

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

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

**t1 = K /. X[i\_, j\_, k\_, l\_] => A \* p[i, l] \* p[j, k] + B \* p[i, j] \* p[k, l]**

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

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

**t2 = Expand[t1]**

A<sup>2</sup> B p[2, 5] p[2, 6] p[3, 5] p[4, 1]<sup>2</sup> p[6, 3] +

A B<sup>2</sup> p[2, 6] p[3, 5] p[4, 1] p[4, 2] p[5, 1] p[6, 3] + A<sup>3</sup> p[2, 5]<sup>2</sup> p[4, 1]<sup>2</sup> p[6, 3]<sup>2</sup> +

A<sup>2</sup> B p[2, 5] p[4, 1] p[4, 2] p[5, 1] p[6, 3]<sup>2</sup> + A B<sup>2</sup> p[1, 3] p[2, 5] p[2, 6] p[3, 5] p[4, 1] p[6, 4] +

B<sup>3</sup> p[1, 3] p[2, 6] p[3, 5] p[4, 2] p[5, 1] p[6, 4] +

A<sup>2</sup> B p[1, 3] p[2, 5]<sup>2</sup> p[4, 1] p[6, 3] p[6, 4] + A B<sup>2</sup> p[1, 3] p[2, 5] p[4, 2] p[5, 1] p[6, 3] p[6, 4]

**t3 = t2 //. p[a\_, b\_] p[b\_, c\_] => p[a, c]**

A B<sup>2</sup> p[2, 5]<sup>2</sup> + A B<sup>2</sup> p[4, 1]<sup>2</sup> + A<sup>2</sup> B p[2, 5]<sup>2</sup> p[4, 1]<sup>2</sup> + B<sup>3</sup> p[1, 1] p[4, 4] + A B<sup>2</sup> p[6, 3]<sup>2</sup> +

A<sup>2</sup> B p[2, 5]<sup>2</sup> p[6, 3]<sup>2</sup> + A<sup>2</sup> B p[4, 1]<sup>2</sup> p[6, 3]<sup>2</sup> + A<sup>3</sup> p[2, 5]<sup>2</sup> p[4, 1]<sup>2</sup> p[6, 3]<sup>2</sup>

**t4 = t3 /. {**

**p[a\_, a\_] => d,**

**p[a\_, b\_] ^ 2 => d**

**}**

3 A B<sup>2</sup> d + 3 A<sup>2</sup> B d<sup>2</sup> + B<sup>3</sup> d<sup>2</sup> + A<sup>3</sup> d<sup>3</sup>

**t5 = t4 /. {B -> 1/A, d -> (-A^2 - 1/A^2)}**

$$\frac{3 \left(-\frac{1}{A^2} - A^2\right)}{A} + \frac{\left(-\frac{1}{A^2} - A^2\right)^2}{A^3} + 3 A \left(-\frac{1}{A^2} - A^2\right)^2 + A^3 \left(-\frac{1}{A^2} - A^2\right)^3$$

**t6 = Expand[t5]**

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