

Name: _____

Show complete work—that is, all the steps needed to completely justify your answer. Simplify your answers as much as possible. You may refer to theorems that we proved in class.

- (1) (a) Define a zero z_0 of $f(z)$ of order m .
(b) Find a Laurent series for $f(z) = \frac{1}{z(z-2)^2}$ centered at $z = 2$ and specify the region in which it converges. (*Hint:* start by computing a *power* series for $\frac{1}{z}$ centered at 2.)
- (2) (a) Define a pole z_0 of $f(z)$ of order m .
(b) Compute $\int_{\gamma} \frac{\exp z}{\sin z} dz$ where γ is the circle $|z| = 2$, oriented counterclockwise.
- (3) (a) Define the residue of $f(z)$ at (the isolated singularity) z_0 .
(b) Compute $\int_{\gamma} z^3 \cos\left(\frac{3}{z}\right) dz$ where γ is the circle $|z| = 2$, oriented counterclockwise.