JNU MCA - 2006

1. In a triangle with one angle $2\pi/3$, the lengths of the sides form an AP. If the length of the greatest side is 7 cm, the radius of the circumcircle of the triangle is

(a) $\frac{7\sqrt{3}}{3}$ (b) $\frac{5\sqrt{3}}{3}$ (c) $\frac{2\sqrt{3}}{3}$ (d) $\frac{\sqrt{3}}{3}$

2. If in a triangle ABC, $\sin A, \sin B, \sin C$ are in AP, then

(a) the altitudes are in AP (b) the altitudes are in HP

(c) the altitudes are in GP (d) None of these

3. $\lim_{n \to \infty} (2k^{1/n} - 1)^n$ is equal to

(a) k^2 (b) $2k$ (c) $2 \ln (k)$ (d) None of these

4. The direction vector along which the function $f(x, y) = \frac{x^2}{2} + \frac{y^2}{2}$ decreases most rapidly at the point (1, 1) is given by

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

5. The function $f : R^2 \to R$ is defined by

$$f(x, y) \begin{cases} \frac{\sin(xy^2)}{x^2 + y^2}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$$

(a) is differentiable at (0, 0) (b) is continuous but not differentiable at (0, 0)

(c) is not continuous at (0, 0) (d) has continuous partial derivatives at (0, 0)

6. Let $f(x) = x^3$, $x \in [a, b]$ and the value of the determinant $\begin{vmatrix} f(b) & b^2 & b & 1 \\ f(a) & a^2 & a & 1 \\ f'(a) & 2a & 1 & 0 \\ f''(a) & 2 & 0 & 0 \end{vmatrix}$ is equal to (– 16) Then $b - a$ is equal to

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

7. For the integral $\int_0^\infty \tan^n x \, dx$ is equal to $(-\pi)$, the least positive value of n is equal to

(a) 3/2 (b) 5/2 (c) 3 (d) 5

8. Let y be an implicit function of x given by $x^4 - axy^2 - a^3 y = 0$. If y is maximum, then

(a) $3xy + 4a^2 = 0$ (b) $3xy - 4a^2 = 0$ (c) $4x^4 + a^3 y = 0$ (d) $3xy + 4a = 0$

9. Let $z = z(x, y)$ be an implicit function of x, y for all $x > 0$, $y > 0$, given by $xyz^2 + x^2 y - xz^4 + y^2 z^2 = 0$. Then z is a homogenous function of degree

(a) 1 (b) 2 (c) 1/2 (d) 1/4

10. The address lines required for a 256 K work memory are

(a) 8 (b) 10 (c) 18 (d) 20

11. A sequential circuit is one in which the state of the output is

(a) entirely determined by the states of the input

(b) determined by the present input as well as past state

(c) unpredictable

(d) not possible at all

12. If $\sin(\alpha + \beta) = 1$ and $\sin(\alpha - \beta) = 1/2$ where $\alpha, \beta \in [0, \pi/2]$, then $\dfrac{\tan(\alpha + 2\beta)}{\tan(2\alpha + \beta)}$ is equal to

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

13. Propositional formula $P \wedge (Q \vee R) \rightarrow [(P \wedge Q) \vee (P \wedge R)]$ is a

(a) tautology (b) contradiction (c) contingency (d) None of these

14. The solution of the differential equation $\dfrac{dy}{dx} = \dfrac{x^2 + xy + y^2}{x^2}$ is

(a) $x = c \exp[\cot^{-1}(y/x)]$ (b) $x = c \exp[\sin^{-1}(y/x)]$

(c) $x = c \exp[\tan^{-1}(y/x)]$ (d) None of these

15. If the random variables, X, Y and Z have the mean $\mu_x = 2$, $\mu_y = -3$ and $\mu_z = 2$, the variances $\sigma_X^2 = 1$, $\sigma_Y^2 = 5$ and $\sigma_Z^2 = 2$ and covariaces $\text{cov}(X, Y) = -2$ $\text{cov}(X, Z) = -1$ and $\text{cov}(Y, Z) = 1$, the variance of $W = 3X - Y + 2Z$ is

(a) 17 (b) 18 (c) 20 (d) None of these

16. The determinant $\begin{vmatrix} a^2 & a & 1 \\ \cos(nx) & \cos(n+1)x & \cos(n+2)x \\ \sin(nx) & \sin(n+1)x & \sin(n+2)x \end{vmatrix}$ is independent of

(a) n (b) a (c) x (d) None of these

17. If a, b and c are three positive real numbers, then the minimum value of the expression $\dfrac{b+c}{a} + \dfrac{c+a}{b} + \dfrac{a+b}{c}$ is

(a) 1 (b) 2 (c) 3 (d) None of these

18. If p, q are r are any real numbers, then

(a) $\max(p, q) < \max(p, q, r)$ (b) $\min(p, q) = \dfrac{1}{2}(p + q - |p - q|)$

(c) $\min(p, q) < \min(p, q, r)$ (d) None of above

19. A computationally efficient way to compute the sample mean of the data $x_1, x_2, \ldots x_n$ is an follows

$$\overline{x_{j+1}} = \overline{x_j} + \frac{x_{j+1} - \overline{x_j}}{K(J)}, \; j = 1, 2, \ldots n$$

Then $K(j)$ is equal to

(a) j (b) $j + 1$ (c) $j(j - 1)$ (d) j^{-1}

20. A system composed of n separate components is said to be parallel system if it functions when at least one of the components functions. For such a system, if a component i functions with probability p_i independent of other components, $i = 1, 2, \ldots n$, what is the probability that the system functions ?

(a) $p_1 p_2 \ldots p_n$ (b) $p_1 + p_2 + \ldots + p_n$

(c) $1 - (1 - p_1)(1 - p_2) \ldots (1 - p_n)$ (d) $(1 - p_1)(1 - p_2) \ldots (1 - p_n)$

21. Centre of mass of a half disc with radius a and uniform mass density is equal to

(a) $2a/3\pi$ (b) $4a/3\pi$ (c) $a/4\pi$ (d) $a/2\pi$

22. The value of the double integral $\int_0^{\pi/2} \int_x^{\pi/2} \frac{\sin y}{y} \, dy \, dx$ is equal to

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

23. Let $w = x^2 + y^2$ and $y^3 - xy = 2$. Then the value of $\partial w/\partial x$ at the point $(x, y) = (-1, -1)$ is equal to

(a) -2 (b) $-3/2$ (c) $2/3$ (d) None of these

24. The function $f(x) = \sum \frac{n^3}{n^4 + 1} \sin nx$ is

(a) continuous at $x = 0$ and differentiable in $(0, 2\pi)$

(b) discontinuous at $x = 0$ and non-differentiable in $(0, 2\pi)$

(c) continuous at $x = 0$ and non-differentiable in $(0, 2\pi)$

(d) discontinuous at $x = 0$ and differentiable in $(0, 2\pi)$

25. If the number $(z - 1)(z + 1)$ is purely imaginary, then

(a) $|z| = 1$ (b) $|z| > 1$ (c) $|z| < 1$ (d) $|z| > 2$

26. If $F = (y^2 + z^3, 2xy - 5z, 3xz^2 - 5y)$, then a scalar function $\Phi(x, y, z)$ such that $F = \text{grad}\,[\Phi]$ is given by

(a) $xy + xz^3 - yz + c$ (b) $y + xz^2 + 2xy + c$ (c) $xy^2 + xz^3 - 5yz + c$ (d) $xyz + xz^2 + yz + c$

27. A person walking along a straight road observes that at two points 1 km apart, the angles of elevation of a pole in front of him are 30° and 75°. The height of the pole is

(a) $250(\sqrt{3} + 1)\,m$ (b) $250(\sqrt{3} - 1)\,m$ (c) $225(\sqrt{2} - 1)\,m$ (d) $225(\sqrt{2} + 1)\,m$

28. X is a continuous random variable with probability function $f(x) = N \exp\ (-x^2 + 6x)\ -\infty < x < \infty$, the value of N is

(a) $\frac{1}{\sqrt{2\pi}}$ (b) e^{-9} (c) $\frac{e^{-9}}{\sqrt{\pi}}$ (d) None of these

29. The value of $\int_0^{\infty} \frac{1}{(4x^2 + \pi^2)\cosh x} \, dx$ is equal to

(a) $\frac{\ln 2}{2\pi}$ (b) $\frac{2 \ln 2}{2\pi}$ (c) $\frac{\pi}{2 \ln 2}$ (d) None of these

30. The value of $\oint_C x^2 y dx + (y^3 - xy^2) dy$, where C is the boundary of the region enclosed by the circles $x^2 + y^2 = 4$, $x^2 + y^2 = 16$ is

(a) 2π (b) 12π (c) 120π (d) None of these

31. Let $\vec{\mathbf{a}}$, $\vec{\mathbf{b}}$, and $\vec{\mathbf{c}}$, are three non-coplanar vectors, and let $\vec{\mathbf{p}}$, $\vec{\mathbf{q}}$ and $\vec{\mathbf{r}}$, be the vectors defined by the relations

$\vec{\mathbf{p}} = \frac{\vec{\mathbf{b}} \times \vec{\mathbf{c}}}{[\vec{\mathbf{a}}\ \vec{\mathbf{b}}\ \vec{\mathbf{c}}]}$, $\vec{\mathbf{q}} = \frac{\vec{\mathbf{c}} \times \vec{\mathbf{a}}}{[\vec{\mathbf{a}}\ \vec{\mathbf{b}}\ \vec{\mathbf{c}}]}$ and $\vec{\mathbf{r}} = \frac{\vec{\mathbf{a}} \times \vec{\mathbf{b}}}{[\vec{\mathbf{a}}\ \vec{\mathbf{b}}\ \vec{\mathbf{c}}]}$.

Then the value of the expression $(\vec{\mathbf{a}} + \vec{\mathbf{b}}) \cdot \vec{\mathbf{p}} + (\vec{\mathbf{b}} + \vec{\mathbf{c}}) \cdot \vec{\mathbf{q}} + (\vec{\mathbf{c}} + \vec{\mathbf{a}}) \cdot \vec{\mathbf{r}}$ is equal to

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

32. Consider a complete binary tree. The number of nodes at level k is

(a) $2^k - 1$ (b) 2^k (c) $2^{k-1} - 1$ (d) 2^{k-1}

33. Derivative of $\sin^{-1}\left\{\frac{2x}{1+x^2}\right\}$ w.r.t. $\cos^{-1}\left\{\frac{1-x^2}{1+x^2}\right\}$ is

(a) – 2 (b) – 1 (c) 1 (d) 2

34. $\lim_{n\to\infty}\left\{\frac{1}{1-n^2}+\frac{2}{1-n^2}+\ldots+\frac{n}{1-n^2}\right\}$ is equal to

(a) 0 (b) $-\frac{1}{2}$ (c) $\frac{1}{2}$ (d) None of these

35. Backward Euler method for solving differential equation $\frac{dy}{dx} = f(x, y)$ is

(a) $y_{n-1} = y_n + hf(x_{n+1}, y_{n+1})$ (b) $y_{n-1} = y_{n-1} + 2hf(x_n, y_n)$

(c) $y_{n+1} = y_n + hf(x_n, y_n)$ (d) $y_{n+1} = (1+h) f(x_{n-1}, y_{n+1})$

36. The value of integral $\int_0^{\pi/2} \frac{\sqrt{\cot x}}{\sqrt{\cot x} + \sqrt{\tan x}}\, dx$ is

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$ (c) π (d) None of these

37. If $y = ae^{-kt}\cos(pt + c)$ and

$\frac{d^2y}{dx^2} + 2k\frac{dy}{dx} + n^2 y = 0$, then n^2 equals

(a) $p^2 + k^2$ (b) p^2 (c) k^2 (d) $p^2 - k^2$

38. What is the meaning of following declaration ?

(a) f is a function returning integer value (b) f is a function returning pointer to integer

(c) f is pointer to a function returning integer (d) It is not a valid declaration

39. Program counter PC is used to store

(a) the number of statements in a program

(b) the number of instructions in a process

(c) the address of the next instruction to be executed

(d) the address of the first instruction of process

40. $(Z + X)(Z + \overline{X} + Y)$ is equal to

(a) $(Z + X)(Z + Y)$ (b) $Z(X + Y)$ (c) $X \cdot Z + Y$ (d) $ZX + ZY + XY$

41. Let $b_n = \int_0^1 \min\cdot(x, a_{n-1})\, dx$ and $a_n = \int_0^1 \max(x, b_{n-1})\, dx$, $c_n = a_n + b_n$. Then the sequence (c_n) converges to

(a) $\sqrt{2}$ (b) 1 (c) 2 (d) None of these

42. The value of the integral $\int_0^1 y^2\left(\ln\frac{1}{y^3}\right)^{-1/2} dy$ is equal to

(a) $\frac{1}{3}$ (b) $\sqrt{\pi}$ (c) $\frac{\sqrt{\pi}}{3}$ (d) $\frac{\pi}{3}$

43. The number of solutions to the equation $z^2 + \overline{z} = 0$ is

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

44. If $\frac{2\sin\alpha}{1+\cos\alpha+\sin\alpha} = y$, then $\frac{1-\cos\alpha+\sin\alpha}{1+\sin\alpha}$ is equal to

(a) $1/y$ (b) y (c) $1 - y$ (d) $1 + y$

45. If $\sin\theta$ and $\cos\theta$ are the roots of the equation $ax^2 - bx + c = 0$ then a, b and c satisfy the relation

(a) $a^2 + b^2 + 2ac = 0$ (b) $a^2 - b^2 + 2ac = 0$ (c) $a^2 + c^2 + 2ab = 0$ (d) $a^2 - b^2 - 2ac = 0$

46. The number of solutions of the equation $\sin 5x \cos 3x = \sin 6x \cos 2x$ in the interval $[0, \pi]$ is

(a) 3 (b) 4 (c) 5 (d) 6

47. If sum of the distances of a point from two perpendicular lines in a plane is 1, then its locus is

(a) a square (b) a circle (c) a straight line (d) two intersecting lines

48. X is an exponential random variable with parameter λ with p.d.f. $f(x) = \lambda e^{-\lambda x}$ if $x \geq 0 = 0$ if $x < 0$, identify the correct one

(a) $P(X > s + t) = P(X > s) P(X > t)$

(b) $P(X > s + t) = P(X > s) + P(X > t)$

(c) $P(X > s + t) = 1 - P(X = s) P(X = t)$

(d) $P(X > s + t) = \lambda st \, P(X > s) P(X > t)$

49. Two circles $x^2 + y^2 = 6$ and $x^2 + y^2 - 6x + 8 = 0$ are given. Then the equation of the circle through their points of intersection and the point (1, 1) is

(a) $x^2 + y^2 - 6x + 4 = 0$

(b) $x^2 + y^2 - 3x + 1 = 0$

(c) $x^2 + y^2 - 4y + 2 = 0$

(d) None of these

50. There exists a function $f(x)$ satisfying $f(0) = 1$, $f(0) = -1$, $f(x) > 0$ for all x, and

(a) $f''(x) > 0$ for all x

(b) $-1 < f''(x) < 0$ for all x

(c) $-2 < f''(x) < -1$ for all x

(d) $f''(x) < -$ for all x

51. The value of $\int_{-\infty}^{\infty} \frac{\sin 3\theta}{(5 - 3\cos\theta)} d\theta$ is equal to

(a) infinity (b) 2/3 (c) 1/3 (d) None of these

52. The number of vectors of unit length perpendicular to the vectors $\vec{\mathbf{a}} = (1, 1, 0)$ and $\vec{\mathbf{b}} = (0, 1, 1)$ is

(a) one (b) two (c) three (d) None of these

53. Given the following Truth Table : (R is the result)

A	B	R
0	0	1
0	1	0
1	0	1
1	1	1

Above TT corresponds to following formula

(a) $A \to B$ (b) $B \to A$ (c) $A \to B \vee B \to A$ (d) None of these

54. What will be the output of following program segment ?

```
int array [5], i, *p;
for (i = 0 ; i < 5 ; 1 + +)
array [i] = i;
ip = array
print f("%d \ n",*(ip + 3 * size of (int)))
```

(a) 3 (b) 6 (c) Garbage (d) None of these

55. If the vectors $(a, 1, i)$, $(1, b, 1)$ and $(1, 1, c)$ $(a \neq b \neq c \neq 1)$ are coplanar, then $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$ is equal to

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

56. The number of terms in the exponential series such that their sum gives the value of e^x correct to six decimal places at $x = 1$ is

(a) 6 (b) 8 (c) 10 (d) 14

57. Newton's iterative formula to find $\sqrt{N}$ is

(a) $x_{n+1} = x_n (2 - Nx_n)$ (b) $x_{n+1} = x_n (2 + Nx_n)$ (c) $x_{n+1} = 2\left(x_n + \frac{N}{x_n}\right)$ (d) None of these

58. The equations $2x + 3y + 5z = 9; 7x + 3y - 2z = 8; 2x + 3y + \lambda z = \mu$ have infinite number of solutions if

(a) $\lambda = 5$ (b) $\mu = 5$ (c) $\lambda = \mu = 5$ (d) None of these

59. Determine the value of K for which the function given by $f(x, y) = kxy$ for $x = 1, 2, 3$ can serve as a joint probability distribution

(a) $\frac{1}{36}$ (b) 1 (c) $\frac{1}{9}$ (d) 8

60. S is defined as $S = |x - 1| + \left|x - \frac{1}{2}\right| + \left|x - \frac{1}{3}\right| + \left|x - \frac{1}{4}\right| + \left|x - \frac{1}{5}\right|$. Find the value of x for which S is minium

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{78}{80}$

61. The centre of a circle passing through the point (0, 1) and touching the curve $y = x^2$ at (2, 4) is

(a) $\left(\frac{-16}{5}, \frac{27}{10}\right)$ (b) $\left(\frac{-16}{7}, \frac{5}{10}\right)$ (c) $\left(\frac{-16}{5}, \frac{53}{10}\right)$ (d) None of these

62. If $u = \cos(x + y) + \cos(x - y)$, then which of the following is/are true ?

(a) $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial y^2}$ (b) $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial x \partial y}$ (c) $\frac{\partial^2 u}{\partial y^2} = \frac{\partial^2 u}{\partial y \partial x}$

(a) (a) only (b) (b) only (c) (a) and (b) only (d) (a) and (c) only

63. The TEST instruction for 8086 microprocessor performs the function of

(a) destructive AND (b) non-destructive AND

(c) wait for an event (d) None of these

64. Let $s_n = \sum_{k=0}^{n} f_k^2$, f_k is the kth Fibonacci number $f_0 = f_1 = 1$, $f_{n+1} = f_n + f_{n-1}$. Then the value $\sum_{n=0}^{\infty} (-1)^n s_n$ is equal to

(a) 1/2 (b) $\sqrt{5}/2$ (c) $(\sqrt{5} - 1)/2$ (d) None of these

65. The real value of θ for which the expression $\frac{1 + i\cos\theta}{1 - 2i\cos\theta}$ is a real number is

(a) $2n\pi$ (b) $(2n + 1)\pi$ (c) $2n\pi \pm \pi/2$ (d) None of these

66. If $\cos\alpha + \cos\beta + \cos\gamma = \sin\alpha + \sin\beta + \sin\gamma = 0$, then which of the following are true ?

(i) $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = 0$ (ii) $\cos(\alpha + \beta) + \cos(\beta + \gamma) + \cos(\gamma + \alpha) = 0$

(iii) $\sin 2\alpha + \sin 2\beta + \sin 2\gamma = 0$

(a) (i) and (ii) only (b) (ii) and (iii) only

(c) (iii) and (i) only (d) (i), (ii) and (iii)

67. The set of real x such that $\frac{2x - 1}{2x^3 + 3x^2 + x} > 0$ is

(a) $(-\infty, -1)$ (b) $(-\infty, 0)$ (c) $(-\infty, \infty)$ (d) None of above

68. If $\sin x + \sin^2 x = 1$, then the value of $\cos^{12} x + 3\cos^{10} x + 3\cos^8 x + \cos^6 x - 1$ is equal to

(a) 0 (b) 1 (c) -1 (d) None of these

69. A variable chord is drawn through the origin to the circle $x^2 + y^2 - 2ax = 0$. The locus of the centre of the circle drawn on this chord as diameter is

(a) $x^2 + y^2 + ax = 0$ (b) $x^2 + y^2 + ay = 0$

(c) $x^2 + y^2 - ax = 0$ (d) $x^2 + y^2 - ay = 0$

70. The value of $\int_0^\infty \frac{\sin x}{x} dx$ is

(a) infinity (b) $\frac{\pi}{2}$ (c) π (d) None of these

71. Which of the following pairs is logically equivalent ?

(a) $A \to B$ and $\neg A \vee B$ (b) $\neg(A \vee B)$ and $\neg A \wedge \neg B$

(c) $(A \vee \neg B) \to C$ and $(\neg A \wedge B \vee C)$ (d) All of above

72. What will be the output of following program segment ?

int ij;
$j = 0$
for $(i = 1 ; i < 10 ; i + +)$
{
continue;
$++j$;
print f (%d'', j);

(a) 0 (b) 55 (c) 10 (d) None of these

73. Hexadecimal D9 is equivalent to octal

(a) 113 (b) 331 (c) 131 (d) 313

74. DMA is reponsible for

(a) data movement in registers

(b) data movement in ALU

(c) data movement in I/O devices

(d) data movement from I/O to memory and vice-versa

75. If $|z^2 - 1| = |z|^2 + 1$. then z lies on a/an

(a) straight line (b) circle (c) ellipse (d) None of above

76. The equation $3^{x-1} + 5^{x-1} = 34$ has

(a) no solution (b) one solution (c) two solutions (d) more than two solutions

77. Given a statement:

If it rains I am not going.

Converse of the statement is

(a) If I don't go, it rains (b) If I go it doesn't rain

(c) If I don't go it doesn't rain (d) None of above

78. If $x = 6$, $y = 11$, $z = -2$, find the value of statement $((x/2 > y)) || (x > z)$ in c language.

(a) 0 (b) 1 (c) 3 (d) None of above

79. If the lines $2(\sin A + \sin B)\, x - 2\sin(A - B)\, y = 3$ and $2(\cos A + \cos B)\, x + 2\cos(A - B) y = 5$ are perpendicular, then $\sin 2A + \sin 2B$ is equal to

(a) $\sin(A - B) - 2\sin(A + B)$ (b) $2\sin(A - B) - \sin(A + B)$

(c) $\sin(2(A - B) - \sin(A + B)$ (d) $\sin(2(A - B)) - 2\sin(A + B)$

80. If G is the centroid and I is the incentre of the triangle with vertices $A(-36,7)$, $B(20, 7)$ and $C(0, -8)$, then GI is equal to

(a) $\frac{\sqrt{250}}{3}$ (b) $\frac{\sqrt{205}}{3}$ (c) $\frac{\sqrt{181}}{3}$ (d) None of these

81. Locus of the mid-points of the chords of the circle $x^2 + y^2 = 4$ which subtends a right angle at the centre is

(a) $x + y = 2$ (b) $x^2 + y^2 = 1$ (c) $x^2 + y^2 = 2$ (d) $x - y = 0$

82. The value of $\int_{-\infty}^{\infty} \frac{1}{(5+4x+x^2)^2} dx$ is equal to

(a) π (b) $\frac{\pi}{2}$ (c) infinity (d) None of these

83. The value of k for which the points $A(1, 0, 3)$, $B(-1, 3, 4)$, $C(1, 2, 1)$ and $D(k, 2, 5)$ are coplanar is

(a) 1 (b) 2 (c) 0 (d) – 1

84. If the equation of one tangent to the circle with centre at $(2, -1)$ from the origin is $3x + y = 0$, then the equation of the other tangent through the origin is

(a) $3x - y = 0$ (b) $x + 3y = 0$ (c) $x - 3y = 0$ (d) $x + 2y = 0$

85. The value of $\int_0^{\infty} \frac{x^{p-1}}{1+x} dx, 0 < p < 1$ is equal to

(a) π (b) infinity (c) $\frac{\pi}{2}$ (d) None of above

86. The value of $[\vec{\mathbf{a}} - \vec{\mathbf{b}}, \vec{\mathbf{b}} - \vec{\mathbf{c}}, \vec{\mathbf{c}} - \vec{\mathbf{a}}]$ is

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

87. If $z = x + iy$, $z^{1/3} = a - ib$, $a \neq \pm ba, b \neq 0$, then $\frac{x}{a} - \frac{y}{b} = k(a^2 - b^2)$, where k is equal to

(a) 0 (b) 2 (c) 4 (d) None of these

88. The inequality $n! > 2^{n-1}$ is true for

(a) all $n \in N$ (b) $n > 2$ (c) $n > 1$ (d) $n \notin N$

89. The equation $3\sin^2 x + 10\cos x - 6 = 0$ is satisfied for $n \in I$, if

(a) $x = n\pi + \cos^{-1}(1/3)$ (b) $x = n\pi - \cos^{-1}(1/3)$ (c) $x = 2n\pi + \cos^{-1}(1/3)$ (d) None of these

90. If $\vec{\mathbf{a}}$ and $\vec{\mathbf{b}}$ are two unit vectors, then the vector $(\vec{\mathbf{a}} + \vec{\mathbf{b}}) \times (\vec{\mathbf{a}} \times \vec{\mathbf{b}})$ is parallel to the vector

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

91. The solution set of the inequality $||x| - 1| < 1 - x$ is

(a) (1, 1) (b) $(0, \infty)$ (c) $(-1, \infty)$ (d) None of these

92. The solution set of the inequality $4^{-x+0.5} - 7.2^{-x} - 4 < 0$ $(x \in R)$ is

(a) $(-\infty, \infty)$ (b) $(-2, \infty)$ (c) $(2, \infty)$ (d) 2, 3.5)

93. If $x\cos\alpha + y\sin\alpha = x\cos\beta + y\sin\beta = 2a$ $(0 < \alpha, \beta < \pi/2)$ then it is also true that

(a) $\cos\alpha + \cos\beta = \frac{4ax}{x^2 + y^2}$ (b) $\cos\alpha\cos\beta = \frac{4a^2 - y^2}{x^2 + y^2}$

(c) $\cos\alpha\cos\beta = \frac{4ax}{x^2 + y^2}$ (d) $\cos\alpha + \cos\beta = \frac{4a^2 - y^2}{x^2 + y^2}$

The correct possibilities are

(a) (a) and (b) only (b) (c) and (d) only (c) (a) and (c) only (d) (b) and (d) only

94. The coordinates (x, y) of a moving point P satisfy the equation $\frac{dx}{dt} = x$ and $\frac{dy}{dt} = -x^2$ for all $t \geq 0$. Find an equation of the curve in rectangular coordinates if it passes through $(1, -4)$ when $t = 0$

(a) $y = \frac{x^2 + 7}{7}$ (b) $y = \frac{-x^2 - 7}{2}$ (c) $y = x^2 + 7$ (d) $x^2 - y^2 = 7$

95. The number of flip-flops used to construct a ring counter which counts from decimal one to decimal eight will be

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

96. The straight line $y = 4x + c$ is tangent to the ellipse $\frac{x^2}{8} + \frac{y^2}{4} = 1$. Then c is equal to

(a) ± 4 (b) $\pm \sqrt{6}$ (c) ± 1 (d) $\pm \sqrt{132}$

97. The area bounded by the curve $y = f(x)$, the x-axis and the ordinates $x = 1$ and $x = b$ is $(b - 1)\sin(3b + 4)$. Then $f(x)$ is

(a) $(x - 1)\cos(3x + 4)$ (b) $\sin(3x + 4)$

(c) $\sin(3x + 4) + 3(x - 1)\cos(3x + 4)$ (d) None of these

98. The least value of the expression $2\log_{10}(x) - \log_x(0.01)$, for $x > 1$ is

(a) 10 (b) – 0.01 (c) 2 (d) None of these

99. If $y = \frac{1 + \sqrt{1 - \sin 4A}}{\sqrt{1 + \sin 4A} - 1}$, then one of the values of y is

(a) $\tan A$ (b) $\cot A$ (c) $-\tan(2A)$ (d) $-\cot A$

100. The expression $(2\sqrt{3} + 4)\sin x + 4\cos x$ lies in the interval

(a) $(-4, 4)$ (b) $(-2\sqrt{5}, 2\sqrt{5})$ (c) $(-2 + \sqrt{5}, 2 + \sqrt{5})$ (d) $(-2(2 + \sqrt{5}), 2(2 + \sqrt{5}))$

101. Let $a, b, c > 0$. The series $\sum_{n=1}^{\infty}\left\{a^{1/n} - \left(\frac{a^{1/n} + c^{1/n}}{2}\right)\right\}$ is convergent if

(a) $a = bc$ (b) $a = \sqrt{bc}$ (c) $a = \sqrt{b}c$ (d) $a = b\sqrt{c}$

102. The region bounded by the parabola $y = x^2$ and the line $y = 2x$ in the first quadrant is revolved about the y-axis to generate a solid. The volume of the solid is equal to

(a) $8\pi/3$ (b) $32\pi/3$ (c) $4\pi/3$ (d) $16\pi/3$

103. Let $f(t) = \int_t^{t^2} \frac{\sin tx}{x}\, dx, t \neq 0$. Then the value of $f'(1)$ is equal to

(a) $\sin(1)$ (b) 0 (c) $-\sin(1)$ (d) $2\sin(1)$

104. If the area of a triangle on the complex plane formed by the point z, $z + iz$ and iz is 50, then $|z|$ is

(a) 1 (b) 5 (c) 10 (d) 15

105. If A lies in the second quadrant and $3\tan A + 4 = 0$, the value of $2\cot A - 5\cos A + \sin A$ is equal to

(a) –53/10 (b) 23/10 (c) 37/10 (d) 7/10

106. If $\tan(\pi\cos\theta) = \cot(\pi\sin\theta)$, then $\cos(\theta - \pi/4)$ is equal to

(a) $\pm\frac{1}{2\sqrt{2}}$ (b) $\pm\frac{1}{\sqrt{2}}$ (c) $\pm\sqrt{2}$ (d) $\pm 2\sqrt{2}$

107. The value of $\tan 1^\circ \tan 2^\circ \ldots \tan 89^\circ$ is

(a) – 1 (b) 0 (c) 1 (d) None of above

108. If $\vec{\mathbf{A}} = (1, 1, 1)$ and $\vec{\mathbf{C}} = (0, 1, -1)$ are given vectors, then a vector $\vec{\mathbf{B}}$ satisfying $\vec{\mathbf{A}} \times \vec{\mathbf{B}} = \vec{\mathbf{C}}$ and $\vec{\mathbf{A}}.\vec{\mathbf{B}} = 3$ is

(a) $\left(\frac{5}{3}, \frac{2}{3}, \frac{2}{3}\right)$ (b) $\left(\frac{2}{3}, \frac{5}{3}, \frac{2}{3}\right)$ (c) $\left(\frac{2}{3}, \frac{2}{3}, \frac{5}{3}\right)$ (d) None of these

109. For a real number y, let $[y]$ denote the greatest integer less than or equal to y. Function $f(x)$ is given by $\frac{\tan(\pi[x - \pi])}{1 + [x]^2}$

(a) Then the function $f(x)$ is discontinuous at some x

(b) Then the function $f(x)$ is continuous at all x, but the derivative $f'(x)$ does not exist for some x

(c) Then for the function $f(x)$, $f''(x)$ exists for all x

(d) Then for the function $f(x)$, $f'(x)$ exists for all x but the second derivative $f''(x)$ does not exist for some x

110. Let a, b, c be non-zero real numbers such that

$$\int_0^1 (1 + \cos^2 x)(ax^2 + bx + c)\, dx = \int_0^2 (1 + \cos^2 x)(ax^2 + bx + c)\, dx$$

Then the quadratic equation $ax^2 + bx + c = 0$ has

(a) no root in (0, 2) (b) a double root in (0, 2)

(c) two imaginary roots (d) at least one root in (0, 2)

111. The solution of the differential equation $y(2xy + e^x)\,dx - e^x dy = 0$ is

(a) $x^2 + c + ye^x = 0$ (b) $x(y^2 + c) + e^x = 0$ (c) $y(x^2 + c) + e^x = 0$ (d) None of these

112. The propagation delay encountered in a ripple carry adder of four-bit size, with delay of a single flip-floop as t_p will be

(a) 0 (b) $t_p * 4$ (c) $t_p/2$ (d) exp (t_p)

113. The Gray code equivalent of 1010_2 will be

(a) 1111 (v) 0101 (c) 0011 (d) 1001

114. The 2's complement of N in n bit is

(a) 2^n (b) $2^n - N$ (c) 2^N (d) $N - 2$

115. What is the output of following program ?

```
# include <stdio.h>
main ()
{
int a, b, funct (int * a, int b);
a = 20;
b = 20;
funct (&a, b);
print f(''a = %d b = %d'', a, b);
}
funct(int*a, int b)
{
*a = 10;
b = b + 10;
return;
}
```

(a) $a = 10$ $b = 20$ (b) $a = 20$ $b = 10$ (c) $a = 20$ $b = 30$ (d) None of these

116. What is the output of following program ?

```
# include <stdio.h>
main ()
{
int n, a, sum(int n);
int (*ptr)sum(int n);
n = 100;
ptr = & sum;
a = (*ptr)(n)
print("Sum = %d/n", a);
}
int sum (int n)
{
Int i, j;
j = 0;
for (i = 1; i <= n ; i + +)
```

```
j+ = i;
return(j)
}
```

(a) Sum = 5050 (b) Sum = 5000

(c) Produces compile time error (d) Produces run time error

117. If $z = (\lambda + 3) + i\,(5 - \lambda^2)^{1/2}$, then the locus of z is a/an

(a) ellipse (b) circle (c) plane (d) None of these

118. If $x = \sqrt{2 + \sqrt{2 + \sqrt{2 + \ldots}}}$, then x =

(a) 4 (b) 2 (c) 3.14 (d) None of these

119. The number of real solutions of $\sin(e^x) = 5x + 5^{-x}$ is

(a) infinite (b) 5 (c) 0 (d) None of these

120. The solution of the differential equation $\frac{dy}{dx} = \frac{xy + y}{xy + x}$ is

(a) $y + x = \log \frac{kx}{y}$ (b) $y - x = \log \frac{ky}{x}$ (c) $y - x = \log \frac{kx}{y}$ (d) None of these