

Due date: _____

Name: _____

Tools for Modeling (Part 1)

Notes

Let $f(x)$ be defined on the interval $a < x < b$. Suppose x_1 and x_2 are in that interval.

f is increasing on that interval if $f(x_2) > f(x_1)$ whenever $x_2 > x_1$

f is decreasing on that interval if $f(x_2) < f(x_1)$ whenever $x_2 > x_1$

f is constant on that interval if $f(x_2) = f(x_1)$

Suppose $x = c$ is in the domain of $f(x)$.

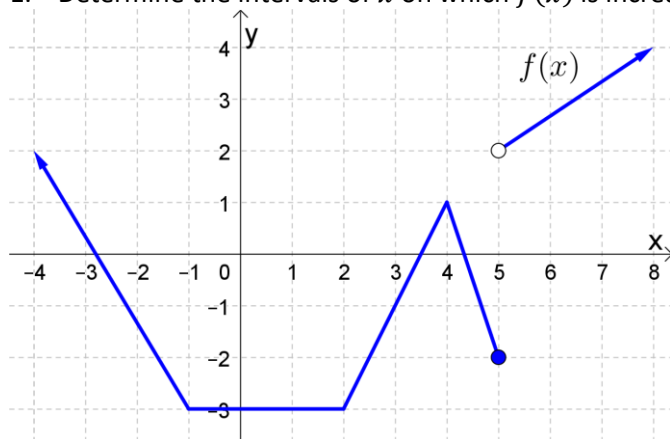
$f(c)$ is a local maximum of f if $f(c) \geq f(x)$ when x is near c . (Local maxes are peaks.)

$f(c)$ is a local minimum of f if $f(c) \leq f(x)$ when x is near c . (Local mins are valleys.)

The absolute maximum is the largest function value in the domain of the function (if any).

The absolute minimum is the smallest function value in the domain of the function (if any).

1. Determine the intervals of x on which $f(x)$ is increasing, decreasing, and constant.

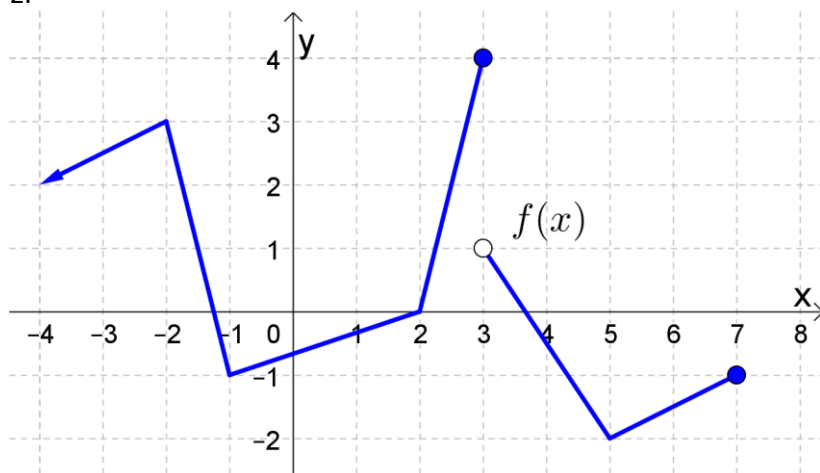


Increasing: _____

Decreasing: _____

Constant: _____

2.



- a) Determine the intervals of x on which $f(x)$ is increasing, decreasing, and constant (if any).

Increasing: _____

Decreasing: _____

Constant: _____

- b) Find all local maxima and minima (write answers in the form $f(123) = 456$).

Local maxima: _____

Local minima: _____

- c) Find the absolute maximum and absolute minimum of $f(x)$, if any (write answers in the form $f(123) = 456$).

Absolute maxima: _____

Absolute minima: _____

Notes

ex: Solve the following inequality.

$$\frac{x^2 - x - 6}{x^3 + x^2 - x - 1} \geq 0$$

3. Solve the following inequality.

$$\frac{x^2}{(2-x)(5+x)} < 0$$

Notes

ex: Find all x -values where $f(x) = 0$ or $f(x)$ is undefined.

$$f(x) = \ln(x^2 - 4)$$

$$f(x) = \frac{\sqrt[3]{x}}{\sqrt{9-x^2}}$$

$$f(x) = 2x^{2/3} + 4x^{-1/3}$$

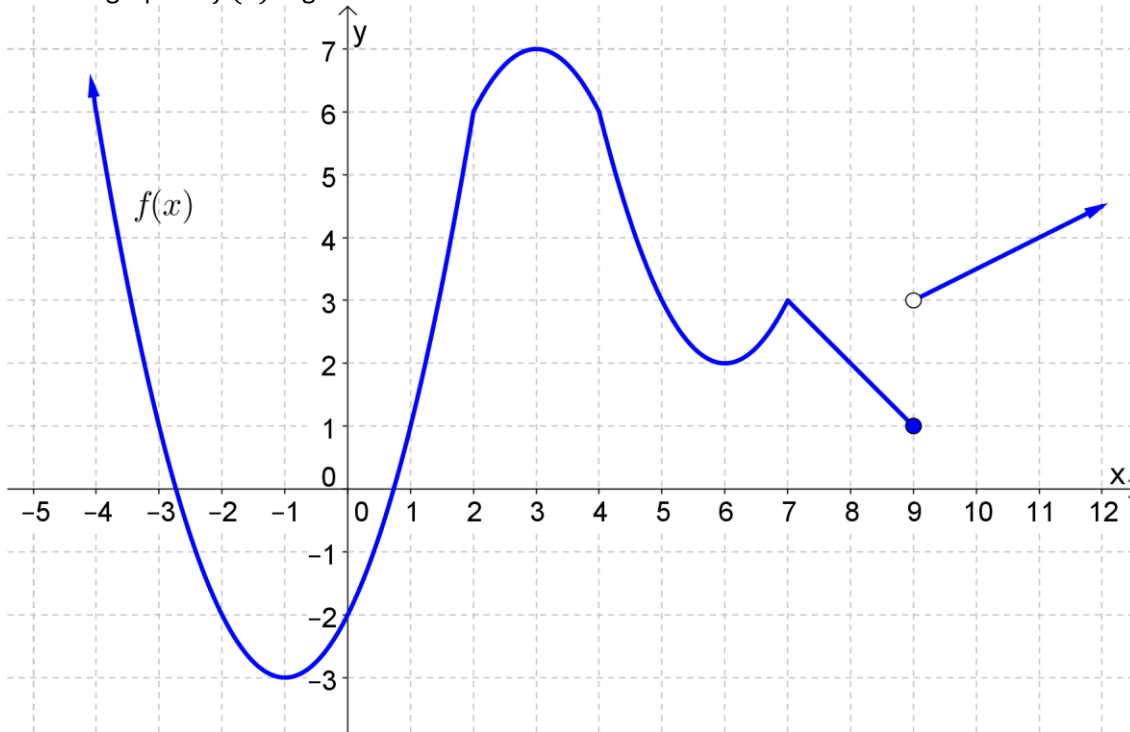
4. Find all x -values where $f(x) = 0$ or $f(x)$ is undefined.

a) $f(x) = 2x^{1/4} - x^{-3/4}$

b) $f(x) = \frac{x^2+3}{(x^2-4)^2}$

Practice at home

5. The graph of $f(x)$ is given below.



a) Determine the intervals of x on which $f(x)$ is increasing, decreasing, and constant (if any).

Increasing: _____

Decreasing: _____

Constant: _____

b) Find all local maxima and minima (write answers in the form $f(123) = 456$).

Local maxima: _____

Local minima: _____

c) Find the absolute maximum and absolute minimum of $f(x)$, if any (write answers in the form $f(123) = 456$).

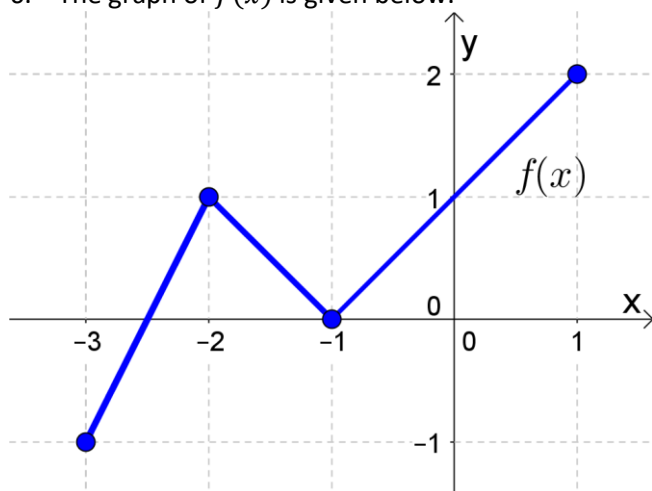
Absolute maxima: _____

Absolute minima: _____

d) Find the values of x for which $f(x) = 1$.

$x =$ _____

6. The graph of $f(x)$ is given below.



a) Determine the intervals of x on which $f(x)$ is increasing, decreasing, and constant (if any).

Increasing: _____

Decreasing: _____

Constant: _____

b) Find all local maxima and minima (write answers in the form $f(123) = 456$).

Local maxima: _____

Local minima: _____

c) Find the absolute maximum and absolute minimum of $f(x)$, if any (write answers in the form $f(123) = 456$).

Absolute maxima: _____

Absolute minima: _____

d) Find the values of x for which $f(x) = 1$.

$x =$ _____

e) Find the domain of $f(x)$.

Domain: _____

f) Find the range of $f(x)$.

Range: _____

7. Solve the following inequality.

$$\frac{3-x}{x^2-x-2} \geq 0$$

8. Solve the following inequality.

$$\frac{x^2+4}{(x+1)(x-2)^2} \leq 0$$

9. Solve the following inequality.

$$\frac{2x^2+2x}{(2x+1)^2} < 0$$

10. Find all x -values where $f(x) = 0$ or $f(x)$ is undefined.

a) $f(x) = e^{2x} - 4$

b) $f(x) = \ln(9 - x^2)$

c) $f(x) = x^2 e^x + x e^x - 2e^x$

d) $f(x) = \frac{2x^3 - 6x^2}{(x-2)^2}$

$$\text{e) } f(x) = \frac{x^2-3}{(x^2+1)^3}$$

$$\text{f) } f(x) = \frac{5}{3}x^{2/3} - \frac{10}{3}x^{-1/3}$$

$$\text{g) } f(x) = \frac{4}{3}x^{1/3} - \frac{4}{3}x^{-2/3}$$

$$\text{h) } f(x) = x\sqrt{x^2 - 1}$$