Math 5160 **Homework #8** **Do after Gamelin VI.2**

#1 Laurent Has Decomposed Consider $f(z) = \dfrac{1}{z^2 - z}$.

(a) Find all of the Laurent expansions centered at $z = 0$.

(b) Find the Laurent expansion centered at $z = -1$ that converges at $z = 1/2$.
Determine the largest open set where this expansion converges.

#2 I am Just a Simple Pole in a Complex Plane Find the isolated singularities of the following functions and determine whether they are removable, essential, or poles. For poles, determine the order and find the principal part at that pole.

(a) $\dfrac{z}{(z^2-1)^2}$ (b) $\dfrac{ze^z}{z^2-1}$

#3 Beware of Cancellation Find the radius of convergence of the power series for the following functions, expanded about the indicated point.

(a) $\dfrac{z-1}{z^4-1}$ about $z = 3 + i$ (b) $\dfrac{\cos(z)}{z^2 - \pi^2/4}$ about $z = 0$