**Series of Common Functions** at :

For expansion at , use Taylor’s expansion.

**Roots** of Common Functions

**Determining Poles**

1. Identify where the poles may be. (Approximations such as might help).
2. If but then take least to be the “order”. (Using Mathematica might be useful.)
3. Series Expansion

**Residue**

Either use series expansion or residue formula.

General residue formula for order :

Residue formula for simple pole where ( gives simple pole):

**Residue Theorem**

(For positively oriented curve)

**General Strategy for Residue Calculus**

When given an integral over , change trigs to exponential: .

When given an integral over , change trigs to exponential:

**Jordan’s Lemma**

meromorphic on . Suppose as in . Then, as ,

(For any . is the circular arc on .)

**Epsilon Lemma**

meromorphic with simple pole at . with . Then:

(BE CAREFUL: FOR CLOCKWISE, need the opposite sign)

(Also, when circumventing zero, for even function.)

**Strategy for Choosing Contour**

If there is a pole at zero, use a half circular contour, but bypassing the zero.

If there is a branch point, take a keyhole contour bypassing the branch cut (but sometimes previous might be easier.)

If integrating from 0 to infinity of multifunction, contour integral might give insight (the straight part).