In[1]:=
```
q = q0 * Exp[I * (k * x + w * t)];
qjn = q0 * Exp[I * (k * xj + w * tn)];
qjbar = Integrate[q, {x, xj - dx / 2, xj + dx / 2}] / (dx);
qjnbar = qjbar /. t → tn;
MA = qjn / qjnbar;

qntbar = Integrate[q, {t, tn, tn + dt}] / (dt);
qjntbar = qntbar /. x → xj;
MtA = qjntbar / qjn;

qjphn = q0 * Exp[I * (k * (xj + dx / 2) + w * tn)];
RA = Simplify[MA * qjphn / (qjn)];

vmultG = H + H^3 / 3 * k^2;
GnA = -U * RA / vmultG;
GGA = RA / vmultG;
GcA = -U * H / vmultG;

fn1A = H * vh + U * eh;
fn1A = fn1A /. vh → (GGA * Gca + GnA * eca) /. eh → RA * eca;
fn1Gca0A = fn1A /. Gca → 0;
fn1eca0A = fn1A /. eca → 0;
fnnA = Simplify[fn1Gca0A / eca];
fnGA = fn1eca0A / Gca;
fncA = H * GcA;

fG1A = U * Gh + U * H * vh + g * H * eh;
fG1A = fG1A /. vh → (GGA * Gca + GnA * eca) /. eh → RA * eca /. Gh → RA * Gca;
fG1Gca0A = fG1A /. Gca → 0;
fG1eca0A = fG1A /. eca → 0;
fGnA = Simplify[fG1Gca0A / eca];
fGGA = Simplify[fG1eca0A / Gca];
fGcA = U * H * GcA;

FnnA = -MtA * dt / dx * (1 - Exp[-I * k * dx]) * fnnA;
FnGA = -MtA * dt / dx * (1 - Exp[-I * k * dx]) * fnGA;
FGnA = -MtA * dt / dx * (1 - Exp[-I * k * dx]) * fGnA;
FGGA = -MtA * dt / dx * (1 - Exp[-I * k * dx]) * fGGA;

MatA = {{FnnA, FnGA}, {FGnA, FGGA}};
EA = {{1, 0}, {0, 1}} + MatA;
```

$$wAp = U * k + \frac{\sqrt{3}\ k \sqrt{g\,H\left(3 + H^2\,k^2\right)}}{3 + H^2\,k^2};$$

$$wAm = U * k - \frac{\sqrt{3}\ k \sqrt{g\,H\left(3 + H^2\,k^2\right)}}{3 + H^2\,k^2};$$

In[37]:=
```
M = 1;
Merr = Series[M - MA, {dx, 0, 4}];
Rm = 1;
Rmerr = Series[Rm - RA, {dx, 0, 4}];
Rp = Exp[I * k * dx];
Rperr = Series[Rp - RA, {dx, 0, 4}];
Ru = (1 + Exp[I * k * dx]) / 2;
Ruerr = Series[Ru - Exp[I * k * dx / 2], {dx, 0, 4}];
Gold = H - H^3 / 3 * (2 * Cos[k * dx] - 2) / dx^2;
GG2 = Simplify[Ru / Gold];
GG2err = Series[GG2 - GGA, {dx, 0, 5}];
Gn2 = Simplify[-U * Ru / Gold];
Gn2err = Series[Gn2 - GnA, {dx, 0, 5}];
```

In[50]:=
```
Text[Row[{"M  ||   ", M}]]
Text[Row[{"M  ||   ", TeXForm[M]}]]
Text[Row[{"M error  ||   ", TeXForm[Merr]}]]
Text[Row[{"M error  ||   ", Merr}]]
Text[" "]
Text[Row[{"Rm  ||   ", Rm}]]
Text[Row[{"Rm  ||   ", TeXForm[Rm]}]]
Text[Row[{"Rm error  ||   ", Rmerr}]]
Text[Row[{"Rm error  ||   ", TeXForm[Rmerr]}]]
Text[" "]
Text[Row[{"Rp  ||   ", Rp}]]
Text[Row[{"Rp  ||   ", TeXForm[Rp]}]]
Text[Row[{"Rp error  ||   ", Rperr}]]
Text[Row[{"Rp error  ||   ", TeXForm[Rperr]}]]
Text[" "]
Text[Row[{"GG2  ||   ", GG2}]]
Text[Row[{"GG2  ||   ", TeXForm[GG2]}]]
Text[Row[{"GG2 error  ||   ", GG2err}]]
Text[Row[{"GG2 error  ||   ", TeXForm[GG2err]}]]
Text[" "]
Text[Row[{"Gn2  ||   ", Gn2}]]
Text[Row[{"Gn2  ||   ", TeXForm[Gn2]}]]
Text[Row[{"Gn2 error  ||   ", Gn2err}]]
Text[Row[{"Gn2 error  ||   ", TeXForm[Gn2err]}]]
```

Out[50]= M || 1

Out[51]= M || 1

Out[52]= M error || −\frac{\text{dx}^2 k^2}{24}−\frac{7 \text{dx}^4 k^4}{5760}+O\left(\text{dx}^5\right)

Out[53]= M error || $-\frac{k^2\,dx^2}{24}-\frac{7\,k^4\,dx^4}{5760}+O[dx]^5$

Out[54]=

Out[55]= Rm || 1

Out[56]= Rm || 1

Out[57]= Rm error || $-\frac{1}{2}\,i\,k\,dx+\frac{k^2\,dx^2}{12}+\frac{k^4\,dx^4}{720}+O[dx]^5$

Out[58]= Rm error || −\frac{1}{2} i \text{dx} k+\frac{\text{dx}^2 k^2}{12}+\frac{\text{dx}^4 k^4}{720}+O\left(\text{dx}^5\right)

Out[59]=

Out[60]= Rp || $e^{i\,dx\,k}$

Out[61]= Rp || e^{i \text{dx} k}

Out[62]= Rp error || $\frac{i\,k\,dx}{2}-\frac{5\,k^2\,dx^2}{12}-\frac{1}{6}\,i\,k^3\,dx^3+\frac{31\,k^4\,dx^4}{720}+O[dx]^5$

Out[63]= Rp error || \frac{i \text{dx} k}{2}−\frac{5 \text{dx}^2 k^2}{12}−\frac{1}{6} i \text{dx}^3 k^3+\frac{31 \text{dx}^4 k^4}{720}+O\left(\text{dx}^5\right)

Out[64]=

Out[65]= GG2 || $\frac{1+e^{i\,dx\,k}}{2\left(H-\frac{2\,H^3\,(-1+\text{Cos}[dx\,k])}{3\,dx^2}\right)}$

Out[66]= GG2 || \frac{1+e^{i \text{dx} k}}{2 \left(H−\frac{2 H^3 (\cos (\text{dx} k)−1)}{3 \text{dx}^2}\right)}

Out[67]= GG2 error || $\frac{\left(-6\,k^2-H^2\,k^4\right)dx^2}{4\,H\left(3+H^2\,k^2\right)^2}-\frac{i\left(6\,k^3+H^2\,k^5\right)dx^3}{8\,H\left(3+H^2\,k^2\right)^2}+\frac{\left(144\,k^4+45\,H^2\,k^6+4\,H^4\,k^8\right)dx^4}{240\,H\left(3+H^2\,k^2\right)^3}-\frac{i\left(-54\,k^5+H^4\,k^9\right)dx^5}{480\,H\left(3+H^2\,k^2\right)^3}+O[dx]^6$

Out[68]= GG2 error || \frac{\text{dx}^2 \left(−H^2 k^4−6 k^2\right)}{4 H \left(H^2 k^2+3\right)^2}−\frac{i \text{dx}^3 \left(H^2 k^5+6 k^3\right)}{8 H \left(H^2 k^2+3\right)^2}+\frac{\text{dx}^4 \left(4 H^4 k^8+45 H^2 k^6+144 k^4\right)}{240 H \left(H^2 k^2+3\right)^3}−\frac{i \text{dx}^5 \left(H^4 k^9−54 k^5\right)}{480 H \left(H^2 k^2+3\right)^3}+O\left(\text{dx}^6\right)

Out[69]=

Out[70]= Gn2 || $-\frac{\left(1+e^{i\,dx\,k}\right)U}{2\left(H-\frac{2\,H^3\,(-1+\text{Cos}[dx\,k])}{3\,dx^2}\right)}$

Out[71]= Gn2 || −\frac{U \left(1+e^{i \text{dx} k}\right)}{2 \left(H−\frac{2 H^3 (\cos (\text{dx} k)−1)}{3 \text{dx}^2}\right)}

Out[72]= Gn2 error || $\frac{\left(6\,k^2+H^2\,k^4\right)U\,dx^2}{4\,H\left(3+H^2\,k^2\right)^2}+\frac{i\left(6\,k^3+H^2\,k^5\right)U\,dx^3}{8\,H\left(3+H^2\,k^2\right)^2}-\frac{\left(\left(144\,k^4+45\,H^2\,k^6+4\,H^4\,k^8\right)U\right)dx^4}{240\left(H\left(3+H^2\,k^2\right)^3\right)}+\frac{i\left(-54\,k^5+H^4\,k^9\right)U\,dx^5}{480\,H\left(3+H^2\,k^2\right)^3}+O[dx]^6$

Out[73]= Gn2 error ||

\frac{\text{dx}^2 U \left(H^2 k^4+6 k^2\right)}{4 H \left(H^2 k^2+3\right)^2}+\frac{i \text{dx}^3 U \left(H^2 k^5+6 k^3\right)}{8 H \left(H^2 k^2+3\right)^2}−\frac{\text{dx}^4 \left(U \left(4 H^4 k^8+45 H^2 k^6+144 k^4\right)\right)}{240 \left(H \left(H^2 k^2+3\right)^3\right)}+\frac{i \text{dx}^5 U \left(H^4 k^9−54 k^5\right)}{480 H \left(H^2 k^2+3\right)^3}+O\left(\text{dx}^6\right)

In[74]:=
```
KurF = (fm * ap - fp * am + am * ap * (qp - qm)) / (ap - am);
KurFWS = KurF /. ap → (U + Sqrt[g * H]) /. am → (U - Sqrt[g * H]);
KurFWSeta =
  KurFWS /. fp → (H * v + U * Rpp * n) /. fm → (H * v + U * Rmp * n) /. qp → Rpp * n /.
   qm → Rmp * n;
KurFWSeta = KurFWSeta /. v → (GGp * G + Gnp * n);
Kfnnp = FullSimplify[KurFWSeta /. G → 0 /. n → 1];
KfnGp = FullSimplify[KurFWSeta /. n → 0 /. G → 1];
Kfnn = Kfnnp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
KfnG = KfnGp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
Fnn2 = -dt * (1 - Exp[-I * k * dx]) / dx * Kfnn;
Fnn2TA = Series[Fnn2 - FnnA, {dx, 0, 3}, {dt, 0, 3}];
Fnn2TAr = Refine[Fnn2TA , {k > 0, U > 0, H > 0, g > 0}];
FnG2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfnG;
FnG2TA = Series[FnG2 - FnGA, {dx, 0, 3}, {dt, 0, 3}];
FnG2TAr = Refine[FnG2TA , {k > 0, U > 0, H > 0, g > 0}];

KurFWSG = KurFWS /. fp → (U * Rpp * G + U * H * v + g * H * Rpp * n) /.
      fm → (U * Rmp * G + U * H * v + g * H * Rmp * n) /. qp → Rpp * G /. qm → Rmp * G;
KurFWSG = KurFWSG /. v → (GGp * G + Gnp * n);
KfGnp = FullSimplify[KurFWSG /. G → 0 /. n → 1];
KfGGp = FullSimplify[KurFWSG /. n → 0 /. G → 1];
KfGn = KfGnp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
KfGG = KfGGp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;

FGn2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfGn;
FGn2TA = Series[FGn2 - FGnA, {dx, 0, 3}, {dt, 0, 3}];
FGn2TAr = Refine[FGn2TA , {k > 0, U > 0, H > 0, g > 0}];
fGG2 = U * H * GG2 + U / 2 * (Rm + Rp) - (Sqrt[ g * H]) / (2) * (Rp - Rm);
FGG2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfGG;
FGG2TA = Series[FGG2 - FGGA, {dx, 0, 4}, {dt, 0, 3}];
FGG2TAr = Refine[FGG2TA , {k > 0, U > 0, H > 0, g > 0}];
Fmat2 = {{Fnn2, FnG2}, {FGn2, FGG2}};
Emat2 = IdentityMatrix[2] + Fmat2 ;
Eerr = Series[Emat2 - EA, {dx, 0, 4}, {dt, 0, 4}];
```

```
EigvFmat2 = Eigenvalues[Fmat2];

RKStep = Log[ 1 + EigvFmat2 ] / (I * dt);
RKstepTay = Series[RKStep, {dx, 0, 4}, {dt, 0, 4}];
RKstepTayr = Simplify[-RKstepTay - {wAp, wAm}, {k > 0, H > 0, g > 0, U > 0} ];


Text[Row[{" -Sqrt(gH) < U  < Sqrt(gH)"}]]
Text[" "]
Text[Row[{"Fnn  ||   ", Kfnnp}]]
Text[Row[{"Fnn  ||   ", TeXForm[Kfnnp]}]]
Text[Row[{"Fnn error  ||   ", Fnn2TAr}]]
Text[Row[{"Fnn error  ||   ", TeXForm[Fnn2TAr]}]]
Text[" "]
Text[Row[{"FnG  ||   ", KfnGp}]]
Text[Row[{"FnG  ||   ", TeXForm[KfnGp]}]]
Text[Row[{"FnG error  ||   ", FnG2TAr}]]
Text[Row[{"FnG error  ||   ", TeXForm[FnG2TAr]}]]
Text[" "]
Text[Row[{"FGn  ||   ", KfGnp}]]
Text[Row[{"FGn  ||   ", TeXForm[KfGnp]}]]
Text[Row[{"FGn error  ||   ", FGn2TAr}]]
Text[Row[{"FGn error  ||   ", TeXForm[FGn2TAr]}]]
Text[" "]
Text[Row[{"FGG  ||   ", KfGGp}]]
Text[Row[{"FGG  ||   ", TeXForm[KfGGp]}]]
Text[Row[{"FGG error  ||   ", FGG2TAr}]]
Text[Row[{"FGG error  ||   ", TeXForm[FGG2TAr]}]]
Text[" "]
Text[" "]
Text[Row[{"Omega error  ||   ", RKstepTayr}]]
Text[Row[{"Omega error  ||   ", TeXForm[RKstepTayr]}]]
Text[" "]
Text[Row[{"EA ||   ", EA}]]
Text[Row[{"EA  ||   ", TeXForm[EA]}]]
Text[Row[{"Eerr ||   ", Eerr}]]
Text[Row[{"Eerr ||   ", TeXForm[Eerr]}]]
```

Out[108]= $-\text{Sqrt(gH)} < \text{U} < \text{Sqrt(gH)}$

Out[109]=

Out[110]= Fnn || $\frac{1}{2}\left(2\,\text{Gnp}\,H + \text{Rpp}\left(-\sqrt{g\,H}\ + U\right) + \text{Rmp}\left(\sqrt{g\,H}\ + U\right)\right)$

Out[111]= Fnn || \frac{1}{2} \left(\text{Rmp} \left(\sqrt{g H}+U\right)+\text{Rpp} \left(U−\sqrt{g H}\right)+2 \text{Gnp} H\right)

Out[112]= Fnn error || $\left(-\frac{\left(H^2\,k^3\,U\,w\right)dt^2}{2\left(3+H^2\,k^2\right)} - \frac{i\,H^2\,k^3\,U\,w^2\,dt^3}{6\left(3+H^2\,k^2\right)} + O[dt]^4\right) + \left(-\frac{1}{2}\left(\sqrt{g\,H}\ k^2\right)dt + O[dt]^4\right)dx +$
$\left(\frac{i\left(9\,H^2\,k^5+2\,H^4\,k^7\right)U\,dt}{12\left(3+H^2\,k^2\right)^2} + O[dt]^4\right)dx^2 + \left(\frac{1}{24}\sqrt{g\,H}\ k^4\,dt + O[dt]^4\right)dx^3 + O[dx]^4$

Out[113]= Fnn error ||
\left(−\frac{\text{dt}^2 \left(H^2 k^3 U w\right)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 H^2 k^3 U w^2}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(−\frac{1}{2} \left(\sqrt{g H} k^2\right) \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 H^4 k^7+9 H^2 k^5\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(\frac{1}{24} \sqrt{g H} k^4 \text{dt}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[114]=

Out[115]= FnG || GGp H

Out[116]= FnG || \text{GGp} H

Out[117]= FnG error || $\left(-\frac{3\,(k\,w)\,dt^2}{2\left(3+H^2\,k^2\right)} - \frac{i\,k\,w^2\,dt^3}{2\left(3+H^2\,k^2\right)} + O[dt]^4\right) + \left(\frac{i\left(6\,k^3+H^2\,k^5\right)dt}{4\left(3+H^2\,k^2\right)^2} + O[dt]^4\right)dx^2 + O[dx]^4$

Out[118]= FnG error || \left(−\frac{3 \text{dt}^2 (k w)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 k w^2}{2 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(H^2 k^5+6 k^3\right) \text{dt}}{4 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[119]=

Out[120]= FGn || $\frac{1}{2}\left(g\,H\,(\text{Rmp} + \text{Rpp}) + \left(2\,\text{Gnp}\,H + \sqrt{g\,H}\ (\text{Rmp} - \text{Rpp})\right)U\right)$

Out[121]= FGn ||
\frac{1}{2} \left(U \left(\sqrt{g H} (\text{Rmp}−\text{Rpp})+2 \text{Gnp} H\right)+g H (\text{Rmp}+\text{Rpp})\right)

Out[122]= FGn error || $\left(-\frac{\left(k\left(3\,g\,H+g\,H^3\,k^2-3\,U^2\right)w\right)dt^2}{2\left(3+H^2\,k^2\right)} - \frac{i\,k\left(3\,g\,H+g\,H^3\,k^2-3\,U^2\right)w^2\,dt^3}{6\left(3+H^2\,k^2\right)} + O[dt]^4\right) + \left(-\frac{1}{2}\left(\sqrt{g\,H}\ k^2\,U\right)dt + O[dt]^4\right)dx +$
$\left(\frac{i\left(18\,g\,H\,k^3+12\,g\,H^3\,k^5+2\,g\,H^5\,k^7-18\,k^3\,U^2-3\,H^2\,k^5\,U^2\right)dt}{12\left(3+H^2\,k^2\right)^2} + O[dt]^4\right)dx^2 + \left(\frac{1}{24}\sqrt{g\,H}\ k^4\,U\,dt + O[dt]^4\right)dx^3 + O[dx]^4$

Out[123]= FGn error ||
\left(−\frac{\text{dt}^2 \left(k w \left(g H^3 k^2+3 g H−3 U^2\right)\right)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 k w^2 \left(g H^3 k^2+3 g H−3 U^2\right)}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(−\frac{1}{2} \left(\sqrt{g H} k^2 U\right) \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 g H^5 k^7+12 g H^3 k^5−3 H^2 U^2 k^5−18 U^2 k^3+18 g H k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(\frac{1}{24} \sqrt{g H} k^4 U \text{dt}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[124]=

Out[125]= FGG || $\frac{1}{2}\left(\sqrt{g\,H}\ \text{Rmp}-\sqrt{g\,H}\ \text{Rpp}+(2\,\text{GGp}\,H+\text{Rmp}+\text{Rpp})\,U\right)$

Out[126]= FGG || \frac{1}{2} \left(\text{Rmp} \sqrt{g H}-\text{Rpp} \sqrt{g H}+U (2 \text{GGp} H+\text{Rmp}+\text{Rpp})\right)

Out[127]= FGG error || $\left(-\frac{(k\,(6+H^2\,k^2)\,U\,w)\,dt^2}{2\,(3+H^2\,k^2)}-\frac{i\,k\,(6+H^2\,k^2)\,U\,w^2\,dt^3}{6\,(3+H^2\,k^2)}+O[dt]^4\right)+$
$\left(-\frac{1}{2}\left(\sqrt{g\,H}\ k^2\right)dt+O[dt]^4\right)dx+\left(\frac{i\,(36\,k^3\,U+15\,H^2\,k^5\,U+2\,H^4\,k^7\,U)\,dt}{12\,(3+H^2\,k^2)^2}+O[dt]^4\right)dx^2+$
$\left(\frac{1}{24}\sqrt{g\,H}\ k^4\,dt+O[dt]^4\right)dx^3+\left(-\frac{i\,(108\,k^5\,U+54\,H^2\,k^7\,U+17\,H^4\,k^9\,U+2\,H^6\,k^{11}\,U)\,dt}{240\,(3+H^2\,k^2)^3}+O[dt]^4\right)dx^4+O[dx]^5$

Out[128]= FGG error ||
\left(-\frac{\text{dt}^2 \left(k U w \left(H^2 k^2+6\right)\right)}{2 \left(H^2 k^2+3\right)}-\frac{i \text{dt}^3 k U w^2 \left(H^2 k^2+6\right)}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(-\frac{1}{2} \sqrt{g H} k^2\right) \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 H^4 U k^7+15 H^2 U k^5+36 U k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(\frac{1}{24} \sqrt{g H} k^4 \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^4 \left(-\frac{i \left(2 H^6 U k^{11}+17 H^4 U k^9+54 H^2 U k^7+108 U k^5\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^5\right)

Out[129]=

Out[130]=

Out[131]= Omega error || $\left\{\left(\frac{i\left(\sqrt{3}\ k\sqrt{g\,H\,(3+H^2\,k^2)}+3\,k\,U+H^2\,k^3\,U\right)^2 dt}{2\,(3+H^2\,k^2)^2}-\frac{1}{3\,(3+H^2\,k^2)^2}\right.\right.$
$\left(k^3\left(\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+(3+H^2\,k^2)\,U\right)\left(3\,g\,H+U\left(2\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+(3+H^2\,k^2)\,U\right)\right)\right)dt^2-$
$\frac{1}{4\,(3+H^2\,k^2)^3}i\,k^4\left(\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+(3+H^2\,k^2)\,U\right)\left(3\,g\left(\sqrt{3}\ H\sqrt{g\,H\,(3+H^2\,k^2)}+9\,H\,U+3\,H^3\,k^2\,U\right)+\right.$
$\left.U^2\left(H^4\,k^4\,U+9\left(\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+U\right)+3\,k^2\left(\sqrt{3}\ \sqrt{g\,H^5\,(3+H^2\,k^2)}+2\,H^2\,U\right)\right)\right)dt^3+$
$\frac{1}{5\,(3+H^2\,k^2)^3}k^5\left(\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+(3+H^2\,k^2)\,U\right)$
$\left(9\,g^2\,H^2+6\,g\,H\,U\left(2\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+3\,(3+H^2\,k^2)\,U\right)+\right.$
$\left.\left.U^3\left(12\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+9\,U+H^4\,k^4\,U+2\,k^2\left(2\sqrt{3}\ \sqrt{g\,H^5\,(3+H^2\,k^2)}+3\,H^2\,U\right)\right)\right)dt^4+$
$O[dt]^5\Bigg)+\Bigg(-\frac{1}{4}\,i\,k^2\left(2\sqrt{g\,H}+\frac{\sqrt{3}\ U}{\sqrt{3+H^2\,k^2}}\right)+\frac{k^3\left(2\sqrt{g\,H\,(3+H^2\,k^2)}+\sqrt{3}\ U\right)\left(\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+(3+H^2\,k^2)\,U\right)dt}{4\,(3+H^2\,k^2)^{3/2}}+$
$\frac{1}{4\,(3+H^2\,k^2)^{3/2}}i\,k^4\left(2\sqrt{g\,H\,(3+H^2\,k^2)}+\sqrt{3}\ U\right)\left(3\,g\,H+U\left(2\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}+(3+H^2\,k^2)\,U\right)\right)dt^2-$
$\frac{1}{4\,(3+H^2\,k^2)^{5/2}}\left(k^5\left(2\sqrt{g\,H\,(3+H^2\,k^2)}+\sqrt{3}\ U\right)\left(3\,g\left(\sqrt{3}\ H\sqrt{g\,H\,(3+H^2\,k^2)}+9\,H\,U+3\,H^3\,k^2\,U\right)+\right.\right.$

$$U^2\left(H^4 k^4 U + 9\left(\sqrt{3}\ \sqrt{g H\left(3+H^2 k^2\right)}\ + U\right) + 3 k^2\left(\sqrt{3}\ \sqrt{g H^5\left(3+H^2 k^2\right)}\ + 2 H^2 U\right)\right)\Big)\Big)$$

$$dt^3 - \frac{1}{4\left(3+H^2 k^2\right)^{5/2}} i k^6\left(2\sqrt{g H\left(3+H^2 k^2\right)}\ + \sqrt{3}\ U\right)$$

$$\left(9 g^2 H^2 + 6 g H U\left(2\sqrt{3}\ \sqrt{g H\left(3+H^2 k^2\right)}\ + 3\left(3+H^2 k^2\right) U\right) + U^3\left(12\sqrt{3}\ \sqrt{g H\left(3+H^2 k^2\right)}\ + 9 U + H^4 k^4 U + 2 k^2\left(2\sqrt{3}\ \sqrt{g H^5\left(3+H^2 k^2\right)}\ + 3 H^2 U\right)\right)\right) dt^4 +$$

$$O[dt]^5\Bigg) dx + \Bigg(-\Bigg(\Big(k^3\left(12\sqrt{3}\ g H\left(4+H^2 k^2\right) + U\left(48\sqrt{g H\left(3+H^2 k^2\right)}\ - 9\sqrt{3}\ U + k^2\left(16\sqrt{g H^5\left(3+H^2 k^2\right)}\ - 3\sqrt{3}\ H^2 U\right)\right)\right)\Big/\left(96\left(\sqrt{g H}\ \left(3+H^2 k^2\right)^{3/2}\right)\right)\Big) -$$

$$\Big(i k^4\Big(9 U^2\left(16\sqrt{g H\left(3+H^2 k^2\right)}\ - 3\sqrt{3}\ U\right) + k^4 U^2\left(16\sqrt{g H^9\left(3+H^2 k^2\right)}\ - 3\sqrt{3}\ H^4 U\right) + 6 k^2\left(18\sqrt{g^3 H^7\left(3+H^2 k^2\right)}\ + 16\sqrt{g H^5\left(3+H^2 k^2\right)}\ U^2 - 3\sqrt{3}\ H^2 U^3\right) + 4 g H\left(63\sqrt{g H\left(3+H^2 k^2\right)}\ + 99\sqrt{3}\ U + 63\sqrt{3}\ H^2 k^2 U + k^4\left(3\sqrt{g H^9\left(3+H^2 k^2\right)}\ + 10\sqrt{3}\ H^4 U\right)\right)\Big) dt\Big)\Big/\left(96\sqrt{g H}\ \left(3+H^2 k^2\right)^{5/2}\right) +$$

$$\Big(k^5\Big(12\sqrt{3}\ g^2 H^2\left(30+15 H^2 k^2+2 H^4 k^4\right) + 9 U^3\left(16\sqrt{g H\left(3+H^2 k^2\right)}\ - 3\sqrt{3}\ U\right) + k^4 U^3\left(16\sqrt{g H^9\left(3+H^2 k^2\right)}\ - 3\sqrt{3}\ H^4 U\right) + 6 k^2\left(56\sqrt{g^3 H^7\left(3+H^2 k^2\right)}\ U + 16\sqrt{g H^5\left(3+H^2 k^2\right)}\ U^3 - 3\sqrt{3}\ H^2 U^4\right) + g H U\left(864\sqrt{g H\left(3+H^2 k^2\right)}\ + 675\sqrt{3}\ U + 429\sqrt{3}\ H^2 k^2 U + 4 k^4\left(6\sqrt{g H^9\left(3+H^2 k^2\right)}\ + 17\sqrt{3}\ H^4 U\right)\right)\Big) dt^2\Big)\Big/\left(96\sqrt{g H}\ \left(3+H^2 k^2\right)^{5/2}\right) +$$

$$\frac{1}{96\sqrt{g H}\ \left(3+H^2 k^2\right)^{7/2}} i k^6\Big(9 k^2\Big(84\sqrt{g^5 H^9\left(3+H^2 k^2\right)}\ + 404\sqrt{3}\ g^2 H^4 U + 438\sqrt{g^3 H^7\left(3+H^2 k^2\right)}\ U^2 + 314\sqrt{3}\ g H^3 U^3 + 48\sqrt{g H^5\left(3+H^2 k^2\right)}\ U^4 - 9\sqrt{3}\ H^2 U^5\Big) + 27\Big(52\sqrt{g^5 H^5\left(3+H^2 k^2\right)}\ + 172\sqrt{3}\ g^2 H^2 U + 16\sqrt{g H\left(3+H^2 k^2\right)}\ U^4 - 3\sqrt{3}\ U^5 + g H U^2\left(210\sqrt{g H\left(3+H^2 k^2\right)}\ + 109\sqrt{3}\ U\right)\Big) + 3 k^4\Big(36\sqrt{g^5 H^{13}\left(3+H^2 k^2\right)}\ + 304\sqrt{3}\ g^2 H^6 U + 48\sqrt{g H^9\left(3+H^2 k^2\right)}\ U^4 - 9\sqrt{3}\ H^4 U^5 + g H^5 U^2\left(264\sqrt{g H\left(3+H^2 k^2\right)}\ + 301\sqrt{3}\ U\right)\Big) + k^6 U\left(72\sqrt{3}\ g^2 H^8 + 12 g H^7 U\left(3\sqrt{g H\left(3+H^2 k^2\right)}\ + 8\sqrt{3}\ U\right) + U^3\left(16\sqrt{g H^{13}\left(3+H^2 k^2\right)}\ - 3\sqrt{3}\ H^6 U\right)\Big)\Big) dt^3 - \frac{1}{96\left(\sqrt{g H}\ \left(3+H^2 k^2\right)^{7/2}\right)}$$

$$\Big(k^7\Big(36\sqrt{3}\ g^3 H^3\left(48+27 H^2 k^2+4 H^4 k^4\right) + 3\sqrt{3}\ g^2 H^2\left(4113+3075 H^2 k^2+712 H^4 k^4+48 H^6 k^6\right) U^2 + 2 g H U^3\left(5076\sqrt{g H\left(3+H^2 k^2\right)}\ + 1971\sqrt{3}\ U + 1872\sqrt{3}\ H^2 k^2 U +\right.$$

$$
\begin{aligned}
&3\,k^4\left(216\sqrt{g\,H^9\left(3+H^2\,k^2\right)}+197\sqrt{3}\;H^4\,U\right)+2\,k^6\left(12\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}+31\sqrt{3}\right.\\
&\qquad\left.H^6\,U\right)+U\left(7344\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}+432\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^4-81\sqrt{3}\;U^5+\right.\\
&\qquad k^6\,U^4\left(16\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}-3\sqrt{3}\;H^6\,U\right)+9\,k^2\left(400\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+\right.\\
&\qquad\qquad 760\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2+48\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^4-9\sqrt{3}\;H^2\,U^5\Big)+\\
&\qquad\qquad 9\,k^4\left(48\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}+16\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\;U^4-3\sqrt{3}\;H^4\,U^5\right)\Big)\Big)\Big)\,dt^4+O[dt]^5\Big)
\end{aligned}
$$

$$
\begin{aligned}
&dx^2+\left(\left(i\,k^4\left(3\sqrt{3}\;\left(3+H^2\,k^2\right)U^3+4\,g\,H\left(12\sqrt{g\,H\left(3+H^2\,k^2\right)}+6\sqrt{3}\;U+\right.\right.\right.\right.\\
&\qquad\left.\left.\left.\left.k^2\left(4\sqrt{g\,H^5\left(3+H^2\,k^2\right)}+\sqrt{3}\;H^2\,U\right)\right)\right)\right)\Big/\left(384\,g\,H\left(3+H^2\,k^2\right)^{3/2}\right)-\\
&\left(\left(k^5\left(8\sqrt{3}\;g^2\,H^2\left(54+33\,H^2\,k^2+5\,H^4\,k^4\right)+3\sqrt{3}\;\left(3+H^2\,k^2\right)^2U^4+2\,g\,H\,U\right.\right.\right.\\
&\qquad\left.\left.\left.\left(81\left(4\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\;U\right)+24\,k^2\left(7\sqrt{g\,H^5\left(3+H^2\,k^2\right)}+2\sqrt{3}\;H^2\,U\right)+\right.\right.\right.\\
&\qquad\qquad\left.\left.\left.k^4\left(24\sqrt{g\,H^9\left(3+H^2\,k^2\right)}+7\sqrt{3}\;H^4\,U\right)\right)\right)dt\right)\Big/\left(384\left(g\,H\left(3+H^2\,k^2\right)^{5/2}\right)\right)-\\
&\left(i\,k^6\left(3\,k^2\left(96\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+380\sqrt{3}\;g^2\,H^4\,U+224\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2+\right.\right.\right.\\
&\qquad 51\sqrt{3}\;g\,H^3\,U^3+6\sqrt{3}\;H^2\,U^5\Big)+k^4\left(16\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}+168\sqrt{3}\;g^2\,H^6\,U+\right.\\
&\qquad 3\sqrt{3}\;H^4\,U^5+8\,g\,H^5\,U^2\left(10\sqrt{g\,H\left(3+H^2\,k^2\right)}+3\sqrt{3}\;U\right)\Big)+9\left(96\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}+\\
&\qquad\left.\left.\left.224\sqrt{3}\;g^2\,H^2\,U+3\sqrt{3}\;U^5+g\,H\,U^2\left(160\sqrt{g\,H\left(3+H^2\,k^2\right)}+27\sqrt{3}\;U\right)\right)\right)dt^2\right)\Big/\\
&\left(384\,g\,H\left(3+H^2\,k^2\right)^{5/2}\right)+\frac{1}{384\,g\,H\left(3+H^2\,k^2\right)^{7/2}}k^7\left(\sqrt{3}\;\sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\\
&\left(3\,k^2\left(184\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+608\sqrt{3}\;g^2\,H^4\,U+334\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2+72\sqrt{3}\;g\,H^3\,U^3-\right.\right.\\
&\qquad 3\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^4+6\sqrt{3}\;H^2\,U^5\Big)+k^4\left(48\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}+\right.\\
&\qquad 272\sqrt{3}\;g^2\,H^6\,U+3\sqrt{3}\;H^4\,U^5+2\,g\,H^5\,U^2\left(56\sqrt{g\,H\left(3+H^2\,k^2\right)}+17\sqrt{3}\;U\right)\Big)+\\
&\qquad 9\left(160\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}+352\sqrt{3}\;g^2\,H^2\,U-3\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^4+\right.\\
&\qquad\left.\left.3\sqrt{3}\;U^5+2\,g\,H\,U^2\left(121\sqrt{g\,H\left(3+H^2\,k^2\right)}+19\sqrt{3}\;U\right)\right)\right)dt^3+\\
&\frac{1}{384\,g\,H\left(3+H^2\,k^2\right)^{9/2}}i\,k^8\left(\sqrt{3}\;\sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)^2\\
&\left(3\,k^2\left(304\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+884\sqrt{3}\;g^2\,H^4\,U+456\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2+95\sqrt{3}\;g\,H^3\,U^3-\right.\right.\\
&\qquad 6\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^4+6\sqrt{3}\;H^2\,U^5\Big)+k^4\left(96\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}+\right.\\
&\qquad 400\sqrt{3}\;g^2\,H^6\,U+3\sqrt{3}\;H^4\,U^5+4\,g\,H^5\,U^2\left(36\sqrt{g\,H\left(3+H^2\,k^2\right)}+11\sqrt{3}\;U\right)\Big)+\\
&\qquad 27\left(80\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}+168\sqrt{3}\;g^2\,H^2\,U-2\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^4+\sqrt{3}\;U^5+\right.\\
&\qquad\left.U\,U^2\left(118\sqrt{g\,H\left(3+H^2\,k^2\right)}+17\sqrt{3}\;U\right)\right)k^4+O[dt]^5\Big)\,dt^3
\end{aligned}
$$

$$g\,H\,U^2\left(112\sqrt{g\,H\left(3+H^2\,k^2\right)}+17\sqrt{3}\;U\right)\Big)\Big)\,dt^3+O[dt]^3\Big)\,dx^3+$$

$$\Big(\Big(k^5\left(16\sqrt{3}\;g^2\,H^2\left(144+48\,H^2\,k^2+5\,H^4\,k^4\right)-75\sqrt{3}\;\left(3+H^2\,k^2\right)^2\,U^4+8\,g\,H\left(3+H^2\,k^2\right)U\right.$$

$$\left.\left(96\sqrt{g\,H\left(3+H^2\,k^2\right)}+k^2\left(32\sqrt{g\,H^5\left(3+H^2\,k^2\right)}+5\sqrt{3}\;H^2\,U\right)\right)\right)\Big)\Big/$$

$$\left(30\,720\,(g\,H)^{3/2}\left(3+H^2\,k^2\right)^{5/2}\right)+\frac{1}{92\,160\,(g\,H)^{3/2}\left(3+H^2\,k^2\right)^{7/2}}$$

$$i\,k^6\Big(9\,k^2\Big(8448\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+16\,160\sqrt{3}\;g^2\,H^4\,U+6144\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2-$$

$$240\sqrt{3}\;g\,H^3\,U^3-675\sqrt{3}\;H^2\,U^5\Big)+k^6\Big(1920\sqrt{g^5\,H^{17}\left(3+H^2\,k^2\right)}+4368\sqrt{3}\;g^2\,H^8\,U+$$

$$2048\,g\,H^7\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^2-225\sqrt{3}\;H^6\,U^5\Big)+27\Big(3968\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}+$$

$$6016\sqrt{3}\;g^2\,H^2\,U-225\sqrt{3}\;U^5+8\,g\,H\,U^2\left(256\sqrt{g\,H\left(3+H^2\,k^2\right)}-15\sqrt{3}\;U\right)\Big)+$$

$$3\,k^4\Big(6720\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}+14\,512\sqrt{3}\;g^2\,H^6\,U-675\sqrt{3}\;H^4\,U^5+$$

$$24\,g\,H^5\,U^2\left(256\sqrt{g\,H\left(3+H^2\,k^2\right)}-5\sqrt{3}\;U\right)\Big)\Big)\,dt-$$

$$\frac{1}{92\,160\left((g\,H)^{3/2}\left(3+H^2\,k^2\right)^{7/2}\right)}\Big(k^7\Big(48\sqrt{3}\;g^3\,H^3\left(6192+5004\,H^2\,k^2+1425\,H^4\,k^4+140\,H^6\,k^6\right)+$$

$$8\sqrt{3}\;g^2\,H^2\left(60\,426+55\,557\,H^2\,k^2+17\,121\,H^4\,k^4+1772\,H^6\,k^6\right)U^2+$$

$$g\,H\,U^3\Big(89\,856\sqrt{g\,H\left(3+H^2\,k^2\right)}-5265\sqrt{3}\;U-4590\sqrt{3}\;H^2\,k^2\,U+$$

$$9\,k^4\Big(3328\sqrt{g\,H^9\left(3+H^2\,k^2\right)}-145\sqrt{3}\;H^4\,U\Big)+8\,k^6\Big(416\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}-$$

$$15\sqrt{3}\;H^6\,U\Big)\Big)+3\,U\Big(81\Big(2816\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}-25\sqrt{3}\;U^5\Big)+$$

$$3\,k^2\Big(52\,352\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+9984\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2-675\sqrt{3}\;H^2\,U^5\Big)+$$

$$3\,k^4\Big(11\,776\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}-225\sqrt{3}\;H^4\,U^5\Big)+$$

$$5\,k^6\Big(512\sqrt{g^5\,H^{17}\left(3+H^2\,k^2\right)}-15\sqrt{3}\;H^6\,U^5\Big)\Big)\Big)\Big)\,dt^2-\frac{1}{30\,720\,(g\,H)^{3/2}\left(3+H^2\,k^2\right)^{9/2}}$$

$$i\,k^8\Big(27\,k^2\Big(20\,416\sqrt{g^7\,H^{11}\left(3+H^2\,k^2\right)}+80\,544\sqrt{3}\;g^3\,H^5\,U+82\,240\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}\;U^2+$$

$$46\,960\sqrt{3}\;g^2\,H^4\,U^3+6144\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^4-305\sqrt{3}\;g\,H^3\,U^5-300\sqrt{3}\;H^2\,U^7\Big)+$$

$$9\,k^4\Big(19\,040\sqrt{g^7\,H^{15}\left(3+H^2\,k^2\right)}+99\,856\sqrt{3}\;g^3\,H^7\,U+88\,512\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}\;U^2+$$

$$66\,296\sqrt{3}\;g^2\,H^6\,U^3-450\sqrt{3}\;H^4\,U^7+3\,g\,H^5\,U^4\left(3072\sqrt{g\,H\left(3+H^2\,k^2\right)}-155\sqrt{3}\;U\right)\Big)+$$

$$3\,k^6\Big(6720\sqrt{g^7\,H^{19}\left(3+H^2\,k^2\right)}+55\,216\sqrt{3}\;g^3\,H^9\,U+39\,488\sqrt{g^5\,H^{17}\left(3+H^2\,k^2\right)}\;U^2+$$

$$41\,728\sqrt{3}\;g^2\,H^8\,U^3-300\sqrt{3}\;H^6\,U^7+3\,g\,H^7\,U^4\left(2048\sqrt{g\,H\left(3+H^2\,k^2\right)}-105\sqrt{3}\;U\right)\Big)+$$

$$243\Big(2592\sqrt{g^7\,H^7\left(3+H^2\,k^2\right)}+8128\sqrt{3}\;g^3\,H^3\,U+9152\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}\;U^2+$$

$$4168\sqrt{3}\;g^2\,H^2\,U^3-25\sqrt{3}\;U^7+g\,H\,U^4\left(512\sqrt{g\,H\left(3+H^2\,k^2\right)}-25\sqrt{3}\;U\right)\Big)+$$

$$k^8\Big(480\sqrt{g^7\,H^{23}\left(3+H^2\,k^2\right)}+11\,520\sqrt{3}\;g^3\,H^{11}\,U+5760\sqrt{g^5\,H^{21}\left(3+H^2\,k^2\right)}\;U^2+$$

$$9888\sqrt{3}\ g^2 H^{10} U^3 - 75\sqrt{3}\ H^8 U^7 + 16\, g H^9 U^4 \left(96\sqrt{g H \left(3 + H^2 k^2\right)} - 5\sqrt{3}\ U\right)\Big)\Big) dt^3 +$$

$$\frac{1}{92160\,(g H)^{3/2}\left(3+H^2 k^2\right)^{9/2}} k^9 \Big(144\sqrt{3}\ g^4 H^4 \left(23832 + 22104 H^2 k^2 + 7395 H^4 k^4 + 1000 H^6 k^6 + 40 H^8 k^8\right) +$$

$$24\sqrt{3}\ g^3 H^3 \left(893700 + 953451 H^2 k^2 + 376029 H^4 k^4 + 64744 H^6 k^6 + 4080 H^8 k^8\right) U^2 +$$

$$3\sqrt{3}\ g^2 H^2 \left(3 + H^2 k^2\right)^2 \left(197625 + 114352 H^2 k^2 + 16944 H^4 k^4\right) U^4 +$$

$$2\, g H U^5 \Big(238464\sqrt{g H \left(3 + H^2 k^2\right)} - 8505\sqrt{3}\ U - 13365\sqrt{3}\ H^2 k^2 U +$$

$$27 k^4 \Big(5888\sqrt{g H^9 \left(3 + H^2 k^2\right)} - 285\sqrt{3}\ H^4 U\Big) + 3 k^6 \Big(11776\sqrt{g H^{13}\left(3 + H^2 k^2\right)} - 645$$

$$\sqrt{3}\ H^6 U\Big) + 4 k^8 \Big(736\sqrt{g H^{17}\left(3 + H^2 k^2\right)} - 45\sqrt{3}\ H^8 U\Big)\Big) +$$

$$3 U \Big(135\Big(33920\sqrt{g^7 H^7 \left(3 + H^2 k^2\right)} + 39424\sqrt{g^5 H^5 \left(3 + H^2 k^2\right)}\ U^2 - 45\sqrt{3}\ U^7\Big) +$$

$$36 k^2 \Big(105472\sqrt{g^7 H^{11}\left(3 + H^2 k^2\right)} + 144512\sqrt{g^5 H^9 \left(3 + H^2 k^2\right)}$$

$$U^2 + 5888\sqrt{g^3 H^7 \left(3 + H^2 k^2\right)}\ U^4 - 225\sqrt{3}\ H^2 U^7\Big) +$$

$$18 k^4 \Big(60608\sqrt{g^7 H^{15}\left(3 + H^2 k^2\right)} + 100096\sqrt{g^5 H^{13}\left(3 + H^2 k^2\right)}\ U^2 - 225\sqrt{3}\ H^4 U^7\Big) +$$

$$12 k^6 \Big(9600\sqrt{g^7 H^{19}\left(3 + H^2 k^2\right)} + 20864\sqrt{g^5 H^{17}\left(3 + H^2 k^2\right)}\ U^2 - 75\sqrt{3}\ H^6 U^7\Big) +$$

$$5 k^8 \Big(384\sqrt{g^7 H^{23}\left(3 + H^2 k^2\right)} + 2048\sqrt{g^5 H^{21}\left(3 + H^2 k^2\right)}\ U^2 - 15\sqrt{3}\ H^8 U^7\Big)\Big)\Big) dt^4 +$$

$$O[dt]^5\Big) dx^4 + O[dx]^5, \left\{\frac{i\left(-\sqrt{3}\ k\sqrt{g H\left(3+H^2 k^2\right)} + 3 k U + H^2 k^3 U\right)^2 dt}{2\left(3+H^2 k^2\right)^2} - \frac{1}{3\left(3+H^2 k^2\right)^2}\right.$$

$$\Big(k^3\Big(-\sqrt{3}\ \sqrt{g H\left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)$$

$$\Big(3 g H + U\Big(-2\sqrt{3}\ \sqrt{g H\left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)\Big)\Big) dt^2 -$$

$$\frac{1}{4\left(3+H^2 k^2\right)^3} i k^4 \Big(-\sqrt{3}\ \sqrt{g H\left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)$$

$$\Big(3 g H\Big(-\sqrt{3}\ \sqrt{g H\left(3 + H^2 k^2\right)} + 3\left(3 + H^2 k^2\right) U\Big) +$$

$$U^2\Big(-9\sqrt{3}\ \sqrt{g H\left(3 + H^2 k^2\right)} + 9 U + H^4 k^4 U - 3 k^2\Big(\sqrt{3}\ \sqrt{g H^5\left(3 + H^2 k^2\right)} - 2 H^2 U\Big)\Big)\Big) dt^3 +$$

$$\frac{1}{5\left(3+H^2 k^2\right)^3} k^5 \Big(-\sqrt{3}\ \sqrt{g H\left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)$$

$$\Big(9 g^2 H^2 + 6 g H U\Big(-2\sqrt{3}\ \sqrt{g H\left(3 + H^2 k^2\right)} + 3\left(3 + H^2 k^2\right) U\Big) +$$

$$U^3\Big(-12\sqrt{3}\ \sqrt{g H\left(3 + H^2 k^2\right)} + 9 U + H^4 k^4 U + k^2\Big(-4\sqrt{3}\ \sqrt{g H^5\left(3 + H^2 k^2\right)} + 6 H^2 U\Big)\Big)\Big) dt^4 + O[$$

$$dt]^5\Big) +$$

$$\Big(\qquad\qquad k^3\Big(2\sqrt{g H\left(3+H^2 k^2\right)} - \sqrt{3}\ U\Big)\Big(-\sqrt{3}\ \sqrt{g H\left(3+H^2 k^2\right)} + \left(3+H^2 k^2\right) U\Big) dt$$

$$\left(-\frac{1}{4} i k^2 \left(2 \sqrt{g H} - \frac{\sqrt{3}\ U}{\sqrt{3+H^2 k^2}}\right) + \frac{\left(\text{[illegible]}\right)\left(\text{[illegible]}\right)}{4\left(3+H^2 k^2\right)^{3/2}} + \right.$$

$$\frac{1}{4\left(3+H^2 k^2\right)^{3/2}}$$

$$i k^4 \left(2 \sqrt{g H \left(3 + H^2 k^2\right)} - \sqrt{3}\ U\right)$$

$$\left(3 g H + U\left(-2 \sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\right)\right)$$

$$dt^2 - \frac{1}{4\left(3+H^2 k^2\right)^{5/2}}$$

$$\left(k^5 \left(2 \sqrt{g H \left(3 + H^2 k^2\right)} - \sqrt{3}\ U\right)\left(3 g H \left(-\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 3\left(3 + H^2 k^2\right) U\right) + \right.$$

$$\left. U^2 \left(-9 \sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 9 U + H^4 k^4 U - 3 k^2 \left(\sqrt{3}\ \sqrt{g H^5 \left(3 + H^2 k^2\right)} - 2 H^2 U\right)\right)\right)\right)$$

$$dt^3 - \frac{1}{4\left(3+H^2 k^2\right)^{5/2}} i k^6 \left(2 \sqrt{g H \left(3 + H^2 k^2\right)} - \sqrt{3}\ U\right)$$

$$\left(9 g^2 H^2 + 6 g H U \left(-2 \sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 3\left(3 + H^2 k^2\right) U\right) + \right.$$

$$\left. U^3 \left(-12 \sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 9 U + H^4 k^4 U + k^2 \left(-4 \sqrt{3}\ \sqrt{g H^5 \left(3 + H^2 k^2\right)} + 6 H^2 U\right)\right)\right) dt^4 +$$

$$\left. O[dt]^5 \right) dx + \left(\left(k^3 \left(12 \sqrt{3}\ g H \left(4 + H^2 k^2\right) - U \left(48 \sqrt{g H \left(3 + H^2 k^2\right)} + 9 \sqrt{3}\ U + \right.\right.\right.\right.$$

$$\left.\left.\left.\left. k^2 \left(16 \sqrt{g H^5 \left(3 + H^2 k^2\right)} + 3 \sqrt{3}\ H^2 U\right)\right)\right)\right) \Big/ \left(96 \sqrt{g H}\ \left(3 + H^2 k^2\right)^{3/2}\right) -$$

$$\left(i k^4 \left(9 U^2 \left(16 \sqrt{g H \left(3 + H^2 k^2\right)} + 3 \sqrt{3}\ U\right) + k^4 U^2 \left(16 \sqrt{g H^9 \left(3 + H^2 k^2\right)} + 3 \sqrt{3}\ H^4 U\right) + \right.\right.$$

$$6 k^2 \left(18 \sqrt{g^3 H^7 \left(3 + H^2 k^2\right)} + 16 \sqrt{g H^5 \left(3 + H^2 k^2\right)}\ U^2 + 3 \sqrt{3}\ H^2 U^3\right) +$$

$$4 g H \left(63 \sqrt{g H \left(3 + H^2 k^2\right)} - 99 \sqrt{3}\ U - 63 \sqrt{3}\ H^2 k^2 U + \right.$$

$$\left.\left. k^4 \left(3 \sqrt{g H^9 \left(3 + H^2 k^2\right)} - 10 \sqrt{3}\ H^4 U\right)\right)\right) dt\Big) \Big/ \left(96 \sqrt{g H}\ \left(3 + H^2 k^2\right)^{5/2}\right) +$$

$$\left(k^5 \left(-12 \sqrt{3}\ g^2 H^2 \left(30 + 15 H^2 k^2 + 2 H^4 k^4\right) + 9 U^3 \left(16 \sqrt{g H \left(3 + H^2 k^2\right)} + 3 \sqrt{3}\ U\right) + \right.\right.$$

$$k^4 U^3 \left(16 \sqrt{g H^9 \left(3 + H^2 k^2\right)} + 3 \sqrt{3}\ H^4 U\right) +$$

$$6 k^2 \left(56 \sqrt{g^3 H^7 \left(3 + H^2 k^2\right)}\ U + 16 \sqrt{g H^5 \left(3 + H^2 k^2\right)}\ U^3 + 3 \sqrt{3}\ H^2 U^4\right) +$$

$$g H U \left(864 \sqrt{g H \left(3 + H^2 k^2\right)} - 675 \sqrt{3}\ U - 429 \sqrt{3}\ H^2 k^2 U + \right.$$

$$\left.\left. 4 k^4 \left(6 \sqrt{g H^9 \left(3 + H^2 k^2\right)} - 17 \sqrt{3}\ H^4 U\right)\right)\right) dt^2\Big) \Big/ \left(96 \sqrt{g H}\ \left(3 + H^2 k^2\right)^{5/2}\right) +$$

$$\frac{1}{96 \sqrt{g H}\ \left(3+H^2 k^2\right)^{7/2}} i k^6 \left(9 k^2 \left(84 \sqrt{g^5 H^9 \left(3 + H^2 k^2\right)} - 404 \sqrt{3}\ g^2 H^4 U + 438 \sqrt{g^3 H^7 \left(3 + H^2 k^2\right)}\ U^2 - \right.\right.$$

$$314 \sqrt{3}\ g H^3 U^3 + 48 \sqrt{g H^5 \left(3 + H^2 k^2\right)}\ U^4 + 9 \sqrt{3}\ H^2 U^5\Big) +$$

$$3 k^4 \left(36 \sqrt{g^5 H^{13} \left(3 + H^2 k^2\right)} - 304 \sqrt{3}\ g^2 H^6 U + 48 \sqrt{g H^9 \left(3 + H^2 k^2\right)}\ U^4 + \right.$$

$$9 \sqrt{3}\ H^4 U^5 + g H^5 U^2 \left(264 \sqrt{g H \left(3 + H^2 k^2\right)} - 301 \sqrt{3}\ U\right)\Big) +$$

$$27\left(52\sqrt{g^5 H^5 (3+H^2 k^2)} - 172\sqrt{3}\, g^2 H^2 U + 16\sqrt{g H (3+H^2 k^2)}\, U^4 +\right.$$

$$\left.\left. 3\sqrt{3}\, U^5 + g H U^2 \left(210\sqrt{g H (3+H^2 k^2)} - 109\sqrt{3}\, U\right)\right)\right) -$$

$$k^6 U \left(72\sqrt{3}\, g^2 H^8 + 12 g H^7 U \left(-3\sqrt{g H (3+H^2 k^2)} + 8\sqrt{3}\, U\right) -\right.$$

$$\left.\left.\left. U^3 \left(16\sqrt{g H^{13} (3+H^2 k^2)} + 3\sqrt{3}\, H^6 U\right)\right)\right)\right) dt^3 + \frac{1}{96\sqrt{g H}\,(3+H^2 k^2)^{7/2}}$$

$$k^7 \left(36\sqrt{3}\, g^3 H^3 (48 + 27 H^2 k^2 + 4 H^4 k^4) + 3\sqrt{3}\, g^2 H^2 (4113 + 3075 H^2 k^2 + 712 H^4 k^4 + 48 H^6 k^6) U^2 +\right.$$

$$2 g H U^3 \left(-5076\sqrt{g H (3+H^2 k^2)} + 1971\sqrt{3}\, U + 1872\sqrt{3}\, H^2 k^2 U +\right.$$

$$3 k^4 \left(-216\sqrt{g H^9 (3+H^2 k^2)} + 197\sqrt{3}\, H^4 U\right) +$$

$$\left.\left. 2 k^6 \left(-12\sqrt{g H^{13} (3+H^2 k^2)} + 31\sqrt{3}\, H^6 U\right)\right)\right) -$$

$$U \left(7344\sqrt{g^5 H^5 (3+H^2 k^2)} + 432\sqrt{g H (3+H^2 k^2)}\, U^4 + 81\sqrt{3}\, U^5 +\right.$$

$$k^6 U^4 \left(16\sqrt{g H^{13} (3+H^2 k^2)} + 3\sqrt{3}\, H^6 U\right) + 9 k^2 \left(400\sqrt{g^5 H^9 (3+H^2 k^2)} + 760\right.$$

$$\left.\sqrt{g^3 H^7 (3+H^2 k^2)}\, U^2 + 48\sqrt{g H^5 (3+H^2 k^2)}\, U^4 + 9\sqrt{3}\, H^2 U^5\right) +$$

$$\left.\left.\left. 9 k^4 \left(48\sqrt{g^5 H^{13} (3+H^2 k^2)} + 16\sqrt{g H^9 (3+H^2 k^2)}\, U^4 + 3\sqrt{3}\, H^4 U^5\right)\right)\right) dt^4 + O[dt]^5\right) dx^2 +$$

$$\left(-\left(\left(i\, k^4 \left(3\sqrt{3}\, (3+H^2 k^2) U^3 + 4 g H \left(-12\sqrt{g H (3+H^2 k^2)} + 6\sqrt{3}\, U +\right.\right.\right.\right.\right.$$

$$\left.\left.\left.\left.\left. k^2 \left(-4\sqrt{g H^5 (3+H^2 k^2)} + \sqrt{3}\, H^2 U\right)\right)\right)\right) \Big/ \left(384 g H (3+H^2 k^2)^{3/2}\right)\right) +$$

$$\left(k^5 \left(8\sqrt{3}\, g^2 H^2 (54 + 33 H^2 k^2 + 5 H^4 k^4) + 3\sqrt{3}\, (3+H^2 k^2)^2 U^4 - 2 g H U\right.\right.$$

$$\left(324\sqrt{g H (3+H^2 k^2)} - 81\sqrt{3}\, U + 24 k^2 \left(7\sqrt{g H^5 (3+H^2 k^2)} - 2\sqrt{3}\, H^2 U\right) +\right.$$

$$\left.\left.\left. k^4 \left(24\sqrt{g H^9 (3+H^2 k^2)} - 7\sqrt{3}\, H^4 U\right)\right)\right) dt\right) \Big/ \left(384 g H (3+H^2 k^2)^{5/2}\right) -$$

$$\left(i\, k^6 \left(3 k^2 \left(96\sqrt{g^5 H^9 (3+H^2 k^2)} - 380\sqrt{3}\, g^2 H^4 U + 224\sqrt{g^3 H^7 (3+H^2 k^2)}\, U^2 -\right.\right.\right.$$

$$\left. 51\sqrt{3}\, g H^3 U^3 - 6\sqrt{3}\, H^2 U^5\right) + 9 \left(96\sqrt{g^5 H^5 (3+H^2 k^2)} - 224\sqrt{3}\, g^2 H^2 U -\right.$$

$$\left. 3\sqrt{3}\, U^5 + g H U^2 \left(160\sqrt{g H (3+H^2 k^2)} - 27\sqrt{3}\, U\right)\right) + k^4 \left(16\sqrt{g^5 H^{13} (3+H^2 k^2)} -\right.$$

$$\left.\left.\left. 168\sqrt{3}\, g^2 H^6 U - 3\sqrt{3}\, H^4 U^5 + 8 g H^5 U^2 \left(10\sqrt{g H (3+H^2 k^2)} - 3\sqrt{3}\, U\right)\right)\right) dt^2\right) \Big/$$

$$\left(384 g H (3+H^2 k^2)^{5/2}\right) - \frac{1}{384 \left(g H (3+H^2 k^2)^{7/2}\right)} \left(k^7 \left(-\sqrt{3}\, \sqrt{g H (3+H^2 k^2)} + (3+H^2 k^2) U\right)\right.$$

$$\left(-3 k^2 \left(184\sqrt{g^5 H^9 (3+H^2 k^2)} - 608\sqrt{3}\, g^2 H^4 U + 334\sqrt{g^3 H^7 (3+H^2 k^2)}\, U^2 -\right.\right.$$

$$\left. 72\sqrt{3}\, g H^3 U^3 - 3\sqrt{g H^5 (3+H^2 k^2)}\, U^4 - 6\sqrt{3}\, H^2 U^5\right) -$$

$$9 \left(160\sqrt{g^5 H^5 (3+H^2 k^2)} - 352\sqrt{3}\, g^2 H^2 U - 3\sqrt{g H (3+H^2 k^2)}\, U^4 - 3\sqrt{3}\, U^5 +\right.$$

$$\left. 2 g H U^2 \left(121\sqrt{g H (3+H^2 k^2)} - 19\sqrt{3}\, U\right)\right) - k^4 \left(48\sqrt{g^5 H^{13} (3+H^2 k^2)} -\right.$$

$$272\sqrt{3}\ g^2 H^6 U - 3\sqrt{3}\ H^4 U^5 + 2 g H^5 U^2\left(56\sqrt{g H\left(3+H^2 k^2\right)} - 17\sqrt{3}\ U\right)\Big)\Big)\Big)$$

$$dt^3 - \frac{1}{384\, g H\left(3+H^2 k^2\right)^{9/2}} i k^8\left(\sqrt{3}\ \sqrt{g H\left(3+H^2 k^2\right)} - \left(3+H^2 k^2\right) U\right)^2$$

$$\Big(-3 k^2\Big(304\sqrt{g^5 H^9\left(3+H^2 k^2\right)} - 884\sqrt{3}\ g^2 H^4 U + 456\sqrt{g^3 H^7\left(3+H^2 k^2\right)}\ U^2 -$$

$$95\sqrt{3}\ g H^3 U^3 - 6\sqrt{g H^5\left(3+H^2 k^2\right)}\ U^4 - 6\sqrt{3}\ H^2 U^5\Big) -$$

$$27\Big(80\sqrt{g^5 H^5\left(3+H^2 k^2\right)} - 168\sqrt{3}\ g^2 H^2 U - 2\sqrt{g H\left(3+H^2 k^2\right)}\ U^4 -$$

$$\sqrt{3}\ U^5 + g H U^2\left(112\sqrt{g H\left(3+H^2 k^2\right)} - 17\sqrt{3}\ U\right)\Big) -$$

$$k^4\Big(96\sqrt{g^5 H^{13}\left(3+H^2 k^2\right)} - 400\sqrt{3}\ g^2 H^6 U - 3\sqrt{3}\ H^4 U^5 +$$

$$4 g H^5 U^2\left(36\sqrt{g H\left(3+H^2 k^2\right)} - 11\sqrt{3}\ U\right)\Big)\Big) dt^4 + O[dt]^5\Big) dx^3 +$$

$$\Big(\Big(k^5\Big(-16\sqrt{3}\ g^2 H^2\left(144+48 H^2 k^2+5 H^4 k^4\right) + 75\sqrt{3}\ \left(3+H^2 k^2\right)^2 U^4 + 8 g H\left(3+H^2 k^2\right) U$$

$$\left(96\sqrt{g H\left(3+H^2 k^2\right)} + k^2\left(32\sqrt{g H^5\left(3+H^2 k^2\right)} - 5\sqrt{3}\ H^2 U\right)\right)\Big)\Big)\Big/$$

$$\left(30\,720\,(g H)^{3/2}\left(3+H^2 k^2\right)^{5/2}\right) + \frac{1}{92\,160\,(g H)^{3/2}\left(3+H^2 k^2\right)^{7/2}}$$

$$i k^6\Big(9 k^2\Big(8448\sqrt{g^5 H^9\left(3+H^2 k^2\right)} - 16\,160\sqrt{3}\ g^2 H^4 U + 6144\sqrt{g^3 H^7\left(3+H^2 k^2\right)}\ U^2 +$$

$$240\sqrt{3}\ g H^3 U^3 + 675\sqrt{3}\ H^2 U^5\Big) + k^6\Big(1920\sqrt{g^5 H^{17}\left(3+H^2 k^2\right)} -$$

$$4368\sqrt{3}\ g^2 H^8 U + 2048 g H^7\sqrt{g H\left(3+H^2 k^2\right)}\ U^2 + 225\sqrt{3}\ H^6 U^5\Big) +$$

$$3 k^4\Big(6720\sqrt{g^5 H^{13}\left(3+H^2 k^2\right)} - 14\,512\sqrt{3}\ g^2 H^6 U + 675\sqrt{3}\ H^4 U^5 +$$

$$24 g H^5 U^2\left(256\sqrt{g H\left(3+H^2 k^2\right)} + 5\sqrt{3}\ U\right)\Big) + 27\Big(3968\sqrt{g^5 H^5\left(3+H^2 k^2\right)} -$$

$$6016\sqrt{3}\ g^2 H^2 U + 225\sqrt{3}\ U^5 + 8 g H U^2\left(256\sqrt{g H\left(3+H^2 k^2\right)} + 15\sqrt{3}\ U\right)\Big)\Big) dt -$$

$$\frac{1}{92\,160\left((g H)^{3/2}\left(3+H^2 k^2\right)^{7/2}\right)}\Big(k^7\Big(-48\sqrt{3}\ g^3 H^3\left(6192+5004 H^2 k^2+1425 H^4 k^4+140 H^6 k^6\right) -$$

$$8\sqrt{3}\ g^2 H^2\left(60\,426+55\,557 H^2 k^2+17\,121 H^4 k^4+1772 H^6 k^6\right) U^2 +$$

$$g H U^3\Big(89\,856\sqrt{g H\left(3+H^2 k^2\right)} + 5265\sqrt{3}\ U + 4590\sqrt{3}\ H^2 k^2 U +$$

$$9 k^4\left(3328\sqrt{g H^9\left(3+H^2 k^2\right)} + 145\sqrt{3}\ H^4 U\right) + 8 k^6\Big(416\sqrt{g H^{13}\left(3+H^2 k^2\right)} +$$

$$15\sqrt{3}\ H^6 U\Big)\Big) + 3 U\Big(81\Big(2816\sqrt{g^5 H^5\left(3+H^2 k^2\right)} + 25\sqrt{3}\ U^5\Big) +$$

$$3 k^2\Big(52\,352\sqrt{g^5 H^9\left(3+H^2 k^2\right)} + 9984\sqrt{g^3 H^7\left(3+H^2 k^2\right)}\ U^2 + 675\sqrt{3}\ H^2 U^5\Big) +$$

$$3 k^4\left(11\,776\sqrt{g^5 H^{13}\left(3+H^2 k^2\right)} + 225\sqrt{3}\ H^4 U^5\right) +$$

$$5 k^6\left(512\sqrt{g^5 H^{17}\left(3+H^2 k^2\right)} + 15\sqrt{3}\ H^6 U^5\right)\Big)\Big) dt^2 - \frac{1}{30\,720\,(g H)^{3/2}\left(3+H^2 k^2\right)^{9/2}}$$

$$i k^8\Big(27 k^2\Big(20\,416\sqrt{g^7 H^{11}\left(3+H^2 k^2\right)} - 80\,544\sqrt{3}\ g^3 H^5 U + 82\,240\sqrt{g^5 H^9\left(3+H^2 k^2\right)}\ U^2 -$$

$$46\,960\sqrt{3}\ g^2 H^4 U^3 + 6144\sqrt{g^3 H^7 \left(3+H^2 k^2\right)}\ U^4 + 305\sqrt{3}\ g H^3 U^5 + 300\sqrt{3}\ H^2 U^7\Big) +$$
$$k^8\Big(480\sqrt{g^7 H^{23}\left(3+H^2 k^2\right)} - 11\,520\sqrt{3}\ g^3 H^{11} U + 5760\sqrt{g^5 H^{21}\left(3+H^2 k^2\right)}\ U^2 -$$
$$9888\sqrt{3}\ g^2 H^{10} U^3 + 75\sqrt{3}\ H^8 U^7 + 16 g H^9 U^4\Big(96\sqrt{g H\left(3+H^2 k^2\right)} + 5\sqrt{3}\ U\Big)\Big) +$$
$$243\Big(2592\sqrt{g^7 H^7\left(3+H^2 k^2\right)} - 8128\sqrt{3}\ g^3 H^3 U + 9152\sqrt{g^5 H^5\left(3+H^2 k^2\right)}\ U^2 -$$
$$4168\sqrt{3}\ g^2 H^2 U^3 + 25\sqrt{3}\ U^7 + g H U^4\Big(512\sqrt{g H\left(3+H^2 k^2\right)} + 25\sqrt{3}\ U\Big)\Big) +$$
$$3 k^6\Big(6720\sqrt{g^7 H^{19}\left(3+H^2 k^2\right)} - 55\,216\sqrt{3}\ g^3 H^9 U + 39\,488\sqrt{g^5 H^{17}\left(3+H^2 k^2\right)}\ U^2 -$$
$$41\,728\sqrt{3}\ g^2 H^8 U^3 + 300\sqrt{3}\ H^6 U^7 + 3 g H^7 U^4\Big(2048\sqrt{g H\left(3+H^2 k^2\right)} + 105\sqrt{3}\ U\Big)\Big) +$$
$$9 k^4\Big(19\,040\sqrt{g^7 H^{15}\left(3+H^2 k^2\right)} - 99\,856\sqrt{3}\ g^3 H^7 U + 88\,512\sqrt{g^5 H^{13}\left(3+H^2 k^2\right)}\ U^2 - 66\,296$$
$$\sqrt{3}\ g^2 H^6 U^3 + 450\sqrt{3}\ H^4 U^7 + 3 g H^5 U^4\Big(3072\sqrt{g H\left(3+H^2 k^2\right)} + 155\sqrt{3}\ U\Big)\Big)\Big)\,dt^3 +$$
$$\frac{1}{92\,160\,(g H)^{3/2}\left(3+H^2 k^2\right)^{9/2}} k^9\Big(-144\sqrt{3}\ g^4 H^4\left(23\,832 + 22\,104 H^2 k^2 + 7395 H^4 k^4 + 1000 H^6 k^6 + 40 H^8 k^8\right) -$$
$$24\sqrt{3}\ g^3 H^3\left(893\,700 + 953\,451 H^2 k^2 + 376\,029 H^4 k^4 + 64\,744 H^6 k^6 + 4080 H^8 k^8\right) U^2 -$$
$$3\sqrt{3}\ g^2 H^2\left(3+H^2 k^2\right)^2\left(197\,625 + 114\,352 H^2 k^2 + 16\,944 H^4 k^4\right) U^4 +$$
$$2 g H U^5\Big(238\,464\sqrt{g H\left(3+H^2 k^2\right)} + 8505\sqrt{3}\ U + 13\,365\sqrt{3}\ H^2 k^2 U +$$
$$27 k^4\Big(5888\sqrt{g H^9\left(3+H^2 k^2\right)} + 285\sqrt{3}\ H^4 U\Big) + 3 k^6\Big(11\,776\sqrt{g H^{13}\left(3+H^2 k^2\right)} + 645$$
$$\sqrt{3}\ H^6 U\Big) + 4 k^8\Big(736\sqrt{g H^{17}\left(3+H^2 k^2\right)} + 45\sqrt{3}\ H^8 U\Big)\Big) +$$
$$3 U\Big(135\Big(33\,920\sqrt{g^7 H^7\left(3+H^2 k^2\right)} + 39\,424\sqrt{g^5 H^5\left(3+H^2 k^2\right)}\ U^2 + 45\sqrt{3}\ U^7\Big) +$$
$$36 k^2\Big(105\,472\sqrt{g^7 H^{11}\left(3+H^2 k^2\right)} + 144\,512\sqrt{g^5 H^9\left(3+H^2 k^2\right)}$$
$$U^2 + 5888\sqrt{g^3 H^7\left(3+H^2 k^2\right)}\ U^4 + 225\sqrt{3}\ H^2 U^7\Big) +$$
$$18 k^4\Big(60\,608\sqrt{g^7 H^{15}\left(3+H^2 k^2\right)} + 100\,096\sqrt{g^5 H^{13}\left(3+H^2 k^2\right)}\ U^2 + 225\sqrt{3}\ H^4 U^7\Big) +$$
$$12 k^6\Big(9600\sqrt{g^7 H^{19}\left(3+H^2 k^2\right)} + 20\,864\sqrt{g^5 H^{17}\left(3+H^2 k^2\right)}\ U^2 + 75\sqrt{3}\ H^6 U^7\Big) +$$
$$5 k^8\Big(384\sqrt{g^7 H^{23}\left(3+H^2 k^2\right)} + 2048\sqrt{g^5 H^{21}\left(3+H^2 k^2\right)}$$
$$U^2 + 15\sqrt{3}\ H^8 U^7\Big)\Big)\Big)\,dt^4 + O[dt]^5\Big)\,dx^4 + O[dx]^5\Big\}$$

Out[132]= Omega error ||

\left\{\left(\frac{i \left(H^2 U k^3+3 U k+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} k\right)^2 \text{dt}}{2 \left(H^2 k^2+3\right)^2}-\frac{\left(k^3 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{3 \left(H^2 k^2+3\right)^2}-\frac{i k^4 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+3 \left(2 U H^2+\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 \left(U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) U^2+3 g \left(3 k^2 U H^3+9 U H+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} H\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^3}+\frac{k^5 \left(\left(H^2

\sqrt{g H \left(H^2 k^2+3\right)} H\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^3}+\frac{k^3 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+2 \left(3 U H^2+2 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U+12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{5 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right)+\left(-\frac{1}{4} i k^2 \left(\frac{\sqrt{3} U}{\sqrt{H^2 k^2+3}}+2 \sqrt{g H}\right)+\frac{k^3 \left(\sqrt{3} U+2 \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \text{dt}}{4 \left(H^2 k^2+3\right)^{3/2}}+\frac{i k^4 \left(\sqrt{3} U+2 \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{4 \left(H^2 k^2+3\right)^{3/2}}-\frac{\left(k^5 \left(\sqrt{3} U+2 \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+3 \left(2 U H^2+\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 \left(U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) U^2+3 g \left(3 k^2 U H^3+9 U H+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} H\right)\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^{5/2}}-\frac{i k^6 \left(\sqrt{3} U+2 \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+2 \left(3 U H^2+2 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U+12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{4 \left(H^2 k^2+3\right)^{5/2}}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(-\frac{k^3 \left(12 \sqrt{3} g H \left(H^2 k^2+4\right)+U \left(\left(16 \sqrt{g H^5 \left(H^2 k^2+3\right)}-3 \sqrt{3} H^2 U\right) k^2-9 \sqrt{3} U+48 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)}{96 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{3/2}\right)}-\frac{i k^4 \left(U^2 \left(16 \sqrt{g H^9 \left(H^2 k^2+3\right)}-3 \sqrt{3} H^4 U\right) k^4+6 \left(-3 \sqrt{3} H^2 U^3+16 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+18 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+9 U^2 \left(16 \sqrt{g H \left(H^2 k^2+3\right)}-3 \sqrt{3} U\right)+4 g H \left(\left(10 \sqrt{3} U H^4+3 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+63 \sqrt{3} H^2 U k^2+99 \sqrt{3} U+63 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{k^5 \left(U^3 \left(16 \sqrt{g H^9 \left(H^2 k^2+3\right)}-3 \sqrt{3} H^4 U\right) k^4+6 \left(-3 \sqrt{3} H^2 U^4+16 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+56 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+12 \sqrt{3} g^2 H^2 \left(2 H^4 k^4+15 H^2 k^2+30\right)+9 U^3 \left(16 \sqrt{g H \left(H^2 k^2+3\right)}-3 \sqrt{3} U\right)+g H U \left(4 \left(17 \sqrt{3} U H^4+6 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+429 \sqrt{3} H^2 U k^2+675 \sqrt{3} U+864 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(U \left(72 \sqrt{3} g^2 H^8+12 g U \left(8 \sqrt{3} U+3 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7+U^3 \left(16 \sqrt{g H^{13} \left(H^2 k^2+3\right)}-3 \sqrt{3} H^6 U\right)\right) k^6+3 \left(304 \sqrt{3} g^2 U H^6+g U^2 \left(301 \sqrt{3} U+264 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5-9 \sqrt{3} U^5 H^4+48 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+36 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+9 \left(-9 \sqrt{3} H^2 U^5+48 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+314 \sqrt{3} g H^3 U^3+438 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+404 \sqrt{3} g^2 H^4 U+84 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+27 \left(-3 \sqrt{3} U^5+16 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(109 \sqrt{3} U+210 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+172 \sqrt{3} g^2 H^2 U+52 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}-\frac{\left(k^7 \left(36 \sqrt{3} g^3 \left(4 H^4 k^4+27 H^2 k^2+48\right) H^3+3 \sqrt{3} g^2 \left(48 H^6 k^6+712 H^4 k^4+3075 H^2 k^2+4113\right) U^2 H^2+2 g U^3 \left(2 \left(31 \sqrt{3} U H^6+12 \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right) k^6+3 \left(197 \sqrt{3} U H^4+216 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+1872 \sqrt{3} H^2 U k^2+1971 \sqrt{3} U+5076 \sqrt{g H \left(H^2 k^2+3\right)}\right) H+U \left(U^4 \left(16 \sqrt{g H^{13} \left(H^2 k^2+3\right)}-3 \sqrt{3} H^6 U\right) k^6+9 \left(-3 \sqrt{3}

$$H^4 U^5+16 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+48 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+9 \left(-9 \sqrt{3} H^2 U^5+48 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+760 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+400 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2-81 \sqrt{3} U^5+432 \sqrt{g H \left(H^2 k^2+3\right)} U^4+7344 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^4}{96 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{7/2}\right)}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{i k^4 \left(3 \sqrt{3} \left(H^2 k^2+3\right) U^3+4 g H \left(\left(\sqrt{3} U H^2+4 \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+6 \sqrt{3} U+12 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)}{384 g H \left(H^2 k^2+3\right)^{3/2}}-\frac{\left(k^5 \left(3 \sqrt{3} \left(H^2 k^2+3\right)^2 U^4+2 g H \left(\left(7 \sqrt{3} U H^4+24 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+24 \left(2 \sqrt{3} U H^2+7 \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+81 \left(\sqrt{3} U+4 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) U+8 \sqrt{3} g^2 H^2 \left(5 H^4 k^4+33 H^2 k^2+54\right)\right)\right) \text{dt}}{384 \left(g H \left(H^2 k^2+3\right)^{5/2}\right)}-\frac{i k^6 \left(\left(168 \sqrt{3} g^2 U H^6+8 g U^2 \left(3 \sqrt{3} U+10 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+3 \sqrt{3} U^5 H^4+16 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+3 \left(6 \sqrt{3} H^2 U^5+51 \sqrt{3} g H^3 U^3+224 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+380 \sqrt{3} g^2 H^4 U+96 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+9 \left(3 \sqrt{3} U^5+g H \left(27 \sqrt{3} U+160 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+224 \sqrt{3} g^2 H^2 U+96 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{384 g H \left(H^2 k^2+3\right)^{5/2}}+\frac{k^7 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(272 \sqrt{3} g^2 U H^6+2 g U^2 \left(17 \sqrt{3} U+56 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+3 \sqrt{3} U^5 H^4+48 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+3 \left(6 \sqrt{3} H^2 U^5-3 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+72 \sqrt{3} g H^3 U^3+334 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+608 \sqrt{3} g^2 H^4 U+184 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+9 \left(3 \sqrt{3} U^5-3 \sqrt{g H \left(H^2 k^2+3\right)} U^4+2 g H \left(19 \sqrt{3} U+121 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+352 \sqrt{3} g^2 H^2 U+160 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{384 g H \left(H^2 k^2+3\right)^{7/2}}+\frac{i k^8 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)^2 \left(\left(400 \sqrt{3} g^2 U H^6+4 g U^2 \left(11 \sqrt{3} U+36 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+3 \sqrt{3} U^5 H^4+96 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+3 \left(6 \sqrt{3} H^2 U^5-6 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+95 \sqrt{3} g H^3 U^3+456 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+884 \sqrt{3} g^2 H^4 U+304 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+27 \left(\sqrt{3} U^5-2 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(17 \sqrt{3} U+112 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+168 \sqrt{3} g^2 H^2 U+80 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^4}{384 g H \left(H^2 k^2+3\right)^{9/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(\frac{k^5 \left(-75 \sqrt{3} \left(H^2 k^2+3\right)^2 U^4+8 g H \left(H^2 k^2+3\right) \left(\left(5 \sqrt{3} U H^2+32 \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+96 \sqrt{g H \left(H^2 k^2+3\right)}\right) U+16 \sqrt{3} g^2 H^2 \left(5 H^4 k^4+48 H^2 k^2+144\right)\right)}{30720 (g H)^{3/2} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(\left(4368 \sqrt{3} g^2 U H^8+2048 g \sqrt{g H \left(H^2 k^2+3\right)} U^2 H^7-225 \sqrt{3} U^5 H^6+1920 \sqrt{g^5 H^{17} \left(H^2 k^2+3\right)}\right) k^6+3 \left(14512 \sqrt{3} g^2 U H^6+24 g U^2 \left(256 \sqrt{g H \left(H^2 k^2+3\right)}-5 \sqrt{3} U\right) H^5-675 \sqrt{3} U^5 H^4+6720 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+9 \left(-675 \sqrt{3} H^2 U^5-240 \sqrt{3} g H^3 U^3+6144 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+16160 \sqrt{3} g^2 H^4 U+8448 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+27 \left(-225 \sqrt{3} U^5+8 g H \left(256 \sqrt{g H \left(H^2 k^2+3\right)}-15 \sqrt{3} U\right) U^2+6016 \sqrt{3} g^2 H^2 U+3968 \sqrt{g^5 H^5 \left(H^2$$

k^2+3\right)}\right)\right) \text{dt}}{92160 (g H)^{3/2} \left(H^2 k^2+3\right)^{7/2}}−\frac{\left(k^7 \left(48 \sqrt{3} g^3 \left(140 H^6 k^6+1425 H^4 k^4+5004 H^2 k^2+6192\right) H^3+8 \sqrt{3} g^2 \left(1772 H^6 k^6+17121 H^4 k^4+55557 H^2 k^2+60426\right) U^2 H^2+g U^3 \left(8 \left(416 \sqrt{g H^{13} \left(H^2 k^2+3\right)}−15 \sqrt{3} H^6 U\right) k^6+9 \left(3328 \sqrt{g H^9 \left(H^2 k^2+3\right)}−145 \sqrt{3} H^4 U\right) k^4−4590 \sqrt{3} H^2 U k^2−5265 \sqrt{3} U+89856 \sqrt{g H \left(H^2 k^2+3\right)}\right) H+3 U \left(5 \left(512 \sqrt{g^5 H^{17} \left(H^2 k^2+3\right)}−15 \sqrt{3} H^6 U^5\right) k^6+3 \left(11776 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}−225 \sqrt{3} H^4 U^5\right) k^4+3 \left(−675 \sqrt{3} H^2 U^5+9984 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+52352 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+81 \left(2816 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}−25 \sqrt{3} U^5\right)\right)\right) \text{dt}^2}{92160 \left((g H)^{3/2} \left(H^2 k^2+3\right)^{7/2}\right)}−\frac{i k^8 \left(\left(11520 \sqrt{3} g^3 U H^{11}+9888 \sqrt{3} g^2 U^3 H^{10}+16 g U^4 \left(96 \sqrt{g H \left(H^2 k^2+3\right)}−5 \sqrt{3} U\right) H^9−75 \sqrt{3} U^7 H^8+5760 \sqrt{g^5 H^{21} \left(H^2 k^2+3\right)} U^2+480 \sqrt{g^7 H^{23} \left(H^2 k^2+3\right)}\right) k^8+3 \left(55216 \sqrt{3} g^3 U H^9+41728 \sqrt{3} g^2 U^3 H^8+3 g U^4 \left(2048 \sqrt{g H \left(H^2 k^2+3\right)}−105 \sqrt{3} U\right) H^7−300 \sqrt{3} U^7 H^6+39488 \sqrt{g^5 H^{17} \left(H^2 k^2+3\right)} U^2+6720 \sqrt{g^7 H^{19} \left(H^2 k^2+3\right)}\right) k^6+9 \left(99856 \sqrt{3} g^3 U H^7+66296 \sqrt{3} g^2 U^3 H^6+3 g U^4 \left(3072 \sqrt{g H \left(H^2 k^2+3\right)}−155 \sqrt{3} U\right) H^5−450 \sqrt{3} U^7 H^4+88512 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)} U^2+19040 \sqrt{g^7 H^{15} \left(H^2 k^2+3\right)}\right) k^4+27 \left(−300 \sqrt{3} H^2 U^7−305 \sqrt{3} g H^3 U^5+6144 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^4+46960 \sqrt{3} g^2 H^4 U^3+82240 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)} U^2+80544 \sqrt{3} g^3 H^5 U+20416 \sqrt{g^7 H^{11} \left(H^2 k^2+3\right)}\right) k^2+243 \left(−25 \sqrt{3} U^7+g H \left(512 \sqrt{g H \left(H^2 k^2+3\right)}−25 \sqrt{3} U\right) U^4+4168 \sqrt{3} g^2 H^2 U^3+9152 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)} U^2+8128 \sqrt{3} g^3 H^3 U+2592 \sqrt{g^7 H^7 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{30720 (g H)^{3/2} \left(H^2 k^2+3\right)^{9/2}}+\frac{k^9 \left(2 g H \left(4 \left(736 \sqrt{g H^{17} \left(H^2 k^2+3\right)}−45 \sqrt{3} H^8 U\right) k^8+3 \left(11776 \sqrt{g H^{13} \left(H^2 k^2+3\right)}−645 \sqrt{3} H^6 U\right) k^6+27 \left(5888 \sqrt{g H^9 \left(H^2 k^2+3\right)}−285 \sqrt{3} H^4 U\right) k^4−13365 \sqrt{3} H^2 U k^2−8505 \sqrt{3} U+238464 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^5+3 \sqrt{3} g^2 H^2 \left(H^2 k^2+3\right)^2 \left(16944 H^4 k^4+114352 H^2 k^2+197625\right) U^4+24 \sqrt{3} g^3 H^3 \left(4080 H^8 k^8+64744 H^6 k^6+376029 H^4 k^4+953451 H^2 k^2+893700\right) U^2+3 \left(5 \left(−15 \sqrt{3} U^7 H^8+2048 \sqrt{g^5 H^{21} \left(H^2 k^2+3\right)} U^2+384 \sqrt{g^7 H^{23} \left(H^2 k^2+3\right)}\right) k^8+12 \left(−75 \sqrt{3} H^6 U^7+20864 \sqrt{g^5 H^{17} \left(H^2 k^2+3\right)} U^2+9600 \sqrt{g^7 H^{19} \left(H^2 k^2+3\right)}\right) k^6+18 \left(−225 \sqrt{3} H^4 U^7+100096 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)} U^2+60608 \sqrt{g^7 H^{15} \left(H^2 k^2+3\right)}\right) k^4+36 \left(−225 \sqrt{3} H^2 U^7+5888 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^4+144512 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)} U^2+105472 \sqrt{g^7 H^{11} \left(H^2 k^2+3\right)}\right) k^2+135 \left(−45 \sqrt{3} U^7+39424 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)} U^2+33920 \sqrt{g^7 H^7 \left(H^2 k^2+3\right)}\right)\right) U+144 \sqrt{3} g^4 H^4 \left(40 H^8 k^8+1000 H^6 k^6+7395 H^4 k^4+22104 H^2 k^2+23832\right)\right) \text{dt}^4}{92160 (g H)^{3/2} \left(H^2 k^2+3\right)^{9/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right),\left(\frac{i \left(H^2 U k^3+3 U k−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} k\right)^2 \text{dt}}{2 \left(H^2 k^2+3\right)^2}−\frac{\left(k^3 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U−2 \sqrt{3}

\sqrt{g H \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^2}{3 \left(H^2 k^2+3\right)^2}−\frac{i k^4 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4−3 \left(\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}−2 H^2 U\right) k^2+9 U−9 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+3 g H \left(3 \left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^3}+\frac{k^5 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+\left(6 H^2 U−4 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U−12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{5 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right)+\left(−\frac{1}{4} i k^2 \left(2 \sqrt{g H}−\frac{\sqrt{3} U}{\sqrt{H^2 k^2+3}}\right)+\frac{k^3 \left(2 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} U\right) \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \text{dt}}{4 \left(H^2 k^2+3\right)^{3/2}}+\frac{i k^4 \left(2 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} U\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{4 \left(H^2 k^2+3\right)^{3/2}}−\frac{\left(k^5 \left(2 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} U\right) \left(\left(H^4 U k^4−3 \left(\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}−2 H^2 U\right) k^2+9 U−9 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+3 g H \left(3 \left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^{5/2}}−\frac{i k^6 \left(2 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} U\right) \left(\left(H^4 U k^4+\left(6 H^2 U−4 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U−12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{4 \left(H^2 k^2+3\right)^{5/2}}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{k^3 \left(12 \sqrt{3} g H \left(H^2 k^2+4\right)−U \left(\left(3 \sqrt{3} U H^2+16 \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 \sqrt{3} U+48 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}−\frac{i k^4 \left(U^2 \left(3 \sqrt{3} U H^4+16 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+6 \left(3 \sqrt{3} H^2 U^3+16 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+18 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+9 U^2 \left(3 \sqrt{3} U+16 \sqrt{g H \left(H^2 k^2+3\right)}\right)+4 g H \left(\left(3 \sqrt{g H^9 \left(H^2 k^2+3\right)}−10 \sqrt{3} H^4 U\right) k^4−63 \sqrt{3} H^2 U k^2−99 \sqrt{3} U+63 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{k^5 \left(U^3 \left(3 \sqrt{3} U H^4+16 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+6 \left(3 \sqrt{3} H^2 U^4+16 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+56 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2−12 \sqrt{3} g^2 H^2 \left(2 H^4 k^4+15 H^2 k^2+30\right)+9 U^3 \left(3 \sqrt{3} U+16 \sqrt{g H \left(H^2 k^2+3\right)}\right)+g H U \left(4 \left(6 \sqrt{g H^9 \left(H^2 k^2+3\right)}−17 \sqrt{3} H^4 U\right) k^4−429 \sqrt{3} H^2 U k^2−675 \sqrt{3} U+864 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(−U \left(72 \sqrt{3} g^2 H^8+12 g U \left(8 \sqrt{3} U−3 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7−U^3 \left(3 \sqrt{3} U H^6+16 \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right)\right) k^6+3 \left(−304 \sqrt{3} g^2 U H^6+g U^2 \left(264 \sqrt{g H \left(H^2 k^2+3\right)}−301 \sqrt{3} U\right) H^5+9 \sqrt{3} U^5 H^4+48 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+36 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+9 \left(9 \sqrt{3} H^2 U^5+48 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4−314 \sqrt{3} g H^3 U^3+438 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2−404 \sqrt{3} g^2 H^4 U+84 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+27 \left(3 \sqrt{3} U^5+16 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(210 \sqrt{g H \left(H^2 k^2+3\right)}−109

$$\sqrt{3} U\right) U^2-172 \sqrt{3} g^2 H^2 U+52 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}+\frac{k^7 \left(36 \sqrt{3} g^3 \left(4 H^4 k^4+27 H^2 k^2+48\right) H^3+3 \sqrt{3} g^2 \left(48 H^6 k^6+712 H^4 k^4+3075 H^2 k^2+4113\right) U^2 H^2+2 g U^3 \left(2 \left(31 \sqrt{3} H^6 U-12 \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right) k^6+3 \left(197 \sqrt{3} H^4 U-216 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+1872 \sqrt{3} H^2 U k^2+1971 \sqrt{3} U-5076 \sqrt{g H \left(H^2 k^2+3\right)}\right) H-U \left(U^4 \left(3 \sqrt{3} U H^6+16 \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right) k^6+9 \left(3 \sqrt{3} H^4 U^5+16 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+48 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+9 \left(9 \sqrt{3} H^2 U^5+48 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+760 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+400 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+81 \sqrt{3} U^5+432 \sqrt{g H \left(H^2 k^2+3\right)} U^4+7344 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^4}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(-\frac{i k^4 \left(3 \sqrt{3} \left(H^2 k^2+3\right) U^3+4 g H \left(\left(\sqrt{3} H^2 U-4 \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+6 \sqrt{3} U-12 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)}{384 g H \left(H^2 k^2+3\right)^{3/2}}+\frac{k^5 \left(3 \sqrt{3} \left(H^2 k^2+3\right)^2 U^4-2 g H \left(\left(24 \sqrt{g H^9 \left(H^2 k^2+3\right)}-7 \sqrt{3} H^4 U\right) k^4+24 \left(7 \sqrt{g H^5 \left(H^2 k^2+3\right)}-2 \sqrt{3} H^2 U\right) k^2-81 \sqrt{3} U+324 \sqrt{g H \left(H^2 k^2+3\right)}\right) U+8 \sqrt{3} g^2 H^2 \left(5 H^4 k^4+33 H^2 k^2+54\right)\right) \text{dt}}{384 g H \left(H^2 k^2+3\right)^{5/2}}-\frac{i k^6 \left(\left(-168 \sqrt{3} g^2 U H^6+8 g U^2 \left(10 \sqrt{g H \left(H^2 k^2+3\right)}-3 \sqrt{3} U\right) H^5-3 \sqrt{3} U^5 H^4+16 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+3 \left(-6 \sqrt{3} H^2 U^5-51 \sqrt{3} g H^3 U^3+224 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2-380 \sqrt{3} g^2 H^4 U+96 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+9 \left(-3 \sqrt{3} U^5+g H \left(160 \sqrt{g H \left(H^2 k^2+3\right)}-27 \sqrt{3} U\right) U^2-224 \sqrt{3} g^2 H^2 U+96 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{384 g H \left(H^2 k^2+3\right)^{5/2}}-\frac{\left(k^7 \left(\left(H^2 k^2+3\right) U-\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(-\left(-272 \sqrt{3} g^2 U H^6+2 g U^2 \left(56 \sqrt{g H \left(H^2 k^2+3\right)}-17 \sqrt{3} U\right) H^5-3 \sqrt{3} U^5 H^4+48 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4-3 \left(-6 \sqrt{3} H^2 U^5-3 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4-72 \sqrt{3} g H^3 U^3+334 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2-608 \sqrt{3} g^2 H^4 U+184 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2-9 \left(-3 \sqrt{3} U^5-3 \sqrt{g H \left(H^2 k^2+3\right)} U^4+2 g H \left(121 \sqrt{g H \left(H^2 k^2+3\right)}-19 \sqrt{3} U\right) U^2-352 \sqrt{3} g^2 H^2 U+160 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^3}{384 \left(g H \left(H^2 k^2+3\right)^{7/2}\right)}-\frac{i k^8 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}-\left(H^2 k^2+3\right) U\right)^2 \left(-\left(-400 \sqrt{3} g^2 U H^6+4 g U^2 \left(36 \sqrt{g H \left(H^2 k^2+3\right)}-11 \sqrt{3} U\right) H^5-3 \sqrt{3} U^5 H^4+96 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4-3 \left(-6 \sqrt{3} H^2 U^5-6 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4-95 \sqrt{3} g H^3 U^3+456 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2-884 \sqrt{3} g^2 H^4 U+304 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2-27 \left(-\sqrt{3} U^5-2 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(112 \sqrt{g H \left(H^2 k^2+3\right)}-17 \sqrt{3} U\right) U^2-168 \sqrt{3} g^2 H^2 U+80 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^4}{384 g H \left(H^2 k^2+3\right)^{9/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(\frac{k^5 \left(75 \sqrt{3} \left(H^2 k^2+3\right)^2 U^4+8 g H \left(H^2 k^2+3\right) \left(\left(32 \sqrt{g H^5 \left(H^2 k^2+3\right)}-5 \sqrt{3} H^2 U\right) k^2+96 \sqrt{g H \left(H^2 k^2+3\right)}\right) U-16 \sqrt{3} g^2 H^2 \left(5 H^4 k^4+48 H^2 k^2+144\right)\right)}{30720 (g H)^{3/2} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(\left(-4368 \sqrt{3} g^2 U H^8+2048 g \sqrt{g H \left(H^2 k^2+3\right)} U^2 H^7+225 \sqrt{3}$$

\left(\left(-4368 \sqrt{3} g^2 U H^8+2048 g \sqrt{g H \left(H^2 k^2+3\right)} U^2 H^7+225 \sqrt{3}
U^5 H^6+1920 \sqrt{g^5 H^{17} \left(H^2 k^2+3\right)}\right) k^6+3 \left(-14512 \sqrt{3} g^2 U
H^6+24 g U^2 \left(5 \sqrt{3} U+256 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+675 \sqrt{3} U^5
H^4+6720 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+9 \left(675 \sqrt{3} H^2 U^5+240
\sqrt{3} g H^3 U^3+6144 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2-16160 \sqrt{3} g^2 H^4 U+8448
\sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+27 \left(225 \sqrt{3} U^5+8 g H \left(15 \sqrt{3} U+256
\sqrt{g H \left(H^2 k^2+3\right)}\right) U^2-6016 \sqrt{3} g^2 H^2 U+3968 \sqrt{g^5 H^5 \left(H^2
k^2+3\right)}\right)\right) \text{dt}}{92160 (g H)^{3/2} \left(H^2 k^2+3\right)^{7/2}}-\frac{\left(k^7
\left(-48 \sqrt{3} g^3 \left(140 H^6 k^6+1425 H^4 k^4+5004 H^2 k^2+6192\right) H^3-8 \sqrt{3}
g^2 \left(1772 H^6 k^6+17121 H^4 k^4+55557 H^2 k^2+60426\right) U^2 H^2+g U^3 \left(8 \left(15
\sqrt{3} U H^6+416 \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right) k^6+9 \left(145 \sqrt{3} U H^4+3328
\sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+4590 \sqrt{3} H^2 U k^2+5265 \sqrt{3} U+89856
\sqrt{g H \left(H^2 k^2+3\right)}\right) H+3 U \left(5 \left(15 \sqrt{3} U^5 H^6+512 \sqrt{g^5 H^{17}
\left(H^2 k^2+3\right)}\right) k^6+3 \left(225 \sqrt{3} H^4 U^5+11776 \sqrt{g^5 H^{13} \left(H^2
k^2+3\right)}\right) k^4+3 \left(675 \sqrt{3} H^2 U^5+9984 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}
U^2+52352 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+81 \left(25 \sqrt{3} U^5+2816 \sqrt{g^5
H^5 \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^2}{92160 \left((g H)^{3/2} \left(H^2
k^2+3\right)^{7/2}\right)}-\frac{i k^8 \left(\left(-11520 \sqrt{3} g^3 U H^{11}-9888 \sqrt{3} g^2
U^3 H^{10}+16 g U^4 \left(5 \sqrt{3} U+96 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^9+75 \sqrt{3}
U^7 H^8+5760 \sqrt{g^5 H^{21} \left(H^2 k^2+3\right)} U^2+480 \sqrt{g^7 H^{23} \left(H^2
k^2+3\right)}\right) k^8+3 \left(-55216 \sqrt{3} g^3 U H^9-41728 \sqrt{3} g^2 U^3 H^8+3 g U^4
\left(105 \sqrt{3} U+2048 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7+300 \sqrt{3} U^7 H^6+39488
\sqrt{g^5 H^{17} \left(H^2 k^2+3\right)} U^2+6720 \sqrt{g^7 H^{19} \left(H^2 k^2+3\right)}\right)
k^6+9 \left(-99856 \sqrt{3} g^3 U H^7-66296 \sqrt{3} g^2 U^3 H^6+3 g U^4 \left(155 \sqrt{3}
U+3072 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+450 \sqrt{3} U^7 H^4+88512 \sqrt{g^5 H^{13}
\left(H^2 k^2+3\right)} U^2+19040 \sqrt{g^7 H^{15} \left(H^2 k^2+3\right)}\right) k^4+27 \left(300
\sqrt{3} H^2 U^7+305 \sqrt{3} g H^3 U^5+6144 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^4-46960
\sqrt{3} g^2 H^4 U^3+82240 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)} U^2-80544 \sqrt{3} g^3 H^5
U+20416 \sqrt{g^7 H^{11} \left(H^2 k^2+3\right)}\right) k^2+243 \left(25 \sqrt{3} U^7+g H \left(25
\sqrt{3} U+512 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^4-4168 \sqrt{3} g^2 H^2 U^3+9152
\sqrt{g^5 H^5 \left(H^2 k^2+3\right)} U^2-8128 \sqrt{3} g^3 H^3 U+2592 \sqrt{g^7 H^7 \left(H^2
k^2+3\right)}\right)\right) \text{dt}^3}{30720 (g H)^{3/2} \left(H^2 k^2+3\right)^{9/2}}+\frac{k^9
\left(2 g H \left(4 \left(45 \sqrt{3} U H^8+736 \sqrt{g H^{17} \left(H^2 k^2+3\right)}\right) k^8+3
\left(645 \sqrt{3} U H^6+11776 \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right) k^6+27 \left(285 \sqrt{3}
U H^4+5888 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+13365 \sqrt{3} H^2 U k^2+8505 \sqrt{3}
U+238464 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^5-3 \sqrt{3} g^2 H^2 \left(H^2 k^2+3\right)^2
\left(16944 H^4 k^4+114352 H^2 k^2+197625\right) U^4-24 \sqrt{3} g^3 H^3 \left(4080 H^8
k^8+64744 H^6 k^6+376029 H^4 k^4+953451 H^2 k^2+893700\right) U^2+3 \left(5 \left(15
\sqrt{3} U^7 H^8+2048 \sqrt{g^5 H^{21} \left(H^2 k^2+3\right)} U^2+384 \sqrt{g^7 H^{23} \left(H^2
k^2+3\right)}\right) k^8+12 \left(75 \sqrt{3} H^6 U^7+20864 \sqrt{g^5 H^{17} \left(H^2 k^2+3\right)}
U^2+9600 \sqrt{g^7 H^{19} \left(H^2 k^2+3\right)}\right) k^6+18 \left(225 \sqrt{3} H^4 U^7+100096
\sqrt{g^5 H^{13} \left(H^2 k^2+3\right)} U^2+60608 \sqrt{g^7 H^{15} \left(H^2 k^2+3\right)}\right)
k^4+36 \left(225 \sqrt{3} H^2 U^7+5888 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^4+144512
\sqrt{g^5 H^9 \left(H^2 k^2+3\right)} U^2+105472 \sqrt{g^7 H^{11} \left(H^2 k^2+3\right)}\right)

k^2+135 \left(45 \sqrt{3} U^7+39424 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)} U^2+33920 \sqrt{g^7 H^7 \left(H^2 k^2+3\right)}\right)\right) U−144 \sqrt{3} g^4 H^4 \left(40 H^8 k^8+1000 H^6 k^6+7395 H^4 k^4+22104 H^2 k^2+23832\right)\right) \text{dt}^4}{92160 (g H)^{3/2} \left(H^2 k^2+3\right)^{9/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right)\right\}

Out[133]=

Out[134]= EA || $\left\{\left\{1+\frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) H^2 k^3 U \text{Csc}\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2 H^2 k^2\right) w},\ \frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) H k \text{Csc}\left[\frac{\text{dx}\,k}{2}\right]}{2\left(H+\frac{H^3 k^2}{3}\right) w}\right\},$

$\left\{\frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) k\left(g H\left(3+H^2 k^2\right)-3 U^2\right) \text{Csc}\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2 H^2 k^2\right) w},\ 1+\frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) k\left(6+H^2 k^2\right) U \text{Csc}\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2 H^2 k^2\right) w}\right\}\right\}$

Out[135]= EA || \left(
\begin{array}{cc}
\frac{i e^{\frac{i \text{dx} k}{2}} \left(1-e^{-i \text{dx} k}\right) \left(-1+e^{i \text{dt} w}\right) H^2 U \csc \left(\frac{\text{dx} k}{2}\right) k^3}{\left(2 H^2 k^2+6\right) w}+1 & \frac{i e^{\frac{i \text{dx} k}{2}} \left(1-e^{-i \text{dx} k}\right) \left(-1+e^{i \text{dt} w}\right) H k \csc \left(\frac{\text{dx} k}{2}\right)}{2 \left(\frac{k^2 H^3}{3}+H\right) w} \\
\frac{i e^{\frac{i \text{dx} k}{2}} \left(1-e^{-i \text{dx} k}\right) \left(-1+e^{i \text{dt} w}\right) k \left(g H \left(H^2 k^2+3\right)-3 U^2\right) \csc \left(\frac{\text{dx} k}{2}\right)}{\left(2 H^2 k^2+6\right) w} & \frac{i e^{\frac{i \text{dx} k}{2}} \left(1-e^{-i \text{dx} k}\right) \left(-1+e^{i \text{dt} w}\right) k \left(H^2 k^2+6\right) U \csc \left(\frac{\text{dx} k}{2}\right)}{\left(2 H^2 k^2+6\right) w}+1 \\
\end{array}
\right)

Out[136]= Eerr || $\left\{\left\{\left(-\frac{\left(H^2 k^3 U w\right) \text{dt}^2}{2\left(3+H^2 k^2\right)}-\frac{i H^2 k^3 U w^2 \text{dt}^3}{6\left(3+H^2 k^2\right)}+\frac{H^2 k^3 U w^3 \text{dt}^4}{24\left(3+H^2 k^2\right)}+O[\text{dt}]^5\right)+\right.$

$\left(-\frac{1}{2}\left(\sqrt{g H}\ k^2\right)\text{dt}+O[\text{dt}]^5\right)\text{dx}+\left(\frac{i\left(9 H^2 k^5+2 H^4 k^7\right) U \text{dt}}{12\left(3+H^2 k^2\right)^2}+O[\text{dt}]^5\right)\text{dx}^2+\left(\frac{1}{24}\sqrt{g H}\ k^4\,\text{dt}+O[\text{dt}]^5\right)\text{dx}^3+$

$\left(-\frac{i k^7\left(54 H^2 U+19 H^4 k^2 U+2 H^6 k^4 U\right)\text{dt}}{240\left(3+H^2 k^2\right)^3}+O[\text{dt}]^5\right)\text{dx}^4+O[\text{dx}]^5,\left(-\frac{3(k w)\,\text{dt}^2}{2\left(3+H^2 k^2\right)}-\frac{i k w^2 \text{dt}^3}{2\left(3+H^2 k^2\right)}+\frac{k w^3 \text{dt}^4}{8\left(3+H^2 k^2\right)}+O[\text{dt}]^5\right)+$

$\left.\left(\frac{i\left(6 k^3+H^2 k^5\right)\text{dt}}{4\left(3+H^2 k^2\right)^2}+O[\text{dt}]^5\right)\text{dx}^2+\left(\frac{i\left(-54 k^5+H^4 k^9\right)\text{dt}}{240\left(3+H^2 k^2\right)^3}+O[\text{dt}]^5\right)\text{dx}^4+O[\text{dx}]^5\right\},$

$\left\{\left(-\frac{\left(k\left(3 g H+g H^3 k^2-3 U^2\right) w\right)\text{dt}^2}{2\left(3+H^2 k^2\right)}-\frac{i k\left(3 g H+g H^3 k^2-3 U^2\right) w^2 \text{dt}^3}{6\left(3+H^2 k^2\right)}+\frac{k\left(3 g H+g H^3 k^2-3 U^2\right) w^3 \text{dt}^4}{24\left(3+H^2 k^2\right)}+O[\text{dt}]^5\right)+\right.$

$\left(-\frac{1}{2}\left(\sqrt{g H}\ k^2 U\right)\text{dt}+O[\text{dt}]^5\right)\text{dx}+\left(\frac{i\left(18 g H k^3+12 g H^3 k^5+2 g H^5 k^7-18 k^3 U^2-3 H^2 k^5 U^2\right)\text{dt}}{12\left(3+H^2 k^2\right)^2}+O[\text{dt}]^5\right)\text{dx}^2+$

$\left(\frac{1}{24}\sqrt{g H}\ k^4 U\,\text{dt}+O[\text{dt}]^5\right)\text{dx}^3+\left(-\frac{i\left(54 g H k^5+54 g H^3 k^7+18 g H^5 k^9+2 g H^7 k^{11}-54 k^5 U^2+H^4 k^9 U^2\right)\text{dt}}{240\left(3+H^2 k^2\right)^3}+O[\text{dt}]^5\right)\text{dx}^4+O[\text{dx}]^5,$

$\left(-\frac{\left(k\left(6+H^2 k^2\right) U w\right)\text{dt}^2}{2\left(3+H^2 k^2\right)}-\frac{i k\left(6+H^2 k^2\right) U w^2 \text{dt}^3}{6\left(3+H^2 k^2\right)}+\frac{k\left(6+H^2 k^2\right) U w^3 \text{dt}^4}{24\left(3+H^2 k^2\right)}+O[\text{dt}]^5\right)+\left(-\frac{1}{2}\left(\sqrt{g H}\ k^2\right)\text{dt}+O[\text{dt}]^5\right)\text{dx}+$

$\left(\frac{i\left(36 k^3 U+15 H^2 k^5 U+2 H^4 k^7 U\right)\text{dt}}{12\left(3+H^2 k^2\right)^2}+O[\text{dt}]^5\right)\text{dx}^2+\left(\frac{1}{24}\sqrt{g H}\ k^4\,\text{dt}+O[\text{dt}]^5\right)\text{dx}^3+$

$\left.\left(-\frac{i\left(108 k^5 U+54 H^2 k^7 U+17 H^4 k^9 U+2 H^6 k^{11} U\right)\text{dt}}{240\left(3+H^2 k^2\right)^3}+O[\text{dt}]^5\right)\text{dx}^4+O[\text{dx}]^5\right\}\right\}$

Out[137]= Eerr || \left(
\begin{array}{cc}
\left(-\frac{\left(H^2 k^3 U w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i H^2 k^3 U w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{H^2 k^3 U w^3 \text{dt}^4}{24 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(-\frac{1}{2} \left(\sqrt{g H} k^2\right) \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 H^4 k^7+9 H^2 k^5\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{1}{24} \sqrt{g H} k^4 \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i k^7 \left(2 k^4 U H^6+19 k^2 U H^4+54 U H^2\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) &
\left(-\frac{3 (k w) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i k w^2 \text{dt}^3}{2 \left(H^2 k^2+3\right)}+\frac{k w^3 \text{dt}^4}{8 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(\frac{i \left(H^2 k^5+6 k^3\right) \text{dt}}{4 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{i \left(H^4 k^9-54 k^5\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) \\
\left(-\frac{\left(k \left(g k^2 H^3+3 g H-3 U^2\right) w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i k \left(g k^2 H^3+3 g H-3 U^2\right) w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{k \left(g k^2 H^3+3 g H-3 U^2\right) w^3 \text{dt}^4}{24 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(-\frac{1}{2} \left(\sqrt{g H} k^2 U\right) \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 g H^5 k^7+12 g H^3 k^5-3 H^2 U^2 k^5-18 U^2 k^3+18 g H k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{1}{24} \sqrt{g H} k^4 U \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i \left(2 g H^7 k^{11}+18 g H^5 k^9+H^4 U^2 k^9+54 g H^3 k^7-54 U^2 k^5+54 g H k^5\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) &
\left(-\frac{\left(k \left(H^2 k^2+6\right) U w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i k \left(H^2 k^2+6\right) U w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{k \left(H^2 k^2+6\right) U w^3 \text{dt}^4}{24 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(-\frac{1}{2} \left(\sqrt{g H} k^2\right) \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 H^4 U k^7+15 H^2 U k^5+36 U k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{1}{24} \sqrt{g H} k^4 \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i \left(2 H^6 U k^{11}+17 H^4 U k^9+54 H^2 U k^7+108 U k^5\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) \\
\end{array}
\right)

In[138]:=
```
KurF = (fm * ap - fp * am + am * ap * (qp - qm)) / (ap - am);
KurFWS = KurF /. ap → (U + Sqrt[g * H]) /. am → 0;
KurFWSeta =
  KurFWS /. fp → (H * v + U * Rpp * n) /. fm → (H * v + U * Rmp * n) /. qp → Rpp * n /.
   qm → Rmp * n;
KurFWSeta = KurFWSeta /. v → (GGp * G + Gnp * n);
Kfnnp = FullSimplify[KurFWSeta /. G → 0 /. n → 1];
KfnGp = FullSimplify[KurFWSeta /. n → 0 /. G → 1];
Kfnn = Kfnnp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
```

```
KfnG = KfnGp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
Fnn2 = -dt * (1 - Exp[-I * k * dx]) / dx * Kfnn;
Fnn2TA = Series[Fnn2 - FnnA, {dx, 0, 3}, {dt, 0, 3}];
Fnn2TAr = Refine[Fnn2TA , {k > 0, U > 0, H > 0, g > 0}];
FnG2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfnG;
FnG2TA = Series[FnG2 - FnGA, {dx, 0, 3}, {dt, 0, 3}];
FnG2TAr = Refine[FnG2TA , {k > 0, U > 0, H > 0, g > 0}];

KurFWSG = KurFWS /. fp → (U * Rpp * G + U * H * v + g * H * Rpp * n) /.
      fm → (U * Rmp * G + U * H * v + g * H * Rmp * n) /. qp → Rpp * G /. qm → Rmp * G;
KurFWSG = KurFWSG /. v → (GGp * G + Gnp * n);
KfGnp = FullSimplify[KurFWSG /. G → 0 /. n → 1];
KfGGp = FullSimplify[KurFWSG /. n → 0 /. G → 1];
KfGn = KfGnp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
KfGG = KfGGp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;

FGn2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfGn;
FGn2TA = Series[FGn2 - FGnA, {dx, 0, 3}, {dt, 0, 3}];
FGn2TAr = Refine[FGn2TA , {k > 0, U > 0, H > 0, g > 0}];
fGG2 = U * H * GG2 + U / 2 * (Rm + Rp) - (Sqrt[ g * H]) / (2) * (Rp - Rm);
FGG2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfGG;
FGG2TA = Series[FGG2 - FGGA, {dx, 0, 4}, {dt, 0, 3}];
FGG2TAr = Refine[FGG2TA , {k > 0, U > 0, H > 0, g > 0}];
Fmat2 = {{Fnn2, FnG2}, {FGn2, FGG2}};
Emat2 = IdentityMatrix[2] + Fmat2 ;
Eerr = Series[Emat2 - EA, {dx, 0, 4}, {dt, 0, 4}];
EigvFmat2 = Eigenvalues[Fmat2];

RKStep = Log[ 1 + EigvFmat2 ] / (I * dt);
RKstepTay = Series[RKStep, {dx, 0, 4}, {dt, 0, 4}];
RKstepTayr = Simplify[-RKstepTay - {wAp, wAm}, {k > 0, H > 0, g > 0, U > 0} ];


Text[Row[{" U  > Sqrt(gH)"}]]
Text[" "]
Text[Row[{"Fnn  ||   ", Kfnnp}]]
Text[Row[{"Fnn  ||   ", TeXForm[Kfnnp]}]]
Text[Row[{"Fnn error  ||   ", Fnn2TAr}]]
Text[Row[{"Fnn error  ||   ", TeXForm[Fnn2TAr]}]]
Text[" "]
Text[Row[{"FnG  ||   ", KfnGp}]]
Text[Row[{"FnG  ||   ", TeXForm[KfnGp]}]]
Text[Row[{"FnG error  ||   ", FnG2TAr}]]
```

```
Text[Row[{"FnG error  ||   ", TeXForm[FnG2TAr]}]]
Text[" "]
Text[Row[{"FGn  ||   ", KfGnp}]]
Text[Row[{"FGn  ||   ", TeXForm[KfGnp]}]]
Text[Row[{"FGn error  ||   ", FGn2TAr}]]
Text[Row[{"FGn error  ||   ", TeXForm[FGn2TAr]}]]
Text[" "]
Text[Row[{"FGG  ||   ", KfGGp}]]
Text[Row[{"FGG  ||   ", TeXForm[KfGGp]}]]
Text[Row[{"FGG error  ||   ", FGG2TAr}]]
Text[Row[{"FGG error  ||   ", TeXForm[FGG2TAr]}]]
Text[" "]
Text[" "]
Text[Row[{"Omega error  ||   ", RKstepTayr}]]
Text[Row[{"Omega error  ||   ", TeXForm[RKstepTayr]}]]
Text[" "]
Text[Row[{"EA ||   ", EA}]]
Text[Row[{"EA  ||   ", TeXForm[EA]}]]
Text[Row[{"Eerr ||   ", Eerr}]]
Text[Row[{"Eerr ||   ", TeXForm[Eerr]}]]
```

Out[172]= U > Sqrt(gH)

Out[173]=

Out[174]= Fnn || Gnp H + Rmp U

Out[175]= Fnn || \text{Gnp} H+\text{Rmp} U

Out[176]= Fnn error || $\left(-\frac{\left(H^2\,k^3\,U\,w\right)dt^2}{2\left(3+H^2\,k^2\right)}-\frac{i\,H^2\,k^3\,U\,w^2\,dt^3}{6\left(3+H^2\,k^2\right)}+O[dt]^4\right)+$
$\left(-\frac{1}{2}\left(k^2\,U\right)dt+O[dt]^4\right)dx+\left(\frac{i\left(9\,H^2\,k^5+2\,H^4\,k^7\right)U\,dt}{12\left(3+H^2\,k^2\right)^2}+O[dt]^4\right)dx^2+\left(\frac{1}{24}\,k^4\,U\,dt+O[dt]^4\right)dx^3+O[dx]^4$

Out[177]= Fnn error ||
\left(-\frac{\text{dt}^2 \left(H^2 k^3 U w\right)}{2 \left(H^2 k^2+3\right)}-\frac{i \text{dt}^3 H^2 k^3 U w^2}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(-\frac{1}{2} \left(k^2 U\right) \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 H^4 k^7+9 H^2 k^5\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(\frac{1}{24} k^4 U \text{dt}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[178]=

Out[179]= FnG || GGp H

Out[180]= FnG || \text{GGp} H

Out[181]= FnG error || $\left(-\frac{3\,(k\,w)\,dt^2}{2\left(3+H^2\,k^2\right)}-\frac{i\,k\,w^2\,dt^3}{2\left(3+H^2\,k^2\right)}+O[dt]^4\right)+\left(\frac{i\left(6\,k^3+H^2\,k^5\right)dt}{4\left(3+H^2\,k^2\right)^2}+O[dt]^4\right)dx^2+O[dx]^4$

Out[182]= FnG error || \left(−\frac{3 \text{dt}^2 (k w)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 k w^2}{2 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(H^2 k^5+6 k^3\right) \text{dt}}{4 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[183]=

Out[184]= FGn || H (g Rmp + Gnp U)

Out[185]= FGn || H (g \text{Rmp}+\text{Gnp} U)

Out[186]= FGn error || $\left(-\frac{\left(k \left(3 g H+g H^3 k^2-3 U^2\right) w\right) dt^2}{2 \left(3+H^2 k^2\right)}-\frac{i k \left(3 g H+g H^3 k^2-3 U^2\right) w^2 dt^3}{6 \left(3+H^2 k^2\right)}+O[dt]^4\right)+\left(-\frac{1}{2} \left(g H k^2\right) dt+O[dt]^4\right) dx+\left(\frac{i \left(18 g H k^3+12 g H^3 k^5+2 g H^5 k^7-18 k^3 U^2-3 H^2 k^5 U^2\right) dt}{12 \left(3+H^2 k^2\right)^2}+O[dt]^4\right) dx^2+\left(\frac{1}{24} g H k^4 dt+O[dt]^4\right) dx^3+O[dx]^4$

Out[187]= FGn error ||
\left(−\frac{\text{dt}^2 \left(k w \left(g H^3 k^2+3 g H−3 U^2\right)\right)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 k w^2 \left(g H^3 k^2+3 g H−3 U^2\right)}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(−\frac{1}{2} \left(g H k^2\right) \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 g H^5 k^7+12 g H^3 k^5−3 H^2 U^2 k^5−18 U^2 k^3+18 g H k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(\frac{1}{24} g H k^4 \text{dt}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[188]=

Out[189]= FGG || (GGp H + Rmp) U

Out[190]= FGG || U (\text{GGp} H+\text{Rmp})

Out[191]= FGG error ||
$\left(-\frac{\left(k \left(6+H^2 k^2\right) U w\right) dt^2}{2 \left(3+H^2 k^2\right)}-\frac{i k \left(6+H^2 k^2\right) U w^2 dt^3}{6 \left(3+H^2 k^2\right)}+O[dt]^4\right)+\left(-\frac{1}{2} \left(k^2 U\right) dt+O[dt]^4\right) dx+\left(\frac{i \left(36 k^3+15 H^2 k^5+2 H^4 k^7\right) U dt}{12 \left(3+H^2 k^2\right)^2}+O[dt]^4\right) dx^2+\left(\frac{1}{24} k^4 U dt+O[dt]^4\right) dx^3+\left(-\frac{i \left(108 k^5+54 H^2 k^7+17 H^4 k^9+2 H^6 k^{11}\right) U dt}{240 \left(3+H^2 k^2\right)^3}+O[dt]^4\right) dx^4+O[dx]^5$

Out[192]= FGG error ||
\left(−\frac{\text{dt}^2 \left(k U w \left(H^2 k^2+6\right)\right)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 k U w^2 \left(H^2 k^2+6\right)}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(−\frac{1}{2} \left(k^2 U\right) \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 H^4 k^7+15 H^2 k^5+36 k^3\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(\frac{1}{24} k^4 U \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^4 \left(−\frac{i \left(2 H^6 k^{11}+17 H^4 k^9+54 H^2 k^7+108 k^5\right) U \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^5\right)

Out[193]=

Out[194]=

Out[195]= Omega error || $\left\{\left|\frac{i \left(\sqrt{3}\ k \sqrt{g H \left(3+H^2 k^2\right)}+3 k U+H^2 k^3 U\right)^2 dt}{2 \left(3+H^2 k^2\right)^2}-\frac{1}{3 \left(3+H^2 k^2\right)^2}\right.$

$$\left(\left(k^3\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\left(3\,g\,H+U\left(2\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\right)\right)dt^2-\right.$$

$$\frac{1}{4\left(3+H^2\,k^2\right)^3}i\,k^4\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\left(3\,g\left(\sqrt{3}\ H\sqrt{g\,H\left(3+H^2\,k^2\right)}+9\,H\,U+3\,H^3\,k^2\,U\right)+\right.$$

$$\left.\left.U^2\left(H^4\,k^4\,U+9\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+U\right)+3\,k^2\left(\sqrt{3}\ \sqrt{g\,H^5\left(3+H^2\,k^2\right)}+2\,H^2\,U\right)\right)\right)dt^3+$$

$$\frac{1}{5\left(3+H^2\,k^2\right)^3}k^5\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)$$

$$\left(9\,g^2\,H^2+6\,g\,H\,U\left(2\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+3\left(3+H^2\,k^2\right)U\right)+\right.$$

$$\left.U^3\left(12\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+9\,U+H^4\,k^4\,U+2\,k^2\left(2\sqrt{3}\ \sqrt{g\,H^5\left(3+H^2\,k^2\right)}+3\,H^2\,U\right)\right)\right)dt^4+$$

$$O[dt]^5\Bigg)+\Bigg(-\frac{1}{4}\,i\,k^2\left(\sqrt{3}\ \sqrt{\frac{g\,H}{3+H^2\,k^2}}+2\,U\right)+\frac{k^3\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\left(\sqrt{3}\ g\,H+2\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U\right)dt}{4\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{3/2}}+$$

$$\left(i\,k^4\left(\sqrt{3}\ g\,H+2\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U\right)\left(3\,g\,H+U\left(2\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\right)dt^2\right)\Big/$$

$$\left(4\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{3/2}\right)-$$

$$\left(\left(k^5\left(\sqrt{3}\ g\,H+2\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U\right)\left(3\,g\left(\sqrt{3}\ H\sqrt{g\,H\left(3+H^2\,k^2\right)}+9\,H\,U+3\,H^3\,k^2\,U\right)+\right.\right.\right.$$

$$\left.\left.\left.U^2\left(H^4\,k^4\,U+9\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+U\right)+3\,k^2\left(\sqrt{3}\ \sqrt{g\,H^5\left(3+H^2\,k^2\right)}+2\,H^2\,U\right)\right)\right)\right)$$

$$dt^3\Big)\Big/\left(4\left(\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{5/2}\right)\right)-\left(i\,k^6\left(\sqrt{3}\ g\,H+2\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U\right)\right.$$

$$\left(9\,g^2\,H^2+6\,g\,H\,U\left(2\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+3\left(3+H^2\,k^2\right)U\right)+\right.$$

$$\left.\left.U^3\left(12\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+9\,U+H^4\,k^4\,U+2\,k^2\left(2\sqrt{3}\ \sqrt{g\,H^5\left(3+H^2\,k^2\right)}+3\,H^2\,U\right)\right)\right)$$

$$dt^4\Big)\Big/\left(4\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{5/2}\right)+O[dt]^5\Bigg)\,dx+$$

$$\left(-\left(\left(k^3\left(3\sqrt{3}\ g\,H\left(13+3\,H^2\,k^2\right)+16\left(3\sqrt{g\,H\left(3+H^2\,k^2\right)}+k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\right)U\right)\right)\Big/\right.\right.$$

$$\left.\left.\left(96\left(\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{3/2}\right)\right)\right)-$$

$$\left(i\,k^4\left(g\,H\left(144\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\ \left(369+234\,H^2\,k^2+37\,H^4\,k^4\right)U\right)+4\left(63\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^2+\right.\right.\right.$$

$$\left.\left.\left.7\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^2+3\,k^2\left(3\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+14\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^2\right)\right)\right)$$

$$dt\Big)\Big/\left(96\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{5/2}\right)+\left(k^5\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\right.$$

$$\left(g\,H\left(171\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\ \left(477+306\,H^2\,k^2+49\,H^4\,k^4\right)U\right)+5\left(72\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^2+\right.\right.$$

$$\left.\left.\left.8\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^2+3\,k^2\left(3\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+16\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^2\right)\right)\right)$$

$$dt^2\Big)\Big/\left(96\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{7/2}\right)+\left(i\,k^6\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)^2\right.$$

$$\mathrm{dt}\Big)\Big/\Big(96\sqrt{g\,H}\,\left(3+H^2\,k^2\right)\Big)+\Big(i\,k\,\left(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)$$

$$\Big(468\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+52\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+$$

$$g\,H\left(198\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\,\left(585+378\,H^2\,k^2+61\,H^4\,k^4\right)U\right)+$$

$$6\,k^2\left(9\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+52\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\right)\Big)\,\mathrm{dt}^3\Big)\Big/\Big(96\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{9/2}\Big)-$$

$$\Big(\Big(k^7\left(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)^3\Big(576\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+64\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+$$

$$g\,H\left(225\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\,\left(693+450\,H^2\,k^2+73\,H^4\,k^4\right)U\right)+$$

$$3\,k^2\left(21\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+128\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\right)\Big)\Big)\,\mathrm{dt}^4\Big)\Big/$$

$$\Big(96\left(\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{11/2}\right)\Big)+O[\mathrm{dt}]^5\Big)\,\mathrm{dx}^2+\left(\frac{i\,k^4\left(\sqrt{3}\,g\,H\left(33+7\,H^2\,k^2\right)+16\left(3\sqrt{g\,H\left(3+H^2\,k^2\right)}+k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\right)U\right)}{384\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{3/2}}-\right.$$

$$\Big(\Big(k^5\Big(g\,H\left(72\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\,\left(207+126\,H^2\,k^2+19\,H^4\,k^4\right)U\right)+16\Big(9\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+$$

$$k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+k^2\left(\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+6\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\right)\Big)\Big)\Big)\,\mathrm{dt}\Big)\Big/$$

$$\Big(128\left(\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\right)\Big)-\Big(i\,k^6\Big(9\sqrt{3}\,g^2\,H^2\left(13+3\,H^2\,k^2\right)+5\,g\,H\,U\Big(96\sqrt{g\,H\left(3+H^2\,k^2\right)}+$$

$$\sqrt{3}\,\left(129+82\,H^2\,k^2+13\,H^4\,k^4\right)U\Big)+32\Big(9\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^3+k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}$$

$$U^3+2\,k^2\left(2\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,U+3\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^3\right)\Big)\Big)\,\mathrm{dt}^2\Big)\Big/$$

$$\Big(128\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\Big)+\Big(k^7\left(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\Big(24\sqrt{3}\,g^2\,H^2\left(21+5\,H^2\,k^2\right)+$$

$$3\,g\,H\,U\left(717\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\,\left(1011+646\,H^2\,k^2+103\,H^4\,k^4\right)U\right)+$$

$$5\Big(288\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^3+32\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^3+$$

$$3\,k^2\left(39\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,U+64\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^3\right)\Big)\Big)\,\mathrm{dt}^3\Big)\Big/$$

$$\Big(384\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{7/2}\Big)+\Big(i\,k^8\left(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)^2$$

$$\Big(5\sqrt{3}\,g^2\,H^2\left(45+11\,H^2\,k^2\right)+720\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^3+80\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^3+$$

$$g\,H\,U\left(990\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\,\left(1449+930\,H^2\,k^2+149\,H^4\,k^4\right)U\right)+$$

$$2\,k^2\left(137\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,U+240\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^3\right)\Big)$$

$$\left.\mathrm{dt}^4\Big)\Big/\Big(128\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{9/2}\Big)+O[\mathrm{dt}]^5\right)\mathrm{dx}^3+$$

$$\Big(\Big(k^5\Big(3\sqrt{3}\,g\,H\left(543+146\,H^2\,k^2+15\,H^4\,k^4\right)+256\Big(9\sqrt{g\,H\left(3+H^2\,k^2\right)}+6\,k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}+$$

$$k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\Big)U\Big)\Big)\Big/\Big(30\,720\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\Big)+$$

$$\left(i\,k^6\left(3\,g\,H\left(18\,432\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+51\,039\,\sqrt{3}\;U+45\,735\,\sqrt{3}\;H^2\,k^2\,U+\right.\right.\right.$$
$$\left.\left.\left.1381\,\sqrt{3}\;H^6\,k^6\,U+k^4\left(960\,\sqrt{g\,H^9\left(3+H^2\,k^2\right)}+13\,717\,\sqrt{3}\;H^4\,U\right)\right)+\right.$$
$$\left.128\left(837\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^2+279\,k^4\,\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\;U^2+31\,k^6\,\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\;U^2+\right.\right.$$
$$\left.\left.27\,k^2\left(7\,\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+31\,\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^2\right)\right)\right)dt\Big)\Big/$$
$$\left(92\,160\,\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{7/2}\right)-\left(\left(k^7\left(9\,\sqrt{3}\;g^2\,H^2\left(12\,999+6258\,H^2\,k^2+775\,H^4\,k^4\right)+\right.\right.\right.$$
$$\left.\left.\left.g\,H\,U\left(617\,661\,\sqrt{3}\;H^2\,k^2\,U+20\,551\,\sqrt{3}\;H^6\,k^6\,U+81\left(5888\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+\right.\right.\right.\right.$$
$$\left.\left.\left.\left.8053\,\sqrt{3}\;U\right)+3\,k^4\left(12\,288\,\sqrt{g\,H^9\left(3+H^2\,k^2\right)}+65\,021\,\sqrt{3}\;H^4\,U\right)\right)+\right.$$
$$\left.128\left(2322\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^3+774\,k^4\,\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\;U^3+86\,k^6\,\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\right.\right.$$
$$\left.\left.U^3+9\,k^2\left(229\,\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U+258\,\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^3\right)\right)\right)\Big)$$
$$dt^2\Big)\Big/\left(92\,160\left(\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{7/2}\right)\right)-\frac{1}{30\,720\,\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{9/2}}$$
$$i\,k^8\left(k^8\,U^3\left(21\,253\,\sqrt{3}\;g\,H^9+7776\,\sqrt{g\,H^{17}\left(3+H^2\,k^2\right)}\;U\right)+\right.$$
$$243\left(832\,\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}+4423\,\sqrt{3}\;g^2\,H^2\,U+2592\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^4+\right.$$
$$\left.g\,H\,U^2\left(8832\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+7823\,\sqrt{3}\;U\right)\right)+3\,k^6\,U\left(9181\,\sqrt{3}\;g^2\,H^8+\right.$$
$$\left.31\,104\,\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\;U^3+4\,g\,H^7\,U\left(5312\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+21\,787\,\sqrt{3}\;U\right)\right)+$$
$$27\,k^2\left(35\,319\,\sqrt{3}\;g^2\,H^4\,U+91\,580\,\sqrt{3}\;g\,H^3\,U^3+\right.$$
$$\left.64\left(59\,\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+1155\,\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2+486\,\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^4\right)\right)+$$
$$9\,k^4\left(31\,231\,\sqrt{3}\;g^2\,H^6\,U+2\,g\,H^5\,U^2\left(34\,336\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+67\,003\,\sqrt{3}\;U\right)+\right.$$
$$\left.\left.288\left(5\,\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}+162\,\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\;U^4\right)\right)\right)dt^3+$$
$$\frac{1}{92\,160\,\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{11/2}}k^9\left(\sqrt{3}\;\sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)$$
$$\left(k^8\,U^3\left(111\,559\,\sqrt{3}\;g\,H^9+42\,368\,\sqrt{g\,H^{17}\left(3+H^2\,k^2\right)}\;U\right)+\right.$$
$$27\,k^2\left(18\,078\,\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+172\,047\,\sqrt{3}\;g^2\,H^4\,U+372\,075\,\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2+\right.$$
$$\left.477\,940\,\sqrt{3}\;g\,H^3\,U^3+169\,472\,\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^4\right)+$$
$$81\left(11\,603\,\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}+63\,917\,\sqrt{3}\;g^2\,H^2\,U+42\,368\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^4+\right.$$
$$\left.g\,H\,U^2\left(132\,513\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+122\,207\,\sqrt{3}\;U\right)\right)+3\,k^6\,U\left(45\,573\,\sqrt{3}\;g^2\,H^8+\right.$$
$$\left.169\,472\,\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\;U^3+g\,H^7\,U\left(108\,089\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+456\,644\,\sqrt{3}\;U\right)\right)+$$
$$9\,k^4\left(7035\,\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}+153\,703\,\sqrt{3}\;g^2\,H^6\,U+254\,208\,\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\;U^4+\right.$$

$$g H^5 U^2 \left(347\,651 \sqrt{g H \left(3 + H^2 k^2\right)} + 700\,818 \sqrt{3}\ U\right)\Big)\Big) dt^4 + O[dt]^5\Big) dx^4 + O[dx]^5,$$

$$\Bigg(\frac{i\left(-\sqrt{3}\ k \sqrt{g H \left(3+H^2 k^2\right)} + 3 k U + H^2 k^3 U\right)^2 dt}{2\left(3+H^2 k^2\right)^2} - \frac{1}{3\left(3+H^2 k^2\right)^2}\Big(k^3 \Big(-\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)$$

$$\Big(3 g H + U\Big(-2\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)\Big)\Big) dt^2 -$$

$$\frac{1}{4\left(3+H^2 k^2\right)^3} i k^4 \Big(-\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)$$

$$\Big(3 g H \Big(-\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 3\left(3 + H^2 k^2\right) U\Big) +$$

$$U^2 \Big(-9\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 9 U + H^4 k^4 U - 3 k^2 \Big(\sqrt{3}\ \sqrt{g H^5 \left(3 + H^2 k^2\right)} - 2 H^2 U\Big)\Big)\Big) dt^3 +$$

$$\frac{1}{5\left(3+H^2 k^2\right)^3} k^5 \Big(-\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)$$

$$\Big(9 g^2 H^2 + 6 g H U \Big(-2\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 3\left(3 + H^2 k^2\right) U\Big) +$$

$$U^3 \Big(-12\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 9 U + H^4 k^4 U + k^2 \Big(-4\sqrt{3}\ \sqrt{g H^5 \left(3 + H^2 k^2\right)} + 6 H^2 U\Big)\Big)\Big) dt^4 + O[$$

$$dt]^5\Bigg) +$$

$$\Bigg(\frac{1}{4} i k^2 \Big(\sqrt{3}\ \sqrt{\frac{g H}{3+H^2 k^2}} - 2 U\Big) - \frac{\Big(k^3 \Big(-\sqrt{3}\ \sqrt{g H \left(3+H^2 k^2\right)} + \left(3+H^2 k^2\right) U\Big)\Big(\sqrt{3}\ g H - 2\sqrt{g H \left(3+H^2 k^2\right)}\ U\Big)\Big) dt}{4\left(\sqrt{g H}\ \left(3+H^2 k^2\right)^{3/2}\right)} -$$

$$\Big(i k^4 \Big(\sqrt{3}\ g H - 2\sqrt{g H \left(3 + H^2 k^2\right)}\ U\Big)\Big(3 g H + U\Big(-2\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + \left(3 + H^2 k^2\right) U\Big)\Big) dt^2\Big) \Big/$$

$$\Big(4\sqrt{g H}\ \left(3 + H^2 k^2\right)^{3/2}\Big) +$$

$$\Big(k^5 \Big(\sqrt{3}\ g H - 2\sqrt{g H \left(3 + H^2 k^2\right)}\ U\Big)\Big(3 g H \Big(-\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 3\left(3 + H^2 k^2\right) U\Big) + U^2$$

$$\Big(-9\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 9 U + H^4 k^4 U - 3 k^2 \Big(\sqrt{3}\ \sqrt{g H^5 \left(3 + H^2 k^2\right)} - 2 H^2 U\Big)\Big)\Big) dt^3\Big) \Big/$$

$$\Big(4\sqrt{g H}\ \left(3 + H^2 k^2\right)^{5/2}\Big) + \Big(i k^6 \Big(\sqrt{3}\ g H - 2\sqrt{g H \left(3 + H^2 k^2\right)}\ U\Big)$$

$$\Big(9 g^2 H^2 + 6 g H U \Big(-2\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 3\left(3 + H^2 k^2\right) U\Big) +$$

$$U^3 \Big(-12\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)} + 9 U + H^4 k^4 U + k^2 \Big(-4\sqrt{3}\ \sqrt{g H^5 \left(3 + H^2 k^2\right)} + 6 H^2 U\Big)\Big)\Big)$$

$$dt^4\Big) \Big/ \Big(4\sqrt{g H}\ \left(3 + H^2 k^2\right)^{5/2}\Big) + O[dt]^5\Bigg) dx +$$

$$\Bigg(\frac{k^3 \Big(3\sqrt{3}\ g H \left(13+3 H^2 k^2\right) - 16\Big(3\sqrt{g H \left(3+H^2 k^2\right)}\ U + k^2 \sqrt{g H^5 \left(3+H^2 k^2\right)}\ U\Big)\Big)}{\sqrt{}} +$$

$$96 \sqrt{g H} \left(3+H^2 k^2\right)^{3/2}$$

$$\Big(i k^4 \Big(g H \Big(-144 \sqrt{g H \left(3+H^2 k^2\right)} + \sqrt{3} \left(369+234 H^2 k^2+37 H^4 k^4\right) U\Big) - 4 \Big(63 \sqrt{g H \left(3+H^2 k^2\right)} U^2 + 7 k^4 \sqrt{g H^9 \left(3+H^2 k^2\right)} U^2 + 3 k^2 \Big(3 \sqrt{g^3 H^7 \left(3+H^2 k^2\right)} + 14 \sqrt{g H^5 \left(3+H^2 k^2\right)} U^2\Big)\Big)\Big) dt\Big) \Big/ \Big(96 \sqrt{g H} \left(3+H^2 k^2\right)^{5/2}\Big) -$$

$$\Big(\Big(k^5 \Big(\sqrt{3} \sqrt{g H \left(3+H^2 k^2\right)} - \left(3+H^2 k^2\right) U\Big) \Big(g H \Big(171 \sqrt{g H \left(3+H^2 k^2\right)} - \sqrt{3} \left(477+306 H^2 k^2+49 H^4 k^4\right) U\Big) + 5 \Big(72 \sqrt{g H \left(3+H^2 k^2\right)} U^2 + 8 k^4 \sqrt{g H^9 \left(3+H^2 k^2\right)} U^2 + 3 k^2 \Big(3 \sqrt{g^3 H^7 \left(3+H^2 k^2\right)} + 16 \sqrt{g H^5 \left(3+H^2 k^2\right)} U^2\Big)\Big)\Big)\Big) dt^2\Big) \Big/$$

$$\Big(96 \Big(\sqrt{g H} \left(3+H^2 k^2\right)^{7/2}\Big)\Big) + \Big(i k^6 \Big(\sqrt{3} \sqrt{g H \left(3+H^2 k^2\right)} - \left(3+H^2 k^2\right) U\Big)^2 \Big(468 \sqrt{g H \left(3+H^2 k^2\right)} U^2 + 52 k^4 \sqrt{g H^9 \left(3+H^2 k^2\right)} U^2 + g H \Big(198 \sqrt{g H \left(3+H^2 k^2\right)} - \sqrt{3} \left(585+378 H^2 k^2+61 H^4 k^4\right) U\Big) + 6 k^2 \Big(9 \sqrt{g^3 H^7 \left(3+H^2 k^2\right)} + 52 \sqrt{g H^5 \left(3+H^2 k^2\right)} U^2\Big)\Big) dt^3\Big) \Big/ \Big(96 \sqrt{g H} \left(3+H^2 k^2\right)^{9/2}\Big) +$$

$$\Big(k^7 \Big(\sqrt{3} \sqrt{g H \left(3+H^2 k^2\right)} - \left(3+H^2 k^2\right) U\Big)^3 \Big(576 \sqrt{g H \left(3+H^2 k^2\right)} U^2 + 64 k^4 \sqrt{g H^9 \left(3+H^2 k^2\right)} U^2 + g H \Big(225 \sqrt{g H \left(3+H^2 k^2\right)} - \sqrt{3} \left(693+450 H^2 k^2+73 H^4 k^4\right) U\Big) + 3 k^2 \Big(21 \sqrt{g^3 H^7 \left(3+H^2 k^2\right)} + 128 \sqrt{g H^5 \left(3+H^2 k^2\right)} U^2\Big)\Big) dt^4\Big) \Big/ \Big(96 \sqrt{g H} \left(3+H^2 k^2\right)^{11/2}\Big) +$$

$$O[dt]^5\Bigg) dx^2 + \left(\frac{i k^4 \Big(-\sqrt{3} g H \left(33+7 H^2 k^2\right) + 16 \Big(3 \sqrt{g H \left(3+H^2 k^2\right)} + k^2 \sqrt{g H^5 \left(3+H^2 k^2\right)}\Big) U\Big)}{384 \sqrt{g H} \left(3+H^2 k^2\right)^{3/2}} + \right.$$

$$\Big(k^5 \Big(g H \Big(-72 \sqrt{g H \left(3+H^2 k^2\right)} + \sqrt{3} \left(207+126 H^2 k^2+19 H^4 k^4\right) U\Big) - 16 \Big(9 \sqrt{g H \left(3+H^2 k^2\right)} U^2 + k^4 \sqrt{g H^9 \left(3+H^2 k^2\right)} U^2 + k^2 \Big(\sqrt{g^3 H^7 \left(3+H^2 k^2\right)} + 6 \sqrt{g H^5 \left(3+H^2 k^2\right)} U^2\Big)\Big)\Big) dt\Big) \Big/ \Big(128 \sqrt{g H} \left(3+H^2 k^2\right)^{5/2}\Big) +$$

$$\Big(i k^6 \Big(9 \sqrt{3} g^2 H^2 \left(13+3 H^2 k^2\right) + 5 g H U \Big(-96 \sqrt{g H \left(3+H^2 k^2\right)} + \sqrt{3} \left(129+82 H^2 k^2+13 H^4 k^4\right) U\Big) - 32 \Big(9 \sqrt{g H \left(3+H^2 k^2\right)} U^3 + k^4 \sqrt{g H^9 \left(3+H^2 k^2\right)} U^3 + 2 k^2 \Big(2 \sqrt{g^3 H^7 \left(3+H^2 k^2\right)} U + 3 \sqrt{g H^5 \left(3+H^2 k^2\right)} U^3\Big)\Big)\Big) dt^2\Big) \Big/ \Big(128 \sqrt{g H} \left(3+H^2 k^2\right)^{5/2}\Big) -$$

$$\Big(\Big(k^7 \Big(-\sqrt{3} \sqrt{g H \left(3+H^2 k^2\right)} + \left(3+H^2 k^2\right) U\Big) \Big(24 \sqrt{3} g^2 H^2 \left(21+5 H^2 k^2\right) + 3 g H U \Big(-717 \sqrt{g H \left(3+H^2 k^2\right)} + \sqrt{3} \left(1011+646 H^2 k^2+103 H^4 k^4\right) U\Big) - 5 \Big(288 \sqrt{g H \left(3+H^2 k^2\right)} U^3 + 32 k^4 \sqrt{g H^9 \left(3+H^2 k^2\right)} U^3 + 3 k^2 \Big(39 \sqrt{g^3 H^7 \left(3+H^2 k^2\right)} U + 64 \sqrt{g H^5 \left(3+H^2 k^2\right)} U^3\Big)\Big)\Big)\Big) dt^3\Big) \Big/$$

$$\left(384\left(\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{7/2}\right)\right)-\left(i\,k^8\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ -\left(3+H^2\,k^2\right)U\right)^2\left(5\sqrt{3}\ g^2\,H^2\right.\right.$$
$$\left(45+11\,H^2\,k^2\right)+g\,H\,U\left(-990\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\sqrt{3}\ \left(1449+930\,H^2\,k^2+149\,H^4\,k^4\right)U\right)-$$
$$2\left(360\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^3+40\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^3+k^2\left(137\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\ U+\right.\right.$$
$$\left.\left.\left.\left.240\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^3\right)\right)\right)dt^4\Bigg)\Big/\left(128\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{9/2}\right)+O[dt]^5\Bigg)dx^3+$$

$$\left(\left(k^5\left(-3\sqrt{3}\ g\,H\left(543+146\,H^2\,k^2+15\,H^4\,k^4\right)+256\left(9\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +6\,k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ +\right.\right.\right.\right.$$
$$\left.\left.\left.\left.k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ \right)U\right)\right)\Big/\left(30\,720\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{5/2}\right)+$$
$$\left(i\,k^6\left(-3\,g\,H\left(-18\,432\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +51\,039\sqrt{3}\ U+45\,735\sqrt{3}\ H^2\,k^2\,U+\right.\right.\right.$$
$$\left.\left.\left.1381\sqrt{3}\ H^6\,k^6\,U+k^4\left(-960\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ +13\,717\sqrt{3}\ H^4\,U\right)\right)+\right.$$
$$128\left(837\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^2+279\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^2+31\,k^6\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\ U^2+\right.$$
$$\left.\left.\left.27\,k^2\left(7\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\ +31\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^2\right)\right)\right)dt\Bigg)\Big/$$
$$\left(92\,160\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{7/2}\right)+\left(k^7\left(9\sqrt{3}\ g^2\,H^2\left(12\,999+6258\,H^2\,k^2+775\,H^4\,k^4\right)+\right.\right.$$
$$g\,H\,U\left(617\,661\sqrt{3}\ H^2\,k^2\,U+20\,551\sqrt{3}\ H^6\,k^6\,U+81\left(-5888\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\right.\right.$$
$$\left.\left.8053\sqrt{3}\ U\right)-3\,k^4\left(12\,288\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ -65\,021\sqrt{3}\ H^4\,U\right)\right)-$$
$$128\left(2322\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^3+774\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^3+86\,k^6\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\ U^3+\right.$$
$$\left.\left.9\,k^2\left(229\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\ U+258\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^3\right)\right)\right)dt^2\Bigg)\Big/$$
$$\left(92\,160\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{7/2}\right)-\frac{1}{30\,720\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{9/2}}i\,k^8$$
$$\left(k^8\,U^3\left(-21\,253\sqrt{3}\ g\,H^9+7776\sqrt{g\,H^{17}\left(3+H^2\,k^2\right)}\ U\right)+\right.$$
$$243\left(832\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}\ -4423\sqrt{3}\ g^2\,H^2\,U+2592\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^4+\right.$$
$$g\,H\,U^2\left(8832\sqrt{g\,H\left(3+H^2\,k^2\right)}\ -7823\sqrt{3}\ U\right)-3\,k^6\,U\left(9181\sqrt{3}\ g^2\,H^8-\right.$$
$$31\,104\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\ U^3+4\,g\,H^7\,U\left(-5312\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +21\,787\sqrt{3}\ U\right)+$$
$$27\,k^2\left(-35\,319\sqrt{3}\ g^2\,H^4\,U-91\,580\sqrt{3}\ g\,H^3\,U^3+\right.$$
$$64\left(59\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}\ +1155\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\ U^2+486\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^4\right)+$$
$$9\,k^4\left(-31\,231\sqrt{3}\ g^2\,H^6\,U+2\,g\,H^5\,U^2\left(34\,336\sqrt{g\,H\left(3+H^2\,k^2\right)}\ -67\,003\sqrt{3}\ U\right)+\right.$$
$$\left.\left.\left.288\left(5\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}\ +162\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^4\right)\right)\right)dt^3-\frac{1}{92\,160\left(\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{11/2}\right)}$$

$$\left(k^9\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}-\left(3+H^2\,k^2\right)U\right)\left(k^8\,U^3\left(-111\,559\,\sqrt{3}\ g\,H^9+42\,368\,\sqrt{g\,H^{17}\left(3+H^2\,k^2\right)}\ U\right)+\right.\right.$$
$$27\,k^2\left(18\,078\,\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}-172\,047\,\sqrt{3}\ g^2\,H^4\,U+372\,075\,\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\ U^2-\right.$$
$$\left.477\,940\,\sqrt{3}\ g\,H^3\,U^3+169\,472\,\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^4\right)+$$
$$9\,k^4\left(7035\,\sqrt{g^5\,H^{13}\left(3+H^2\,k^2\right)}-153\,703\,\sqrt{3}\ g^2\,H^6\,U+254\,208\,\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^4+\right.$$
$$\left.g\,H^5\,U^2\left(347\,651\,\sqrt{g\,H\left(3+H^2\,k^2\right)}-700\,818\,\sqrt{3}\ U\right)\right)+$$
$$81\left(11\,603\,\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}-63\,917\,\sqrt{3}\ g^2\,H^2\,U+42\,368\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^4+\right.$$
$$\left.g\,H\,U^2\left(132\,513\,\sqrt{g\,H\left(3+H^2\,k^2\right)}-122\,207\,\sqrt{3}\ U\right)\right)-$$
$$3\,k^6\,U\left(45\,573\,\sqrt{3}\ g^2\,H^8-169\,472\,\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\ U^3+\right.$$
$$\left.\left.\left.g\,H^7\,U\left(-108\,089\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+456\,644\,\sqrt{3}\ U\right)\right)\right)\right)\,dt^4+O[dt]^5\Bigg)\,dx^4+O[dx]^5\Bigg\}$$

Out[196]= Omega error ||

\left\{\left(\frac{i \left(H^2 U k^3+3 U k+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} k\right)^2 \text{dt}}{2 \left(H^2 k^2+3\right)^2}-\frac{\left(k^3 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{3 \left(H^2 k^2+3\right)^2}-\frac{i k^4 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+3 \left(2 U H^2+\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 \left(U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) U^2+3 g \left(3 k^2 U H^3+9 U H+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} H\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^3}+\frac{k^5 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+2 \left(3 U H^2+2 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U+12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{5 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right)+\left(-\frac{1}{4} i k^2 \left(2 U+\sqrt{3} \sqrt{\frac{g H}{H^2 k^2+3}}\right)+\frac{k^3 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\sqrt{3} g H+2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \text{dt}}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{i k^4 \left(\sqrt{3} g H+2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}-\frac{\left(k^5 \left(\sqrt{3} g H+2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(\left(H^4 U k^4+3 \left(2 U H^2+\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 \left(U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) U^2+3 g \left(3 k^2 U H^3+9 U H+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} H\right)\right) \text{dt}^3}{4 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{5/2}\right)}-\frac{i k^6 \left(\sqrt{3} g H+2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(\left(H^4 U k^4+2 \left(3 U H^2+2 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U+12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(-\frac{k^3 \left(3 \sqrt{3} g H \left(3 H^2 k^2+13\right)+16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+3 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)

U\right)}{96 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{3/2}\right)}−\frac{i k^4 \left(g H \left(\sqrt{3} \left(37 H^4 k^4+234 H^2 k^2+369\right) U+144 \sqrt{g H \left(H^2 k^2+3\right)}\right)+4 \left(7 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(14 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+3 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+63 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{k^5 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(g H \left(\sqrt{3} \left(49 H^4 k^4+306 H^2 k^2+477\right) U+171 \sqrt{g H \left(H^2 k^2+3\right)}\right)+5 \left(8 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(16 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+3 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+72 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}^2}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}+\frac{i k^6 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)^2 \left(52 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+6 \left(52 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+9 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+468 \sqrt{g H \left(H^2 k^2+3\right)} U^2+g H \left(\sqrt{3} \left(61 H^4 k^4+378 H^2 k^2+585\right) U+198 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}−\frac{\left(k^7 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)^3 \left(64 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(128 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+21 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+576 \sqrt{g H \left(H^2 k^2+3\right)} U^2+g H \left(\sqrt{3} \left(73 H^4 k^4+450 H^2 k^2+693\right) U+225 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^4}{96 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{11/2}\right)}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{i k^4 \left(\sqrt{3} g H \left(7 H^2 k^2+33\right)+16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+3 \sqrt{g H \left(H^2 k^2+3\right)}\right) U\right)}{384 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}−\frac{\left(k^5 \left(g H \left(\sqrt{3} \left(19 H^4 k^4+126 H^2 k^2+207\right) U+72 \sqrt{g H \left(H^2 k^2+3\right)}\right)+16 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+\left(6 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+\sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+9 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right)\right) \text{dt}}{128 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{5/2}\right)}−\frac{i k^6 \left(9 \sqrt{3} g^2 \left(3 H^2 k^2+13\right) H^2+5 g U \left(\sqrt{3} \left(13 H^4 k^4+82 H^2 k^2+129\right) U+96 \sqrt{g H \left(H^2 k^2+3\right)}\right) H+32 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+2 \left(3 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+2 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+9 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^2}{128 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{k^7 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(24 \sqrt{3} g^2 \left(5 H^2 k^2+21\right) H^2+3 g U \left(\sqrt{3} \left(103 H^4 k^4+646 H^2 k^2+1011\right) U+717 \sqrt{g H \left(H^2 k^2+3\right)}\right) H+5 \left(32 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+3 \left(64 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+39 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+288 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^3}{384 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}+\frac{i k^8 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)^2 \left(80 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+2 \left(240 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+137 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+720 \sqrt{g H \left(H^2 k^2+3\right)} U^3+5 \sqrt{3} g^2 H^2 \left(11 H^2 k^2+45\right)+g H U \left(\sqrt{3} \left(149 H^4 k^4+930 H^2 k^2+1449\right) U+990 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^4}{128 \sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(\frac{k^5 \left(3 \sqrt{3} g H \left(15 H^4 k^4+146 H^2 k^2+543\right)+256 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} k^4+6 \sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+9 \sqrt{g H \left(H^2 k^2+3\right)}\right) U\right)}{30720 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(3 g H \left(1381 \sqrt{3} H^6 U k^6+\left(13717 \sqrt{3} U H^4+960 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+45735 \sqrt{3} H^2 U k^2+51039

\sqrt{3} U H^4+960 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+45753 \sqrt{3} H^2 U k^2+31039 \sqrt{3} U+18432 \sqrt{g H \left(H^2 k^2+3\right)}\right)+128 \left(31 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^2 k^6+279 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+27 \left(31 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+7 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+837 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{92160 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}-\frac{\left(k^7 \left(9 \sqrt{3} g^2 \left(775 H^4 k^4+6258 H^2 k^2+12999\right) H^2+g U \left(20551 \sqrt{3} H^6 U k^6+3 \left(65021 \sqrt{3} U H^4+12288 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+617661 \sqrt{3} H^2 U k^2+81 \left(8053 \sqrt{3} U+5888 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) H+128 \left(86 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3 k^6+774 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+9 \left(258 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+229 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+2322 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right)\right) \text{dt}^2}{92160 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{7/2}\right)}-\frac{i k^8 \left(U^3 \left(21253 \sqrt{3} g H^9+7776 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U\right) k^8+3 U \left(9181 \sqrt{3} g^2 H^8+4 g U \left(21787 \sqrt{3} U+5312 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7+31104 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3\right) k^6+9 \left(31231 \sqrt{3} g^2 U H^6+2 g U^2 \left(67003 \sqrt{3} U+34336 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+288 \left(162 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+5 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right)\right) k^4+27 \left(35319 \sqrt{3} g^2 U H^4+91580 \sqrt{3} g U^3 H^3+64 \left(486 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+1155 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+59 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right)\right) k^2+243 \left(2592 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(7823 \sqrt{3} U+8832 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+4423 \sqrt{3} g^2 H^2 U+832 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{30720 \sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}+\frac{k^9 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(U^3 \left(111559 \sqrt{3} g H^9+42368 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U\right) k^8+3 U \left(45573 \sqrt{3} g^2 H^8+g U \left(456644 \sqrt{3} U+108089 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7+169472 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3\right) k^6+9 \left(153703 \sqrt{3} g^2 U H^6+g U^2 \left(700818 \sqrt{3} U+347651 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+254208 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+7035 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+27 \left(172047 \sqrt{3} g^2 U H^4+477940 \sqrt{3} g U^3 H^3+169472 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+372075 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+18078 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+81 \left(42368 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(122207 \sqrt{3} U+132513 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+63917 \sqrt{3} g^2 H^2 U+11603 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^4}{92160 \sqrt{g H} \left(H^2 k^2+3\right)^{11/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right),\left(\frac{i \left(H^2 U k^3+3 U k-\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} k\right)^2 \text{dt}}{2 \left(H^2 k^2+3\right)^2}-\frac{\left(k^3 \left(\left(H^2 k^2+3\right) U-\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U-2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^2}{3 \left(H^2 k^2+3\right)^2}-\frac{i k^4 \left(\left(H^2 k^2+3\right) U-\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4-3 \left(\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}-2 H^2 U\right) k^2+9 U-9 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+3 g H \left(3 \left(H^2 k^2+3\right) U-\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^3}+\frac{k^5 \left(\left(H^2 k^2+3\right) U-\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+\left(6 H^2 U-4 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U-12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U-2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{5

\left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right)+\left(\frac{1}{4} i k^2 \left(\sqrt{3} \sqrt{\frac{g H}{H^2 k^2+3}}−2 U\right)−\frac{\left(k^3 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\sqrt{3} g H−2 \sqrt{g H \left(H^2 k^2+3\right)} U\right)\right) \text{dt}}{4 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{3/2}\right)}−\frac{i k^4 \left(\sqrt{3} g H−2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{k^5 \left(\sqrt{3} g H−2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(\left(H^4 U k^4−3 \left(\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}−2 H^2 U\right) k^2+9 U−9 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+3 g H \left(3 \left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(\sqrt{3} g H−2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(\left(H^4 U k^4+\left(6 H^2 U−4 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U−12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{k^3 \left(3 \sqrt{3} g H \left(3 H^2 k^2+13\right)−16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} U k^2+3 \sqrt{g H \left(H^2 k^2+3\right)} U\right)\right)}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{i k^4 \left(g H \left(\sqrt{3} \left(37 H^4 k^4+234 H^2 k^2+369\right) U−144 \sqrt{g H \left(H^2 k^2+3\right)}\right)−4 \left(7 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(14 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+3 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+63 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}−\frac{\left(k^5 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}−\left(H^2 k^2+3\right) U\right) \left(g H \left(171 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} \left(49 H^4 k^4+306 H^2 k^2+477\right) U\right)+5 \left(8 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(16 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+3 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+72 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right)\right) \text{dt}^2}{96 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{7/2}\right)}+\frac{i k^6 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}−\left(H^2 k^2+3\right) U\right)^2 \left(52 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+6 \left(52 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+9 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+468 \sqrt{g H \left(H^2 k^2+3\right)} U^2+g H \left(198 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} \left(61 H^4 k^4+378 H^2 k^2+585\right) U\right)\right) \text{dt}^3}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}+\frac{k^7 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}−\left(H^2 k^2+3\right) U\right)^3 \left(64 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(128 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+21 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+576 \sqrt{g H \left(H^2 k^2+3\right)} U^2+g H \left(225 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} \left(73 H^4 k^4+450 H^2 k^2+693\right) U\right)\right) \text{dt}^4}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{11/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{i k^4 \left(16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+3 \sqrt{g H \left(H^2 k^2+3\right)}\right) U−\sqrt{3} g H \left(7 H^2 k^2+33\right)\right)}{384 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{k^5 \left(g H \left(\sqrt{3} \left(19 H^4 k^4+126 H^2 k^2+207\right) U−72 \sqrt{g H \left(H^2 k^2+3\right)}\right)−16 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+\left(6 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+\sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+9 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{128 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(9 \sqrt{3} g^2 \left(3 H^2 k^2+13\right) H^2+5 g U \left(\sqrt{3} \left(13 H^4 k^4+82 H^2 k^2+129\right) U−96 \sqrt{g H \left(H^2 k^2+3\right)}\right) H−32 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+2 \left(3 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+2 \sqrt{g^3 H^7 \left(H^2

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k^2+3\right)} U\right) k^2+9 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^2}{128 \sqrt{g
H} \left(H^2 k^2+3\right)^{5/2}}-\frac{\left(k^7 \left(\left(H^2 k^2+3\right) U-\sqrt{3} \sqrt{g H
\left(H^2 k^2+3\right)}\right) \left(24 \sqrt{3} g^2 \left(5 H^2 k^2+21\right) H^2+3 g U \left(\sqrt{3}
\left(103 H^4 k^4+646 H^2 k^2+1011\right) U-717 \sqrt{g H \left(H^2 k^2+3\right)}\right) H-5
\left(32 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+3 \left(64 \sqrt{g H^5 \left(H^2 k^2+3\right)}
U^3+39 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+288 \sqrt{g H \left(H^2 k^2+3\right)}
U^3\right)\right)\right) \text{dt}^3}{384 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{7/2}\right)}-\frac{i
k^8 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}-\left(H^2 k^2+3\right) U\right)^2 \left(5 \sqrt{3}
g^2 \left(11 H^2 k^2+45\right) H^2+g U \left(\sqrt{3} \left(149 H^4 k^4+930 H^2 k^2+1449\right)
U-990 \sqrt{g H \left(H^2 k^2+3\right)}\right) H-2 \left(40 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3
k^4+\left(240 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+137 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}
U\right) k^2+360 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^4}{128 \sqrt{g H} \left(H^2
k^2+3\right)^{9/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(\frac{k^5 \left(256 \left(\sqrt{g
H^9 \left(H^2 k^2+3\right)} k^4+6 \sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+9 \sqrt{g H \left(H^2
k^2+3\right)}\right) U-3 \sqrt{3} g H \left(15 H^4 k^4+146 H^2 k^2+543\right)\right)}{30720 \sqrt{g H}
\left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(128 \left(31 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^2
k^6+279 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+27 \left(31 \sqrt{g H^5 \left(H^2 k^2+3\right)}
U^2+7 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+837 \sqrt{g H \left(H^2 k^2+3\right)}
U^2\right)-3 g H \left(1381 \sqrt{3} H^6 U k^6+\left(13717 \sqrt{3} H^4 U-960 \sqrt{g H^9 \left(H^2
k^2+3\right)}\right) k^4+45735 \sqrt{3} H^2 U k^2+51039 \sqrt{3} U-18432 \sqrt{g H \left(H^2
k^2+3\right)}\right)\right) \text{dt}}{92160 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}+\frac{k^7 \left(9
\sqrt{3} g^2 \left(775 H^4 k^4+6258 H^2 k^2+12999\right) H^2+g U \left(20551 \sqrt{3} H^6 U k^6-3
\left(12288 \sqrt{g H^9 \left(H^2 k^2+3\right)}-65021 \sqrt{3} H^4 U\right) k^4+617661 \sqrt{3} H^2
U k^2+81 \left(8053 \sqrt{3} U-5888 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) H-128 \left(86
\sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3 k^6+774 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+9
\left(258 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+229 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right)
k^2+2322 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^2}{92160 \sqrt{g H} \left(H^2
k^2+3\right)^{7/2}}-\frac{i k^8 \left(U^3 \left(7776 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U-21253
\sqrt{3} g H^9\right) k^8-3 U \left(9181 \sqrt{3} g^2 H^8+4 g U \left(21787 \sqrt{3} U-5312 \sqrt{g
H \left(H^2 k^2+3\right)}\right) H^7-31104 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3\right) k^6+9
\left(-31231 \sqrt{3} g^2 U H^6+2 g U^2 \left(34336 \sqrt{g H \left(H^2 k^2+3\right)}-67003 \sqrt{3}
U\right) H^5+288 \left(162 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+5 \sqrt{g^5 H^{13} \left(H^2
k^2+3\right)}\right)\right) k^4+27 \left(-35319 \sqrt{3} g^2 U H^4-91580 \sqrt{3} g U^3 H^3+64
\left(486 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+1155 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+59
\sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right)\right) k^2+243 \left(2592 \sqrt{g H \left(H^2 k^2+3\right)}
U^4+g H \left(8832 \sqrt{g H \left(H^2 k^2+3\right)}-7823 \sqrt{3} U\right) U^2-4423 \sqrt{3} g^2
H^2 U+832 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{30720 \sqrt{g H} \left(H^2
k^2+3\right)^{9/2}}-\frac{\left(k^9 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}-\left(H^2 k^2+3\right)
U\right) \left(U^3 \left(42368 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U-111559 \sqrt{3} g H^9\right)
k^8-3 U \left(45573 \sqrt{3} g^2 H^8+g U \left(456644 \sqrt{3} U-108089 \sqrt{g H \left(H^2
k^2+3\right)}\right) H^7-169472 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3\right) k^6+9 \left(-153703
\sqrt{3} g^2 U H^6+g U^2 \left(347651 \sqrt{g H \left(H^2 k^2+3\right)}-700818 \sqrt{3} U\right)
H^5+254208 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+7035 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right)
```

```
k^4+27 \left(-172047 \sqrt{3} g^2 U H^4-477940 \sqrt{3} g U^3 H^3+169472 \sqrt{g H^5 \left(H^2
k^2+3\right)} U^4+372075 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+18078 \sqrt{g^5 H^9 \left(H^2
k^2+3\right)}\right) k^2+81 \left(42368 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(132513
\sqrt{g H \left(H^2 k^2+3\right)}-122207 \sqrt{3} U\right) U^2-63917 \sqrt{3} g^2 H^2 U+11603
\sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^4}{92160 \left(\sqrt{g H} \left(H^2
k^2+3\right)^{11/2}\right)}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right)\right\}
```

Out[197]=

Out[198]= EA || $\left\{\left\{1+\frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) H^2 k^3 U \csc\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2 H^2 k^2\right) w},\ \frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) H k \csc\left[\frac{\text{dx}\,k}{2}\right]}{2\left(H+\frac{H^3 k^2}{3}\right) w}\right\},\right.$

$\left.\left\{\frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) k\left(g H\left(3+H^2 k^2\right)-3 U^2\right) \csc\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2 H^2 k^2\right) w},\ 1+\frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) k\left(6+H^2 k^2\right) U \csc\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2 H^2 k^2\right) w}\right\}\right\}$

Out[199]=

$$\left(\begin{array}{cc}
\frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) H^2 U \csc\left(\frac{\text{dx}\,k}{2}\right) k^3}{\left(2 H^2 k^2+6\right) w}+1 & \frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) H k \csc\left(\frac{\text{dx}\,k}{2}\right)}{2\left(\frac{k^2 H^3}{3}+H\right) w} \\
\frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) k\left(g H\left(H^2 k^2+3\right)-3 U^2\right) \csc\left(\frac{\text{dx}\,k}{2}\right)}{\left(2 H^2 k^2+6\right) w} & \frac{i e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) k\left(H^2 k^2+6\right) U \csc\left(\frac{\text{dx}\,k}{2}\right)}{\left(2 H^2 k^2+6\right) w}+1 \\
\end{array}\right)$$

Out[200]= Eerr ||

$$\left\{\left\{\left(-\frac{\left(H^2 k^3 U w\right) \text{dt}^2}{2\left(3+H^2 k^2\right)}-\frac{i H^2 k^3 U w^2 \text{dt}^3}{6\left(3+H^2 k^2\right)}+\frac{H^2 k^3 U w^3 \text{dt}^4}{24\left(3+H^2 k^2\right)}+O[\text{dt}]^5\right)+\left(-\frac{1}{2}\left(k^2 U\right) \text{dt}+O[\text{dt}]^5\right) \text{dx}+\left(\frac{i\left(9 H^2 k^5+2 H^4 k^7\right) U \text{dt}}{12\left(3+H^2 k^2\right)^2}+O[\text{dt}]^5\right)\right.$$
$$\left.\text{dx}^2+\left(\frac{1}{24} k^4 U \text{dt}+O[\text{dt}]^5\right) \text{dx}^3+\left(-\frac{i\left(54 H^2 k^7+19 H^4 k^9+2 H^6 k^{11}\right) U \text{dt}}{240\left(3+H^2 k^2\right)^3}+O[\text{dt}]^5\right) \text{dx}^4+O[\text{dx}]^5,\right.$$
$$\left(-\frac{3 (k w) \text{dt}^2}{2\left(3+H^2 k^2\right)}-\frac{i k w^2 \text{dt}^3}{2\left(3+H^2 k^2\right)}+\frac{k w^3 \text{dt}^4}{8\left(3+H^2 k^2\right)}+O[\text{dt}]^5\right)+\left(\frac{i\left(6 k^3+H^2 k^5\right) \text{dt}}{4\left(3+H^2 k^2\right)^2}+O[\text{dt}]^5\right) \text{dx}^2+\left(\frac{i\left(-54 k^5+H^4 k^9\right) \text{dt}}{240\left(3+H^2 k^2\right)^3}+O[\text{dt}]^5\right) \text{dx}^4+$$
$$O[\text{dx}]^5\Big\},\ \Big\{\Big(-\frac{\left(k\left(3 g H+g H^3 k^2-3 U^2\right) w\right) \text{dt}^2}{2\left(3+H^2 k^2\right)}-\frac{i k\left(3 g H+g H^3 k^2-3 U^2\right) w^2 \text{dt}^3}{6\left(3+H^2 k^2\right)}+\frac{k\left(3 g H+g H^3 k^2-3 U^2\right) w^3 \text{dt}^4}{24\left(3+H^2 k^2\right)}+O[\text{dt}]^5\Big)+$$
$$\left(-\frac{1}{2}\left(g H k^2\right) \text{dt}+O[\text{dt}]^5\right) \text{dx}+\left(\frac{i\left(18 g H k^3+12 g H^3 k^5+2 g H^5 k^7-18 k^3 U^2-3 H^2 k^5 U^2\right) \text{dt}}{12\left(3+H^2 k^2\right)^2}+O[\text{dt}]^5\right) \text{dx}^2+$$
$$\left(\frac{1}{24} g H k^4 \text{dt}+O[\text{dt}]^5\right) \text{dx}^3+\left(-\frac{i\left(54 g H k^5+54 g H^3 k^7+18 g H^5 k^9+2 g H^7 k^{11}-54 k^5 U^2+H^4 k^9 U^2\right) \text{dt}}{240\left(3+H^2 k^2\right)^3}+O[\text{dt}]^5\right) \text{dx}^4+O[\text{dx}]^5,$$
$$\left(-\frac{\left(k\left(6+H^2 k^2\right) U w\right) \text{dt}^2}{2\left(3+H^2 k^2\right)}-\frac{i k\left(6+H^2 k^2\right) U w^2 \text{dt}^3}{6\left(3+H^2 k^2\right)}+\frac{k\left(6+H^2 k^2\right) U w^3 \text{dt}^4}{24\left(3+H^2 k^2\right)}+O[\text{dt}]^5\right)+\left(-\frac{1}{2}\left(k^2 U\right) \text{dt}+O[\text{dt}]^5\right) \text{dx}+$$
$$\left(\frac{i\left(36 k^3+15 H^2 k^5+2 H^4 k^7\right) U \text{dt}}{12\left(3+H^2 k^2\right)^2}+O[\text{dt}]^5\right) \text{dx}^2+\left(\frac{1}{24} k^4 U \text{dt}+O[\text{dt}]^5\right) \text{dx}^3+$$
$$\left.\left(-\frac{i\left(108 k^5+54 H^2 k^7+17 H^4 k^9+2 H^6 k^{11}\right) U \text{dt}}{240\left(3+H^2 k^2\right)^3}+O[\text{dt}]^5\right) \text{dx}^4+O[\text{dx}]^5\right\}\right\}$$

Out[201]=
```
Eerr || \left(
\begin{array}{cc}
 \left(-\frac{\left(H^2 k^3 U w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i
      H^2 k^3 U w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{H^2 k^3 U w^3 \text{dt}^4}{24
      \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(-\frac{1}{2} \left(k^2 U\right)
      \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 H^4 k^7+9 H^2 k^5\right) U
      \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{1}{24}
      k^4 U \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i \left(2 H^6 k^{11}+19 H^4
      k^9+54 H^2 k^7\right) U \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right)
      \text{dx}^4+O\left(\text{dx}^5\right) & \left(-\frac{3 (k w) \text{dt}^2}{2 \left(H^2
      k^2+3\right)}-\frac{i k w^2 \text{dt}^3}{2 \left(H^2 k^2+3\right)}+\frac{k w^3 \text{dt}^4}{8 \left(H^2
      k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(\frac{i \left(H^2 k^5+6 k^3\right) \text{dt}}{4 \left(H^2
      k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{i \left(H^4 k^9-54 k^5\right)
      \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) \\
 \left(-\frac{\left(k \left(g k^2 H^3+3 g H-3 U^2\right) w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i k \left(g
      k^2 H^3+3 g H-3 U^2\right) w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{k \left(g k^2 H^3+3 g H-3
      U^2\right) w^3 \text{dt}^4}{24 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(-\frac{1}{2} \left(g H
      k^2\right) \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 g H^5 k^7+12 g H^3 k^5-3 H^2
      U^2 k^5-18 U^2 k^3+18 g H k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right)
      \text{dx}^2+\left(\frac{1}{24} g H k^4 \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i
      \left(2 g H^7 k^{11}+18 g H^5 k^9+H^4 U^2 k^9+54 g H^3 k^7-54 U^2 k^5+54 g H k^5\right)
      \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right)
      & \left(-\frac{\left(k \left(H^2 k^2+6\right) U w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i
      k \left(H^2 k^2+6\right) U w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{k \left(H^2 k^2+6\right)
      U w^3 \text{dt}^4}{24 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(-\frac{1}{2}
      \left(k^2 U\right) \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 H^4 k^7+15
      H^2 k^5+36 k^3\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right)
      \text{dx}^2+\left(\frac{1}{24} k^4 U \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i
      \left(2 H^6 k^{11}+17 H^4 k^9+54 H^2 k^7+108 k^5\right) U \text{dt}}{240 \left(H^2
      k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) \\
\end{array}
\right)
```

In[202]:=
```
KurF = (fm * ap - fp * am + am * ap * (qp - qm)) / (ap - am);
KurFWS = KurF /. ap → 0 /. am → (U - Sqrt[g * H]);
KurFWSeta =
  KurFWS /. fp → (H * v + U * Rpp * n) /. fm → (H * v + U * Rmp * n) /. qp → Rpp * n /.
   qm → Rmp * n;
KurFWSeta = KurFWSeta /. v → (GGp * G + Gnp * n);
Kfnnp = FullSimplify[KurFWSeta /. G → 0 /. n → 1];
KfnGp = FullSimplify[KurFWSeta /. n → 0 /. G → 1];
Kfnn = Kfnnp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
KfnG = KfnGp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
```

```
Fnn2 = -dt * (1 - Exp[-I * k * dx]) / dx * Kfnn;
Fnn2TA = Series[Fnn2 - FnnA, {dx, 0, 3}, {dt, 0, 3}];
Fnn2TAr = Refine[Fnn2TA , {k > 0, U > 0, H > 0, g > 0}];
FnG2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfnG;
FnG2TA = Series[FnG2 - FnGA, {dx, 0, 3}, {dt, 0, 3}];
FnG2TAr = Refine[FnG2TA , {k > 0, U > 0, H > 0, g > 0}];

KurFWSG = KurFWS /. fp → (U * Rpp * G + U * H * v + g * H * Rpp * n) /.
      fm → (U * Rmp * G + U * H * v + g * H * Rmp * n) /. qp → Rpp * G /. qm → Rmp * G;
KurFWSG = KurFWSG /. v → (GGp * G + Gnp * n);
KfGnp = FullSimplify[KurFWSG /. G → 0 /. n → 1];
KfGGp = FullSimplify[KurFWSG /. n → 0 /. G → 1];
KfGn = KfGnp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
KfGG = KfGGp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;

FGn2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfGn;
FGn2TA = Series[FGn2 - FGnA, {dx, 0, 3}, {dt, 0, 3}];
FGn2TAr = Refine[FGn2TA , {k > 0, U > 0, H > 0, g > 0}];
fGG2 = U * H * GG2 + U / 2 * (Rm + Rp) - (Sqrt[ g * H]) / (2) * (Rp - Rm);
FGG2 = -dt * (1 - Exp[-I * k * dx]) / dx * KfGG;
FGG2TA = Series[FGG2 - FGGA, {dx, 0, 4}, {dt, 0, 3}];
FGG2TAr = Refine[FGG2TA , {k > 0, U > 0, H > 0, g > 0}];
Fmat2 = {{Fnn2, FnG2}, {FGn2, FGG2}};
Emat2 = IdentityMatrix[2] + Fmat2 ;
Eerr = Series[Emat2 - EA, {dx, 0, 4}, {dt, 0, 4}];
EigvFmat2 = Eigenvalues[Fmat2];

RKStep = Log[ 1 + EigvFmat2 ] / (I * dt);
RKstepTay = Series[RKStep, {dx, 0, 4}, {dt, 0, 4}];
RKstepTayr = Simplify[-RKstepTay - {wAp, wAm}, {k > 0, H > 0, g > 0, U > 0} ];


Text[Row[{" U < -Sqrt(gH)"}]]
Text[" "]
Text[Row[{"Fnn  ||   ", Kfnnp}]]
Text[Row[{"Fnn  ||   ", TeXForm[Kfnnp]}]]
Text[Row[{"Fnn error  ||   ", Fnn2TAr}]]
Text[Row[{"Fnn error  ||   ", TeXForm[Fnn2TAr]}]]
Text[" "]
Text[Row[{"FnG  ||   ", KfnGp}]]
Text[Row[{"FnG  ||   ", TeXForm[KfnGp]}]]
Text[Row[{"FnG error  ||   ", FnG2TAr}]]
Text[Row[{"FnG error  ||   ", TeXForm[FnG2TAr]}]]
```

```
Text[" "]
Text[Row[{"FGn  ||   ", KfGnp}]]
Text[Row[{"FGn  ||   ", TeXForm[KfGnp]}]]
Text[Row[{"FGn error  ||   ", FGn2TAr}]]
Text[Row[{"FGn error  ||   ", TeXForm[FGn2TAr]}]]
Text[" "]
Text[Row[{"FGG  ||   ", KfGGp}]]
Text[Row[{"FGG  ||   ", TeXForm[KfGGp]}]]
Text[Row[{"FGG error  ||   ", FGG2TAr}]]
Text[Row[{"FGG error  ||   ", TeXForm[FGG2TAr]}]]
Text[" "]
Text[" "]
Text[Row[{"Omega error  ||   ", RKstepTayr}]]
Text[Row[{"Omega error  ||   ", TeXForm[RKstepTayr]}]]
Text[" "]
Text[Row[{"EA ||   ", EA}]]
Text[Row[{"EA  ||   ", TeXForm[EA]}]]
Text[Row[{"Eerr ||   ", Eerr}]]
Text[Row[{"Eerr ||   ", TeXForm[Eerr]}]]
```

Out[236]= U < −Sqrt(gH)

Out[237]=

Out[238]= Fnn || Gnp H + Rpp U

Out[239]= Fnn || \text{Gnp} H+\text{Rpp} U

Out[240]= Fnn error || $\left(-\frac{\left(H^2\,k^3\,U\,w\right)dt^2}{2\left(3+H^2\,k^2\right)}-\frac{i\,H^2\,k^3\,U\,w^2\,dt^3}{6\left(3+H^2\,k^2\right)}+O[dt]^4\right)+\left(\frac{1}{2}\,k^2\,U\,dt+O[dt]^4\right)dx+$
$\left(\frac{i\left(9\,H^2\,k^5+2\,H^4\,k^7\right)U\,dt}{12\left(3+H^2\,k^2\right)^2}+O[dt]^4\right)dx^2+\left(-\frac{1}{24}\left(k^4\,U\right)dt+O[dt]^4\right)dx^3+O[dx]^4$

Out[241]= Fnn error ||
\left(−\frac{\text{dt}^2 \left(H^2 k^3 U w\right)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 H^2 k^3 U w^2}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(\frac{1}{2} k^2 U \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 H^4 k^7+9 H^2 k^5\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(−\frac{1}{24} \left(k^4 U\right) \text{dt}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[242]=

Out[243]= FnG || GGp H

Out[244]= FnG || \text{GGp} H

Out[245]= FnG error || $\left(-\frac{3\,(k\,w)\,dt^2}{2\left(3+H^2\,k^2\right)}-\frac{i\,k\,w^2\,dt^3}{2\left(3+H^2\,k^2\right)}+O[dt]^4\right)+\left(\frac{i\left(6\,k^3+H^2\,k^5\right)dt}{4\left(3+H^2\,k^2\right)^2}+O[dt]^4\right)dx^2+O[dx]^4$

Out[246]= FnG error || \left(−\frac{3 \text{dt}^2 (k w)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 k w^2}{2 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(H^2 k^5+6 k^3\right) \text{dt}}{4 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[247]=

Out[248]= FGn || H (g Rpp + Gnp U)

Out[249]= FGn || H (g \text{Rpp}+\text{Gnp} U)

Out[250]= FGn error || $\left(-\frac{\left(k \left(3 g H+g H^3 k^2-3 U^2\right) w\right) dt^2}{2 \left(3+H^2 k^2\right)}-\frac{i k \left(3 g H+g H^3 k^2-3 U^2\right) w^2 dt^3}{6 \left(3+H^2 k^2\right)}+O[dt]^4\right)+\left(\frac{1}{2} g H k^2 dt+O[dt]^4\right) dx+\left(\frac{i \left(18 g H k^3+12 g H^3 k^5+2 g H^5 k^7-18 k^3 U^2-3 H^2 k^5 U^2\right) dt}{12 \left(3+H^2 k^2\right)^2}+O[dt]^4\right) dx^2+\left(-\frac{1}{24}\left(g H k^4\right) dt+O[dt]^4\right) dx^3+O[dx]^4$

Out[251]= FGn error ||
\left(−\frac{\text{dt}^2 \left(k w \left(g H^3 k^2+3 g H−3 U^2\right)\right)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 k w^2 \left(g H^3 k^2+3 g H−3 U^2\right)}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(\frac{1}{2} g H k^2 \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 g H^5 k^7+12 g H^3 k^5−3 H^2 U^2 k^5−18 U^2 k^3+18 g H k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(−\frac{1}{24} \left(g H k^4\right) \text{dt}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^4\right)

Out[252]=

Out[253]= FGG || (GGp H + Rpp) U

Out[254]= FGG || U (\text{GGp} H+\text{Rpp})

Out[255]= FGG error ||
$\left(-\frac{\left(k \left(6+H^2 k^2\right) U w\right) dt^2}{2 \left(3+H^2 k^2\right)}-\frac{i k \left(6+H^2 k^2\right) U w^2 dt^3}{6 \left(3+H^2 k^2\right)}+O[dt]^4\right)+\left(\frac{1}{2} k^2 U dt+O[dt]^4\right) dx+\left(\frac{i \left(36 k^3+15 H^2 k^5+2 H^4 k^7\right) U dt}{12 \left(3+H^2 k^2\right)^2}+O[dt]^4\right) dx^2+\left(-\frac{1}{24}\left(k^4 U\right) dt+O[dt]^4\right) dx^3+\left(-\frac{i \left(108 k^5+54 H^2 k^7+17 H^4 k^9+2 H^6 k^{11}\right) U dt}{240 \left(3+H^2 k^2\right)^3}+O[dt]^4\right) dx^4+O[dx]^5$

Out[256]= FGG error ||
\left(−\frac{\text{dt}^2 \left(k U w \left(H^2 k^2+6\right)\right)}{2 \left(H^2 k^2+3\right)}−\frac{i \text{dt}^3 k U w^2 \left(H^2 k^2+6\right)}{6 \left(H^2 k^2+3\right)}+O\left(\text{dt}^4\right)\right)+\text{dx} \left(\frac{1}{2} k^2 U \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^2 \left(\frac{i \left(2 H^4 k^7+15 H^2 k^5+36 k^3\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^4\right)\right)+\text{dx}^3 \left(−\frac{1}{24} \left(k^4 U\right) \text{dt}+O\left(\text{dt}^4\right)\right)+\text{dx}^4 \left(−\frac{i \left(2 H^6 k^{11}+17 H^4 k^9+54 H^2 k^7+108 k^5\right) U \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^4\right)\right)+O\left(\text{dx}^5\right)

Out[257]=

Out[258]=

Out[259]= Omega error || $\left\{\left|\frac{i \left(\sqrt{3}\ k \sqrt{g H \left(3+H^2 k^2\right)+3 k U+H^2 k^3 U}\right)^2 dt}{2 \left(3+H^2 k^2\right)^2}-\frac{1}{3 \left(3+H^2 k^2\right)^2}\right.$

$$\left(\left(k^3\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\left(3+H^2\,k^2\right)U\right)\left(3\,g\,H+U\left(2\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\left(3+H^2\,k^2\right)U\right)\right)\right)dt^2-\right.$$

$$\frac{1}{4\left(3+H^2\,k^2\right)^3}i\,k^4\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\left(3+H^2\,k^2\right)U\right)\left(3\,g\left(\sqrt{3}\ H\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +9\,H\,U+3\,H^3\,k^2\,U\right)+\right.$$

$$\left.U^2\left(H^4\,k^4\,U+9\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +U\right)+3\,k^2\left(\sqrt{3}\ \sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ +2\,H^2\,U\right)\right)\right)dt^3+$$

$$\frac{1}{5\left(3+H^2\,k^2\right)^3}k^5\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\left(3+H^2\,k^2\right)U\right)$$

$$\left(9\,g^2\,H^2+6\,g\,H\,U\left(2\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +3\left(3+H^2\,k^2\right)U\right)+\right.$$

$$\left.U^3\left(12\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +9\,U+H^4\,k^4\,U+2\,k^2\left(2\sqrt{3}\ \sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ +3\,H^2\,U\right)\right)\right)dt^4+$$

$$O[dt]^5\Bigg)+\Bigg(\frac{1}{4}\,i\,k^2\left(\sqrt{3}\ \sqrt{\frac{g\,H}{3+H^2\,k^2}}\ +2\,U\right)-\frac{\left(k^3\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\left(3+H^2\,k^2\right)U\right)\left(\sqrt{3}\ g\,H+2\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U\right)\right)dt}{4\left(\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{3/2}\right)}-$$

$$\left(i\,k^4\left(\sqrt{3}\ g\,H+2\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U\right)\left(3\,g\,H+U\left(2\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\left(3+H^2\,k^2\right)U\right)\right)dt^2\right)\Big/$$

$$\left(4\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{3/2}\right)+$$

$$\left(k^5\left(\sqrt{3}\ g\,H+2\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U\right)\left(3\,g\left(\sqrt{3}\ H\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +9\,H\,U+3\,H^3\,k^2\,U\right)+\right.\right.$$

$$\left.\left.U^2\left(H^4\,k^4\,U+9\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +U\right)+3\,k^2\left(\sqrt{3}\ \sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ +2\,H^2\,U\right)\right)\right)dt^3\right)\Big/$$

$$\left(4\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{5/2}\right)+\left(i\,k^6\left(\sqrt{3}\ g\,H+2\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U\right)\right.$$

$$\left(9\,g^2\,H^2+6\,g\,H\,U\left(2\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +3\left(3+H^2\,k^2\right)U\right)+\right.$$

$$\left.\left.U^3\left(12\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +9\,U+H^4\,k^4\,U+2\,k^2\left(2\sqrt{3}\ \sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ +3\,H^2\,U\right)\right)\right)\right.$$

$$\left.dt^4\right)\Big/\left(4\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{5/2}\right)+O[dt]^5\Bigg)dx+$$

$$\left(-\left(\left(k^3\left(3\sqrt{3}\ g\,H\left(13+3\,H^2\,k^2\right)+16\left(3\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\right)U\right)\right)\Big/\right.\right.$$

$$\left.\left.\left(96\left(\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{3/2}\right)\right)\right)-$$

$$\left(i\,k^4\left(g\,H\left(144\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\sqrt{3}\ \left(369+234\,H^2\,k^2+37\,H^4\,k^4\right)U\right)+4\left(63\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^2+\right.\right.\right.$$

$$\left.\left.\left.7\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^2+3\,k^2\left(3\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\ +14\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^2\right)\right)\right)\right.$$

$$\left.dt\right)\Big/\left(96\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{5/2}\right)+\left(k^5\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\left(3+H^2\,k^2\right)U\right)\right.$$

$$\left(g\,H\left(171\sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\sqrt{3}\ \left(477+306\,H^2\,k^2+49\,H^4\,k^4\right)U\right)+5\left(72\sqrt{g\,H\left(3+H^2\,k^2\right)}\ U^2+\right.\right.$$

$$\left.\left.\left.8\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\ U^2+3\,k^2\left(3\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\ +16\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\ U^2\right)\right)\right)\right.$$

$$\left.dt^2\right)\Big/\left(96\sqrt{g\,H}\ \left(3+H^2\,k^2\right)^{7/2}\right)+\left(i\,k^6\left(\sqrt{3}\ \sqrt{g\,H\left(3+H^2\,k^2\right)}\ +\left(3+H^2\,k^2\right)U\right)^2\right.$$

$$
\begin{aligned}
&\text{dt}^3\Big)\Big/\Big(96\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\Big)+\Big(i\,k^8\Big(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\left(3+H^2\,k^2\right)U\Big)\\
&\quad\Big(468\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+52\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+\\
&\qquad g\,H\Big(198\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\sqrt{3}\,\left(585+378\,H^2\,k^2+61\,H^4\,k^4\right)U\Big)+\\
&\qquad 6\,k^2\Big(9\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,+52\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\Big)\Big)\,\text{dt}^3\Big)\Big/\Big(96\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{9/2}\Big)-\\
&\Big(\Big(k^7\Big(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\left(3+H^2\,k^2\right)U\Big)^3\Big(576\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+64\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+\\
&\qquad g\,H\Big(225\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\sqrt{3}\,\left(693+450\,H^2\,k^2+73\,H^4\,k^4\right)U\Big)+\\
&\qquad 3\,k^2\Big(21\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,+128\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\Big)\Big)\Big)\\
&\quad \text{dt}^4\Big)\Big/\Big(96\Big(\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{11/2}\Big)\Big)+O[\text{dt}]^5\Big)\,\text{dx}^2+\\
&\Big(-\Big(\Big(i\,k^4\Big(\sqrt{3}\,g\,H\left(33+7\,H^2\,k^2\right)+16\Big(3\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,\Big)U\Big)\Big)\Big/\\
&\qquad\Big(384\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{3/2}\Big)\Big)+\\
&\quad\Big(k^5\Big(g\,H\Big(72\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\sqrt{3}\,\left(207+126\,H^2\,k^2+19\,H^4\,k^4\right)U\Big)+\\
&\qquad 16\Big(9\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+\\
&\qquad\quad k^2\Big(\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,+6\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\Big)\Big)\Big)\,\text{dt}\Big)\Big/\Big(128\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\Big)+\\
&\Big(i\,k^6\Big(9\sqrt{3}\,g^2\,H^2\left(13+3\,H^2\,k^2\right)+5\,g\,H\,U\Big(96\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\sqrt{3}\,\left(129+82\,H^2\,k^2+13\,H^4\,k^4\right)U\Big)+\\
&\qquad 32\Big(9\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^3+k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^3+2\,k^2\Big(2\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,U+\\
&\qquad\quad 3\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^3\Big)\Big)\Big)\,\text{dt}^2\Big)\Big/\Big(128\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\Big)-\\
&\Big(\Big(k^7\Big(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\left(3+H^2\,k^2\right)U\Big)\Big(24\sqrt{3}\,g^2\,H^2\left(21+5\,H^2\,k^2\right)+\\
&\qquad 3\,g\,H\,U\Big(717\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\sqrt{3}\,\left(1011+646\,H^2\,k^2+103\,H^4\,k^4\right)U\Big)+\\
&\qquad 5\Big(288\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^3+32\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^3+\\
&\qquad\quad 3\,k^2\Big(39\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,U+64\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^3\Big)\Big)\Big)\Big)\,\text{dt}^3\Big)\Big/\\
&\quad\Big(384\Big(\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{7/2}\Big)\Big)-\Big(i\,k^8\Big(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\left(3+H^2\,k^2\right)U\Big)^2\\
&\qquad\Big(5\sqrt{3}\,g^2\,H^2\left(45+11\,H^2\,k^2\right)+720\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^3+80\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^3+\\
&\qquad g\,H\,U\Big(990\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+\sqrt{3}\,\left(1449+930\,H^2\,k^2+149\,H^4\,k^4\right)U\Big)+\\
&\qquad 2\,k^2\Big(137\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,U+240\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^3\Big)\Big)\\
&\quad \text{dt}^4\Big)\Big/\Big(128\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{9/2}\Big)+O[\text{dt}]^5\Big)\,\text{dx}^3+\\
&\Big(\Big(k^5\Big(3\sqrt{3}\,g\,H\left(543+146\,H^2\,k^2+15\,H^4\,k^4\right)+256\Big(9\sqrt{g\,H\left(3+H^2\,k^2\right)}\,+6\,k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,+
\end{aligned}
$$

$$k^4 \sqrt{g H^9 \left(3 + H^2 k^2\right)}\ \Big) U\Big)\Big)\Big/\Big(30\,720 \sqrt{g H}\ \left(3 + H^2 k^2\right)^{5/2}\Big) +$$

$$\Big(i k^6 \Big(3 g H \Big(18\,432 \sqrt{g H \left(3 + H^2 k^2\right)}\ + 51\,039 \sqrt{3}\ U + 45\,735 \sqrt{3}\ H^2 k^2 U +$$

$$1381 \sqrt{3}\ H^6 k^6 U + k^4 \Big(960 \sqrt{g H^9 \left(3 + H^2 k^2\right)}\ + 13\,717 \sqrt{3}\ H^4 U\Big)\Big) +$$

$$128 \Big(837 \sqrt{g H \left(3 + H^2 k^2\right)}\ U^2 + 279 k^4 \sqrt{g H^9 \left(3 + H^2 k^2\right)}\ U^2 + 31 k^6 \sqrt{g H^{13} \left(3 + H^2 k^2\right)}\ U^2 +$$

$$27 k^2 \Big(7 \sqrt{g^3 H^7 \left(3 + H^2 k^2\right)}\ + 31 \sqrt{g H^5 \left(3 + H^2 k^2\right)}\ U^2\Big)\Big)\Big) dt\Big)\Big/$$

$$\Big(92\,160 \sqrt{g H}\ \left(3 + H^2 k^2\right)^{7/2}\Big) - \Big(\Big(k^7 \Big(9 \sqrt{3}\ g^2 H^2 \left(12\,999 + 6258 H^2 k^2 + 775 H^4 k^4\right) +$$

$$g H U \Big(617\,661 \sqrt{3}\ H^2 k^2 U + 20\,551 \sqrt{3}\ H^6 k^6 U + 81 \Big(5888 \sqrt{g H \left(3 + H^2 k^2\right)}\ +$$

$$8053 \sqrt{3}\ U\Big) + 3 k^4 \Big(12\,288 \sqrt{g H^9 \left(3 + H^2 k^2\right)}\ + 65\,021 \sqrt{3}\ H^4 U\Big)\Big) +$$

$$128 \Big(2322 \sqrt{g H \left(3 + H^2 k^2\right)}\ U^3 + 774 k^4 \sqrt{g H^9 \left(3 + H^2 k^2\right)}\ U^3 + 86 k^6 \sqrt{g H^{13} \left(3 + H^2 k^2\right)}$$

$$U^3 + 9 k^2 \Big(229 \sqrt{g^3 H^7 \left(3 + H^2 k^2\right)}\ U + 258 \sqrt{g H^5 \left(3 + H^2 k^2\right)}\ U^3\Big)\Big)\Big)\Big)$$

$$dt^2\Big)\Big/\Big(92\,160 \Big(\sqrt{g H}\ \left(3 + H^2 k^2\right)^{7/2}\Big)\Big) - \frac{1}{30\,720 \sqrt{g H}\ \left(3+H^2 k^2\right)^{9/2}}$$

$$i k^8 \Big(k^8 U^3 \Big(21\,253 \sqrt{3}\ g H^9 + 7776 \sqrt{g H^{17} \left(3 + H^2 k^2\right)}\ U\Big) +$$

$$243 \Big(832 \sqrt{g^5 H^5 \left(3 + H^2 k^2\right)}\ + 4423 \sqrt{3}\ g^2 H^2 U + 2592 \sqrt{g H \left(3 + H^2 k^2\right)}\ U^4 +$$

$$g H U^2 \Big(8832 \sqrt{g H \left(3 + H^2 k^2\right)}\ + 7823 \sqrt{3}\ U\Big)\Big) + 3 k^6 U \Big(9181 \sqrt{3}\ g^2 H^8 +$$

$$31\,104 \sqrt{g H^{13} \left(3 + H^2 k^2\right)}\ U^3 + 4 g H^7 U \Big(5312 \sqrt{g H \left(3 + H^2 k^2\right)}\ + 21\,787 \sqrt{3}\ U\Big)\Big) +$$

$$27 k^2 \Big(35\,319 \sqrt{3}\ g^2 H^4 U + 91\,580 \sqrt{3}\ g H^3 U^3 +$$

$$64 \Big(59 \sqrt{g^5 H^9 \left(3 + H^2 k^2\right)}\ + 1155 \sqrt{g^3 H^7 \left(3 + H^2 k^2\right)}\ U^2 + 486 \sqrt{g H^5 \left(3 + H^2 k^2\right)}\ U^4\Big)\Big) +$$

$$9 k^4 \Big(31\,231 \sqrt{3}\ g^2 H^6 U + 2 g H^5 U^2 \Big(34\,336 \sqrt{g H \left(3 + H^2 k^2\right)}\ + 67\,003 \sqrt{3}\ U\Big) +$$

$$288 \Big(5 \sqrt{g^5 H^{13} \left(3 + H^2 k^2\right)}\ + 162 \sqrt{g H^9 \left(3 + H^2 k^2\right)}\ U^4\Big)\Big)\Big) dt^3 +$$

$$\frac{1}{92\,160 \sqrt{g H}\ \left(3+H^2 k^2\right)^{11/2}} k^9 \Big(\sqrt{3}\ \sqrt{g H \left(3 + H^2 k^2\right)}\ + \left(3 + H^2 k^2\right) U\Big)$$

$$\Big(k^8 U^3 \Big(111\,559 \sqrt{3}\ g H^9 + 42\,368 \sqrt{g H^{17} \left(3 + H^2 k^2\right)}\ U\Big) +$$

$$27 k^2 \Big(18\,078 \sqrt{g^5 H^9 \left(3 + H^2 k^2\right)}\ + 172\,047 \sqrt{3}\ g^2 H^4 U + 372\,075 \sqrt{g^3 H^7 \left(3 + H^2 k^2\right)}\ U^2 +$$

$$477\,940 \sqrt{3}\ g H^3 U^3 + 169\,472 \sqrt{g H^5 \left(3 + H^2 k^2\right)}\ U^4\Big) +$$

$$81 \Big(11\,603 \sqrt{g^5 H^5 \left(3 + H^2 k^2\right)}\ + 63\,917 \sqrt{3}\ g^2 H^2 U + 42\,368 \sqrt{g H \left(3 + H^2 k^2\right)}\ U^4 +$$

$$g H U^2 \Big(132\,513 \sqrt{g H \left(3 + H^2 k^2\right)}\ + 122\,207 \sqrt{3}\ U\Big)\Big) + 3 k^6 U \Big(45\,573 \sqrt{3}\ g^2 H^8 +$$

$$169\,472 \sqrt{g H^{13} \left(3 + H^2 k^2\right)}\ U^3 + g H^7 U \Big(108\,089 \sqrt{g H \left(3 + H^2 k^2\right)}\ + 456\,644 \sqrt{3}\ U\Big) +$$

$$9 k^4 \Big(7035 \sqrt{g^5 H^{13} \left(3 + H^2 k^2\right)}\ + 153\,703 \sqrt{3}\ g^2 H^6 U + 254\,208 \sqrt{g H^9 \left(3 + H^2 k^2\right)}\ U^4 +$$

$$9\,k^3\left(7035\sqrt{g^2H^2\left(3+H^2k^2\right)}+153\,703\sqrt{3}\,g^2H^2U+254\,208\sqrt{gH^2\left(3+H^2k^2\right)}\,U^2+\right.$$
$$\left.gH^5U^2\left(347\,651\sqrt{gH\left(3+H^2k^2\right)}+700\,818\sqrt{3}\,U\right)\right)\Big)dt^4+O[dt]^5\Big)dx^4+O[dx]^5,$$

$$\left(\frac{i\left(-\sqrt{3}\,k\sqrt{gH\left(3+H^2k^2\right)}+3kU+H^2k^3U\right)^2dt}{2\left(3+H^2k^2\right)^2}-\frac{1}{3\left(3+H^2k^2\right)^2}\Big(k^3\left(-\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+\left(3+H^2k^2\right)U\right)\right.$$
$$\left.\left(3gH+U\left(-2\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+\left(3+H^2k^2\right)U\right)\right)\Big)dt^2-$$
$$\frac{1}{4\left(3+H^2k^2\right)^3}ik^4\left(-\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+\left(3+H^2k^2\right)U\right)$$
$$\left(3gH\left(-\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+3\left(3+H^2k^2\right)U\right)+\right.$$
$$\left.U^2\left(-9\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+9U+H^4k^4U-3k^2\left(\sqrt{3}\,\sqrt{gH^5\left(3+H^2k^2\right)}-2H^2U\right)\right)\right)dt^3+$$
$$\frac{1}{5\left(3+H^2k^2\right)^3}k^5\left(-\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+\left(3+H^2k^2\right)U\right)$$
$$\left(9g^2H^2+6gHU\left(-2\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+3\left(3+H^2k^2\right)U\right)+\right.$$
$$\left.U^3\left(-12\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+9U+H^4k^4U+k^2\left(-4\sqrt{3}\,\sqrt{gH^5\left(3+H^2k^2\right)}+6H^2U\right)\right)\right)dt^4+O[$$
$$dt]^5\Bigg)+$$

$$\left(-\frac{1}{4}ik^2\left(\sqrt{3}\,\sqrt{\frac{gH}{3+H^2k^2}}-2U\right)+\frac{k^3\left(-\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+\left(3+H^2k^2\right)U\right)\left(\sqrt{3}\,gH-2\sqrt{gH\left(3+H^2k^2\right)}\,U\right)dt}{4\sqrt{gH}\,\left(3+H^2k^2\right)^{3/2}}+\right.$$
$$\left(ik^4\left(\sqrt{3}\,gH-2\sqrt{gH\left(3+H^2k^2\right)}\,U\right)\left(3gH+U\left(-2\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+\left(3+H^2k^2\right)U\right)\right)dt^2\right)\Big/$$
$$\left(4\sqrt{gH}\,\left(3+H^2k^2\right)^{3/2}\right)-$$
$$\left(\left(k^5\left(\sqrt{3}\,gH-2\sqrt{gH\left(3+H^2k^2\right)}\,U\right)\left(3gH\left(-\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+3\left(3+H^2k^2\right)U\right)+\right.\right.\right.$$
$$\left.\left.\left.U^2\left(-9\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+9U+H^4k^4U-3k^2\left(\sqrt{3}\,\sqrt{gH^5\left(3+H^2k^2\right)}-2H^2U\right)\right)\right)\right)$$
$$dt^3\Big)\Big/\left(4\left(\sqrt{gH}\,\left(3+H^2k^2\right)^{5/2}\right)\right)-\left(ik^6\left(\sqrt{3}\,gH-2\sqrt{gH\left(3+H^2k^2\right)}\,U\right)\right.$$
$$\left(9g^2H^2+6gHU\left(-2\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+3\left(3+H^2k^2\right)U\right)+\right.$$
$$\left.U^3\left(-12\sqrt{3}\,\sqrt{gH\left(3+H^2k^2\right)}+9U+H^4k^4U+k^2\left(-4\sqrt{3}\,\sqrt{gH^5\left(3+H^2k^2\right)}+6H^2U\right)\right)\right)$$
$$\left.dt^4\Big)\Big/\left(4\sqrt{gH}\,\left(3+H^2k^2\right)^{5/2}\right)+O[dt]^5\right)dx+$$

$$\left(k^3\left(3\sqrt{3}\,gH\left(13+3H^2k^2\right)-16\left(3\sqrt{gH\left(3+H^2k^2\right)}\,U+k^2\sqrt{gH^5\left(3+H^2k^2\right)}\,U\right)\right)\right.$$

$$\left(\frac{\left(\right.}{96\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{3/2}}+\right.$$

$$\left(i\,k^4\left(g\,H\left(-144\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\,\left(369+234\,H^2\,k^2+37\,H^4\,k^4\right)U\right)-\right.\right.$$
$$4\left(63\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+7\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+\right.$$
$$\left.\left.\left.3\,k^2\left(3\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+14\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\right)\right)\right)dt\Big)\Big/\left(96\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\right)-$$
$$\left(\left(k^5\left(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}-\left(3+H^2\,k^2\right)U\right)\left(g\,H\left(171\sqrt{g\,H\left(3+H^2\,k^2\right)}-\sqrt{3}\,\left(477+306\,H^2\,k^2+\right.\right.\right.\right.$$
$$\left.\left.\left.\left.49\,H^4\,k^4\right)U\right)+5\left(72\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+8\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+\right.\right.\right.$$
$$\left.\left.\left.3\,k^2\left(3\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+16\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\right)\right)\right)\right)dt^2\Big)\Big/$$
$$\left(96\left(\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{7/2}\right)\right)+\left(i\,k^6\left(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}-\left(3+H^2\,k^2\right)U\right)^2\right.$$
$$\left(468\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+52\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+\right.$$
$$g\,H\left(198\sqrt{g\,H\left(3+H^2\,k^2\right)}-\sqrt{3}\,\left(585+378\,H^2\,k^2+61\,H^4\,k^4\right)U\right)+$$
$$\left.6\,k^2\left(9\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+52\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\right)\right)dt^3\Big)\Big/\left(96\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{9/2}\right)+$$
$$\left(k^7\left(\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}-\left(3+H^2\,k^2\right)U\right)^3\left(576\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+64\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+\right.$$
$$g\,H\left(225\sqrt{g\,H\left(3+H^2\,k^2\right)}-\sqrt{3}\,\left(693+450\,H^2\,k^2+73\,H^4\,k^4\right)U\right)+$$
$$\left.3\,k^2\left(21\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+128\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\right)\right)dt^4\Big)\Big/\left(96\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{11/2}\right)+$$

$$O[dt]^5\Bigg)dx^2+\left(\frac{i\,k^4\left(\sqrt{3}\,g\,H\left(33+7\,H^2\,k^2\right)-16\left(3\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U+k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U\right)\right)}{384\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{3/2}}+\right.$$

$$\left(k^5\left(g\,H\left(72\sqrt{g\,H\left(3+H^2\,k^2\right)}-\sqrt{3}\,\left(207+126\,H^2\,k^2+19\,H^4\,k^4\right)U\right)+16\left(9\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^2+\right.\right.\right.$$
$$\left.\left.\left.k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^2+k^2\left(\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+6\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^2\right)\right)\right)dt\Big)\Big/$$
$$\left(128\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\right)+\left(i\,k^6\left(-9\sqrt{3}\,g^2\,H^2\left(13+3\,H^2\,k^2\right)-\right.\right.$$
$$5\,g\,H\,U\left(-96\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\,\left(129+82\,H^2\,k^2+13\,H^4\,k^4\right)U\right)+$$
$$32\left(9\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^3+k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^3+2\,k^2\left(2\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,U+\right.\right.$$
$$\left.\left.\left.3\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\,U^3\right)\right)\right)dt^2\Big)\Big/\left(128\sqrt{g\,H}\,\left(3+H^2\,k^2\right)^{5/2}\right)+$$
$$\left(k^7\left(-\sqrt{3}\,\sqrt{g\,H\left(3+H^2\,k^2\right)}+\left(3+H^2\,k^2\right)U\right)\left(24\sqrt{3}\,g^2\,H^2\left(21+5\,H^2\,k^2\right)+\right.\right.$$
$$3\,g\,H\,U\left(-717\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\,\left(1011+646\,H^2\,k^2+103\,H^4\,k^4\right)U\right)-$$
$$5\left(288\sqrt{g\,H\left(3+H^2\,k^2\right)}\,U^3+32\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\,U^3+3\,k^2\left(39\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\,U+\right.\right.$$

$$64\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^3\Big)\Big)\Big)\,dt^3\Big)\Big/\Big(384\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{7/2}\Big)+$$
$$\Big(i\,k^8\Big(\sqrt{3}\;\sqrt{g\,H\left(3+H^2\,k^2\right)}-\left(3+H^2\,k^2\right)U\Big)^2\Big(5\sqrt{3}\;g^2\,H^2\left(45+11\,H^2\,k^2\right)+$$
$$g\,H\,U\Big(-990\sqrt{g\,H\left(3+H^2\,k^2\right)}+\sqrt{3}\;\left(1449+930\,H^2\,k^2+149\,H^4\,k^4\right)U\Big)-$$
$$2\Big(360\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^3+40\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\;U^3+k^2\Big(137\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U+$$
$$240\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^3\Big)\Big)\Big)\,dt^4\Big)\Big/\Big(128\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{9/2}\Big)+O[dt]^5\Bigg)\,dx^3+$$
$$\Big(\Big(k^5\Big(-3\sqrt{3}\;g\,H\left(543+146\,H^2\,k^2+15\,H^4\,k^4\right)+256\Big(9\sqrt{g\,H\left(3+H^2\,k^2\right)}+6\,k^2\sqrt{g\,H^5\left(3+H^2\,k^2\right)}+$$
$$k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\Big)U\Big)\Big)\Big/\Big(30\,720\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{5/2}\Big)+$$
$$\Big(i\,k^6\Big(-3\,g\,H\Big(-18\,432\sqrt{g\,H\left(3+H^2\,k^2\right)}+51\,039\sqrt{3}\;U+45\,735\sqrt{3}\;H^2\,k^2\,U+$$
$$1381\sqrt{3}\;H^6\,k^6\,U+k^4\Big(-960\sqrt{g\,H^9\left(3+H^2\,k^2\right)}+13\,717\sqrt{3}\;H^4\,U\Big)\Big)+$$
$$128\Big(837\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^2+279\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\;U^2+31\,k^6\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\;U^2+$$
$$27\,k^2\Big(7\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}+31\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^2\Big)\Big)\Big)\,dt\Big)\Big/$$
$$\Big(92\,160\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{7/2}\Big)+\Big(k^7\Big(9\sqrt{3}\;g^2\,H^2\left(12\,999+6258\,H^2\,k^2+775\,H^4\,k^4\right)+$$
$$g\,H\,U\Big(617\,661\sqrt{3}\;H^2\,k^2\,U+20\,551\sqrt{3}\;H^6\,k^6\,U+81\Big(-5888\sqrt{g\,H\left(3+H^2\,k^2\right)}+$$
$$8053\sqrt{3}\;U\Big)-3\,k^4\Big(12\,288\sqrt{g\,H^9\left(3+H^2\,k^2\right)}-65\,021\sqrt{3}\;H^4\,U\Big)\Big)-$$
$$128\Big(2322\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^3+774\,k^4\sqrt{g\,H^9\left(3+H^2\,k^2\right)}\;U^3+86\,k^6\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\;U^3+$$
$$9\,k^2\Big(229\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U+258\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^3\Big)\Big)\Big)\,dt^2\Big)\Big/$$
$$\Big(92\,160\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{7/2}\Big)-\frac{1}{30\,720\sqrt{g\,H}\;\left(3+H^2\,k^2\right)^{9/2}}i\,k^8$$
$$\Big(k^8\,U^3\Big(-21\,253\sqrt{3}\;g\,H^9+7776\sqrt{g\,H^{17}\left(3+H^2\,k^2\right)}\;U\Big)+$$
$$243\Big(832\sqrt{g^5\,H^5\left(3+H^2\,k^2\right)}-4423\sqrt{3}\;g^2\,H^2\,U+2592\sqrt{g\,H\left(3+H^2\,k^2\right)}\;U^4+$$
$$g\,H\,U^2\Big(8832\sqrt{g\,H\left(3+H^2\,k^2\right)}-7823\sqrt{3}\;U\Big)\Big)-3\,k^6\,U\Big(9181\sqrt{3}\;g^2\,H^8-$$
$$31\,104\sqrt{g\,H^{13}\left(3+H^2\,k^2\right)}\;U^3+4\,g\,H^7\,U\Big(-5312\sqrt{g\,H\left(3+H^2\,k^2\right)}+21\,787\sqrt{3}\;U\Big)\Big)+$$
$$27\,k^2\Big(-35\,319\sqrt{3}\;g^2\,H^4\,U-91\,580\sqrt{3}\;g\,H^3\,U^3+$$
$$64\Big(59\sqrt{g^5\,H^9\left(3+H^2\,k^2\right)}+1155\sqrt{g^3\,H^7\left(3+H^2\,k^2\right)}\;U^2+486\sqrt{g\,H^5\left(3+H^2\,k^2\right)}\;U^4\Big)\Big)+$$
$$9\,k^4\Big(-31\,231\sqrt{3}\;g^2\,H^6\,U+2\,g\,H^5\,U^2\Big(34\,336\sqrt{g\,H\left(3+H^2\,k^2\right)}-67\,003\sqrt{3}\;U\Big)+$$
$$288\Big(5\sqrt{5\,H^{13}\left(3+H^2\,k^2\right)}-162\sqrt{H^9\left(3+H^2\,k^2\right)}\;U^4\Big)\Big)\Big)\,k^3\qquad\frac{1}{}$$

$$288\left(5\sqrt{g^{3}H^{15}\left(3+H^2k^2\right)}+162\sqrt{gH^{7}\left(3+H^2k^2\right)}\,U^{4}\right)\Bigg)\Bigg)\,dt^{3}-\frac{}{92\,160\left(\sqrt{g\,H}\,\left(3+H^2k^2\right)^{11/2}\right)}$$

$$\left(k^9\left(\sqrt{3}\,\sqrt{g\,H\left(3+H^2k^2\right)}-\left(3+H^2k^2\right)U\right)\left(k^8U^3\left(-111\,559\sqrt{3}\,g\,H^9+42\,368\sqrt{g\,H^{17}\left(3+H^2k^2\right)}\,U\right)+\right.\right.$$

$$27k^2\left(18\,078\sqrt{g^5H^9\left(3+H^2k^2\right)}-172\,047\sqrt{3}\,g^2H^4U+372\,075\sqrt{g^3H^7\left(3+H^2k^2\right)}\,U^2-\right.$$

$$\left.477\,940\sqrt{3}\,g\,H^3U^3+169\,472\sqrt{g\,H^5\left(3+H^2k^2\right)}\,U^4\right)+$$

$$9k^4\left(7035\sqrt{g^5H^{13}\left(3+H^2k^2\right)}-153\,703\sqrt{3}\,g^2H^6U+254\,208\sqrt{g\,H^9\left(3+H^2k^2\right)}\,U^4+\right.$$

$$\left.g\,H^5U^2\left(347\,651\sqrt{g\,H\left(3+H^2k^2\right)}-700\,818\sqrt{3}\,U\right)\right)+$$

$$81\left(11\,603\sqrt{g^5H^5\left(3+H^2k^2\right)}-63\,917\sqrt{3}\,g^2H^2U+42\,368\sqrt{g\,H\left(3+H^2k^2\right)}\,U^4+\right.$$

$$\left.g\,H\,U^2\left(132\,513\sqrt{g\,H\left(3+H^2k^2\right)}-122\,207\sqrt{3}\,U\right)\right)-$$

$$3k^6U\left(45\,573\sqrt{3}\,g^2H^8-169\,472\sqrt{g\,H^{13}\left(3+H^2k^2\right)}\,U^3+\right.$$

$$\left.\left.\left.\left.g\,H^7U\left(-108\,089\sqrt{g\,H\left(3+H^2k^2\right)}+456\,644\sqrt{3}\,U\right)\right)\right)\right)dt^4+O[dt]^5\right)dx^4+O[dx]^5\Big\}$$

Out[260]= Omega error ||

\left\{\left(\frac{i \left(H^2 U k^3+3 U k+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} k\right)^2 \text{dt}}{2 \left(H^2 k^2+3\right)^2}−\frac{\left(k^3 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^2}{3 \left(H^2 k^2+3\right)^2}−\frac{i k^4 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+3 \left(2 U H^2+\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 \left(U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) U^2+3 g \left(3 k^2 U H^3+9 U H+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} H\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^3}+\frac{k^5 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+2 \left(3 U H^2+2 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U+12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{5 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right)+\left(\frac{1}{4} i k^2 \left(2 U+\sqrt{3} \sqrt{\frac{g H}{H^2 k^2+3}}\right)−\frac{\left(k^3 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\sqrt{3} g H+2 \sqrt{g H \left(H^2 k^2+3\right)} U\right)\right) \text{dt}}{4 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{3/2}\right)}−\frac{i k^4 \left(\sqrt{3} g H+2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{k^5 \left(\sqrt{3} g H+2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(\left(H^4 U k^4+3 \left(2 U H^2+\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 \left(U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) U^2+3 g \left(3 k^2 U H^3+9 U H+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} H\right)\right) \text{dt}^3}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(\sqrt{3} g H+2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(\left(H^4 U k^4+2 \left(3 U H^2+2 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U+12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(−\frac{k^3 \left(3 \sqrt{3} g H \left(3 H^2 k^2+13\right)+16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+3 \sqrt{g H \left(H^2 k^2+3\right)}\right)

k^2+15\right)+16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+3 \sqrt{g H \left(H^2 k^2+3\right)}\right)
U\right)}{96 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{3/2}\right)}−\frac{i k^4 \left(g H \left(\sqrt{3} \left(37
H^4 k^4+234 H^2 k^2+369\right) U+144 \sqrt{g H \left(H^2 k^2+3\right)}\right)+4 \left(7 \sqrt{g H^9
\left(H^2 k^2+3\right)} U^2 k^4+3 \left(14 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+3 \sqrt{g^3 H^7
\left(H^2 k^2+3\right)}\right) k^2+63 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{96
\sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{k^5 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H
\left(H^2 k^2+3\right)}\right) \left(g H \left(\sqrt{3} \left(49 H^4 k^4+306 H^2 k^2+477\right) U+171
\sqrt{g H \left(H^2 k^2+3\right)}\right)+5 \left(8 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(16
\sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+3 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+72 \sqrt{g H
\left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}^2}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}+\frac{i
k^6 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)^2 \left(52 \sqrt{g H^9
\left(H^2 k^2+3\right)} U^2 k^4+6 \left(52 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+9 \sqrt{g^3 H^7
\left(H^2 k^2+3\right)}\right) k^2+468 \sqrt{g H \left(H^2 k^2+3\right)} U^2+g H \left(\sqrt{3} \left(61
H^4 k^4+378 H^2 k^2+585\right) U+198 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{96
\sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}−\frac{\left(k^7 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g
H \left(H^2 k^2+3\right)}\right)^3 \left(64 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(128
\sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+21 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+576
\sqrt{g H \left(H^2 k^2+3\right)} U^2+g H \left(\sqrt{3} \left(73 H^4 k^4+450 H^2 k^2+693\right)
U+225 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^4}{96 \left(\sqrt{g H} \left(H^2
k^2+3\right)^{11/2}\right)}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(−\frac{i k^4 \left(\sqrt{3}
g H \left(7 H^2 k^2+33\right)+16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+3 \sqrt{g H \left(H^2
k^2+3\right)}\right) U\right)}{384 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{k^5 \left(g H \left(\sqrt{3}
\left(19 H^4 k^4+126 H^2 k^2+207\right) U+72 \sqrt{g H \left(H^2 k^2+3\right)}\right)+16 \left(\sqrt{g
H^9 \left(H^2 k^2+3\right)} U^2 k^4+\left(6 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+\sqrt{g^3 H^7
\left(H^2 k^2+3\right)}\right) k^2+9 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{128
\sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(9 \sqrt{3} g^2 \left(3 H^2 k^2+13\right) H^2+5
g U \left(\sqrt{3} \left(13 H^4 k^4+82 H^2 k^2+129\right) U+96 \sqrt{g H \left(H^2 k^2+3\right)}\right)
H+32 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+2 \left(3 \sqrt{g H^5 \left(H^2 k^2+3\right)}
U^3+2 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+9 \sqrt{g H \left(H^2 k^2+3\right)}
U^3\right)\right) \text{dt}^2}{128 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}−\frac{\left(k^7 \left(\left(H^2
k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(24 \sqrt{3} g^2 \left(5 H^2
k^2+21\right) H^2+3 g U \left(\sqrt{3} \left(103 H^4 k^4+646 H^2 k^2+1011\right) U+717 \sqrt{g
H \left(H^2 k^2+3\right)}\right) H+5 \left(32 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+3 \left(64
\sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+39 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+288
\sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right)\right) \text{dt}^3}{384 \left(\sqrt{g H} \left(H^2
k^2+3\right)^{7/2}\right)}−\frac{i k^8 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2
k^2+3\right)}\right)^2 \left(80 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+2 \left(240 \sqrt{g H^5
\left(H^2 k^2+3\right)} U^3+137 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+720 \sqrt{g H
\left(H^2 k^2+3\right)} U^3+5 \sqrt{3} g^2 H^2 \left(11 H^2 k^2+45\right)+g H U \left(\sqrt{3} \left(149
H^4 k^4+930 H^2 k^2+1449\right) U+990 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^4}{128
\sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(\frac{k^5 \left(3
\sqrt{3} g H \left(15 H^4 k^4+146 H^2 k^2+543\right)+256 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)}
k^4+6 \sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+9 \sqrt{g H \left(H^2 k^2+3\right)}\right) U\right)}{30720
\sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(3 g H \left(1381 \sqrt{3} H^6 U k^6+\left(13717

\sqrt{3} U H^4+960 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+45735 \sqrt{3} H^2 U k^2+51039 \sqrt{3} U+18432 \sqrt{g H \left(H^2 k^2+3\right)}\right)+128 \left(31 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^2 k^6+279 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+27 \left(31 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+7 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+837 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{92160 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}−\frac{\left(k^7 \left(9 \sqrt{3} g^2 \left(775 H^4 k^4+6258 H^2 k^2+12999\right) H^2+g U \left(20551 \sqrt{3} H^6 U k^6+3 \left(65021 \sqrt{3} U H^4+12288 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+617661 \sqrt{3} H^2 U k^2+81 \left(8053 \sqrt{3} U+5888 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) H+128 \left(86 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3 k^6+774 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+9 \left(258 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+229 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+2322 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right)\right) \text{dt}^2}{92160 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{7/2}\right)}−\frac{i k^8 \left(U^3 \left(21253 \sqrt{3} g H^9+7776 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U\right) k^8+3 U \left(9181 \sqrt{3} g^2 H^8+4 g U \left(21787 \sqrt{3} U+5312 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7+31104 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3\right) k^6+9 \left(31231 \sqrt{3} g^2 U H^6+2 g U^2 \left(67003 \sqrt{3} U+34336 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+288 \left(162 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+5 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right)\right) k^4+27 \left(35319 \sqrt{3} g^2 U H^4+91580 \sqrt{3} g U^3 H^3+64 \left(486 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+1155 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+59 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right)\right) k^2+243 \left(2592 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(7823 \sqrt{3} U+8832 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+4423 \sqrt{3} g^2 H^2 U+832 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{30720 \sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}+\frac{k^9 \left(\left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(U^3 \left(111559 \sqrt{3} g H^9+42368 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U\right) k^8+3 U \left(45573 \sqrt{3} g^2 H^8+g U \left(456644 \sqrt{3} U+108089 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7+169472 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3\right) k^6+9 \left(153703 \sqrt{3} g^2 U H^6+g U^2 \left(700818 \sqrt{3} U+347651 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^5+254208 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+7035 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right) k^4+27 \left(172047 \sqrt{3} g^2 U H^4+477940 \sqrt{3} g U^3 H^3+169472 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+372075 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+18078 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+81 \left(42368 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(122207 \sqrt{3} U+132513 \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+63917 \sqrt{3} g^2 H^2 U+11603 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^4}{92160 \sqrt{g H} \left(H^2 k^2+3\right)^{11/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right),\left(\frac{i \left(H^2 U k^3+3 U k−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} k\right)^2 \text{dt}}{2 \left(H^2 k^2+3\right)^2}−\frac{\left(k^3 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^2}{3 \left(H^2 k^2+3\right)^2}−\frac{i k^4 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4−3 \left(\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}−2 H^2 U\right) k^2+9 U−9 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+3 g H \left(3 \left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{4 \left(H^2 k^2+3\right)^3}+\frac{k^5 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\left(H^4 U k^4+\left(6 H^2 U−4 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U−12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right)

U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{5 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right)+\left(−\frac{1}{4} i k^2 \left(\sqrt{3} \sqrt{\frac{g H}{H^2 k^2+3}}−2 U\right)+\frac{k^3 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(\sqrt{3} g H−2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \text{dt}}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{i k^4 \left(\sqrt{3} g H−2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(3 g H+U \left(\left(H^2 k^2+3\right) U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}^2}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}−\frac{\left(k^5 \left(\sqrt{3} g H−2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(\left(H^4 U k^4−3 \left(\sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}−2 H^2 U\right) k^2+9 U−9 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+3 g H \left(3 \left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^3}{4 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{5/2}\right)}−\frac{i k^6 \left(\sqrt{3} g H−2 \sqrt{g H \left(H^2 k^2+3\right)} U\right) \left(\left(H^4 U k^4+\left(6 H^2 U−4 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) k^2+9 U−12 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^3+6 g H \left(3 \left(H^2 k^2+3\right) U−2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U+9 g^2 H^2\right) \text{dt}^4}{4 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{k^3 \left(3 \sqrt{3} g H \left(3 H^2 k^2+13\right)−16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} U k^2+3 \sqrt{g H \left(H^2 k^2+3\right)} U\right)\right)}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{i k^4 \left(g H \left(\sqrt{3} \left(37 H^4 k^4+234 H^2 k^2+369\right) U−144 \sqrt{g H \left(H^2 k^2+3\right)}\right)−4 \left(7 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(14 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+3 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+63 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}−\frac{\left(k^5 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}−\left(H^2 k^2+3\right) U\right) \left(g H \left(171 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} \left(49 H^4 k^4+306 H^2 k^2+477\right) U\right)+5 \left(8 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(16 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+3 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+72 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right)\right) \text{dt}^2}{96 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{7/2}\right)}+\frac{i k^6 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}−\left(H^2 k^2+3\right) U\right)^2 \left(52 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+6 \left(52 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+9 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+468 \sqrt{g H \left(H^2 k^2+3\right)} U^2+g H \left(198 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} \left(61 H^4 k^4+378 H^2 k^2+585\right) U\right)\right) \text{dt}^3}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}+\frac{k^7 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}−\left(H^2 k^2+3\right) U\right)^3 \left(64 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+3 \left(128 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+21 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+576 \sqrt{g H \left(H^2 k^2+3\right)} U^2+g H \left(225 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} \left(73 H^4 k^4+450 H^2 k^2+693\right) U\right)\right) \text{dt}^4}{96 \sqrt{g H} \left(H^2 k^2+3\right)^{11/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{i k^4 \left(\sqrt{3} g H \left(7 H^2 k^2+33\right)−16 \left(\sqrt{g H^5 \left(H^2 k^2+3\right)} U k^2+3 \sqrt{g H \left(H^2 k^2+3\right)} U\right)\right)}{384 \sqrt{g H} \left(H^2 k^2+3\right)^{3/2}}+\frac{k^5 \left(g H \left(72 \sqrt{g H \left(H^2 k^2+3\right)}−\sqrt{3} \left(19 H^4 k^4+126 H^2 k^2+207\right) U\right)+16 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+\left(6 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+\sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+9 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)\right) \text{dt}}{128 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(−9 \sqrt{3} g^2 \left(3 H^2 k^2+13\right) H^2−5 g U \left(\sqrt{3} \left(13 H^4 k^4+82 H^2 k^2+129\right) U−96 \sqrt{g H \left(H^2 k^2+3\right)}\right) H+32 \left(\sqrt{g H^9 \left(H^2

k^2+3\right)} U^3 k^4+2 \left(3 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+2 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+9 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^2}{128 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{k^7 \left(\left(H^2 k^2+3\right) U−\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \left(24 \sqrt{3} g^2 \left(5 H^2 k^2+21\right) H^2+3 g U \left(\sqrt{3} \left(103 H^4 k^4+646 H^2 k^2+1011\right) U−717 \sqrt{g H \left(H^2 k^2+3\right)}\right) H−5 \left(32 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+3 \left(64 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+39 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+288 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^3}{384 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}+\frac{i k^8 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}−\left(H^2 k^2+3\right) U\right)^2 \left(5 \sqrt{3} g^2 \left(11 H^2 k^2+45\right) H^2+g U \left(\sqrt{3} \left(149 H^4 k^4+930 H^2 k^2+1449\right) U−990 \sqrt{g H \left(H^2 k^2+3\right)}\right) H−2 \left(40 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+\left(240 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+137 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+360 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^4}{128 \sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(\frac{k^5 \left(256 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} k^4+6 \sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+9 \sqrt{g H \left(H^2 k^2+3\right)}\right) U−3 \sqrt{3} g H \left(15 H^4 k^4+146 H^2 k^2+543\right)\right)}{30720 \sqrt{g H} \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^6 \left(128 \left(31 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^2 k^6+279 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^2 k^4+27 \left(31 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^2+7 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)}\right) k^2+837 \sqrt{g H \left(H^2 k^2+3\right)} U^2\right)−3 g H \left(1381 \sqrt{3} H^6 U k^6+\left(13717 \sqrt{3} H^4 U−960 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+45735 \sqrt{3} H^2 U k^2+51039 \sqrt{3} U−18432 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) \text{dt}}{92160 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}+\frac{k^7 \left(9 \sqrt{3} g^2 \left(775 H^4 k^4+6258 H^2 k^2+12999\right) H^2+g U \left(20551 \sqrt{3} H^6 U k^6−3 \left(12288 \sqrt{g H^9 \left(H^2 k^2+3\right)}−65021 \sqrt{3} H^4 U\right) k^4+617661 \sqrt{3} H^2 U k^2+81 \left(8053 \sqrt{3} U−5888 \sqrt{g H \left(H^2 k^2+3\right)}\right)\right) H−128 \left(86 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3 k^6+774 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+9 \left(258 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^3+229 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+2322 \sqrt{g H \left(H^2 k^2+3\right)} U^3\right)\right) \text{dt}^2}{92160 \sqrt{g H} \left(H^2 k^2+3\right)^{7/2}}−\frac{i k^8 \left(U^3 \left(7776 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U−21253 \sqrt{3} g H^9\right) k^8−3 U \left(9181 \sqrt{3} g^2 H^8+4 g U \left(21787 \sqrt{3} U−5312 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7−31104 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3\right) k^6+9 \left(−31231 \sqrt{3} g^2 U H^6+2 g U^2 \left(34336 \sqrt{g H \left(H^2 k^2+3\right)}−67003 \sqrt{3} U\right) H^5+288 \left(162 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+5 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right)\right) k^4+27 \left(−35319 \sqrt{3} g^2 U H^4−91580 \sqrt{3} g U^3 H^3+64 \left(486 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+1155 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+59 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right)\right) k^2+243 \left(2592 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(8832 \sqrt{g H \left(H^2 k^2+3\right)}−7823 \sqrt{3} U\right) U^2−4423 \sqrt{3} g^2 H^2 U+832 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \text{dt}^3}{30720 \sqrt{g H} \left(H^2 k^2+3\right)^{9/2}}−\frac{\left(k^9 \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}−\left(H^2 k^2+3\right) U\right) \left(U^3 \left(42368 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U−111559 \sqrt{3} g H^9\right) k^8−3 U \left(45573 \sqrt{3} g^2 H^8+g U \left(456644 \sqrt{3} U−108089 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7−169472 \sqrt{g H^{13} \left(H^2 k^2+3\right)} U^3\right) k^6+9 \left(−153703 \sqrt{3} g^2 U H^6+g U^2 \left(347651 \sqrt{g H \left(H^2 k^2+3\right)}−700818 \sqrt{3} U\right) H^5+254208 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+7035 \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)}\right)\right)

H^3+254208 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+7035 \sqrt{g^3 H^{13} \left(H^2 k^2+3\right)}\right) k^4+27 \left(-172047 \sqrt{3} g^2 U H^4-477940 \sqrt{3} g U^3 H^3+169472 \sqrt{g H^5 \left(H^2 k^2+3\right)} U^4+372075 \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U^2+18078 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)}\right) k^2+81 \left(42368 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g H \left(132513 \sqrt{g H \left(H^2 k^2+3\right)}-122207 \sqrt{3} U\right) U^2-63917 \sqrt{3} g^2 H^2 U+11603 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^4}{92160 \left(\sqrt{g H} \left(H^2 k^2+3\right)^{11/2}\right)}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right)\right\}

Out[261]=

Out[262]= EA || $\left\{\left\{1+\frac{i\, e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) H^2\, k^3\, U \text{Csc}\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2\, H^2\, k^2\right) w},\ \frac{i\, e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) H\, k\, \text{Csc}\left[\frac{\text{dx}\,k}{2}\right]}{2\left(H+\frac{H^3\, k^2}{3}\right) w}\right\},\right.$

$\left.\left\{\frac{i\, e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) k\left(g\, H\left(3+H^2\, k^2\right)-3\, U^2\right) \text{Csc}\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2\, H^2\, k^2\right) w},\ 1+\frac{i\, e^{\frac{i\,\text{dx}\,k}{2}}\left(1-e^{-i\,\text{dx}\,k}\right)\left(-1+e^{i\,\text{dt}\,w}\right) k\left(6+H^2\, k^2\right) U \text{Csc}\left[\frac{\text{dx}\,k}{2}\right]}{\left(6+2\, H^2\, k^2\right) w}\right\}\right\}$

Out[263]= EA || \left(
\begin{array}{cc}
 \frac{i e^{\frac{i \text{dx} k}{2}} \left(1-e^{-i \text{dx} k}\right) \left(-1+e^{i \text{dt} w}\right) H^2 U \csc \left(\frac{\text{dx} k}{2}\right) k^3}{\left(2 H^2 k^2+6\right) w}+1 & \frac{i e^{\frac{i \text{dx} k}{2}} \left(1-e^{-i \text{dx} k}\right) \left(-1+e^{i \text{dt} w}\right) H k \csc \left(\frac{\text{dx} k}{2}\right)}{2 \left(\frac{k^2 H^3}{3}+H\right) w} \\
 \frac{i e^{\frac{i \text{dx} k}{2}} \left(1-e^{-i \text{dx} k}\right) \left(-1+e^{i \text{dt} w}\right) k \left(g H \left(H^2 k^2+3\right)-3 U^2\right) \csc \left(\frac{\text{dx} k}{2}\right)}{\left(2 H^2 k^2+6\right) w} & \frac{i e^{\frac{i \text{dx} k}{2}} \left(1-e^{-i \text{dx} k}\right) \left(-1+e^{i \text{dt} w}\right) k \left(H^2 k^2+6\right) U \csc \left(\frac{\text{dx} k}{2}\right)}{\left(2 H^2 k^2+6\right) w}+1 \\
\end{array}
\right)

Out[264]= Eerr ||
$\left\{\left\{\left(-\frac{\left(H^2\, k^3\, U\, w\right) \text{dt}^2}{2\left(3+H^2\, k^2\right)}-\frac{i\, H^2\, k^3\, U\, w^2\, \text{dt}^3}{6\left(3+H^2\, k^2\right)}+\frac{H^2\, k^3\, U\, w^3\, \text{dt}^4}{24\left(3+H^2\, k^2\right)}+O[\text{dt}]^5\right)+\left(\frac{1}{2} k^2\, U\, \text{dt}+O[\text{dt}]^5\right) \text{dx}+\left(\frac{i\left(9\, H^2\, k^5+2\, H^4\, k^7\right) U\, \text{dt}}{12\left(3+H^2\, k^2\right)^2}+O[\text{dt}]^5\right) \text{dx}^2+\right.$
$\left.\left(-\frac{1}{24}\left(k^4\, U\right) \text{dt}+O[\text{dt}]^5\right) \text{dx}^3+\left(-\frac{i\, k^7\left(54\, H^2\, U+19\, H^4\, k^2\, U+2\, H^6\, k^4\, U\right) \text{dt}}{240\left(3+H^2\, k^2\right)^3}+O[\text{dt}]^5\right) \text{dx}^4+O[\text{dx}]^5,\right.$
$\left(-\frac{3\,(k\, w)\, \text{dt}^2}{2\left(3+H^2\, k^2\right)}-\frac{i\, k\, w^2\, \text{dt}^3}{2\left(3+H^2\, k^2\right)}+\frac{k\, w^3\, \text{dt}^4}{8\left(3+H^2\, k^2\right)}+O[\text{dt}]^5\right)+\left(\frac{i\left(6\, k^3+H^2\, k^5\right) \text{dt}}{4\left(3+H^2\, k^2\right)^2}+O[\text{dt}]^5\right) \text{dx}^2+\left(\frac{i\left(-54\, k^5+H^4\, k^9\right) \text{dt}}{240\left(3+H^2\, k^2\right)^3}+O[\text{dt}]^5\right) \text{dx}^4+$
$O[\text{dx}]^5\Big\},\ \Big\{\Big(-\frac{\left(k\left(3\, g\, H+g\, H^3\, k^2-3\, U^2\right) w\right) \text{dt}^2}{2\left(3+H^2\, k^2\right)}-\frac{i\, k\left(3\, g\, H+g\, H^3\, k^2-3\, U^2\right) w^2\, \text{dt}^3}{6\left(3+H^2\, k^2\right)}+\frac{k\left(3\, g\, H+g\, H^3\, k^2-3\, U^2\right) w^3\, \text{dt}^4}{24\left(3+H^2\, k^2\right)}+O[\text{dt}]^5\Big)+$
$\left(\frac{1}{2}\, g\, H\, k^2\, \text{dt}+O[\text{dt}]^5\right) \text{dx}+\left(\frac{i\left(18\, g\, H\, k^3+12\, g\, H^3\, k^5+2\, g\, H^5\, k^7-18\, k^3\, U^2-3\, H^2\, k^5\, U^2\right) \text{dt}}{12\left(3+H^2\, k^2\right)^2}+O[\text{dt}]^5\right) \text{dx}^2+$
$\left(-\frac{1}{24}\left(g\, H\, k^4\right) \text{dt}+O[\text{dt}]^5\right) \text{dx}^3+\left(-\frac{i\left(54\, g\, H\, k^5+54\, g\, H^3\, k^7+18\, g\, H^5\, k^9+2\, g\, H^7\, k^{11}-54\, k^5\, U^2+H^4\, k^9\, U^2\right) \text{dt}}{240\left(3+H^2\, k^2\right)^3}+O[\text{dt}]^5\right) \text{dx}^4+O[\text{dx}]^5,$
$\left(-\frac{\left(k\left(6+H^2\, k^2\right) U\, w\right) \text{dt}^2}{2\left(3+H^2\, k^2\right)}-\frac{i\, k\left(6+H^2\, k^2\right) U\, w^2\, \text{dt}^3}{6\left(3+H^2\, k^2\right)}+\frac{k\left(6+H^2\, k^2\right) U\, w^3\, \text{dt}^4}{24\left(3+H^2\, k^2\right)}+O[\text{dt}]^5\right)+\left(\frac{1}{2} k^2\, U\, \text{dt}+O[\text{dt}]^5\right) \text{dx}+$
$\left(\frac{i\left(36\, k^3+15\, H^2\, k^5+2\, H^4\, k^7\right) U\, \text{dt}}{12\left(3+H^2\, k^2\right)^2}+O[\text{dt}]^5\right) \text{dx}^2+\left(-\frac{1}{24}\left(k^4\, U\right) \text{dt}+O[\text{dt}]^5\right) \text{dx}^3+$
$\left.\left.\left(-\frac{i\left(108\, k^5+54\, H^2\, k^7+17\, H^4\, k^9+2\, H^6\, k^{11}\right) U\, \text{dt}}{240\left(3+H^2\, k^2\right)^3}+O[\text{dt}]^5\right) \text{dx}^4+O[\text{dx}]^5\right\}\right\}$

Out[265]=

$$
\text{Eerr} \parallel \left(
\begin{array}{cc}
\left(-\frac{\left(H^2 k^3 U w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i H^2 k^3 U w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{H^2 k^3 U w^3 \text{dt}^4}{24 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(\frac{1}{2} k^2 U \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 H^4 k^7+9 H^2 k^5\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(-\frac{1}{24} \left(k^4 U\right) \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i k^7 \left(2 k^4 U H^6+19 k^2 U H^4+54 U H^2\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) & \left(-\frac{3 (k w) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i k w^2 \text{dt}^3}{2 \left(H^2 k^2+3\right)}+\frac{k w^3 \text{dt}^4}{8 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(\frac{i \left(H^2 k^5+6 k^3\right) \text{dt}}{4 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(\frac{i \left(H^4 k^9-54 k^5\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) \\
\left(-\frac{\left(k \left(g k^2 H^3+3 g H-3 U^2\right) w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i k \left(g k^2 H^3+3 g H-3 U^2\right) w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{k \left(g k^2 H^3+3 g H-3 U^2\right) w^3 \text{dt}^4}{24 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(\frac{1}{2} g H k^2 \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 g H^5 k^7+12 g H^3 k^5-3 H^2 U^2 k^5-18 U^2 k^3+18 g H k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(-\frac{1}{24} \left(g H k^4\right) \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i \left(2 g H^7 k^{11}+18 g H^5 k^9+H^4 U^2 k^9+54 g H^3 k^7-54 U^2 k^5+54 g H k^5\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) & \left(-\frac{\left(k \left(H^2 k^2+6\right) U w\right) \text{dt}^2}{2 \left(H^2 k^2+3\right)}-\frac{i k \left(H^2 k^2+6\right) U w^2 \text{dt}^3}{6 \left(H^2 k^2+3\right)}+\frac{k \left(H^2 k^2+6\right) U w^3 \text{dt}^4}{24 \left(H^2 k^2+3\right)}+O\left(\text{dt}^5\right)\right)+\left(\frac{1}{2} k^2 U \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}+\left(\frac{i \left(2 H^4 k^7+15 H^2 k^5+36 k^3\right) U \text{dt}}{12 \left(H^2 k^2+3\right)^2}+O\left(\text{dt}^5\right)\right) \text{dx}^2+\left(-\frac{1}{24} \left(k^4 U\right) \text{dt}+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(-\frac{i \left(2 H^6 k^{11}+17 H^4 k^9+54 H^2 k^7+108 k^5\right) U \text{dt}}{240 \left(H^2 k^2+3\right)^3}+O\left(\text{dt}^5\right)\right) \text{dx}^4+O\left(\text{dx}^5\right) \\
\end{array}
\right)
$$

In[266]:=