

K = X[1, 4, 2, 5] * X[3, 6, 4, 1] * X[5, 2, 6, 3]

X[1, 4, 2, 5] X[3, 6, 4, 1] X[5, 2, 6, 3]

t1 = K /. X[a_, b_, c_, d_] => A P[a, d] P[b, c] + B P[a, b] P[c, d]

(B P[1, 4] P[2, 5] + A P[1, 5] P[4, 2])

(A P[2, 6] P[5, 3] + B P[5, 2] P[6, 3]) (B P[3, 6] P[4, 1] + A P[3, 1] P[6, 4])

t2 = Expand[t1]

A B² P[1, 4] P[2, 5] P[2, 6] P[3, 6] P[4, 1] P[5, 3] +
A² B P[1, 5] P[2, 6] P[3, 6] P[4, 1] P[4, 2] P[5, 3] +
B³ P[1, 4] P[2, 5] P[3, 6] P[4, 1] P[5, 2] P[6, 3] +
A B² P[1, 5] P[3, 6] P[4, 1] P[4, 2] P[5, 2] P[6, 3] +
A² B P[1, 4] P[2, 5] P[2, 6] P[3, 1] P[5, 3] P[6, 4] +
A³ P[1, 5] P[2, 6] P[3, 1] P[4, 2] P[5, 3] P[6, 4] +
A B² P[1, 4] P[2, 5] P[3, 1] P[5, 2] P[6, 3] P[6, 4] +
A² B P[1, 5] P[3, 1] P[4, 2] P[5, 2] P[6, 3] P[6, 4]

t3 = t2 //. {P[a_, b_] P[b_, c_] => P[a, c], P[a_, b_] ^2 => P[a, a]}

A² B P[2, 2] + A B² P[1, 1] P[2, 2] + B³ P[1, 1] P[2, 2] P[3, 3] + A² B P[4, 4] +
A³ P[3, 3] P[4, 4] + A B² P[3, 3] P[4, 4] + A² B P[6, 6] + A B² P[2, 2] P[6, 6]

t4 = Expand[t3 /. P[a_, a_] -> -A^2 - B^2 /. B -> 1 / A]

$-\frac{1}{A^9} + \frac{1}{A} + A^3 + A^7$