# Chapter 12 – 1 First Derivative and Graphs

A **partition number** for a function of x is a value at which the function is zero or undefined. Partition numbers for a function divide the domain of the function into subintervals over which the function has the same sign (i.e., it is always positive or it is always negative).

If a value is in the domain of a function and is a partition number for the derivative of the function, it is called a **critical value** of the function. Critical values divide the domain of the function into subintervals over which the function is always increasing (positive derivative) or decreasing (negative derivative).

Given a function f(x), f(c) is a **local maximum** if there exists an interval (m, n) containing c for which f(c) ≥ f(x) for all x in the interval (m, n). Over its domain, a function may have zero, one, or more local maxima.

Similarly, f(c) is a **local minimum** if there exists an interval (m, n) containing c for which f(c) ≤ f(x) for all x in the interval (m, n). Over its domain, a function may have zero, one, or more local minima.

The value, f(c), is a **local extremum** if it is either a local maximum or a local minimum. Over its domain, a function may have zero, one, or more local extrema.

Local extrema occur at critical values of the function (i.e., where the derivative is zero or undefined).

For the following problems, find the partition numbers and the critical values and determine where the function is positive and where it is negative and where it is increasing and where it is decreasing and the local extrema.

**Example 1.**

Partition numbers:

Critical values:

Local Minimum: at This is also the absolute minimum.

**Example 2.**

Partition numbers:

Critical values:

Local Maximum: at

Local Minimum: at

**Example 3.**

Partition numbers:

Critical values:

Local Maximum: at . This is also the absolute maximum.

**Example 4.**

Partition numbers:

Critical values:

Local Maximum at

Local Minimum at

**Example 5.**

Partition numbers:

Critical values:

Local Maximum at

Local Minimum at

Local Minimum at