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Notes: By Nota

Nota

Nota, is a simple script to manage notes. It manages all my class notes which are markdown files and compiles them to PDF versions. This is so people can see my notes and I can share them easier. Not only that but the PDF version makes for easier reading, while the markdown versions are easy to edit and easy to search for items. Hope you enjoy!

Unit 1

Domain & Range

- Definition: A function from a set D to a set R is a rule that assigns to every element in D a unique in element in R.
- Familiar Definition: A function exists when every input(x) has only on output(y)
- Notation: $y = f(x)$
- Here x is the **independent variable** and y is the **dependent variable**
- To be a function the graph must pass the vertical line test which states that a graph (set of points (x,y)) in the *xy*-plane defines y as a function of x if no vertical line intersects the graph in more than one point

Domain

Given a function $y = f(x)$, the domain of the function is set of all permissible inputs and the range is the set of all resulting outputs. Domains can be found algebraically; rangges are often found algebraically and graphically. Domains and Ranges are sets. Therefore, you must use the proper notation.

Notation

- { } - Set (of intervals)
- (,) - Interval does not include the endpoint

- [,] - Intervals includes the endpoints
- $\cup$ - The union of intervals

Finding Domain

- The key to finding a domain is to find everything that can't be used.

1. Domain of all polynomial functions is the $\mathbb{R}$
2. Square root functions cannot contain a negative underneath the radical
3. Rational functions cannot have zeroes in the denominator

Continuity

- Definition: A function is continuos at a point if, graphically speaking, the graph does not come apart at that point. In other words, the graph has no breaks or holes. This graph is continuos everywhere. Notice that the graph has no breaks or holes. This means that if we are studying the behavior of the function *f* for *x* values close to any particular real number *a*, we can be assured that the *f(x)* will be close to the *f(a)*.

Types of Discontinuity

1. Removable Continuity
    - Can be patched up by re-defining the hole
2. Jump Discontinuity
    - Jump in function values that make it so you can't redefine the hole
3. Infinite Discontinuity
    - Vertical asymptote, limits so that its seperated by an asymptote

Piecewise Functions

- Definition: Piecewise functions are functions that are defined by using different equationss for different parts of the domain. Studied for discontinuity.

Increasing and Decreasing

- Definition: You can visually determine the parts of a function (intervals) where it is either increasing, decreasing, or constant.

1. Increasing: If for any two points in the interval, a positive change in *x* results in a positive change in *y*
2. Decreasing: If for any two points in the interval, a positive change in *x* results in a negative change for *y*
3. Constant: If for any two points in the interval, a positve change in *x* results in a zero change in *y*

Local and Absolute Extrema

- Definition: Extrema are the peaks and valleys where a graph changes from increasing to decreasing or vice versa. Extrema come in two forms: maxima and minima.
    - Local / Relative: Maximum or minimum on some open interval
    - Absolute: Maximum or minimum for the function

Graphs

**NOTE: THESE DON'T RENDER RIGHT ON WEBSITE ### $f(x) = x$ - Domain: $(-\infty, \infty)$ - Range: $(-\infty, \infty)$ - Increasing: $(-\infty, \infty)$ - Decreasing: N/A - Constant: N/A - Extrema: None - Symmetry: Odd - Asymptotes: None

$f(x) = x^2$

- Domain: $(-\infty, \infty)$
- Range: $[0, \infty)$
- Increasing: $[0, \infty)$
- Decreasing: $(-\infty, 0]$
- Constant: N/A
- Exrema:
  - Abs. Minima: 0 when x = 0
- Symmetry: Even
- Asymptotes: None

$f(x) = x^3$

- Domain: $(-\infty, \infty)$
- Range: $(-\infty, \infty)$
- Increasing: $(-\infty, \infty)$
- Decreasing: N/A
- Constant: N/A
- Extrema: None
- Symmetry: Odd
- Asymptotes: None

$f(x) = \frac{1}{x}$

- Domain: $(-\infty, 0)U(0, \infty)$
- Range: $(-\infty, 0)U(0, \infty)$
- Increasing: N/A
- Decreasing: $(-\infty, 0)U(0, \infty)$
- Constant: N/A
- Extrema: None
- Symmetry: Odd
- Asympototes: $x = 0, y = 0$