

A practical problem arising in my study

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Now I have a real function

$$H = H(z, \phi), \tag{1}$$

which is defined on the domain D , $-1 \leq z \leq 1$, $0 \leq \phi \leq 2\pi$. Some important properties are satisfied,

$$H(-1, \phi) = C_1, \tag{2}$$

$$H(1, \phi) = C_2, \tag{3}$$

$$H(z, 0) = H(z, 2\pi), \tag{4}$$

where C_1 and C_2 are two constants.

We are interested in the number of saddle points and minimum and maximum points of H , and the relation between them. We know there is a theorem asserting that on the earth, the number of mountain peaks P , the number of valleys V , and the number of saddle points S satisfy

$$P - S + V = 2. \tag{5}$$

My question is, is there a similar relation for H on the domain D ?