

1. Which one of the following is TRUE of stacks and queues?
 - A. A stack is a last-in, first-out structure, and a queue is a first-in, first-out structure
 - B. A stack is a first-in, first-out structure, and both structures are random access structures.
 - C. A queue is a last-in, first-out structure, and a stack is a first-in, first-out structure.
 - D. A queue is a first-in, first-out structure, and a stack is a random access structure.

2. Suppose each node of a binary tree T has either 0 or 2 children. The inorder traversal of the binary tree T is: A D B G C F E. Which one of the following nodes is the root node of that tree?
 - A. A
 - B. B
 - C. D
 - D. G

3. Which one of the following is the correct C++ syntax to declare that class B is derived from class A?
 - A. class A derives B { ... };
 - B. class B extends A { ... };
 - C. class B : public A { ... };
 - D. class B subclass of A { ... };

4. Which one of the following is the equivalent infix expression for the postfix expression $n m + p * ?$
 - A. $p * n + m$
 - B. $m + (p * n)$
 - C. $(n + m) * p$
 - D. $n + m * p$

5. For implementation of the quick sort algorithm which one of the following is used?
 - A. Recursion
 - B. Graph traversal
 - C. Queue
 - D. Tree traversal

6. In a selection sort of n elements, how many times is the swap function called in the complete execution of the algorithm?
 - A. 1
 - B. $n - 1$
 - C. $n \log n$
 - D. n^2

7. In which one of the following situations is insertion sort a good choice for sorting an array?
 - A. Each component of the array requires a large amount of memory.
 - B. Each component of the array requires a small amount of memory.
 - C. The array has only a few items out of place.
 - D. The processor speed is fast.

8. What is the worst-case time complexity for mergesort to sort an array of n elements?
 - A. $O(\log n)$
 - B. $O(n)$
 - C. $O(n \log n)$
 - D. $O(n^2)$

9. In C++, which of the following best corresponds to the notion of an Abstract Data Type (ADT)?

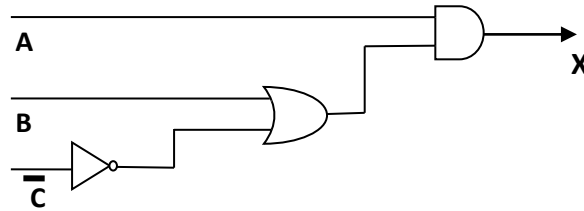
- A. Private members of a class
 - B. All the methods of a class
 - C. An abstract class with only pure virtual methods
 - D. A class with fully implemented methods
10. Consider the following C program fragment. What is the worst-case time complexity for the program fragment?
- ```

int n;
scanf("%d", &n);
while (n > 0) {
 n = n/10;
}

```
- A.  $O(1)$
  - B.  $O(\log n)$
  - C.  $O(n)$
  - D.  $O(n^2)$
11. Which one of the following is NOT involved in a memory write operation in a processor?
- A. MAR
  - B. PC
  - C. MDR
  - D. Data Bus
12. Which one of the following words is most similar in meaning to the word **entice**?
- A. Hallow
  - B. Repulse
  - C. Terrify
  - D. Attract
13. The word **FIXED** is to **VARIABLE** as **SOLID** is to:
- A. Glass
  - B. Malleable
  - C. Hard
  - D. Rotate
14. Which one of the following words is most similar in meaning to **slog**?
- A. Drudgery
  - B. Dig
  - C. Machinery
  - D. Dread
15. Which one of the following base-5 numbers is equivalent to the decimal number 88?
- A. 444
  - B. 323
  - C. 313
  - D. 423
16. To convert octal code to binary code which of the following digital functions should be used?
- A. Decoder
  - B. Encoder
  - C. Multiplexer
  - D. Demultiplexer
17. A machine cycle refers to which one of the following?
- A. Fetching an instruction
  - B. Clock speed
  - C. Fetching, decoding and executing an instruction
  - D. Executing an instruction
18. Which of the following addressing modes specifies a register which contains the memory address of the operand?
- A. Indirect addressing mode
  - B. Register addressing mode
  - C. Register indirect addressing mode

D. Index addressing mode

19. Which one of the following Boolean expressions describes the out X in the following logic diagram?



- A.  $X=A+B+C$
- B.  $X=A.(B+C)$
- C.  $X=A+B.C$
- D.  $X=(A.B)+C$

20. Which one of the following logic gates has the following truth table?

| A | B | C |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

- A. Exclusive OR
- B. NOR
- C. Exclusive NOR
- D. NAND

21. Suppose several processes are accessing the same data concurrently and the outcome of an execution depends on the particular order in which the accesses takes place. Which one of the following terms describes this situation?

- A. Live lock
- B. Race condition
- C. Synchronization
- D. Critical condition

22. Which one of the following is used to protect an organization's network from outside attack?

- A. Antivirus software
- B. Router
- C. Proxy
- D. Firewall

23. Which one of the following OSI layers deals with physical addressing of a device?

- A. Network layer
- B. Physical layer
- C. Data link layer
- D. Transport layer

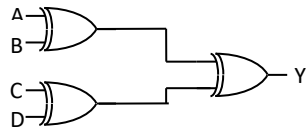
24. Consider the following Karnaugh map representation of a function F. Which one of the following represents the minimized SOP form of the function?

YZ

|           |    |    |    |    |
|-----------|----|----|----|----|
| $\bar{X}$ | 00 | 01 | 10 | 11 |
| 0         | 1  | 1  | 1  | 0  |
| 1         | 0  | 0  | 1  | 0  |

- A.  $F = \bar{X}Y + YZ$
- B.  $F = \bar{X}\bar{Y} + YZ$
- C.  $F = \bar{X}\bar{Y} + Y\bar{Z}$
- D.  $F = \bar{X}\bar{Y} + \bar{Y}Z$

25. Consider the following logic circuit. A, B, C, and D are inputs to the circuit and Y is the output. Which one of the following statements about the sum S of A,B,C,D and Y is correct?



- A. If S is 0, Y is 0
- B. If S is 1, Y is 0
- C. If S is odd, Y is 0
- D. If S is even, Y is 1

26. The packing of data and functions into a single unit in a program is known as:

- A. Polymorphism
- B. Dynamic binding
- C. Encapsulation
- D. Inheritance

27. Consider the statement: "An employee is either a worker or a manager." Assuming that Employee and Manager to be two classes, what can be said about the relationship between these two classes?
- Association
  - Generalization-specialization
  - Containment
  - Polymorphism
28. Which one of the following best characterizes inheritance?
- It is the same as encapsulation.
  - Aggregation of data.
  - Generalization and specialization.
  - Polymorphism
29. What would be the result of the binary division  $11000 \div 100$  ?
- 110
  - 1100
  - 11
  - 101
30. The OSI Network Layer corresponds to which layer in the TCP/IP reference model?
- IP layer
  - TCP layer
  - UDP layer
  - MAC layer
31. Which one of the following equipments can connect the different subnets of a network at the network layer?
- Bridge
  - Router
  - Channel
  - Hub
32. Which of the following is the correct syntax for calling a base class constructor in the definition of a derived class constructor?
- `DerivedClass::BaseClass() { DerivedClass(); }`
  - `DerivedClass::DerivedClass() { BaseClass(); }`
  - `DerivedClass::BaseClass() : DerivedClass() { }`
  - `DerivedClass::DerivedClass() : BaseClass() { }`
33. If you are designing a class that implements an array of doubles called `ArrayOfDoubles`, which one of the following would be a correct declaration of a function that overloads the subscript operator?
- `double subscript(int i);`
  - `bool operator[](int i);`
  - `double operator[](int i);`
  - `double operator[int i];`
34. Suppose you are designing a class that implements an array of doubles called `ArrayOfDoubles`. What would be the correct definition of a destructor for this class?
- `ArrayOfDoubles::~~ArrayOfDoubles() { delete [] array; }`

- B. `ArrayOfDoubles::~destructor() { delete [] array ; }`
  - C. `ArrayOfDoubles::ArrayOfDoubles() { delete [] array ; }`
  - D. `ArrayOfDoubles::~~ArrayOfDoubles(double* array) { delete [] array ; }`
35. The complexity of the solution to the recurrence  $T(n) = T(n/2) + n$  is which one of the following?
- A.  $O(\log n)$
  - B.  $O(n)$
  - C.  $O(n \log n)$
  - D.  $O(n^2)$
36. Which one of the following is the standard output device for Unix?
- A. Printer
  - B. Monitor
  - C. Keyboard
  - D. Mouse
37. A In which of the following adder circuits, the carry look ripple delay is eliminated ?
- A. Half adder
  - B. Full adder
  - C. Parallel adder
  - D. Carry-look-ahead adder
38. Which one of the following Unix commands is used to display the attributes of a directory rather than its contents?
- A. `ls -l`
  - B. `ls -d`
  - C. `ls -x`
  - D. `ls -a`
39. Consider the following C program segment. What will be the values of p and q after completion of execution of the program segment?
- ```

int p=10, q=20;
while (p < q){
    p++;
    while (p < q)
        q--;
}

```
- A. `p=10, q=10`
 - B. `p=11, q=11`
 - C. `P=11, q=19`
 - D. `P=19, q=19`
40. Which one of the following is TRUE regarding the continue statement in a for loop?
- A. Continue transfers the control flow to the initialization statement of the for loop.
 - B. Continue transfers the control flow to the statement just before the for loop
 - C. Continue transfers the control flow to the conditional statement of the for loop.
 - D. Continue transfers the control flow to the statement just after the for loop
41. Consider the following program segment. How many times will the phrase "In the loop" printed when the program segment completes execution?
- ```

int a = 6, b = 12;
while(a<b){

```

```
printf("In the loop");
a+=2; b-=2;
}
```

- A. 1
- B. 2
- C. 3
- D. 4

42. Consider a computer system that has 6 tape drives, with n processes competing for them. Each process may need upto 3 tape drives. What is the maximum value of n for which the system is guaranteed to be deadlock?

- A. 4
- B. 3
- C. 2
- D. 1

43. Which one of the following statements is TRUE for C++ programs?

- A. Private members of a base class cannot be directly accessed by derived class member functions
- B. There might be several different methods in a class implementing the same operation
- C. Multiple subclasses may inherit features of one base class
- D. Private members of a base class can be directly accessed by derived class member functions

44. What is the general syntax for doing output in a C++ program?

- A. cout << var1 << var2;
- B. cout >> var1 >> var2;
- C. var1 >> var2 >> cout;
- D. var1 >> cout << var2;

45. What would the following program segment execute on completion of execution?

```
int main () {
 int theNum=4, total=1;
 while (theNum > 1) {
 total *= --theNum;
 }
 printf ("%d", total);
 return 0;
}
```

- A. 1
- B. 2
- C. 3
- D. 4

46. Which one of the following addressing modes is used in an instruction of the form ADD X,Y?

- A. Absolute
- B. Direct
- C. Register
- D. Register indirect

47. Which of the following most accurately describes the Internet?

- A. LAN
- B. WAN

- C. Metropolitan Area Network
  - D. Ethernet
48. In the OSI model of communication, which one of the following occurs with respect to the protocol headers when a user's message moves from the lowest layer to the top layer?
- A. Added
  - B. Removed
  - C. Rearranged
  - D. Modified
49. In a selection sort of  $n$  elements, how many times is the swap function called in the complete execution of the algorithm?
- A.  $2n$
  - B.  $n - 1$
  - C.  $n \log n$
  - D.  $n^2$
50. What is the worst-case time for quicksort to sort an array of  $n$  elements?
- A.  $O(\log n)$
  - B.  $O(n)$
  - C.  $O(n \log n)$
  - D.  $O(n^2)$
51. Consider a following list of elements: 10, 30, 40, 50, 60, 70, 90. How many comparisons are required to find the element 30 when using the Binary Search Algorithm?
- A. 1
  - B. 2
  - C. 3
  - D. 4
52. In Unix, which one of the following is a command line interpreter?
- A. Shell
  - B. Kernel
  - C. Stream
  - D. Pipe
53. Batch programs are usually which one of the following types of programs?
- A. Interactive
  - B. Non-interactive
  - C. Foreground
  - D. Preemptive
54. Consider the series: VI, 10, V, 11, \_\_, 12, III,.... Which one of the following numbers should appear at the blank place?
- A. II
  - B. IV
  - C. IX
  - D. 14
55. Which one of the following numbers should come next in the series: 1.5, 2.3, 3.1, 3.9...



- A. 4.2
- B. 4.4
- C. 4.7
- D. 5.1

56. Which one of the following list of words is the odd one out? Dodge, Flee, Duck, Avoid

- A. Dodge
- B. Flee
- C. Duck
- D. Avoid

57. **Exercise** is to **gymnasium** as **eating** is to which one of the following options?

- A. Food.
- B. Dieting.
- C. Fitness
- D. Restaurant

58. Which one of the following is a simplified form of the Boolean expression  $(X + Y + XY)(X + Z)$  ?

- A.  $X + Y + Z$
- B.  $XY + YZ$
- C.  $X + YZ$
- D.  $XZ + Y$

59. What would be the decimal equivalent of the binary number 111.111?

- A. 7.875
- B. 7.625
- C. 7.375
- D. 5.325

60. Communication between the keyboard and the attached computer can be considered to be which one of the following types of communication?

- A. Simplex
- B. Full duplex
- C. Bi-Simplex
- D. Half duplex

61. The decimal representation of  $(10111011)_2$  is  
 (A) 185                      (B) 183                      (C) 184                      (D) 187
62. Which of the following is TRUE  
 (A)  $p \vee q$  is true only when both  $p$  and  $q$  are true  
 (B)  $p \wedge (\sim p)$  is a tautology  
 (C)  $p \vee (\sim p)$  is a contradiction  
 (D)  $p \Rightarrow q$  is false when  $p$  is true but  $q$  is false
63. Let  $R$  be a relation on the set of real numbers defined as  $aRb$  iff  $2|a - b| > 0$ . Then the relation  $R$  is  
 (A) Reflexive                      (B) Symmetric                      (C) Transitive                      (D) none of these
64. If  $X$  and  $Y$  are defined as  $X = \{(x, y); y = 2e^x, x \in \mathbb{R}\}, Y = \{(x, y); y = x, x \in \mathbb{R}\}$ , then  
 (A)  $X \subset Y$                       (B)  $Y \subset X$                       (C)  $X \cap Y = \emptyset$                       (D) none of these
65. A relation from a set  $A$  to set  $B$  is  
 (A) subset of  $A \times B$                       (B) subset of  $A \times A$   
 (C) subset of  $B \times B$                       (D) none of these
66. The composition function  $(g \circ f)(x)$  of the maps  $f: \mathbb{R} \rightarrow \mathbb{R}, f(x) = e^x, g: \mathbb{R} \rightarrow \mathbb{R}, g(x) = \sin x$  is  
 (A)  $e^x \sin x$                       (B)  $\sin e^x$                       (C)  $e^x + \sin x$                       (D)  $\frac{e^x}{\sin x}$
67. In a group of 65 people, 40 like cricket, 10 like both cricket and tennis. Then the number of persons liking tennis only and not cricket is  
 (A) 21                      (B) 25                      (C) 15                      (D) none of these
68. If  $n \in \mathbb{N}$  ( here  $\mathbb{N}$  is set of natural numbers ), then  $\sum_{m=1}^n m^2$  is equal to  
 (A)  $\frac{m(m-1)(2m-1)}{6}$                       (B)  $\frac{n(n-1)(2n-1)}{6}$   
 (C)  $\frac{m(m+1)(2m+1)}{6}$                       (D)  $\frac{n(n+1)(2n+1)}{6}$
69. The value of  $\left(\frac{1+i}{\sqrt{2}}\right)^4 + \left(\frac{1-i}{\sqrt{2}}\right)^4$  is equal to  
 (A) 2                      (B) 3                      (C) -3                      (D) -2

70. If  $x + \frac{1}{x} = 2 \cos \theta$ , then  $x^{18} + \frac{1}{x^{18}}$  is equal to  
 (A)  $2 \cos 18\theta$       (B)  $\cos 18\theta$       (C)  $\sin 18\theta$       (D)  $2 \sin 18\theta$
71. If  $7^{103}$  is divided by 25, then the remainder is  
 (A) 20      (B) 16      (C) 15      (D) 18
72.  ${}^7C_0 + {}^7C_1 + {}^7C_2 + {}^7C_3 + {}^7C_4 + {}^7C_5$  is equal to  
 (A) 128      (B) 121      (C) 120      (D) 129
73. The number of parallelograms that can be formed from a set of FIVE parallel lines intersecting another set of four parallel lines is  
 (A) 60      (B) 30      (C) 20      (D) none of these
74. The number of different words can be formed from the letters of the word 'TAHCIL' so that no vowels are together is  
 (A) 120      (B) 260      (C) 240      (D) 480
75. Twelve tickets are numbered from 1 to 12, then the probability of the number to be divisible by 2 or 3 is  
 (A)  $\frac{2}{3}$       (B)  $\frac{3}{13}$       (C)  $\frac{2}{13}$       (D) none of these
76. Let  $Q = \begin{bmatrix} a & 0 & 0 \\ 1 & b & 0 \\ 2 & 3 & c \end{bmatrix}$  be a matrix then  $\det(Q^2)$  (here det denotes the determinant) is  
 (A) 0      (B)  $abc$       (C)  $a^2b^2c^2$       (D) none of these
77. Consider the system of equations,  $\alpha_1 x + \beta_1 y + \gamma_1 z = 0$ ,  $\alpha_2 x + \beta_2 y + \gamma_2 z = 0$   
 $\alpha_3 x + \beta_3 y + \gamma_3 z = 0$ . If  $\det \begin{bmatrix} \alpha_1 & \beta_1 & \gamma_1 \\ \alpha_2 & \beta_2 & \gamma_2 \\ \alpha_3 & \beta_3 & \gamma_3 \end{bmatrix} = 0$ , then the system has  
 (A) no trivial solution  
 (B) a nontrivial solution  
 (C) no solution  
 (D) none of these

78. If  $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -2 & -2 \\ 1 & 3 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 6 \\ 4 \end{bmatrix}$ , then  $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$  is equal to

- (A)  $\begin{bmatrix} 0 \\ 2 \\ 2 \end{bmatrix}$                       (B)  $\begin{bmatrix} 2 \\ 4 \\ -3 \end{bmatrix}$                       (C)  $\begin{bmatrix} 2 \\ -2 \\ 4 \end{bmatrix}$                       (D)  $\begin{bmatrix} 2 \\ 2 \\ -4 \end{bmatrix}$

79. If  $X$  is a square matrix, then

- (A)  $XX^T$  is symmetric ( $X^T$  is transpose of  $X$ )                      (B)  $XX^T$  is skew symmetric  
(C)  $X^T$  is skew-symmetric                      (D) none of these

80. The value of  $\sin 20^\circ - \cos 20^\circ$  is

- (A) positive                      (B) negative                      (C) 0                      (D) 1

81. If  $\cos 7\theta = \cos 13\theta$ , then  $\theta =$

- (A)  $\pm 2n\pi$     (B)  $\frac{2n\pi}{(7\pm 13)}$                       (C)  $\frac{\pm 2n\pi}{20}$                       (D) none of these

(here  $n$  is an integer)

82.  $\sin^{-1}\left(\frac{1}{2}\right) + 2\cos^{-1}\left(\frac{1}{2}\right)$  is equal to

- (A)  $\frac{5\pi}{6}$                       (B)  $\frac{2\pi}{3}$                       (C)  $\frac{\pi}{6}$                       (D) none of these

83. In a  $\Delta ABC$ ,  $a = 2b$  and  $\angle A = 3\angle B$ , then  $\angle A$  is equal to

- (A)  $90^\circ$                       (B)  $60^\circ$                       (C)  $30^\circ$                       (D) none of these

84. The scalar projection of  $\vec{a} = 5\hat{i} + \hat{j} + 4\hat{k}$  on  $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$  is

- (A) 1                      (B) 2                      (C) 3                      (D) 4

85. If  $\vec{a}$  and  $\vec{b}$  are two unit vectors and  $\theta$  is the angle between them, then  $2 \cos \frac{\theta}{2}$  is

- (A)  $|\vec{a} + \vec{b}|$                       (B)  $|\vec{a} - \vec{b}|$                       (C)  $|\vec{a} \cdot \vec{b}|$                       (D) none of these

86. If the projection of a line segment in  $x, y$  and  $z$  axes are respectively 3, 4, 12, then the length of the line segment is

- (A) 12                      (B) 13                      (C) 19                      (D) none of these

87. The equation of the plane through the points  $(2, 3, 1)$  and  $(4, -5, 3)$  and parallel to the  $x$ -axis is

- (A)  $x - y - 1 = 0$                       (B)  $4x + y - 11 = 0$   
(C)  $y + 4z = 7$                       (D) none of these

88. The angle between the lines  $x = 1, y = 2$  and  $y = -1, z = 0$  is  
 (A)  $30^\circ$                       (B)  $60^\circ$                       (C)  $45^\circ$                       (D)  $90^\circ$
89. The equation of the sphere passing through the points  $(0,0,0), (1,0,0), (0,1,0)$  and  $(0,0,1)$  is  
 (A)  $x^2 + y^2 + z^2 - x + y - z = 0$   
 (B)  $x^2 + y^2 + z^2 - x - y + z = 0$   
 (C)  $x^2 + y^2 + z^2 + x - y + z = 0$   
 (D)  $x^2 + y^2 + z^2 - x - y - z = 0$
90. If the equation  $hxy + gx + fy + c = 0, (h \neq 0)$  represents two straight lines, then  
 (A)  $2fgh = c^2$       (B)  $2fg = ch$                       (C)  $fgh = c^2$                       (D)  $fg = ch$
91. The equation of a tangent to the circle  $x^2 + y^2 - 2x - 4y - 4 = 0$ , which is parallel to the line  $3x - 4y - 1 = 0$  is  
 (A)  $3x + 4y - 15 = 0$                       (B)  $3x + 4y + 20 = 0$   
 (C)  $3x - 4y - 10 = 0$                       (D) none of these
92. The focus of the parabola  $x^2 - 2x - y + 2 = 0$  is at  
 (A)  $(1,0)$                       (B)  $(0, \frac{5}{4})$                       (C)  $(\frac{5}{4}, 1)$                       (D)  $(1, \frac{5}{4})$
93. The equation of the ellipse referred to the axes as the axes of the coordinates with minor axis 4 and the distance between the foci is 2, is  
 (A)  $\frac{x^2}{5} + \frac{y^2}{4} = 1$       (B)  $\frac{x^2}{4} + \frac{y^2}{5} = 1$                       (C)  $\frac{x^2}{6} + \frac{y^2}{4} = 1$                       (D) none of these
94. The eccentricity of the hyperbola  $x^2 - y^2 = 1$  is  
 (A)  $\frac{1}{\sqrt{2}}$                       (B)  $\sqrt{2}$                       (C) 1                      (D) none of these
95. Equation of the straight line which passes through the point  $(2,4)$  and whose intercept on  $y$ -axis is twice that on  $x$ -axis is  
 (A)  $2x + y = 8$                       (B)  $3x - y = 2$   
 (C)  $4x - y = 4$                       (D) none of these

96. The degree of the differential equation  $\sqrt{1 + \frac{dy}{dx}} = \frac{d^3y}{dx^3}$  is  
 (A) 3 (B) 2 (C) 1 (D) none of these
97. The solution of the differential equation  $\frac{d^2y}{dx^2} = e^x + x^2$  at  $y(0) = 0, y'(0) = 1$  is  
 (A)  $y = 2e^x + \frac{x^4}{6} - 2$  (B)  $y = e^x + \frac{x^4}{12} - 1$  (C)  $y = e^x - \frac{x^4}{12} - 1$  (D) none of these
98. The differential equation of the family of curves  $y = c_1e^{2x} + c_2e^{3x}$  where  $c_1$  and  $c_2$  are arbitrary constants, is  
 (A)  $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} - 6y = 0$  (B)  $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$   
 (C)  $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} - 6y = 0$  (D) none of these
99. The general solution of the differential equation  $\frac{dy}{dx} = x^2e^{-y}$  is  
 (A)  $\frac{x^3}{5}e^{-y} = c$  (B)  $e^y = \frac{x^3}{3} + c$  (C)  $e^{-y} = \frac{x^3}{3} + c$  (D) none of these
100. A solution of the differential equation  $\left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx} + y = 0$  is  
 (A)  $y = 2$  (B)  $y = 2x$  (C)  $y = 2x^2 - 4$  (D)  $y = 2x - 4$
101.  $2 \int_0^{2\pi} \sqrt{1 + \sin \frac{x}{2}} dx$  is equal to  
 (A) 0 (B) 4 (C) 16 (D) 8
102. Area bounded by the curves  $y = \sqrt{x}$  and  $x = \sqrt{y}$  is  
 (A) 1 (B)  $\frac{2}{3}$  (C)  $\frac{1}{3}$  (D) none of these
103. If  $f(a + b - x) = f(x)$ , then  $\int_a^b xf(x) dx$  is equal to  
 (A)  $\frac{a+b}{2} \int_a^b f(x) dx$  (B)  $\frac{a-b}{2} \int_a^b f(x) dx$  (C) 0 (D) none of these
104.  $\int_0^{\frac{\pi}{2}} \frac{dx}{\sqrt{\tan x} - \sqrt{\cot x}}$  is equal to  
 (A)  $\frac{\pi}{2}$  (B)  $\frac{\pi}{4}$  (C) 0 (D) none of these
105.  $\int \frac{d^2}{dx^2} (\cot^{-1} x)$  is equal to  
 (A)  $-\frac{1}{1+x^2} + c$  (B)  $\cot^{-1} x + c$

(C)  $x \cot^{-1}x - \frac{1}{2} \ln(1 + x^2) + c$

(D) none of these

106.  $\int \frac{dx}{\sin^6 x + \cos^6 x}$  is equal to

(A)  $\tan^{-1}(\tan x + \cot x) + c$

(B)  $\tan^{-1}(\cot x - \tan x) + c$

(C)  $\tan^{-1}(\tan x - \cot x) + c$

(D) none of these

107.  $\int \frac{dx}{\sqrt{x^2+16}}$  is equal to

(A)  $\sin^{-1} \frac{x}{4}$

(B)  $\frac{1}{4} \tan^{-1} \frac{x}{4}$

(C)  $\ln|x + \sqrt{x^2 + 16}|$

(D) none of these

108. The slope of the normal to the curve  $x = t^2 + 3t - 2$ ,  $y = 2t^2 - 2t - 2$  at the point  $t = 2$  is

(A)  $\frac{7}{6}$

(B)  $-\frac{7}{6}$

(C) 2

(D) none of these

109. The function  $f(x) = 4x^4 - 2x + 2$  is increasing for

(A)  $x < 1$

(B)  $x > 0$

(C)  $x < \frac{1}{2}$

(D)  $x > \frac{1}{2}$

110. The value of  $\lim_{x \rightarrow \infty} 4^x \sin\left(\frac{5}{4x}\right)$  is equal to

(A)  $5 \ln 4$

(B)  $4 \ln 5$

(C) 5

(D) none of these

111. The number of points for which the function  $f(x) = |x - 1| + |x - 2| + \sin x$  is not continuous is

(A) 2

(B) 1

(C) 3

(D) 0

112. Let  $f(x) = \frac{\sin x - 1}{2x - \pi}$ ,  $x \neq \frac{\pi}{2}$ ,  $x \in [0, \pi]$  be continuous, then  $f\left(\frac{\pi}{2}\right)$  is

(A) 0

(B)  $\frac{1}{2}$

(C)  $-\frac{1}{2}$

(D) none of these

113. If  $x = y\sqrt{1 - y^2}$ , then  $\frac{dy}{dx}$  is equal to

(A)  $x$

(B)  $\frac{\sqrt{1-y^2}}{1+2y^2}$

(C)  $\frac{\sqrt{1-y^2}}{1-2y^2}$

(D) 0

114. Derivative of  $\tan^{-1} x$  with respect to  $(1 + x^2)$  is

(A)  $\frac{1}{1+x^2}$

(B)  $\frac{2x}{1+x^2}$

(C)  $\frac{1}{2x(1+x^2)}$

(D)  $\frac{-2x}{1+x^2}$

115. If  $\emptyset(x)$  be the inverse of the function  $f(x) = \frac{1}{1+(\cos x)^4}$ , then  $\frac{d}{dx} \emptyset(x)$  is

(A)  $\frac{1}{1+[\phi(x)]^4}$                       (B)  $\frac{1}{1+[f(x)]^4}$                       (C)  $1 + [\cos \phi(x)]^4$                       (D)  $1 + f(x)$

116. If  $y = (\sin x)^{\cos x}$ , then  $\frac{dy}{dx}$  is equal to

- (A)  $(\sin x)^{\tan x} \cdot (1 + \sec^2 x \cdot \ln \sin x)$                       (B)  $\tan x \cdot (\sin x)^{\tan x - 1} \cos x$   
 (C)  $(\sin x)^{\tan x} \cdot \sec^2 x \cdot \ln \sin x$                       (D) none of these

117.  $\frac{d}{dx}(\sec^{-1} x + \operatorname{cosec}^{-1} x)$  is

- (A)  $\frac{1}{1+x^2}$                       (B)  $\frac{\pi}{2}$                       (C)  $-\frac{1}{1+x^2}$                       (D) 0

118. The function  $f(x) = \begin{cases} x \sin \frac{1}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$  is

- (A) differentiable at  $x = 0$   
 (B) continuous at  $x = 0$   
 (C) both continuous and differentiable at  $x = 0$   
 (D) neither continuous nor differentiable at  $x = 0$

119. The set of points where the function  $f(x) = |x - 3| \sin x$  is differentiable is

- (A)  $(-\infty, \infty)$                       (B)  $(-\infty, \infty) \setminus \{3\}$  ( $\setminus$  denotes set compliment)  
 (C)  $(0, \infty)$                       (D) none of these

120.  $\int e^x \left(\frac{x+2}{x+4}\right)^2 dx$  is equal to

- (A)  $\frac{xe^x}{x+4} + c$                       (B)  $e^x \left(\frac{x+2}{x+4}\right) + c$                       (C)  $\frac{e^x}{x+4} + c$                       (D) none of these