**ACTIVE SITE TUTORIALS**

**Date :** 07-09-2019 **TEST ID: 608**

**Time :** 09:51:00 **MATHEMATICS**

**Marks :** 611

5.CONTINUITY AND DIFFERENTIABILITY

**Single Correct Answer Type**

| 1. | Which of the following functions is non-differentiable? | | | | | | | |
|  | a) | in | | | | | | | |
|  | b) |  | | | | | | | |
|  | c) | at  Where [.] represents the greatest integer function | | | | | | | |
|  | d) |  | | | | | | | |
| 2. | Given that and  Then which one of the following is true? | | | | | | | |
|  | a) | has non-removable discontinuity of finite type at | | | | | | | |
|  | b) | has removable discontinuity at | | | | | | | |
|  | c) | is continuous at | | | | | | | |
|  | d) | has non-removable discontinuity of infinite type at | | | | | | | |
| 3. | If , where denotes the fractional part of , then | | | | | | | |
|  | a) | is continuous at but not at | | | | | | | |
|  | b) | is continuous at but not at | | | | | | | |
|  | c) | is continuous at and at | | | | | | | |
|  | d) | is discontinuous at and at | | | | | | | |
| 4. | The function has | | | | | | | |
|  | a) | Jump discontinuity | | | b) | Removal discontinuity | | |
|  | c) | Infinite discontinuity | | | d) | No discontinuity at | | |
| 5. | where [.] denotes the greatest integer function is | | | | | | | |
|  | a) | Continuous at but discontinuous at | | | | | | | |
|  | b) | Continuous at and | | | | | | | |
|  | c) | Discontinuous at and | | | | | | | |
|  | d) | Discontinuous at but continuous at | | | | | | | |
| 6. | If is differentiable at , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 7. | The function defined by | | | | | | | |
|  | a) | Is continuous at | | | | | | | |
|  | b) | Is discontinuous at since does not exists though exists | | | | | | | |
|  | c) | Is discontinuous at since does not exist though exists | | | | | | | |
|  | d) | Is discontinuous at since neither nor exists | | | | | | | |
| 8. | If , then the number of points of discontinuity of is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | None of these |
| 9. | The set of all points, where is not differentiable, is | | | | | | | |
|  | a) | {0} | b) |  | c) |  | d) | None of these |
| 10. | For a real number , let denotes the greatest integer less than or equal to . Then the function  is | | | | | | | |
|  | a) | Discontinuous at some | | | | | | | |
|  | b) | Continuous at all , but the derivative does not exist for some | | | | | | | |
|  | c) | exists for all , but the derivative does not exist second for some | | | | | | | |
|  | d) | exists for all | | | | | | | |
| 11. | , where [.] and {.} denote the greatest integer function and the fractional part, respectively, is | | | | | | | |
|  | a) | Continuous at | | | b) | Continuous at but not at | | |
|  | c) | Continuous at but not at | | | d) | Discontinuous at and | | |
| 12. | If , (where [.] denotes the greatest integral function), then which is not true? | | | | | | | |
|  | a) | Continuous at | | | b) | Continuous at | | |
|  | c) | Differentiable in | | | d) | Differentiable in | | |
| 13. | If then is non-differentiable for | | | | | | | |
|  | a) | No value of | | | b) | Exactly one value of | | |
|  | c) | Exactly three values of | | | d) | None of these | | |
| 14. | If , then is | | | | | | | |
|  | a) | Differentiable at | | | b) | Continuous but not differentiable at | | |
|  | c) | Discontinuous at | | | d) | None of these | | |
| 15. | The function (where is the greatest integer less than or equal to ), is discontinuous at | | | | | | | |
|  | a) | All integers | | | b) | All integers except 0 and 1 | | |
|  | c) | All integers except 0 | | | d) | All integers except 1 | | |
| 16. | If has exactly four points of discontinuity for , then | | | | | | | |
|  | a) | Minimum value of is 5 | | | b) | Maximum value of is 6 | | |
|  | c) | There are exactly two possible values of | | | d) | None of these | | |
| 17. | If for all , then differentiability at implies differentiability at | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | Cannot say anything |
| 18. | The left-hand derivatives of at , an integer, is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 19. | Which of the following is true about | | | | | | | |
|  | a) | is continuous at | | | | | | | |
|  | b) | has removable discontinuity at | | | | | | | |
|  | c) | has non-removable discontinuity at | | | | | | | |
|  | d) | Discontinuity at can be removed by redefining function at | | | | | | | |
| 20. | , where [.] denotes the greatest integer function. The total number of points, where is non-differentiable, is equal to | | | | | | | |
|  | a) | 2 | b) | 3 | c) | 5 | d) | 4 |
| 21. | Let , then points where is not differentiable, is/(are) | | | | | | | |
|  | a) |  | b) |  | c) | 0 | d) | 1 |
| 22. | The number of values of at which is not differentiable at | | | | | | | |
|  | a) | 0 | b) | 1 | c) | 3 | d) | None of these |
| 23. | If , then | | | | | | | |
|  | a) | is discontinuous at | | | b) | is differentiable at | | |
|  | c) | is non-differentiable at | | | d) | is continuous at | | |
| 24. | The function defined by ([.] denotes the greatest integer function) satisfies | | | | | | | |
|  | a) | Discontinuous for , where is any integer | | | b) |  | | |
|  | c) | for | | | d) | None of these | | |
| 25. | Given that and is continuous at . Then the value of | | | | | | | |
|  | a) | Does not exist | b) | Is | c) | Is 1 | d) | Is 0 |
| 26. | The number of points, where the function is non-differentiable in the interval , is | | | | | | | |
|  | a) | 4 | b) | 6 | c) | 3 | d) | 2 |
| 27. | If , where [.] denotes the greatest integer function, then cannot be | | | | | | | |
|  | a) | 4 | b) | 2 | c) | 5 | d) | 6 |
| 28. | Let be given by and if , then | | | | | | | |
|  | a) | is continuous at and | | | b) | is continuous at and | | |
|  | c) | is continuous at but not at | | | d) | is continuous at but not at | | |
| 29. | If , is continuous at , then  Where and denote the greatest integer and fractional part function, respectively | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 30. | Let be a function for all and . Then , at | | | | | | | |
|  | a) | Is differentiable at and its value is 1 | | | | | | | |
|  | b) | Is differentiable at and its value is 0 | | | | | | | |
|  | c) | Is non-differentiable at as its graph has sharp turn at | | | | | | | |
|  | d) | Is non-differentiable at as its graph has vertical tangent at | | | | | | | |
| 31. | If is continuous but non-differentiable at , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 32. | Let . If and are continuous, then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 33. | is continuous at , then the value of , (where and denotes the greatest integer and fractional part functions, respectively) | | | | | | | |
|  | a) | 0 | b) | 1 | c) |  | d) | None of these |
| 34. | The number of points of non-differentiability for is | | | | | | | |
|  | a) | 4 | b) | 3 | c) | 2 | d) | 5 |
| 35. | If is continuous at exactly two points, then the possible values of are | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 36. | Let be a function defined by . The set of all point where is NOT differentiable is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 37. | A point where function is not continuous where in ; [.] denotes the greatest integer is | | | | | | | |
|  | a) | (3, 0) | b) | (2, 0) | c) | (1, 0) | d) | None of these |
| 38. | Let denotes the greatest integer function and , then | | | | | | | |
|  | a) | does not exist | | | b) | is continuous at | | |
|  | c) | is not differentiable at | | | d) |  | | |
| 39. | A function is defined as  . The least value of for which is continuous at is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | None |
| 40. | The function , is continuous at . Then the value of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 41. | The function is NOT differentiable at | | | | | | | |
|  | a) |  | b) | 0 | c) | 1 | d) | 2 |
| 42. | A function is defined as  is continuous at | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 43. | then is | | | | | | | |
|  | a) | Continuous but non-differentiable at | | | b) | Differentiable at | | |
|  | c) | Discontinuous at | | | d) | None of these | | |
| 44. | If both and are differentiable functions at , then the function defined as = maximum : | | | | | | | |
|  | a) | Is always differentiable at | | | | | | | |
|  | b) | Is never differentiable at | | | | | | | |
|  | c) | Is differentiable at provided | | | | | | | |
|  | d) | Cannot be differentiable at if | | | | | | | |
| 45. | Let is | | | | | | | |
|  | a) | Continuous and differentiable at | | | b) | Continuous but not differentiable at | | |
|  | c) | Neither continuous nor differentiable at | | | d) | None of these | | |
| 46. | The function is | | | | | | | |
|  | a) | Not differentiable at | | | b) | Differentiable at | | |
|  | c) | Differentiable at | | | d) | Differentiable at | | |
| 47. | Which of the following statement is always true? ([.] represents the greatest integer function) | | | | | | | |
|  | a) | If is discontinuous, then is discontinuous | | | | | | | |
|  | b) | If is discontinuous, then is discontinuous | | | | | | | |
|  | c) | is discontinuous when g is an integer | | | | | | | |
|  | d) | None of these | | | | | | | |
| 48. | If is differentiable at , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 49. | If , then | | | | | | | |
|  | a) | is derivable at | | | b) | is continuous but not derivable at | | |
|  | c) | L.H.D. at is 1 | | | d) | R.H.D. at is 1 | | |
| 50. | Let , where is an even function differentiable at , passing through the origin. The | | | | | | | |
|  | a) | Is equal to 1 | b) | Is equal to 0 | c) | Is equal to 2 | d) | Does not exist |
| 51. | The function is | | | | | | | |
|  | a) | Discontinuous at only one point | | | b) | Discontinuous exactly at two points | | |
|  | c) | Discontinuous exactly at three points | | | d) | None of these | | |
| 52. | If , is continuous at , then the value of is | | | | | | | |
|  | a) | 1 | b) | 1/2 | c) | 1/3 | d) |  |
| 53. | The function , where [.] denotes the greatest integer function, is discontinuous at | | | | | | | |
|  | a) | All | | | b) | All integer points | | |
|  | c) | No | | | d) | which is not an integer | | |
| 54. | Let , then which of the following is not true? | | | | | | | |
|  | a) | Discontinuous at infinite number of points | | | b) | Discontinuous at | | |
|  | c) | Discontinuous at | | | d) | None of these | | |
| 55. | Let a function be defined by , then which of the following is not true | | | | | | | |
|  | a) | Discontinuous at | | | b) | Discontinuous at | | |
|  | c) | Not differentiable at | | | d) | Not differentiable at | | |
| 56. | The function , and 1 if | | | | | | | |
|  | a) | Is continuous at | | | | | | | |
|  | b) | Has removable discontinuity at | | | | | | | |
|  | c) | Has jump of discontinuity at | | | | | | | |
|  | d) | Has oscillating discontinuity at | | | | | | | |
| 57. | Number of points where the function  and is continuous but non-differentiable is/are (where and represent greatest integer and fractional part function, respectively) | | | | | | | |
|  | a) | 0 | b) | 1 | c) | 2 | d) | None of these |
| 58. | If , then the points where is non-differentiable are | | | | | | | |
|  | a) | {0, 1} | b) |  | c) |  | d) | None of these |
| 59. | . Then | | | | | | | |
|  | a) | is discontinuous at | | | | | | | |
|  | b) | is continuous but non-differentiable at | | | | | | | |
|  | c) | is differentiable at | | | | | | | |
|  | d) |  | | | | | | | |
| 60. | . The value of , such that is differentiable at , is equal to | | | | | | | |
|  | a) | 1 | b) |  | c) | 0 | d) | None of these |
| 61. | Let . Then which of the following can best represent the graph of ? | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 62. | If , where [.] denotes the greatest integer function, then is  Discuss the continuity and differentiability of in [0, 2) | | | | | | | |
|  | a) | Differentiable for all | | | b) | Continuous at | | |
|  | c) | is non-differentiable at | | | d) | None of these | | |
| 63. | If , then the set of point at which the function is not differentiable is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 64. | denotes the fractional part function) | | | | | | | |
|  | a) | is discontinuous at infinite number of integers but not all integers | | | | | | | |
|  | b) | is discontinuous at finite number of integers | | | | | | | |
|  | c) | is discontinuous at all integers | | | | | | | |
|  | d) | is continuous at all integers | | | | | | | |
| 65. | If is differentiable at , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 66. | Let be a polynomial of degree one and be defined by . If is continuous satisfying then g is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 67. | If for is continuous at , then the value of is | | | | | | | |
|  | a) | 0 | b) | 5 | c) | 10 | d) | 25 |
| 68. | Let and g. Then which of the following is not true ([.] represents greatest integer function) | | | | | | | |
|  | a) | exists but g is not continuous at | | | | | | | |
|  | b) | does not exist and is not continuous at | | | | | | | |
|  | c) | is a discontinuous function | | | | | | | |
|  | d) | is a discontinuous function | | | | | | | |
| 69. | Let; and are integers, , and let be the left hand derivative of at . If , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 70. | Let . Then which of the following is not true | | | | | | | |
|  | a) | is continuous at | | | b) | is not differentiable at | | |
|  | c) | is not differentiable at exactly three point | | | d) | None of these | | |
| 71. | Let be a continuous function on such that . Then the value of is | | | | | | | |
|  | a) | 1 | b) | 1/2 | c) | 0 | d) | None of these |
| 72. | has maximum points of non-differentiability for , then cannot be | | | | | | | |
|  | a) | 4 | b) | 2 | c) | 5 | d) | 6 |
| 73. | If  Is continuous at . Then the value of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 74. | is discontinuous at | | | | | | | |
|  | a) | only | b) | only | c) | and 2 | d) | None of these |
| 75. | Let , then | | | | | | | |
|  | a) | is continuous and differentiable for all | | | | | | | |
|  | b) | is continuous but not differentiable for all | | | | | | | |
|  | c) | is discontinuous at infinite number of points | | | | | | | |
|  | d) | is discontinuous at finite number of points | | | | | | | |
| 76. | Which of the following function is not differentiable at ? | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) | None of these | | |
| 77. | If , then as a function of is | | | | | | | |
|  | a) | Continuous at | b) | Derivable at | c) | for all | d) | None of these |
| 78. | Which of the following functions have finite number of points if discontinuity in represents greatest integer function)? | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 79. | The function , where [.] denotes the greatest integer function and {.} is the fractional part function, is discontinuous at | | | | | | | |
|  | a) | All | | | b) | All integer points | | |
|  | c) | No | | | d) | which is not an integer | | |
| 80. | The value of , so that the function is continuous at each point in its domain, is equal to | | | | | | | |
|  | a) | 2 | b) | 1/3 | c) | 2/3 | d) |  |
| 81. | Which of the following functions is differentiable at ? | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 82. | The number of points is discontinuous at ([.] denotes the greatest integer function) | | | | | | | |
|  | a) | Two points | b) | Three points | c) | Four points | d) | No points |
| 83. | If , then is | | | | | | | |
|  | a) | Continuous on and differentiable on | | | b) | Continuous and differentiable on | | |
|  | c) | Continuous and differentiable on | | | d) | None of these | | |
| 84. | If then where represents the greatest integer function is | | | | | | | |
|  | a) | Discontinuous at | | | b) | Continuous at | | |
|  | c) | Continuous at | | | d) | Continuous at | | |
| 85. | Let be defined in the interval such that  Then number of points where is discontinuous is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | None of these |
| 86. | If and is continuous at , then the ordered pair is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 87. | Let . Then | | | | | | | |
|  | a) | is continuous at | | | b) |  | | |
|  | c) |  | | | d) | does not exist | | |
| 88. | The set of points where is thrice differentiable is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 89. | Let . Then is continuous at when, | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 90. | If , then is differentiable at | | | | | | | |
|  | a) |  | | | | | | | |
|  | b) |  | | | | | | | |
|  | c) |  | | | | | | | |
|  | d) |  | | | | | | | |
| 91. | If , where [.] and {.} denote the greatest integer function and the fractional part function, respectively, then | | | | | | | |
|  | a) | is continuous but non-differentiable at | | | | | | | |
|  | b) | is differentiable at | | | | | | | |
|  | c) | is discontinuous at | | | | | | | |
|  | d) | None of these | | | | | | | |

**Multiple Correct Answers Type**

| 92. | If then | | | | | | | |
|  | a) | is continuous everywhere in | | | | | | | |
|  | b) | is discontinuous in | | | | | | | |
|  | c) | is differentiable everywhere in | | | | | | | |
|  | d) | is non-differentiable nowhere in | | | | | | | |
| 93. | Which of the following function is thrice differentiable at ? | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 94. | A function satisfies the relation . If , then | | | | | | | |
|  | a) | is a polynomial function | | | | | | | |
|  | b) | is an exponential function | | | | | | | |
|  | c) | is twice differentiable for all | | | | | | | |
|  | d) |  | | | | | | | |
| 95. | Let and ([.] represents greatest integer function). Then | | | | | | | |
|  | a) | exists but is not continuous at | | | b) | is not continuous at | | |
|  | c) | is continuous for all | | | d) | is continuous for all | | |
| 96. | Let , for every real number of , then | | | | | | | |
|  | a) | is continuous for all | | | | | | | |
|  | b) | is differentiable for all | | | | | | | |
|  | c) | , for all | | | | | | | |
|  | d) | is not differentiable at two values of | | | | | | | |
| 97. | Let be any function and . Then which of following is/are not true | | | | | | | |
|  | a) | g is onto if is onto | | | b) | g is one-one if is one-to-one | | |
|  | c) | g is continuous if is continuous | | | d) | g is differentiable if is differentiable | | |
| 98. | The function is | | | | | | | |
|  | a) | Continuous at all points | | | | | | | |
|  | b) | Differentiable at all points | | | | | | | |
|  | c) | Differentiable at all points except at and | | | | | | | |
|  | d) | Continuous at all points except at and , where it is discontinuous | | | | | | | |
| 99. | The function | | | | | | | |
|  | a) | Is discontinuous at infinite points | | | b) | Is continuous everywhere | | |
|  | c) | Is discontinuous only at | | | d) | None of these | | |
| 100. | Which of the statement(s) is/are incorrect? | | | | | | | |
|  | a) | If g is continuous at , then and g are continuous at | | | | | | | |
|  | b) | If exists, then both and exist | | | | | | | |
|  | c) | Discontinuity at non-existence of limit | | | | | | | |
|  | d) | All functions defined on a closed interval attain a maximum or a minimum value in that interval | | | | | | | |
| 101. | Let , where . At | | | | | | | |
|  | a) | g is differentiable but g’ is not continuous | | | b) | g is differentiable while is not | | |
|  | c) | Both and g are differentiable | | | d) | g is differentiable and g’ is continuous | | |
| 102. | Let , then (where [.] represents the greatest integer function) | | | | | | | |
|  | a) | is continuous at | | | | | | | |
|  | b) | is differentiable at | | | | | | | |
|  | c) | is non-differentiable at | | | | | | | |
|  | d) |  | | | | | | | |
| 103. | Which of the following function has/have a removable discontinuity at the indicated point? | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) |  | | |
| 104. | is differentiable function and is differentiable at , then | | | | | | | |
|  | a) | must be differentiable at | | | b) | If is discontinuous, then | | |
|  | c) | , then must be differentiable | | | d) | None of these | | |
| 105. | for , where represents the greatest integer function and represents the fractional part of , then which of the following is true | | | | | | | |
|  | a) | is injective discontinuous function | | | | | | | |
|  | b) | surjective non-differentiable function | | | | | | | |
|  | c) |  | | | | | | | |
|  | d) | max ( values of point of discontinuity) | | | | | | | |
| 106. | Let then for all | | | | | | | |
|  | a) | is differentiable | | | | | | | |
|  | b) | is differentiable | | | | | | | |
|  | c) | is continuous | | | | | | | |
|  | d) | is continuous | | | | | | | |
| 107. | Which of the following is/are true for | | | | | | | |
|  | a) | Discontinuous no where | | | b) | An even function | | |
|  | c) | is periodic | | | d) | is differentiable for all | | |
| 108. | and and if is continuous at then which of the following is/are true (where represents the fractional part function) | | | | | | | |
|  | a) | If , then can take any real value | | | b) | If , then | | |
|  | c) | No values of and are possible | | | d) | There exist finite ordered pairs | | |
| 109. | Let , where is the signum function, then | | | | | | | |
|  | a) | Is continuous over its domain | | | b) | Has a missing point discontinuity | | |
|  | c) | Has isolated point discontinuity | | | d) | Irremovable discontinuity | | |
| 110. | The function is | | | | | | | |
|  | a) | Continuous at | | | | | | | |
|  | b) | Differentiable at | | | | | | | |
|  | c) | Continuous at | | | | | | | |
|  | d) | Differentiable at | | | | | | | |
| 111. | If , then as a function of is | | | | | | | |
|  | a) | Defined for all real | | | b) | Continuous at | | |
|  | c) | Differentiable for all | | | d) | Such that for | | |
| 112. | If and and is discontinuous at exactly one point then which of the following values of and are possible | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 113. | If , where [ ] and { } represents the greatest integer and the fractional part function, respectively | | | | | | | |
|  | a) | is differentiable at | | | | | | | |
|  | b) | is continuous but non-differentiable at | | | | | | | |
|  | c) | is non-differentiable at | | | | | | | |
|  | d) | is discontinuous at | | | | | | | |
| 114. | Let , then | | | | | | | |
|  | a) | is continuous at if | | | | | | | |
|  | b) | is discontinuous at if | | | | | | | |
|  | c) | has irremovable discontinuity at if | | | | | | | |
|  | d) | has removable discontinuity at if | | | | | | | |
| 115. | If has maximum number of points of discontinuity, then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 116. | If , where [.] denotes the greatest integer function, then which of the following is not true? | | | | | | | |
|  | a) | is continuous | | | | | | | |
|  | b) | is continuous from right and discontinuous from left | | | | | | | |
|  | c) | is continuous from left and discontinuous from right | | | | | | | |
|  | d) | is continuous at | | | | | | | |
| 117. | The function is | | | | | | | |
|  | a) | Continuous at and | | | | | | | |
|  | b) | Continuous at but not derivable at | | | | | | | |
|  | c) | Continuous at but not derivable at | | | | | | | |
|  | d) | Continuous at and 2 but not derivable at and | | | | | | | |
| 118. | Which of the following function(s) has/have removable discontinuity at ? | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 119. | is continuous at , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 120. | Let , where  At | | | | | | | |
|  | a) | is differentiable but is not continuous | | | | | | | |
|  | b) | is differentiable while f is not differentiable | | | | | | | |
|  | c) | Both f and g are differentiable | | | | | | | |
|  | d) | is differentiable but is continuous | | | | | | | |
| 121. | The function is | | | | | | | |
|  | a) | Continuous nowhere | | | | | | | |
|  | b) | Continuous everywhere | | | | | | | |
|  | c) | Not differentiable at | | | | | | | |
|  | d) | Not differentiable at infinite number of points | | | | | | | |
| 122. | Let denotes the greatest integer less than or equal to . If , then is | | | | | | | |
|  | a) | Continuous at | | | b) | Continuous in | | |
|  | c) | Differentiable at | | | d) | Differentiable in | | |
| 123. | The set of all points, where the function , is differentiable is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 124. | If , then in | | | | | | | |
|  | a) | Both and are continuous | | | | | | | |
|  | b) | is continuous but is not continuous | | | | | | | |
|  | c) | and are discontinuous | | | | | | | |
|  | d) | None of these | | | | | | | |
| 125. | The following functions are continuous on | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) |  | | |
| 126. | If and , where [.] denotes the greatest integer function, then | | | | | | | |
|  | a) | is continuous everywhere | | | | | | | |
|  | b) | is differentiable everywhere | | | | | | | |
|  | c) | is differentiable everywhere | | | | | | | |
|  | d) | is continuous but not differentiable at | | | | | | | |
| 127. | If then | | | | | | | |
|  | a) | is not continuous at | | | | | | | |
|  | b) | is continuous at | | | | | | | |
|  | c) | is continuous at but not differentiable at | | | | | | | |
|  | d) | is differentiable at | | | | | | | |
| 128. | The function defined as  Which of the following does not hold good? | | | | | | | |
|  | a) | Continuous at but discontinuous at | | | | | | | |
|  | b) | Continuous at but discontinuous at | | | | | | | |
|  | c) | Continuous both at and | | | | | | | |
|  | d) | Discontinuous both at and | | | | | | | |
| 129. | If , then | | | | | | | |
|  | a) | Domain of is | | | | | | | |
|  | b) | Range of is | | | | | | | |
|  | c) | is continuous at | | | | | | | |
|  | d) | The right hand limit of at is zero | | | | | | | |
| 130. | A function is defined on an interval . Which of the following statement(s) is/are incorrect? | | | | | | | |
|  | a) | If and have opposite signs, then there must be a point such that | | | | | | | |
|  | b) | If is continuous on and , then there must be a point such that | | | | | | | |
|  | c) | If is continuous on , then there is a point in such that , then and have opposite signs | | | | | | | |
|  | d) | If has no zeros on , then and have the same sign | | | | | | | |
| 131. | If , then | | | | | | | |
|  | a) | If then has 5 points of discontinuity | | | | | | | |
|  | b) | If , then has no point of discontinuity | | | | | | | |
|  | c) | If , then has 6 points of discontinuity | | | | | | | |
|  | d) | If , then has 6 points of discontinuity | | | | | | | |

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| **Assertion - Reasoning Type** | | | |
| This section contain(s) 0 questions numbered 132 to 131. Each question containsstatement 1(Assertion) and statement 2(Reason). Each question has the 4 choices (a), (b), (c) and (d) out of which **only one** is correct. | | | |
|  | a) | Statement 1 is True, Statement 2 is True; Statement 2 **is** correct explanation for Statement 1 | |
|  | b) | Statement 1 is True, Statement 2 is True; Statement 2 **is not** correct explanation for Statement 1 | |
|  | c) | Statement 1 is True, Statement 2 is False | |
|  | d) | Statement 1 is False, Statement 2 is True | |

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| 132 |  | | |
|  | **Statement 1:** | | is non-differentiable at |
|  | **Statement 2:** | | If the graph of has sharp turn at , then it is non-differentiable |

|  |  |  |  |
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| 133 |  | | |
|  | **Statement 1:** | | The function , where are constants, is differentiable at if |
|  | **Statement 2:** | | is a many-one function |

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| 134 |  | | |
|  | **Statement 1:** | | Let , and . Then is continuous for all |
|  | **Statement 2:** | | and are discontinuous for all |

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| 135 |  | | |
|  | **Statement 1:** | | If is a continuous function such that and , then |
|  | **Statement 2:** | | If is a onto function, then has at least one solution |

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| 136 |  | | |
|  | **Statement 1:** | | is non-differentiable at |
|  | **Statement 2:** | | If is not differentiable and is differentiable at , then can still be differentiable at |

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| 137 |  | | |
|  | **Statement 1:** | | is non-differentiable at |
|  | **Statement 2:** | | Principal value of are |

|  |  |  |  |
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| 138 |  | | |
|  | **Statement 1:** | | If for all , then is continuous at 0 |
|  | **Statement 2:** | | If is continuous, then is also continuous |

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| 139 |  | | |
|  | **Statement 1:** | | If and are two differentiable functions , then is always continuous but not differentiable at the point of intersection of graphs of and |
|  | **Statement 2:** | | is always differentiable in between the two consecutive roots of if both the functions and are differentiable |

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| 140 |  | | |
|  | **Statement 1:** | | and , both are differentiable functions |
|  | **Statement 2:** | | Differentiable of differentiability of |

|  |  |  |  |
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| 141 |  | | |
|  | **Statement 1:** | | Both the functions and are both continuous for all |
|  | **Statement 2:** | | Continuity of continuity of |

|  |  |  |  |
| --- | --- | --- | --- |
| 142 |  | | |
|  | **Statement 1:** | | is differentiable at |
|  | **Statement 2:** | | Product of two differentiable function is always differentiable |

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| 143 |  | | |
|  | **Statement 1:** | | The function is discontinuous for all integral values of in its domain (where is the greatest integer ) |
|  | **Statement 2:** | | will be discontinuous for all given by , where is any integer |

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| 144 |  | | |
|  | **Statement 1:** | | is continuous for all |
|  | **Statement 2:** | | has no real roots if |

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| --- | --- | --- | --- |
| 145 |  | | |
|  | **Statement 1:** | | is not differentiable at 5 points |
|  | **Statement 2:** | | If the graph of crosses the -axis at distinct points, then is always non-differentiable at least at distinct points |

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| 146 |  | | |
|  | **Statement 1:** | | The function is discontinuous at |
|  | **Statement 2:** | |  |

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| 147 | Consider the functions and | | |
|  | **Statement 1:** | | The composite function is not derivable at |
|  | **Statement 2:** | | and |

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| 148 |  | | |
|  | **Statement 1:** | | is discontinuous at is discontinuous at |
|  | **Statement 2:** | | Discontinuity of discontinuity of |

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| --- | --- | --- | --- |
| 149 | Consider and denote the greatest integer function and the fractional part function, respectively  Let | | |
|  | **Statement 1:** | | is not differentiable at integral values of |
|  | **Statement 2:** | | is not continuous at integral points |

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| 150 |  | | |
|  | **Statement 1:** | | is discontinuous at , where [.] represent the greatest integer function |
|  | **Statement 2:** | | If and g are discontinuous at , then is discontinuous at |

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| 151 | Let and | | |
|  | **Statement 1:** | | is differentiable at and its derivative is continuous at that point |
|  | **Statement 2:** | | is twice differentiable at |

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| 152 | Consider the function and , where denotes the greatest integer function | | |
|  | **Statement 1:** | | The function is discontinuous at |
|  | **Statement 2:** | | If is discontinuous at and is also discontinuous at , then the product function is discontinuous at |

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| 153 |  | | |
|  | **Statement 1:** | | is discontinuous at |
|  | **Statement 2:** | | If limit of function exists at but not equal to , then is discontinuous at |

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| 154 |  | | |
|  | **Statement 1:** | | If is discontinuous at and , then cannot be equal to |
|  | **Statement 2:** | | If is continuous at and , then |

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| 155 | Consider the function  , where denotes the greatest integer function | | |
|  | **Statement 1:** | | is discontinuous at |
|  | **Statement 2:** | | is non-differentiable at |

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| 156 |  | | |
|  | **Statement 1:** | | If exists then is continuous |
|  | **Statement 2:** | | Every differentiable function is continuous |

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| 157 |  | | |
|  | **Statement 1:** | | is discontinuous at where [.] denotes the greatest integer function |
|  | **Statement 2:** | | If is continuous and is discontinuous at , then will necessary be discontinuous at |

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| 158 |  | | |
|  | **Statement 1:** | | is non-differentiable at |
|  | **Statement 2:** | | Non-differentiability of non-differentiability of |

|  |  |  |  |  |  |  |  |  |  |
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| **Matrix-Match Type** | | | | | | | | | |
| This section contain(s) 0 question(s). Each question contains Statements given in 2 columns which have to be matched. Statements (A, B, C, D) in **columns I** have to be matched with Statements (p, q, r, s) in **columns II**. | | | | | | | | | |

| 159. | Consider the function , where | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** |  | | (p) | | 1 | |
|  | **(B)** |  | | (q) | | 2 | |
|  | **(C)** |  | | (r) | | 3 | |
|  | **(D)** |  | | (s) | | 5 | |
|  | **CODES :** | | | | | | | |

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|  |  | **A** | **B** | **C** | **D** |  |  |
|  | **a)** | p | q | s | r |  |  |
|  | **b)** | q | p | r | s |  |  |
|  | **c)** | r | s | q | p |  |  |
|  | **d)** | s | r | p | q |  |  |

| 160. | Let | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | is | | (p) | | Continuous at | |
|  | **(B)** | is | | (q) | | Discontinuous at | |
|  | **(C)** | is | | (r) | | Differentiable at | |
|  | **(D)** | is | | (s) | | Non-differentiable at | |
|  | **CODES :** | | | | | | | |

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|  |  | **A** | **B** | **C** | **D** |  |  |
|  | **a)** | P,s | q,s | p,q | p,r |  |  |
|  | **b)** | p,r | q,s | p,s | q |  |  |
|  | **c)** | q,s | p,s | p,r | q,s |  |  |
|  | **d)** | p,s | p,q | q,s | p,r |  |  |

| 161. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | , where {.} denotes the fractional part function at | | (p) | | Continuous | |
|  | **(B)** | at | | (q) | | Discontinuous | |
|  | **(C)** | , where [.] and {.} denote the greatest integer and the fractional part function, respectively at | | (r) | | Differentiable | |
|  | **(D)** | at | | (s) | | Non-differentiable | |
|  | **CODES :** | | | | | | | |

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|  |  | **A** | **B** | **C** | **D** |  |  |
|  | **a)** | Q,s | p,r | p,r | p,s |  |  |
|  | **b)** | p,r | q,s | p,s | p,r |  |  |
|  | **c)** | q,s | p,s | p,r | p,q |  |  |
|  | **d)** | p,q | q,s | p,s | q,r |  |  |

| 162. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | is differentiable everywhere and , then the value of is | | (p) | | 2 | |
|  | **(B)** | If has exactly one point of discontinuity, then the value of can be | | (q) | |  | |
|  | **(C)** | has exactly 11 points of discontinuity, then the value of is | | (r) | | 1 | |
|  | **(D)** | has exactly three points of non-differentiability, then the value of is | | (s) | |  | |
|  | **CODES :** | | | | | | | |

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|  |  | **A** | **B** | **C** | **D** |  |  |
|  | **a)** | P,q | p,r | p,s | q,s |  |  |
|  | **b)** | r,s | p,q | p,q | p,r |  |  |
|  | **c)** | p,r | q,s | p,q | r,s |  |  |
|  | **d)** | q,s | p,r | r,s | p,q |  |  |

| 163. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | is | | (p) | | Continuous in | |
|  | **(B)** | is | | (q) | | Differentiable in | |
|  | **(C)** | is | | (r) | | Differentiable in (0, 1) | |
|  | **(D)** | is | | (s) | | Not differentiable at least at one point in | |
|  | **CODES :** | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **A** | **B** | **C** | **D** |  |  |
|  | **a)** | P,q,r | p,r,s | p,r,s | p,r,s |  |  |
|  | **b)** | p,q | p,r,s | q,r | p,r |  |  |
|  | **c)** | q,r | p,s | p,r | p,r,s |  |  |
|  | **d)** | p,q | s,q | p,r | q,s |  |  |

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| **Linked Comprehension Type**  This section contain(s) 11 paragraph(s) and based upon each paragraph, multiple choice questions have to be answered. Each question has atleast 4 choices (a), (b), (c) and (d) out of which **only one** is correct.  **Paragraph for Question Nos. 164 to -164** | | | | | | | | |
| Let f(x=a1-x sinx+bcosx+5x2, x<03, x=01+Pxx21/x, x>0, where P(x) is a cubic function and f is continuous at x=0 | | | | |

| 164. | The range of function is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| **Paragraph for Question Nos. 165 to - 165** | | | | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Let fx=x+2, 0≤x<26-x, x≥2,gx=1+tanx, 0≤x<π43-cotx,π4≤x<π | | | | |

| 165. | is | | | | | | | |
|  | a) | Discontinuous at | | | | | | | |
|  | b) | Differentiable at | | | | | | | |
|  | c) | Continuous but non-differentiable at | | | | | | | |
|  | d) | Differentiable at , but derivative is not continuous | | | | | | | |
| **Paragraph for Question Nos. 166 to - 166** | | | | | | | | |

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| Consider fx=x2+ax+3 and gx=x+b and Fx=limn→∞fx+x2ngx1+x2n | | | | |

| 166. | If is continuous at , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| **Paragraph for Question Nos. 167 to - 167** | | | | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Let fx=x, -2≤x≤-122x2-1, -12<x≤2 and gx=fx+fx, where [∙] represencts greatest integer function | | | | |

| 167. | The number of points where is non-differentiable is | | | | | | | |
|  | a) | 3 | b) | 4 | c) | 2 | d) | 5 |
| **Paragraph for Question Nos. 168 to - 168** | | | | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Given the continuous functiony=fx=x2+10x+8, x≤-2ax2+bx+c, -2<x<0x2+2x, x≥0, a≠0If a line L touches the graph of y=f(x) at three points, then | | | | |

| 168. | The slope of the line ‘’ is equal to | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 4 | d) | 6 |

**Integer Answer Type**

| 169. | is non-differentiable at . Then the value of is (where represents greatest integer function) | | | | | | | |
| 170. | Number of points of discontinuity for is | | | | | | | |
| 171. | Let and be two continuous functions and . If limit of exists at , then one root of is | | | | | | | |
| 172. | Let and . Then is continuous at if is equal to | | | | | | | |
| 173. | A differentiable function satisfying a relation and . Then the value of is (where represents greatest integer function) | | | | | | | |
| 174. | If the function is continuous at , then the value of is | | | | | | | |
| 175. | Let . If is continuous for all , then the value of is | | | | | | | |
| 176. | If is a continuous function and the , and , where denotes the greatest integer function, is continuous , then the least positive integral value of is | | | | | | | |
| 177. | Number of points where is discontinuous is (where denotes the greatest integer function) | | | | | | | |
| 178. | Let , if is differentiable on (0, 5) then equals | | | | | | | |
| 179. | Number of points of non-differentiability of function is | | | | | | | |
| 180. | Given where is continuous and differentiable function and . If ; then the value of ‘’ for which is continuous is | | | | | | | |
| 181. | Number of points where , then ( denotes the greatest integer function) is discontinuous for | | | | | | | |
| 182. | The least integer value of for which is everywhere continuous where | | | | | | | |

**ACTIVE SITE TUTORIALS**

**Date :** 07-09-2019 **TEST ID: 608**

**Time :** 09:51:00 **MATHEMATICS**

**Marks :** 611

5.CONTINUITY AND DIFFERENTIABILITY

|  |
| --- |
| **: ANSWER KEY :** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1) d 2) c 3) b 4) a**  **5) a 6) b 7) d 8) a**  **9) d 10) d 11) d 12) b**  **13) c 14) a 15) d 16) c**  **17) c 18) a 19) c 20) c**  **21) a 22) c 23) c 24) a**  **25) d 26) a 27) d 28) a**  **29) d 30) b 31) c 32) c**  **33) a 34) d 35) c 36) d**  **37) d 38) b 39) c 40) b**  **41) d 42) a 43) c 44) c**  **45) b 46) b 47) d 48) c**  **49) a 50) b 51) c 52) b**  **53) c 54) d 55) b 56) d**  **57) b 58) c 59) c 60) d**  **61) c 62) c 63) d 64) a**  **65) c 66) b 67) a 68) c**  **69) c 70) d 71) a 72) b**  **73) c 74) c 75) a 76) c**  **77) a 78) c 79) c 80) b**  **81) d 82) b 83) b 84) b**  **85) b 86) b 87) c 88) c**  **89) d 90) b 91) a 1) a,c 2) b,c,d 3) a,c,d 4) a,b,c**  **5) a,c,d 6) a,c,d 7) a,c 8) a,c**  **9) a,b,c,d 10) a,b 11) a,b 12) a,c,d**  **13) b,c 14) a,b,d 15) b,c,d 16) a,b**  **17) a,b 18) b,d 19) a,b,c 20) a,b,d**  **21) a,b 22) a,c,d 23) a,b,c,d 24) a,b**  **25) b,d 26) a,b 27) b,d 28) a,c**  **29) a,b 30) b,d,e 31) a,b,d 32) a**  **33) d 34) b,c 35) a,c 36) b,d**  **37) b,c 38) a, c 39) a,c,d 40) a,b,c,d**  **1) b 2) b 3) b 4) b**  **5) d 6) b 7) b 8) d**  **9) c 10) c 11) b 12) c**  **13) a 14) c 15) b 16) a**  **17) c 18) a 19) c 20) c**  **21) c 22) b 23) d 24) b**  **25) d 26) a 27) c 1) d 2) c 3) a 4) b**  **5) a 1) b 2) c 3) a 4) a**  **5) c 1) 7 2) 5 3) 1 4) 6**  **5) 8 6) 2 7) 8 8) 6**  **9) 4 10) 2 11) 7 12) 1**  **13) 8 14) 5** | | | | |

**ACTIVE SITE TUTORIALS**

**Date :** 07-09-2019 **TEST ID: 608**

**Time :** 09:51:00 **MATHEMATICS**

**Marks :** 611

5.CONTINUITY AND DIFFERENTIABILITY

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| --- |
| **: HINTS AND SOLUTIONS :** |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | **(d)**  Now, both and are differentiable  [as is differentiable when g]  Hence, is differentiable  is rational function is which denominator never becomes zero  Hence, is differentiable  Hence, is differentiable at  Which is non-differentiable at  Here is continuous and the graph has vertical tangent at ; however, graph is smooth in neighbourhood of | | | | | | | |
| 2 | **(c)**  Given that (1)  Taking logarithm to the base ‘’ on both sides of equation (1) and then differentiating w.r.t. , we get  We have  Clearly  Hence is continuous at | | | | | | | |
| 3 | **(b)**  ,  Hence is continuous at  ,  Hence is discontinuous at | | | | | | | |
| 4 | **(a)**  Thus, has non-removable discontinuity at | | | | | | | |
| 5 | **(a)**  Now is discontinuous when or or  Thus, is discontinuous at  Also is discontinuous at  But  Hence, is discontinuous at  Both and are continuous at , hence, is continuous at | | | | | | | |
| 6 | **(b)**  and are not differentiable at and is differentiable at  Therefore, for to be differentiable at ,  We must have and can be any real number | | | | | | | |
| 7 | **(d)**  We have  And,  So, and do not exist | | | | | | | |
| 8 | **(a)**  Discontinuous at number of points of discount 1 | | | | | | | |
| 9 | **(d)**  Hence, differentiable for all | | | | | | | |
| 10 | **(d)**  By definition, is an integer whatever be the value of and so is an integral multiple of  Consequently,  And since for any , we conclude that  Thus is constant function and so it is continuous and differentiable | | | | | | | |
| 11 | **(d)**  Thus, is discontinuous at | | | | | | | |
| 12 | **(b)**  Obviously, is discontinuous at , otherwise is continuous and differentiable in and (0, 1) | | | | | | | |
| 13 | **(c)**  [as is not possible and is true ]  Which is non-differentiable at and when or  Hence, has exactly three points of non-differentiability | | | | | | | |
| 14 | **(a)**  Clearly is continuous at  Now  (applying L’ Hopital’s rule)  Also  Thus, is differentiable at | | | | | | | |
| 15 | **(d)**  Let is integer  If is continuous at , then | | | | | | | |
| 16 | **(c)**  is discontinuous when  or or  For exactly four point of discontinuity, can take value 4 or 5 as shown in the diagram | | | | | | | |
| 17 | **(c)**  Replace by , we have or  Hence is symmetrical about line  Now put in (1), we get , hence differentiability at implies differentiability at | | | | | | | |
| 18 | **(a)**  L.H.D. at  ( integer) | | | | | | | |
| 19 | **(c)**  Thus, L.H.L. R.H.L.  Hence, the function has non-removable discontinuity at | | | | | | | |
| 20 | **(c)**  is non-differentiable at and is non-differentiable at  Thus, is definitely non-differentiable at  Also,  Thus, is also non-differentiable at and | | | | | | | |
| 21 | **(a)**  Using graphical transformation    As, we know the function is not differentiable at6 sharp edges and in figure (iii) we have 3 sharp edges at  is not differentiable at | | | | | | | |
| 22 | **(c)**  is continuous everywhere but not differentiable at is continuous everywhere but not differentiable at, and is continuous in except at  Hence is not differentiable at | | | | | | | |
| 23 | **(c)**  Where is not possible thus, neglecting we get,  (1)  Clearly is continuous at , but non-differentiable at  (2)  Clearly is discontinuous at , but continuous at  Also,  is non-differentiable at and | | | | | | | |
| 24 | **(a)**  is discontinuous  When  For  For | | | | | | | |
| 25 | **(d)**  is continuous at  Now  (as g(0) = 0) = 0  Hence, exists and | | | | | | | |
| 26 | **(a)**    The functions is not differentiable and continuous at two points between and . Also the function is not continuous at and . Hence, at four points, the function is not differentiable | | | | | | | |
| 27 | **(d)**  Hence, is discontinuous at  Also  and  Hence, is discontinuous at | | | | | | | |
| 28 | **(a)**  is continuous when | | | | | | | |
| 29 | **(d)**  (Using expansion of )  ; hence for continuous  Now  Hence, | | | | | | | |
| 30 | **(b)**  Thus, is differentiable and | | | | | | | |
| 31 | **(c)**  This limit will not exist if  Now if  Thus, | | | | | | | |
| 32 | **(c)**  Clearly, is continuous for all except possibly at  For to be continuous at , we must have  For to be differentiable at , we must have L.H.D. at R.H.D. at  Putting in equation (1), we get | | | | | | | |
| 33 | **(a)**  Thus has irremovable discontinuity at , hence does not exist | | | | | | | |
| 34 | **(d)**    Clearly from the graph, is non-differentiable at five points, | | | | | | | |
| 35 | **(c)**  Is continuous when or  Which must have two distinct roots for | | | | | | | |
| 36 | **(d)**    From the graph  Clearly, is not differentiable at and 1 | | | | | | | |
| 37 | **(d)**  For  Hence, there is discontinuity at point | | | | | | | |
| 38 | **(b)**  when  Hence, is continuous and differentiable at , also | | | | | | | |
| 39 | **(c)**  must exist  For  Now  Limit exists if | | | | | | | |
| 40 | **(b)**  Given is continuous at | | | | | | | |
| 41 | **(d)**  and are differentiable for all  But is non-differentiable at  Hence, is non-differentiable at | | | | | | | |
| 42 | **(a)**  is continuous at some where or or | | | | | | | |
| 43 | **(c)**  and | | | | | | | |
| 44 | **(c)**    Consider the graph of , which is non-differentiable at , hence statement (a) is false  From the graph is differentiable at , hence statement (b) is false  Statement (c) is always true  Statement (d) is false as consider at , for which at , but is differentiable at | | | | | | | |
| 45 | **(b)**  Hence, is continuous at  Hence, is non-differentiable at | | | | | | | |
| 46 | **(b)**  Since both and are continuous function. is also a continuous function. Now  Hence, is non-differentiable at | | | | | | | |
| 48 | **(c)**  is differentiable at  Then is continuous at  Also  We must have | | | | | | | |
| 49 | **(a)**  We have  Clearly, is continuous at  (L.H.D. at  Similar (R.H.D. at )=0  So, is differentiable at | | | | | | | |
| 50 | **(b)**  is an even function, then g  Now | | | | | | | |
| 51 | **(c)**  We have  Clearly, there are three points of discontinuity, viz., | | | | | | | |
| 52 | **(b)**  is continuous at  Now by applying L’ Hopital’s rule, | | | | | | | |
| 53 | **(c)**  When is not an integer, both the functions and are continuous  is continuous on all non-integral points  For  Also  is continuous at all integral points as well. Thus, is continuous everywhere | | | | | | | |
| 54 | **(d)**  Since  Thus, is continuous at all , except for those values of for which , i.e., | | | | | | | |
| 55 | **(b)**  We have  Clearly, is discontinuous at as it is not defined at . Since is not defined at , therefore cannot be differentiable at . Clearly is continuous at , but it is not differentiable at , because and | | | | | | | |
| 56 | **(d)**  We have which does not exist and oscillates between and 1. Similarly, lies between and 1 | | | | | | | |
| 57 | **(b)**    is continuous at but not differentiable | | | | | | | |
| 58 | **(c)**  Given that  Clearly, the domain of is  It is non-differentiable at the points | | | | | | | |
| 59 | **(c)**  At ,  L.H.L.  R.H.L.  and  L.H.L = R.H.L.  Hence, is continuous at  Also L.H.D.  and R.H.D.  Hence, is differentiable at and | | | | | | | |
| 60 | **(d)**  Clearly, is continuous at if  Now,  Thus, no values of exists | | | | | | | |
| 61 | **(c)**  Obviously ,  Hence is continuous at  Hence is differentiable at . Also | | | | | | | |
| 62 | **(c)**  Since  graph of    It is clear from graph that is discontinuous at and differentiable at and | | | | | | | |
| 63 | **(d)**  is always differentiable (also at )  Also is not differentiable at  So, is not differentiable at | | | | | | | |
| 64 | **(a)**  Hence check continuity at  For positive integers  For negative integers,  Hence, is continuous at positive integers and discontinuous at negative intergers | | | | | | | |
| 65 | **(c)**  For to be continuous at , we have  Hence, | | | | | | | |
| 66 | **(b)**  (Using L’ Hopital rule)  Let  For | | | | | | | |
| 67 | **(a)**  is continuous at , only if is finite  Now when  Then we must have for which  Hence, | | | | | | | |
| 68 | **(c)**  Since, and  So, is not continuous at but exists  We have  and,  So, does not exist and so is not continuous at  We have  We have  Which is clearly not continuous | | | | | | | |
| 69 | **(c)**  Given, are integers and  The left hand derivative of at is  Also,  [using L ‘Hospital’s rule]  and | | | | | | | |
| 70 | **(d)**    From the graph it is clear that is everywhere continuous but not differentiable at | | | | | | | |
| 71 | **(a)**  As is continuous so | | | | | | | |
| 72 | **(b)**    Thus, for the maximum points of non-differentiability, graphs of and must intersect at maximum number of points which occurs when  Hence, the least value of is 4 | | | | | | | |
| 73 | **(c)**  (1)  R.H.L.  In 4 In 2 (2)  R.H.L. | | | | | | | |
| 74 | **(c)**  Thus, is discontinuous at | | | | | | | |
| 75 | **(a)** | | | | | | | |
| 76 | **(c)**  Which is differentiable at  For  Hence, is differentiable at  For  Hence, is non-differentiable at | | | | | | | |
| 77 | **(a)**  We have    Clearly, is continuous at but non-differentiable at | | | | | | | |
| 78 | **(c)**  is discontinuous when  is discontinuous when  is discontinuous when  Thus, all the above functions have infinite number of points of discontinuity  But is discontinuous when only | | | | | | | |
| 79 | **(c)**  sin (integral multiple of )  Hence, is continuous for all | | | | | | | |
| 80 | **(b)**  The function is clearly continuous at each point in its domain except possibly at . Given that is continuous at  Therefore, | | | | | | | |
| 81 | **(d)**  is non-differentiable at as is non-differentiable at . Similarly is non-differentiable at  Which is not differentiable at  is differentiable at | | | | | | | |
| 82 | **(b)**  Consider  From the graph given in figure, it is clear that is discontinuous at  (1)    Now consider  For and for  Also  and 2 may be the points at which is discontinuous (2)  Thus, is continuous when | | | | | | | |
| 83 | **(b)**  We have  The domain of definition of is  For , we have  Since is not defined on the right side of and on the left side of  Also, when or  So, we check the differentiability at  Now, L.H.D. at  Similarly, R.H.D. at is  Hence, is not differentiable at | | | | | | | |
| 84 | **(b)**  We have  ( is given)  Clearly, is continuous for all and discontinuous at , 1 | | | | | | | |
| 85 | **(b)**  is discontinuous at and  may be discontinuous when or 2  Now , where is continuous  Now  Hence is discontinuous at | | | | | | | |
| 86 | **(b)**  We must have  and  and  and | | | | | | | |
| 87 | **(c)**  For as and for as . So  Thus,  and | | | | | | | |
| 88 | **(c)**  Let which could be expressed as  So, exists for all real  So, exists for all real  However, does not exist since and which are not equal. Thus, the set of points where is thrice differentiable is | | | | | | | |
| 89 | **(d)**  We have,  L.H.L.  R.H.L.  Since is continuous at , therefore  and | | | | | | | |
| 90 | **(b)**  is clearly continuous for    Thus, is non-differentiable at | | | | | | | |
| 91 | **(a)**  Hence, is continuous at  Now  Hence, is non-differentiable at | | | | | | | |
| 92 | **(a,c)**  (any value between to 1) = 0  Hence is continuous at  (any value between to 1) = 0  Similarly,  Hence, is continuous and differentiable in and , respectively | | | | | | | |
| 93 | **(b,c,d)**  Hence does not exist  Hence and exists  Similarly for and , also and exists | | | | | | | |
| 94 | **(a,c,d)**  Differentiating w.r.t. , keeping as constant, we get  Now put  Also  is twice differentiable for all and | | | | | | | |
| 95 | **(a,b,c)**  Since, and  So, is not continuous at but exists  We have  and  So, does not exist and hence is not continuous at  We have  So, is continuous for all  We have  Which is clearly not continuous | | | | | | | |
| 96 | **(a,c,d)**  From the figure, it is clear that    From the graph, it is clear that is continuous for all for all , and is not differentiable at and 1 | | | | | | | |
| 97 | **(a,c,d)**  **a** is not correct as from to is onto but its reciprocal function g is not onto on  **b** is obviously true  Also is not continuous, hence not differentiable though is continuous and differentiable in the above case | | | | | | | |
| 98 | **(a,c)**    From the graph, it is clear that is continuous everywhere and also differentiable everywhere except at and | | | | | | | |
| 99 | **(a,c)**    The function is clearly continuous for  We observe that  Also, and  Thus is discontinuous for  Hence **a** and **c** are the correct answers | | | | | | | |
| 100 | **(a,b,c,d)**  **a**, **b**, and **c** are false. Refer to definitions for **d**, must be continuous False | | | | | | | |
| 101 | **(a,b)**  We have  If  Which exists for  If ,  Then  At is not continuous, therefore is not continuous at . At  Which does not exist | | | | | | | |
| 102 | **(a,b)**  for ,  for  Hence is continuous and differentiable at | | | | | | | |
| 103 | **(a,c,d)**  Hence has removable discontinuity at  Similarly in options (c) and (d) has also removable discontinuity  Hence has non-removable discontinuity at | | | | | | | |
| 104 | **(b,c)**  Option (a) is wrong as and , is non-differentiable at , but is differentiable at | | | | | | | |
| 105 | **(a,b,d)**    Clearly, is discontinuous and bijective function | | | | | | | |
| 106 | **(b,c,d)**  which exists except possibly at  At  is differentiable  Clearly, is non-differentiable | | | | | | | |
| 107 | **(a,b)**  Also  Hence, is continuous everywhere  Both and are odd functions  Hence, is an even function  Obviously, is non-periodic  Now  and  Hence, is non-differentiable at | | | | | | | |
| 108 | **(a,b)**  For , we have  Also  and  Hence, is continuous for  For ,  and  For continuity at , we must have or | | | | | | | |
| 109 | **(b,d)**  is discontinuous when or  or or  Hence is discontinuous | | | | | | | |
| 110 | **(a,b,c)**    Clearly, is non-differentiable at  For , where function changes its definition  Hence, is differentiable at  Hence, is continuous for all but non-differentiable at | | | | | | | |
| 111 | **(a,b,d)**  Given that  If , then  If then  If , then  Thus, we can define  Clearly, is continuous but non-differentiable at | | | | | | | |
| 112 | **(a,b)**  is continuous for all if it is continuous at for which or  is continuous for all if it is continuous at for which or  thus, is continuous for all if  hence, is discontinuous at exactly one point for options **a** and **b** | | | | | | | |
| 113 | **(a,c,d)**  For continuity at  Also,  L.H.L. = R.H.L. . Hence, is continuous at  Now for differentiability,  and  Hence, is differentiable at  Now at ,  Hence, L.H.L R.H.L.  Hence, is discontinuous at and then is also non-differentiable at | | | | | | | |
| 114 | **(a,b,c,d)**  **a**.  If , then  is continuous at if  **c**. If , then does not exist  is a point of irremovable type of discontinuity  **d**. if , then  removable type of discontinuity at | | | | | | | |
| 115 | **(a,b)**  For maximum points of discontinuity of ,  must have two distinct roots, for which | | | | | | | |
| 117 | **(a,b)** | | | | | | | |
| 118 | **(b,d)**  **a**. and ,  hence has non-removable discontinuity  **b**.  has removable discontinuity at  **c**. and  Hence, the limit does not exist  **d**. (Rationalizing)  has removable discontinuity at | | | | | | | |
| 119 | **(a,c)**  Also  is continuous at  and | | | | | | | |
| 121 | **(b,d,e)**    is continuous for all but not differentiable when (where crosses -axis) or | | | | | | | |
| 122 | **(a,b,d)**    From the graph, , for  Hence, | | | | | | | |
| 123 | **(a)**  is differentiable everywhere except probably at  For  is differentiable at  Hence, is differentiable in | | | | | | | |
| 124 | **(d)**  , which is continuous in  is continuous in  which is clearly continuous but is not continuous | | | | | | | |
| 125 | **(b,c)**  On  **a**.  we know is discontinuous at  **b**.  which is well-defined on  being differentiable is continuous on  **c**.  Clearly, is continuous on except possibly at , where  Also  As is continuous on  **d**.  Here will be continuous on if it is continuous at . At  As is not continuous | | | | | | | |
| 126 | **(a,c)**  Since both and g are continuous everywhere, is also continuous everywhere  is non-differentiable and  Hence is non-differentiable at  Now  Clearly, is continuous at  Also  is differentiable everywhere | | | | | | | |
| 127 | **(b,d)**  We have  Hence, is differentiable at  Hence, **b** and **d** are the correct answers | | | | | | | |
| 128 | **(b,c)**  Also discontinuous at  Further,  discontinuous at | | | | | | | |
| 129 | **(a, c)**  Clearly, is defined for all satisfying and  So, domain of  Clearly, range of  Also,  So, is continuous at  Now,  (An oscillating number)  does not exist | | | | | | | |
| 130 | **(a,c,d)**  **a** is wrong as continuity is a must for  **b** is the correct form of intermediate value theorem    **c** as per the graph (in figure), is incorrect    **d** is wrong if is discontinuous | | | | | | | |
| 131 | **(a,b,c,d)**  Given function is discontinuous when  Now if  If not possible  If  has 6 values, 2 each for one cycle of period 2  If  Hence, all the options are correct | | | | | | | |
| 132 | **(b)**  Statement 2 as it is fundamental concept for non-differentiability  But given function is non-differentiable at , as it has vertical tangent at , but not due to sharp turn  The graph of the function is smooth in the neighbourhood of | | | | | | | |
| 133 | **(b)**  Statement 1 is correct as is non-differentiable at | | | | | | | |
| 134 | **(b)**  We know that  Hence, or 1, as  or  Also, since , then integer if and integer if and integer, if irrational  Hence,  when which is continuous for all however, statement 2 does not correctly explain statement 1 as the addition of discontinuous functions may be continuous | | | | | | | |
| 135 | **(b)**    Since is a continuous function such that and  The graph of always lies above the graph of  Hence  Hence, (as is onto function, takes all real values which acts as )  Statement 2 is a fundamental property of continuous function, but does not explain statement 1 | | | | | | | |
| 136 | **(d)**  is differentiable at | | | | | | | |
| 137 | **(b)**  Statement 2 is obviously true  But is non-differentiable at as is not defined at . Hence statement 1 is true but statement 2 is not the correct explanation of statement 1 | | | | | | | |
| 138 | **(b)**  Graph of lies between the graph of and  Also  Also from Sandwich theorem,  is continuous at  Also statement 2 is correct but it has no link with statement 1 | | | | | | | |
| 139 | **(d)**  Statement 1 is false, as consider the function which is equivalent to  Here is continuous and differentiable at  However, statement 2 is obviously true | | | | | | | |
| 140 | **(c)**  Statement 1 is obviously true  But statement 2 is false as is differentiable, but is non-differentiable at  has vertical tangent at | | | | | | | |
| 141 | **(c)**  Consider  Hence for all is continuous at but is discontinuous at | | | | | | | |
| 142 | **(b)**  is continuous function as both and are continuous  But is not differentiable at  However,  and  Hence, is differentiable at , through is not differentiable at  However, statement 2 is correct but it is not a correct explanation of statement 1 | | | | | | | |
| 143 | **(c)**  Statement 1 is true as is monotonic function. But statement 2 is false as is continuous at , though (integer) | | | | | | | |
| 144 | **(a)**  Statement 2 is true as it is a fundamental concept  Also, is discontinuous when g  Now the given function may be discontinuous when , which is not possible: it has imaginary roots as its discriminant is | | | | | | | |
| 145 | **(c)**  See the graph of ,    Which is non-differentiable at 5 points,  However, statement 2 is false,  As crosses -axis at ,  But is differentiable at | | | | | | | |
| 146 | **(b)**  Statement 2 is true as  Now  and  Thus L.H.L. R.H.L.  Hence, the function has no-removable discontinuity at  Hence, statement 2 is not a correct explanation of statement 1 | | | | | | | |
| 147 | **(a)**  ,  Hence, and  Hence, both statement are correct and statement 2 is a correct explanation of statement 1 | | | | | | | |
| 148 | **(c)**  We know that is discontinuous at  Also which is discontinuous at  Consider . Here is discontinuous at but for all is continuous at  Hence, answer is **c** | | | | | | | |
| 149 | **(a)**  Let  Hence, is not continuous at integral points  Hence, correct answer is **a** | | | | | | | |
| 150 | **(c)**  We know that both and are discontinuous at  Also is discontinuous at  As and  But the difference of two discontinuous function is not necessarily discontinuous | | | | | | | |
| 151 | **(c)**  and  Clearly,  is differentiable at and also its derivative is continuous at  Now,  and  is not twice differentiable at | | | | | | | |
| 152 | **(c)**  and  is discontinuous  But for and g then is continuous at | | | | | | | |
| 153 | **(b)**  is discontinuous at  and  Hence, is discontinuous at as the limit of the function does not exist | | | | | | | |
| 154 | **(d)**  Statement 1 is incorrect because if and approach from the same side of (say right side), and , then  Statement 2 is correct | | | | | | | |
| 155 | **(b)**  [in the interval ]  Hence, is discontinuous and non-derivable, but non-derivability does not imply discontinuity | | | | | | | |
| 156 | **(d)**  Consider which is differentiable at , but derivative is not continuous at  However, statement 2 is correct | | | | | | | |
| 157 | **(a)**  Thus, limit does not exist, hence is discontinuous at  Statement 2 is a fundamental property and is a correct explanation of statement 1 | | | | | | | |
| 158 | **(c)**    From the graph, statement 1 is true  Consider is differentiable at , through is non-differentiable at | | | | | | | |
| 160 | **(c)**  **a**.  Hence, is discontinuous and non-differentiable at  **b**.  Hence, is continuous at  Hence, is not differentiable, but continuous at  **c**. For ,  Let  Hence, is differentiable at , then it is always continuous at  **d.** Clearly from the above discussion is discontinuous and hence non-differentiable at | | | | | | | |
| 161 | **(a)**  **a**.  obviously,  and  is discontinuous at  **b**.  Obviously, is continuous at  Hence, is differentiable at  **c**.  Also  is continuous at  Similarly,  **d**. at  is continuous when which has as one of the solutions. Hence, it is continuous  Also in the neighbourhood of ,  Here,  is not differentiable at | | | | | | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 162 | **(b)**  **a**. The given function is clearly continuous at all points except possibly at  As is an even function, so we need to check its continuity only at  (1)  Clearly, is differentiable for all , except possible at . As is an even function, so we need to check its differentiability at only  Putting in (1) we get  **b**. If is discontinuous then must have only one real root. Hence  **c**. has exactly 11 points of discontinuity in  The required number of points are  **d**. has exactly three points of non-differentiability  is non-differentiable at or  Hence, the value of must be positive, as negative value of allows to have real roots, which given more points of non-differentiability   |  |  |  | | --- | --- | --- | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |  |  |  | |

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| 163 | **(a)**  **a**. is continuous and differentiable    **b**. is continuous    Clearly from the graph, is non-differentiable at  **c**. is continuous    Clearly from the graph, is non-differentiable at  **d**. is continuous    Clearly from the graph, is no-differentiable at | | | | | | | |
| 164 | **(b)**  Where  is continuous at  R.H.L. exists  For the existence of R.H.L.,  ( form)  L.H.L.  For finite value of L.H.L., and  Solving, we get  Now which has the range  Also  Further, has only one real root, as the graph of meets only once for negative value of | | | | | | | |
| 165 | **(c)**  For  So  and for  So  Let  Clearly, is continuous in  Now  So is differentiable everywhere in other than at  Which is non-differentiable at and where or  For  For  Hence, the range is | | | | | | | |
| 166 | **(a)**  If is continuous must be made continuous out at  For continuity at  (1)  For continuity at  (2)  Solving equations (1) and (2), we get and | | | | | | | |
| 167 | **(a)**  Hence, is discontinous at  is continuous at  Now,  Hence, is non-differentiable at | | | | | | | |
| 168 | **(c)**  For continuous at  Continuous at  (1)  Now let the line is tangent to all the three curves  Solving and  (2)  Again solving and  and  Hence equation of the tangent to first and last curves is  (3)  Now solving this with as )  Also (from (1))  and (as ) | | | | | | | |
| 169 | **(7)**  Let  Therefore  Hence is non-differentiable at | | | | | | | |
| 170 | **(5)**  is discontinuous when | | | | | | | |
| 171 | **(1)**  exists  has a root at | | | | | | | |
| 172 | **(6)**  and for to be continuous at | | | | | | | |
| 173 | **(8)** | | | | | | | |
| 174 | **(2)** | | | | | | | |
| 175 | **(8)**  For continuity at we have  Hence, (1)  For continuity at  (2)  Hence and | | | | | | | |
| 176 | **(6)**  is continuous if for for which we must have  Hence the least value of is 6 | | | | | | | |
| 177 | **(4)**  is discontinuous when or  is discontinuous at  Thus is discontinuous at  Now both and are discontinuous at and 2  Then may be continuous at and 2  But and  Thus is discontinuous at  Also and  Hence is discontinuous at also | | | | | | | |
| 178 | **(2)**  (1)  For existence of limit  (2)  Now (3)  Substituting in equation (1)  Hence  From equation (2) and (4)  and | | | | | | | |
| 179 | **(7)**  is periodic with period | | | | | | | |
| 180 | **(1)**  Given  Since  Now  For continuity at  In either or | | | | | | | |
| 181 | **(8)**  We have  Which is discontinuous when or  Hence points of discontinuity are 1/3, 2/3, 3/3, 4/3, 5/3, 6/3, 7/3, 8/3 | | | | | | | |
| 182 | **(5)**  and lie between to . For , RHL = 2 LHL  For is not continuous | | | | | | | |