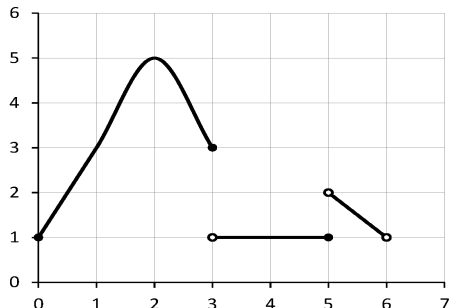


Group #: _____ Name: _____

There are multiple ways to calculate average rate of change for a function: **graphical** via function's graph (#1), **numerical** via data points (#2), and **algebraic** via function's algebraic representation (#3).

1. (30 points) The graph of a piecewise function f is given here.



- Find $f(1)$, $f(3)$, $f(5)$, and $f(6)$.
 - Find the values of x for which $f(x) > 3$. Use interval notation.
 - Find the values of x for which $f(x) = 1$. Use interval notation.
 - Find the net change of f between $x = 3$ and $x = 5$.
 - What is the slope of the secant line between $x = 0$ and $x = 2$ on the graph of f ?
 - Give an example of an interval over which the average rate of change of f is 0.
2. (20 points) When a bowl of soup is left in a room, the soup eventually cools down to room temperature. The temperature T of the soup is a function of time t . The table below gives the temperature (in $^{\circ}\text{F}$) of a bowl of soup t minutes after it was set on the table. Find the average rate of change of the temperature of the soup over the first 20 minutes and over the next 20 minutes. During which interval did the soup cool off more quickly? Justify your answer.

| t (min) | T ($^{\circ}\text{F}$) | t (min) | T ($^{\circ}\text{F}$) |
|-----------|----------------------------|-----------|----------------------------|
| 0 | 200 | 35 | 94 |
| 5 | 172 | 40 | 89 |
| 10 | 150 | 50 | 81 |
| 15 | 133 | 60 | 77 |
| 20 | 119 | 90 | 72 |
| 25 | 108 | 120 | 70 |
| 30 | 100 | 150 | 70 |

3. (20 points) For the following function, determine the average rate of change of f between the given input values, x_1 and x_2 .

(a) $f(x) = x^2 + 2x$; $x_1 = -1, x_2 = 4$

(b) $f(x) = \frac{2}{x}$; $x_1 = a, x_2 = a + h$

4. (30 points) The graph of the function, h , is given below.

(a) Describe the domain of h in interval notation.

(b) Describe the range of h in set-builder notation.

(c) Find the interval(s) on which the h is increasing. Use interval notation.

(d) Find the interval(s) on which the h is decreasing. Use interval notation.

(e) Use the sentence structure “ h has a local minimum/maximum value of _____, attained at $x =$ _____” to find all local extrema of h .

