1. (20 pts) Differentiate the following. You need not simplify your answer.
2. 
3. 
4. 
5. 
6. (20 pts) Find the indicated derivatives. Simplify as needed.
7. Find  for 

(b) 

(c)) Find  for 

(d)  find 

3. (20 pts) Find the indicated limit. If the limit does not exist, explain. Show all work.

1. 

(b) 

1. 
2. 
3. 
4. (10 pts) Given , use the limit definition of the derivative to find .
5. (10 pts) Find the equation of line tangent to the curve  at the point (0,2)
6. (10 pts) Find the absolute maximum and absolute minimum values of  on the interval [-1,4].
7. (20 pts) Below is the graph of , of a function .
8. On what intervals is *f* increasing?
9. On what intervals is *f* decreasing?
10. For what values of *x* does *f* have a local maximum?
11. For what values of *x* does f have a local minimum?
12. Determine the =\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
13. Sketch a possible graph of for on the same axis as  . Label on the graph ofwhere the local max/min and points of infection are located.



8. (10 pts) Use Newton's method to approximate the number  to the second approximation. For the first approximation let .

9. (10pts) Determine the point(s) on a hyperbola , which are closest to the point (0,8).

10. (10 pts) A paper cup in the shape of a cone has a height if 10 cm and radius of 3 cm (at the top). If water is poured into the cup at a constant rate of 2cm3/s, how fast is the water level rising when the water is 5 cm deep? The volume of a cone is  (Hint: think similar triangles.)

3cm

 3cm

 10cm

11. (20 pts) Find the following integrals.

(a) 

(b) 

(c) 

(d) 

12. (20 pts) Below is the graph of .

1. Use the fundamental theorem of calculus to determine the points on the graph of the antiderivative by accumulating area. Assume that and fill in the table

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| The graph of  |

|  |  |
| --- | --- |
| x | f(x) |
| 0 | 0 |
| 2 |  |
| 4 |  |
| 5 |  |
| 6 |  |

 |

1. Create a piecewise function for the antiderivative



1. Sketch the graph of using the information from (a) and (b). Be clear in the graphing of concavity and label the local max/min points.

13. (10 points) Given 

 Use limits to explain why is continuous or discontinuous at  . If  is discontinuous, then find a continuous function *g* such that *f(x) = g(x)* everywhere except x=3.

14 (10 points) Given .

(a) Create sign charts and find the critical values for the first and second derivatives. Use this information to sketch a possible graph of  . Indicate and label the local max/min and inflection points.

(b) Find . Explain how this is related to your graph.