Section 1.5

Vertical Line Test for Functions: A set of points in a coordinate plane is the graph of y as a function of x if and only if no vertical line intersects the graph at more than one point.

Zeros of a Function: The zeros of a function f of x are the x-values for which $f(x) = 0$.

Increasing and Decreasing Functions

a) A function f is **increasing** on an interval if, for any x_1 and x_2 in the interval, $x_1 < x_2$ implies $f(x_1) < f(x_2)$.

b) A function f is **decreasing** on an interval if, for any x_1 and x_2 in the interval, $x_1 < x_2$ implies $f(x_1) > f(x_2)$.

c) A function f is constant on an interval if, for any x_1 and x_2 in the interval, $f(x_1) = f(x_2)$.

Relative Maximum and Relative Minimum

A function value $f(a)$ is called the relative minimum of f if there exists an interval (x_1, x_2) that contains a such that

$$x_1 < x < x_2 \quad \text{implies} \quad f(a) \leq f(x).$$

A function value $f(a)$ is called the relative maximum of f if there exists an interval (x_1, x_2) that contains a such that

$$x_1 < x < x_2 \quad \text{implies} \quad f(a) \geq f(x).$$

Average Rate of Change: The average rate of change between any two points $\big(x_1, f(x_1)\big)$ and $\big(x_2, f(x_2)\big)$ is the slope of the line through the two points.

$$\text{A. R. of C. of } f \text{ from } x_1 \text{ to } x_2 = \frac{f(x_2) - f(x_1)}{x_2 - x_1}.$$

Even and Odd Functions

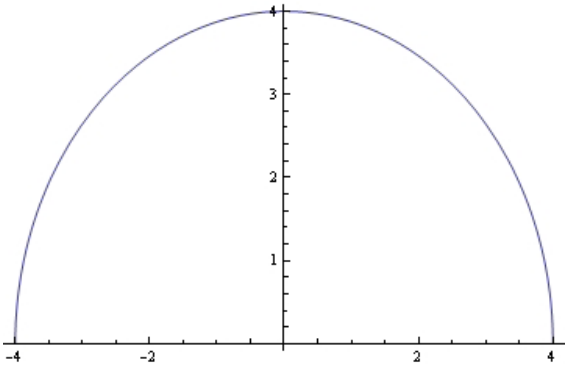
A function $y = f(x)$ is even if, for each x in the domain of f,

$$f(x) = f(-x).$$

A function $y = f(x)$ is odd if, for each x in the domain of f,

$$-f(x) = f(-x) \quad \text{or} \quad f(x) = -f(-x).$$

Problem 1. Use the graph of the function to find the domain and range of f.



Problem 2. Find the zeros of the function algebraically.

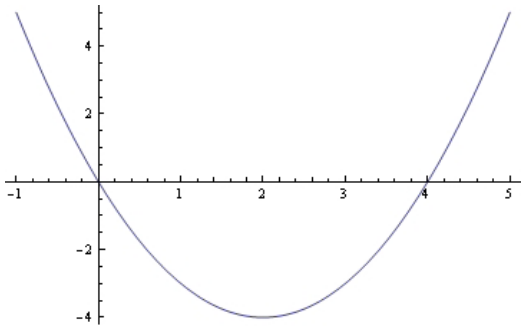
a) $f(x) = 2x^2 - 7x - 30$

b) $f(x) = \sqrt{2x} - 1$

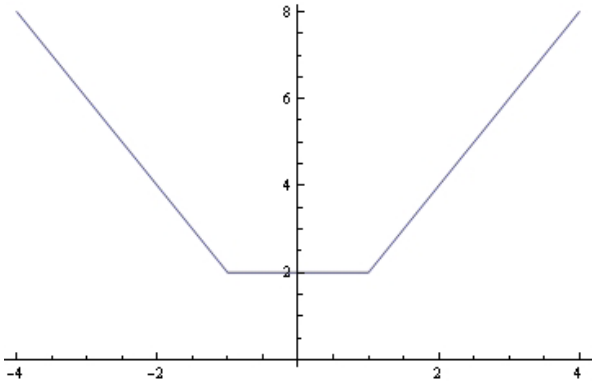
c) $f(x) = 9x^4 - 25x^2$

Problem 3. Determine the intervals over which the function is increasing, decreasing, or constant.

a) $f(x) = x^2 - 4x$



b) $f(x) = |x - 1| + |x + 1|$



c) $f(x) = \begin{cases} 2x + 1, & x \leq -1 \\ x^2 - 2, & x > -1 \end{cases}$

Problem 4. Find the average rate of change of the function from x_1 to x_2.

a) $f(x) = x^2 - 2x + 8, \quad x_1 = 1,\ x_2 = 5.$

b) $f(x) = -\sqrt{x+1} + 3, \quad x_1 = 3,\ x_2 = 8.$

Problem 5. Determine whether the function is even, odd, or neither. Then describe the symmetry.

a) $h(x) = x^3 - 5$

b) $f(t) = t^2 + 3t - 4$

Homework: Read section 1.5, do #7, 13, 15, 21, 23, 33, 35, 41, 51, 63, 71 (the quiz for this section will be taken from these problems)