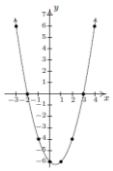
Section 1.6

Graphs of Functions

The Fundamental Graphing Principle for Functions

- The graph of a function f is the set of points which satisfy the equation y = f(x)
- That is, the point (x,y) is on the graph of f if and only if y = f(x)
- Example: Graph $f(x) = x^2 - x - 6$

x	$f(x)$	$(x, f(x))$
-3	6	$(-3, 6)$
-2	0	$(-2, 0)$
-1	-4	$(-1, -4)$
0	-6	$(0, -6)$
1	-6	$(1, -6)$
2	-4	$(2, -4)$
3	0	$(3, 0)$
4	6	$(4, 6)$



Zeros of Function

- The zeros of a function f are the solutions to the equation f(x) = 0.
- In other words, x is a zero of f if and only if (x,0) is an x-intercept of the graph of y = f(x).

Symmetries and Even/Odd Functions

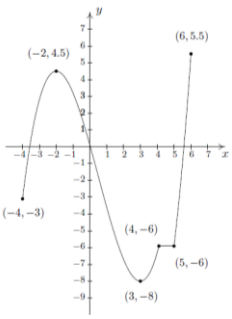
- Steps for testing if the graph of a function possesses symmetry:
- About the y-axis if and only if f(-x) = f(x) for all x in the domain of f
- About the origin if and only if f(-x) = -f(x) for all x in the domain of f
- We call a function even if its graph is symmetric about the y-axis or odd if its graph is symmetric about the origin.

Function Behavior on an Interval

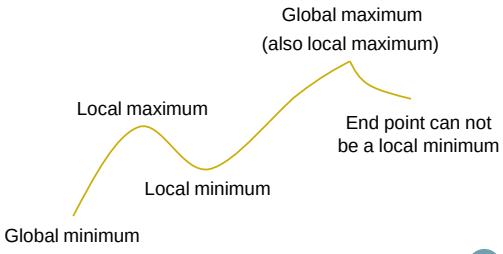
- Suppose f is a function defined on an interval I
- We say f is:
  - increasing on I if and only if f(a) < f(b) for all real numbers a, b in I with a < b. In other words, if moving to the right on a graph, going uphill.
  - decreasing on I if and only if f(a) > f(b) for all real numbers a, b in I with a < b. In other words, if moving to the right on a graph, going downhill.
  - constant on I if and only if f(a) = f(b) for all real numbers a, b in I. In other words, if moving to the right on a graph, staying flat.

Function behavior

- Increasing?
- Decreasing?
- Constant?



Minimums and Maximums

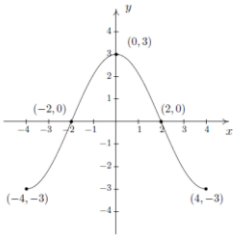


Minimums and Maximums

- A local maximum is a maximum within some neighborhood that need not be (but can be) a global maximum.
- A local minimum is a minimum within some neighborhood that need not be (but can be) a global minimum.
- End Points of functions cannot be local minimums or maximums.
- End Points of functions can be global minimums and maximums.

Example

- Given the graph of y = f(x)



Example (continued)

- Answer all of the following questions:
  1. Find the domain of f
  2. Find the range of f
  3. Determine f(2)
  4. List the x-intercepts, if any exist
  5. List the y-intercepts, if any exist
  6. Find the zeros of f
  7. Solve f(x) < 0
  8. Determine the number of solutions to the equation f(x) = 1
  9. List the intervals on which f is increasing.
  10. List the intervals on which f is decreasing.
  11. List the local maximums, if any exist.
  12. List the local minimums, if any exist.
  13. Find the maximum, if it exists.
  14. Find the minimum, if it exists.
  15. Does f appear to be even, odd, or neither?