1. Compute the following integrals. In some cases you must find a suitable parametrization for the given contour:

   (a) $\int_\gamma (\mathrm{Im}(z))^2 \, dz$ where $\gamma(t) = 3t + 2it, -2 \leq t \leq 2$.

   (b) $\int_\gamma \frac{z+1}{\overline{z}} \, dz$ where γ is the right half of the unit circle from $-i$ to i .

   (c) $\int_\gamma |z|^2 \, dz$ where $\gamma(t) = t^2 + \frac{i}{t}, 1 \leq t \leq 2$.

   (d) $\int_\gamma e^{\overline{z}} \, dz$ where γ consists of the line segment from $z = 0$ to $z = 2$ followed by the line segment from $z = 2$ to $z = 1 + \pi i$.

   (e) $\int_\gamma \mathrm{Re}(z) \, dz$ where γ is the circle of radius 2 with positive orientation.

2. Compute the following integrals. Explain your reasoning, especially if relying on the path independence theorem.

   (a) $\int_\gamma 2z \, dz$ where $\gamma(t) = 2\cos^3(\pi t) - i \sin^2(\pi t/4), 0 \leq t \leq 2$.

   (b) $\int_\gamma \frac{1}{z} \, dz$ where γ is the right half of the unit circle from $-i$ to i .

   (c) $\int_\gamma \frac{1}{z} \, dz$ where γ is the left half of the unit circle from $-i$ to i .

   (d) $\int_\gamma z \sin(z^2) \, dz$ where γ is the spiral $\gamma(t) = te^{it}, 0 \leq t \leq 8\pi$.