1. Prove that

Solution 1:

Finding the LCM and adding,

Divide through by

Divide both sides by

1. Differentiate

Solution:

1. If
2. State L’hopital’s rule and its application to engineering

Solution:

Applying l’hopital’s rule,

Apllying lhopital’s rule again,

1. Sketch the graph of this function, and clearly state all the assumptions

There’ll be a verical asymptote at x=1

There’ll be a horizontal asymptote at y=-1

1. Differentiate

Solution:

1. Find the derivative of

Solution:

1. If
2. If
3. The concentration x of a certain medication in the blood stream of a patient, t hours after taking a dose is given by
4. What is the concentration in the blood stream when the patient initially takes the dose. Answer: 0
5. Solve for the time t at which the patient has the greatest concentration of medication in his blood stream. Answer: t = 1/6
6. Determine the maximum concentration of the medication. Round your answer to three decimal places. Answer: x=-18.387
7. According to the model, does the concentration ever reach 0 again
8. The pressure P of the atmosphere at height h above the ground level is given by . Where is the pressure at ground level and c is a constant.
9. Determine the rate of change of pressure with height when and at 1450 meters. Answer: 1.7772Pa/m
10. With a well labelled diagram, show the differences among three common types of asymptotes
11. Show if the function below is continuous or not, given that the function f is defined by
12. Differentiate the following inverse and logarithmic functions

Solution:

1. Show that if, then

Solution:

1. Calculate the following limits if they exist, if they do not exist then indicate whether they are +infinity, -infinity or undefined
2. Show which of the following should one use the one sided limit
3. Identify and give the type of the points of discontinuity of each of the following:
4. Given that , find
5. All values of a and b such that f(x) is continuous
6. All values of a and b such that f’(x) is continuous
7. Identify each of the following functions as even, odd or neither. Kindly give reason(s) to support your conclusion
8. Compute , where tan-1(x) denotes the inverse tangent function
9. Find the derivatives given that
10. A poster is to be designed with of printed type, 4 inch margins on both top and bottom and 2 inch margins on each side. Find the dimensions of the poster which minimizes the amount of paper used. Indicate why the answer you found is minimum
11. A tennis ball bounces so that its initial speed straight upwards is b feet per second. Its height S in feet at time t seconds is given by
12. Find the velocity
13. Find the time at which the height of the ball is at its maximum height and the maximum height attained
14. Make a graph of v and directly below it a graph of S as a function of time. Hence, mark the maximum of S and the beginning and end of the bounce
15. Suppose that when the ball bounces a second time it rises to half the height of the first bounce. Make a graph of S and of v of both bounces, labelling the important points(hint: you will have to decide how long the second bounce lasts and the initial velocity at the start of the bounce)
16. If the ball continues to bounce, how long does it take before it stops
17. Sketch the graph of the following . Identify in writing all local maximums and minimums, regions where the function is increasing/decreasing, points of inflection, symmetries and vertical or horizontal asymptotes(if any of those behaviours occur)
18. Evaluate the derivatives, all letters represent constants except for the dependent and independent variables
19. ,
20. Find:
21. , and simplify as much as possible
22. A coffee in a cup at a temperature at time in a room at temperature a cools according to Newton’s law of cooling; assume, c=; . You are going to add milk so that the cup has 10% milk and 90% coffee. If the coffee has temperature T1 and the milk T2, the temperature of the milk will be . The coffee temperature is at time t = 0 and you will drink the mixture at t=10s. The milk is refrigerated at What is the best moment to add the milk so that the coffee will be the hottest when you drink it
23. Find:
25. Evaluate the values for which all values of a and b for which f(x) is differentiable
26. Show that every polynomial is the sum of an even and odd function
27. Assuming part (a) to be an arbitrary function f(x) given by

Verify this equation and show that the two functions on the right are respectively even and odd

1. How would you write as the sum of an even and an odd function
2. Find the conditions on a, b and c for which the cubic function has a local maximum and minimum. Using the following methods:
3. Find the condition under which has two distinct roots. Which of these roots is at local maximum and which is at local minimum? Draw a picture.
4. Find the condition under which at the point of inflexion points. Why does this property imply that there is a local maximum and local minimum
5. A utility company has a small power plant that can produce x kilowatt hours of electricity daily at a cost of cents each for. Consumers will use kilowatt hours of electricity at a price p Cents per kilowatt hour. What price should the utility charge to maximize its profits
6. The two sides forming the right-angle of a right-angled triangle are denoted by a and b. The hypotenuse h. If both a and b increase by 0.5%, what is the percentage increase in
7. The area of the triangle
8. The length of the hypotenuse
9. The total surface area S of a cone of base radius r and perpendicular height h is given by If r and h are each increasing at the rate of , find the rate at which S is increasing at the instant when r=3cm and h=4cm
10. Determine all the numbers c which satisfy the conclusion of the mean value theorem for the following function.

on [-1, 2]

1. The position of an object at any time tis given by
2. Does the object ever stop changing position?
3. When is the object moving to the right and when is it moving to the left
4. Find the Taylor series for about x=2
5. Use Taylor’s series expansion to express as a series of powers of h and find the approximate of . Correct to 5dp.