

## MTH 445 Review Guide for Test 3 Tuesday April 7th

### Section 21 Continuous Functions

Definition 21.1 State and apply to problems like Exercise 21.4

Statement of Theorem 21.1

Dirichlet and modified Dirichlet Function (Examples 21.8 and 21.9)

Statement of Theorem 21.1 and Theorem 21.12

### Section 22 Properties of Continuous Functions

Statement of Theorem 22.2

Statement of Extreme Value Theorem -- How is Theorem 22.2 used to get this corollary

For a given function interpret the EVT – are hypotheses satisfied, does it have a max and min?

Intermediate Value Theorem (22.6) -- statement. Outline the Bisection Algorithm (From alternative proof done in class.)

Use this theorem for problem like exercises 22.4 and 22.5

### Section 23 Uniform Continuity

Give definition of uniform continuity and contrast that with ordinary continuity.

Show a function is uniformly continuous from definition (like exercise 23.4)

Give ( or recognize) an example of a function that is

- Discontinuous at a point.
- Discontinuous but with a removable discontinuity.
- Continuous but not uniformly continuous.
- Uniformly continuous.

Statement of Theorem 23.6 -- apply to problems

### Section 25 The Derivative

Give the definition of differentiable at a point  $c$  and the derivative of a function at a point  $c$ .

What does it mean for a function to be differentiable on a set  $S$ .

Use the definition of derivative to show that a simple function such as  $f(x) = x^2$  or exercises 25.4 is differentiable and find its derivative.

Discuss (and be able to formally verify) (non?) differentiability of  $x \sin\left(\frac{1}{x}\right)$  and  $x^2 \sin\left(\frac{1}{x^2}\right)$  -- use

graph to support your argument.

Know the statement of Theorem 25.7 and be able to prove parts a, b, c.

Know the statement of Theorem 25.10 (Chain Rule) – don't have to know proof.

Apply Theorem 25.7 and 25.10 to compute derivatives of functions

### Section 26 The Mean Value Theorem

Complete the statement of Theorem 26.1

Outline or fill in blanks for Theorem 26.1. Demonstrate concepts graphically for proof.

State and outline or complete the proof of Theorem 26.2 Rolle's Theorem.

State the Mean Value Theorem (Theorem 26.3)

Show or explain how Rolle's Theorem is used to prove the Mean Value Theorem.

Important results derived from the Mean Value Theorem—know what they say and how to derive using the MVT.

1. Theorem 26.6
2. Corollary 26.7
3. Theorem 26.8

Apply the above results to problems like 26.3, 26.5

Statement of the Intermediate Value Theorem for Derivatives.

Statement of the Inverse Function Theorem- Sketch what it says – as in figure 26.3