For all questions the answer “E. NOTA” is to be interpreted as none of the above answers is correct.

1. Find  given 
2. 
3. 
4. 
5. 
6. NOTA
7. Find the values of  that satisfy the mean value theorem for derivatives for the function  on the interval 
8. 
9. 
10. 
11. 
12. NOTA
13. The longest diagonal in a cube is increasing at a rate of ft per second. Find the rate at which the volume of the cube is changing in cubic yards when  given .
14. 
15. 
16. 
17. 
18. NOTA
19. Find the length of the curve defined by the parametric function  on the interval 
20. 
21. 
22. 
23. 
24. NOTA
25. Nick is making a rectangular pen using  of fencing and a wall. Given that the fencing makes three sides of the rectangular pen and the wall is the fourth side, find the maximum area in square feet Nick can enclose within his pen.
26. 
27. 
28. 
29. 
30. NOTA
31. Evaluate
32. 
33. 
34. 
35. 
36. NOTA
37. Determine the area under the parametric curve given by the parametric curves, and on the interval.
38. 
39. 
40. 
41. 
42. NOTA
43. A pipe of negligible diameter is to be carried horizontally around a 90 degree corner from a hallway 64 feet wide into a hallway 27 feet wide. What is the maximum length the pipe can have?
44. 
45. 
46. 
47. 
48. NOTA
49. Soha creates the function  on her calculator in order to investigate the nature of its first derivative. She creates an algorithm  in order to solve for the real zero of . Soha notices, after running the algorithm a few times, that her answer is approaching the real zero of and that the error reduces as approaches. Hence find her approximation of given.
50. 
51. 
52. 
53. 
54. NOTA
55. Find all intervals where the function is decreasing on the interval 
56. 
57. 
58. 
59. 
60. NOTA
61. The rate the water, in, is being drained from a ditch is modeled by and the rate the water, in , is being pumped into the ditch is modeled by . Given the ditch contains 6 gallons of water at, find the time  that the ditch becomes empty.
62. 
63. 
64. 
65. 
66. NOTA
67. Let the equation for the unit normal vector to the function at  be , where. Find .
68. 
69. 
70. 
71. 
72. NOTA
73. An ellipse is constructed such that the length of the major axis is increasing at a rate of  and the length of the minor axis is increasing at a rate of . The equation of the ellipse at  is given as . At the point in time the distance between the foci is, find the rate at which the area of the ellipse is changing in .
74. 
75. 
76. 
77. 
78. NOTA
79. Find the volume of the solid formed by rotating an equilateral triangle of side length 4, centered at, about the line.
80. 
81. 
82. 
83. 
84. NOTA

Andres creates a continuous random variablethat has a probability density function that satisfies all conditions denoted as .

1. Find the probability that he chooses a number  randomly on the interval 
2. 
3. 
4. 
5. 
6. NOTA
7. Find  of his density function
8. 
9. 
10. 
11. 
12. NOTA
13. Given the relation , maximize the determinant of.
14. 
15. 
16. 
17. 
18. NOTA
19. Evaluate 
20. 
21. 
22. 
23. 
24. NOTA
25. Use differentials to approximate  given 
26. 
27. 
28. 
29. 
30. NOTA
31. Connor owns a factory that produces  widgets in a week and establishes the prices based on the function . The cost for producing any set of widgets is defined by the function . Assume the company is well renowned and will always sell the widgets it produces in the same week they were made. Find the number of widgets Connor would have to sell to maximize the profits his company makes.
32. 
33. 
34. 
35. 
36. NOTA
37. Find  given  represents the acute angle formed, in radians, by the intersection of the curves  and on the interval .
38. 
39. 
40. 
41. 
42. NOTA
43. Find the minimum value of the slope of the tangents to the function  on the interval 
44. 
45. 
46. 
47. 
48. NOTA
49. Cameron leaves a glass of tea out  with a temperature  and at  the temperature is . Assuming Cameron leaves the glass out till, find the temperature to two decimal places, of the glass of tea at  using Newton’s Law of Cooling.
50. 
51. 
52. 
53. 
54. NOTA
55. In physics, to measure the total resistance, in  of  parallel resistors we use the expression. Suppose  resistors are connected in parallel with respective resistances, and that each is changing at a respective rate . Find.
56. 
57. 
58. 
59. 
60. NOTA
61. Find the average value ofon the interval 
62. 
63. 
64. 
65. 
66. NOTA
67. Find the area of the region bounded between the curves  and 
68. 
69. 
70. 
71. 
72. NOTA
73. Richa creates an open box out of an inch rectangular metal strip by removing 4 equally sized squares from the corners of the strip and then folding up the metal flaps. Meghan creates an open box out of an  inch rectangular metal strip using the same process as Richa, cutting out squares of the same size as those cut from Richa’s metal strip . Let the volume of any box Richa creates be  and the volume of any box Meghan creates be . Maximize .
74. 
75. 
76. 
77. 
78. NOTA

1. Water is being drained from a conical cup at a rate of  into a basin below the cup with a volume of . The cup has a height of and a base diameter of. If the cup is initially full, before being drained, find the rate that the depth of the water in the cup is decreasing just before the basin begins to overflow.
2. 
3. 
4. 
5. 
6. NOTA
7. Joy is investigating finding areas via the calculus route. He finds one method taken with  equal subintervals and an area of  to have an error  provided  for all . Assuming Joy is always right, find the error for the expressiongiven.
8. 
9. 
10. 
11. 
12. NOTA
13. Which of the following is equivalent to?
14. 
15. 
16. 
17. 
18. NOTA