Overview: The symmetric group of permutations on \( n \) elements, \( S_n \), is a group of functions. In particular, the functions in \( S_n \) are the one-to-one, onto functions from \( \{1, 2, \ldots, n\} \) to itself (i.e., bijections from \( \{1, 2, \ldots, n\} \) to itself). The binary operation is function composition. So, for \( f, g \in S_n \), \((f \circ g)(i) = f(g(i))\).

A few problems:

1. Define a permutation \( \sigma \in S_6 \) by \( \sigma(1) = 4, \sigma(2) = 2, \sigma(3) = 6, \sigma(4) = 3, \sigma(5) = 1, \sigma(6) = 5 \). Write \( \sigma \) in one-line notation, in two-line notation, and in cycle notation.

2. Write \([1, 9, 4, 8, 2, 7, 5, 3, 6]\) as a product of transpositions.

3. Write \((5, 3, 4, 7)(1, 3, 8)(2, 1, 5)(6, 4, 3)(2, 8, 5, 3, 4)\) in disjoint cycle form.

4. Let \( \sigma = [1, 6, 2, 5, 3, 4] \) and \( \tau = [5, 2, 6, 4, 3, 1] \). Compute \( \sigma \circ \tau \). Write your answer in two-line notation.

5. Is \([1, 4, 3, 2, 5]\) an element of \( S_6 \)?