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For a natural number  $n$ , let  $r(n)$  denote the number of ways of writing  $n$  as a sum of two squares, and  $P(x)$  the remainder term in the circle problem of Gauss, that is,  $P(x) = \sum_{n \leq x} r(n) - \pi x$ . The purpose of this paper is to study some properties of the summatory function  $\sum_{n \leq x} P(n)^k$  with an arbitrarily fixed natural number  $k$ . In particular, we consider the cases  $k = 2$  and  $3$  in detail.

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