Reading: Textbook, rest of Chapter 1, first two sections of Chapter 2

Practice problems: (don’t hand these in)

1. Compute \( \int_\gamma x \, dz \) where \( \gamma \) is the directed line segment from 0 to \( 1 + i \).

2. Compute \( \int_{|z|=r} x \, dz \), where the circle is traversed in the positive direction (i.e., counterclockwise), in two ways. First, use a parametrization and second by observing that \( x = \frac{1}{2}(z + \overline{z}) = \frac{1}{2} \left( z + \frac{z^2}{z} \right) \) on the circle.

3. Compute \( \int_{|z|=2} \frac{dz}{z^2 - 1} \) where the circle is traversed in the positive direction.

4. Textbook page 30, problem 25(b)

Problems to hand in:

1. Suppose that \( f(z) \) is analytic and that \( f'(z) \) is continuous in a region that contains the closed curve \( \gamma \). Show that
   \[ \int_\gamma f(z)f'(z) \, dz \]
   is purely imaginary.

2. Assume that \( f(z) \) is analytic and satisfies the inequality \( |f(z) - 1| < 1 \) in a region \( \Omega \). Show that
   \[ \int_\gamma \frac{f'(z)}{f(z)} \, dz = 0 \]
   for every closed curve \( \gamma \) in \( \Omega \).

3. If \( P(z) \) is a polynomial and \( C \) denotes the circle \( |z - a| = R \), what is the value of
   \[ \int_C P(z) \, dz \]

4. Textbook page 30, problem 25 (a),(c)