#1) Let C denote the positively oriented circle $|z| = 2$ and evaluate the integral

(a) $\int_C \tan z \, dz$

(b) $\int_C \frac{dz}{\sinh 2z}$.

#2) (a) Find the bilinear transformation $w = S(z)$ that maps the crescent-shaped region that lies inside the disk D:$|z-2| < 2$ and outside the circle $|z-1| = 1$ onto a horizontal strip.

(b) Graph.

#3) (a) The Euler numbers are the numbers $E_n (n = 0, 1, 2, \ldots)$ in the Maclaurin series representation $\frac{1}{\cosh z} = \sum_{n=0}^{\infty} \frac{E_n}{n!} z^n$, where $\left(|z| < \frac{\pi}{2}\right)$. Point out why this representation is valid in the indicated disk and why $E_{2n+1} = 0$, where $(n = 0, \ 1, 2, \ldots)$.

(b) Show that $E_0 = 1$, $E_2 = -1$, $E_4 = 5$, and $E_6 = -61$.

#4) Evaluate the integral $\int_C \frac{dz}{(z^2-1)^2+3}$, where C is the positively oriented boundary of the rectangle whose sides lie along the lines $x = \pm 2$, $y = 0$, and $y = 1$.

#5) Show that the mapping $w = S(z) = \frac{(1-i)z+2}{(1+i)z+2}$ maps the disk D:$|z+1| < 1$, one-to-one and onto the upper half plane $Im\,(w) > 0$.