Chapter 3.3 Notes
Properties of Functions

* Function is “even” if the graph is symmetric with respect to the y-axis.

* Function is “odd” if the graph is symmetric with respect to the x-axis.

* A function can increase, decrease, or stay the same.

* Local maximum — the “x” value where the graph reaches a peak

* Local minimum — the “x” value where the graph reaches a valley

* Local maximum value — the value of “y” where the graph reaches a peak

* Local minimum value — the value of “y” where the graph reaches a valley

* Absolute maximum — the highest point on a graph

* Absolute minimum — the lowest point on the graph

* average rate of change: $\frac{f(b)-f(a)}{b-a}$

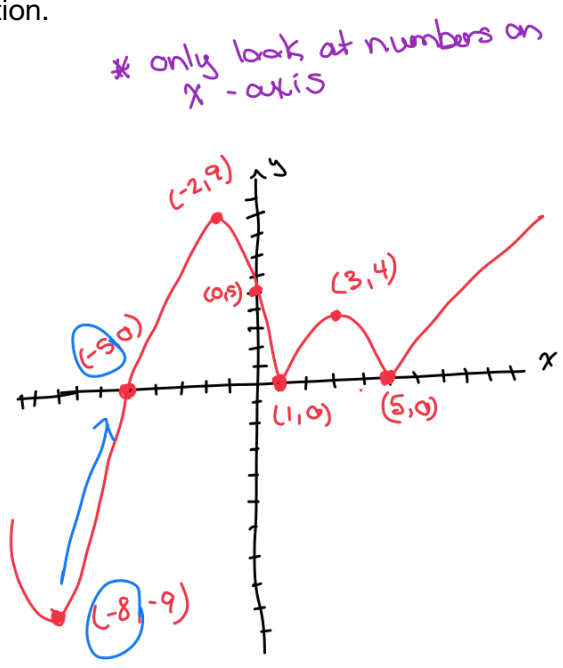
1. Use the graph of the function f given below to answer the question.
   * is f increasing on the interval [-8,-5]?

[-8, -5]

yes, its increasing

* Look at the first number. Find the ordered pair with that number as the x in the ordered pair (the 1st number in the ordered pair.)

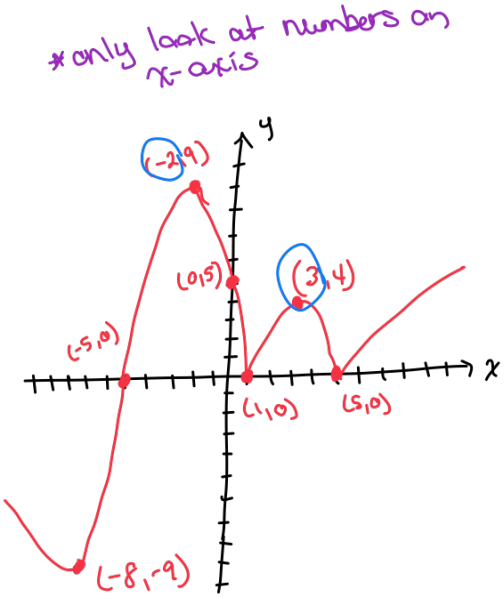
* Look at the second number. Find the ordered pair with that number as the x in the ordered pair (the 1st number in the ordered pair.)



* Look at the line between the points. If the line slants up ↗, then it is increasing.
* If the line slants down ↘, then it’s decreasing.

2. Use the graph of the function f given below to answer the question.
*is f increasing on the interval [-2,3]?

*only look at numbers on x-axis



[-2, 3]

No, because it increases + decreases

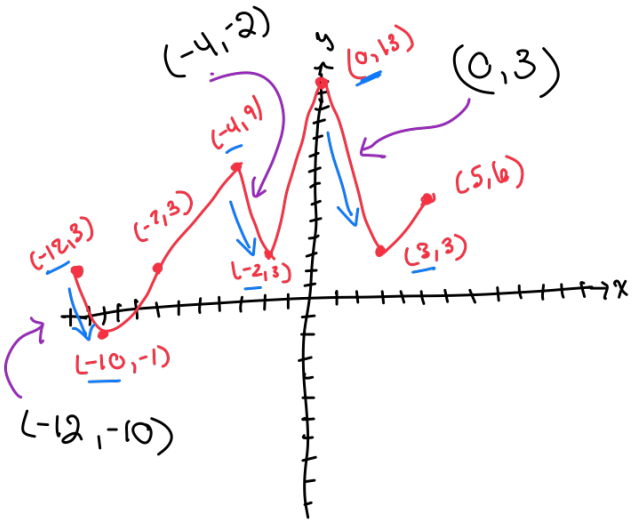
* Look at the first number. Find the ordered pair with that number as the x in the ordered pair (the 1st number in the ordered pair.)

* Look at the second number. Find the ordered pair with that number as the x in the ordered pair (the 1st number in the ordered pair.)

* Look at the line between the points. If the line slants up ／ , then it is increasing.
* If the line slants down \ , then it's decreasing.

3. List the intervals on which f is decreasing.

(-12, -10), (-4, -2), (0, 3)



* Start on the left side of the graph. Trace the graph with your finger.
* Find the point where the graph begins to go down. Write down the "x" number. Then trace the graph until it starts to turn and go up, and write down that number.
* Keep following the graph and doing the same thing.

4. Use the graph of the function f given below to answer the questions.

*Is there a local minimum at x = 4?

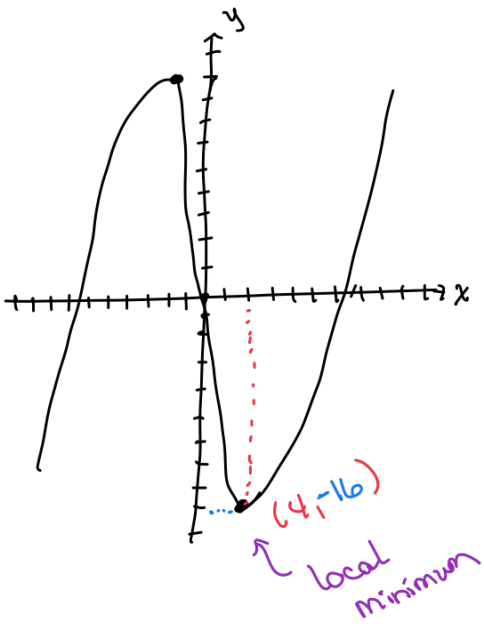
yes, there is a local minimum at $x=4$

* To find the local minimum, find where the graph has a valley. Write down what the x value is at that point.

The local minimum is

$y = -16$

* This is the y value at that point.



5. Use the graph of the function f given below to answer the questions.

Local maximum:

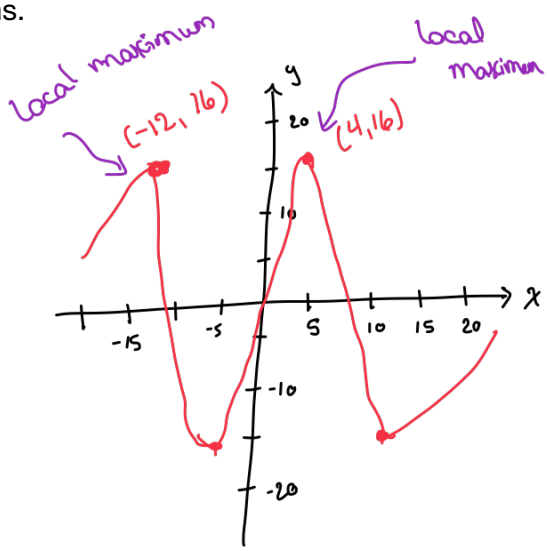
$x = -12, 4$

* The x-value of each pair.

The local maxima are:

16, 16

* The y-values of each pair

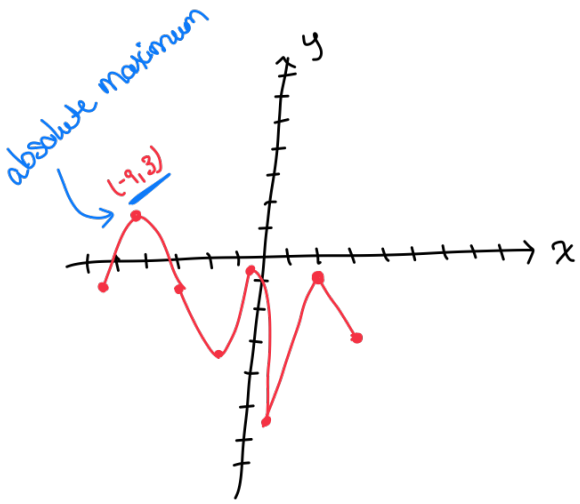


6. Find the absolute maximum of f on [-11,6].

The absolute maximum of f is

$f(\underset{x}{-9}) = \underset{y}{3}$

* This is the higest point on the graph.



7. Use the graph to find:

a.) The values of x at which f has a local maximum is:

$x = \boxed{0}$

The local maximum is

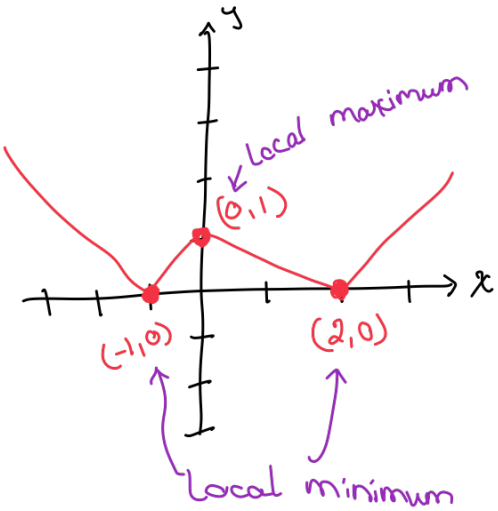
$y = \boxed{1}$

b.) The values at which x has a local minimum is

$x = \boxed{-1, 2}$

The local minimum are

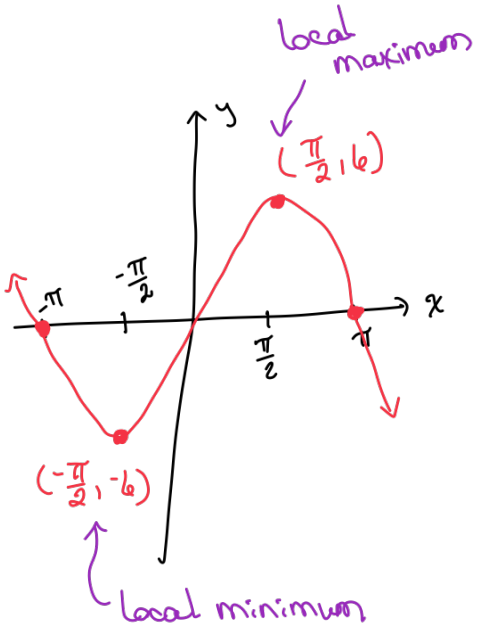
$y = \boxed{0, 0}$



* Local maximum is any mountain top

* Local minimum is any valley point

8. Use the given graph of the function f to find the following:



a) Find the values of x at which f has a local maximum.

$x = \frac{\pi}{2}$

Find the local maximum.

The local maximus is 6

b) Find the values of x at which f has a local minimum.

$x = -\frac{\pi}{2}$

Find the local minimum.

The local minimum is -6

9. Determine algebraically whether the given function is even, odd, or neither.

$f(x) = -9x^3 + 3x$

write equation down twice.

$f(x) = -9x^3 + 3x$

Replace x with (1)

$= -9(1)^3 + 3(1)$

$= -6$

$f(x) = -9x^3 + 3x$

Replace x with (-1)

$= -9(-1)^3 + 3(-1)$

$= 6$

Odd

* Replace each x with a 1.
* Then type in calculator.

* Then write down equation again, but replace x with a (-1).

Even:
If numbers are exact same

Odd:
If number are the same but have different signs

10. Determine algebraically whether the given function is even, odd, or neither.

$g(x) = -3x^3 - 2$

write down equation twice

Replace x with (1)

$g(x) = -3x^3 - 2$

$= -3(1)^3 - 2$

$= -5$

Replace x with (-1)

$g(x) = -3x^3 - 2$

$= -3(-1)^3 - 2$

$= 1$

Neither

* Replace each x with a 1.
* Then type in calculator.

* Then write down equation again, but replace x with a (-1).

Even:
If numbers are exact same

Odd:
If number are the same but have different signs

11. Determine algebraically whether the given function is even, odd, or neither.

$f(x) = \sqrt[7]{6x}$

Replace x with (1)

$f(x) = \sqrt[7]{6x}$

$= \sqrt[7]{6(1)}$

$= 1.2917$

Replace x with (-1)

$f(x) = \sqrt[7]{6x}$

$= \sqrt[7]{6(-1)}$

$= -1.2917$

Odd

Even:
If numbers are exact same

Odd:
If number are the same but have different signs

12. Determine algebraically whether the given function is even, odd, or neither.

$f(x) = \frac{5}{x^{16}}$

Replace x with 1

$f(x) = \frac{5}{x^{16}}$

$= \frac{5}{(1)^{16}}$

$= 5$

Replace x with (-1)

$f(x) = \frac{5}{x^{16}}$

$= \frac{5}{(-1)^{16}}$

$= 5$

Even

Even:
If numbers are exact same

Odd:
If number are the same but have different signs

13. Find the average rate of change of $f(x) = 2x^2 + 5$ over the following intervals.

a. From 2 to 4

a = 2, b = 4

Replace x with # for a

Replace x with # for b

$$\frac{2x^2+5 - (2x^2+5)}{b-a}$$

$$\frac{2(4)^2+5 - (2(2)^2+5)}{4-2} = \boxed{12}$$

Type into calculator

average Rate of change formula:

$$\frac{f(b)-f(a)}{b-a}$$

Replace x's with # for b

Replaces x's with # for a

$$\frac{\text{equation} - (\text{equation})}{b-a}$$

b. From 4 to 6

a = 4, b = 6

Replace x with # for a

Replace x with # for b

$$\frac{2x^2+5 - (2x^2+5)}{b-a}$$

$$\frac{2(6)^2+5 - (2(4)^2+5)}{6-4} = \boxed{20}$$

Type into calculator

c. From 2 to 5

a = 2, b = 5

Replace x with # for a

Replace x with # for b

$$\frac{2x^2+5 - (2x^2+5)}{b-a}$$

$$\frac{2(5)^2+5 - (2(2)^2+5)}{5-2} = \boxed{14}$$

Type into calculator

14. Find the average rate of change of $f(x) = x^3 - 7x + 7$ over the following intervals.

$$f(x) = x^3 - 7x + 7$$

$$\frac{f(b) - f(a)}{b - a}$$

A. From -7 to -5

a ↑ ↑ b

Replace x's with # for b

Replace x's with # for a

$$\frac{x^3 - 7x + 7 - (x^3 - 7x + 7)}{b - a}$$

$$\frac{(-5)^3 - 7(-5) + 7 - ((-7)^3 - 7(-7) + 7)}{-5 - (-7)} = \boxed{102}$$

Type into calculator

B. From -1 to 5

a ↑ ↑ b

Replace x's with #'s for b

Replace x's with # for a

$$\frac{x^3 - 7x + 7 - (x^3 - 7x + 7)}{b - a}$$

$$\frac{(5)^3 - 7(5) + 7 - ((-1)^3 - 7(-1) + 7)}{5 - (-1)} = \boxed{14}$$

Type into Calculator

C. From 5 to 8

a ↑ ↑ b

Replace x's with # for b

Replace x's with # for a

$$\frac{x^3 - 7x + 7 - (x^3 - 7x + 7)}{b - a}$$

$$\frac{(8)^3 - 7(8) + 7 - (5^3 - 7(5) + 7)}{8 - 5} = \boxed{122}$$

Type into calculator