1. (10 points) Evaluate

\[ \int_0^2 \overline{z} \, dz \]

along the upper semi-circle with center at 1.

\[ z(t) = 1 - e^{-it}, \quad 0 \leq t \leq \pi \]
\[ \overline{z} = 1 - e^{it}, \quad dz = i e^{-it} \, dt \]
\[ \int_0^2 \overline{z} \, dz = \int_0^\pi (1 - e^{it}) i e^{-it} \, dt \]
\[ = i \int_0^\pi (e^{-it} - 1) \, dt = i (\frac{e^{-it}}{-i} - t) \bigg|_0^\pi \]
\[ = 2 - \pi i \]

2. (10 points) Evaluate

\[ \int_{-2}^{-i} \frac{dz}{z} \]

along the straight line.

\[ \int_{-2}^{-i} \frac{dz}{z} = \log z \bigg|_{-2}^{-i} = \log (-i) - \log (-2) \]
\[ = \frac{3\pi i}{2} - (\ln 2 + i\pi) = -\ln 2 + \frac{\pi i}{2} \]

Choose the branch of \( \log z \) such that \( 0 < \arg z < 2\pi \)
(cut along positive x-axis)