**ACTIVE SITE TUTORIALS**

**Date :** 07-09-2019 **TEST ID: 607**

**Time :** 20:06:00 **MATHEMATICS**

**Marks :** 1187

6.APPLICATION OF DERIVATIVES

**Single Correct Answer Type**

| 1. | The function decreases in the interval | | | | | | | |
|  | a) |  | b) | (0, 1) | c) |  | d) | None of these |
| 2. | Complete set of values of such that as a local minima at is | | | | | | | |
|  | a) |  | b) |  | c) | [1, 2] | d) |  |
| 3. | If , then the maximum value of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 4. | The function increases if | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 5. | If there is an error of in measuring the edge of a cube, then the percent error in estimating its volume is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 6. | In [0, 1] Lagranges Mean value theorem is NOT applicable to | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) |  | | |
| 7. | A rectangle is inscribed in an equilateral triangle of side length units. The maximum area of this rectangle can be | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 8. | If the function is strictly increasing for all values of , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 9. | If is a monotonically decreasing function of in the largest possible interval , then | | | | | | | |
|  | a) |  | | | | | | | |
|  | b) |  | | | | | | | |
|  | c) |  | | | | | | | |
|  | d) | has no real value | | | | | | | |
| 10. | If , then the quadratic equation has | | | | | | | |
|  | a) | At least one root in | | | b) | One root in and the other in | | |
|  | c) | Imaginary roots | | | d) | None of these | | |
| 11. | Let the function be defined as follows  Then has | | | | | | | |
|  | a) | A local minimum at | | | | | | | |
|  | b) | A global maximum at | | | | | | | |
|  | c) | An absolute minimum at | | | | | | | |
|  | d) | An absolute maximum at | | | | | | | |
| 12. | Let the function be given by. Then, is | | | | | | | |
|  | a) | Even and is strictly increasing in | | | b) | Odd and is strictly decreasing in | | |
|  | c) | Odd and is strictly increasing in | | | d) | Neither even nor odd, but is strictly increasing in | | |
| 13. | The length of the largest continuous interval in which the function is monotonic is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 14. | The distance between the origin and the tangent to the curve drawn at the point is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 15. | Which of the following statements is true for the function | | | | | | | |
|  | a) | It is monotonic increasing | | | | | | | |
|  | b) | fails to exist for three distinct real values of | | | | | | | |
|  | c) | changes its sign twice as varies from to | | | | | | | |
|  | d) | The function attains its extreme values at and , such that | | | | | | | |
| 16. | The normal to the curve at any point is such that | | | | | | | |
|  | a) | It makes a constant angle with the -axis | | | b) | It passes through the origin | | |
|  | c) | It is at a constant distance from the origin | | | d) | None of these | | |
| 17. | If is the slope of a tangent to the curve , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 18. | If and , then the maximum value of is | | | | | | | |
|  | a) |  | b) |  | c) | 3 | d) |  |
| 19. | At any point on the curve , the mean proportional between the abscissa and the difference between the abscissa and the subnormal drawn to the curve at the same point is equal to | | | | | | | |
|  | a) | Ordinate | | | | | | | |
|  | b) | Radius vector | | | | | | | |
|  | c) | -intercept of tangent | | | | | | | |
|  | d) | Sub-tangent | | | | | | | |
| 20. | The tangent to the curve at a point (0, 1) meets the -axis at where then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 21. | The volume of the greatest cylinder which can be inscribed in a cone of height 30 cm and semi-vertical angle is | | | | | | | |
|  | a) | cubic cm | b) | cubic cm | c) | cubic cm | d) | None of these |
| 22. | The angel made by the tangent of the curve with the -axis at any point on it is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 23. | The value of for which the function has an extremum at is | | | | | | | |
|  | a) | 1 | b) |  | c) | 0 | d) | 2 |
| 24. | Let be a function such that . If is decreasing for all real values of , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 25. | If , then has a zero between and . The theorem that best describes this is | | | | | | | |
|  | a) | Mean value theorem | | | b) | Maximum-minimum value theorem | | |
|  | c) | Intermediate value theorem | | | d) | None of these | | |
| 26. | The triangle formed by the tangent to the curve at the point (1, 1) and the co-ordinate axes lies in the first quadrant. If its area is 2, then the value of is | | | | | | | |
|  | a) |  | b) | 3 | c) |  | d) | 1 |
| 27. | If and , then in | | | | | | | |
|  | a) | is strictly increasing function | | | b) | has a local maxima | | |
|  | c) | is strictly decreasing function | | | d) | is bounded | | |
| 28. | A cube of ice melts without changing its shape at the uniform rate of . The rate of change of the surface area of the cube, in , when the volume of the cube is , is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 29. | Tangents are drawn to from the point . These tangents meet the -axis at and . If the area of triangle is minimum, then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 30. | The minimum value of is | | | | | | | |
|  | a) |  | b) |  | c) | 1 | d) | 0 |
| 31. | If and are differentiable functions for such that , then in the interval (0, 1) | | | | | | | |
|  | a) | for all | | | b) | for at least one | | |
|  | c) | for at most one | | | d) | None of these | | |
| 32. | The function assumes the minimum value of given by | | | | | | | |
|  | a) | 5 | b) |  | c) | 3 | d) | 2 |
| 33. | Let . Then decreases in the interval | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 34. | A value of for which the conclusion of mean value theorem holds for the function on the interval is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 35. | On which of the following intervals is the function decreasing? | | | | | | | |
|  | a) |  | b) | (0, 1) | c) |  | d) | None of these |
| 36. | Let be the curve (where takes all real values). The tangent at meets the curve again at . If the gradient at is times the gradient at , then is equal to | | | | | | | |
|  | a) | 4 | b) | 2 | c) |  | d) |  |
| 37. | Let and . Then increases in | | | | | | | |
|  | a) | (1/2, 2) | b) | (4/3, 2) | c) |  | d) | (0, 4/3) |
| 38. | The curve given by has a tangent parallel to the -axis at the point | | | | | | | |
|  | a) |  | b) |  | c) | (1, 1) | d) | None of these |
| 39. | The co-ordinates of a point on the parabola whose distance from the circle is minimum is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 40. | Consider the following statements is and : Both and are decreasing functions in the interval  If a differentiable function decreases in an interval , then its derivative also decreases in , which of the following is true? | | | | | | | |
|  | a) | Both and are wrong | | | | | | | |
|  | b) | Both and are correct, but is not the correct explanation of | | | | | | | |
|  | c) | is correct and is the correct explanation for | | | | | | | |
|  | d) | is correct and is wrong | | | | | | | |
| 41. | All possible values of for which the function  In is possible is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 42. | If the length of sub-normal is equal to the length of sub-tangent at any point (3, 4) on the curve and the tangent at (3, 4) to meets the coordinate axes at and , then the maximum area of the triangle , where is origin, is | | | | | | | |
|  | a) | 45/2 | b) | 49/2 | c) | 25/2 | d) | 81/2 |
| 43. | If at each point of the curve , the tangent is inclined at an acute angle with the positive direction of the -axis, then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 44. | The value of in Lagrange’s theorem for the function in the interval | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 45. | Let be continuous and differentiable function such that and have opposite signs everywhere. Then | | | | | | | |
|  | a) | is increasing | | | | | | | |
|  | b) | is decreasing | | | | | | | |
|  | c) | is non-monotonic | | | | | | | |
|  | d) | is decreasing | | | | | | | |
| 46. | , then the range of so that has maxima at , is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 47. | In a and . The area of the triangle is maximum when is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 48. | The curve represented parametrically by the equations In cot and | | | | | | | |
|  | a) | Tangent and normal intersect at the point (2, 1) | | | | | | | |
|  | b) | Normal at is parallel to the -axis | | | | | | | |
|  | c) | Tangent at is parallel to the line | | | | | | | |
|  | d) | Tangent at is parallel to the -axis | | | | | | | |
| 49. | Which of the following statements is always true? | | | | | | | |
|  | a) | If is increasing, then is decreasing | | | | | | | |
|  | b) | If is increasing, then is also increasing | | | | | | | |
|  | c) | If and g are positive function and is increasing and g is decreasing, then /g is a decreasing function | | | | | | | |
|  | d) | If and g are positive function and is decreasing and g is increasing, then g is a decreasing function | | | | | | | |
| 50. | Let be a function such that . Then is invertible if | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 51. | The lines tangent to the curves and at the origin intersect at an angle equal to | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 52. | The number of solutions of the equation in is | | | | | | | |
|  | a) | One | b) | Two | c) | Three | d) | Zero |
| 53. | If a variable tangent to the curve makes intercepts on -and -axes, respectively, then the value of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 54. | Let then at has | | | | | | | |
|  | a) | A local maximum | b) | No local maximum | c) | A local minimum | d) | No extremum |
| 55. | The largest term in the sequence is given by | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 56. | The point on the curve , the normal at which passes through the origin, is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 57. | If , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 58. | If and , then is increasing in | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 59. | If is monotonoically increasing in , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 60. | The greatest value of is (where represents the greatest integer function) | | | | | | | |
|  | a) |  | b) | 1 | c) | 0 | d) | None of these |
| 61. | If is a polynomial function and and , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 62. | A given right cone has a volume , and the largest right circular cylinder that can be inscribed in the cone has a volume . Then is | | | | | | | |
|  | a) | 9:4 | b) | 8:3 | c) | 7:2 | d) | None of these |
| 63. | The slope of the tangent to the curve at the point, where the ordinate and the abscissa are equal, is | | | | | | | |
|  | a) |  | b) | 1 | c) | 0 | d) | None of these |
| 64. | If the function , where attains its maximum and minimum at and , respectively such that , then equals to | | | | | | | |
|  | a) | 1 | b) | 2 | c) |  | d) | 3 |
| 65. | If a function has and , then | | | | | | | |
|  | a) | is a maximum for | | | b) | is a minimum for | | |
|  | c) | It is difficult to say and | | | d) | is necessary a constant function | | |
| 66. | If then the equation will have | | | | | | | |
|  | a) | No real solution | | | b) | At least one real root in | | |
|  | c) | At least one real root in (0, 1) | | | d) | None of these | | |
| 67. | The least value of , for which the equation has at least one solution in the interval , is | | | | | | | |
|  | a) | 9 | b) | 4 | c) | 8 | d) | 1 |
| 68. | The radius of a right circular cylinder increases at the rate of 0.1 cm/min, and the height decreases at the rate of 0.2 cm/min. The rate of change of the volume of the cylinder, in , when the radius is 2 cm and the height is 3 cm is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 69. | The function is | | | | | | | |
|  | a) | Increasing in | | | b) | Decreasing in | | |
|  | c) | Increasing in , decreasing in | | | d) | Decreasing in , increasing in | | |
| 70. | If and then has the value equal to | | | | | | | |
|  | a) | 7/4 | b) | 9/4 | c) | 13/4 | d) | 5/2 |
| 71. | Let and . If can be concluded from the mean value theorem, then the largest value of equals | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 72. | If and for . The smallest possible value of is | | | | | | | |
|  | a) | 9 | b) | 12 | c) | 15 | d) | 19 |
| 73. | If the line joining the points (0, 3) and (5, –2) is a tangent to the curve , then the value of is | | | | | | | |
|  | a) | 1 | b) |  | c) | 4 | d) | None of these |
| 74. | If has local maximum and minimum at and , respectively, then | | | | | | | |
|  | a) | (0, 1) | b) | (1, 3) | c) | (1, 0) | d) | None of these |
| 75. | The maximum slope of the curve is | | | | | | | |
|  | a) | 0 | b) | 12 | c) | 16 | d) | 32 |
| 76. | Let and let be the minimum value of . As varies, the range of is | | | | | | | |
|  | a) | [0, 1] | b) | (0, 1/2] | c) | [1/2, 1] | d) | (0, 1] |
| 77. | If is a normal to the curve at, then the value of is | | | | | | | |
|  | a) | 9 | b) |  | c) |  | d) |  |
| 78. | The maximum value of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 79. | The function is an increasing function in | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 80. | Tangent of acute angle between the curves and at their points of intersection is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 81. | is differentiable such that , then is always | | | | | | | |
|  | a) | Increasing | | | b) | Decreasing | | |
|  | c) | Either increasing or decreasing | | | d) | Non-monotonic | | |
| 82. | monotonically decreases in | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 83. | Let  Then on , this function has | | | | | | | |
|  | a) | A minimum | | | b) | A maximum | | |
|  | c) | Either a maximum or a minimum | | | d) | Neither a maximum nor a minimum | | |
| 84. | The number of values of for which the equation has two distinct roots lying in the interval (0, 1) is | | | | | | | |
|  | a) | Three | b) | Two | c) | Infinitely many | d) | Zero |
| 85. | A rectangle of the greatest area is inscribed in a trapezium . One of whose non-parallel sides is perpendicular to the base, so that one of the rectangle’s side lies on the larger base of the treapezium. The base of trapezium are 6 and 10 cm and is 8 cm long. Then the maximum area of the rectangle is | | | | | | | |
|  | a) | 24 sq. cm | b) | 48 sq. cm | c) | 36 sq. cm | d) | None of these |
| 86. | Consider the function then the number of points in (0, 1) where the derivative vanishes is | | | | | | | |
|  | a) | 0 | b) | 1 | c) | 2 | d) | Infinite |
| 87. | The function has its local maxima at , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 88. | , monotonically decreases in | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 89. | The - intercept of the tangent at any arbitrary point of the curve is proportional to | | | | | | | |
|  | a) | Square of the abscissa of the point of tangency | | | | | | | |
|  | b) | Square root of the abscissa of the point of tangency | | | | | | | |
|  | c) | Cube of the abscissa of the point of tangency | | | | | | | |
|  | d) | Cube root of the abscissa of the point of tangency | | | | | | | |
| 90. | The vertices of a triangle are (0, 0), and where . The maximum area for such a triangle in sq. units is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 91. | Tangent is drawn to ellipse at (where). Then the value of such that sum of intercepts on axes made by this tangent is minimum, is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 92. | If and , then the value of for which Rolle’s theorem can be applied in [0, 1] is | | | | | | | |
|  | a) | -2 | b) | -1 | c) | 0 | d) | 1/2 |
| 93. | If the normal to the curve at the point makes an angle with the positive -axis, then is equal to | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | 1 |
| 94. | The three sides of a trapezium are equal, each being 8 cm. The area of the trapezium, when it is maximum, is | | | | | | | |
|  | a) | sq. cm | b) | sq. cm | c) | sq. cm | d) | None of these |
| 95. | Let . The absolute minimum value of is | | | | | | | |
|  | a) | 0 | b) |  | c) |  | d) | None of these |
| 96. | If the function satisfies conditions of Rolle’s theorem in for , then value of and , respectively, are | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 97. | Let be a continuous, differentiable and bijective function. If the tangent to at is also the normal to at , then there exists at least one such that | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 98. | A function is defined by . The local maximum value of the function is | | | | | | | |
|  | a) | 1 | b) |  | c) |  | d) |  |
| 99. | Let be a differentiable function for all values of and has the property that and have opposite signs for all values of . Then, | | | | | | | |
|  | a) | is an increasing function | | | b) | is a decreasing function | | |
|  | c) | is a decreasing function | | | d) | is an increasing function | | |
| 100. | The largest area of a trapezium inscribed in a semi-circle of radius , if the lower base is on the diameter, is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 101. | A factory is to be connected by a road with a straight railway line on which a town is situated. The distance of the factory to the railway line is km. Length of the railway line is 20 km. Freight charges on the road are twice the charges on the railway. The point on the railway line should the road be connected so as to ensure minimum freight charges from the factory to the town is | | | | | | | |
|  | a) | km | b) | km | c) | km | d) | None of these |
| 102. | If be a continuous function on differentiable in such that , then there exists some such that | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 103. | The function has a local minimum at | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 104. | The least perimeter of an isosceles triangle in which a circle of radius can be inscribed is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 105. | If then | | | | | | | |
|  | a) | is a point of maxima | | | b) | is a point of minima | | |
|  | c) | is a point of intersection | | | d) | None of these | | |
| 106. | In the interval [0, 1], the function takes its maximum value at the point | | | | | | | |
|  | a) | 0 | b) |  | c) |  | d) |  |
| 107. | If has its extremum values a and , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 108. | A bell tent consists of a conical portion above a cylindrical portion near the ground. For a given volume and a circular base of a given radius, the amount of the canvas used is a minimum when the semi-vertical angle of the cone is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 109. | A box, constructed from a rectangular metal sheet, is 21 cm by 16 cm by cutting equal squares of sides from the corners of the sheet and then turning up the projected portions. The value of so that volume of the box is maximum is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | 4 |
| 110. | The maximum value of the function in the interval occurs at | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 111. | If the function increases in the interval , and , then | | | | | | | |
|  | a) | increases in | | | | | | | |
|  | b) | decreases in | | | | | | | |
|  | c) | We cannot say that increases or decreases in | | | | | | | |
|  | d) | None of these | | | | | | | |
| 112. | The maximum value of is | | | | | | | |
|  | a) | 1 | b) |  | c) |  | d) |  |
| 113. | Suppose that is a polynomial of degree 3 and that at any of the stationary point. Then | | | | | | | |
|  | a) | has exactly one stationary point | | | b) | must have no stationary point | | |
|  | c) | must have exactly two stationary points | | | d) | has either zero or two stationary point | | |
| 114. | A cylindrical gas container is closed at the top and open at the bottom, if the iron plate of the top is 5/4 times as thick as the plate forming the cylindrical sides, the ratio of the radius to the height of the cylinder using minimum material for the same capacity is | | | | | | | |
|  | a) | 3:4 | b) | 5:6 | c) | 4:5 | d) | None of these |
| 115. | , then ‘’ decreases in | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 116. | The minimum value of is | | | | | | | |
|  | a) |  | b) | 2 | c) | 1 | d) | None of these |
| 117. | The normal to the curve at the point (2, 2) cuts the curve again at | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 118. | Let be a function defined as below: and Then at | | | | | | | |
|  | a) | Has a local maximum | b) | Has a local minimum | c) | Is discontinuous | d) | None of these |
| 119. | If where denotes the fractional part of then is decreasing in | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 120. | A differentiable function has a relative minimum at , then the function has a relative minimum at for | | | | | | | |
|  | a) | All and all | b) | All if | c) | All | d) | All |
| 121. | The number of points in the rectangle and which lie on the curve and at which the tangent to the curve is parallel to the - axis is | | | | | | | |
|  | a) | 0 | b) | 2 | c) | 4 | d) | 8 |
| 122. | The greatest value of on [0, 1] is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) |  |
| 123. | Consider the function defined by . Which of the following is not true? | | | | | | | |
|  | a) | Maximum value of is not attained even though is bounded | | | | | | | |
|  | b) | is increasing on and has minimum at | | | | | | | |
|  | c) | is decreasing on and has minimum at | | | | | | | |
|  | d) | is increasing on and has neither a local maximum nor a local minimum at | | | | | | | |
| 124. | The fuel charges for running a train are proportional to the square of the speed generated in km per hour, and the cost is Rs. 48 at 16 km per hour. If the fixed charges amount to Rs. 300 per hour, the most economical speed is | | | | | | | |
|  | a) | 60 kmph | b) | 40 kmph | c) | 48 kmph | d) | 36 kmph |
| 125. | A lamp of negligible height is placed on the ground away from a wall. man m tall is walking at a speed of m/s from the lamp to the nearest point on the wall. When he is midway between the lamp and the wall, the rate of change in the length of this shadow on the wall is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 126. | If and are two functions such that and , then the functions has | | | | | | | |
|  | a) | A maxima at | | | b) | A minima at | | |
|  | c) | A point of inflexion at | | | d) | None of these | | |
| 127. | Given that for all real , and , then for all belongs to | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 128. | The global maximum value of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 129. | A function is defined as and is an increasing function, then is increasing in the interval | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) | None of these | | |
| 130. | Let . Then -intercept of the line, that is, the tangent to the graph of is | | | | | | | |
|  | a) | Zero | b) |  | c) |  | d) |  |
| 131. |  | | | | | | | |
|  | a) | Is monotonically increasing | | | b) | Is monotonically decreasing | | |
|  | c) | Has a point of maxima | | | d) | Has a point of minima | | |
| 132. | Let have extrema at such that and . Then the equation has | | | | | | | |
|  | a) | Three equal real roots | | | b) | One negative roots if and | | |
|  | c) | One positive roots if and | | | d) | None of these | | |
| 133. | If , then increases in | | | | | | | |
|  | a) | (2, 2) | b) | No value of | c) |  | d) |  |
| 134. | The number of tangents to the curve , which are equally inclined to the axes, is | | | | | | | |
|  | a) | 2 | b) | 1 | c) | 0 | d) | 4 |
| 135. | At the point on the graph of in the first quadrant, a normal is drawn. The normal intersects the -axis at the point . If , then equals | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | 4 |
| 136. | The curves and at (3, 2) | | | | | | | |
|  | a) | Touch each other | b) | Cut orthogonally | c) | Intersect at | d) | Intersect at |
| 137. | is a diameter of a circle and is any point on the circumference of the circle. Then | | | | | | | |
|  | a) | The area of is maximum when it is isosceles | | | | | | | |
|  | b) | The area of is minimum when it is isosceles | | | | | | | |
|  | c) | The perimeter of is minimum when it is isosceles | | | | | | | |
|  | d) | None of these | | | | | | | |
| 138. | The equation of the tangent to the curve at the point where it crosses the -axis is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 139. | Let and be differentiable for , such that . Let there exists a real number in (0, 1) such that , then the value of g(1) must be | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 140. | A curve is represented by the equations and where is a parameter. If the tangent at the point on the curve, where meets the curve again at the point then is equal to | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 141. | If the function , where is a parameter that has a minimum and maximum, then the range of values of is | | | | | | | |
|  | a) | (0, 4) | b) |  | c) |  | d) |  |
| 142. | In which of the following functions is Rolle’s theorem applicable? | | | | | | | |
|  | a) | on [0, 1] | | | | | | | |
|  | b) | on | | | | | | | |
|  | c) | on | | | | | | | |
|  | d) |  | | | | | | | |
| 143. | A point on the parabola at which the ordinate increases at twice the rate of the abscissa is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 144. | At what points of curve , the tangent makes the equal angle with the axis? | | | | | | | |
|  | a) | and | b) | and | c) | and | d) | and |
| 145. | is monotonically increasing in | | | | | | | |
|  | a) |  | | | | | | | |
|  | b) |  | | | | | | | |
|  | c) |  | | | | | | | |
|  | d) |  | | | | | | | |
| 146. | A wire of length is cut into parts which are bent, respectively, in the form of a square and a circle. The least value of the sum of the areas so formed is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 147. | The rate of change of the volume of a sphere w.r.t. its surface area, when the radius is 2 cm, is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | 4 |
| 148. | A function is matched below against an interval where it is supposed to be increasing. Which of the following parts is incorrectly matched?  **Interval Function** | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) |  | | |
| 149. | For all | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 150. | The maximum value of the function in the interval [0, 1] is | | | | | | | |
|  | a) |  | b) |  | c) | 1 | d) |  |
| 151. | The real number when added to its inverse gives the minimum value of the sum at equals to | | | | | | | |
|  | a) | 1 | b) |  | c) |  | d) | 2 |
| 152. | Suppose that is differentiable for all and that for all . If and , then has the value equal to | | | | | | | |
|  | a) | 3 | b) | 4 | c) | 6 | d) | 8 |
| 153. | The least natural number for which is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 5 | d) | None of these |
| 154. | The set of value(s) of for which the function possesses a negative point of inflection is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | Empty set |
| 155. | The number of real roots of the equation is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | 4 |
| 156. | Given and the line , then the line is | | | | | | | |
|  | a) | Tangent to | b) | Normal to | c) | Chord of | d) | None of these |
| 157. | If and , where , then in this interval | | | | | | | |
|  | a) | Both and are increasing function | | | | | | | |
|  | b) | Both and are decreasing function | | | | | | | |
|  | c) | is an increasing function | | | | | | | |
|  | d) | is an increasing function | | | | | | | |
| 158. | If for a function , then at is | | | | | | | |
|  | a) | Minimum | b) | Maximum | c) | Not an extreme point | d) | Extreme point |
| 159. | A function has a second-order derivative If its graph passes through the point (2, 1) and at that point tangent to the graph is then the value of is | | | | | | | |
|  | a) | 1 | b) |  | c) | 2 | d) | 0 |
| 160. | Function is monotonically increasing when | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 161. | The greatest value of the function on the interval is | | | | | | | |
|  | a) |  | b) |  | c) | 1 | d) |  |
| 162. | The angle of intersection of the normals at the point of the curves and is | | | | | | | |
|  | a) | 0 | b) |  | c) |  | d) |  |
| 163. | Let for , where and are odd numbers and , then has | | | | | | | |
|  | a) | No local extremums | b) | One local maximum | c) | One local minimum | d) | None of these |
| 164. | Let be a twice differentiable function for all real values of and satisfies  Then which of the following is definitely true? | | | | | | | |
|  | a) | for | | | b) | for some | | |
|  | c) |  | | | d) | for some | | |
| 165. | If , then is | | | | | | | |
|  | a) | Increasing on | | | | | | | |
|  | b) | Decreasing on | | | | | | | |
|  | c) | Increasing on | | | | | | | |
|  | d) | Decreasing on | | | | | | | |
| 166. | A man is moving away from a tower 41.6 m high at a rate of 2 m/s. If the eye level of the man is 1.6 m above the ground, then the rate at which the angle of elevation of the top of the tower changes, when he is at a distance of 30 m from the foot of the tower, is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 167. | Let . Then is | | | | | | | |
|  | a) | Increasing in , decreasing in | | | | | | | |
|  | b) | Increasing in , decreasing in | | | | | | | |
|  | c) | Increasing in decreasing in | | | | | | | |
|  | d) | None of these | | | | | | | |
| 168. | The slope of the tangent to the curve at is . If the curve passes through the point , then the area bounded by the curve, the -axis and the line is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | 6 |
| 169. | The abscissa if points and on the curve such that tangents at and make with the -axis | | | | | | | |
|  | a) | In and in | | | b) | In | | |
|  | c) | In | | | d) | In | | |
| 170. | The maximum value of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 171. | The two curves cut orthogonally at a point, then is equal to | | | | | | | |
|  | a) |  | b) | 3 | c) | 2 | d) |  |
| 172. | Let be a differentiable function . If the tangent drawn to the curve at any point always lies below the curve, then | | | | | | | |
|  | a) |  | | | | | | | |
|  | b) |  | | | | | | | |
|  | c) |  | | | | | | | |
|  | d) | None of these | | | | | | | |
| 173. | The function , has a local minimum at , then | | | | | | | |
|  | a) | is any even number | | | b) | is an odd number | | |
|  | c) | is odd prime number | | | d) | is any natural number | | |
| 174. | Consider the function , then identify the statement which is correct | | | | | | | |
|  | a) | is neither odd nor even | | | | | | | |
|  | b) | is monotonic decreasing at | | | | | | | |
|  | c) | has a maxima at | | | | | | | |
|  | d) | has a minima at | | | | | | | |

**Multiple Correct Answers Type**

| 175. | If , then | | | | | | | |
|  | a) | has a local maxima at | | | | | | | |
|  | b) | has a local minima at | | | | | | | |
|  | c) | has neither maxima nor minima at | | | | | | | |
|  | d) | has a local maxima at | | | | | | | |
| 176. | The angle between the tangents at any point and the line joining to the origin, where is a point on the curve in is a constant, is | | | | | | | |
|  | a) | Independent of | | | b) | Independent of | | |
|  | c) | Independent of but dependent on | | | d) | Independent of but dependent on | | |
| 177. | Let and , then | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) |  | | |
| 178. | If , then | | | | | | | |
|  | a) | is increasing in | | | | | | | |
|  | b) | is continuous on | | | | | | | |
|  | c) | does not exist | | | | | | | |
|  | d) | has the maximum value at | | | | | | | |
| 179. | Let , then | | | | | | | |
|  | a) | is monotonically increasing in | | | b) | is monotonically decreasing in (3/2, 4) | | |
|  | c) | The maximum value of is | | | d) | The minimum value of is 0 | | |
| 180. | In which of the following graphs is the point of inflection? | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 181. | The angle formed by the positive -axis and the tangent to at is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| 182. | Let be a real-valued function defined on the interval, by. Then, which of the following statement (s) is (are) true? | | | | | | | |
|  | a) | exist for all | | | | | | | |
|  | b) | exists for all and is continuous on , but not differentiable on | | | | | | | |
|  | c) | There exists such that for all | | | | | | | |
|  | d) | There exists such that from all | | | | | | | |
| 183. | Which of the following function has point of extremum at ?  (where represents fractional part function) | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) |  | | |
| 184. | Let and g be increasing and decreasing functions, respectively from to . Let . If , then is | | | | | | | |
|  | a) | Always zero | b) | Always negative | c) | Always positive | d) | Strictly increasing |
| 185. | If , then is a point of | | | | | | | |
|  | a) | Local maximum, if is odd | | | b) | Local minimum, if is odd | | |
|  | c) | Local maximum, if is even | | | d) | Local minimum, if is even | | |
| 186. | In the curve , the | | | | | | | |
|  | a) | Sub-tangent is constant | | | | | | | |
|  | b) | Sub-normal varies as the square of the ordinate | | | | | | | |
|  | c) | Tangent at on the curve intersects the -axis at a distance of from the origin | | | | | | | |
|  | d) | Equation of the normal at the point where the curve cuts -axis is | | | | | | | |
| 187. | Let be a polynomial in a real variable with . The function has | | | | | | | |
|  | a) | Neither a maximum nor a minimum | | | | | | | |
|  | b) | Only one maximum | | | | | | | |
|  | c) | Only one minimum | | | | | | | |
|  | d) | Only one maximum and only one minimum | | | | | | | |
| 188. | If the line is a normal to the curve then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 189. | Let for every real number , then | | | | | | | |
|  | a) | is increasing whenever is increasing | | | | | | | |
|  | b) | is increasing whenever is decreasing | | | | | | | |
|  | c) | is decreasing whenever is decreasing | | | | | | | |
|  | d) | Nothing can be said in general | | | | | | | |
| 190. | For the function , which of the following hold good? | | | | | | | |
|  | a) | is monotonic in its entire domain | | | | | | | |
|  | b) | Maximum of is not attained even though is bounded | | | | | | | |
|  | c) | has a point of inflection | | | | | | | |
|  | d) | has one asymptote | | | | | | | |
| 191. | If , then | | | | | | | |
|  | a) | Increases in | | | b) | Decreases in | | |
|  | c) | Neither increase nor decreases in | | | d) | Increases in | | |
| 192. | The angle between the tangents to the curves and at (1, 1) is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 193. | The critical points of the function where , is | | | | | | | |
|  | a) | 0 | b) | 2 | c) | 4 | d) | 6 |
| 194. | Let where s are real and has a positive root . Then | | | | | | | |
|  | a) | has a root such that | | | | | | | |
|  | b) | has at least two real roots | | | | | | | |
|  | c) | has at least one real root | | | | | | | |
|  | d) | None of these | | | | | | | |
| 195. | The values of parameter for which the point of minimum of the function satisfies the inequality are | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 196. | Let . Then has | | | | | | | |
|  | a) | A maximum at if is odd | | | b) | A maximum at if is even | | |
|  | c) | A minimum at if is even | | | d) | A minima at if is even | | |
| 197. | The function has a | | | | | | | |
|  | a) | Minimum at if | | | b) | Maximum at if | | |
|  | c) | Maximum for no real value of | | | d) | Point of inflection at if | | |
| 198. | If and are two positive and increasing functions, then which of the following is not always true? | | | | | | | |
|  | a) | is always increasing | | | | | | | |
|  | b) | If is decreasing, then | | | | | | | |
|  | c) | If is increasing, then | | | | | | | |
|  | d) | If , then is increasing | | | | | | | |
| 199. | Let  Then at , which of the following is/are not true? | | | | | | | |
|  | a) | has a local maxima | | | | | | | |
|  | b) | has an local minima | | | | | | | |
|  | c) | has an inflection point | | | | | | | |
|  | d) | has a removable discontinuity | | | | | | | |
| 200. | If , then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 201. | The value of for which the function does not possess critical points is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 202. | The function has a local minimum at | | | | | | | |
|  | a) | 0 | b) | 1 | c) | 2 | d) | 3 |
| 203. | For the function | | | | | | | |
|  | a) | The point is the point of inflection | | | b) | is the point of minima | | |
|  | c) | The graph is concave downwards in (0, 1) | | | d) | The graph is concave upwards in | | |
| 204. | The function | | | | | | | |
|  | a) | Has two inflection points | | | | | | | |
|  | b) | Has one point of extremum | | | | | | | |
|  | c) | Is non-differentiable | | | | | | | |
|  | d) | Range of is | | | | | | | |
| 205. | Let then | | | | | | | |
|  | a) | has global minimum value | | | b) | Global maximum value occurs at | | |
|  | c) | Global maximum value occurs at | | | d) | is point of local minima | | |
| 206. | If composite function times is an increasing function and if of s are decreasing function while rest are increasing, then maximum value of is | | | | | | | |
|  | a) | , when is an even number | | | b) | , when is an odd number | | |
|  | c) | , when is an odd number | | | d) | , when is an even number | | |
| 207. | Which of the following pair(s) of curves is/are orthogonal? | | | | | | | |
|  | a) |  | | | b) | at (0, 0) | | |
|  | c) |  | | | d) |  | | |
| 208. | The smallest positive root of the equation lies in | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 209. | If , for every real number , then the minimum value of | | | | | | | |
|  | a) | Does not exist because is unbounded | | | b) | Is not attained even through is unbounded | | |
|  | c) | Is equal to 1 | | | d) | Is equal to | | |
| 210. | The function | | | | | | | |
|  | a) | Is its own inverse | | | b) | Decreases at all values of in the domain | | |
|  | c) | Has a graph entirely above the -axis | | | d) | Is unbounded | | |
| 211. | An extremum of the function occurs at | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 212. | Let , then has local extremum at , when | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 213. | Let . Then which of the following is/are true? | | | | | | | |
|  | a) | Graph of is symmetrical about the line | | | | | | | |
|  | b) | Maximum value of is 1 | | | | | | | |
|  | c) | Absolute minimum value of does not exist | | | | | | | |
|  | d) | None of these | | | | | | | |
| 214. | Which of the following function/functions has/have point of inflection? | | | | | | | |
|  | a) |  | | | | | | | |
|  | b) |  | | | | | | | |
|  | c) |  | | | | | | | |
|  | d) |  | | | | | | | |
| 215. | The number of values of where the function attains its maximum is | | | | | | | |
|  | a) | 0 | b) | 1 | c) | 2 | d) | Infinite |
| 216. | The equations of the tangents to the curve form the point (2, 0) not on the curve are given by | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) |  | | |
| 217. | If where g and g is continuous at , then | | | | | | | |
|  | a) | is increasing in the neighbourhood of if g | | | | | | | |
|  | b) | is increasing in the neighbourhood of if g | | | | | | | |
|  | c) | is decreasing in the neighbourhood of if g | | | | | | | |
|  | d) | is decreasing in the neighbourhood of if g | | | | | | | |
| 218. | Let the parabolas and touch each other at the point (1, 0), then | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 219. | The abscissa of a point on the curve , the normal which cuts off numerically equal intercepts from the coordinate axes, is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 220. | For , the tangent lines which are parallel to the bisector of the first coordinate angle is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 221. | Let be an increasing function defined on . If , then the possible integers in the range of is/are | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | 4 |
| 222. | The co-ordinates of the point(s) on the graph of the function , where the tangent drawn cuts off intercepts from the co-ordinate axes which are equal in magnitude but opposite in sign, is | | | | | | | |
|  | a) | (2, 8/3) | b) | (3, 7/2) | c) | (1, 5/6) | d) | None of these |
| 223. | Let , where are real and has a positive root . Then | | | | | | | |
|  | a) | has a root such that | | | b) | has at least one real root | | |
|  | c) | has at least one real root | | | d) | None of these | | |
| 224. | Points on the curve where the tangent is inclined at an angle of to the -axis are | | | | | | | |
|  | a) | (0, 0) | b) |  | c) |  | d) |  |
| 225. | Which of the following is/are correct? | | | | | | | |
|  | a) | Between any two roots of , there exists at least one root of | | | | | | | |
|  | b) | Between any two roots of , there exists at least one root of | | | | | | | |
|  | c) | Between any two roots of , there exists at least one root of | | | | | | | |
|  | d) | Between any two roots of , there exists at least one root of | | | | | | | |
| 226. | If the tangent at any point of is also a normal to the curve , then the value of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 227. | Given then in [0, 1] Lagrange’s mean value theorem is NOT applicable to the (where [⋅] and {⋅} represents greatest integer functions and fractional part functions, respectively) | | | | | | | |
|  | a) |  | b) | g | c) |  | d) |  |
| 228. | Which of the following pair(s) of curves is/are orthogonal? | | | | | | | |
|  | a) |  | | | b) | at | | |
|  | c) |  | | | d) |  | | |
| 229. | Which of the following hold(s) good for the function ? | | | | | | | |
|  | a) | has two points of extremum | | | | | | | |
|  | b) | is concave upward for | | | | | | | |
|  | c) | is non-differentiable function | | | | | | | |
|  | d) | is continuous function | | | | | | | |
| 230. | In which of the following functions, Rolle’s theorem is applicable? | | | | | | | |
|  | a) | in | | | b) | in | | |
|  | c) | in | | | d) | in | | |
| 231. | Let and , then | | | | | | | |
|  | a) | Range of is | | | b) | is one-one | | |
|  | c) | Both and g are one-one | | | d) | Both and g are onto | | |
| 232. | For the cubic function , which one of the following statement/statements hold good? | | | | | | | |
|  | a) | is non-monotonic | | | | | | | |
|  | b) | increase in and decreases in | | | | | | | |
|  | c) | is bijective | | | | | | | |
|  | d) | Inflection point occurs at | | | | | | | |
| 233. | The function has no maxima or minima if | | | | | | | |
|  | a) |  | | | b) |  | | |
|  | c) |  | | | d) | None of these | | |
| 234. | Which of the following is true about point of extremum of function ? | | | | | | | |
|  | a) | At , function may be discontinuous | | | | | | | |
|  | b) | At , function may be continuous but non-differentiable | | | | | | | |
|  | c) | At , function may have point of inflection | | | | | | | |
|  | d) | None of these | | | | | | | |
| 235. | Let , then | | | | | | | |
|  | a) | increases on | | | b) | decreases on | | |
|  | c) | has a minimum at | | | d) | has neither maximum nor minimum | | |
| 236. | Let for every real number , then | | | | | | | |
|  | a) | is increasing whenever is increasing | | | b) | is increasing whenever is decreasing | | |
|  | c) | is decreasing whenever is decreasing | | | d) | is decreasing whenever is increasing | | |
| 237. | Which one of the following curves cut the parabola at right angles? | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| 238. | Let , where and are constants. Then at has | | | | | | | |
|  | a) | A maxima whenever | | | | | | | |
|  | b) | A maxima whenever | | | | | | | |
|  | c) | Minima whenever | | | | | | | |
|  | d) | Neither a maxima nor a minima whenever | | | | | | | |
| 239. | Let , then which of the following is/are true | | | | | | | |
|  | a) | has only one real root which is positive if | | | | | | | |
|  | b) | has only one real root which is negative if | | | | | | | |
|  | c) | has only one real root which is negative if | | | | | | | |
|  | d) | None of these | | | | | | | |

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| **Assertion - Reasoning Type** | | | |
| This section contain(s) 0 questions numbered 240 to 239. 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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| 240 |  | | |
|  | **Statement 1:** | | The function , is increasing function of , then |
|  | **Statement 2:** | | for all |

|  |  |  |  |
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| 241 |  | | |
|  | **Statement 1:** | | Both and are increasing for |
|  | **Statement 2:** | | If is increasing then its inverse is also increasing |

|  |  |  |  |
| --- | --- | --- | --- |
| 242 |  | | |
|  | **Statement 1:** | | If is differentiable in such that , then for any , there exists such that |
|  | **Statement 2:** | | If is differentiable in , where , then there exists such that |

|  |  |  |  |
| --- | --- | --- | --- |
| 243 |  | | |
|  | **Statement 1:** | | The ordinate of a point describing the circle decreases at the rate of 1.5 cm/s. The rate of change of the abscissa of the point when ordinate equals 4 cm is 2 cm/s |
|  | **Statement 2:** | |  |

|  |  |  |  |
| --- | --- | --- | --- |
| 244 | Let be a continuous function defined by | | |
|  | **Statement 1:** | | for some |
|  | **Statement 2:** | | for all |

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| --- | --- | --- | --- |
| 245 |  | | |
|  | **Statement 1:** | | Lagrange’s mean value theorem is not applicable to |
|  | **Statement 2:** | | is not differentiable at |

|  |  |  |  |
| --- | --- | --- | --- |
| 246 |  | | |
|  | **Statement 1:** | | For all the function has exactly one extremum |
|  | **Statement 2:** | | If a cubic function is monotonic, then its graph cuts the -axis only once |

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| 247 | Observe the following statements  Then which of the following is true? | | |
|  | **Statement 1:** | | is increasing outside the interval (1, 2) |
|  | **Statement 2:** | | for |

|  |  |  |  |
| --- | --- | --- | --- |
| 248 |  | | |
|  | **Statement 1:** | | The points on the curve at which the tangent is parallel to -axis lies on a straight line |
|  | **Statement 2:** | | Tangent is parallel to -axis, then or |

|  |  |  |  |
| --- | --- | --- | --- |
| 249 |  | | |
|  | **Statement 1:** | | has point of minima at |
|  | **Statement 2:** | | is non-differentiable at |

|  |  |  |  |
| --- | --- | --- | --- |
| 250 |  | | |
|  | **Statement 1:** | | If , then Rolle’s theorem applies for in |
|  | **Statement 2:** | | LMVT is applied in in any interval |

|  |  |  |  |
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| 251 |  | | |
|  | **Statement 1:** | | has positive point of maxima for |
|  | **Statement 2:** | | has both roots positive for |

|  |  |  |  |
| --- | --- | --- | --- |
| 252 |  | | |
|  | **Statement 1:** | | If , then has neither maximum nor minimum at |
|  | **Statement 2:** | | changes sign from negative to positive at |

|  |  |  |  |
| --- | --- | --- | --- |
| 253 |  | | |
|  | **Statement 1:** | | The maximum value of  (where ) is 36 |
|  | **Statement 2:** | | The maximum distance between the point and the point on the circle is 6 |

|  |  |  |  |
| --- | --- | --- | --- |
| 254 | Consider a curve and a straight line | | |
|  | **Statement 1:** | | The set of values of ‘’ for which the line intersects the curve at three distinct points is |
|  | **Statement 2:** | | The line is always passing through point of inflection of the curve |

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| 255 |  | | |
|  | **Statement 1:** | | If is continuous in and differentiable in , then there exists at least one , then |
|  | **Statement 2:** | |  |

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| --- | --- | --- | --- |
| 256 | Let | | |
|  | **Statement 1:** | | is neither maximum nor minimum at |
|  | **Statement 2:** | | If a function is a point of inflection, then it is not a point of extremum |

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| 257 |  | | |
|  | **Statement 1:** | | If , then is positive for all |
|  | **Statement 2:** | | is increasing for and decreasing for |

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| --- | --- | --- | --- |
| 258 |  | | |
|  | **Statement 1:** | | Both and are decreasing functions in |
|  | **Statement 2:** | | If a differentiable function decreases in an interval , then its derivative also decreases in |

|  |  |  |  |
| --- | --- | --- | --- |
| 259 |  | | |
|  | **Statement 1:** | | The function is decreasing for every |
|  | **Statement 2:** | | is increasing for and has no point of inflection |

|  |  |  |  |
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| 260 |  | | |
|  | **Statement 1:** | | is increasing for |
|  | **Statement 2:** | | If is increasing, then may vanish at some finite number of points |

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| 261 |  | | |
|  | **Statement 1:** | | If is a differentiate function and Rolle’s theorem is not applicable to in , then has at least one root in |
|  | **Statement 2:** | | If , then Rolle’s theorem is applicable for |

|  |  |  |  |
| --- | --- | --- | --- |
| 262 |  | | |
|  | **Statement 1:** | | The tangent at to the curve again meets the curve at |
|  | **Statement 2:** | | When the equation of a tangent solved with the given curve, repeated roots are obtained at point of tangency |

|  |  |  |  |
| --- | --- | --- | --- |
| 263 | Let is differentiable and strictly increasing function throughout its domain | | |
|  | **Statement 1:** | | If is also strictly increasing function, then has no real roots |
|  | **Statement 2:** | | When or , but cannot be equal to zero |

|  |  |  |  |
| --- | --- | --- | --- |
| 264 |  | | |
|  | **Statement 1:** | | The function In is increasing in |
|  | **Statement 2:** | | If both and are increasing in then must be increasing in |

|  |  |  |  |
| --- | --- | --- | --- |
| 265 |  | | |
|  | **Statement 1:** | | If both functions and are continuous on the closed interval , differentiable on the open interval , and is not zero on that open interval, then there exists some in , such that |
|  | **Statement 2:** | | If and are continuous and differentiable in , then there exists some in () such that and from Lagrange’s mean value theorem |

|  |  |  |  |
| --- | --- | --- | --- |
| 266 |  | | |
|  | **Statement 1:** | | A tangent parallel to -axis can be drawn for in the interval [1, 3] |
|  | **Statement 2:** | | A horizontal tangent can be drawn in Rolle’s theorem |

|  |  |  |  |
| --- | --- | --- | --- |
| 267 |  | | |
|  | **Statement 1:** | | Let in , then is decreasing in |
|  | **Statement 2:** | | is a decreasing function |

|  |  |  |  |
| --- | --- | --- | --- |
| 268 | Observe the statement given below  Which of the following is correct? | | |
|  | **Statement 1:** | | has the maximum at |
|  | **Statement 2:** | | and |

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| --- | --- | --- | --- |
| 269 |  | | |
|  | **Statement 1:** | | , for 2.91 |
|  | **Statement 2:** | | is a decreasing function for |

|  |  |  |  |
| --- | --- | --- | --- |
| 270 | Let is a polynomial of degree odd with real coefficients and is any point | | |
|  | **Statement 1:** | | There always exists a line passing through and touching the curve at some point |
|  | **Statement 2:** | | A polynomial of degree odd with real coefficients have at least one real root |

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| --- | --- | --- | --- |
| 271 |  | | |
|  | **Statement 1:** | | If , then the equation has at least one real root lying between (0, 3) |
|  | **Statement 2:** | | If is continuous in derivable in such that , then at least one point such that |

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| --- | --- | --- | --- |
| 272 |  | | |
|  | **Statement 1:** | | The value of is 1, where denotes the greatest integer function |
|  | **Statement 2:** | | For |

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| --- | --- | --- | --- |
| 273 |  | | |
|  | **Statement 1:** | | For the function , LMVT is application in and the value of is 3/2 because |
|  | **Statement 2:** | | If LMVT is known to be applicable for any quadratic polynomial in then of LMVT is |

|  |  |  |  |
| --- | --- | --- | --- |
| 274 |  | | |
|  | **Statement 1:** | | If Rolle’s theorem be applied in , then Lagrange Mean Value Theorem (LMVT) is also applied in |
|  | **Statement 2:** | | Both Rolle’s theorem and LMVT cannot be applied in |

|  |  |  |  |
| --- | --- | --- | --- |
| 275 |  | | |
|  | **Statement 1:** | | The graph has extremum, if |
|  | **Statement 2:** | | is either increasing or decreasing |

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| --- | --- | --- | --- |
| 276 |  | | |
|  | **Statement 1:** | | Let , then at the function attains neither the least value nor the greatest value |
|  | **Statement 2:** | | At , first derivative does not exist |

|  |  |  |  |
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| 277 |  | | |
|  | **Statement 1:** | | Let be a function such that. Then, is  one-one |
|  | **Statement 2:** | | is decreasing function |

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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**. | | | | | | | | | |

| 278. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** |  | | (p) | | Has no points of extrema | |
|  | **(B)** |  | | (q) | | Has one point of maxima | |
|  | **(C)** |  | | (r) | | Has one point of minima | |
|  | **(D)** |  | | (s) | | Has infinite points of minima | |
|  | **CODES :** | | | | | | | |

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

| 279. | Consider function | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | Two negative real roots | | (p) | | For | |
|  | **(B)** | Two real roots of opposite sign | | (q) | | For | |
|  | **(C)** | Four real roots | | (r) | | For | |
|  | **(D)** | No real roots | | (s) | | For or | |
|  | **CODES :** | | | | | | | |

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

| 280. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | The sides of a triangle vary slightly in such a way that its circum-radius remains constant, if  then the values of is | | (p) | | 1 | |
|  | **(B)** | The length of sub-tangent to the curve at the point is then the value of is | | (q) | |  | |
|  | **(C)** | The curve intersects the -axis at an angle then the value of is | | (r) | | 2 | |
|  | **(D)** | The area of a triangle formed by normal at the point (1, 0) on the curve with axes is | sq. units, then the value of is | | (s) | |  | |
|  | **CODES :** | | | | | | | |

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

| 281. |  | | | | | | | | |

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

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

| 282. | Let and | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | Both and are the points of minima if | | (p) | | is even | |
|  | **(B)** | is a point of minima and is a point of inflection if | | (q) | | is odd | |
|  | **(C)** | is a point of minima and is a point of inflection if | | (r) | | is even | |
|  | **(D)** | Both and are the points of inflection if | | (s) | | is odd | |
|  | **CODES :** | | | | | | | |

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

| 283. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | A circular plate is expanded by heat from radius 6 cm to 6.06 cm. Approximate increase in the area is | | (p) | | 5 | |
|  | **(B)** | If an edge of a cube increases by 2%, then the percentage increase in the volume is | | (q) | |  | |
|  | **(C)** | If the rate of decrease of is thrice the rate of decrease of , then is equal to (rate of increase is non-zero) | | (r) | |  | |
|  | **(D)** | The rate of increase in the area of an equilateral triangle of side 30 cm, when each side increase at the rate of 0.1 cm/s is | | (s) | |  | |
|  | **CODES :** | | | | | | | |

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

| 284. | Match the points on the curve with the slopes of normals at those points and choose the correct answer. | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | (7, 2) | | (1) | |  | |
|  | **(B)** |  | | (2) | | -8 | |
|  | **(C)** | (1, -1) | | (3) | | 4 | |
|  | **(D)** |  | | (4) | | 0 | |
|  |  |  | | (5) | |  | |
|  | **CODES :** | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **A** | **B** | **C** | **D** |  |  |
|  | **a)** | 2 | 4 | 3 | 1 |  |  |
|  | **b)** | 2 | 5 | 3 | 1 |  |  |
|  | **c)** | 2 | 3 | 5 | 1 |  |  |
|  | **d)** | 2 | 5 | 1 | 4 |  |  |

| 285. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | and | | (p) | |  | |
|  | **(B)** | an | | (q) | | Any one of or | |
|  | **(C)** | and | | (r) | |  | |
|  | **(D)** | and at other than origin | | (s) | |  | |
|  | **CODES :** | | | | | | | |

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

| 286. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** |  | | (p) | | has one point of minima | |
|  | **(B)** |  | | (q) | | has one point of maxima | |
|  | **(C)** |  | | (r) | | increases in | |
|  | **(D)** |  | | (s) | | decreases in | |
|  | **CODES :** | | | | | | | |

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

| 287. | The function has its non-zero local minimum and maximum values at and , respectively. If is a root of , then match the following | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | The value/values of | | (p) | | = 0 | |
|  | **(B)** | The value/values of | | (q) | | = 24 | |
|  | **(C)** | The value/values of | | (r) | | > 32 | |
|  | **(D)** | The value/values of | | (s) | |  | |
|  | **CODES :** | | | | | | | |

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

| 288. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** |  | | (p) | | Has points of maxima | |
|  | **(B)** |  | | (q) | | Has point of minima | |
|  | **(C)** |  | | (r) | | Has point of inflection | |
|  | **(D)** |  | | (s) | | Has no point of extrema | |
|  | **CODES :** | | | | | | | |

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

| 289. |  | | | | | | | | |

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|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** | At | | (p) | | Is increasing | |
|  | **(B)** | At | | (q) | | Is decreasing | |
|  | **(C)** | At | | (r) | | Has point of maxima | |
|  | **(D)** | At | | (s) | | Has point of minima | |
|  | **CODES :** | | | | | | | |

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

| 290. |  | | | | | | | | |

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| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Column-I** | | | **Column- II** | | | |
|  | **(A)** |  | | (p) | | Has point of minima | |
|  | **(B)** |  | | (q) | | Has point of maxima | |
|  | **(C)** |  | | (r) | | Is always increasing | |
|  | **(D)** |  | | (s) | | Is always decreasing | |
|  | **CODES :** | | | | | | | |

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

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| **Linked Comprehension Type**  This section contain(s) 35 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. 291 to -291** | | | | | | | | |
| A cubic fx=ax3+bx2+cx+d vanishes at x=-2 and has relative minimum/maximum at x=-1 and x=13 and if -11f(x)dx=143On the basis of above information, answer the following questions | | | | |

| 291. | The value of is | | | | | | | |
|  | a) |  | b) |  | c) | 0 | d) | 2 |
| **Paragraph for Question Nos. 292 to - 292** | | | | | | | | |

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| A window of fixed perimeter (including the base of the arch) is in the form of a rectangle surmounted by a semi-circle. The semi-circular portion is fitted with coloured glass, while the rectangular portion is fitted with clear glass. The clear glass transmits three times as much light per square metre as the coloured glass.Suppose that y is the length and x is the breath of the rectangular portion and P is the perimeter.On the basis of above information, answer the following questions | | | | |

| 292. | The ratio of the sides of the rectangle so that the window transmit the maximum light is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| **Paragraph for Question Nos. 293 to - 293** | | | | | | | | |

|  |  |  |  |  |
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| Consider the function f:-∞, ∞→(-∞,∞) defined byfx=x2+ax+1x2+ax+1;0<a<2On the basis of above information, answer the following questions | | | | |

| 293. | Which of the following is true? | | | | | | | |
|  | a) |  | | | | | | | |
|  | b) |  | | | | | | | |
|  | c) |  | | | | | | | |
|  | d) |  | | | | | | | |
| **Paragraph for Question Nos. 294 to - 294** | | | | | | | | |

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| Tangent at a point P1 [other than (0, 0)] on the curve y=x3 meets the curve again at P2. The tangent at P2 meets the curve again at P3 and so on | | | | |

| 294. | If has co-ordinates then the sum is (where are abscissas of respectively) | | | | | | | |
|  | a) | 2/3 | b) | 1/3 | c) | 1/2 | d) | 3/2 |
| **Paragraph for Question Nos. 295 to - 295** | | | | | | | | |

|  |  |  |  |  |
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| Consider the curve x=1-3t2, y=t-3t3. If a tangent at point (1-3t2, t-3t3) inclined at an angle θ to the positive x-axis and another tangent at point P(-2, 2) cuts the curve again at Q | | | | |

| 295. | The value of is equal to | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| **Paragraph for Question Nos. 296 to - 296** | | | | | | | | |

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| A spherical balloon is being inflated so that its volume increases uniformly at the rate of 40 cm3/min | | | | |

| 296. | At , its surface area increases at the rate | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| **Paragraph for Question Nos. 297 to - 297** | | | | | | | | |

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| --- | --- | --- | --- | --- |
| fx=sin-1x+x2-3x+x33, x∈[0, 1] | | | | |

| 297. | Which of the following is true about ? | | | | | | | |
|  | a) | has a point of maxima | | | b) | has a point of minima | | |
|  | c) | is increasing | | | d) | is decreasing | | |
| **Paragraph for Question Nos. 298 to - 298** | | | | | | | | |

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| Let f'sinx<0 and f''sinx>0 ∀ x∈0,π2 and gx=fsinx+f(cosx) | | | | |

| 298. | Which of the following is true? | | | | | | | |
|  | a) | g’ is increasing | | | b) | g’ is decreasing | | |
|  | c) | g’ has a point of minima | | | d) | g’ has a point of maxima | | |
| **Paragraph for Question Nos. 299 to - 299** | | | | | | | | |

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| Consider function f(x)=-x2+4x+a, x≤3ax+b, 3<x<4-b4x+6, x≥4(For questions 6 to 8 consider f(x) as a continuous function) | | | | |

| 299. | Which of the following is true? | | | | | | | |
|  | a) | is discontinuous function for any value of and | | | | | | | |
|  | b) | is continuous for finite number of values of and | | | | | | | |
|  | c) | cannot be differentiable for any value of and | | | | | | | |
|  | d) | is continuous for infinite values of and | | | | | | | |
| **Paragraph for Question Nos. 300 to - 300** | | | | | | | | |

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| If ϕ(x) is a differentiable real-valued function satisfying ϕ'x+2ϕ(x)≤1, then it can be adjusted as e2xϕ'x+2e2xϕ(x)≤e2x or ddxe2xϕx-e2x2≤0 or ddxe2xϕx-12≤0Here e2x is called integrating factor which helps in creating single differential coefficient as shown above. Answer the following questions: | | | | |

| 300. | If and for all , then | | | | | | | |
|  | a) |  | | | b) | is a constant function | | |
|  | c) |  | | | d) | None of these | | |
| **Paragraph for Question Nos. 301 to - 301** | | | | | | | | |

|  |  |  |  |  |
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| Let hx=fx-afx2+afx3 for every real number x | | | | |

| 301. | increases as increases for all real values of if | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| **Paragraph for Question Nos. 302 to - 302** | | | | | | | | |

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| --- | --- | --- | --- | --- |
| fx=x3-9x2+24x+c=0 has three real and distinct root α, β and γ | | | | |

| 302. | Possible values of are | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| **Paragraph for Question Nos. 303 to - 303** | | | | | | | | |

|  |  |  |  |  |
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| Consider the graph of y=gx=f'(x), given that fc=0, where y=f(x) is a polynomial function | | | | |

| 303. | The graph of will intersect the -axis | | | | | | | |
|  | a) | Twice | b) | Once | c) | Never | d) | None of these |
| **Paragraph for Question Nos. 304 to - 304** | | | | | | | | |

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| Let fx=4x2-4ax+a2-2a+2 and the global minimum value of f(x) for x∈[0, 2] is equal to 3 | | | | |

| 304. | The number of values of for which the global minimum value equal to 3 for occurs at the end point if interval [0, 2] is | | | | | | | |
|  | a) | 1 | b) | 2 | c) | 3 | d) | 0 |
| **Paragraph for Question Nos. 305 to - 305** | | | | | | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Let fx=x3-37-ax2-39-a2x+2 | | | | |

| 305. | The values of parameter if has a negative point of local minimum are | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| **Paragraph for Question Nos. 306 to - 306** | | | | | | | | |

|  |  |  |  |  |
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| Consider the function fx=1+1xx | | | | |

| 306. | The domain of is | | | | | | | |
|  | a) |  | b) |  | c) |  | d) |  |
| **Paragraph for Question Nos. 307 to - 307** | | | | | | | | |

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| Consider the function fx=x+cosx-a | | | | |

| 307. | Which of the following is not true about ? | | | | | | | |
|  | a) | It is an increasing function | | | b) | It is a monotonic function | | |
|  | c) | It has infinite points of inflection | | | d) | None of these | | |
| **Paragraph for Question Nos. 308 to - 308** | | | | | | | | |

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| Consider the function fx=3x4+4x3-12x2 | | | | |

| 308. | increases in the interval | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |
| **Paragraph for Question Nos. 309 to - 309** | | | | | | | | |

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| Consider the function f:R→R, fx=x2-6x+4x2+2x+4 | | | | |

| 309. | is | | | | | | | |
|  | a) | Unbounded function | b) | One-one function | c) | Onto function | d) | None of these |
| **Paragraph for Question Nos. 310 to - 310** | | | | | | | | |

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| Consider a polynomial y=Px of the least degree passing through A(-1, 1) and whose graph has two points of inflection B(1, 2) and C with abscissa 0 at which the curve is inclined to the positive axis of abscissa at an angle of sec-12 | | | | |

| 310. | The value of is | | | | | | | |
|  | a) |  | b) | 0 | c) | 1 | d) | 2 |
| **Paragraph for Question Nos. 311 to - 311** | | | | | | | | |

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| Let f(x) be a real-valued continuous function on R defined as fx=x2e-|x| | | | | |

| 311. | The values of for which the equation has four real roots | | | | | | | |
|  | a) |  | b) |  | c) |  | d) | None of these |

**Integer Answer Type**

| 312. | At the point on the graph of in the first quadrant a normal is drawn. The normal intersects the -axis at the point . If , then equals | | | | | | | |
| 313. | Let . If has a local maxima at , then greatest value of is | | | | | | | |
| 314. | Let be a non-constant thrice differentiable function defined on such that and . If is the minimum number or roots of in the interval [0, 6], then the value of is | | | | | | | |
| 315. | A right triangle is drawn in a semicircle of radius with one of its legs along the diameter. If the maximum area of the triangle is , then the value of is | | | | | | | |
| 316. | Consider be a polynomial of degree 5 having extremum at and . Then the value of is (where represents greatest integer function) | | | | | | | |
| 317. | The number of non-zero integral values of ‘’ for which the function is concave upward along the entire real line is | | | | | | | |
| 318. | Water is dropped at the rate of into a cone of semi-vertical angle . If the rate at which periphery of water surface changes when the height of the water in the cone is 2 m is , then the value of is | | | | | | | |
| 319. | For a cubic function at each point on it and it crosses the -axis at at an angle of with positive direction of the -axis. Then the value of is | | | | | | | |
| 320. | Number of integral values of for which the equation has 3 distinct solutions is | | | | | | | |
| 321. | The least area of a circle circumscribing any right triangle of area is | | | | | | | |
| 322. | If is an integer satisfying , where is a real number for which is greater than or equal to In, then the number of maximum possible values of (where represents the greatest integer function) | | | | | | | |
| 323. | If m is the minimum value of when and are subjected to the restrictions and , then the value of is | | | | | | | |
| 324. | Let be drawn with and for each real number the tangent to at , has intercept . If is of the form of , then has the value equal to | | | | | | | |
| 325. | Let , then the number of critical points on the graph of the function is | | | | | | | |
| 326. | Suppose are such that the curve is tangent to at (1, 0) and is also tangent to at (3, 4), then the value of equals | | | | | | | |
| 327. | Let , then number of times changes its sign in is | | | | | | | |
| 328. | A curve is given by the equations . If the tangent at where meets the curve again at , then is, where represents the greatest integer function | | | | | | | |
| 329. | From a given solid cone of height , another inverted cone is carved whose height is such that its volume is maximum. Then the ratio is | | | | | | | |
| 330. | There is a point on the graph of and a point on the graph of , where and . If the line through and is also tangent to both the curves at these points, respectively, then the value of is | | | | | | | |
| 331. | Let be a cubic polynomial which has local maximum at and has a local minimum has at . If and , then one fourth of the distance between its two horizontal tangents is | | | | | | | |
| 332. | A rectangle with one side lying along the -axis is to be inscribed in the closed region of the plane bounded by the lines and . If is the largest area of such a rectangle, then the value of is | | | | | | | |
| 333. | If the slope of line through the origin which is tangent to the curve is , then the value of is | | | | | | | |
| 334. | If is the minimum distance between the curves and , then the value of is | | | | | | | |
| 335. | The least integral value of where is monotonically decreasing is | | | | | | | |
| 336. | A curve is defined parametrically by the equations and . A variable pair of perpendicular lines through the origin ‘’ meet the curve at and . If the locus of the point of intersection of the tangents at and is , then the value of is | | | | | | | |
| 337. | Let be a curve defined by . The curve passes through the point and the slope of the tangent at is . Then the value of is | | | | | | | |
| 338. | Let then number of points where attains its minimum value is | | | | | | | |
| 339. | If the curve in the plane has the equation , then the fourth power of the greatest distance of a point on from the origin, is | | | | | | | |

**ACTIVE SITE TUTORIALS**

**Date :** 07-09-2019 **TEST ID: 607**

**Time :** 20:06:00 **MATHEMATICS**

**Marks :** 1187

6.APPLICATION OF DERIVATIVES

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| **: ANSWER KEY :** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **1) c 2) b 3) c 4) b**  **5) b 6) a 7) d 8) d**  **9) a 10) a 11) b 12) c**  **13) b 14) a 15) c 16) c**  **17) d 18) b 19) a 20) d**  **21) a 22) a 23) d 24) b**  **25) c 26) c 27) a 28) b**  **29) d 30) c 31) b 32) c**  **33) c 34) d 35) d 36) a**  **37) d 38) b 39) b 40) d**  **41) d 42) b 43) c 44) b**  **45) d 46) a 47) c 48) d**  **49) d 50) d 51) d 52) d**  **53) c 54) a 55) c 56) a**  **57) c 58) d 59) c 60) b**  **61) a 62) a 63) a 64) b**  **65) c 66) b 67) a 68) d**  **69) b 70) d 71) b 72) d**  **73) c 74) b 75) b 76) d**  **77) a 78) c 79) a 80) c**  **81) c 82) b 83) d 84) d**  **85) b 86) d 87) a 88) b**  **89) c 90) a 91) b 92) d**  **93) d 94) b 95) b 96) d**  **97) a 98) c 99) c 100) a**  **101) a 102) d 103) a 104) c**  **105) a 106) b 107) b 108) a**  **109) c 110) a 111) c 112) d**  **113) d 114) c 115) a 116) c**  **117) a 118) b 119) a 120) b**  **121) a 122) b 123) d 124) b**  **125) b 126) a 127) b 128) b**  **129) b 130) b 131) a 132) d**  **133) d 134) b 135) c 136) b**  **137) a 138) d 139) b 140) d**  **141) c 142) d 143) d 144) a**  **145) a 146) d 147) a 148) d**  **149) b 150) c 151) a 152) b**  **153) b 154) a 155) a 156) a**  **157) c 158) c 159) b 160) d**  **161) c 162) b 163) a 164) d**  **165) a 166) a 167) a 168) a**  **169) b 170) d 171) d 172) c**  **173) a 174) b 1) b,d 2) a,b 3) b,c 4) a,b,c,d**  **5) a,b,c,d 6) a,b,d 7) b,c 8) b,c**  **9) a,b,d 10) a 11) a,d 12) a,b,c,d**  **13) c 14) b,c 15) a,c 16) a,b,c**  **17) a,d 18) a,b,c 19) a,b,c 20) a,b,c**  **21) a,b 22) a,c,d 23) a,c,d 24) a,b,c**  **25) a,b,d 26) b,c 27) a,d 28) b,d**  **29) a,b,c,d 30) a,b,c,d 31) a,b,c,d 32) c,d**  **33) a,b,c,d 34) c 35) d 36) a,b,d**  **37) a,c 38) a,c,d 39) a,b,c 40) c,d**  **41) b 42) a,c 43) a,d 44) a,c,d**  **45) a,c 46) a,b 47) b,c,d 48) a,b**  **49) a,b,c 50) a,b,d 51) a,b,c 52) a,b**  **53) a,b,d 54) a,b,c,d 55) a,b,c,d 56) d**  **57) a,b,c,d 58) a,b,d 59) a,b,c 60) a,b,c**  **61) a,c 62) a,c 63) b,d 64) a,c**  **65) a,b,c 1) d 2) a 3) a 4) a**  **5) c 6) d 7) a 8) b**  **9) d 10) d 11) b 12) a**  **13) c 14) a 15) b 16) b**  **17) c 18) a 19) c 20) a**  **21) b 22) c 23) d 24) a**  **25) c 26) c 27) b 28) b**  **29) a 30) a 31) a 32) a**  **33) b 34) a 35) b 36) a**  **37) d 38) c 1) b 2) a 3) a 4) d**  **5) a 6) b 7) b 8) c**  **9) b 10) c 11) a 12) b**  **13) d 1) b 2) b 3) a 4) a**  **5) a 6) b 7) b 8) a**  **9) d 10) a 11) a 12) a**  **13) b 14) b 15) a 16) c**  **17) d 18) c 19) d 20) c**  **21) c 1) 2 2) 9 3) 6 4) 9**  **5) 2 6) 4 7) 5 8) 3**  **9) 1 10) 9 11) 9 12) 3**  **13) 4 14) 3 15) 9 16) 4**  **17) 3 18) 3 19) 5 20) 8**  **21) 5 22) 9 23) 8 24) 4**  **25) 7 26) 5 27) 1 28) 4** | | | | |

**ACTIVE SITE TUTORIALS**

**Date :** 07-09-2019 **TEST ID: 607**

**Time :** 20:06:00 **MATHEMATICS**

**Marks :** 1187

6.APPLICATION OF DERIVATIVES

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| **: HINTS AND SOLUTIONS :** |

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| 1 | **(c)** | | | | | | | |
| 2 | **(b)**  Clearly, in decreasing just before and increasing after . For to be the point of local minima, | | | | | | | |
| 3 | **(c)**  Differentiate w.r.t. ,  Put  At will be maximum,  So  **Alternative method:**  Since A.M. G.M.  Hence, maximum value of is | | | | | | | |
| 4 | **(b)**  We have  Now, | | | | | | | |
| 5 | **(b)**  and the percent error in measuring  The percent error in measuring volume  Now, | | | | | | | |
| 6 | **(a)**  For Lagrange’s Mean value theorem we know, should be continuous in [a, b] and differentiable in] a, b [.  Which is clearly not differentiable at at LHD at Lagrange’s Mean Value is not applicable.  Where option, (b), (c), (d) are continuous and differentiable. | | | | | | | |
| 7 | **(d)**    Let  Now, area of rectangle  (using A.M. G.M.) | | | | | | | |
| 8 | **(d)**  Since is increasing for all , therefore for all  for all | | | | | | | |
| 9 | **(a)**  Here  Then situations for is as follow:    Given that decreases in the largest possible interval , then must have roots and  Product of roots is | | | | | | | |
| 10 | **(a)**  Consider the function on [0, 1] then being a polynomial, it is continuous on [0, 1] and differentiable on (0, 1) and  [as given ]  By Rolle’s theorem, there exists at least one such that  Thus, equation has at least one root in [0, 1] | | | | | | | |
| 12 | **(c)**  Given,  Now,  Is an odd function.  Also,  Which is strictly increasing in | | | | | | | |
| 13 | **(b)**  For the continuous domain in  and in  So the required largest continuous interval is , length | | | | | | | |
| 14 | **(a)**  Putting in the given curve, we obtain  So, the given point is (0, 1)  Now,  The equation of the tangent at (0, 1) is  (1)  Required distance = length of the from (0, 0) on (1) | | | | | | | |
| 15 | **(c)**  Function is increasing in , function is decreasing in    is local maxima, local minima  Derivable  Continuous | | | | | | | |
| 16 | **(c)**  (1)  (2)  (slope of the tangent)  Slope of the normal  Equation of the normal is  As varies, inclination is not constant. Therefore, (a) is not correct  Clearly, it does not pass through (0, 0)  Its distance from the origin ,  Which is a constant | | | | | | | |
| 17 | **(d)**  Differentiating w.r.t. , we get  But  , | | | | | | | |
| 18 | **(b)**  Given  Now  or  Where  The other value of rejected as both and are accute angles  If positive and if  Hence maximum when and maximum value | | | | | | | |
| 19 | **(a)**    Given curve is (1)  Sub-normal at (2)  From (1), we get  (3)  Now,  [from (3)]  Mean proportion | | | | | | | |
| 20 | **(d)**  at (0, 1). Equation of the tangent is  Point of intersection with -axis is , where | | | | | | | |
| 21 | **(a)**    From geometry, we have  Now, the volume of cylinder,  Now, let  Hence, | | | | | | | |
| 22 | **(a)**  and  Then, the slope of the tangent | | | | | | | |
| 23 | **(d)**  If has an extremum at , then at  Now, | | | | | | | |
| 24 | **(b)**  We must have | | | | | | | |
| 25 | **(c)**  . So and have opposite sign | | | | | | | |
| 26 | **(c)**    Equation of the tangent at (1, 1) is    -intercept  and -intercept    Given area of triangle is =2 | | | | | | | |
| 27 | **(a)**  Here,  (As we know, if for all  Now,  (where  for all  Hence, is strictly increasing function. | | | | | | | |
| 28 | **(b)**  when  (1)  Also  ; when | | | | | | | |
| 29 | **(d)**    Let  Also  Now,  For to be minimum | | | | | | | |
| 30 | **(c)**  Given  Clearly, the minimum value occurs when as | | | | | | | |
| 31 | **(b)**  We know that there exists at least one in (0, 1) for which  or or for at least one in(0, 1) | | | | | | | |
| 32 | **(c)**  gives and for all  is minimum for | | | | | | | |
| 33 | **(c)**  For decreasing function, | | | | | | | |
| 34 | **(d)**  Here, | | | | | | | |
| 35 | **(d)**  If , then , therefore is increasing on  If , then  and [ lies between 0 and 1 radian]  is increasing on (0, 1)  If , then  is increasing in | | | | | | | |
| 36 | **(a)**    at  or ( is not possible)  Now, and | | | | | | | |
| 37 | **(d)**  We have  Given  So, is decreasing on (0, 2)  Let  Thus,  decreasing in  and increasing in | | | | | | | |
| 38 | **(b)**  Differentiating w.r.t., , we get  This holds for | | | | | | | |
| 39 | **(b)**  Any point on the parabola or is or  For its minimum distance from the circle means its distance from the centre of the circle  Let be the distance, then  hence minimum  point is | | | | | | | |
| 40 | **(d)**  From the graph, it is clear that both and in the internal are the decreasing functions    Therefore, is correct  To disprove let us consider the counter example,  in  So that  Again from the graph, it is clear that is increasing in , but is decreasing in  Therefore, is wrong. Therefore, **d**. is the correct option | | | | | | | |
| 41 | **(d)**  if  and if | | | | | | | |
| 42 | **(b)**  Length of sub-normal = length of sub-tangent  If , equation of the tangent  , area of  If , equation of the tangent is  , area | | | | | | | |
| 43 | **(c)**  Given that  for all | | | | | | | |
| 44 | **(b)**  By Lagrange’s mean value theorem,  Thus, | | | | | | | |
| 45 | **(d)**  Now as and keep opposite sign, then  Hence is decreasing | | | | | | | |
| 46 | **(a)**  will have maxima at only if | | | | | | | |
| 47 | **(c)**    or  area  or or  or  Therefore, is maximum when | | | | | | | |
| 48 | **(d)**  In cot  Slope of the tangent | | | | | | | |
| 49 | **(d)**  If increases then increases. Refer figure    If increases, then  decreases  If and are functions and and , then | | | | | | | |
| 50 | **(d)**  , where  For invertible, must be monotonic  or  or  or  or | | | | | | | |
| 51 | **(d)**  Differentiating w. r.t. , we get  Differentiating w.r.t. ,  We have  Thus, both the curves intersect at right angle | | | | | | | |
| 52 | **(d)**  Let  Now the least value of is  And the greatest value of  is strictly an increasing function also and  Thus, for the given interval, never becomes zero  Hence, the number of roots is zero | | | | | | | |
| 53 | **(c)**  Differentiating w.r.t. , we have  Equation of the tangent at  gives , and gives  Now, | | | | | | | |
| 54 | **(a)**    From the graph and is the point of maxima | | | | | | | |
| 55 | **(c)**  Consider the function (1)  When ,  has maxima at  Since , either or is the greatest term of the sequence  and and  is the greatest term | | | | | | | |
| 56 | **(a)**  Let the required point be  Now,  The equation of the normal at is  If it passes through the origin, then  (1)  Since lies on the given curve  Therefore, (2)  Solving equations (1) and (2), we obtain and  Hence, the required point is | | | | | | | |
| 57 | **(c)**  and  Clearly  Also, is increasing whereas g is decreasing  Thus | | | | | | | |
| 58 | **(d)**  Since is increasing  So,  Also,  So, is increasing in | | | | | | | |
| 59 | **(c)**  , i.e., | | | | | | | |
| 60 | **(b)**  Since for all . Therefore, for all | | | | | | | |
| 61 | **(a)**  Given  is an increasing function  Since is a polynomial | | | | | | | |
| 62 | **(a)**    Let be the height of the cone and be its semi-vertical angle. Suppose that is the radius of the inscribed cylinder and be its height volume of the cylinder  Also, (1)  So, or ;  So, is maximum when  [from (1)]  Hence, | | | | | | | |
| 63 | **(a)**  Here . Putting in , we get  So, the point is )  Differentiating w.r.t.  or | | | | | | | |
| 64 | **(b)**  and  For maximum/minimum,  or  Now,  and  is maximum at and minimum at  and  Given that | | | | | | | |
| 65 | **(c)**  When , then must also be zero and sign of will decide about maximum or minimum | | | | | | | |
| 66 | **(b)**  Let ,  Which is continuous and differentiable  So, according to Rolle’s theorem, there exists at least one root of in | | | | | | | |
| 67 | **(a)**  Since is least  We have to find the values of in the interval  and the other factor when equated to zero gives  Now,  Put and  is minimum and its value is | | | | | | | |
| 68 | **(d)**  Given,  Differentiating both sides, we get  Thus, when and , | | | | | | | |
| 69 | **(b)**  Now  and also  Thus, is decreasing | | | | | | | |
| 70 | **(d)**    Hence | | | | | | | |
| 71 | **(b)**  Applying LMVT in [0, 1] to the function , we get  , for some  for some  But in (0, 1) | | | | | | | |
| 72 | **(d)**  Using Lagrange’s mean value theorem, for some  such that | | | | | | | |
| 73 | **(c)**  The equation of the line is , i.e.,  Let the line touches the curve at  and  or  . So, | | | | | | | |
| 74 | **(b)**    Clearly is neither a point of maxima nor a point of minima as derivative does not change sign at  is a point of maxima and is a point of minima | | | | | | | |
| 75 | **(b)**  Let the slope of tangent to the curve at any point be (say)  for all  Therefore, is maximum when , i.e., when  Therefore, maximum slope | | | | | | | |
| 76 | **(d)**  The graph of is upward parabola as coefficient of is  The range of is , where is discriminant of | | | | | | | |
| 77 | **(a)**  Slope of the normal at (2, 3) is  Also, (2, 3) lies on the curve | | | | | | | |
| 78 | **(c)**  For maximum or minimum  For changes sign from positive to negative as passes through 1  Therefore, is maximum for , and maximum value | | | | | | | |
| 79 | **(a)**  Here  For  Hence, is increasing in | | | | | | | |
| 80 | **(c)**  Solving and  We have  Points of intersection of the curves and are  Since both the curves are symmetrical about the -axis, points of intersection are also symmetrical  Now,  And | | | | | | | |
| 81 | **(c)**  is always increasing or decreasing as is either always negative or positive | | | | | | | |
| 82 | **(b)**  For ,  increases for and decreases for    From the graph, decreases in | | | | | | | |
| 83 | **(d)**  and , hence is neither a maximum nor a minimum | | | | | | | |
| 84 | **(d)**  Let there be a value of for which has two distinct roots between 0 and 1  Let be two distinct roots of lying between 0 and 1 such that . Let . Then . Since between any two roots of a polynomial , there exists at least one root of its derivative . Therefore, has at least one root between and . But has two roots equal to which do not lie between and . Hence has no real roots lying between 0 and 1 for any value of | | | | | | | |
| 85 | **(b)**    Let rectangle is inscribed  Its area,  Now and are similar, i.e.,  where  Now . Now for  increases. Hence occurs when  Hence, max area | | | | | | | |
| 86 | **(d)**  vanishes at points where  Hence  Also , if  Since the function has a derivative at any interior point of the interval (0, 1), also continuous in [0, 1] and . Hence, Rolle’s theorem is applicable to any one of the interval  Hence, there exists at least one in each of these intervals where infinite points | | | | | | | |
| 87 | **(a)**  Clearly, is the point of local maxima | | | | | | | |
| 88 | **(b)**  Sign scheme of    , if decreases if | | | | | | | |
| 89 | **(c)**  (1)  Equation of the tangent at is  For -intercept, put  -intercept is proportional to the cube of abscissa | | | | | | | |
| 90 | **(a)**  , which is the point of maxima | | | | | | | |
| 91 | **(b)**  Equation of tangent at is  Thus, sum of intercepts [say]  Put  Also, for and for  Minimum at | | | | | | | |
| 92 | **(d)**  To satisfy Rolle’s theorem, it should be continuous in [0, 1].  =0  =0  Which shows otherwise, it would be discontinuous also when  is the possible answer. | | | | | | | |
| 93 | **(d)**  Slope of the tangent is  Therefore, slope of the normal | | | | | | | |
| 94 | **(b)**    Let | | | | | | | |
| 95 | **(b)**  for all  is increasing in  So, the absolute minimum | | | | | | | |
| 96 | **(d)**    Satisfies conditions of Rolle’s theorem in [1, 3]  (1)  and  (2)  From equations (1) and (2), we get | | | | | | | |
| 97 | **(a)**  Since the same line is tangent at one point and normal at other point  Tangent at will be perpendicular to tangent at  Slope of tangent changes from positive to negative or negative to positive. Therefore, it takes the value zero somewhere. Thus, there exists a point where | | | | | | | |
| 98 | **(c)**  We have  Let , then  Now or  and  the maximum value | | | | | | | |
| 99 | **(c)**  is a decreasing function | | | | | | | |
| 100 | **(a)**    Area of trapezium,  For maximum area,  is acute) | | | | | | | |
| 101 | **(a)**    Let the charges for railway line be Rs/km  Now the total for eight charges,  Let | | | | | | | |
| 102 | **(d)**  Consider a function  Since is continuous, is also continuous in [0, 1] and differentiable in (0, 1)  As  Hence Rolle’s theorem is applicable for  Therefore, there exists at least one such that | | | | | | | |
| 103 | **(a)**  We have  and  Now  for  Therefore, has local minima at | | | | | | | |
| 104 | **(c)**    Let be an isosceles triangle in which a circle of radius is inscribed  Let (semi-vertical angle)  In  In  Now, the perimeter of the is  or  For maximum or minimum of  ( as is an acute angle)  Now if is little less and little greater than , then sign of changes from –ve to +ve. Hence is minimum when , which is the point of minima  Hence, the least perimeter of the | | | | | | | |
| 105 | **(a)**  Hence is the point of maxima | | | | | | | |
| 106 | **(b)**  Let  Clearly, critical points are 0, 1/4 and 1  Sign scheme of    Thus, is the point of maxima | | | | | | | |
| 107 | **(b)**  We have  Since, attains its extremum values at  and  and and | | | | | | | |
| 108 | **(a)**    Given volume and  Now, volume of cone + volume of cylinder  Now, surface area,  Now, let | | | | | | | |
| 109 | **(c)**  The dimensions of the box after cutting equal squares of side on the corner will be  and height  or  gives for which is ve and hence maximum | | | | | | | |
| 110 | **(a)**  Its maximum value when  i.e., when | | | | | | | |
| 111 | **(c)**  We do not know the sign of in , so we cannot say about the sign of | | | | | | | |
| 112 | **(d)**  For  and  At changes sign from +ve to ve and hence is maximum at and its value is | | | | | | | |
| 113 | **(d)**  The derivative of a degree 3 polynomial is quadratic. This must have either 0, 1 or 2 roots. If this has precisely one root, then this must be repeated. Hence, we have , where is the repeated root and . So, our original function has a critical point at  Also, , in which case . But we are told that the 2nd derivative is non-zero at critical point. Hence, there must be either 0 or 2 critical points | | | | | | | |
| 114 | **(c)**    Let be the radius and the height of the cylinder gas container. Also let be the thickness of the plates forming the cylindrical sides. Therefore, the thickness of the plate forming the top will be  Capacity of the vessel = vol. of cylinder  (Given) (1)  Now, the volume of the iron plate used for construction of the container is given by  For maximum or minimum of  For this value of is  Hence, is minimum when  Now  Hence, the required ratio is 4:5 | | | | | | | |
| 115 | **(a)**    Let  Hence, decreases in | | | | | | | |
| 116 | **(c)**  Then given expression is minimum when is minimum, which is so when  Hence  Min. value of is | | | | | | | |
| 117 | **(a)**  Slope of normal at point is  Also point lies on the curve and slope of is  Hence the normal meets the curve again at point | | | | | | | |
| 118 | **(b)**  Thus, and  Hence, is a point of minima | | | | | | | |
| 119 | **(a)**  For ,  Also, for  decreases in  Similarly, we can check for other given options say for  Here decreases only in , otherweise in other intervals is constant | | | | | | | |
| 120 | **(b)**  Since has a relative minimum at , therefore and  If the function has a relative minimum at , then  at for  Now,  Hence, has a relative minimum at if and can attain any real value | | | | | | | |
| 121 | **(a)**  , then  Also  But for the given constraint on and , no such exists. Hence, no such tangent exists | | | | | | | |
| 122 | **(b)**  We have  Clearly does not exist at  Now,  Clearly, for any other values of  The value of at is 2  Hence, the greatest value of | | | | | | | |
| 123 | **(d)**  We have  Clearly range of f is  Now,  and  Sign scheme of    is decreasing on and increasing on  Therefore, has a local minimum at | | | | | | | |
| 124 | **(b)**  Fuel charges . Let represents fuel charges  (1)  Given that Rs. 48 per hour, km per hour  From (1),  Let the train covers km in hours  or  Fuel charges in time  Total cost for running the train,  and  For the maximum or minimum value of  . Also,  is minimum when | | | | | | | |
| 125 | **(b)**    Let . From similar triangle property, we get  , when | | | | | | | |
| 126 | **(a)**  Let  is a point of maxima for | | | | | | | |
| 127 | **(b)**  Let  is an increasing function and  Therefore, and | | | | | | | |
| 128 | **(b)**  Let  for  is increasing in [2, 3] | | | | | | | |
| 129 | **(b)**  If (as is an increasing function)  If | | | | | | | |
| 130 | **(b)**    Let be a tangent to  for  (for the line to be tangent )  (1)  Again , for  (2)  From (1) and (2), we get  Put | | | | | | | |
| 131 | **(a)**  Here,  Therefore, is increasing for all domain | | | | | | | |
| 132 | **(d)**  From the given data, graph of can be shown as    Thus from graph, nothing can be said about roots when the sign of and is given | | | | | | | |
| 133 | **(d)**  Given,  Here,  And for all  For | | | | | | | |
| 134 | **(b)**  Given curve is (1)  (Differentiate w.r.t. )  or  Since the tangent is equally inclined to the axes  Putting in (1), we get  and so | | | | | | | |
| 135 | **(c)**  Slope of the normal    Equation of the normal  Put to get -intercept  ; hence, | | | | | | | |
| 136 | **(b)**  Differentiating w.r.t. , we have  At  Also . At  The curves cut orthogonally | | | | | | | |
| 137 | **(a)**    Area of  , where  Which is maximum when or  Hence, , then the triangle is isosceles | | | | | | | |
| 138 | **(d)**  meets the -axis at  Again  At  required tangent is or | | | | | | | |
| 139 | **(b)**  Applying Rolle’s theorem to , we get , | | | | | | | |
| 140 | **(d)**    Eliminating gives  Equation of the tangent at is  Solving with curve and | | | | | | | |
| 141 | **(c)**  For maximum or minimum,  For one maxima and minima,  or | | | | | | | |
| 142 | **(d)**  **a.** Discontinuous at not applicable  **b.** is not continuous (jump discontinuity) at  **c.** Discontinuity (missing point) at not applicable  **d.** Notice that  Hence, if and  is continuous at . So is continuous in the interval  Also, note that . Hence, Rolle’s theorem applies  Setting , we obtain which lies between and 3 | | | | | | | |
| 143 | **(d)**  We have (1)  Given that  Putting in (1), we get  Hence, the point is | | | | | | | |
| 144 | **(a)**  Since the tangent makes equal angles with the axes | | | | | | | |
| 145 | **(a)**  For,  Now, the graph of is    Clearly from the graph, increases in | | | | | | | |
| 146 | **(d)**  Given  Where is side length of the square and is radius of the circle  gives for which is and hence minimum | | | | | | | |
| 147 | **(a)**  When | | | | | | | |
| 148 | **(d)**  When  is increasing | | | | | | | |
| 149 | **(b)**  Then, equation of the tangent at is or    Graph of always lies above the graph of ,  Hence, . Hence, **b**. is true  **c**. is wrong as for  and **d**. is wrong as for | | | | | | | |
| 150 | **(c)**  Hence, is decreasing | | | | | | | |
| 151 | **(a)**  Let  and  For maximum/minimum,  is minimum at | | | | | | | |
| 152 | **(b)**  Using Lagrange’s mean value theorem for in [1, 2]  for  (1)  Again using Lagrange’s mean value theorem in [2, 4]  for  (2)  From (1) and (2), | | | | | | | |
| 153 | **(b)**  Let  Also  is the point of minima  For we must have  Hence, the least value of is 2 | | | | | | | |
| 154 | **(a)**  which is the point of inflection  Given that, we must have | | | | | | | |
| 155 | **(a)**  Let  Also when and when  Further is continuous, hence its graph cuts -axis only at one point  Hence, equation has only one root  **Alternative method:**  Also  As shown in the figure, graphs of and cuts at only one point. Hence, there is only one root | | | | | | | |
| 156 | **(a)**  Slope of given line  , also  also lies on given line  Hence the given line is tangent to the curve | | | | | | | |
| 157 | **(c)**  We have  We know that for  for  Hence, is an increasing function  , where  We know that for  is a decreasing function | | | | | | | |
| 158 | **(c)**  It is a fundamental property | | | | | | | |
| 159 | **(b)**  We have  Integrating, we get (1)  At is tangent to  From equation  Integrating, we get  Since the curve passes through | | | | | | | |
| 160 | **(d)**    Graph of the function is that clearly increases in (0, 1) | | | | | | | |
| 161 | **(c)**  or  Where  and ve  At  Now where  Therefore, is increasing  Hence is greatest at the endpoint of interval i.e.  **Alternative method:**  For , maximum value of occurs when or  Hence, | | | | | | | |
| 162 | **(b)**  At the point  Also  At the point  Since the product of the slopes . Therefore, the normals cut orthogonally, i.e., the required angle is equal to | | | | | | | |
| 163 | **(a)**  As is undefined at and does not change its sign in the neighbourhood. So, no extremums | | | | | | | |
| 164 | **(d)**  Let . We have  From Rolle’s theorem on for at least Let where  Similarly, for at least one Let where  By Rolle’s theorem, at least one such that for some | | | | | | | |
| 165 | **(a)**  Sign scheme of    is increasing in | | | | | | | |
| 166 | **(a)**  Let be the position of man at any time . Let , then . Let    Given, and  We have to find when  From (1)  Differentiating w.r.t. to  (2)  When radian/s | | | | | | | |
| 167 | **(a)**  Now if  Thus, increases in and decreases in | | | | | | | |
| 168 | **(a)**  Slope of the tangent at is  Also the curve passes through (1, 2). Therefore, | | | | | | | |
| 169 | **(b)**  , where is the angle of the tangent with the -axis  For , we have | | | | | | | |
| 170 | **(d)**  Sign scheme of    Hence, is maximum at Maximum value | | | | | | | |
| 171 | **(d)**  Solving the curves, we get point of intersection  For  At  For  At  Since the curves cut orthogonally | | | | | | | |
| 172 | **(c)**    Clearly for [in figure] tangent always lies below the graph  Or [in figure (d)) tangent always lies below the graph | | | | | | | |
| 173 | **(a)**  (a positive value)  if is an even number | | | | | | | |
| 174 | **(b)**  when or  no sign change    This also implies that is decreasing at  is correct  minima at  maxima at | | | | | | | |
| 175 | **(b,d)**  For  if and if  Hence, has local maxima at where and local minima at , where | | | | | | | |
| 176 | **(a,b)**  Let be a point on the curve In  Differentiating both sides with respect to , we get  (say)  Slope of (say) (where is origin)  Let the angle between the tangents at and be  which is independent of and | | | | | | | |
| 177 | **(b,c)**  is increasing and is decreasing  and  and | | | | | | | |
| 178 | **(a,b,c,d)**  We are given that  Then in  decreases in and increases in  Also  And  Hence is continuous  and  Hence, is non-differentiable at  Also, and  Hence, is the point of maxima | | | | | | | |
| 179 | **(a,b,c,d)**    Refer the graph for the answers | | | | | | | |
| 180 | **(a,b,d)**  At the point of inflection, concavity of the curve changes irrespective of any other factor | | | | | | | |
| 181 | **(b,c)**  , where is the angle with positive direction of -axis  Angle with -axis is | | | | | | | |
| 182 | **(b,c)**  Here, but is not differentiable in as may be and then will not exists.  Is continuous for all but is not differentiable on (0,.  Option (b) is true  Also, , if  And , if  Let  Option (c) is true.  (d) It is not possible as when.  Hence, (b, c) are the correct options. | | | | | | | |
| 183 | **(a,b,d)**    Graph of Graph of | | | | | | | |
| 184 | **(a)**  Since g is decreasing in  For (1)  Also and is increasing from to  For  Such that  where  is a decreasing function from to  But (given)  (2)  Also (3)  [as ]  From (2) and (3) we get  Hence, | | | | | | | |
| 185 | **(a,d)**  and  If is even and , then is the point of minima  If is odd and , then is the point of maxima | | | | | | | |
| 186 | **(a,b,c,d)**  We have  sub-tangent = const.  Length of the sub-normal (square of the ordinate)  Equation of the tangent at is  This meets the -axis at a point given by    The curve meets the -axis at  So, the equation of the normal at is | | | | | | | |
| 187 | **(c)**  The given polynomial is and  Here we observe that all coefficients of different powers of , i.e., are positive  Also, only even powers of are involved  Therefore, cannot have any maximum value  Moreover, is minimum, when , i.e.,  Therefore, has only one minimum  **Alternative method**  We have  Clearly for and for  increases for all and decreases for all  Therefore, has as the point of maxima | | | | | | | |
| 188 | **(b,c)**  Let the line be normal to the curve  Differentiate the curve w.r.t., , we get  Slope of the normal  Slope of the given line  Given that (1)  Also lies on the given curve (2)  From (1) and (2), we can conclude that and must have opposite sign | | | | | | | |
| 189 | **(a,c)**  We have  Note that whenever and whenever ,  Thus increases (decreases) whenever increases (decreases)  (**a**) and (**c**) are the correct options | | | | | | | |
| 190 | **(a,b,c)**  is an increasing function  Also, and  Hence, the graph of is as shown    Also,  which is point of inflection  is the inflection point and is bounded in (0, 1)  No maximum and has two asymptotes | | | | | | | |
| 191 | **(a,d)**  We have  for all  Hence, is an increasing function in and in particular in | | | | | | | |
| 192 | **(a,b,c)**  at  at | | | | | | | |
| 193 | **(a,b,c)**  Obviously, at  does not exist    So, is a critical point  Now,  At the function is not differentiable, so they are critical points. | | | | | | | |
| 194 | **(a,b,c)**  has one root  Also, given that has positive root  Thus, the equation must have at least three real roots (as complex root occurs in conjugate pair). Thus has at least two real roots as between two roots of , there lies at least one root of  Similarly, we can say that has at least one real root. Further, has one root between roots and of | | | | | | | |
| 195 | **(a,b)**  Given that  We have to find the extrema for the function  For maximum or minimum,  or and is +ve when is negative  If is positive, then the point of minima is  i.e., or  and if is negative, then the point of minima is  i.e., or  Then, | | | | | | | |
| 196 | **(a,c,d)**  Graph of | | | | | | | |
| 197 | **(a,c,d)**  If  Now,  if , i.e., has a minimum at  Also,  Hence, has maximum for no real value of  When if . So, has a point of inflection at | | | | | | | |
| 198 | **(a,b,c)**  Let  and are positive, but can be negative, which can cause , hence statement (a) is false  If , which does not necessarily make , hence statement (b) is false  can also cause , hence statement (c) is false. But reverse of (c) is true | | | | | | | |
| 199 | **(a,b,d)**    Hence is increasing  is the point of inflection as concavity changes at | | | | | | | |
| 200 | **(b,c)**  is increasing (strictly)  Also, as for | | | | | | | |
| 201 | **(a,d)**  We have  If does not have critical points, then does not have any solution in  Now,  and  Thus, has solutions in if  So, is not solvable in if or , i.e., | | | | | | | |
| 202 | **(b,d)**  The critical points are 0, 1, 2, 3  Sign scheme of    Clearly and are the points of minima | | | | | | | |
| 203 | **(a,b,c,d)**  and  At hence is point of minima  Also, for and for  Hence point of inflection and for , graph is concave downward and for , graph is concave upward | | | | | | | |
| 204 | **(a,b,c,d)**  changes sign from to +ve, at , which is point of minima  Also, does not exist at as has vertical tangent at  at which is the point of inflection at does not exists but changes sign, hence is also the point of inflection  From the above information the graph of is as shown    Also, minimum value of is at which is  Hence, range is | | | | | | | |
| 205 | **(a,b,c,d)**    From the graph global minimum value is and global maximum value is | | | | | | | |
| 206 | **(c,d)**  must be an even integer because two decreasing functions are required to make it increasing function  Let  When is odd, or for maximum values of when is even, for maximum value of  Therefore, maximum when is odd and when is even | | | | | | | |
| 207 | **(a,b,c,d)**  **a**.  . Hence, orthogonal  **b**.  not defined at (0, 0)  at (0, 0)  The two curves are orthogonal at (0, 0)  **c.**  **d**.  orthogonal | | | | | | | |
| 208 | **(c)**    It is clear from the graph that the curves and intersect at in  Thus, the smallest ve roots of is | | | | | | | |
| 209 | **(d)**  For to be should be max, which is so if is min and is min at | | | | | | | |
| 210 | **(a,b,d)**  Therefore, is decreasing in as well as in  is its own inverse | | | | | | | |
| 211 | **(a,c)**  Therefore, is a maximum and is a minimum, hence is the point of inflection | | | | | | | |
| 212 | **(a,c,d)**  If power even, them neither max not min. | | | | | | | |
| 213 | **(a,b,c)**  Also,  Hence, function is symmetrical about line  Also,  Also, for domain of the function is or  For decreases hence is point of maxima  Also, maximum value of the function is 1  Also, , when , hence absolute minimum value of f does not exists | | | | | | | |
| 214 | **(c,d)**  , here does not change sign, hence has no point of inflection    For but does not changes sign in the neighbourhood of  for  Also, sign changes sign in the neighbourhood of , hence function has infinite points of inflection  , here changes sign in the neighbourhood of , hence has point of inflection | | | | | | | |
| 215 | **(b)**  The maximum value of occurs when and  and  Comparing the value of only | | | | | | | |
| 216 | **(a,c)**  Given,  Equation of Tangent at is  It pass through (2, 0), then  Point of contact are (0, 0) and  Equations of tangents are | | | | | | | |
| 217 | **(a,d)**  Since , therefore either g or g. Let g. Since g is continuous at , therefore there exists a neighbourhood of in which .  is increasing in the neighbourhood of . Let g. Since g is continuous at , therefore there exists a neighbourhood of in which  is decreasing in the neightbourhood of | | | | | | | |
| 218 | **(a,c,d)**  (1)  (2)  Slope of (1) curve  And at (1, 0), (say)  Slope of (2) curve  at (say)  Curves are touching at (1, 0)  (3)  Also (1, 0) lies on both the curves  and (4)  Solving (3) and (4), we get | | | | | | | |
| 219 | **(a,c)**  Now | | | | | | | |
| 220 | **(a,b)**  and  Equation of tangent at and at are  and | | | | | | | |
| 221 | **(b,c,d)**  Since is defined on  Therefore, which is true as  Also  or (1)  As is increasing hence  (2)  From (1) and (2), we get  Hence,  Therefore, possible integers are | | | | | | | |
| 222 | **(a,b)**  Since the intercepts are equal in magnitude but opposite in sign  Now  or3 | | | | | | | |
| 223 | **(a,b,c)**  Clearly, . So has two real roots . Therefore, has a real root lying between 0 and . So,  Again, is a fourth-degree equation. As imaginary roots occur in conjugate pairs, will have another real root . Therefore, will have a real root lying between and . As is an equation of the fifth degree, it will have at least three real roots and so will have at least two real roots | | | | | | | |
| 224 | **(a,b,d)**  The point are | | | | | | | |
| 225 | **(a,b,c)**  **a**. Let  ,which has a root between two roots of  **b**. Let ,  , which has a root between two roots of  **c**. Let ,  , which has a root between two roots of | | | | | | | |
| 226 | **(a,b)**  (1)  Slope of the tangent at  Equation of the tangent at is  or (2)  It cuts the curve again at point . Solving (1) and (2), we get  Put in equation (2)  Slope of the tangent at  Slope of the normal at  Since tangent at is normal at | | | | | | | |
| 227 | **(a,b,d)**  is not differentiable at  g is not continuous in [0, 1] at  is not continuous in [0, 1] at  , where , which is continuous and differentiable | | | | | | | |
| 228 | **(a,b,c,d)**  **a**. and  and  Let the intersection point be  and  . Hence orthogonal  **b**. and  , not defined at  at  The two curves are orthogonal at (0, 0)  **c**. and  orthogonal  **d**. and  and  orthogonal | | | | | | | |
| 229 | **(a,b,c,d)**  Sign scheme of derivative is    has point of maxima at and point of minima at  Also is non-differentiable at | | | | | | | |
| 230 | **(d)**  are not differential at  is discontinuous at  gives real and imaginary value at  Only function which satisfies Rolle’s therorem is  in | | | | | | | |
| 231 | **(a,b,c,d)**  . Hence, is strictly increasing, hence one-one and onto  , hence is strictly increasing and hence one-one and onto  Also, is one-one  has range as the range of is | | | | | | | |
| 232 | **(a,b,d)**  for , where decreases  for where increases  is the point of inflection    From the graph, is many-one, hence it is not bijective | | | | | | | |
| 233 | **(a,b,c)**  If , then will be a constant, i.e., or or , then has no minima | | | | | | | |
| 234 | **(a,b,c)**  The following function is discontinuous at , but has point of maxima    has point of minima at , through it is non-differentiable at    has point of inflection at , as curve changes its concavity at , however is point of minima for the function | | | | | | | |
| 235 | **(a,c)**  for  Hence, increases in . Moreover, for  Hence, has a minimum at | | | | | | | |
| 236 | **(a,c)**  Given,  Discriminant of the quadratic equation  Is  will be same as that of sigh of  is increasing whenever is increasing and is decreasing whenever is decreasing. | | | | | | | |
| 237 | **(b,d)**  For , -axis is tangent at (0, 0), while for , -axis is tangent at (0, 0)  Thus the two curves cut each other at right angles  Also for  For  and intersect at right angle | | | | | | | |
| 239 | **(a,b,c)**    If , then or is an increasing function, then has +ve root if and ve root if  If , then or is decreasing function, then has negative root if | | | | | | | |
| 240 | **(d)**  and is an increasing function | | | | | | | |
| 241 | **(a)**  Statement 2 is obviously true  Also, for  . Hence, statement 1 is true | | | | | | | |
| 242 | **(a)**  Consider,  By Rolle’s theorem, | | | | | | | |
| 243 | **(a)**  Given, | | | | | | | |
| 244 | **(c)**  Using  for all  statement II is true and statement I as for some ‘e’  which is not true  Alternate  Maximum value of | | | | | | | |
| 245 | **(d)**  Though is non-differentiable at is differentiable at , for which Lagrange’s mean value theorem is applicable | | | | | | | |
| 246 | **(a)**  and  is an increasing function  But is a polynomial of degree it has exactly one real root | | | | | | | |
| 247 | **(b)**  For increasing function,  Is increasing outside the interval (1, 2), therefore it is true statement.  Now,  A and R are both true, but, R is not the correct reason. | | | | | | | |
| 248 | **(d)**  Given,  Here,  From Eq. (i),  On integrating w.r.t. , we get  …(i)  Where is constant of integration  And  From Eq. (i),  Also,  Then,  On comparing with | | | | | | | |
| 249 | **(d)**  Statement 2 is true as is non-differentiable at . But has a point of minima at and not at | | | | | | | |
| 250 | **(b)**  and are continuous and differentiable every where, so is continuous and differentiable  And  And  Rolle’s theorem is verified  LMVT is also applied  , Rolle’s theorem is a special case of LMVT  Since, | | | | | | | |
| 251 | **(a)**  If has positive point of maxima, then point of minima is also positive. Hence, both the roots of equation must be positive  sum of roots , product of roots and discriminant | | | | | | | |
| 252 | **(c)**  It is clear from figure has no sign change at  Hence, is neither maximum nor minimum at | | | | | | | |
| 253 | **(a)**  Let  or point lies on this circle  Then, the given expression is , which is the square of distance between point and any point on the circle which has centre and radius 1  Now then the maximum distance between the point and any point on the circles is 6  Maximum value of is 36 | | | | | | | |
| 254 | **(b)**  Point of inflection of the curve is and this satisfies the line    Slope of the tangent to the curve at  As the slope decreases from , line cuts the curve at three distinct points and the minimum slope of the line when it intersects the curve at three distinct points is | | | | | | | |
| 255 | **(b)**  Let  Where, is selected in such a way  …(i)  but  hence, satisfies all conditions of Rolle’s theorem  From Eq. (i), | | | | | | | |
| 256 | **(c)**  Clearly, and , hence is the point of inflection and hence not a point of extrema. Thus, statement 1 is true  But statement 2 is false, as it is not necessary that at point of inflection, extrema does not occur. Consider the following graph (figure) | | | | | | | |
| 257 | **(a)**  for and for  is increasing when and decreasing for  Hence, for  Again is decreasing in  Then for  is positive for all  Thus, Statement 1 is true and follows from Statement 2 | | | | | | | |
| 258 | **(c)**  Statement 1 is true, but statement 2 is false as consider the functions in statement 1 in | | | | | | | |
| 259 | **(a)**  Sign scheme of    From the sign scheme of increases for  Since is a polynomial function, which is continuous, and has no point of inflection, intervals of increase and decrease occur alternatively | | | | | | | |
| 260 | **(b)**  ,  is increasing  Statement 2 is true but does not explain statement 1  Therefore, according to statement 2, may vanish at finite number of points but in statement 1 vanishes at infinite number of points | | | | | | | |
| 261 | **(c)**  Statement 1 is correct is and Rolle’s theorem is not applicable, then it implies that either is discontinuous or does not exist at at least one point in . Since it is given that is differentiable, has at least one value of in  Statement 2 is false as must be differentiable in is not given | | | | | | | |
| 262 | **(d)**  When  Equation of the tangent is  Solving with the curve,  (1 is repeated root)  the tangent meets the curve again at  statement 1 is false and statement 2 is true | | | | | | | |
| 263 | **(a)**  Suppose has real root say , then for all  Thus becomes strictly decreasing in which is a contradiction | | | | | | | |
| 264 | **(c)**  Both and are increasing in but is decreasing | | | | | | | |
| 265 | **(c)**  Statement 1 is correct as it is the statement of Cauchy’s mean value theorem. Statement 2 is false as it is necessary that in both and is same | | | | | | | |
| 266 | **(b)**  Put | | | | | | | |
| 267 | **(b)**  for  Statement 2 is also true, but it is not the only reason for statement 1 to be correct | | | | | | | |
| 268 | **(a)**  Given  For maximum, put  And  Both A and R are true and R is the correct reason for A. | | | | | | | |
| 269 | **(a)**  for or is increasing  is decreasing for | | | | | | | |
| 270 | **(a)**  Equation of a tangent at on is  (1)  Suppose (1) passes through  must hold good for some  Now represents an equation of degree odd in  some ‘’ for which LHS vanishes | | | | | | | |
| 271 | **(a)**  Consider  and  Hence, Rolle’s theorem is applicable for  there exists at least one in such that | | | | | | | |
| 272 | **(b)**  Let  is an increasing function  is an increasing function  Thus, statement 1 is true, also statement 2 is true but it does not explain statement 1 | | | | | | | |
| 273 | **(a)**  Verify by taking in | | | | | | | |
| 274 | **(b)**  For Rolle’s Theorem and LMVT, must be continuous in and differentiable in  Hence, Statement I is true  Since, in is non-differentiable in    Hence, Statement II is also true | | | | | | | |
| 275 | **(a)**  For no extremum  or for all | | | | | | | |
| 276 | **(d)**  Statement 1 is false as attains the greatest value at , through it is not differentiable at , and for extreme value if is not necessary that exists at that point  Statement 2 is obviously true | | | | | | | |
| 277 | **(c)**  is an increasing function  is one-one | | | | | | | |
| 278 | **(b)**  **a.s.** Graph of    From the graph has infinite points of minima  **b.s.** for we have which has infinite points of extrema  **c.r.** Graph of    From the graph has one points of minima  **d.q.** Graph of    From the graph has one point of maxima | | | | | | | |
| 279 | **(a)**    Now, nature of roots of can be obtained by shifting the graph of by units upwards or downward depending on whether is positive or negative | | | | | | | |
| 280 | **(a)**  **a**. Given (say)  (1)  Also So, (2)  From equations (1) and (2), we get  **b.** (1)  Differentiating (1) w.r.t we get    **c.** intersects -axis at  Angle of intersection with -axis  or  **d.** slope of the normal at  equation of the normal is  Area | | | | | | | |
| 283 | **(b)**  **a.**  **b.**  **c.**  **d.** | | | | | | | |
| 284 | **(b)**  Given,  The slope of the normal is  Options (b) satisfy the all four statements. | | | | | | | |
| 285 | **(c)**  **a.** and intersect at point (0, 0) and (4, 4)    Hence, at point (0, 0)  **b.** Solving I : and II : ; we get and  at for I  at for II  Hence, angle  now, for I  angle between the two curves at the origin is  **c.** The two curves are  (1)  (2)  Solving (1) and (2), the points of intersection are and  Differentiating (1), (say)  Differentiating (2), (say)  At both points,  Hence, the two curves touch each other  d.  For the 1st curve,  Again for the 2nd curve,  solving and ;  and  Now | | | | | | | |
| 286 | **(b)**  **a**.  For which is the point of minima as derivative changes sign from negative to positive  Also, the function decreases in  **b**.  and  For  at  is min for  **c**.  For . Also, derivative changes sign from positive to negative at , hence it is the point of maxima  **d**.  , which is clearly point of maxima | | | | | | | |
| 287 | **(c)**  Since is minimum at and maximum at , let  is also minimum at and maximum at  is a root of , i.e.,  Then,  ( is minimum at and maximum at )  On comparing, we get  and    Since minimum and maximum values are positive  and  It is clear  Hence, | | | | | | | |
| 288 | **(a)**  **a.q,r**.  Sign of derivative does not change at and  Sign of derivative changes sign at from ve to ve  Hence, function has point of minima  Also, for and  Hence, function has two points of inflection  **b. r,s**  , hence is decreasing function  Also, for infinite values of , hence function has infinite points of inflection  **c. p,r**    From the graph points of maxima as well as point of inflection  **d. r,s**  for all real  Also, which changes sign at  Hence, is point of inflection | | | | | | | |
| 289 | **(b)**  a. r. From the graph is point of maxima    **b. s**.  and , hence is point of minima  **c. p**.  , hence  Thus, is increasing at  **d. q**.  Thus,  Hence, is decreases at | | | | | | | |
| 290 | **(d)**    for  for  Hence is point of maxima  **b.p**    From the graph for  For  Hence, is point of minima  **c.s**  Now  Hence , for all real  is always decreasing  **d.r.**  Now min. value of is 7 but maximum value of is  Hence, for all real  Hence, is always increasing | | | | | | | |
| 291 | **(b)**  On integrating w.r.t. , we get  …(i)  Where is constant of integration  And  From Eq. (i),  Also,  Then,  On comparing with | | | | | | | |
| 292 | **(b)**  Let be the length and be the breadth of the rectangular portion. Total perimeter of the window is  (say)  Let amount of light per square meter for the coloured glass be. If is the total light transmitted, then  Area of rectangle portion+ Area of semi-circular portion  Put | | | | | | | |
| 293 | **(a)**    …(i)  and  Now,  And | | | | | | | |
| 294 | **(a)**  Let is a point on the curve  Tangent at is (1)  The intersection of (1) and  If , then  Similarly, the tangent at will meet the curve at the point  when and so on  The abscissa of are  in G.P  ( say)  and  If , then  Then sum of infinite G.P. with common ratio with first term 1 | | | | | | | |
| 295 | **(a)** | | | | | | | |
| 296 | **(b)**  Let be the volume and the radius of the balloon at any time, then  (1)  Now let be the surface area of the balloon when its radius is , then  (2)  From (1) and (2),  When , the rate of increase of  Increase of in minute  If is the radius of the balloon after min, then  Or nearly or or nearly  Required increase in the radius | | | | | | | |
| 297 | **(b)**  Let  for some    and  is the point of minimum  is continuous  Hence, the global maxima exist at or  is global maxima | | | | | | | |
| 298 | **(a)**  (as it is given and  is increasing in . Also  and  Thus is decreasing in | | | | | | | |
| 299 | **(d)**  If is continuous then  (1)  Also (2)  is continuous for infinite values of and  Also, . For to be differentiable, and  Hence, can be differentiable | | | | | | | |
| 300 | **(a)**  is an increasing function | | | | | | | |
| 301 | **(a)**  Now increases if increases and for all  and  and | | | | | | | |
| 302 | **(a)**  Let  Sign scheme of    For three real roots of  must lie in the interval  for  if or if  or if  and if  Now  Thus,  Now if  If | | | | | | | |
| 303 | **(b)**  , so is a decreasing function and cuts -axis once when | | | | | | | |
| 304 | **(b)**  . Vertex of this parabola is  **Case 1**:  In this case, will attain the minimum value at  Thus,    **Case 2**:  In this, attains the global minimum value at  Thus  Thus  **Case 3**:  In this case, attains the global minimum value at . Thus  Convert the following graph    . Thus,  Hence, the permissible values of are and  is monotonic in  Hence, the point of minima of function should not lie in  Now . If  For to be monotonic in or | | | | | | | |
| 305 | **(a)**  For real root ,  (1)  When point of minima is negative, point of maxima is also negative  Hence, equation has both roots negative  For which sum of roots or , which is not possible as from (1),  When point of maxima is positive, point of minima is also positive  Hence, equation has both roots positive  For which sum of roots (2)  Also product of roots is positive or  or (3)  From (1), (2) and (3);  For points of extrema of opposite sign, equation (1) has roots of opposite sign | | | | | | | |
| 306 | **(c)**  is defined if  Now  Now is always positive, hence the sign of depends on sign of In  Let  (1) for  is monotonically decreasing for  and since  (2) for  is monotonically increasing for  Hence from (1) and (2) we get for all  is monotonically increasing in its domain  Also  and  The graph of is shown in figure    Range is | | | | | | | |
| 307 | **(d)**  Thus is increasing in , as for is not forming an interval  Also  Hence infinite points of inflection  Now  For positive root . For negative root | | | | | | | |
| 308 | **(c)**  The sign scheme of is as follows    The graph of the function is as follows    Thus, we have,  and  Hence, range of the function is  Also, a has no real roots if | | | | | | | |
| 309 | **(d)**  or  The graph of is as shown    Hence | | | | | | | |
| 310 | **(c)**  Since two points of inflection occur at and  Also, Given  Hence, , so  As  (1)  Solving (1) and (2),  We have and  and | | | | | | | |
| 311 | **(c)**  We have  increases in  and decreases in    has four roots. Hence, four points of inflection | | | | | | | |
| 312 | **(2)**  Slope of normal  Equation of normal  Put to get -intercept  ; Hence | | | | | | | |
| 313 | **(9)**  Hence, greatest value of is 9 | | | | | | | |
| 314 | **(6)**  (1)  On differentiating (1) w.r.t. , we get  (2)  Putting in (2), we get  Similarly  has minimum 7 roots in [0, 6]  Now, consider a function  As satisfy Rolle’s theorem in intervals and respectively  So, by Rolle’s theorem, the equation has minimum 6 roots  Now , where  Clearly has minimum 13 roots in [0, 6]  Hence again by Rolle’s theorem, has minimum 12 zeroes in [0, 6] | | | | | | | |
| 315 | **(9)**    But  If  which is the point of maxima  Hence, maximum area is | | | | | | | |
| 316 | **(2)**  Given  Consider  Now,  and  On solving, we get  Hence, | | | | | | | |
| 317 | **(4)**  Number of non-zero integral values of ‘’ is | | | | | | | |
| 318 | **(5)**    We have  (1)  Now, perimeter  (2) (Using equation (1))  When  Hence | | | | | | | |
| 319 | **(3)**  Given | | | | | | | |
| 320 | **(1)**  or  For three distinct roots where and are the roots of | | | | | | | |
| 321 | **(9)**    Area of the circles  Therefore, least area of circle sq. units | | | | | | | |
| 322 | **(9)**  Let  takes the values 0, 1, 2, 3, 4  is satisfied by ,  Therefore, number of values of is 9 | | | | | | | |
| 323 | **(3)**  We have  Let , then and  is strictly increasing in | | | | | | | |
| 324 | **(4)**  We have  Now  For intercept , so  On integration both sides w.r.t. , we get  In  Hence | | | | | | | |
| 325 | **(3)**  are the 3 critical points of    At , it has vertical tangent, hence non-differentiable  At , it is non-differentiable  At | | | | | | | |
| 326 | **(9)**  When (1)  and  (2)  (3)  Solving (1), (2) and (3) | | | | | | | |
| 327 | **(4)**  changes sign at | | | | | | | |
| 328 | **(3)**  at  Also the point for is (2, 1)  Equation of tangent is  or (1)  This meets the curve whose Cartesian equation on eliminating by is  (2)  Solving (1) and (2), we get  Hence is (2,1) as given and is | | | | | | | |
| 329 | **(3)**    Volume  if  and is a point of maximum | | | | | | | |
| 330 | **(5)**  and and (1)  Equating at and , we get  (1)    Now  Hence | | | | | | | |
| 331 | **(8)**  Let  Given  and  So, and are two horizontal tangents  Distance between theses tangents | | | | | | | |
| 332 | **(5)**    and | | | | | | | |
| 333 | **(9)** | | | | | | | |
| 334 | **(8)**    Since the graphs of and are symmetrical about the line minimum distance is the distance along the common normal to both the curves, i.e., must be parallel to the tangent as both the curves are inverse of each other  and  and | | | | | | | |
| 335 | **(4)**  or (1)  Now,  For to be decreasing  (2)  From (1) and (2); | | | | | | | |
| 336 | **(7)**  (1)    ; hence  Product of roots  Now must satisfy equation (1)  or | | | | | | | |
| 337 | **(5)**  , passes through (1, 1)  also  and | | | | | | | |
| 338 | **(1)**  Let  and  Hence, minimum value of is 0 at  Hence, number of points | | | | | | | |
| 339 | **(4)**  Let | | | | | | | |