The problem is in $\mathcal{NP}$ because we can exhibit a partition of the numbers into sets, and then sum the squares of the totals in each set.

We now show that *Number Partitioning*, which we proved NP-complete in the previous problem, is reducible to this problem. Thus, given a collection of $x_1, \ldots, x_n$, where we want to know if they can be divided into two sets with the same sum, we construct an instance of this sum-of-squares problem in which $k = 2$ and $B = \frac{1}{2}S^2$, where $S = \sum_{i=1}^{n} x_i$.

If there is a partition of the numbers into two sets with the same sum, then the squared sum of each set is $(\frac{S}{2})^2 = \frac{1}{4}S^2$, and adding this together for the two sets gives $\frac{1}{2}S^2 = B$. Conversely, suppose we have two sets whose total sums are S_1 and S_2 respectively. Then we have $S_1 + S_2 = S$, and $S_1^2 + S_2^2 = \frac{1}{2}S^2$. The only solution to this is $S_1 = S_2 = \frac{1}{2}S$, so these two sets form a solution to the instance of *Number Partitioning*.

[1] ex981.457.448