1 

(a) Locate all critical values

Find where the derivative is zero (or undefined, which does not apply here).

 

Critical values are −2 and 0

(b) Find the open intervals on which *f* is increasing or decreasing

|

|











   

Decreasing on 

Increasing on 

(c) Identify all relative extrema.

 Maximum at , 

 Maximum is (–2, 0)

 Minimum at , 

 Minimum is (0, –4)

(d) Find the open intervals on which the graph of *f* is concave up or concave down.

 

Find where the derivative is zero (or undefined, which does not apply here).

 







  

Concave down on ; Concave up on 

(e) Identify the point of inflection.

Point of inflection at ; 

Point of inflection is 

(f) Sketch the graph of 



2. Find all asymptotes of 

First note that the function cannot be reduced.

Vertical asymptotes:

 

 The vertical asymptotes are *x* = 4 and *x* = ­–4

Horizontal asymptote: 

 Also, 

 The horizontal asymptote is 

3. 

(a) Find all intercepts

*x*-intercepts: Solve 

 

*y*-intercept: 

 

(b) Locate all critical values

Find where or where is undefined but is continuous







is undefined at , but so is so is not a critical value.

(c) Find the open intervals on which *f* is increasing or decreasing

Mark where** is zero or undefined

|

|

|















   

(d) Identify all relative extrema.

Minimum:  Maximum: 

(e) Find the open intervals on which the graph of *f* is concave up or concave down.

(f) Identify any points of inflection.

None

(g) Find all asymptotes



(h) Sketch the graph of *f*(*x*)



4. 

(a) Find all intercepts

(b) Locate all critical values



(c) Find the open intervals on which *f* is increasing or decreasing

Decreasing ; Increasing 

(d) Identify all relative extrema.

Minimum: 

(e) Find the open intervals on which the graph of *f* is concave up or concave down.

Concave down:  Concave up: 

(f) Identify any points of inflection.

(

(g) Find all asymptotes



(h) Sketch the graph of *f*(*x*)



(b) Locate all critical values



(c) Find the open intervals on which *f* is increasing or decreasing

Decreasing ; Increasing 

(d) Identify all relative extrema.

Minimum: 

(e) Find the open intervals on which the graph of *f* is concave up or concave down.

Concave down:  Concave up: 

(f) Identify any points of inflection.

(

(g) Find all asymptotes



(h) Sketch the graph of *f*(*x*)



5. Find  by implicit differentiation: 

 



6. A ladder 5 meters long is resting against a vertical wall on horizontal ground. Following an ice storm the bottom of the ladder begins slipping away from the wall at 0.5 meters per second. Find how quickly the top of the ladder is slipping down the wall when to bottom of the ladder is 3 meters from the wall.

You know 

You are given and 

The problem is to find .

Differentiate  with respect to *t*.

 

You can now see that you need to know *y*, which you find using:

 

5

*y*

*x*

*Now plug what you have into *

 **

The top of the ladder is slipping down the wall at  meters per second

7. Find the extrema of  and use the second derivative test to classify them as maxima or minima. Find where the derivative is zero (or undefined, which does not apply here). You find . Then solve:

 

You check the sign of the second derivative at the critical values. If the second derivative is positive you have a minimum and if it is negative you have a maximum.

 

 and , so (2, −16) is a minimum

 and , so (−2, 16) is a maximum

8. A rectangular box with a volume of 320 ft3 is to be constructed with a square base and top. The cost per ft2 for the bottom is 15ȼ for the top is 10 ȼ and for the sides is 2.5 ȼ. What dimensions will minimize the cost?

9. Evaluate and  if ; ; 



 

10. Use differentials to approximate 

 Use 

The idea is to choose an appropriate function, in this case  and reasonable values of *x* and such that the right hand side is easy to evaluate and is small

 

 

 Then 

Choose  and , then

 