Review For Complex Comprehensive

All Chapters and Problems are referring to *Schaum's Outline of Complex Variables*, 2ed Speigel et al. Definitions of the words in **boldface** may be asked on the exam.

Chapter 1 Definitions: **absolute value(norm), conjugate, polar form, n^{th} roots of unity, Euler's formula**
Proofs:Trig identities (22), Reverse triangle inequality 7(c)
Sample problems:13,16,37,131

Chapter 2 Definitions: multiple-valued functions, **exp(z), ln(z), cos(z), sin(z), limits, continuity**, branch lines, sequences, infinite series
Sample problems:4, 8,13,16, 30, find real imaginary parts of functions above

Chapter 3 Definitions: **derivative, analytic, Cauchy-Riemann equations, harmonic functions, harmonic conjugates** singular points, orthogonal families
Proofs: Cauchy Riemann equations(3.5).
If $f = u + iv$ is analytic show that u, v are harmonic if they have continuous second partial derivatives. (3.6)
Orthogonal families. (3.27)
Sample problems: 1,2,4,7,11, be able to verify C-R in polar form

Chapter 4 Definitions: complex line integral,indefinite integral simply and multiply connected regions, **Cauchy's Theorem, Morera's Theorem, Theorem 4.1-4.5 pg 117**
Proofs: Cauchy's Theorem (4.11)
Sample problems:2,17,21,22,23,27,43

Chapter 5 Definitions: **Cauchy Integral formulas, Cauchy's Inequality Liouville's theorem, Fundamental Theorem of Algebra, Gauss Mean value Theorem**, Poisson Integral formulas.
Proofs: Cauchy Integral formulas, Liouville's theorem, Gauss Mean Value Theorem
Sample problems: 5.2,5.5, 5.29, 5.52, 5.70

Chapter 6 Definitions: **Singularities, Poles, Taylors Series, Laurent Series**
Be able to compute Taylor and Laurent series, identify orders of poles and give examples. Know Taylor series of $\frac{1}{1-z}$ $e^z, \sin(z), \cos(z)$.
Proofs: Taylors Theorem (6.22)
Sample problems: 6.23a, 6.26,6.27,

Chapter 7 Definitions: **Residue, Cauchy Principal value** Know and be able to apply the Residue Theorem, Calculate residues, Use residue theory to calculate real integrals.
Proofs: $\oint_C f(z)dz = 2\pi i a_{-1}$ pg 205, 7.7
Sample problems:7.9, 7.10,7.12,7.18

Chapter 8 Definitions: **Conformal Mapping, Jacobian, Fractional transformation**
Proofs: If $f(z) = u + iv$ is analytic in R then $\frac{\partial(u,v)}{\partial(x,y)} = |f'(z)|^2$ pg 259 8.5
If $f(z)$ is analytic and $f'(z) \neq 0$ in a region R then the mapping $w = f(z)$ is conformal at all points in R.
Sample problems: 8.12,8.16,

Chapter 9 Definitions: **Laplace's Equation, Dirichlet Problem, Poisson formulas**
Sample problems:9.2, 9.7, 9.8