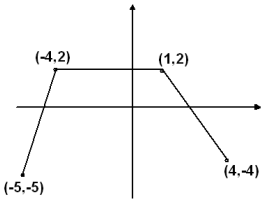
Mini-Lecture 2.3
Properties of Functions

Learning Objectives:

1. Determine even and odd functions from a graph
2. Identify even and odd functions from the equation
3. Use a graph to determine where a function is increasing, decreasing, or constant
4. Use a graph to locate local maxima and local minima
5. Use a graph to locate the absolute maximum and the absolute minimum
6. Use a graphing utility to approximate local maxima and local minima and to determine where a function is increasing or decreasing
7. Find the average rate of change of a function

Examples:

1. For the graph below,
   (a) State the intervals where the function is increasing, decreasing, or constant.
   (b) State the domain and range.
   (c) State whether the graph is odd, even or neither.
   (d) Locate the maxima and minima.



2. Determine algebraically whether the function $f(x) = x^3 - 2x + 1$ is odd, even, or neither.
3. Find the average rate of change of $f(x) = -x^3 + 3x^2$ from x=-1 to x=4.

Teaching Notes:

- Graphically determining even and odd will not present a problem, but determining this algebraically can be difficult for students. Show the graph of a function and give its algebraic definition at the same time. This will help reinforce this concept.
- Determining increasing, decreasing, or constant is done fairly easily by just drawing some graphs and going over the properties. This is fairly intuitive. The main difficulty the students will have is showing the proper intervals. They will often want to use the y-values and not the x-values in their intervals.
- Students will usually give a point and not a value for a max or min. They need to understand that a max or min is a value and not an ordered pair.

Answers:

1. (a) Increasing on $(-5,-4)$; Decreasing on $(1,4)$; Continuous on $(-4,1)$
   (b) Domain = $[-5,4]$; Range = $[-5,2]$. (c) Not odd or even.
   (d) Local Maximum = 2, Local Minimum = -5.
2. Neither 3. -4