Preamble

$$R1 := simplify\left(DiagonalMatrix\left(\grave{\sim}\grave{}_{q}\left(Diagonal\left(\frac{2}{3}\, KP(H1, subs(\lambda = \Lambda, H1)) + \frac{2}{3}\, KP(H2, subs(\mu = \mathrm{M}, H2)) + \frac{1}{3}\, KP(H2, subs(\lambda = \Lambda, H1)) + \frac{1}{3}\, KP(H1, subs(\mu = \mathrm{M}, H2)) \right) \right) \right) \cdot (IdentityMatrix(64) + 2\,\mathrm{I}\,KP(E1, F1)) \cdot (IdentityMatrix(64) + 2\,\mathrm{I}\,KP(E3, F3)) \cdot (IdentityMatrix(64) + 2\,\mathrm{I}\,KP(E2, F2)), power \right) :$$

$$R := \grave{\sim}\grave{}_{simplify}\left(\grave{\sim}\grave{}_{expand}\left(subs\left(\mu = -\frac{2\,\mathrm{I}\ln(s)}{\pi}, \lambda = -\frac{2\,\mathrm{I}\ln(t)}{\pi}, \mathrm{M} = -\frac{2\,\mathrm{I}\ln(s)}{\pi}, \Lambda = -\frac{2\,\mathrm{I}\ln(t)}{\pi}, \frac{P \cdot R1}{R1_{8,8}} \right) \right) \right) :$$

$$U := ssimplify(R^{-1}) : Ri := KP(R, id) : iR := KP(id, R) : Ui := KP(U, id) : iU := KP(id, U) : iiR := KP(id, iR) : iiU := KP(id, iU) : iRi := KP(id, Ri) : iUi := KP(id, Ui) : Rii := KP(Ri, id) : Uii := KP(Ui, id) : RR := KP(R, R) : UU := KP(U, U) : \kappa := simplify(K1^{-2}.K2^{-2}) : simplify\left(\frac{1}{8}\, Trace(KP(id, \kappa).R) \right);$$

$$1 \tag{1}$$

```
sl3 := proc(A, B) local n, m, k, l, v, i :
 n, m := op(1, A);
   k, l := op(1, B);
 if m ≠ k then error "incompatible dimensions"; end if;
 v := Vector(k) :
 for i from 1 to m do
 v[i] := DotProduct(Transpose(A)[.., i], B[.., i], conjugate = false) :
end do:
 return simplify(1/8 add(v));
 end:
```

Invariants

$$A31 := KP(id, \mathrm{kappa}).R : B31 := R^2 : K31 := sl3(A31, B31);$$

$$K31 := \frac{1}{s^4 t^4}\left(\left(t^8 - t^6 + t^4\right) s^8 + \left(-t^8 + 2\,t^6 - 2\,t^4 + t^2\right) s^6 + \left(t^8 - 2\,t^6 + t^4 - 2\,t^2 + 1\right) s^4 + \left(t^6 - 2\,t^4 + 2\,t^2 - 1\right) s^2 + t^4 - t^2 + 1 \right) \tag{2.1}$$

$$A41 := KP(id, KP(\mathrm{kappa}, \mathrm{kappa})).spmm(iU, Ri) : B41 := spmm(iU, Ri) : K41 := sl3(A41, B41);$$

$$K41 := \frac{1}{s^4 t^4}\left(\left(t^8 - 3\,t^6 + t^4\right) s^8 + \left(-3\,t^8 + 12\,t^6 - 12\,t^4 + 3\,t^2\right) s^6 + \left(t^8 - 12\,t^6 + 25\,t^4 - 12\,t^2 + 1\right) s^4 + \left(3\,t^6 - 12\,t^4 + 12\,t^2 - 3\right) s^2 + t^4 - 3\,t^2 + 1 \right) \tag{2.2}$$

$$A51 := KP(id, \mathrm{kappa}).R^2 : B51 := R^3 : K51 := sort(sort(expand(sl3(A51, B51)), s), t);$$

$$K51 := s^8 t^8 - s^6 t^8 + s^4 t^8 - s^2 t^8 + t^8 - s^8 t^6 + 2\,s^6 t^6 - 2\,s^4 t^6 + 2\,s^2 t^6 + \frac{t^6}{s^2} - 2\,t^6 + s^8 t^4 \tag{2.3}$$

$$-2\,s^6\,t^4+s^4\,t^4-s^2\,t^4-\frac{2\,t^4}{s^2}+\frac{t^4}{s^4}+t^4-s^8\,t^2+2\,s^6\,t^2-s^4\,t^2+\frac{t^2}{s^2}-\frac{2\,t^2}{s^4}+\frac{t^2}{s^6}$$
$$+\frac{s^6}{t^2}-\frac{2\,s^4}{t^2}+\frac{s^2}{t^2}-\frac{1}{s^4\,t^2}+\frac{2}{s^6\,t^2}-\frac{1}{s^8\,t^2}+\frac{s^4}{t^4}-\frac{2\,s^2}{t^4}-\frac{1}{s^2\,t^4}+\frac{1}{s^4\,t^4}-\frac{2}{s^6\,t^4}$$
$$+\frac{1}{s^8\,t^4}+\frac{1}{t^4}+\frac{s^2}{t^6}+\frac{2}{s^2\,t^6}-\frac{2}{s^4\,t^6}+\frac{2}{s^6\,t^6}-\frac{1}{s^8\,t^6}-\frac{2}{t^6}-\frac{1}{s^2\,t^8}+\frac{1}{s^4\,t^8}-\frac{1}{s^6\,t^8}$$
$$+\frac{1}{s^8\,t^8}+\frac{1}{t^8}+s^8-2\,s^6+s^4+\frac{1}{s^4}-\frac{2}{s^6}+\frac{1}{s^8}+1$$

$A52 := KP(id, KP(\text{kappa}, \text{kappa}))\,.spmm(iR, Ui) : B52 := spmm(iR, KP(R^3, id)) : K52 := sl3(A52, B52);$

$$K52 := \frac{1}{s^4\,t^4}\left(\left(6\,t^8-10\,t^6+6\,t^4\right)s^8+\left(-10\,t^8+26\,t^6-26\,t^4+10\,t^2\right)s^6+\left(6\,t^8-26\,t^6+37\,t^4-26\,t^2+6\right)s^4+\left(10\,t^6-26\,t^4+26\,t^2-10\right)s^2+6\,t^4-10\,t^2+6\right) \tag{2.4}$$

#Computed Externally

$\#A61 := spmm(KP(id, KP(\text{kappa}, KP(\text{kappa}, \text{kappa}))), spmm(KP(id, spmm(iU, Ri))), UU))$:
$B61 := KP(spmm(iR, KP(R^2, id)), id) : K61 := sl3(A61, B61);$

$$K61 := 6\,s^4\,t^4-14\,s^4\,t^2-14\,s^2\,t^4+6\,s^4+46\,s^2\,t^2+6\,t^4-46\,s^2-46\,t^2+\frac{14\,s^2}{t^2}+\frac{14\,t^2}{s^2}-\frac{46}{s^2}$$
$$-\frac{46}{t^2}+\frac{6}{s^4}+\frac{6}{t^4}+\frac{46\,t^2}{s^2\,t^4}-\frac{14}{s^2\,t^4}-\frac{14}{s^4\,t^2}+\frac{6}{s^4\,t^4}+85;$$

$$K61 := 6\,s^4\,t^4-14\,s^4\,t^2-14\,s^2\,t^4+6\,s^4+46\,s^2\,t^2+6\,t^4-46\,s^2-46\,t^2+\frac{14\,s^2}{t^2}+\frac{14\,t^2}{s^2}-\frac{46}{s^2}-\frac{46}{t^2}+\frac{6}{s^4}+\frac{6}{t^4}+\frac{46}{s^2\,t^2}-\frac{14}{s^2\,t^4}-\frac{14}{s^4\,t^2}+\frac{6}{s^4\,t^4}+85 \tag{2.5}$$

$A62 := spmm(KP(id, KP(\text{kappa}, \text{kappa})), spmm(iU, Ri)) : B62 := spmm(iU, KP(R^3, id)) :$
$K62 := sort(sort(expand(sl3(A62, B62)), s), t);$

$$K62 := s^8\,t^8-3\,s^6\,t^8+3\,s^4\,t^8-3\,s^2\,t^8+t^8-3\,s^8\,t^6+12\,s^6\,t^6-18\,s^4\,t^6+18\,s^2\,t^6+\frac{3\,t^6}{s^2}-12\,t^6+3\,s^8\,t^4-18\,s^6\,t^4+35\,s^4\,t^4-37\,s^2\,t^4-\frac{18\,t^4}{s^2}+\frac{3\,t^4}{s^4}+35\,t^4-3\,s^8\,t^2+18\,s^6\,t^2-37\,s^4\,t^2+38\,s^2\,t^2+\frac{37\,t^2}{s^2}-\frac{18\,t^2}{s^4}+\frac{3\,t^2}{s^6}-38\,t^2+\frac{3\,s^6}{t^2}-\frac{18\,s^4}{t^2}+\frac{37\,s^2}{t^2}+\frac{38}{s^2\,t^2}-\frac{37}{s^4\,t^2}+\frac{18}{s^6\,t^2}-\frac{3}{s^8\,t^2}-\frac{38}{t^2}+\frac{3\,s^4}{t^4}-\frac{18\,s^2}{t^4}-\frac{37}{s^2\,t^4}+\frac{35}{s^4\,t^4}-\frac{18}{s^6\,t^4}+\frac{3}{s^8\,t^4}+\frac{35}{t^4}+\frac{3\,s^2}{t^6}+\frac{18}{s^2\,t^6}-\frac{18}{s^4\,t^6}+\frac{12}{s^6\,t^6}-\frac{3}{s^8\,t^6}-\frac{12}{t^6}-\frac{3}{s^2\,t^8}+\frac{3}{s^4\,t^8}-\frac{3}{s^6\,t^8}+\frac{1}{s^8\,t^8}+\frac{1}{t^8}+s^8-12\,s^6+35\,s^4-38\,s^2-\frac{38}{s^2}+\frac{35}{s^4}-\frac{12}{s^6}+\frac{1}{s^8}+25 \tag{2.6}$$

$A63 := spmm(KP(id, KP(\text{kappa}, \text{kappa})), spmm(KP(id, U^2), Ri)) : B63 := spmm(iU, KP(R^2,$

$id))$: $K63 := sort(sort(expand(sl3(A63, B63))), s), t)$

$$K63 := s^8 t^8 - 3 s^6 t^8 + 5 s^4 t^8 - 3 s^2 t^8 + t^8 - 3 s^8 t^6 + 12 s^6 t^6 - 24 s^4 t^6 + 24 s^2 t^6 + \frac{3 t^6}{s^2} \tag{2.7}$$
$$- 12 t^6 + 5 s^8 t^4 - 24 s^6 t^4 + 53 s^4 t^4 - 71 s^2 t^4 - \frac{24 t^4}{s^2} + \frac{5 t^4}{s^4} + 53 t^4 - 3 s^8 t^2 + 24 s^6 t^2$$
$$- 71 s^4 t^2 + 124 s^2 t^2 + \frac{71 t^2}{s^2} - \frac{24 t^2}{s^4} + \frac{3 t^2}{s^6} - 124 t^2 + \frac{3 s^6}{t^2} - \frac{24 s^4}{t^2} + \frac{71 s^2}{t^2}$$
$$+ \frac{124}{s^2 t^2} - \frac{71}{s^4 t^2} + \frac{24}{s^6 t^2} - \frac{3}{s^8 t^2} - \frac{124}{t^2} + \frac{5 s^4}{t^4} - \frac{24 s^2}{t^4} - \frac{71}{s^2 t^4} + \frac{53}{s^4 t^4} - \frac{24}{s^6 t^4}$$
$$+ \frac{5}{s^8 t^4} + \frac{53}{t^4} + \frac{3 s^2}{t^6} + \frac{24}{s^2 t^6} - \frac{24}{s^4 t^6} + \frac{12}{s^6 t^6} - \frac{3}{s^8 t^6} - \frac{12}{t^6} - \frac{3}{s^2 t^8} + \frac{5}{s^4 t^8}$$
$$- \frac{3}{s^6 t^8} + \frac{1}{s^8 t^8} + \frac{1}{t^8} + s^8 - 12 s^6 + 53 s^4 - 124 s^2 - \frac{124}{s^2} + \frac{53}{s^4} - \frac{12}{s^6} + \frac{1}{s^8} + 169$$

$A71 := KP(id, \text{kappa}).R^2 : B71 := R^5 : K71 := sort(sort(expand(sl3(A71, B71))), s), t);$

$$K71 := s^{12} t^{12} - s^{10} t^{12} + s^8 t^{12} - s^6 t^{12} + s^4 t^{12} - s^2 t^{12} + t^{12} - s^{12} t^{10} + 2 s^{10} t^{10} - 2 s^8 t^{10} \tag{2.8}$$
$$+ 2 s^6 t^{10} - 2 s^4 t^{10} + 2 s^2 t^{10} + \frac{t^{10}}{s^2} - 2 t^{10} + s^{12} t^8 - 2 s^{10} t^8 + s^8 t^8 - s^6 t^8 + s^4 t^8 - s^2 t^8$$
$$- \frac{2 t^8}{s^2} + \frac{t^8}{s^4} + t^8 - s^{12} t^6 + 2 s^{10} t^6 - s^8 t^6 + \frac{t^6}{s^2} - \frac{2 t^6}{s^4} + \frac{t^6}{s^6} + s^{12} t^4 - 2 s^{10} t^4 + s^8 t^4$$
$$+ s^4 t^4 - s^2 t^4 + \frac{t^4}{s^4} - \frac{2 t^4}{s^6} + \frac{t^4}{s^8} + t^4 - s^{12} t^2 + 2 s^{10} t^2 - s^8 t^2 - s^4 t^2 + 2 s^2 t^2 + \frac{t^2}{s^2}$$
$$+ \frac{t^2}{s^6} - \frac{2 t^2}{s^8} + \frac{t^2}{s^{10}} - 2 t^2 + \frac{s^{10}}{t^2} - \frac{2 s^8}{t^2} + \frac{s^6}{t^2} + \frac{s^2}{t^2} + \frac{2}{s^2 t^2} - \frac{1}{s^4 t^2} - \frac{1}{s^8 t^2}$$
$$+ \frac{2}{s^{10} t^2} - \frac{1}{s^{12} t^2} - \frac{2}{t^2} + \frac{s^8}{t^4} - \frac{2 s^6}{t^4} + \frac{s^4}{t^4} - \frac{1}{s^2 t^4} + \frac{1}{s^4 t^4} + \frac{1}{s^8 t^4} - \frac{2}{s^{10} t^4}$$
$$+ \frac{1}{s^{12} t^4} + \frac{1}{t^4} + \frac{s^6}{t^6} - \frac{2 s^4}{t^6} + \frac{s^2}{t^6} - \frac{1}{s^8 t^6} + \frac{2}{s^{10} t^6} - \frac{1}{s^{12} t^6} + \frac{s^4}{t^8} - \frac{2 s^2}{t^8} - \frac{1}{s^2 t^8}$$
$$+ \frac{1}{s^4 t^8} - \frac{1}{s^6 t^8} + \frac{1}{s^8 t^8} - \frac{2}{s^{10} t^8} + \frac{1}{s^{12} t^8} + \frac{1}{t^8} + \frac{s^2}{t^{10}} + \frac{2}{s^2 t^{10}} - \frac{2}{s^4 t^{10}} + \frac{2}{s^6 t^{10}}$$
$$- \frac{2}{s^8 t^{10}} + \frac{2}{s^{10} t^{10}} - \frac{1}{s^{12} t^{10}} - \frac{2}{t^{10}} - \frac{1}{s^2 t^{12}} + \frac{1}{s^4 t^{12}} - \frac{1}{s^6 t^{12}} + \frac{1}{s^8 t^{12}} - \frac{1}{s^{10} t^{12}}$$
$$+ \frac{1}{s^{12} t^{12}} + \frac{1}{t^{12}} + s^{12} - 2 s^{10} + s^8 + s^4 - 2 s^2 - \frac{2}{s^2} + \frac{1}{s^4} + \frac{1}{s^8} - \frac{2}{s^{10}} + \frac{1}{s^{12}} + 1$$

#Computed Externally

#iRUiiR:=ssimplify(spmm(iR, spmm(Ui, iR))) : $A72 := spmm(KP(id, KP(\text{kappa}, KP(\text{kappa}, \text{kappa}))), KP(id, iRUiiR))$: $B72 := KP(spmm(iRUiiR, KP(R^3, id)), id)$: $K72 := sl3(A72, B72);$

$$K72 := \frac{1}{s^4 t^4}\left(\left(13 t^8 - 23 t^6 + 13 t^4\right) s^8 + \left(-23 t^8 + 64 t^6 - 64 t^4 + 23 t^2\right) s^6 + \left(13 t^8 - 64 t^6 + 97 t^4 - 64 t^2 + 13\right) s^4 + \left(23 t^6 - 64 t^4 + 64 t^2 - 23\right) s^2 + 13 t^4 - 23 t^2 + 13\right);$$

$$K72 := \frac{1}{s^4 t^4}\left(\left(13 t^8 - 23 t^6 + 13 t^4\right) s^8 + \left(-23 t^8 + 64 t^6 - 64 t^4 + 23 t^2\right) s^6 + \left(13 t^8 - 64 t^6 + 97 t^4 - 64 t^2 + 13\right) s^4 + \left(23 t^6 - 64 t^4 + 64 t^2 - 23\right) s^2 + 13 t^4 - 23 t^2 + 13\right) \quad \textbf{(2.9)}$$

$A73 := spmm(KP(id, KP(\text{kappa}, \text{kappa}))), spmm(iU, Ri))) : B73 := spmm(iU, KP(U^5, id))) :$
$K73 := sort(sort(expand(sl3(A73, B73))), s), t);$

$$K73 := 6 s^8 t^8 - 10 s^6 t^8 + 10 s^4 t^8 - 10 s^2 t^8 + 6 t^8 - 10 s^8 t^6 + 26 s^6 t^6 - 32 s^4 t^6 + 32 s^2 t^6 + \frac{10 t^6}{s^2} - 26 t^6 + 10 s^8 t^4 - 32 s^6 t^4 + 39 s^4 t^4 - 37 s^2 t^4 - \frac{32 t^4}{s^2} + \frac{10 t^4}{s^4} + 39 t^4 - 10 s^8 t^2 + 32 s^6 t^2 - 37 s^4 t^2 + 24 s^2 t^2 + \frac{37 t^2}{s^2} - \frac{32 t^2}{s^4} + \frac{10 t^2}{s^6} - 24 t^2 + \frac{10 s^6}{t^2} - \frac{32 s^4}{t^2} + \frac{37 s^2}{t^2} + \frac{24}{s^2 t^2} - \frac{37}{s^4 t^2} + \frac{32}{s^6 t^2} - \frac{10}{s^8 t^2} - \frac{24}{t^2} + \frac{10 s^4}{t^4} - \frac{32 s^2}{t^4} - \frac{37}{s^2 t^4} + \frac{39}{s^4 t^4} - \frac{32}{s^6 t^4} + \frac{10}{s^8 t^4} + \frac{39}{t^4} + \frac{10 s^2}{t^6} + \frac{32}{s^2 t^6} - \frac{32}{s^4 t^6} + \frac{26}{s^6 t^6} - \frac{10}{s^8 t^6} - \frac{26}{t^6} - \frac{10}{s^2 t^8} + \frac{10}{s^4 t^8} - \frac{10}{s^6 t^8} + \frac{6}{s^8 t^8} + \frac{6}{t^8} + 6 s^8 - 26 s^6 + 39 s^4 - 24 s^2 - \frac{24}{s^2} + \frac{39}{s^4} - \frac{26}{s^6} + \frac{6}{s^8} + 13$$

#Computed Externally

$\#A74 := spmm(KP(id, KP(\text{kappa}, KP(\text{kappa}, \text{kappa}))), KP(id, spmm(iU, spmm(Ri, spmm(iU, Ui^2))))) : B74 := KP(spmm(Ri, spmm(iU, KP(U^2, id)))), id) : K74 := sort(sort(expand(sl3(A74, B74))), s), t) ;$

$$K74 := \frac{1}{s^4 t^4}\left(\left(36 t^8 - 68 t^6 + 36 t^4\right) s^8 + \left(-68 t^8 + 196 t^6 - 196 t^4 + 68 t^2\right) s^6 + \left(36 t^8 - 196 t^6 + 313 t^4 - 196 t^2 + 36\right) s^4 + \left(68 t^6 - 196 t^4 + 196 t^2 - 68\right) s^2 + 36 t^4 - 68 t^2 + 36\right);$$

$$K74 := \frac{1}{s^4 t^4}\left(\left(36 t^8 - 68 t^6 + 36 t^4\right) s^8 + \left(-68 t^8 + 196 t^6 - 196 t^4 + 68 t^2\right) s^6 + \left(36 t^8 - 196 t^6 + 313 t^4 - 196 t^2 + 36\right) s^4 + \left(68 t^6 - 196 t^4 + 196 t^2 - 68\right) s^2 + 36 t^4 - 68 t^2 + 36\right) \quad \textbf{(2.11)}$$

$A75 := spmm(KP(id, KP(\text{kappa}, \text{kappa}))), spmm(KP(id, R^2), Ui))) : B75 := spmm(iR, KP(R^4, id))) : K75 := sort(sort(expand(sl3(A75, B75))), s), t);$

$$K75 := 6 s^8 t^8 - 14 s^6 t^8 + 18 s^4 t^8 - 14 s^2 t^8 + 6 t^8 - 14 s^8 t^6 + 44 s^6 t^6 - 68 s^4 t^6 + 68 s^2 t^6 + \frac{14 t^6}{s^2} - 44 t^6 + 18 s^8 t^4 - 68 s^6 t^4 + 114 s^4 t^4 - 132 s^2 t^4 - \frac{68 t^4}{s^2} + \frac{18 t^4}{s^4} + 114 t^4 - 14 s^8 t^2 + 68 s^6 t^2 - 132 s^4 t^2 + 164 s^2 t^2 + \frac{132 t^2}{s^2} - \frac{68 t^2}{s^4} + \frac{14 t^2}{s^6} - 164 t^2 + \frac{14 s^6}{t^2} \quad \textbf{(2.12)}$$

$$-\frac{68\,s^4}{t^2}+\frac{132\,s^2}{t^2}+\frac{164}{s^2\,t^2}-\frac{132}{s^4\,t^2}+\frac{68}{s^6\,t^2}-\frac{14}{s^8\,t^2}-\frac{164}{t^2}+\frac{18\,s^4}{t^4}-\frac{68\,s^2}{t^4}$$
$$-\frac{132}{s^2\,t^4}+\frac{114}{s^4\,t^4}-\frac{68}{s^6\,t^4}+\frac{18}{s^8\,t^4}+\frac{114}{t^4}+\frac{14\,s^2}{t^6}+\frac{68}{s^2\,t^6}-\frac{68}{s^4\,t^6}+\frac{44}{s^6\,t^6}-\frac{14}{s^8\,t^6}$$
$$-\frac{44}{t^6}-\frac{14}{s^2\,t^8}+\frac{18}{s^4\,t^8}-\frac{14}{s^6\,t^8}+\frac{6}{s^8\,t^8}+\frac{6}{t^8}+6\,s^8-44\,s^6+114\,s^4-164\,s^2-\frac{164}{s^2}$$
$$+\frac{114}{s^4}-\frac{44}{s^6}+\frac{6}{s^8}+181$$

#Computed Externally

*#A76:=spmm(KP(id, KP(*kappa, *KP(*kappa, kappa*))), KP(id, spmm(iR, Ui*))) : *B76* := *spmm*(*RR*, *KP*(*spmm*(*iU*, *KP*(*R*^2, *id*)), *id*)) : *K76* := *sort*(*sort*(*expand*(*sl3*(*A76*, *B76*)), *s*), *t*);

$$K76 := \frac{1}{s^8\,t^8}\left(t^8\left(t^8-5\,t^6+7\,t^4-5\,t^2+1\right)s^{16}+\left(-5\,t^{16}+30\,t^{14}-60\,t^{12}+60\,t^{10}-30\,t^8+5\,t^6\right)s^{14}+\left(7\,t^{16}-60\,t^{14}+163\,t^{12}-215\,t^{10}+163\,t^8-60\,t^6+7\,t^4\right)s^{12}+\left(-5\,t^{16}+60\,t^{14}-215\,t^{12}+366\,t^{10}-366\,t^8+215\,t^6-60\,t^4+5\,t^2\right)s^{10}+\left(t^{16}-30\,t^{14}+163\,t^{12}-366\,t^{10}+457\,t^8-366\,t^6+163\,t^4-30\,t^2+1\right)s^8+\left(5\,t^{14}-60\,t^{12}+215\,t^{10}-366\,t^8+366\,t^6-215\,t^4+60\,t^2-5\right)s^6+\left(7\,t^{12}-60\,t^{10}+163\,t^8-215\,t^6+163\,t^4-60\,t^2+7\right)s^4+\left(5\,t^{10}-30\,t^8+60\,t^6-60\,t^4+30\,t^2-5\right)s^2+t^8-5\,t^6+7\,t^4-5\,t^2+1\right);$$

$$K76 := \frac{1}{s^8\,t^8}\left(t^8\left(t^8-5\,t^6+7\,t^4-5\,t^2+1\right)s^{16}+\left(-5\,t^{16}+30\,t^{14}-60\,t^{12}+60\,t^{10}-30\,t^8+5\,t^6\right)s^{14}+\left(7\,t^{16}-60\,t^{14}+163\,t^{12}-215\,t^{10}+163\,t^8-60\,t^6+7\,t^4\right)s^{12}+\left(-5\,t^{16}+60\,t^{14}-215\,t^{12}+366\,t^{10}-366\,t^8+215\,t^6-60\,t^4+5\,t^2\right)s^{10}+\left(t^{16}-30\,t^{14}+163\,t^{12}-366\,t^{10}+457\,t^8-366\,t^6+163\,t^4-30\,t^2+1\right)s^8+\left(5\,t^{14}-60\,t^{12}+215\,t^{10}-366\,t^8+366\,t^6-215\,t^4+60\,t^2-5\right)s^6+\left(7\,t^{12}-60\,t^{10}+163\,t^8-215\,t^6+163\,t^4-60\,t^2+7\right)s^4+\left(5\,t^{10}-30\,t^8+60\,t^6-60\,t^4+30\,t^2-5\right)s^2+t^8-5\,t^6+7\,t^4-5\,t^2+1\right) \quad \textbf{(2.13)}$$

#Computed Externally

*#A77:=spmm(KP(id, KP(*kappa, *KP(*kappa, kappa*))), spmm(iiU, spmm(iRi, iiU*))) : *B77* := *spmm*(*iRi*, *spmm*(*Uii*, *spmm*(*iRi*, *Uii*))) : *K77* := *sort*(*sort*(*expand*(*sl3*(*A77*, *B77*)), *s*), *t*);

$$K77 := s^8\,t^8-5\,s^6\,t^8+9\,s^4\,t^8-5\,s^2\,t^8+t^8-5\,s^8\,t^6+30\,s^6\,t^6-70\,s^4\,t^6+70\,s^2\,t^6+\frac{5\,t^6}{s^2}-30\,t^6$$
$$+9\,s^8\,t^4-70\,s^6\,t^4+209\,s^4\,t^4-301\,s^2\,t^4-\frac{70\,t^4}{s^2}+\frac{9\,t^4}{s^4}+209\,t^4-5\,s^8\,t^2+70\,s^6\,t^2$$
$$-301\,s^4\,t^2+608\,s^2\,t^2+\frac{301\,t^2}{s^2}-\frac{70\,t^2}{s^4}+\frac{5\,t^2}{s^6}-608\,t^2+\frac{5\,s^6}{t^2}-\frac{70\,s^4}{t^2}+\frac{301\,s^2}{t^2}+\frac{608}{s^2\,t^2}$$
$$-\frac{301}{s^4\,t^2}+\frac{70}{s^6\,t^2}-\frac{5}{s^8\,t^2}-\frac{608}{t^2}+\frac{9\,s^4}{t^4}-\frac{70\,s^2}{t^4}-\frac{301}{s^2\,t^4}+\frac{209}{s^4\,t^4}-\frac{70}{s^6\,t^4}+\frac{9}{s^8\,t^4}+\frac{209}{t^4}$$
$$+\frac{5\,s^2}{t^6}+\frac{70}{s^2\,t^6}-\frac{70}{s^4\,t^6}+\frac{30}{s^6\,t^6}-\frac{5}{s^8\,t^6}-\frac{30}{t^6}-\frac{5}{s^2\,t^8}+\frac{9}{s^4\,t^8}-\frac{5}{s^6\,t^8}+\frac{1}{s^8\,t^8}+\frac{1}{t^8}+s^8$$

$$-30\,s^6+209\,s^4-608\,s^2-\frac{608}{s^2}+\frac{209}{s^4}-\frac{30}{s^6}+\frac{1}{s^8}+865;$$

$$K77 := s^8\,t^8-5\,s^6\,t^8+9\,s^4\,t^8-5\,s^2\,t^8+t^8-5\,s^8\,t^6+30\,s^6\,t^6-70\,s^4\,t^6+70\,s^2\,t^6+\frac{5\,t^6}{s^2} \tag{2.14}$$
$$-30\,t^6+9\,s^8\,t^4-70\,s^6\,t^4+209\,s^4\,t^4-301\,s^2\,t^4-\frac{70\,t^4}{s^2}+\frac{9\,t^4}{s^4}+209\,t^4-5\,s^8\,t^2$$
$$+70\,s^6\,t^2-301\,s^4\,t^2+608\,s^2\,t^2+\frac{301\,t^2}{s^2}-\frac{70\,t^2}{s^4}+\frac{5\,t^2}{s^6}-608\,t^2+\frac{5\,s^6}{t^2}-\frac{70\,s^4}{t^2}$$
$$+\frac{301\,s^2}{t^2}+\frac{608}{s^2\,t^2}-\frac{301}{s^4\,t^2}+\frac{70}{s^6\,t^2}-\frac{5}{s^8\,t^2}-\frac{608}{t^2}+\frac{9\,s^4}{t^4}-\frac{70\,s^2}{t^4}-\frac{301}{s^2\,t^4}+\frac{209}{s^4\,t^4}$$
$$-\frac{70}{s^6\,t^4}+\frac{9}{s^8\,t^4}+\frac{209}{t^4}+\frac{5\,s^2}{t^6}+\frac{70}{s^2\,t^6}-\frac{70}{s^4\,t^6}+\frac{30}{s^6\,t^6}-\frac{5}{s^8\,t^6}-\frac{30}{t^6}-\frac{5}{s^2\,t^8}$$
$$+\frac{9}{s^4\,t^8}-\frac{5}{s^6\,t^8}+\frac{1}{s^8\,t^8}+\frac{1}{t^8}+s^8-30\,s^6+209\,s^4-608\,s^2-\frac{608}{s^2}+\frac{209}{s^4}-\frac{30}{s^6}$$
$$+\frac{1}{s^8}+865$$

$A89 := spmm(KP(id, KP(\text{kappa}, \text{kappa}))), spmm(spmm(KP(id, U^3), Ri), iU))) : B89 := KP(R^3, id) : K89 := sort(sort(expand(sl3(A89, B89))), s), t);$

$$K89 := s^{12}\,t^{12}-3\,s^{10}\,t^{12}+5\,s^8\,t^{12}-7\,s^6\,t^{12}+5\,s^4\,t^{12}-3\,s^2\,t^{12}+t^{12}-3\,s^{12}\,t^{10}+12\,s^{10}\,t^{10} \tag{2.15}$$
$$-24\,s^8\,t^{10}+36\,s^6\,t^{10}-36\,s^4\,t^{10}+24\,s^2\,t^{10}+\frac{3\,t^{10}}{s^2}-12\,t^{10}+5\,s^{12}\,t^8-24\,s^{10}\,t^8$$
$$+53\,s^8\,t^8-83\,s^6\,t^8+101\,s^4\,t^8-83\,s^2\,t^8-\frac{24\,t^8}{s^2}+\frac{5\,t^8}{s^4}+53\,t^8-7\,s^{12}\,t^6+36\,s^{10}\,t^6$$
$$-83\,s^8\,t^6+128\,s^6\,t^6-164\,s^4\,t^6+164\,s^2\,t^6+\frac{83\,t^6}{s^2}-\frac{36\,t^6}{s^4}+\frac{7\,t^6}{s^6}-128\,t^6+5\,s^{12}\,t^4$$
$$-36\,s^{10}\,t^4+101\,s^8\,t^4-164\,s^6\,t^4+217\,s^4\,t^4-251\,s^2\,t^4-\frac{164\,t^4}{s^2}+\frac{101\,t^4}{s^4}-\frac{36\,t^4}{s^6}$$
$$+\frac{5\,t^4}{s^8}+217\,t^4-3\,s^{12}\,t^2+24\,s^{10}\,t^2-83\,s^8\,t^2+164\,s^6\,t^2-251\,s^4\,t^2+344\,s^2\,t^2$$
$$+\frac{251\,t^2}{s^2}-\frac{164\,t^2}{s^4}+\frac{83\,t^2}{s^6}-\frac{24\,t^2}{s^8}+\frac{3\,t^2}{s^{10}}-344\,t^2+\frac{3\,s^{10}}{t^2}-\frac{24\,s^8}{t^2}+\frac{83\,s^6}{t^2}$$
$$-\frac{164\,s^4}{t^2}+\frac{251\,s^2}{t^2}+\frac{344}{s^2\,t^2}-\frac{251}{s^4\,t^2}+\frac{164}{s^6\,t^2}-\frac{83}{s^8\,t^2}+\frac{24}{s^{10}\,t^2}-\frac{3}{s^{12}\,t^2}-\frac{344}{t^2}$$
$$+\frac{5\,s^8}{t^4}-\frac{36\,s^6}{t^4}+\frac{101\,s^4}{t^4}-\frac{164\,s^2}{t^4}-\frac{251}{s^2\,t^4}+\frac{217}{s^4\,t^4}-\frac{164}{s^6\,t^4}+\frac{101}{s^8\,t^4}-\frac{36}{s^{10}\,t^4}$$
$$+\frac{5}{s^{12}\,t^4}+\frac{217}{t^4}+\frac{7\,s^6}{t^6}-\frac{36\,s^4}{t^6}+\frac{83\,s^2}{t^6}+\frac{164}{s^2\,t^6}-\frac{164}{s^4\,t^6}+\frac{128}{s^6\,t^6}-\frac{83}{s^8\,t^6}+\frac{36}{s^{10}\,t^6}$$

$$-\frac{7}{s^{12}t^6}-\frac{128}{t^6}+\frac{5s^4}{t^8}-\frac{24s^2}{t^8}-\frac{83}{s^2t^8}+\frac{101}{s^4t^8}-\frac{83}{s^6t^8}+\frac{53}{s^8t^8}-\frac{24}{s^{10}t^8}+\frac{5}{s^{12}t^8}$$
$$+\frac{53}{t^8}+\frac{3s^2}{t^{10}}+\frac{24}{s^2t^{10}}-\frac{36}{s^4t^{10}}+\frac{36}{s^6t^{10}}-\frac{24}{s^8t^{10}}+\frac{12}{s^{10}t^{10}}-\frac{3}{s^{12}t^{10}}-\frac{12}{t^{10}}$$
$$-\frac{3}{s^2t^{12}}+\frac{5}{s^4t^{12}}-\frac{7}{s^6t^{12}}+\frac{5}{s^8t^{12}}-\frac{3}{s^{10}t^{12}}+\frac{1}{s^{12}t^{12}}+\frac{1}{t^{12}}+s^{12}-12s^{10}+53s^8$$
$$-128s^6+217s^4-344s^2-\frac{344}{s^2}+\frac{217}{s^4}-\frac{128}{s^6}+\frac{53}{s^8}-\frac{12}{s^{10}}+\frac{1}{s^{12}}+433$$

#Computed Externally

#iRRi:=ssimplify(spmm(iR, Ri)) : RiiRUi := ssimplify(spmm(spmm(Ri, iR), Ui)) : RiiURi := ssimplify(spmm(Ri, spmm(iU, Ri))) :

#A946:=spmm(KP(id, KP(kappa, KP(kappa, kappa)))), spmm(KP(id, iRRi), KP(Ui, id))) : B946 := spmm(KP(id, RiiRUi), KP(RiiURi, id)) : K946 := sl3(A946, B946);

$$K946 := 6s^4t^4-14s^4t^2-14s^2t^4+6s^4+46s^2t^2+6t^4-46s^2-46t^2+\frac{14s^2}{t^2}+\frac{14t^2}{s^2}-\frac{46}{s^2}$$
$$-\frac{46}{t^2}+\frac{6}{s^4}+\frac{6}{t^4}+\frac{46}{s^2t^2}-\frac{14}{s^2t^4}-\frac{14}{s^4t^2}+\frac{6}{s^4t^4}+85;$$

$$K946 := 6s^4t^4-14s^4t^2-14s^2t^4+6s^4+46s^2t^2+6t^4-46s^2-46t^2+\frac{14s^2}{t^2}+\frac{14t^2}{s^2} \quad \textbf{(2.16)}$$
$$-\frac{46}{s^2}-\frac{46}{t^2}+\frac{6}{s^4}+\frac{6}{t^4}+\frac{46}{s^2t^2}-\frac{14}{s^2t^4}-\frac{14}{s^4t^2}+\frac{6}{s^4t^4}+85$$

#Computed Externally

#UiiRRi:=ssimplify(spmm(spmm(Ui, iR), Ri)) : R2iiRU3i := ssimplify(spmm(spmm(KP(R^2, id), iR), KP(U^3, id))) :

#A10132:=spmm(KP(id, KP(kappa, KP(kappa, kappa)))), KP(id, spmm(KP(id, R^2), UiiRRi))) : B10132 := KP(R2iiRU3i, id) : K10132 := sort(sort(expand(sl3(A10132, B10132)), s), t);

$$K10132 := \frac{1}{s^8t^8}\left(t^8\left(t^8-t^6+t^4-t^2+1\right)s^{16}+\left(-t^{16}+2t^{14}-4t^{12}+4t^{10}-2t^8+t^6\right)s^{14}\right.$$
$$+t^4\left(t^{12}-4t^{10}+9t^8-13t^6+9t^4-4t^2+1\right)s^{12}+\left(-t^{16}+4t^{14}-13t^{12}+32t^{10}-32t^8\right.$$
$$\left.+13t^6-4t^4+t^2\right)s^{10}+\left(t^{16}-2t^{14}+9t^{12}-32t^{10}+49t^8-32t^6+9t^4-2t^2+1\right)s^8$$
$$+\left(t^{14}-4t^{12}+13t^{10}-32t^8+32t^6-13t^4+4t^2-1\right)s^6+\left(t^{12}-4t^{10}+9t^8-13t^6+9t^4\right.$$
$$\left.-4t^2+1\right)s^4+\left(t^{10}-2t^8+4t^6-4t^4+2t^2-1\right)s^2+t^8-t^6+t^4-t^2+1\Big);$$

$$K10132 := \frac{1}{s^8t^8}\left(t^8\left(t^8-t^6+t^4-t^2+1\right)s^{16}+\left(-t^{16}+2t^{14}-4t^{12}+4t^{10}-2t^8+t^6\right)s^{14}\right. \quad \textbf{(2.17)}$$
$$+t^4\left(t^{12}-4t^{10}+9t^8-13t^6+9t^4-4t^2+1\right)s^{12}+\left(-t^{16}+4t^{14}-13t^{12}+32t^{10}\right.$$
$$\left.-32t^8+13t^6-4t^4+t^2\right)s^{10}+\left(t^{16}-2t^{14}+9t^{12}-32t^{10}+49t^8-32t^6+9t^4-2t^2\right.$$
$$\left.+1\right)s^8+\left(t^{14}-4t^{12}+13t^{10}-32t^8+32t^6-13t^4+4t^2-1\right)s^6+\left(t^{12}-4t^{10}+9t^8\right.$$
$$\left.-13t^6+9t^4-4t^2+1\right)s^4+\left(t^{10}-2t^8+4t^6-4t^4+2t^2-1\right)s^2+t^8-t^6+t^4-t^2$$
$$\left.+1\right)$$

$A10155 := spmm(KP(id, KP(kappa, kappa)), spmm(KP(U^3, id), spmm(KP(id, U), KP(R^2,

$id))))$: $B10155 := spmm(KP(id, U), spmm(KP(R^2, id), KP(id, U)))$: $K10155 := sort(sort(expand(sl3(A10155, B10155)), s), t)$;

$$K10155 := s^{12}t^{12} - 3s^{10}t^{12} + 5s^8t^{12} - 7s^6t^{12} + 5s^4t^{12} - 3s^2t^{12} + t^{12} - 3s^{12}t^{10} \quad \textbf{(2.18)}$$
$$+ 12s^{10}t^{10} - 24s^8t^{10} + 36s^6t^{10} - 36s^4t^{10} + 24s^2t^{10} + \frac{3t^{10}}{s^2} - 12t^{10} + 5s^{12}t^8$$
$$- 24s^{10}t^8 + 53s^8t^8 - 79s^6t^8 + 93s^4t^8 - 79s^2t^8 - \frac{24t^8}{s^2} + \frac{5t^8}{s^4} + 53t^8 - 7s^{12}t^6$$
$$+ 36s^{10}t^6 - 79s^8t^6 + 108s^6t^6 - 124s^4t^6 + 124s^2t^6 + \frac{79t^6}{s^2} - \frac{36t^6}{s^4} + \frac{7t^6}{s^6} - 108t^6$$
$$+ 5s^{12}t^4 - 36s^{10}t^4 + 93s^8t^4 - 124s^6t^4 + 105s^4t^4 - 91s^2t^4 - \frac{124t^4}{s^2} + \frac{93t^4}{s^4}$$
$$- \frac{36t^4}{s^6} + \frac{5t^4}{s^8} + 105t^4 - 3s^{12}t^2 + 24s^{10}t^2 - 79s^8t^2 + 124s^6t^2 - 91s^4t^2 + 24s^2t^2$$
$$+ \frac{91t^2}{s^2} - \frac{124t^2}{s^4} + \frac{79t^2}{s^6} - \frac{24t^2}{s^8} + \frac{3t^2}{s^{10}} - 24t^2 + \frac{3s^{10}}{t^2} - \frac{24s^8}{t^2} + \frac{79s^6}{t^2}$$
$$- \frac{124s^4}{t^2} + \frac{91s^2}{t^2} + \frac{24}{s^2t^2} - \frac{91}{s^4t^2} + \frac{124}{s^6t^2} - \frac{79}{s^8t^2} + \frac{24}{s^{10}t^2} - \frac{3}{s^{12}t^2} - \frac{24}{t^2} + \frac{5s^8}{t^4}$$
$$- \frac{36s^6}{t^4} + \frac{93s^4}{t^4} - \frac{124s^2}{t^4} - \frac{91}{s^2t^4} + \frac{105}{s^4t^4} - \frac{124}{s^6t^4} + \frac{93}{s^8t^4} - \frac{36}{s^{10}t^4} + \frac{5}{s^{12}t^4}$$
$$+ \frac{105}{t^4} + \frac{7s^6}{t^6} - \frac{36s^4}{t^6} + \frac{79s^2}{t^6} + \frac{124}{s^2t^6} - \frac{124}{s^4t^6} + \frac{108}{s^6t^6} - \frac{79}{s^8t^6} + \frac{36}{s^{10}t^6} - \frac{7}{s^{12}t^6}$$
$$- \frac{108}{t^6} + \frac{5s^4}{t^8} - \frac{24s^2}{t^8} - \frac{79}{s^2t^8} + \frac{93}{s^4t^8} - \frac{79}{s^6t^8} + \frac{53}{s^8t^8} - \frac{24}{s^{10}t^8} + \frac{5}{s^{12}t^8} + \frac{53}{t^8}$$
$$+ \frac{3s^2}{t^{10}} + \frac{24}{s^2t^{10}} - \frac{36}{s^4t^{10}} + \frac{36}{s^6t^{10}} - \frac{24}{s^8t^{10}} + \frac{12}{s^{10}t^{10}} - \frac{3}{s^{12}t^{10}} - \frac{12}{t^{10}} - \frac{3}{s^2t^{12}}$$
$$+ \frac{5}{s^4t^{12}} - \frac{7}{s^6t^{12}} + \frac{5}{s^8t^{12}} - \frac{3}{s^{10}t^{12}} + \frac{1}{s^{12}t^{12}} + \frac{1}{t^{12}} + s^{12} - 12s^{10} + 53s^8 - 108s^6$$
$$+ 105s^4 - 24s^2 - \frac{24}{s^2} + \frac{105}{s^4} - \frac{108}{s^6} + \frac{53}{s^8} - \frac{12}{s^{10}} + \frac{1}{s^{12}} - 23$$

#*Computed Externally*

#*UiiRUi*:=*ssimplify*(*spmm*(*Ui*, *spmm*(*iR*, *Ui*)))

#*A1134*:=*spmm*(*spmm*(*KP*(*id*, *KP*(kappa, *KP*(kappa, kappa)))), *KP*(U^2, R^2)), *KP*(*id*, *KP*(R^2, *id*)))) : $B1134 := spmm(KP(U, R), KP(id, UiiRUi))$: $K1134 := sort(sort(expand(sl3(A1134, B1134)), s), t)$;

$$K1134 := 2s^8t^{12} - 4s^6t^{12} + 2s^4t^{12} - 4s^{10}t^{10} + 4s^8t^{10} + 8s^6t^{10} - 8s^4t^{10} - 4s^2t^{10} + 4t^{10}$$
$$+ 2s^{12}t^8 + 4s^{10}t^8 - 20s^8t^8 + 8s^6t^8 + 12s^4t^8 + 8s^2t^8 + \frac{4t^8}{s^2} + \frac{2t^8}{s^4} - 20t^8 - 4s^{12}t^6$$
$$+ 8s^{10}t^6 + 8s^8t^6 - 4s^6t^6 - 46s^4t^6 + 46s^2t^6 - \frac{8t^6}{s^2} - \frac{8t^6}{s^4} + \frac{4t^6}{s^6} + 4t^6 + 2s^{12}t^4$$

$$-8\,s^{10}\,t^4+12\,s^8\,t^4-46\,s^6\,t^4+164\,s^4\,t^4-248\,s^2\,t^4-\frac{46\,t^4}{s^2}+\frac{12\,t^4}{s^4}-\frac{8\,t^4}{s^6}+\frac{2\,t^4}{s^8}+164\,t^4$$
$$-4\,s^{10}\,t^2+8\,s^8\,t^2+46\,s^6\,t^2-248\,s^4\,t^2+476\,s^2\,t^2+\frac{248\,t^2}{s^2}-\frac{46\,t^2}{s^4}-\frac{8\,t^2}{s^6}+\frac{4\,t^2}{s^8}-476\,t^2$$
$$+\frac{4\,s^8}{t^2}-\frac{8\,s^6}{t^2}-\frac{46\,s^4}{t^2}+\frac{248\,s^2}{t^2}+\frac{476}{s^2\,t^2}-\frac{248}{s^4\,t^2}+\frac{46}{s^6\,t^2}+\frac{8}{s^8\,t^2}-\frac{4}{s^{10}\,t^2}-\frac{476}{t^2}$$
$$+\frac{2\,s^8}{t^4}-\frac{8\,s^6}{t^4}+\frac{12\,s^4}{t^4}-\frac{46\,s^2}{t^4}-\frac{248}{s^2\,t^4}+\frac{164}{s^4\,t^4}-\frac{46}{s^6\,t^4}+\frac{12}{s^8\,t^4}-\frac{8}{s^{10}\,t^4}+\frac{2}{s^{12}\,t^4}$$
$$+\frac{164}{t^4}+\frac{4\,s^6}{t^6}-\frac{8\,s^4}{t^6}-\frac{8\,s^2}{t^6}+\frac{46}{s^2\,t^6}-\frac{46}{s^4\,t^6}-\frac{4}{s^6\,t^6}+\frac{8}{s^8\,t^6}+\frac{8}{s^{10}\,t^6}-\frac{4}{s^{12}\,t^6}+\frac{4}{t^6}$$
$$+\frac{2\,s^4}{t^8}+\frac{4\,s^2}{t^8}+\frac{8}{s^2\,t^8}+\frac{12}{s^4\,t^8}+\frac{8}{s^6\,t^8}-\frac{20}{s^8\,t^8}+\frac{4}{s^{10}\,t^8}+\frac{2}{s^{12}\,t^8}-\frac{20}{t^8}-\frac{4}{s^2\,t^{10}}-\frac{8}{s^4\,t^{10}}$$
$$+\frac{8}{s^6\,t^{10}}+\frac{4}{s^8\,t^{10}}-\frac{4}{s^{10}\,t^{10}}+\frac{4}{t^{10}}+\frac{2}{s^4\,t^{12}}-\frac{4}{s^6\,t^{12}}+\frac{2}{s^8\,t^{12}}+4\,s^{10}-20\,s^8+4\,s^6+164\,s^4$$
$$-476\,s^2-\frac{476}{s^2}+\frac{164}{s^4}+\frac{4}{s^6}-\frac{20}{s^8}+\frac{4}{s^{10}}+649\,;$$

$$K1134:=2\,s^8\,t^{12}-4\,s^6\,t^{12}+2\,s^4\,t^{12}-4\,s^{10}\,t^{10}+4\,s^8\,t^{10}+8\,s^6\,t^{10}-8\,s^4\,t^{10}-4\,s^2\,t^{10}+4\,t^{10} \quad \textbf{(2.19)}$$
$$+2\,s^{12}\,t^8+4\,s^{10}\,t^8-20\,s^8\,t^8+8\,s^6\,t^8+12\,s^4\,t^8+8\,s^2\,t^8+\frac{4\,t^8}{s^2}+\frac{2\,t^8}{s^4}-20\,t^8$$
$$-4\,s^{12}\,t^6+8\,s^{10}\,t^6+8\,s^8\,t^6-4\,s^6\,t^6-46\,s^4\,t^6+46\,s^2\,t^6-\frac{8\,t^6}{s^2}-\frac{8\,t^6}{s^4}+\frac{4\,t^6}{s^6}+4\,t^6$$
$$+2\,s^{12}\,t^4-8\,s^{10}\,t^4+12\,s^8\,t^4-46\,s^6\,t^4+164\,s^4\,t^4-248\,s^2\,t^4-\frac{46\,t^4}{s^2}+\frac{12\,t^4}{s^4}-\frac{8\,t^4}{s^6}$$
$$+\frac{2\,t^4}{s^8}+164\,t^4-4\,s^{10}\,t^2+8\,s^8\,t^2+46\,s^6\,t^2-248\,s^4\,t^2+476\,s^2\,t^2+\frac{248\,t^2}{s^2}-\frac{46\,t^2}{s^4}$$
$$-\frac{8\,t^2}{s^6}+\frac{4\,t^2}{s^8}-476\,t^2+\frac{4\,s^8}{t^2}-\frac{8\,s^6}{t^2}-\frac{46\,s^4}{t^2}+\frac{248\,s^2}{t^2}+\frac{476}{s^2\,t^2}-\frac{248}{s^4\,t^2}+\frac{46}{s^6\,t^2}$$
$$+\frac{8}{s^8\,t^2}-\frac{4}{s^{10}\,t^2}-\frac{476}{t^2}+\frac{2\,s^8}{t^4}-\frac{8\,s^6}{t^4}+\frac{12\,s^4}{t^4}-\frac{46\,s^2}{t^4}-\frac{248}{s^2\,t^4}+\frac{164}{s^4\,t^4}-\frac{46}{s^6\,t^4}$$
$$+\frac{12}{s^8\,t^4}-\frac{8}{s^{10}\,t^4}+\frac{2}{s^{12}\,t^4}+\frac{164}{t^4}+\frac{4\,s^6}{t^6}-\frac{8\,s^4}{t^6}-\frac{8\,s^2}{t^6}+\frac{46}{s^2\,t^6}-\frac{46}{s^4\,t^6}-\frac{4}{s^6\,t^6}$$
$$+\frac{8}{s^8\,t^6}+\frac{8}{s^{10}\,t^6}-\frac{4}{s^{12}\,t^6}+\frac{4}{t^6}+\frac{2\,s^4}{t^8}+\frac{4\,s^2}{t^8}+\frac{8}{s^2\,t^8}+\frac{12}{s^4\,t^8}+\frac{8}{s^6\,t^8}-\frac{20}{s^8\,t^8}$$
$$+\frac{4}{s^{10}\,t^8}+\frac{2}{s^{12}\,t^8}-\frac{20}{t^8}-\frac{4}{s^2\,t^{10}}-\frac{8}{s^4\,t^{10}}+\frac{8}{s^6\,t^{10}}+\frac{4}{s^8\,t^{10}}-\frac{4}{s^{10}\,t^{10}}+\frac{4}{t^{10}}$$
$$+\frac{2}{s^4\,t^{12}}-\frac{4}{s^6\,t^{12}}+\frac{2}{s^8\,t^{12}}+4\,s^{10}-20\,s^8+4\,s^6+164\,s^4-476\,s^2-\frac{476}{s^2}+\frac{164}{s^4}$$
$$+\frac{4}{s^6}-\frac{20}{s^8}+\frac{4}{s^{10}}+649$$

```
#Computed Externally
#U2iiR2Ui:=spmm(KP(U^2, id), spmm(KP(id, R^2), Ui)) : R2iiURiiURi := spmm(KP(R^2, id),
    spmm(iU, spmm(Ri, spmm(iU, Ri)))) :
# A1142:=spmm(KP(id, KP(kappa, KP(kappa, kappa)))), spmm(KP(U, ID), KP(id,
    U2iiR2Ui))) : B1142 := spmm(KP(R, ID), KP(id, R2iiURiiURi)) : K1142 :=
    sort(sort(expand(sl3(A1142, B1142)), s), t);
```

$$K1142 := \frac{1}{s^6 t^6}\left(\left(12 t^{12} - 34 t^{10} + 34 t^8 - 12 t^6\right) s^{12} + \left(-34 t^{12} + 148 t^{10} - 228 t^8 + 148 t^6 - 34 t^4\right) s^{10} + \left(34 t^{12} - 228 t^{10} + 496 t^8 - 496 t^6 + 228 t^4 - 34 t^2\right) s^8 + \left(-12 t^{12} + 148 t^{10} - 496 t^8 + 721 t^6 - 496 t^4 + 148 t^2 - 12\right) s^6 + \left(-34 t^{10} + 228 t^8 - 496 t^6 + 496 t^4 - 228 t^2 + 34\right) s^4 + \left(-34 t^8 + 148 t^6 - 228 t^4 + 148 t^2 - 34\right) s^2 - 12 t^6 + 34 t^4 - 34 t^2 + 12\right);$$

$$K1142 := \frac{1}{s^6 t^6}\left(\left(12 t^{12} - 34 t^{10} + 34 t^8 - 12 t^6\right) s^{12} + \left(-34 t^{12} + 148 t^{10} - 228 t^8 + 148 t^6 - 34 t^4\right) s^{10} + \left(34 t^{12} - 228 t^{10} + 496 t^8 - 496 t^6 + 228 t^4 - 34 t^2\right) s^8 + \left(-12 t^{12} + 148 t^{10} - 496 t^8 + 721 t^6 - 496 t^4 + 148 t^2 - 12\right) s^6 + \left(-34 t^{10} + 228 t^8 - 496 t^6 + 496 t^4 - 228 t^2 + 34\right) s^4 + \left(-34 t^8 + 148 t^6 - 228 t^4 + 148 t^2 - 34\right) s^2 - 12 t^6 + 34 t^4 - 34 t^2 + 12\right) \quad \textbf{(2.20)}$$