## MATH 313 Exam 1- Review Topics and Problems

## 1. Geometry

- Represent complex numbers, their sums, products, roots and powers, by points in the plane.
- Find and graph the curves in the $z=x+i y$ plane that are mapped into vertical and horizontal lines $u=$ const, $v=$ const in the $w=u+i v$ plane by a function $f(z)$.
Examples: Homework \#1: 10.
Homework \#2: 5,6,14.
Homework \#3: 3.


## 2. Computations

- Find cartesian and exponential representation of complex numbers.
- Use cartesian and exponential representation of complex numbers to perform algebra, including finding powers and roots, logarithms, exponentials.
- Find harmonic conjugates.

Examples: Homework \#1: 1,6,7,10,
Homework \#2: 9,13.
Homework \#3: 2.
Homework \#4: 6.

## 3. Basic Definitions

- Set theory
- $\epsilon-\delta$ definition of limits
- definition of continuity
- definition of the derivative
- Cauchy-Riemann equations
- harmonic functions

Examples: Homework \#2: 7.

## 4. Simple derivations

- Determine where functions are differentiable. Justify.
- Derive a limit using the definition
- Show a limit does not exist
- Derive the Cauchy-Riemann equations for differentiable functions
- Derive simple trig identities using rules
- prove simple properties of modulus, complex conjugate for complex exponentials

Examples: Homework \#1: 2,3,4,9.
Homework \#2: 1,2,3,4,8a,10.
Homework \#3: 4,5,7.
Homework \#4: 1,2,3,4.

