

```
<< KnotTheory`
```

```
Loading KnotTheory` version of February 5, 2013, 3:48:46.4762.
```

```
Read more at http://katlas.org/wiki/KnotTheory.
```

```
TubePlot[TorusKnot[5, 4]]
```



```
TorusKnot[5, 4] // PD
```

```
PD[X[17, 25, 18, 24], X[10, 26, 11, 25], X[3, 27, 4, 26],  
X[11, 19, 12, 18], X[4, 20, 5, 19], X[27, 21, 28, 20], X[5, 13, 6, 12],  
X[28, 14, 29, 13], X[21, 15, 22, 14], X[29, 7, 30, 6], X[22, 8, 23, 7],  
X[15, 9, 16, 8], X[23, 1, 24, 30], X[16, 2, 17, 1], X[9, 3, 10, 2]]
```

```
SetAttributes[P, Orderless];
```

```
KB0[pd] := Expand[
```

```
Expand[Times @@ pd /. X[a_, b_, c_, d_] => A P[a, d] P[b, c] + 1 / A P[a, b] P[c, d]] //.
```

```
{P[a_, b_] P[b_, c_] => P[a, c], P[a_, b_]^2 => P[a, a], P[a_, a_] -> -A^2 - 1 / A^2}
```

```
]
```

```
TorusKnot[5, 4] // PD // KB0 // Timing
```

```
{18.486118,  $\frac{1}{A^{23}} + \frac{1}{A^{19}} + \frac{1}{A^{15}} + \frac{1}{A^{11}} + \frac{1}{A^7} - A - A^5 - A^9$ }
```

```

SetAttributes[P, Orderless];
KB1[pd_PD] := KB1[pd, {}, 1];
KB1[pd_PD, inside_, web_] := Module[
  {pos = First[Ordering[Length[Complement[List@@#, inside]] & /@pd]]},
  pd[[pos]] /. X[a_, b_, c_, d_] => KB1[
    Delete[pd, pos],
    Union[inside, {a, b, c, d}],
    Expand[
      web * (A P[a, d] P[b, c] + 1 / A P[a, b] P[c, d]) // .
      {P[e_, f_] P[f_, g_] => P[e, g],
      P[e_, _]^2 => P[e, e], P[e_, e_] -> -A^2 - 1 / A^2}
    ]
  ];
KB1[PD[], _, web_] := Expand[web]

TorusKnot[5, 4] // PD // KB1 // Timing
{0.062400,  $\frac{1}{A^{23}} + \frac{1}{A^{19}} + \frac{1}{A^{15}} + \frac{1}{A^{11}} + \frac{1}{A^7} - A - A^5 - A^9$ }

```