

In all parts of all problems, prove your answers.

1. Find $\{z : \cos z = 0\}$, $\{z : \sin z = 0\}$, $\{z : e^z = i\}$.
2. Prove that the principal branch of the logarithm is continuous. (Hint either use the usual Arctan function from calculus, or look in Conway, page 44, # 9.)
3. Let $r > 0$, and put $A = \{e^{1/z} : 0 < |z| < r\}$. Describe the set A .
4. Find all possible values of i^i and of $(-1)^i$. Then do the same for i^{2i} . (If you don't see something funny, then you made a mistake.)
5. Prove that there is no branch of the logarithm defined on the punctured plane $\mathbf{C} \setminus \{0\}$. (Hint: Conway, page 44, # 21.)