Name: _____

PID: _____

1. Please justify all answers and show your work.
2. You may work with classmates, but all answers must be your own.

1. Complete exercise 18 in section 1.1 and write your solutions here:

   a. $f(4) =$ _____

   b. Solutions to $f(x) = 4$: _____

2. Suppose you are given the following piecewise function:

$$f(x) = \begin{cases} x^3 + 1 & \text{if } x < 0 \\ 4 & \text{if } 0 \leq x \leq 3 \\ 3x + 1 & \text{if } x > 3 \end{cases}$$

   (a) Evaluate $f(-1)$. Show your work.

   (b) Evaluate $f(2)$. Show your work.

   (c) Evaluate $f(4)$. Show your work.

3. Determine the domains of the following functions. Write your answer in interval notation. Justify your answers.

   (a) $f(x) = 3 \cdot \sqrt{x-2}$.

   (b) $g(x) = \frac{17}{x^2-4x+3}$.

   (c) $h(x) = 3 \cdot \sqrt{x-2} + \frac{17}{x^2-4x+3}$.

4. Suppose your cell phone plan costs \$60 and allows you to use up to 2 GB of data. You can also use additional data, but for all data that you use over 2 GB you are charged at a rate of \$50 per GB.

   (a) How much will you be charged if you use 2.5 GB of data? What about 5 GB of data?

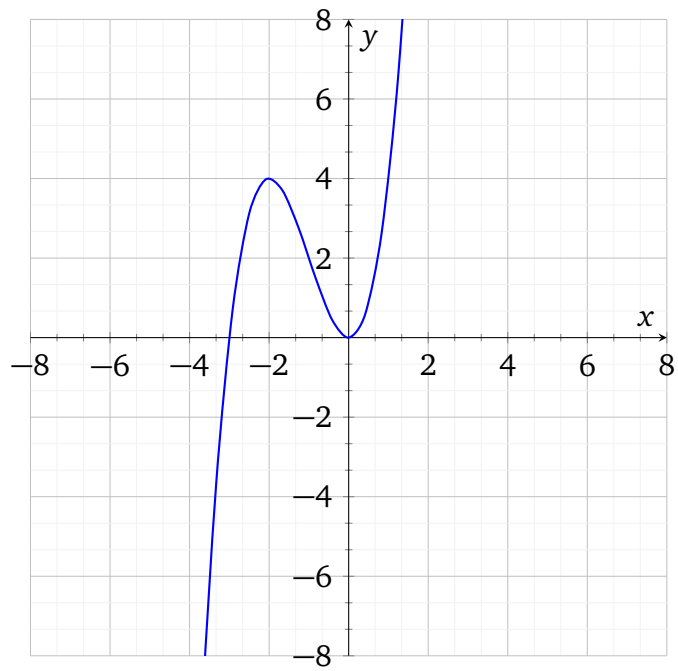
   (b) Write down a piecewise function f which takes as input an amount of data (in GB) and outputs the amount (in dollars) that you are charged for using that much data.

(c) What are the domain and range of f?

(d) Sketch the graph of f.

5. Exercise 1.3.8: Compute the average rate of change of the function $h(x) = 5 - 2x^2$ on the interval $[-2, 4]$. Show your work.

6. Consider the following function



Estimate where this function

(a) is increasing:

(b) is decreasing:

(c) has local minima:

(d) has local maxima:

(e) is concave up:

(f) is concave down:

7. The following table (data taken from Wikipedia) contains data on the number of confirmed COVID-19 cases in the U.S. For each input t, $C(t)$ is the number of confirmed COVID-19 cases in the U.S. up to the day which is t days after March 10th (I've arbitrarily chosen to start looking at the data at March 10). In other words, $C(0)$ is the number of confirmed COVID-19 cases up to March 10, $C(10)$ is the number of confirmed COVID-19 cases up to March 20th, etc.

t	C(t)
0	936
1	1205
2	1598
3	2163
4	2825
5	3501
6	4373
7	5664
8	8074
9	12,022
10	17,439

t	C(t)
11	23,710
12	32,341
13	42,751
14	52,690
15	64,916
16	81,966
17	101,012
18	121,105
19	141,065
20	161,783
21	186,979

(a) Compute the average number of new COVID-19 cases per day between March 10th and March 20th. Show your work.

(b) Compute the average number of new COVID-19 cases per day between March 20th and March 31st. Show your work.

(c) Here is a graph (from worldometers.info), which shows a graph of the above data (and more). Does this function appear to be concave up or concave down? How do the rates of change you computed previously support your conclusion?