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

   (a) $\int_\gamma (\text{Im}(z))^2\, dz$ where γ is parametrized by $z(t) = 3t + 2it, -2 \le t \le 2$.

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

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

   (d) $\int_\gamma e^{\bar{z}}\, dz$ 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) $\int_\gamma \text{Re}(z)\, dz$ 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 γ is parametrized by $z(t) = 2\cos^3(\pi t) - i\sin^2(\pi t/4), 0 \le t \le 2$.

   (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 $z(t) = te^{it}, 0 \le t \le 8\pi$.

   (e) $\int_\gamma \text{Log}(z)\, dz$ where γ is the unit circle . (Harder: be careful with the branch cut.)