READ ME: Merely finding the answer to a problem is not enough to receive full credit; you must show how you arrived at that answer.

1) Compute the Jacobians of the following transformations.

a) (2 points) $T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$, $T(u, v) = \left(\dfrac{u\sin(v) + u\cos(v)}{2}, \dfrac{u\sin(v) - u\cos(v)}{2} \right)$.

b) (2 points) $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$, $T(x, y, z) = (e^{x^2 + y^2}, \sin(xz), y^3 - 2z^2)$.

2) (5 points) Use the transformation in 1a) to evaluate the integral

$$\int_{\mathcal{R}} \arctan\left(\frac{x + y}{x - y} \right) \, dx \, dy$$

where $\mathcal{R}$ is the region above the line $y = -x$, below the x-axis, and in between $x^2 + y^2 = \dfrac{1}{2}$ and $x^2 + y^2 = 2$.