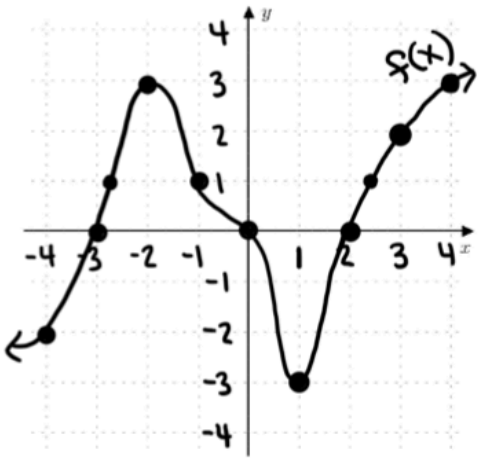
LESSON 23: GETTING INFO FROM THE GRAPH OF A FUNCTION

WARM UP

Use the graph of the function $f(x)$ at right to answer the following questions.



1. Find $f(-2)$, $f(0)$, $f(2)$ and $f(3)$.

   $f(-2) = 3$ $\quad$ $f(2) = 0$

   $f(0) = 0$ $\quad$ $f(3) = 2$

2. Which is larger, $f(-3)$ or $f(1)$?

   $f(-3) > f(1)$

3. Find the value(s) of x for which $f(x) = 1$

   $f(x) = 1$ at $x \approx -\frac{8}{3}$, $x = -1$ & $x \approx \frac{7}{3}$

4. Find the value(s) of x for which $f(x) \geq 1$

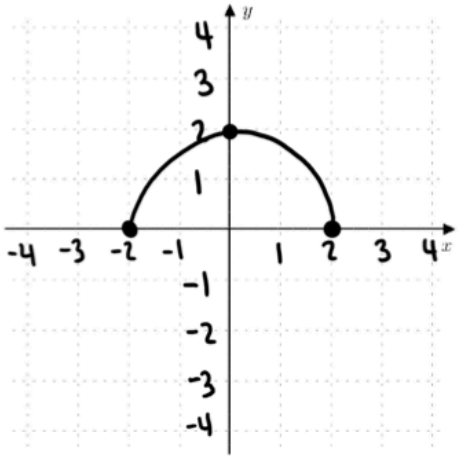
   $[-\frac{8}{3}, -1] \cup [\frac{7}{3}, \infty)$

DOMAIN and RANGE

The domain of a function is the set of all possible inputs (x-values).

The range of a function is the set of all possible outputs (y-values).

Example: Sketch the graph of $f(x) = \sqrt{4 - x^2}$. Then, find the domain and range of f using interval notation.



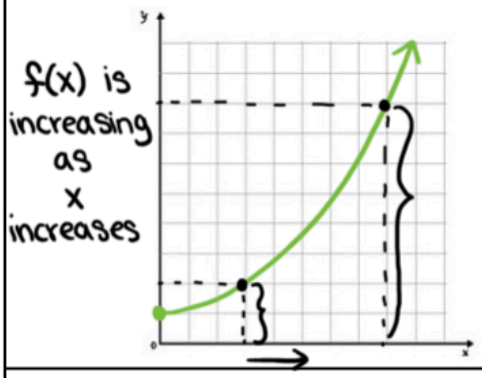
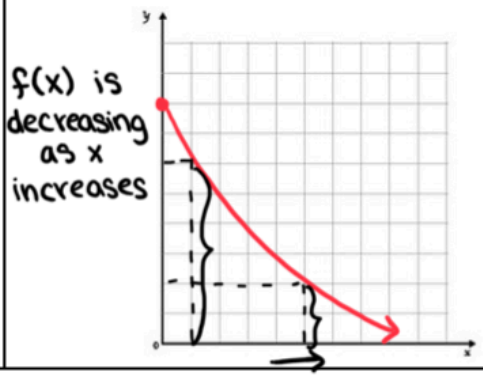
D: $[-2, 2]$

R: $[0, 2]$

INCREASING AND DECREASING functions

It is sometimes useful to know where a graph is increasing or decreasing.

Informally, we can distinguish where the graph increases or decreases based on if it is ___rising___ or ___falling___ on a given interval.

Increasing	Decreasing
	

Examples:

1. On a graphing calculator, graph the function $f(x) = 12x^2 + 4x^3 - 3x^4$.

   a. Find the domain and range of f.

   D: $(-\infty, \infty)$

   R: $(-\infty, 32]$

   b. Find the intervals on which f increases and decreases.

   Increases: $(-\infty, -1) \cup (0, 2)$

   Decreases: $(-1, 0) \cup (2, \infty)$

2. Graph $f(x) = x^{\frac{2}{3}}$ on your graphing calculator.

   a. Find the domain and range of the function.

   D: $(-\infty, \infty)$

   R: $[0, \infty)$

   b. Find the intervals on which f increases and decreases.

   Increasing: $(0, \infty)$

   Decreasing: $(-\infty, 0)$

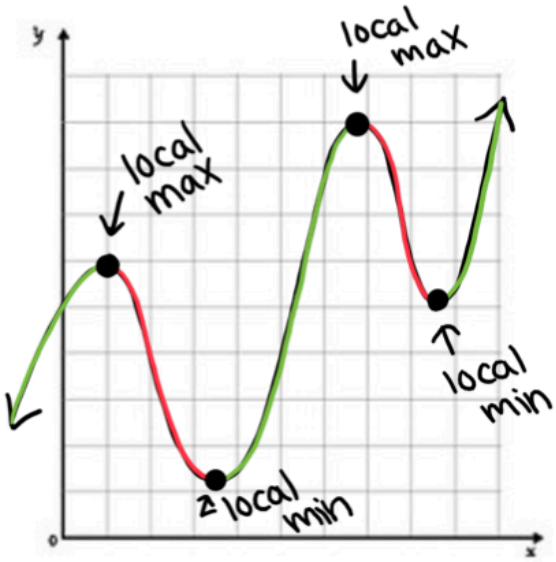
LOCAL MAXIMUM AND MINIMUM values

In many applications, it is important to be able to find the largest or smallest values on a function.

In this section, we will discuss ___local___ or ___relative___ maximum and minimum values.

We call these maximum or minimum values ___extrema___ .

We call these relative or local extrema because they are greater than or less than all other values of a function that are ___"nearby"___ .



A local minimum occurs where f(x) changes from decreasing to increasing.

A local maximum occurs where f(x) changes from increasing to decreasing.

Example: Use your graphing calculator to find the local maximum and minimum values of the function $f(x) = x^3 - 8x + 1$, correct to three decimal places.

Local Maximum at $x \approx -1.633$
Value ≈ 9.709

Local Minimum at $x \approx 1.633$
Value ≈ -7.709