1. (F 2.6.18) Compute the following integral, using the change of variables $x = e^t$ to move the lower limit (and the singularity) to $-\infty$:

$$\int_{0}^{\infty} \frac{(\ln x)^2}{x^2 + 1} \, dx$$

2. Compute the following integral:

$$\int_{0}^{\infty} \frac{x^{1/3}}{x^3 + 1} \, dx$$

3. Fisher 3.3.5(d)

4. Tell if each function is $N$-analytic, specifying $N$, then if the function is 2-analytic, check that the real and imaginary parts are biharmonic:

   a) $F = 7iz + \bar{z} + \bar{z}^2 z^2$

   b) $F = e^z + |z|^2$

   c) $F = (z - 12)(z + 2i)(\bar{z} - 1)$

5. Decide if the following functions are harmonic or not by checking the first Cauchy-Riemann equation $u_x = v_y$, then check if the function is biharmonic by checking if the difference $u_x - v_y$ is harmonic (as we showed in class):

   a) $\bar{z}z^2 + 16\bar{z}^2$

   b) $\bar{z} \cos z$

   c) $z e^z$

6. Based on the previous question, is a biharmonic function also harmonic, or not? Explain.

7. Find all points at which the following mappings would not be conformal:

   a) $w = Ez^2 + k_0$

   b) $w = z \cos 3z$

   c) $w = z + \frac{1}{z}$

   d) $w = \frac{z^2 + 3}{z^2 + i}$

8. Fisher 3.4.8