ethernets is typically false ?

- (a) Ethernets use circuit switching to send message
 (b) Ethernets use buses with multiple masters
 (c) Network connected by Ethernets are limited in length to a few hundred metres
 (d) Packets sent on Ethernets are limited in size

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105. In the internet Protocol (IP) suite of protocols, which of the following best describes the purpose of the Address Resolution Protocol ?

- (a) To determine the appropriate route for a datagram
 (b) To translate Web addresses to host name
 (c) To determine the hardware address of a given host name
 (d) To determine the hardware address of a given address

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106. Let k be an integer greater than 1. Which of the following represents the order of growth of the

expression $\sum_{i=1}^n k^i$ as a function of n ?

- (a) $O(k^n)$ (b) $O(k^{n \log n})$
 (c) $O(k^{n+k})$ (d) $O(k^n \log n)$

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107. Consider the following program :

```
# include (stdio.h)
main ()
{
    int i = 0, x = 0;
    do {
        if (i% == 0) {
            x++;
            printf ("%d", x);
        }
        ++i;
    } while (i < 25);
    printf ("\nx = %d", x);
}
```

The above program would produce output as

- (a) 12345 (b) 01234
 $x=5$ $x=4$
 (a) 23456 (b) none of these
 $x=6$

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108. Consider the following program :
- ```

int fun (int n)
{
 if (n == 1) return (1);
 else return (fun (n/2) + 1)
}

```
- The value of fun (4000) is :
- (a) 10 (b) 9  
(c) 12 (d) none of these
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109. X is binomially distributed with parameters n and p. Then  $E[(X - np) + (X - np)^2]$  equals : D
- (a) np (b)  $n^2p^2$   
(c)  $n(n-1)p^2$  (d)  $np(1-p)$
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110. Let random variable X have m.g.f.  $M(t) = \exp [3t + t^2]$ . What is  $E[X^2]$  ? D
- (a) 6 (b) 3  
(c) 10 (d) 11
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111. A uniform density function over an interval of unit length is such that  $P(1/4 < X < 1/2) = 1/4$ . What is the left-hand end point of that interval of unit length ? A
- (a) cannot be determined (b) 0  
(c) 1/8 (d) 1/4
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112. A company agrees to accept the highest of four sealed bids on a property. The four bids are regarded as four independent random variables with common cumulative distribution function  $F(x) = 1/2(1 + \sin \pi x)$ ,  $(3/2) \leq x \leq (5/2)$ . Which of the following represents the expected value of the accepted bid ? D
- (a)  $\int_{3/2}^{5/2} x \cos \pi x dx$   
(b)  $\frac{\pi}{4} \int_{3/2}^{5/2} x \cos \pi x (1 + \sin \pi x)^3 dx$   
(c)  $\frac{1}{16} \int_{3/2}^{5/2} x (1 + \sin \pi x)^4 dx$   
(d)  $\pi \int_{3/2}^{5/2} x \cos \pi x dx$
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113. The integrating factor of the differential equation  $\frac{dy}{dx}(x \log x) + y = 2 \log x$  is given by :
- (a)  $\log \log x$  (b) x  
(c)  $e^x$  (d)  $\log x$
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114. For solving  $\frac{dy}{dx} = (4x + y + 1)$ , suitable substitution is :

- (a)  $y = Vx$  (b)  $y + 4x + 1 = V$   
(c)  $y = 4x + V$  (d)  $y = 4x + V^2$

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115. For a given data, the line of regression y on x is  $y = 0.4 + 1.3x$  and x on y is  $x = -0.1 + 0.7y$ . Find  $\bar{x}$  and  $\bar{y}$ .
- (a) 0.4, -0.1 (b) 3, 2  
(c) 2, 3 (d) 3, 3

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116. Let  $X_1, X_2, \dots, X_n$  be a random sample from exponential distribution with p.d.f.

$$f(x, \theta) = (1/\theta) \exp [-x/\theta], x \geq 0, \theta \geq 0$$

The maximum likelihood estimate for  $\theta$  is :

- (a)  $\frac{1}{\bar{X}}$  (b)  $(X_1 X_2 \dots X_n)^{-1/n}$   
(c)  $\frac{\sum x_i}{n}$  (d)  $(X_1 X_2 \dots X_n)^{1/n}$

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117. An Olympic diver of mass m begins his descent from a 10 metres high diving board with zero initial velocity. Calculate the velocity on impact with water.

- (a) 14 m/s (b) 28 m/s  
(c) 9.8 m/s (d)  $\sqrt{20}$  m/s

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118. Two coins are available, one unbiased and the other two-headed. Choose a coin at random and toss it once, assume that the unbiased coin is chosen with probability 3/4. Given that the result is head, find the probability that the two-headed coin was chosen.

- (a) 1/5 (b) 2/5  
(c) 3/8 (d) 3/16

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119. The maximum value of  $z = 6x + 8y$  subject to constraints  $2x + y \leq 30$ ,  $x + 2y \leq 24$  and  $x \geq 0$ ,  $y \geq 0$  is

- (a) 80 (b) 112  
(c) 180 (d) 120

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120. A particle executes random walk on a set of integers. Starting from origin, it takes a right step with probability p and a left step with probability  $q = 1 - p$ . Steps are independent and each step is of unit length. The probability that after 200 steps, particle is at 75 is :

- (a)  $p^{75}$  (b)  $p^{75} q^{125}$   
(c)  $\binom{200}{75} p^{75} q^{125}$  (d) 0

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