17.1 Introduction

Definition 17.1.1

Let c be a number in the domain D of a function f. Then $f(c)$ is the

- **absolute maximum** value of f on D if $f(c) \geq f(x)$ for all x in D.
- **absolute minimum** value of f on D if $f(c) \leq f(x)$ for all x in D.

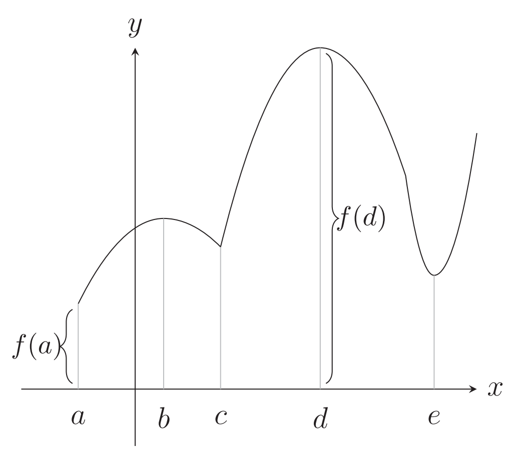
Definition 17.1.2

The number $f(c)$ is a

- **local maximum** value of f if $f(c) \geq f(x)$ when x is near* c.
- **local minimum** value of f if $f(c) \leq f(x)$ when x is near* c.

[1]

a. Given the following graph, identify the absolute and local max and mins and their locations.



a. Local mins and maxes.

b. Global (absolute) mins and maxes.

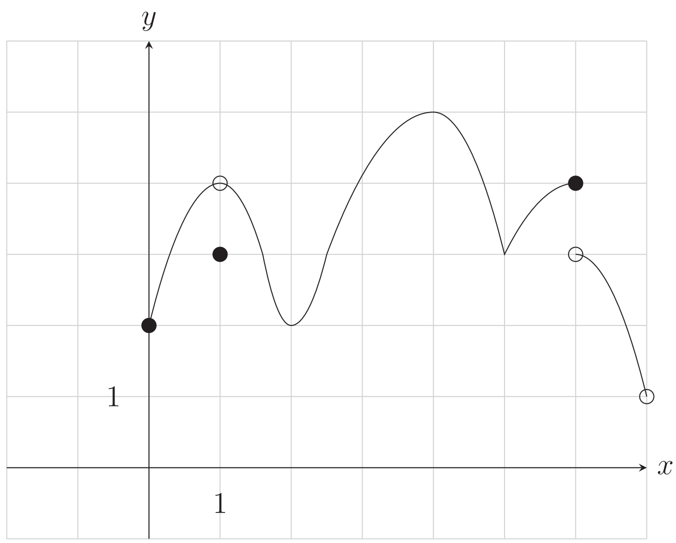
[1]* This is an informal definition. While the word "near" is hopefully conceptually clear, we have not at this point defined what near means. A more formal definition of **local maximum** is: $f(c)$ is a **local maximum** value of f if there exists an ϵ such that $f(c) \geq f(x)$ for all x in $(c-\epsilon, c+\epsilon)$.

17.2 Critical Numbers

Definition 17.2.1

A **critical number** of a function f is a number c in the domain of f such that either $f'(c) = 0$ or $f'(c)$ does not exist.

Example 17.2.1 Determine the critical numbers of the function described by the following graph.



Example 17.2.2 Find the critical numbers of $f(x) = x^{3/5}(4 - x)$.

Example 17.2.3 Suppose $f'(c) = 0$, does this mean that f has a maximum or minimum at c?

17.3 Finding Local and Absolute Maximums and Minimums

Example 17.3.1 What are the local and absolute maximums and minimums on the function $f(x) = 2x^3 - 6x^2 - 18x$?

17.4 The Closed Interval Method

Theorem 17.4.1

The **Extreme Value Theorem**: If f is continuous on a colosed interval $[a, b]$, then f attains an absolute maximum value $f(c)$ and an absolute minimum value $f(d)$ at some numbers c and d in $[a, b]$.

Example 17.4.1 Draw a picture that informs on what the Extreme Value Theorem is saying.

Example 17.4.2 Determine the absolute and local maximums and minimums of $f(x) = \cos(2x) + x$ over the interval $[0, 2\pi]$.