

## PHYS 3090: Homework 3 (due Wednesday Oct. 3)

**Problem 1:** Compute  $\int_0^{2\pi} d\theta \frac{1}{(2-\cos \theta)^2}$  using contour integration. (5 points)

**Problem 2:** Compute p.v.  $\int_{-\infty}^{\infty} dx \frac{\cos x - 1}{x^2}$  by contour integration. (5 points)

**Problem 3:** Compute p.v.  $\int_0^{\infty} dx \frac{1}{1+x^{100}}$  by contour integration. (5 points)

*Hint 1:* You may use the result from problem 2a in HW 2 to compute the residues.

*Hint 2:* The equation for a finite geometric series  $\sum_{n=0}^N x^n = \frac{1-x^{N+1}}{1-x}$  might be useful.

*This problem is a bit challenging. Don't get confused: there is a simple pole at  $z = 1$ , but this is not the singular point you should be concerned with.*

**Problem 4 (5 points):** Compute  $\oint_C dz \frac{e^{1/z}}{1-z}$  where  $C$  is the circle  $|z| = 0.1$ . Hint: you will need to use the formula for an infinite geometric series:  $\sum_{n=0}^{\infty} z^n = \frac{1}{1-z}$  for  $|z| < 1$ .