```
ln[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 \rightarrow tn;
     MA = qjn / qjnbar;
     qntbar = Integrate[q, {t, tn, tn + dt}] / (dt);
     qjntbar = qntbar /. x \rightarrow 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 \rightarrow (GGA * Gca + GnA * eca) /. eh \rightarrow RA * eca;
     fn1Gca0A = fn1A / . Gca \rightarrow 0 ;
     fn1eca0A = fn1A/. eca \rightarrow 0;
     fnnA = Simplify[fn1Gca0A / eca];
     fnGA = fn1eca0A / Gca;
     fncA = H * GcA;
     fG1A = U*Gh + U*H*vh + g*H*eh;
     \texttt{fGlA} = \texttt{fGlA} \ / . \ \texttt{vh} \ \rightarrow \ (\texttt{GGA} \star \texttt{Gca} \ + \ \texttt{GnA} \star \texttt{eca}) \ \ / . \ \ \texttt{eh} \ \rightarrow \ \texttt{RA} \star \texttt{eca} \ / . \ \ \texttt{Gh} \ \rightarrow \ \texttt{RA} \star \texttt{Gca} \ ;
     fG1Gca0A = fG1A / . Gca \rightarrow 0 ;
     fGleca0A = fGlA /. eca \rightarrow 0;
     fGnA = Simplify[fG1Gca0A / eca];
     fGGA = Simplify[fGleca0A / 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 =
$$U * k + \frac{\sqrt{3} k \sqrt{g H (3 + H^2 k^2)}}{3 + H^2 k^2};$$

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

```
ln[37]:= M = 1;
     Merr = Series[M - MA, \{dx, 0, 5\}];
     Rm = (1 + I * Sin[k * dx] / 2);
     Rmerr = Series[Rm - RA, \{dx, 0, 5\}];
     Rp = Exp[I*k*dx]*(1 - I*Sin[k*dx]/2);
     \texttt{Rperr = Series[Rp - RA, \{dx, 0, 5\}];}
     Ru = (1 + Exp[I * k * dx]) / 2;
     Ruerr = Series \left[ Ru - Exp \left[ I * k * dx / 2 \right], \left\{ dx, 0, 5 \right\} \right];
     Gold = H - H^3/3 * (2 * Cos[k * dx] - 2) / dx^2;
     GG2 = Ru / Gold;
     GG2err = Series[GG2 - GGA, \{dx, 0, 5\}];
     Gn2 = -U * Ru / Gold;
     Gn2err = Series[Gn2 - GnA, \{dx, 0, 5\}];
     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}]]
                            ", TeXForm[Rm]}]]
     Text[Row[{"Rm ||
     Text[Row[{"Rm error ||
                                   ", Rmerr}]]
     Text[Row[{"Rm error ||
                                   ", TeXForm[Rmerr]}]]
     Text[" "]
     Text[Row[{"Rp ||
                            ", Rp}]]
                            ", TeXForm[Rp]}]]
     Text[Row[{"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}]]
                                    ", TeXForm[Gn2err]}]]
     Text[Row[{"Gn2 error ||
Out[50]= M \parallel 1
Out[51]= M \parallel 1
\label{eq:outs2} Outs2 = M error \parallel -\frac{k^2}{24}-\frac{4k^2}{5760}+O\left(\frac{k^2}{24}-\frac{4k^4}{5760}\right)+O\left(\frac{k^4}{2k^6}\right)
```

Out[53]= M error
$$\| -\frac{k^2 dx^2}{24} - \frac{7 k^4 dx^4}{5760} + O[dx]^6$$

Out[54]=

Out[55]= Rm || $1 + \frac{1}{2} i \sin[dx k]$

Out[56]= Rm $\parallel 1+\frac{1}{2} i \sin (\text{text}\{dx\} k)$

 $\text{Out}_{[57]} = \text{ Rm error } || \quad \frac{k^2 \, dx^2}{12} - \frac{1}{12} \, \dot{\imath} \, k^3 \, dx^3 + \frac{k^4 \, dx^4}{720} + \frac{1}{240} \, \dot{\imath} \, k^5 \, dx^5 + O[dx]^6$

Out[58]= Rm error || $\frac{dx}^2 k^2}{12}-\frac{1}{12} i \cdot \frac{dx}^3$

 $k^3 + \frac{dx}^4 k^4}{720} + \frac{1}{240} i \cdot \frac{dx}^5 k^5 + O\left(\frac{dx}^6\right)^6\right)$

Out[59]=

Out[60]= Rp || $e^{i dx k} \left(1 - \frac{1}{2} i Sin[dx k]\right)$

Out[62]= Rp error $\|\frac{k^2 dx^2}{12} + \frac{1}{6} \dot{i} k^3 dx^3 - \frac{89 k^4 dx^4}{720} - \frac{7}{120} \dot{i} k^5 dx^5 + O[dx]^6$

 $\label{eq:outf63} \mbox{Outf63]= Rp error } \| \frac{\text{x^2f12}+\frac{1}{6} i \text{x^3}} + \frac{1}{6} i \end{supplementarily}$

 $k^3-\frac{89 \text{ } k^4}{720}-\frac{7}{120} i \text{ } k^5+O\left(\frac{4x}^6\right)^6\right)}{120} i \text{ } k^5+O\left(\frac{4x}^6\right)^6\right)$

Out[64]=

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

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

Out[68]= GG2 error ||

Out[69]=

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

 $Out[71] = Gn2 \parallel -\frac{U \left(1 + e^{i \left(x\right) k}\right)}{2 \left(1 + e^{i \left(x\right) k}\right)} \left(2 \left(1 + e^{i \left(x\right) k}\right)\right)} \left(1 + e^{i \left(x\right) k}\right) \left(1 + e^{i \left(x\right) k}\right) \left(1 + e^{i \left(x\right) k}\right) \left(1 + e^{i \left(x\right) k}\right)\right)} \left(1 + e^{i \left(x\right) k}\right) \left(1 + e^{i \left(x\right) k}\right) \left(1 + e^{i \left(x\right) k}\right) \left(1 + e^{i \left(x\right) k}\right)\right)} \left(1 + e^{i \left(x\right) k}\right) \left(1 + e^{i \left(x\right) k}\right) \left(1 + e^{i \left(x\right) k}\right)\right)$

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

```
Out[73]= Gn2 error |
                \frac{\det(dx)^2 U \left(dx\right)^2 k^4+6 k^2\right)}{4 H\left(dx\right)^2 k^2+3\right)^2}+\frac{dx}{3} U \left(dx\right)^3 U \left(dx\right)^2}
                       k^5+6 k^3\right){8 H \left(\frac{h^2 k^2+3\right)^2}-\frac{t}{4} \left(\frac{4 k^4 k^8+45}{4}\right)^2}
                       H^2 \ k^6+144 \ k^4\right) \ |\{240 \ \| (H^2 \ k^2+3\right)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3\right)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3\right)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3\right)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3\right)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3\right)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3\right)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right) + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240} \ |\{240 \ \| (H^2 \ k^2+3)^3\right] + \frac{1}{240}
                        U \left( H^4 k^9 - 54 k^5 \right) \left( 480 H \left( H^2 k^2 + 3 \right)^3 + O\left( \left( text \left( dx \right)^6 \right) \right) \right) 
 ln[74]:= KurF = (fm*ap - fp*am + am*ap*(qp - qm)) / (ap - am);
            KurFWS = KurF /. ap \rightarrow (U + Sqrt[g * H]) /. am \rightarrow (U - Sqrt[g * H]);
            KurFWSeta =
                 KurFWS /. fp \rightarrow (H * v + U * Rpp * n) /. fm \rightarrow (H * v + U * Rmp * n) /. qp \rightarrow Rpp * n /.
                    qm \rightarrow Rmp * n;
            KurFWSeta = KurFWSeta /. v \rightarrow (GGp * G + Gnp * n);
            Kfnnp = FullSimplify[KurFWSeta /. G \rightarrow 0 /. n \rightarrow 1];
            KfnGp = FullSimplify[KurFWSeta /. n \rightarrow 0 /. G \rightarrow 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 \rightarrow (U * Rpp * G + U * H * v + g * H * Rpp * n) /.
                          fm \rightarrow (U * Rmp * G + U * H * V + g * H * Rmp * n) /. qp \rightarrow Rpp * G /. qm \rightarrow Rmp * G;
            KurFWSG = KurFWSG / . v \rightarrow (GGp * G + Gnp * n);
            KfGnp = FullSimplify[KurFWSG /. G \rightarrow 0 /. n \rightarrow 1];
            KfGGp = FullSimplify[KurFWSG /. n \rightarrow 0 /. G \rightarrow 1];
            KfGn = KfGnp /. Rpp \rightarrow Rp /. Rmp \rightarrow Rm /. GGp \rightarrow GG2 /. Gnp \rightarrow 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}];
            Fmat2 = {{Fnn2, FnG2}, {FGn2, FGG2}};
            Emat2 = IdentityMatrix[2] + Fmat2 + Fmat2.Fmat2 / 2;
            Eerr = Series[Emat2 - Exp[-I * wAp * dt] * IdentityMatrix[2], \{dx, 0, 4\}, \{dt, 0, 4\}];
            EigvFmat2 = Eigenvalues[Fmat2];
```

```
RKStep = Log[1 + EigvFmat2 + EigvFmat2 * EigvFmat2 / 2] / (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)"}]]</pre>
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]}]]
```

```
\begin{array}{ll} \text{Out[108]=} & -Sqrt(gH) < U \\ \end{array} < Sqrt(gH) \end{array}
```

Out[109]=

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

 $\label{eq:output} \begin{tabular}{ll} $$ Output = Fnn & \frac{1}{2} \left(\frac{1}{2} \left(\frac{Rmp}{ett(sqrt\{g H}+U\right)) + \frac{Rmp}{ett(u-sqrt\{g H}+u)} \right) + \frac{1}{2} \left(\frac{1}{2} \left(\frac{1}{2} \left(\frac{1}{2} \right) + \frac{1}{2} \left(\frac{1}{2} \left(\frac{1}{2} \left(\frac{1}{2} \right) + \frac{1}{2} \left(\frac{1}{2} \left(\frac{1}{2} \left(\frac{1}{2} \right) + \frac{1}{2} \left(\frac{1$

Out[112]= Fnn error
$$\| \left(-\frac{\left(H^2 \, k^3 \, U \, w \right) \, dt^2}{2 \, \left(3 + H^2 \, k^2 \right)} - \frac{i \, H^2 \, k^3 \, U \, w^2 \, dt^3}{6 \, \left(3 + H^2 \, k^2 \right)} + O[dt]^4 \right) + \\ \left(-\frac{i \, \left(27 \, k^3 + 9 \, H^2 \, k^5 + H^4 \, k^7 \right) U \, dt}{12 \, \left(3 + H^2 \, k^2 \right)^2} + O[dt]^4 \right) dx^2 + \left(-\frac{1}{8} \left(\sqrt{g \, H} \, k^4 \right) dt + O[dt]^4 \right) dx^3 + O[dx]^4 \right) dx^4 + O[dt]^4 dx^4 + O[d$$

Out[113]= Fnn error

 $\left(-\frac{t}{2 \cdot t}\right)^2 \left(-\frac{t}{2 \cdot$ $\left(H^2 k^2+3\right)+O\left(\left(t^4 k^7+9 H^2\right)\right)$ $k^5+27 \ k^3 \ U \ \text{text} \ dt \ 12 \ \text{left} \ (4^2 \ k^2+3 \ \text{right})^2 + O \ \text{left} \ (4t)^4 \ \text{right}) \ \text{right}) + \text{text} \ dx \ \text{heavily} \ \ \text{heavi$ $\left(-\frac{1}{8}\right)\left(-\frac$

Out[114]=

Out[115]= FnG || GGp H

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

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

 $k^2+3\right)+O\left(\frac{4}{\alpha}^2\right)+O\left(\frac{4}{\alpha}^2\right)$ $\label{left} $$ \left(\frac{dt}{4 \left(\frac{h^2 k^2+3\right)}}-2\right)-\left(\frac{dt}{4 \left(\frac{h^2 k^2+3\right)}}-2\right)-2\right)$$

Out[119]=

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

Out[121]= FGn ||

$$\begin{array}{ll} \text{Out} \text{[122]=} & FGn \; error \; || \; \left(-\frac{\left(k \left(3 \, g \, H + g \, H^3 \, k^2 - 3 \, U^2 \right) \, w \right) \, dt^2}{2 \, \left(3 + H^2 \, k^2 \right)} - \frac{i \, k \left(3 \, g \, H + g \, H^3 \, k^2 - 3 \, U^2 \right) \, w^2 \, dt^3}{6 \, \left(3 + H^2 \, k^2 \right)} + O[dt]^4 \right) + \\ & \left(-\frac{i \left(9 \, g \, H \, k^3 + 6 \, g \, H^3 \, k^5 + g \, H^5 \, k^7 + 18 \, k^3 \, U^2 + 3 \, H^2 \, k^5 \, U^2 \right) \, dt}{12 \, \left(3 + H^2 \, k^2 \right)^2} + O[dt]^4 \right) dx^2 + \left(-\frac{1}{8} \left(\sqrt{g \, H} \, k^4 \, U \right) \, dt + O[dt]^4 \right) dx^3 + O[dx]^4 \right) + O[dt]^4 \right) dx^3 + O[dx]^4 + O[dt]^4 + O[dt$$

Out[123]= FGn error ||

 $\text{text}\{dt\}^3 \text{ k w}^2 \left\{ H^3 \text{ k}^2 + 3 \text{ g H} - 3 \text{ U}^2\right\}$ $k^2+3\right)+O\left(\frac{dt}^4\right)+\frac{dx}^2 \left(\frac{dx}^2 \left(\frac{dx}^4\right)\right)+\frac{dx}^2}{dx}$ k^7+6 g H^3 k^5+3 H^2 U^2 k^5+18 U^2 k^3+9 g H k^3\right) \text{dt}}{12 \left(H^2 $k^2+3\left(\frac{dt}^4\right)+\left(\frac{dt}^4\right)$ H k^4 Uright) $\text{text}\{dt\}+O\left(\frac{dt}^4\right)\right)+O\left(\frac{dt}^4\right)+O\left(\frac{dt}^4\right)$

Out[124]=

$$\begin{array}{ll} \text{Out} \text{[127]=} & FGG \; error \; || \; \left(-\frac{\left(k \left(6 + H^2 \, k^2 \right) \text{U} \, w \right) \, dt^2}{2 \, \left(3 + H^2 \, k^2 \right)} - \frac{i \, k \left(6 + H^2 \, k^2 \right) \text{U} \, w^2 \, dt^3}{6 \, \left(3 + H^2 \, k^2 \right)} + O[dt]^4 \right) + \left(-\frac{i \left(-9 \, k^3 + 3 \, H^2 \, k^5 + H^4 \, k^7 \right) \text{U} \, dt}{12 \, \left(3 + H^2 \, k^2 \right)^2} + O[dt]^4 \right) dx^2 + \\ & \left(-\frac{1}{8} \left(\sqrt{g \, H} \, k^4 \right) dt + O[dt]^4 \right) dx^3 + \left(\frac{i \left(297 \, k^5 \, \text{U} + 351 \, H^2 \, k^7 \, \text{U} + 118 \, H^4 \, k^9 \, \text{U} + 13 \, H^6 \, k^{11} \, \text{U} \right) dt}{240 \, \left(3 + H^2 \, k^2 \right)^3} + O[dt]^4 \right) dx^4 + O[dx]^5 \end{aligned}$$

Out[128]= FGG error |

 $\label{left} $$\left(-\frac{dt}^2 \left(W \right)^2 \left(W \right)^$

 $U w^2 \left(H^2 k^2 + 6\right) + O\left(H^2 k^2 + 3\right) + O\left(H^2 k^2 + 3\right)$

 $\label{left} $$\left(-\frac{i \left(H^4 k^7+3 H^2 k^5-9 k^3\right) U \left(H^2 k^7+3 H^2 k^5-9 k^3\right) U \right) = 1.00 $$$

 $k^2+3\left(\frac{dx}^3\left(-\frac{1}{8}\right)\right)+\frac{dx}^3\left(-\frac{1}{8}\right)$

H^6 U k^{11}+118 H^4 U k^9+351 H^2 U k^7+297 U k^5\right) \text{dt}}{240

 $\left(H^2 k^2+3\right)^3+O\left(\left(text{dt}^4\right)\right)\right)+O\left(text{dx}^5\right)$

Out[129]=

Out[130]=

Out[131]= Omega error ||

$$\begin{cases} \{ \left(\frac{1}{6(3+H^2k^2)^3} k^3 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + (3+H^2\,k^2) \, U \right) \left(3 \, g \, H + U \left(2 \sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + (3+H^2\,k^2) \, U \right) \right) dt^2 + \\ \frac{1}{8(3+H^2k^2)^3} i \, k^4 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + (3+H^2\,k^2) \, U \right) \left(3 \, g \left(\sqrt{3} \right. H \sqrt{g \, H \, (3+H^2\,k^2)} \right. + 9 \, H \, U + 3 \, H^3 \, k^2 \, U \right) + \\ U^2 \left(H^4 \, k^4 \, U + 9 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + (3+H^2\,k^2) \, U \right) \right) \left(3 \, g \, H \, (3+H^2\,k^2) \right. + 2 \, H^2 \, U \right) \right) dt^3 - \\ \frac{1}{20(3+H^2\,k^2)^3} \left(k^5 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + (3+H^2\,k^2) \, U \right) \right) \\ \left(9 \, g^2 \, H^2 + 6 \, g \, H \, U \left(2 \sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + (3+H^2\,k^2) \, U \right) \right) \\ \left(9 \, g^2 \, H^2 + 6 \, g \, H \, U \left(2 \sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + 3 \, H^2 \, k^2 \right) \right) + U^3 \left(12 \sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + \\ \left. 9 \, U + H^4 \, k^4 \, U + 2 \, k^2 \left(2 \sqrt{3} \sqrt{g \, H^5 \, (3+H^2\,k^2)} \right. + 3 \, H^2 \, U \right) \right) \right) dt^4 + O[dt]^5 \right) + \\ \left(\frac{k^3 \left(-3 \sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right)^2 + 2 (3+H^2\,k^2)^2}{24(3+H^2\,k^2)^2} + 3 \, H^3 \, k^2 \, U + 6 \, H^5 \, k^4 \, U \right) + \\ \left. U^2 \left(27 \sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + 54 \, U + 2 \, H^6 \, k^6 \, U + 3 \, k^2 \left(7 \sqrt{3} \sqrt{g \, H^5 \, (3+H^2\,k^2)} \right. + 18 \, H^2 \, U \right) + \\ \left. 2 \, k^4 \left(2 \sqrt{3} \sqrt{g \, H^3 \, (3+H^2\,k^2)} \right. + 54 \, U + 2 \, H^6 \, k^6 \, U + 3 \, k^2 \left(7 \sqrt{3} \sqrt{g \, H^5 \, (3+H^2\,k^2)} \right. + 18 \, H^2 \, U \right) + \\ \left. 2 \, k^4 \left(2 \sqrt{3} \sqrt{g \, H^3 \, (3+H^2\,k^2)} \right. + 18 \, U + 2 \, H^4 \, k^4 \, U + 2 \, k^2 \left(7 \sqrt{3} \sqrt{g \, H^5 \, (3+H^2\,k^2)} \right. + 18 \, H^2 \, U \right) \right) \right) \\ \left(-9 \, g \, H + U \left(3 \sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + 18 \, U + 2 \, H^4 \, k^4 \, U + 2 \, k^2 \left(\sqrt{3} \sqrt{g \, H^5 \, (3+H^2\,k^2)} \right. + 6 \, H^2 \, U \right) \right) \right) \\ \left(9 \, g^2 \, H^2 + 6 \, g \, H \, U \left(2 \sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} \right. + 18 \, U^2 \, 2 \, H^2 \, k^2 \right) U \right) + U^3 \left(12 \sqrt{3} \sqrt{g \, H^3 \, (3+H^2\,k^2)} \right) + 6 \, H^2 \, U \right) \right) \right)$$

$$\frac{1}{234940\sqrt{g \, H} \, (3441842)^{2}} e^{3/2} \left(81 \sqrt{3} \, g^{2} \, H^{2} \, (157 + 124 \, H^{2} \, k^{2} + 20 \, H^{4} \, k^{4}) + \right. \\ \left. 6 \sqrt{3} \, g^{2} \, H^{2} \, (22535 + 32481 \, H^{2} \, k^{2} + 10584 \, H^{4} \, k^{4} + 1124 \, H^{6} \, k^{6}) \, U^{2} + \\ \left. 3 \, g \, H \, U^{3} \left(69120 \sqrt{g \, H} \, (3 + H^{2} \, k^{2}) + 34155 \sqrt{3} \, \, U + 44982 \sqrt{3} \, \, H^{2} \, k^{2} \, U + \right. \\ \left. 396 \sqrt{3} \, \, H^{3} \, k^{3} \, U + 27 \, k^{4} \, \left(816 \sqrt{g \, H^{9} \, (3 + H^{2} \, k^{2})} + 821 \sqrt{3} \, \, H^{4} \, U \right) + \right. \\ \left. 28 \, k^{6} \left(84 \sqrt{g \, H^{13} \, (3 + H^{2} \, k^{2})} \, U^{4} + 173 \sqrt{3} \, \, H^{6} \, U \right) + 8 \, U \, \left(348 \, k^{6} \sqrt{g \, H^{13} \, (3 + H^{2} \, k^{2})} \, U^{4} + \right. \\ \left. 29 \, k^{8} \sqrt{g \, H^{17} \, (3 + H^{2} \, k^{2})} \, U^{4} + 81 \, \left(130 \sqrt{g^{5} \, H^{2} \, k^{2}} \, + 29 \sqrt{g \, H \, (3 + H^{2} \, k^{2})} \, U^{4} \right) + \right. \\ \left. 54 \, k^{2} \left(137 \sqrt{g^{2} \, H^{9} \, (3 + H^{2} \, k^{2})} \, U^{4} + 172 \sqrt{g^{3} \, H^{7} \, (3 + H^{2} \, k^{2})} \, U^{2} + 58 \sqrt{g \, H^{3} \, (3 + H^{2} \, k^{2})} \, U^{2} + 58 \sqrt{g \, H^{3} \, (3 + H^{2} \, k^{2})} \, U^{2} + 58 \sqrt{g \, H^{3} \, (3 + H^{2} \, k^{2})} \, U^{4} + O (dt)^{5} \right) \right. \\ \left. \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \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. \right. \\ \left. \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \right) \right. \right. \\ \left. \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \right) \right. \right. \right. \\ \left. \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \right) \right. \right. \right. \\ \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \right) \right. \right. \\ \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \right) \right. \right. \\ \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \right) \right. \right. \\ \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \right. \right. \\ \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H^{2} \, k^{2})} + (3 + H^{2} \, k^{2}) U \right) \right. \right. \\ \left. \left. \left(1 + 3 \sqrt{3} \sqrt{g \, H \, (3 + H$$

$$\frac{dt^4 + O[dt]^5}{dt^6} \frac{dx^2 + }{dt^6} = \frac{\sqrt{3} \text{ U}}{\sqrt{g \text{ H}(8 + \text{H}^2 \text{ W}^2)}} + \frac{1}{32(3 + \text{H}^2 \text{ W}^2)^{3/5}} \\ i \text{ $k^6} \left(g \left(-6 \text{ H} \sqrt{g \text{ H}(3 + \text{H}^2 \text{ W}^2)} + 15 \sqrt{3} \text{ H} \text{ U} + 4 \sqrt{3} \text{ H}^2 \text{ k}^2 \text{ U}\right) + \\ U^2 \left(-12 \sqrt{g \text{ H}(3 + \text{H}^2 \text{ k}^2)} + 15 \sqrt{3} \text{ H} \text{ U} + 4 \sqrt{3} \text{ H}^2 \text{ k}^2 \text{ U}\right) + \\ U^2 \left(-12 \sqrt{g \text{ H}(3 + \text{H}^2 \text{ k}^2)} + 13 \sqrt{3} \text{ U} + \text{k}^2 \left(-2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + \sqrt{3} \text{ H}^2 \text{ U}\right)\right)\right) dt^2 - \\ \frac{1}{32(3 + \text{H}^2 \text{ W}^2)^{3/6}} \left[k^2 \left(3 \text{ g} \text{ H} + \text{U} \left(-2 \sqrt{3} \sqrt{g \text{ H}(3 + \text{H}^2 \text{ k}^2)} + (3 + \text{H}^2 \text{ k}^2) \text{ U}\right)\right) \left(2 \sqrt{3} \text{ g} \text{ H}(3 + \text{H}^2 \text{ k}^2) + \text{U}\right)\right)\right) dt^2 - \\ \frac{1}{32(3 + \text{H}^2 \text{ K}^2)^{3/6}} \left[k^2 \left(2 \text{ g} \text{ H}(3 + \text{H}^2 \text{ k}^2) + 3 \sqrt{3} \text{ U} + \text{k}^2 \left(-2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + \sqrt{3} \text{ H}^2 \text{ U}\right)\right)\right)\right) dt^2 - \\ \frac{1}{32(3 + \text{H}^2 \text{ K}^2)^{3/6}} \left[k^2 \left(2 \text{ g} \text{ H}(3 + \text{H}^2 \text{ k}^2)^2 + 3 \sqrt{3} \text{ U} + \text{k}^2 \left(-2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + \sqrt{3} \text{ H}^2 \text{ U}\right)\right)\right)\right) dt^2 - \\ \frac{1}{32(3 + \text{H}^2 \text{ K}^2)^{3/6}} \left[k^2 \left(2 \text{ g} \text{ H}(3 + \text{H}^2 \text{ k}^2)^2 + 3 \sqrt{3} \text{ U} + \text{k}^2 \left(-2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + \sqrt{3} \text{ H}^2 \text{ U}\right)\right)\right)\right) dt^2 - \\ \frac{1}{32(3 + \text{H}^2 \text{ K}^2)^{3/6}} \left[k^2 \left(2 \text{ g} \text{ H}(3 + \text{H}^2 \text{ k}^2)^2 + 3 \sqrt{3} \text{ U} + \text{k}^2 \left(-2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + \sqrt{3} \text{ H}^2 \text{ U}\right)\right)\right)\right)\right) dt^4 dt^4 + 4 \sqrt{3} \left(4 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 3 \sqrt{3} \left(-1 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 3 \sqrt{3} \text{ U} + \text{k}^2 \left(-2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + \sqrt{3} \text{ H}^2 \text{ U}\right)\right)\right)} dt^4 \right) dt^4 dt^4 + 4 \sqrt{3} \left(8 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 4 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + \sqrt{3} \text{ H}^2 \text{ U}\right) + 2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)}} + 2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)}} + 2 \sqrt{g \text{ H}^3 (3 + \text{H}^2 \text{ k}^2)} + 2 \sqrt{g \text{ H}^3 (3$$

$$\begin{split} &27\,k^2\left(372\,\sqrt{\,g^3\,H^7\,(3+H^2\,k^2)}\,-2703\,\sqrt{\,3}\,g^2\,H^7\,U\,+4515\,\sqrt{\,g^3\,H^7\,(3+H^2\,k^2)}\,\,U^2\,-4070\,\sqrt{\,3}\,g\,H^3\,U^3\,+928\,\sqrt{\,g\,H^5\,(3+H^2\,k^2)}\,\,U^4\right)\,+\\ &9\,k^4\left(180\,\sqrt{\,g^5\,H^{13}\,(3+H^2\,k^2)}\,-2672\,\sqrt{\,3}\,g^2\,H^6\,U\,+1392\,\sqrt{\,g\,H^9\,(3+H^2\,k^2)}\,\,U^4\,+\,g\,H^5\right)\\ &\qquad U^2\left(4384\,\sqrt{\,g\,H\,(3+H^2\,k^2)}\,-5997\,\sqrt{\,3}\,U\right)\right)\,+\,81\,\left(157\,\sqrt{\,g^5\,H^5\,(3+H^2\,k^2)}\,-883\,\sqrt{\,3}\right)\\ &\qquad g^2\,H^2\,U\,+\,232\,\sqrt{\,g\,H\,(3+H^2\,k^2)}\,\,U^4\,+\,g\,H\,U^2\left(1527\,\sqrt{\,g\,H\,(3+H^2\,k^2)}\,-1033\,\sqrt{\,3}\,U\right)\right)\,-\,12\,k^6\,U\left(213\,\sqrt{\,3}\,g^2\,H^8\,-\,232\,\sqrt{\,g\,H^{13}\,(3+H^2\,k^2)}\,U^3\,+\,g\,H^7\,U\left(-349\,\sqrt{\,g\,H\,(3+H^2\,k^2)}\,+979\,\sqrt{\,3}\,U\right)\right)\right)\right)dt^4\,+\,O[dt]^5\right)dx^4\,+\,O[dx]^5\Big\} \end{split}$$

Out[132]= Omega error ||

\left\\left\\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(3 g H+U $\label{left(H^2 k^2+3\rightarrow U+2 \sqrt{3} \sqrt{3} \sqrt{3} \sqrt{4} \frac{H^2 k^2+3\right)} \left(\frac{h^2 k^2+3\right)}{t^2 k^2+3\right)} (h^2 k^2+3\right) (h^2 k^2+3) (h^2 k^2+3)$ $\label{eq:k-2+3-index} $$k^2+3\right)^2+\frac{k^2+3\left(H^2 k^2+3\right)} U+\sqrt{3} \cdot H\left(H^2 k^2+3\right)^2+\frac{k^2+3\left(H^2 k^2+3\right)}{H^2 k^2+3\right)^2} $$$ $k^2+3\right) H\rightarrow (k^5 \left(\frac{k^5}{k^2+3\right)} H\rightarrow (k^5 \left(\frac{k^5}{k^2+3\right)} + \frac{k^2+3\right) H\rightarrow (k^5 \left(\frac{k^5}{k^2+3\right)} + \frac{k^5}{k^2+3\right) H\rightarrow (k^5 \left(\frac{k^5}{k^2+3\right)} + \frac{k^5}{k^2+3} + \frac$ $U+\sqrt{3} \left(H^2 + \frac{1}{4} \left(H^2 + \frac{1}{4} \right)\right)\right) \left(H^4 + \frac{1}{4} \left(H^4 + \frac{1}{4} \right)\right)$ $H^5 \left(H^2 k^2+3\right) \right) \left(H^2 k^2+3\right) \left(H^2 k$ \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)\right) $\label{eq:left} $$ \left(\frac{dt}^4}{20 \left(\frac{x^2+3\right)^3}+O\left(\frac{dt}^5\right)\right)\right)^2+\left(\frac{x^2+3\right)^3}+O\left(\frac{dt}^5\right)^3\right)^2} $$$ $k^2+3\right)^2 U-3 \left(H^2 k^2+3\right)^2 U-3 \left(H^2 k^2+3\right)^2 +\frac{1}{4} e^2 h^2 e$ $\left(\frac{H^6 U k^6+2 \left(9 U H^4+2 \right) }{18} \right)$ $\label{eq:continuity} U H^2+7 \sqrt{3} \sqrt{g} H^5 \left(H^2 k^2+3\right)\right) h^2+5 U+27 \sqrt{3} \sqrt{3} \left(H^2 k^2+3\right)$ k^2+3\right)\right) U^2+g \left(6 k^4 U H^5+18 k^2 U H^3-9 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} U+2 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)\right)\right) \left(U \left(2 H^4 U k^4+2 \left(6 U H^2+\sqrt{3})) $\sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+18 U+3 \sqrt{3} \sqrt{3} \left(H^2 k^2+3\right)}\right)$ g H\right) \text{dt}^3}{48 \left(H^2 k^2+3\right)^3}-\frac{\\ left(k^7 \\ left(2 \\ left(H^2 k^2+3\right)^2)} $U-3 \left(H^2 k^2+3\right) \left(H^4 U k^4+2 \left(U k^4+2 \left(U H^2+2 \right) \right) \right)$ $\$ \\ \sqrt{g H^5 \\ left(H^2 k^2+3\right)\\ right) \\ $U^3+6 g H \left(\frac{h^2 k^2+3\right)}{U+2 \left(\frac{h^2 k$ $U+9 g^2 H^2\right) + O\left(\frac{dt}^4}{96 \left(\frac{h^2 k^2+3\right)}{4}+O\left(\frac{dt}^5\right)}\right) + O\left(\frac{h^2 k^2+3\right)}{4} + O\left(\frac{h^2 k^2+3\right)}{4}$ $\text{text}(dx)^2 + \left(-\frac{k^4 \left(\frac{2 \text{ g H } \left(\frac{4^2 \text{ k}^2 + 3\right)}}{k^2 + \frac{3}{k^2 + 3}}\right)} + \frac{3 \text{ kgrt}(g \text{ H } \left(\frac{4^2 \text{ k}^2 + 3\right)}}{k^2 + \frac{3 \text{ kgrt}(g \text{ H } \left(\frac{4^2 \text{ k}^2 + 3\right)}}{k^2 + \frac{3 \text{ kgrt}(g \text{ H } \left(\frac{4^2 \text{ k}^2 + 3\right)}}{k^2 + \frac{3 \text{ kgrt}(g \text{ H } \left(\frac{4^2 \text{ k}^2 + 3\right)}}{k^2 + \frac{3 \text{ kgrt}(g \text{ H } \left(\frac{4^2 \text{ k}^2 + 3\right)}}{k^2 + \frac{3 \text{ kgrt}(g \text{ H } \left(\frac{4^2 \text{ k}^2 + 3\right)}{k^2 + 3}\right)}}$ $\left(H^2 k^2+3\right) \left(h^2 k^2+3\right)$ $\left(\frac{4 h^2 k^2+15\right) U+6 \left(\frac{4 h^2 k^2+15\right)}{U+6 \left(\frac{4 h^2 k^2+3\right)}\right) \left(\frac{4 h^2 k^2+15\right) U+6 \left(\frac{4 h^2 k^2+15\right)}{U+6 \left(\frac{4 h^2$ $\left(H^2 k^2+3\right) + \frac{k^2+3\left(H^2 k^2+3\right)}{3/2} + \frac{k^7 \left(H^2 k^2+3\right) + \frac{k^2+3\left(H^2 k^2+3\right)}{3/2}}{1/2} + \frac{k^2+3\left(H^2 k^2+3\right) + \frac{k^2+3\left(H$ $\$ \sqrt{g H^5 \left(H^2 k^2+3\right)\right) \k^2+3 \sqrt{3} U+9 \sqrt{g H \left(H^2 k^2+3\right)\right)\right)\right dt^3 {32 \left(H^2 k^2+3\right)^{5/2}}+\frac{i k^8 \cdot left(2 g H \left(H^2 k^2+3\right)+\sqrt{3} \sqrt{g}

 $H \left(H^2 k^2+3\right) \left(H^4 U k^4+2 \left(H^4 U H^2+2 \right) \right)$ $k^2+3\left(k^2+3\right) k^2+9 U+12 \left(k^2+3\right) k^2+3 U+12 \left(k^2+3\right) k^2$ $H} \left(\frac{d^2 k^2+3\right)^3}{O\left(\frac{d^3}{3}\right)} + O\left(\frac{d^3}{3}\right) \left(\frac{d^3}{3}\right) \left$ $H \left(20 \text{ H}^4 \text{ k}^4 + 124 \text{ H}^2 \text{ k}^2 + 177 \right) + 104 \left(\frac{9 \text{ H}^6 \left(\frac{4^2 \text{ k}^2 + 3 \right)} \text{ k}^4 + 6 \right) }{4^2 \text{ k}^2 + 3 \text{$ $H^5 \left(H^2 k^2 + 3\right) k^2 + 9 \left(H^2 k^2 + 3\right) U\right) U\right) \left(1920 \left(1920 \right) H^5 \left($ k^2+167\right) H^2+g U \left(764 \sqrt{3} H^6 U k^6+24 \left(293 \sqrt{3} U H^4+84 \sqrt{g H^9 \left(H^2 k^2+3\right)\right) k^4+21429 \sqrt{3} H^2 U k^2+81 \left(267 \sqrt{3} U+232 \sqrt{g H \left(H^2 $k^2+3\right) \left(H^2 k^2+3\right) \left(H^2 k^2+3\right) U^3 k^6+153 \right) H^6 \left(H^2 k^2+3\right) U^3 k^6+153 \right) H^6 U^3 k^6+153 \right) H^6 U^3 k^6+153 U^3 k^6+154 U^$ $\left(H^2 k^2+3\right) U^3 k^4+9\left(11 \right) U^3 k^4+9 \left(11 \right) U^3 k^4+9 \left(11 \right) U^3 + 11 U^3 k^4+9 \left(11 \right) U^3 u^4+9 U^3 u^4+9$ $k^2+3\right) U\dot h^2 + 459 \left(H^2 k^2+3\right) U^3\right) U^3\right) text{dt}^2{11520}$ $\left(\frac{4 + 4 \cdot 4 \cdot 4^2 + 3 \cdot 4^2 + 3 \cdot 4^2 + 3 \cdot 4^2 + 3 \cdot 4^2 + 4 \cdot 4^2 \cdot 4^2 + 4 \cdot 4^2 \cdot 4^2 \right) - \frac{4 \cdot 4 \cdot 4^2 + 4 \cdot 4^2 \cdot 4^2 + 4 \cdot 4^2 \cdot 4^$ $H^6+83 \sqrt{13} \left(H^{13} \left(H^2 k^2+3\right)\right) \right) h^6+36 U^3 \left(126 U H^4+85 \right) h^6+36 U^3 \right)$ $\$ \sqrt{g H^9 \left(H^2 k^2+3\right)\right) \k^4+9 \left(1008 H^2 U^4+1039 \\ \qrt{3} \\ \qrt{g H^5 \left(H^2 L^2+3\right)} \\ \qrt{1008 H^2 U^4+1039 \\ \qrt{3} \\ \qrt{1008 H^2 U^4+1039 \\ \qrt{10 k^2+3\right)} U^3+600 \sqrt{3} \sqrt{g^3 H^7 \left(H^2 k^2+3\right)} U\right) k^2+54 g^2 H^2 \left(10 H^4 k^4+62 H^2 k^2+81\right)+243 U^3 \left(28 U+39 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)+3 g H U \left(472 H^6 U k^6+4 \left(1101 U H^4+71 \sqrt{3} \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) $k^4 + 13500 \text{ H}^2 \text{ U k}^2 + 27 \left(504 \text{ U} + 97 \right) \left(3 \right) \left(4 \text{ H}^2 \left(4 \right) \right) \left(4 \right) \right) \right) \left(6 \text{ U} + 97 \right) \left($ dt^3 {3840 \left(H^2 k^2+3\right)^4}+\frac{k^9 \left(81 \sqrt{3} g^3 \left(20 H^4 k^4+124 H^2 H^2)} k^2+157\right) H^3+6 \sqrt{3} g^2 \left(1124 H^6 k^6+10584 H^4 k^4+32481 H^2 k^2+32535\right) U^2 H^2+3 g U^3 \left(396 \sqrt{3} H^8 U k^8+28 \left(173 \sqrt{3} U H^6+84 \sqrt{g H^{13} \left(H^2 $k^2+3\right) \ h^6+27 \left(821 \right) \ H^4+816 \ grt{g H^9 \left(H^2 k^2+3\right) \right) \ h^6+27 \ h^6+27 \ h^6+27 \ h^6+27 \ h^6+21 \ h^6+21$ $k^4 + 44982 \sqrt{4} H^2 U k^2 + 34155 \sqrt{3} U + 69120 \sqrt{g H \left(H^2 k^2 + 3\right)} \right) H + 8 U + 69120 \sqrt{g H \left(H^2 k^2 + 3\right)}$ $k^6+27 \left(58 \right) H^9 \left(58 \right) U^4+43 \left(5^2 H^2 \right) U^4+43 \left(5^2 H^2 \right) \left(5^2 H^2 \right) U^4+43 \left(5^2 H^2 \right) U^4+$ $k^4+54 \left(58 \right) U^4+472 \left(5^3 H^7 \left(H^2 k^2+3\right) U^4+472 \right)$ $\label{eq:update} $$U^2+137 \operatorname{sqrt}(g^5 H^9 \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right)\right) + h^2 \left(19 \operatorname{sqrt}(g H \left(H^2 k^2+3\right)\right) + h^2 \left(H^2 k^2+3\right) + h^2$ $U^4+130 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right)\right) \left(H^2 k^2+3\right)\right)$ $\left(\frac{H^2 k^2+3\right)}{U-\sqrt{H^2 k^2+3\right}} \right) U-\left(\frac{H^2 k^2+3\right)}{U-\sqrt{H^2 k^2+3\right}}$ $k^2+3\right\} \ U-2 \ H\left(H^2 \ k^2+3\right)\right) \ text{dt}^2{6 \left(H^2 \ k^2+3\right)} \ text{dt}^2{6 \left(H^2 \ k^2+3\right)}$ $k^2+3\right)^2+\frac{1}{2}+\frac{1}{2} +\frac{1}{2} +$ $\label{left(H^2 k^2+3\wedge ight)^2} \operatorname{left(H^2 k^2+3\wedge ight)^2}-\operatorname{left(k^5 \left(\left(H^2 k^2+3\right)\right)} \operatorname{left(H^2 k^2+3\wedge ight)^2}-\operatorname{left(h^2 k^2+3\wedge ight)^2}-\operatorname{left(h^2$ $k^2+3\right) U-2 \sqrt{3} \sqrt{4}{20 \left(H^2 k^2+3\right)\right)} \left(H^2 k^2+3\right) \left(H^2 k^2+3\right)$ $k^2+3\right/h^4+O\left(\frac{t}{5\right)}\right)$ $\$ \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)}\right)}{24 \left(H^2 k^2+3\right)^2}+\frac{k^5 \left(\frac{1}{2} (1-x)^2 + \frac{1}{2} (1-x)^2 + \frac{1}{2 $H^6 U k^6-2 \left(\sqrt{3} \right)^9 \left(H^9 \left(H^2 k^2+3\right) -9 H^4 U \right) k^4-3 \left(\sqrt{3} \right)$ $\$ \sqrt{g H^5 \left(H^2 k^2+3\right)}-18 H^2 U\right) k^2+54 U-27 \sqrt{3} \sqrt{g H \left(H^2 L^2 + 24 L^2 k^2+3\right)\right) U^2+3 g \left(2 k^4 U H^5+6 k^2 U H^3+3 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} $H \cdot (H^2 k^2+3\right) \cdot (H^2 k^2+3\right) \cdot (H^2 k^2+3\right) \cdot (H^2 k^2+3) \cdot (H^2 k^$

 $\left(\frac{3} \right) \left(\frac{4^2 \ln(4^2 k^2 + 3 \right)}{6^2 k^2 + 3 \right) - 6^2 U \right) \left(\frac{3^2 k^2 + 3 \ln(k^2 k^2 + 3 \ln(k$ $k^2+3\right)$ | Hright \text{dt}^3}{48 \left(H^2 k^2+3\right)^3}-\frac{(k^7 \left(K^7 \left(K^7 \right)^3)}{48 \left(K^7 \left(K^7 \right)^3}\right)^3} $\left(H^2 k^2+3\right) \left(H^2 k^2+3\right)$ $k^2+3\right) U-2 \sqrt{3} \sqrt{4}{96} k^2+3\right) 10-2 \sqrt{3} \sqrt{4}{96} k^2+3\right) 10-2 \sqrt{4}{96} k^2+3\right) 10-2 \sqrt{4}$ $\left(\frac{H^2 k^2+3\right)^4}+O\left(\frac{dt}^5\right)\right) \$ $\left(\frac{3}{U}\right) = \frac{1}{2\pi} \left(\frac{3}{U}\right)$ $U-2 \left(H^2 k^2+3\right) + 12 \left(H^2 k^2+3\right) + 12$ $\label{eq:update} $$U^2+g \left(\frac{sqrt{3} k^2 U H^3+15 \left(H-6 \right) H\left(H^2 k^2+3\right) H\left(H\right) H\left(H^2 k^2+3\right) H\left(H\right) H\left(H^2 k^2+3\right) H\left(H\right) H\left(H^2 k^2+3\right) H\left(H^$ $\label{eq:left} $$ \operatorname{dt}^2_{32}\left(H^2 k^2+3\right)^{3/2}\right-\left(h^2 k^7 \left(h^7 \left(h^2 k^2+3\right)\right)^{3/2}\right). $$$ $U-2 \sqrt{3} \left(H \left(\frac{h^2 k^2+3\right)}{\sinh(h^2 k^2+3\right)} \right) \left(\frac{h^2 k^2+3\right)}{\sinh(h^2 k^2+3\right)} \left(\frac{h^2 k^2+3\right)}{\sinh(h^2 k^2+3\right)} \left(\frac{h^2 k^2+3\right)}{\sinh(h^2 k^2+3)} \left(\frac{h^2 k^2+3\right)}{h^2 k^2+3} \left(\frac{h^2 k^2+3}{h^2 k^2+3} \right) \left(\frac{h^2 k^2+3}{h^2 k^2+3} \left(\frac{h^2 k^2+3}{h^2 k^2+3} \right) \left(\frac{h^2 k^2+3}{h^2 k^2+3} \left(\frac{h^2 k^2+3}{h^2 k^2+3} \right) \left(\frac{h^2 k$ $\label{left(H^2 k^2+3\left| h^2 k^2 + 3\left| h^3 k^2 + 3\left| h^3$ $\left(2 g H \left(\frac{4^2 k^2+3\right)}{sqrt{g H \left(\frac{4^2 k^2+3\right)} \left(\frac{4^2 k^2+3\right)} U\right)} \right) \left(\frac{4 g H}{u}\right)$ $\label{left} $\left(\left(\frac{H^2 k^2+3\right)} U-2 \right) + \left(\frac{H^2 k^2+3\right)}\left(\frac{H^2 k^2+3\right)}\left(\frac{H^2 k^2+3\right)}{1-H^2 k^2+3}\right) = \frac{1}{2} \left(\frac{H^2 k^2+3\right)}\left(\frac{H^2 k^2+3\right)}{1-H^2 k^2+3}\right) + \frac{1}{2} \left(\frac{H^2 k^2+3\right)}\left(\frac{H^2 k^2+3\right)}{1-H^2 k^2+3}\right) + \frac{1}{2} \left(\frac{H^2 k^2+3\right)}{1-H^2 k^2+3}$ $\sqrt{3} g H \left(0.04^4 k^4 + 124 H^2 k^2 + 177\right) - 104 \left(0.04^6 H^9 \left(0.04^4 k^4 + 124 H^2 k^2 + 177\right)\right)$ $k^4+6 \left(H^2 k^2+3\right) k^2+9 \left(H^2 k^2+3\right) v^2+9 \left$ k^2+167 \right) H^2+g U \left(764 \sqrt{3} H^6 U k^6-24 \left(84 \sqrt{g H^9 \left(H^2 k^2+3 \right)}-293 $\sqrt{3} H^4 U \right) k^4+21429 \sqrt{4} L^2 U k^2+81 \left(267 \right) U-232 \right] H^2 U k^2+81 \left(267 \right) L-232 \right]$ $k^2+3\right) \left(H^2 k^2+3\right) \$ $H^9 \left(H^2 k^2 + 3 \right) U^3 k^4 + 9 \left(51 \right) H^5 \left(H^2 k^2 + 3 \right) U^3 + 8 \left(51 \right)$ $H^7 \left(H^2 k^2+3\right) U\right) U\right) h^2 + 459 \left(H^2 k^2+3\right) U^3\right) U^3\right)$ $\text{dt}^2_{11520 \ \ H} \left(\frac{h^2 k^2+3\right)^{7/2}}-\frac{i k^8 \left(4 H^8 U^4 k^8+4 U^3 \right)^{7/2}}{h^3}$ \left(252 H^6 U-83 \sqrt{3} \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right) \k^6+36 U^3 \left(126 H^4 $U-85 \sqrt{3} \sqrt{9 H^2 k^2+3 \sinh k^4-9 \left(-1008 H^2 U^4+1039 \right)}$ k^2+54 g^2 H^2 \left(10 H^4 k^4+62 H^2 k^2+81\right)+243 U^3 \left(28 U-39 \sqrt{3} \sqrt{g H $\left(H^2 k^2+3\right)\right)$ k^2+3\right)}-1101 H^4 U\right) k^4+13500 H^2 U k^2+27 \left(504 U-97 \sqrt{3} \sqrt{g H $\left(H^2 k^2+3\right)\right)\right)$ \left(\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}-\left(H^2 k^2+3\right) U\right) \left(4 U^3 \left(58 \sqrt{g} $H^{17} \left(H^2 k^2 + 3\right) U - 239 \left(H^9 \right) k^8 - 12 U \left(13 \right) 8 qrt (3) g H^9 \right)$ $U \left(\frac{979 \sqrt{3} U - 349 \sqrt{g H \left(\frac{4^2 k^2 + 3\right)}} \right) + \frac{4^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)}{16^7 + 16^7$ k^2+3\right)} U^3\right) k^6+9 \left(-2672 \sqrt{3} g^2 U H^6+g U^2 \left(4384 \sqrt{g H \left(H^2 $k^2+3\right)=5997 \cdot H^5+1392 \cdot H^9 \cdot H^2 \cdot H^$ $H^{13} \left(H^2 k^2 + 3\right) \right) + h^4 + 27 \left(-2703 \right) qrt{3} g^2 U H^4 - 4070 \right) qrt{3} g U^3$ $H^3+928 \left(H^5 \left(H^2 k^2+3\right) \right) U^4+4515 \left(H^2 k^2+3\right) U^2+372$ $\left(\frac{9^5 H^9 \left(\frac{4^2 k^2+3\right)}}{v^2+3}\right) k^2+81 \left(\frac{32 \left(\frac{4^2 k^2+3\right)}}{v^2+3}\right) U^4+g^2}$ $H \left(1527 \right) + \left($

Out[133]=

$$\begin{aligned} & \text{Out} [\text{134}] = & \text{ EA } \text{ || } & \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{dx} \, w} \right) \, \text{H}^2 \, \text{k}^3 \, \text{U} \, \text{Csc} \left[\frac{d \, \text{k} \, k}{2} \right]}{6 + 2 \, \text{H}^2 \, \text{k}^2 \right) \, \text{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) \, \text{H} \, k \, \text{Csc} \left[\frac{d \, \text{k} \, k}{2} \right]}{2 \left(\text{H} + \frac{\text{H}^3 \, k^2}{3} \right) \, \text{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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{d \, x \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{d \, x \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{d \, x \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{d \, x \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{d \, x \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{d \, x \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{d \, x \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{d \, x \, k}{2} \right] \right\} \right\}$$

Out[135]= $EA \parallel \label{eq:entropy} \$

\begin{array}{cc}

 $w \rightarrow H^2 U \csc \left(\frac{dx}{k}{2} \right) \\ k^3 \left(H^2 K^2 + 6 \right) \\ w + 1$ & $\frac{i e^{\left(i e^{\left(k\right) k}}{2}} \left(1-e^{-i \left(k\right) k}\right) \left(1-e^{-i \left(k\right) k}\right) \left(1-e^{-i \left(k\right) k}\right)}{1-e^{-i \left(k\right) k}}$ $\frac{i e^{\frac{i \cdot k}{2}} \left(1 - e^{-i \cdot kxt\{dx\} k}\right)}{\left(1 - e^{-i \cdot kxt\{dx\} k}\right)} \left(1 - e^{-i \cdot kxt\{dx\} k}\right)} \left(1 - e^{-i \cdot kxt\{dx\} k}\right)$ $\label{left(H^2 k^2+3\circ H^2 k^2+6\circ H^2 k^2+$ $w\} \& \frac{i \cdot (i \cdot k}{2}) \left(1 - e^{-i \cdot k} k\right) \left(1$

 $k \left(H^2 k^2 + 6 \right) U \csc \left(\frac{dx}{k}{2}\right) \left(H^2 k^2 + 6 \right) w + 1 \left(H^2 k^2 + 6 \right)$

\end{array}

\right)

$$\begin{aligned} & \underset{3 + \text{BP}}{\text{Coupling}} \cdot \text{Eerr} \, \| \, \left\{ \left[\frac{i \sqrt{3} \, k \sqrt{g \, H \, (3 + \text{BP} \, k)} \, + k \, U}{3 + \text{BP} \, k^2} + \frac{\sqrt{3} \, k \sqrt{g \, H \, (3 + \text{BP} \, k)} \, - k \, U}{3 + \text{BP} \, k^2} - \frac{i \, k \, U}{3 + \text{BP} \, k^2} - \frac{i \, k \, U}{3 + \text{BP} \, k^2} - \frac{i \, k \, U}{3 + \text{BP} \, k^2} - \frac{i \, k \, U}{3 + \text{BP} \, k^2} \right] \\ & = \frac{i \left(-\frac{i \sqrt{3} \, k \sqrt{g \, H \, (3 + \text{BP} \, k)^2 \, k} \, - i \, k \, U}{3 + \text{BP} \, k^2} \right)^3 + \frac{i \, k \, U}{3 + \text{BP} \, k^2} - \frac{i \, k \, U}{3 + \text{BP} \,$$

Out[137]= Eerr || \left(

\begin{array}{cc}

 $\left(\frac{1}{4} \left(\frac{3 U + \sqrt{3} \left(\frac{4 U + \sqrt{4} \left(\frac{4 U + \sqrt{2} + \frac{4 U + 4 U + \frac{4 U + \frac{4 U + 4 U + 4 U + 4 U + \frac{4 U + 4 U +$

 $k^2+\sqrt{3} \operatorname{H}^2 k^2+3\left(H^2 k^2+3\right) U k^2\right)$ $\label{eq:thm:linear} U \ k-\frac{i \sqrt{h^2 k^2+3}\right}^3 \text{ } text{dt}^3-\frac{1}{24}$ $\label{left} $$\left(-i\ U\ k-\frac{i\ sqrt{3} \ sqrt{g\ H\ left(H^2\ k^2+3\right)}\ k}{H^2\ k^2+3}\right)^4$} $$$ $\label{eq:linear_continuous_con$ \left(H^2 k^2+3\right)^2}-\frac{\left(2 H^4 U^2 k^8+12 H^2 U^2 k^6+36 U^2 k^4-9 g H k^4\right)} $\label{eq:left} $$ \operatorname{dt}^2_{4 \operatorname{left}(H^2 k^2+3\operatorname{left}(-\frac{1}{8}))} \operatorname{dt}^2_{1}(\operatorname{dt}^2_{1}) \operatorname{$ $\left(\frac{H} k^4\right) \left(\frac{H} k^4\right) \left(\frac{H} k^4\right) \left(\frac{H^2 k^7+3 k^5\right) U \left(\frac$ $H^4 U k^9 + 351 H^2 U k^7 + 405 U k^5 \right) \left(\frac{1}{40} \left(\frac{4}{2} k^2 + 3 \right)^3 + \frac{6}{10} \right) \left(\frac{1}{40} \left(\frac{1}{40} k^2 + \frac{1$ H^6 U^2 k^{12}+135 g H^5 k^{10}+387 H^4 U^2 k^{10}+837 g H^3 k^8+297 H^2 U^2 k^8-351 U^2 $k^6+1161 \text{ g H } k^6 \cdot \text{ht}^2 \{1440 \cdot (H^2 k^2+3\right)^3+O\left(\frac{dt}^5\right)^5\right)$ $U + \left(\frac{dt}^2}{H^2 k^2+3} + O\left(\frac{dt}^5\right) + \left(\frac{dt}^5\right) + \left(\frac{dt}^5\right) + \left(\frac{dt}^6\right) + \left(\frac{dt}^6\right)$ $\label{eq:continuity} $$ k^2+\frac{3 i k^3}{2 \left(H^2 k^2+3\right)^2}\right) \left(t^2 k^4 U \left(t^2 k^2+3\right)\right) \left(t^2 k^4 U \left(t^2 k^4 U \left(t^2 k^2+3\right)\right) \left(t^2 k^4 U \left(t$ $\label{left} $$\left(H^2 k^2+3\right)+O\left(\frac{dt}^5\right)\right) \cdot \left(\frac{dt}^5\right) \cdot \left(\frac{dt}^3+\left(\frac{dt}^3+\frac{dt$ \text{dt}}{240 \left(H^2 k^2+3\right)^3}+\frac{\left(45 H^4 U k^{10}+279 H^2 U k^8+387 U k^6\right)} $\t x_{dt}^2_{240 \left(H^2 k^2+3\right)} + O\left(t_{t}^2_{t}^5\right) \right) \t x_{dx}^4 + O\left(t_{t}^2_{t}^5\right) \right) \t x_{dx}^4 + O\left(t_{t}^2_{t}^5\right) \t x_$ $\left(-\frac{k^2 U}{e^2 u^2 + 3} - \frac{k^2 U}{e^2 u^2 + 3} - \frac$ g H-3 U 2 right) \text{dt} 2 {H 2 k 2 +3}+O\left(\text{dt} 5 \right)\right)\right)+\left(-\frac{i \left(g H^5 k^7+6 g H^3 k^5+3 H^2 U^2 k^5+18 U^2 k^3+9 g H k^3\right) \text{dt}}{12 \left(H^2 k^2+3\right)^2}+\frac{\left(-2 g H^5 U k^8-12 g H^3 U k^6-9 U^3 k^4-18 g H U k^4\right)} $\t (t)^2 (12 \left(H^2 k^2 + \sinh^2 \theta \right)^2 + O\left(\frac{dt}^5 \right) \right) \t ext{dx}^2 + \left(-\frac{1}{8} \right)^2 + O\left(\frac{dt}^2 \right)^$ $g H \sqrt{g H} k^5 \right) \left(\frac{dt}^2}{8 \left(\frac{h^2 k^2 + 3\right)}{+ O\left(\frac{dt}^5 \right)}} + O\left(\frac{dt}^5 \right) \right) \right)$ \text{dx}^3+\left(\frac{i} \left(13 g H^7 k^{11}+117 g H^5 k^9-H^4 U^2 k^9+351 g H^3 k^7+54 U^2 k^5+351 g H k^5\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+\frac{\left(73 g H^7 U $k^{12}-135 H^4 U^3 k^{10}+657 g H^5 U k^{10}-837 H^2 U^3 k^8+1971 g H^3 U k^8-1161 U^3$ $k^6+1971 \text{ g H U } k^6 \text{ hight} \text{ text} dt^2 {720 \left(h^2 k^2+3 \right)^3} + O\left(\text{text} dt \right)^5 \right) \text{ text} dt^2 + O\left(h^2 k^2+3 \right) + O\left(h^2 k^2+$ $\t (\sqrt{dx}^4 + O\left(\frac{dx}^5\right) \le \left(\frac{dx}^4 + O\left(\frac{dx}^5\right) \le \left(\frac{dx}^4 + O\left(\frac{dx}^4\right) \le \frac{dx}^4 + O\left(\frac{dx}^4\right) \le O$ $U + \frac{dt}{H^2 k^2 + 3} + \frac{dt}{H^2 k^2 + 3} + \frac{3k^2 \sqrt{3 k^2 + 3 right}}{U - 3k^2 U^2 + 3k^2 U^2$ $\text{text}(dt)^2$ { $H^2 k^2+3$ }-frac(1){6} \left(-i U k-\frac{i \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} k}{H^2} $k^2+3\right\right) + k^2+3\right) + k^2+3\right) + k^2+3\left(-i U k-\frac{1}{24} \cdot k^2+3\right) + k^2+3\left(-i U k-\frac{1$ $k}{H^2 k^2+3}\right)^4 \text{ kext}{dt}^4+O\left(\text{text}{dt}\right)^5\right) + \left(\text{left}(-\frac{i}{h^4 U k^7+3} + \frac{i}{h^2 U k^7+3} + \frac{i}{h^4 U k^7+3}$ $H^2 U k^5 - 9 U k^3 + \frac{dt}{12 \left(\frac{h^2 k^2 + 3 \right)^2} + \frac{h^2 U k^5 - 9 U k^8 - 12 H^2 U k^8 - 12 H^2}{12 \left(\frac{h^2 k^8 - 12 H^2 U k^8 - 12 H^$ $U^2 k^6 + 9 g H k^4 \right) \left(\frac{dt}^2}{24 \left(\frac{k^2 + 3\right)}{2} + O\left(\frac{dt}^5 \right) \right) \right)$ $H^2 k^2+15 \oplus U \text{ (kext{dt}^2}{16 \left(h^2 k^2+3\right) + O\left(\text{kext{dt}^5 \right) } }$ \text{dx}^3+\left(\frac{i \left(13 H^6 U k^{11}+118 H^4 U k^9+351 H^2 U k^7+297 U k^5\right) $\text{text}_{dt}_{240 \left(H^2 k^2 + 3\right)^3} + \frac{10}{400}$ U^2 k^{10}+837 g H^3 k^8+3645 H^2 U^2 k^8+4293 U^2 k^6+1161 g H k^6\right) \text{dt}^2\{1440 $\left(\frac{dt}^2 k^2+3\right)^3+O\left(\frac{dt}^5\right)\right) \left(\frac{dt}^4+O\left(\frac{dt}^5\right)\right)$ \end{array}

\right)

```
ln[138] = KurF = (fm*ap - fp*am + am*ap*(qp - qm)) / (ap - am);
       KurFWS = KurF /. ap \rightarrow (U + Sqrt[g * H]) /. am \rightarrow 0;
       KurFWSeta =
          KurFWS /. fp \rightarrow (H * v + U * Rpp * n) /. fm \rightarrow (H * v + U * Rmp * n) /. qp \rightarrow Rpp * n /.
            qm \rightarrow Rmp * n;
       KurFWSeta = KurFWSeta /. v \rightarrow (GGp * G + Gnp * n);
       Kfnnp = FullSimplify[KurFWSeta /. G \rightarrow 0 /. n \rightarrow 1];
       KfnGp = FullSimplify[KurFWSeta /. n \rightarrow 0 /. G \rightarrow 1];
       \texttt{Kfnn} \; = \; \texttt{Kfnnp} \; / \; . \; \mathsf{Rpp} \; \rightarrow \; \mathsf{Rp} \; \; / \; . \; \; \mathsf{Rmp} \; \rightarrow \; \mathsf{Rm} \; \; / \; . \; \; \mathsf{GGp} \; \rightarrow \; \mathsf{GG2} \; \; / \; . \; \; \mathsf{Gnp} \; \rightarrow \; \mathsf{Gn2} \; ;
       \texttt{KfnG} \; = \; \texttt{KfnGp} \; / \; . \; \texttt{Rpp} \; \rightarrow \; \texttt{Rp} \; \; / \; . \; \; \texttt{Rmp} \; \rightarrow \; \texttt{Rm} \; \; / \; . \; \; \texttt{GGp} \; \rightarrow \; \texttt{GG2} \; \; / \; . \; \; \texttt{Gnp} \; \rightarrow \; \texttt{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 \rightarrow (U * Rpp * G + U * H * v + g * H * Rpp * n) /.
               fm \rightarrow (U*Rmp*G + U*H*v + g*H*Rmp*n) /. qp \rightarrow Rpp*G /. qm \rightarrow Rmp*G;
       KurFWSG = KurFWSG / . v \rightarrow (GGp * G + Gnp * n);
       KfGnp = FullSimplify[KurFWSG /. G \rightarrow 0 /. n \rightarrow 1];
       KfGGp = FullSimplify[KurFWSG /. n \rightarrow 0 /. G \rightarrow 1];
       KfGn = KfGnp /. Rpp \rightarrow Rp /. Rmp \rightarrow Rm /. GGp \rightarrow GG2 /. Gnp \rightarrow 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}];
       Fmat2 = {{Fnn2, FnG2}, {FGn2, FGG2}};
       Emat2 = IdentityMatrix[2] + Fmat2 + Fmat2.Fmat2 / 2;
        \texttt{Eerr} = \texttt{Series}[\texttt{Emat2} - \texttt{Exp}[-\texttt{I} * \texttt{wAp} * \texttt{dt}] * \texttt{IdentityMatrix}[2], \{\texttt{dx}, 0, 4\}, \{\texttt{dt}, 0, 4\}]; 
       EigvFmat2 = Eigenvalues[Fmat2];
       RKStep = Log[1 + EigvFmat2 + EigvFmat2 * EigvFmat2 / 2] / (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) < U "}]]</pre>
      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) < U
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{i\left(27\ k^3+9\ H^2\ k^5+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}{8}\left(k^4\ U\right)dt+O[dt]^4\right)dx^3+O[dx]^4
```

Out[177]= Fnn error |

 $\left(-\frac{t}{2 \left(t\right)^2 \left($ $k^5+27 \ k^3 \ U \ \text{text} \ dt \ 12 \ \text{left} \ (4^2 \ k^2+3 \ \text{right})^2 + O \ \text{left} \ (4t)^4 \ \text{right}) \ \text{right}) + \text{text} \ dx \ \text{head} \ \text{text} \ \text{head} \ \text{text} \ \text{head} \ \text{text} \ \text{head} \ \text{he$ $\left(-\frac{1}{8}\right)\left(\frac{4 U\right)} \left(\frac{4 U\right$

Out[178]=

Out[179]= FnG || GGp H

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

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

 $\label{left-frac} $\operatorname{Im}_{\sigma} = \operatorname{FnG}_{\sigma} = \operatorname{FnG}_{\sigma} \left(\frac{dt}^2 (k w)}{2 \left(\frac{k^2 + 3\right)}{-\frac{t}{4t}^3 k w^2}} \right) - \frac{dt}{4t}^3 k w^2} $$ $\label{eq:continuity} $$ k^2+3\right)+O\left(\frac{t}{4}\right)+\left(\frac{dx}^2\right)=0. $$ k^2+3\right)+O\left(\frac{t}{4}\right)+O\left(\frac{t}{4$ $\label{left} $$ \left(\frac{dt}{4 \left(\frac{h^2 k^2+3\right)}}-2\right)-\left(\frac{dt}{4 \left(\frac{h^2 k^2+3\right)}}-2\right)-2\right)$$

Out[183]=

Out[184]= $FGn \parallel H(gRmp + Gnp U)$

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

$$\begin{array}{ll} \text{Out} [\text{186}] = & FGn \; error \; \mid \mid \; \left(-\frac{\left(k \left(3 \, g \, H + g \, H^3 \, k^2 - 3 \, U^2 \right) w \right) dt^2}{2 \left(3 + H^2 \, k^2 \right)} - \frac{i \, k \left(3 \, g \, H + g \, H^3 \, k^2 - 3 \, U^2 \right) w^2 \, dt^3}{6 \left(3 + H^2 \, k^2 \right)} + O[dt]^4 \right) + \\ & \left(-\frac{i \left(9 \, g \, H \, k^3 + 6 \, g \, H^3 \, k^5 + g \, H^5 \, k^7 + 18 \, k^3 \, U^2 + 3 \, H^2 \, k^5 \, U^2 \right) dt}{12 \left(3 + H^2 \, k^2 \right)^2} + O[dt]^4 \right) dx^2 + \left(-\frac{1}{8} \left(g \, H \, k^4 \right) dt + O[dt]^4 \right) dx^3 + O[dx]^4 \right) dx^4 + O[dt]^4 \right) dx^4 + O[dt]^4 +$$

Out[187]= FGn error ||

 $\label{left} $\left(-\frac{t_4t_4t_5^2 \left(H^2 k^2 + 3 \right)}{2 \left(H^2 k^2 + 3 \right)} - \frac{t_4t_5}{2 \left(H^2 k^2 + 3 \right)} - \frac{t_5}{2 \left(H^2 k^$ $\text{text}\{dt\}^3 \text{ k w}^2 \left\{ H^3 \text{ k}^2 + 3 \text{ g H} - 3 \text{ U}^2\right\}$ $k^2+3\right)+O\left(\frac{dt}^4\right)+\frac{dx}^2\left(\frac{dx}^2\right)+C\left(\frac{dt}^4\right)$ k^7+6 g H^3 k^5+3 H^2 U^2 k^5+18 U^2 k^3+9 g H k^3\right) \text{dt}}{12 $\left(H^2 k^2+3\right)^2+O\left(\left(text\{dt\}^4\right)\right)+\left(text\{dx\}^3 \left(-\frac{1}{8}\right)\right)^2+O\left(text\{dt\}^4\right)\right)$ $\left(H k^4\right) \left(k^4\right) \left(k^4\right) \left(k^4\right) \right) + O\left(k^4\right) + O\left(k^4\right)$

Out[188]=

Out[189]= $FGG \parallel (GGp H + Rmp) U$

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

$$\begin{array}{ll} \text{Out} \text{[191]=} & FGG \; error \; || \; \left(-\frac{\left(k \left(6+H^2 \, k^2 \right) U \, w \right) dt^2}{2 \left(3+H^2 \, k^2 \right)} - \frac{i \, k \left(6+H^2 \, k^2 \right) U \, w^2 \, dt^3}{6 \left(3+H^2 \, k^2 \right)} + O[dt]^4 \right) + \left(-\frac{i \left(-9 \, k^3 + 3 \, H^2 \, k^5 + H^4 \, k^7 \right) U \, dt}{12 \left(3+H^2 \, k^2 \right)^2} + O[dt]^4 \right) dx^2 + \\ & \left(-\frac{1}{8} \left(k^4 \, U \right) dt + O[dt]^4 \right) dx^3 + \left(\frac{i \left(297 \, k^5 + 351 \, H^2 \, k^7 + 118 \, H^4 \, k^9 + 13 \, H^6 \, k^{11} \right) U \, dt}{240 \left(3+H^2 \, k^2 \right)^3} + O[dt]^4 \right) dx^4 + O[dx]^5 \end{array}$$

Out[192]= FGG error ||

 $\left(-\frac{t}{2 k^2 + 3\right)}-\frac{t}{3 k}$ $U w^2 \left(\frac{h^2 k^2+6\right)}{6\left(\frac{h^2 k^2+3\right)}+O\left(\frac{h^2 k^2+3\right)}+O\left(\frac{h^2 k^2+3\right)}{1+O\left(\frac{h^2 k^2+3\right)}+O\left(\frac{h^2 k^2+3\right)}+O\left(\frac{h^2 k^2+3\right)}{1+O\left(\frac{h^2 k^2+3\right)}+O\left(\frac{h^2 k^$ $\left(-\frac{i \left(H^4 k^7+3 H^2 k^5-9 k^3\right) U \left(H^2 k^5\right)}{12 \left(H^2 k^5-9 k^3\right)}\right)$ $k^2+3\right)^2+O\left(\left(\frac{dt}^4\right)\right)+\left(\frac{dt}^3\right)$ $\left(\frac{dt}{dt} - \left(\frac{dt}{dt} \right) \right) + \left(\frac{dt}{dt} - \left(\frac{dt}{dt} \right) \right) + \left(\frac{dt}{dt} \right) + \left(\frac{dt}{dt} - \frac{dt}{dt} - \frac{dt}{dt} \right) + \left(\frac{dt}{dt} - \frac{dt}{dt} - \frac{dt}{dt} \right) + \left(\frac{dt}{dt} - \frac{dt}{dt} - \frac{dt}{dt} - \frac{dt}{dt} \right) + \left(\frac{dt}{dt} - \frac$ \left(13 H^6 k^{11}+118 H^4 k^9+351 H^2 k^7+297 k^5\right) U \text{dt}}{240} $\left(H^2 k^2+3\right)^3+O\left(\left(text\left(dt\right)^4\right)\right)+O\left(text\left(dx\right)^5\right)$

Out[193]=

Out[194]=

Omega error ||
$$\left(\frac{\frac{1}{6(3+H^2 k^2)^2} k^2 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + (3+H^2 \, k^2) \, U \right) \left(3 \, g \, H + U \left(2 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + (3+H^2 \, k^2) \, U \right) \right) dt^2 + \\ \frac{i k^4 \left(3 \, g \, H + U \left(2 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + (3+H^2 \, k^2) \, U \right) \right)^2 dt^3}{8(3+H^2 \, k^2)^2} - \frac{1}{20(3+H^2 \, k^2)^2} \left(k^2 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + (3+H^2 \, k^2) \, U \right) \right)^3 \\ \left(3 \, g \, H + U \left(2 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + (3+H^2 \, k^2) \, U \right) \right) \right) dt^4 + O[dt]^3 \right) + \\ \frac{\left(k^2 \left(-3 \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right) + 2(3+H^2 \, k^2)^2 \, U \right)}{24(3+H^2 \, k^2)^2} + \frac{1}{48(3+H^2 \, k^2)^2} k^2 \left(g \left(-9 \, \sqrt{3} \, H \, \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + 18 \, H^3 \, k^2 \, U + 6 \, H^5 \, k^4 \, U \right) + \\ U^2 \left(27 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + 54 \, U + 2 \, H^6 \, k^6 \, U + 3 \, k^2 \left(7 \, \sqrt{3} \sqrt{g \, H^5 \, (3+H^2 \, k^2)} \right. + 18 \, H^2 \, U \right) + \\ 2 \, k^4 \left(2 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + 54 \, U + 2 \, H^6 \, k^6 \, U + 3 \, k^2 \left(7 \, \sqrt{3} \sqrt{g \, H^5 \, (3+H^2 \, k^2)} \right. + 18 \, H^2 \, U \right) + \\ \frac{1}{48(3+H^2 \, k^2)^2} i \, k^6 \left(3 \, g \, H + U \left(2 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + (3+H^2 \, k^2) \, U \right) \right) \\ \left(-9 \, g \, H + U \left(3 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + 18 \, U + 2 \, H^4 \, k^4 \, U + 2 \, k^2 \left(\sqrt{3} \sqrt{g \, H^5 \, (3+H^2 \, k^2)} \right. + 6 \, H^2 \, U \right) \right) \right) \\ dt^3 - \frac{1}{96(3+H^2 \, k^2)^2} \left(k^2 \left(-3 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right) + 2 \, (3+H^2 \, k^2)^2 \, U \right) \\ \left(3 \, g \, H + U \left(2 \, \sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right. + (3+H^2 \, k^2) \, U \right) \right)^2 \right) dt^4 + O[dt]^2 \right) dx^2 + \\ \left(-\frac{1}{16} i \, k^4 \left(\sqrt{3} \sqrt{\frac{g \, H^4 \, (3+H^2 \, k^2)}{3+H^2 \, k^2}} + 2 \, U \right) - \frac{1}{32(3+H^2 \, k^2)^2} i \, k^6 \left(3 \, g \, H \left(\sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right) + 4 \, (3+H^2 \, k^2) \, U \right) + \\ \left(-\frac{1}{16} i \, k^4 \left(\sqrt{3} \sqrt{\frac{g \, H^4 \, (3+H^2 \, k^2)}{3+H^2 \, k^2}} + 2 \, U \right) - \frac{1}{32(3+H^2 \, k^2)^2} i \, k^6 \left(3 \, g \, H \left(\sqrt{3} \sqrt{g \, H \, (3+H^2 \, k^2)} \right) + 4 \, (3+H^2 \, k^2) \, U \right) + \\ \left(-\frac{1}{16} i \, k^4 \left(\sqrt{3} \sqrt{\frac{g \, H^4 \, (3+H^2 \, k^2)}{3+H^2 \, k^2}} + 2 \, U \right) - \frac{1}{32(3+H^2 \, k^2$$

$$\begin{array}{c} U^* \left(15 \ \sqrt{3} \ \sqrt{g} \ H(3+H^*K^*) + 18 \ U + 2 \ H^*K^* \ U + K^* \left(5 \ \sqrt{3} \ \sqrt{g} \ H^*(3+H^*K^*) + 12 \ H^* \ U \right) \right) dt^* + \\ \frac{1}{31(1+H^*)^2} k^2 \left(3 \ g \ H + U \left(2 \ \sqrt{3} \ \sqrt{g} \ H(3+H^2 k^2) + 2 \left(3 + H^2 k^2 \right) U \right) \right) dt^3 + \\ \frac{1}{64(2+H^2 k^2)^2} k^2 k^2 \left(\sqrt{3} \ \sqrt{g} \ H(3+H^2 k^2) + 2 \left(3 + H^2 k^2 \right) U \right) \right) dt^3 + \\ \frac{1}{64(2+H^2 k^2)^2} k^2 k^2 \left(\sqrt{3} \ \sqrt{g} \ H(3+H^2 k^2) + 2 \left(3 + H^2 k^2 \right) U \right) \right) dt^4 + O[dt]^5 \right) dx^3 + \\ \left(- \left(\left(k^2 \left(3 \ \sqrt{3} \ g \ H \left(177 + 124 \ H^2 k^2 + 20 \ H^4 k^4 \right) + 104 \left(9 \ \sqrt{g} \ H \left(3 + H^2 k^2 \right) \right) + 6 \ k^2 \ \sqrt{g} \ H^5 \left(3 + H^2 k^2 \right) + 4 \left(4 \ \sqrt{g} \ H^9 \left(3 + H^2 k^2 \right) \right) \right) \right) \right) \left(\left(\left(k^2 \left(27 \ \sqrt{3} \ g^2 \ H^2 \left(167 + 124 \ H^2 k^2 + 20 \ H^4 k^4 \right) + g \ H U \left(21 \ 429 \ \sqrt{3} \ H^2 k^2 \right) + 4 \left(24 \ k^4 \ \sqrt{g} \ H^9 \left(3 + H^2 k^2 \right) + 293 \ \sqrt{3} \ H^2 \ U \right) \right) \right) \right) \right) \left(\left(\left(k^2 \left(27 \ \sqrt{3} \ g^2 \ H^2 \left(167 + 124 \ H^2 k^2 + 20 \ H^4 k^4 \right) + g \ H U \left(21 \ 429 \ \sqrt{3} \ H^2 k^2 \right) + 4 \left(24 \ k^4 \ \sqrt{g} \ H^9 \left(3 + H^2 k^2 \right) + 293 \ \sqrt{3} \ H^2 \ U \right) \right) \right) \right) \right) \right) \right) \right) \left(\left(\left(k^2 \left(27 \ \sqrt{3} \ g^2 \ H^3 \left(3 + H^2 k^2 \right) + 20 \ H^3 \left(3 + H^2 k^2 \right) + 293 \ \sqrt{3} \ H^2 \ U \right) \right) \right) \right) \right) \right) \left(\left(11 \ 520 \left(\sqrt{g} \ H \left(3 + H^2 k^2 \right)^2 \right) \right) \right) \right) \left(11 \ 520 \left(\sqrt{g} \ H \left(3 + H^2 k^2 \right)^{2} \right) \right) \right) \right) \left(11 \ 520 \left(\sqrt{g} \ H \left(3 + H^2 k^2 \right)^{2} \right) \right) \right) \left(11 \ 520 \left(\sqrt{g} \ H \left(3 + H^2 k^2 \right)^{2} \right) \right) \right) \left(11 \ 520 \left(\sqrt{g} \ H \left(3 + H^2 k^2 \right)^{2} \right) \right) \left(12 \ 64 \ 4 \left(13 \ 4 H^2 k^2 \right) \right) \left(13 \ 4 H^2 k^2 \right) \right) \left(14 \ 4 \left(13 \ 4 H^2 k^2 \right) \right) \left(14 \ 4 \left(14 \ 4 H^2 k^2 \right) + 10 \ H^4 k^4 \right) \right) \right) \right) \left(11 \ 520 \left(\sqrt{g} \ H \left(3 + H^2 k^2 \right)^2 \right) \left(12 \ 4 H^2 k^2 \right) \right) \left(12 \ 4 H^2 k^2 \right) \right) \left(12 \ 4 H^2 k^2 \right) \right) \left(12 \ 4 H^2 k^2 \right) \left(12 \ 4 H^2 k^2 \right) \left(12 \ 4 H^2 k^2 \right) \left(12 \ 4 H^$$

$$\begin{cases} \frac{1}{6(3+16^2k^2)^2}k^3\Big(-\sqrt{3}\ \sqrt{g\,\Pi\,(3+\Pi^2\,k^2)}\ + (3+\Pi^2\,k^2)\,U\Big)\Big(3\,g\,\Pi+U\Big(-2\,\sqrt{3}\ \sqrt{g\,\Pi\,(3+\Pi^2\,k^2)}\ + (3+\Pi^2\,k^2)\,U\Big)\Big) \\ \frac{dt^2+}{8(3+\Pi^2\,k^2)} + \frac{1}{8(3+\Pi^2\,k^2)} + (3+\Pi^2\,k^2)U\Big)\Big]^2dt^4 \\ -\frac{1}{20(3+\Pi^2\,k^2)^2} \Big(k^5\Big(-\sqrt{3}\ \sqrt{g\,\Pi\,(3+\Pi^2\,k^2)}\ + (3+\Pi^2\,k^2)\,U\Big)\Big)^2\Big(3\,g\,\Pi+U\Big(-2\,\sqrt{3}\ \sqrt{g\,\Pi\,(3+\Pi^2\,k^2)}\ + (3+\Pi^2\,k^2)\,U\Big)\Big)\Big) \\ dt^4+O[dt]^5\Big) + \\ \frac{\left(k^3\Big(3\,\sqrt{3}\ \sqrt{g\,\Pi\,(3+\Pi^2\,k^2)}\ + 2(3+\Pi^2\,k^2)}\ + (3+\Pi^2\,k^2)\,U\Big)\Big)^2\Big(3\,g\,\Pi+U\Big(-2\,\sqrt{3}\ \sqrt{g\,\Pi\,(3+\Pi^2\,k^2)}\ + (3+\Pi^2\,k^2)\,U\Big)\Big)\Big)}{224(3+\Pi^2\,k^2)} + \frac{1}{238(3+\Pi^2\,k^2)} + 54\,U + 2\,H^6\,k^6\,U - 3\,k^2\Big(7\,\sqrt{3}\ \sqrt{g\,H^3\,(3+H^2\,k^2)}\ - 18\,H^2\,U\Big) + \\ U^2\Big(-27\,\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + 54\,U + 2\,H^6\,k^6\,U - 3\,k^2\Big(7\,\sqrt{3}\ \sqrt{g\,H^3\,(3+H^2\,k^2)}\ - 18\,H^2\,U\Big) - \\ 2\,k^4\Big(2\,\sqrt{3}\ \sqrt{g\,H^3\,(3+H^2\,k^2)}\ - 9\,H^4\,U\Big)\Big)\Big)dt^2 + \\ \frac{1}{48(3+\Pi^2\,k^2)^2} i^4\,k^6\Big(3\,g\,H + U\Big(-2\,\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + (3+H^2\,k^2)\,U\Big)\Big) \\ \Big(-9\,g\,H + U\Big(-3\,\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + 2\,(3+H^2\,k^2)\ + (3+H^2\,k^2)\,U\Big)\Big)\Big(3\,g\,H + U\Big(-2\,\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + (3+H^2\,k^2)\ + (3+H^2\,k^2)\Big)\Big)\Big)\Big(dt^4 + O[dt]^5\Big)dx^2 + \\ \Big(\frac{1}{16}\,i\,k^4\Big(\sqrt{3}\ \sqrt{\frac{g\,H}{3}\,H^2\,k^2}\ - 2\,U\Big) - \frac{1}{23(3+\Pi^2\,k^2)^2}\,i\,k^6\Big(-3\,g\,H\Big(\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ - 4\,(3+H^2\,k^2)\ + (3+H^2\,k^2)\,U\Big)\Big)\Big)} \\ dt^2 + \frac{1}{32(3+\Pi^2\,k^2)^2}k^2\Big(3\,g\,H + U\Big(-2\,\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + (3+H^2\,k^2)\,U\Big)\Big)\Big(3\,g\,H + U\Big(-2\,\sqrt{3}\ \sqrt{g\,H^3\,(3+H^2\,k^2)}\ + 12\,H^2\,U\Big)\Big)\Big)\Big)} \\ dt^2 + \frac{1}{32(3+\Pi^2\,k^2)^2}k^2\Big(3\,g\,H + U\Big(-2\,\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + (3+H^2\,k^2)\,U\Big)\Big)\Big(3\,g\,H + U\Big(-3\,\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + 12\,H^2\,U\Big)\Big)\Big)\Big)\Big(3\,g\,H + U\Big(-3\,\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + 2\,(3+H^2\,k^2)\,U\Big)\Big)\Big)dt^3 + \\ \frac{1}{64(3+\Pi^2\,k^2)^2}i^2\,k^2\Big(-\sqrt{3}\ \sqrt{g\,H\,(3+H^2\,k^2)}\ + 2\,(3+H^2\,k^2)\,U\Big)\Big)^2dt^4 + O[dt]^5\Big)$$

$$\begin{split} dx^3 + & \left(\left(k^3 \left(3 \sqrt{3} \right. g \, H \, (177 + 124 \, H^2 \, k^2 + 20 \, H^4 \, k^4 \right) - \right. \\ & \left. 104 \left(9 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right) + 6 \, k^2 \sqrt{g \, H^6} \, \left(3 + H^2 \, k^2 \right) + k^4 \sqrt{g \, H^9} \, \left(3 + H^2 \, k^2 \right) \right) U \right) \right) \right/ \\ & \left(1920 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right)^{5/2} \right) + \left(k^7 \left(27 \sqrt{3} \, g^2 \, H^2 \, (167 + 124 \, H^2 \, k^2 + 20 \, H^4 \, k^4 \right) + g \, H \, U \left(21429 \sqrt{3} \, H^2 \, k^2 \, U + 764 \sqrt{3} \, H^6 \, k^6 \, U + 81 \left(-232 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right) + 267 \sqrt{3} \, U \right) - 24 \, k^4 \left(84 \sqrt{g \, H^9} \, \left(3 + H^2 \, k^2 \right) - 293 \sqrt{3} \, H^4 \, U \right) \right) - \\ & \left. 16 \left(459 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right) \, U^3 + 153 \, k^4 \sqrt{g \, H^9} \, \left(3 + H^2 \, k^2 \right) \, U^3 + 17 \, k^6 \sqrt{g \, H^{13}} \, \left(3 + H^2 \, k^2 \right) \, U^3 + 9 \, k^2 \left(88 \sqrt{g^3 \, H^7} \, \left(3 + H^2 \, k^2 \right) \, U + 51 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) \, U^3 \right) \right) \right) dt^2 \right) / \\ & \left(11520 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right)^{7/2} \right) - \frac{1}{3840 \left(5 + H^2 \, k^2 \right)} \, U + 51 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) \, U^3 \right) \right) dt^2 \right) / \\ & \left(11520 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right)^{7/2} \right) - \frac{1}{3840 \left(5 + H^2 \, k^2 \right)} \, U + 51 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) \, U^3 \right) \right) \right) dt^2 \right) / \\ & \left(11520 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right)^{7/2} \right) - \frac{1}{3840 \left(5 + H^2 \, k^2 \right)} \, U + 51 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) \, U^3 \right) \right) \right) dt^2 \right) / \\ & \left(11520 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right)^{7/2} \right) - \frac{1}{3840 \left(5 + H^2 \, k^2 \right)} \, U + 51 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) \, U^3 \right) \right) \right) dt^2 \right) / \\ & \left(11520 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right)^{7/2} \right) - \frac{1}{3840 \left(5 + H^2 \, k^2 \right)} \, U + 51 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) \, U^3 \right) \right) \right) dt^2 \right) / \\ & \left(11520 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right)^{7/2} \right) - \frac{1}{3840 \left(5 + H^2 \, k^2 \right)} \, U + 51 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) \, U^3 \right) \right) dt^2 \right) / \\ & \left(11520 \sqrt{g \, H} \, \left(3 + H^2 \, k^2 \right)^{7/2} \right) - \frac{1}{3840 \left(5 + H^2 \, k^2 \right)} \, U + 51 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) \, U^3 \right) \right) dt^2 + 2 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) + 2 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) + 2 \sqrt{g \, H^3} \, \left(3 + H^2 \, k^2 \right) + 2 \sqrt{g \, H^3} \, \left(3 + H^2$$

Out[196]= Omega error ||

 $\left(\frac{h^2 k^3 \left(\frac{h^2 k^2+3\right)} U+\sqrt{h^2 k^2+3\right)} U+\sqrt{h^2 k^2+3\right)} \right)$ $\label{left(H^2 k^2+3) right) U+2 sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) \text{dt}^2}{6}$ $\left(H^2 k^2+3\right) + \frac{k^4 \left(3 gH+U\right)^2 k^2+3\right) U+2 \sqrt{k^2+3}}{u+1}$ $\left(\frac{4^2 k^2+3\right)}{right}\right)^2 \left(\frac{4^2 k^2+3\right)^2} \left(\frac{4^2 k^2+3\right)^2}{right}\right)^2 \left(\frac{4^2 k^2+3\right)^2}{right}$ $k^2+3\right\in U+\sqrt{3} \operatorname{left}(H^2 k^2+3\right)$

 $k^2+3\left(U+2 \right) +2 \left(U+2 \right)$ $\label{eq:k-2+3-right} $$ k^2+3\right)+\left(\frac{k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(\frac{k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(k^3 \left(k^3 \left(\frac{k^3 \left(k^3 \left(k^4 \left(k^3 \left(k^3 \left(k^3 \left(k^3 \left(k^3 \left(k^3 \left(k^4 \left(k^3 \left(k^3 \left(k^4 \left(k^3 \left(k^{4} \left(k^{k^3 \left(k^{4} \left(k^{$ $\left(\frac{H^2 k^2+3\right)}{24\left(\frac{H^2 k^2+3\right)}}{24\left(\frac{H^2 k^2+3\right)}{24\left(\frac{H^2 k^2+3\right)}}} \right)$ $\label{left} $\left(9 \cup H^4+2 \right^{3} \right) \left(H^9 \left(H^2 k^2+3\right)\right) \ k^4+3 \left(18 \cup H^2+7 \right) \right. $$$ $H^5 \left(H^2 k^2+3\right)\right) + h^2+54 U+27 \left(H^2 k^2+3\right) + h^2 \left(H^2 k^2+$ $\left(6 \, k^4 \, U \, H^5 + 18 \, k^2 \, U \, H^3 - 9 \, \right) \left(1 \, H^2 \, k^2 + 3 \right) \, H\right) \, \left(1 \, k^2 \, U \, H^3 - 9 \, \right) \, \left(1 \, H^2 \, k^2 + 3 \right) \, H\right) \, H\right) \, H$ $H \left(H^2 k^2+3\right)\right) \left(U \left(H^4 U k^4+2 \left(H^4 U h^2+3\right)\right)\right)$ $\t (dt)^3 {48 \left(\frac{h^2 k^2+3 \right)^3}-\frac{(k^7 \left(\frac{h^2 k^2+3 \right)^3}{48 \left(\frac{h^2 k^2+3 \right)^3}-\frac{h^2 k^2 + \frac{h^2 k^2 + h^2 + \frac{h^2 k^2 + \frac{h^2 k^2 + \frac{h^2 k^2 + h^2 + h^2 h^2 + h^2 h^2 + \frac{h^2 k^2 + \frac{h^2 k^2 + h^2 h^2 + h^2$ $H \left(H^2 k^2 + 3 \right) \left(H^2 k$ $\label{eq:linear_continuity} $$ k^2+3\right)\right) $$ k^2+3\right) $$ k^2+3\left(k^2+3\right) $$ k^2+3\left($ $\label{eq:left-proof-p$ $\label{left} $\left(\left(\frac{H^2 h^4 U k^4+\left(12 U h^2+5 \right) + (14 U h^5 \left(\frac{H^2 k^2+3\right)}{12 U h^2+18 U+15}\right)}\right) $$$ $\$ \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+3 g H \left(H\d \left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g} $H \left(H^2 k^2 + 3 \right) \right) \left(H^2 k^2 + 3 \right) \left(H^$ $\label{left(H^2 k^2+3\wedge ght) U+2 sqrt{3} sqrt{g H \left(H^2 k^2+3\wedge ght)\right)} \left(g g H+U \left(H^2 k^2+3\right)\right) \left(g H+U \left(H^2 k^2+3\right)\right$ $\label{left(H^2 k^2+3\wedge ight) U+3 sqrt{3} sqrt{g H \left(H^2 k^2+3\wedge ight)\right) text{dt}^3}{32 \left(H^2 k^2+3\wedge ight\right) text{dt}^3}{3$ $k^2+3\right)^2+\frac{1}{2} k^2+3\right)^2+\frac{1}{2} k^2+3\right)^2+\frac{1}{2} k^2+3\right)^2+\frac{1}{2} k^2+3\left(k^2+3\right)^2+\frac{1}{2} k^2+3\left(k^2+3\left(k^2+3\right)^2+\frac{1}{2} k^2+3\left(k^2+3\left(k^2+3\right)^2+\frac{1}{2} k^2+3\left(k^2+3\left(k^2+3\right)^2+\frac{1}{2} k$ $\label{left} $$\left(\frac{3 g H+U \left(\frac{4^2 k^2+3\right)} U+2 \right) + \left(\frac{3 g H+U \left(\frac{4^2 k^2+3\right)}{right}\right)^2}$$ $\label{eq:left} $$ \left(\frac{dt}^4}{64 \left(\frac{h^2 k^2+3\right)}}+O\left(\frac{dt}^5\right)\right) \left(\frac{dt}^3+\left(\frac{h^2 k^2+3\right)}{64 \left(\frac{h^2 k^2+3\right)}}\right) \right) $$$ $\$ g H \left(20 H^4 k^4+124 H^2 k^2+177\right)+104 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)}) $k^4+6 \operatorname{left}(H^2 k^2+3\right) k^2+9 \operatorname{left}(H^2 k^2+3\right) U\right) \|h\|^2 \|$ $\label{left(sqrt{g H} \left(H^2 k^2 + 3\right)^{5/2}\right) - \frac{1}{2} \left(h^7 \left(h^7 \right)^{2} \right) - \frac{1}{2} \left(h^7 \right)^{5/2}\right) - \frac{1}{2} \left(h^7 \right)^{5/2} \left(h^$ k^4+124 H^2 k^2+167\right) H^2+g U \left(764 \sqrt{3} H^6 U k^6+24 \left(293 \sqrt{3} U H^4+84 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+21429 \sqrt{3} H^2 U k^2+81 \left(267 \sqrt{3} U+232 $\sqrt{g H \left(\frac{h^2 k^2+3\right)} \right)} U^3 - \frac{h^2 k^2+3\right)} U^3 - \frac{h^2 k^2+3}{h^2 k^2+3} U$ $k^6+153 \sqrt{g} H^9 \left(H^2 k^2+3\right) U^3 k^4+9 \left(51 \sqrt{g} H^5 \left(H^2 k^2+3\right)\right)$ $U^3+88 \sqrt{g^3 H^7 \left(\frac{h^2 k^2+3\right)} U\right)} U\right) k^2+459 \sqrt{g H \left(\frac{h^2 k^2+3\right)}} U\right)$ $U^3\right) \left(\frac{dt}^2}{11520 \left(\frac{H^2 k^2+3\right)}{11520 \left(\frac{K^2 k^2+3\right)}{11520 \left(\frac$ $\left(84 H^8 U^4 k^8+4 U^3 \left(52 U H^6+83 \right) \right) \left(13\right) \left(H^2 k^2+3\right)\right)$ $k^6 + 36\ U^3 \left(126\ U\ H^4 + 85\ sqrt{3} \right) \left(H^9 \left(H^2\ k^2 + 3\right)\right) \right) k^4 + 9 \left(1008\ H^6 + 36\ U^3\right) \left(H^2\ H^6 + 16\ U^6\right) k^4 + 9 \left(H^2\ H^6\right) \left(H^2\ H^6\right) k^4 + 9 \left(H^6\right) H^6 \left(H^6\right) k^4 + 9 \left(H^6\right) H^6 \left(H^6\right) h^6$ $H^2 U^4 + 1039 \sqrt{3} \sqrt{g} H^5 \left(H^2 k^2 + 3 \right) U^3 + 600 \sqrt{3} \sqrt{3} \right)$ k^2+3\right)} U\right) k^2+54 g^2 H^2 \left(10 H^4 k^4+62 H^2 k^2+81\right)+243 U^3 \left(28 U+39) \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)\right)+3 g H U \left(472 H^6 U k^6+4 \left(1101 U H^4+71 \sqrt{3} \sqrt{g H^9 \left(H^2 k^2+3\right)\right) k^4+13500 H^2 U k^2+27 \left(504 U+97 \sqrt{3}) $\left(H^2 k^2+3\right)\right)\right)$ $\label{left} $\left(\left(\frac{H^2 k^2+3\right)} U+\sqrt{3} \right) H(H^2 k^2+3\right) \left(\frac{H^2 k^2+3\right)} \left(\frac{4 U^3 \left(\frac{4 U^3}{16}\right)}{16}\right) H(H^2 k^2+3) H(H^2 k^2+3)$ $\sqrt{3} g H^9+58 \left(g H^{17} \left(h^2 k^2+3\right) U\right) k^8+12 U \left(13 \right) g^2$ $H^8+g \ U \left(1979 \right) \ H^7+232 \ H^{13} \ H^8+g \ U \left(1979 \right) \ H^7+232 \ H^{13} \ H^8+g \ U \left(1979 \right) \ H^7+232 \ H^{13} \ H^8+g \ U \left(1979 \right) \ H^8+g \ U$ \left(H^2 k^2+3\right)\right) \left(2672 \sqrt{3} g^2 U H^6+g U^2 \left(5997 \sqrt{3}) $U+4384 \sqrt{g H \left(\frac{h^2 k^2+3\right)} U^4+180} = U+4384 \sqrt{g H} \left(\frac{h^2 k^2+3\right)} U^4+180 = U+4484 \sqrt{g H} \left(\frac{h^2 k^2+3\right)} U^4+$

 $U^3 H^3 + 928 \sqrt{(H^2 k^2 + 3 + 15)} U^4 + 4515 \sqrt{(H^2 k^2 + 3 +$ $U^2+372 \sqrt{g^5 H^9 \left(H^2 k^2+3\right)} \ln k^2+81 \left(H^2 k^2+3\right)$ $U^4+g \ H \left(1033 \right) - \left(1033$ $H^2 U+157 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right) \left(H^2 U+157 \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right)$ \left(\left(H^2 k^2+3\right) \U-\sqrt{3} \sqrt{g H \left(H^2 k^2+3\right) \left(3 g H+U \left(\left(H^2 k^2+3\right)) \left(3 g H+U \left(\left(H^2 k^2+3\right))) \left(3 g H+U \left(\left(H^2 k^2+3\right)) \left(3 g H+U \left(\left(H^2 k^2+3\right))) \left(3 g H+U \left(H^2 k^2+3\right)) \left(3 g H+U \left(H^2 k^2+ $\label{left} $$k^2+3\right\oplus U-2 \operatorname{left}(H^2 k^2+3\right)\right\to \operatorname{left}(H^2 k^2+3\right) \cdot (H^2 k^2+3) \cdot (H^$ $\label{eq:k-2+3-right} $$k^2+\frac{1}{2}+\frac{1}{2} + \frac{1}{2} + \frac{1}{2}$ $\label{left(H^2 k^2+3\right)} $$ \left(H^2 k^2 + 3\right) \right) \left(h^2 k^2 + 3\right) \left(h^2$ $k^2+3\right\} U-\sqrt{3} \left(H+U \left(h^2 k^2+3\right) \right) + (3 g H+U \left(h^2 k^2+3\right) \right)$ $k^2+3\left(U-2 \right) U-2 \left(H^2 \left(H^2 \left(H^2 \right) \right) \right) \\$ $k^2+3\right/4+O\left(\frac{4t}^5\right)\right)$ $\left(H^2 k^2+3\right)$ $k^6-2 \left(\frac{3} \right) \left(\frac{4-3}{g} \right) - \frac{4-3}{g}$ $\left(\frac{H^2 k^2+3\right)}{18 H^2 U\right) k^2+54 U-27 \sqrt{g} H \left(\frac{h^2 k^2+3\right)}\right)$ U^2+3 g \left(2 k^4 U H^5+6 k^2 U H^3+3 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} H\right)\right) $\label{eq:left} $$ \left(\frac{dt}^2}{48 \left(\frac{h^2 k^2+3\right)}^3}+\frac{k^6 \left(\frac{3 gH+U \left(\frac{h^2 k^2+3\right)}{U-2 \left(\frac{3}{2}\right)}}{U-2 \left(\frac{3}{2}\right)}\right)} \right) = \frac{1}{2} \left(\frac{h^2 k^2+3\right)}{U-2 \left(\frac{3}{2}\right)} + \frac{1}{2} \left(\frac{h^2 k^2+3}{U-2 \left(\frac{3}{2}\right)}\right)} \right) = \frac{1}{2} \left(\frac{h^2 k^2+3}{U-2 \left(\frac{3}{2}\right)}\right) + \frac{1}{2} \left(\frac{h^2 k^2+3}{U-2 \left(\frac{3}{2}\right)}\right)} + \frac{1}{2} \left(\frac{h^2 k^2+3}{$ $H \left(H^2 k^2 + 3 \right) \left(H^2 k$ $\label{eq:linear_continuity} $$ k^2+3\right)\right) $$ k^2+3\right) $$ k^2+3\left(k^2+3\right) $$ k^2+3\left($ \left(U^2 \left(2 H^4 U k^4+\left(12 H^2 U-5 \sqrt{3} \sqrt{g H^5 \left(H^2 k^2+3\right)}\right) $\label{eq:linear_loss} $$ k^2+18 U-15 \operatorname{sqrt}{3} \operatorname{H}\left(H^2 k^2+3\right)\right)\right] = g H \left(sqrt{3} \right) \operatorname{H}\left(H^2 k^2+3\right) - g H \left(sqrt{3} \right) - g H \left(sqrt{3} \right$ $\label{eq:linear_continuous} $$ k^2+3\right)^4 \left(H^2 k^2+3\right)^2+\frac{dt}^2} 32 \left(H^2 k^2+3\right)^2+\frac{dt}^2}.$ $\label{left} $$\left(3 g H+U \left(\frac{4^2 k^2+3\right)} U-2 \right) -2 \left(\frac{3} \kappa(H^2 k^2+3\right)\right)\right)$$ $\left(3 g H+U \left(4^2 k^2+3\right) U-3 \right) + \left(4^2 k^2+3\right) U-3 \right)$ $\label{left} $$ \left(\frac{dt}^3}{32 \left(\frac{h^2 k^2+3\right)^2}+\frac{k^8 \left(\frac{h^2 k^2+3\right)^2}+\frac{h^2 k^2+3\right)^2}{h^2 k^2+3\right)^2}} \right) $$$ $\label{eq:left(H^2 k^2+3\wedge ight) heft(3 g H+U \left(\frac{h^2 k^2+3\wedge ight) U-2 \sqrt{3} \right) heft(H^2 k^2+3\wedge ight) U-2 \right) heft(H^2 k^2+3\wedge ight) heft(H^2 k^2+3\wedge ight)$ $k^2+3\right)$ ight)\right)\right)\right)\right)\right)\right)\right)\right)\right)\right)\right)\right)\right)\right)\right)\right) $\text{dx}^3+\left(\frac{4x^5}{6x^5}\right)$ $H^9 \left(H^2 k^2 + 3 \right) k^4 + 6 \left(H^5 \left(H^2 k^2 + 3 \right) k^2 + 9 \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^2 k^2 + 3 \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^2 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^5 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^6 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^6 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^6 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^6 \left(H^4 k^2 + 3 \right) k^2 \right) k^2 + 9 \left(H^6 \left(H^$ g^2 \left(20 H^4 k^4+124 H^2 k^2+167\right) H^2+g U \left(764 \sqrt{3} H^6 U k^6-24 \left(84 \sqrt{g}) $H^9 \left(H^2 k^2 + 3 \right) - 293 \left(H^4 U \right) k^4 + 21429 \left(H^2 u k^2 + 3 \right) + 12429 \left(H$ $\sqrt{3} U-232 \left(H \left(H^2 k^2+3\right)\right)\right) H-16 \left(17 \right) H-16 \left($ k^2+3\right)} U^3 k^6+153 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^3 k^4+9 \left(51 \sqrt{g H^5 \left(H^2 k^2+3\right)}) $k^2+3\right) U^3+88 \left(H^2 L^2 \right) U^3+88 \left(H^2 L^2 \right)$ $k^2+3\right) U^3\right) + U^3) + U^3) + U^3\right) + U^3) +$ \left(84 H^8 U^4 k^8+4 U^3 \left(252 H^6 U-83 \sqrt{3} \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right) $k^6+36 U^3 \left(126 H^4 U-85 \right) \left(14 H^9 \left(14 K^2+3 \right) \right) k^4-9 \left(14 H^2 K^2+3 H^2 K^2+3 \right) k^4-9 \left(14 H^2 K^2+3 H^2 K^2+3$ $H^2 U^4+1039 \sqrt{3} \sqrt{4+1039 \sqrt{3} \sqrt{4+1039}} U^3+600 \sqrt{3} \sqrt{3} \sqrt{4+1039 \sqrt{3} \sqrt{3} \sqrt{3} U^3+600 \sqrt{3} \sqrt{3} \sqrt{3} U^3+600 \sqrt{3} \sqrt{3} U^3+600 \sqrt{3} U^3+600$ LA2 + 2 right)) I Naight) LA2 + 54 aA2 UA2 \1a4(10 UA4 LA4 + 62 UA2 LA2 + 91\right) + 242 IIA2 \1a4(29 II - 20

K 2+341gm); U41gm) K 2+34 g 2 11 2 45m(10 11 4 K 4+02 11 2 K 2+0141gm)+243 U 3 45m(20 U-37 $\left(H^2 k^2+3\right)\right) \grt{3} \grt{3} \grt{4} H \left(H^2 k^2+3\right)\right) \grt{3} \grt{6} H U \left(H^2 k^2+3\right) \grt{3} \grt{6} H U \left(H^2 k^2+3\right) \grt{3} \grt{6} H U \left(H^2 k^2+3\right) \grt{6} H U$ $H^9 \left(H^2 k^2 + 3 \right) - 1101 H^4 U \right) + 13500 H^2 U k^2 + 27 \left(504 U - 97 \right) \right)$ $H \left(\frac{4^2 k^2+3\right)}{\sinh(k^2)} \left(\frac{4t}{3}{3840} \left(\frac{k^2+3\right)}{4}-\frac{k^2+3\right)}{\hbar(k^2)} \right)$ $\left(\frac{4 - 2 \cdot 4}{1 \cdot 3}\right) = \left(\frac{4 \cdot 4}{1 \cdot 3}\right) - \left(\frac{4 \cdot 4}{1 \cdot 3}\right) = \left(\frac{4 \cdot 4}{1 \cdot 3$ $H^{17} \left(H^2 k^2 + 3\right) U - 239 \left(H^8 + g \right) k^8 - 12 U \left(H^2 k^2 + 3\right) y + 3 \left(H^8 + g \right) k^8 - 12 U \left(H^2 k^2 + 3\right) y + 3 \left(H^8 + g \right) k^8 - 12 U \left(H^8 + g \right) y + 3 \left(H^8 + g$ $U \left(\frac{979 \sqrt{3} U - 349 \sqrt{g H \left(\frac{4^2 k^2 + 3\right)}} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} {16^2 k^2 + 3} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} {16^2 k^2 + 3} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} {16^2 k^2 + 3} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} {16^2 k^2 + 3} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} {16^2 k^2 + 3} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} {16^2 k^2 + 3} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} {16^2 k^2 + 3} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} \left(\frac{4^2 k^2 + 3\right)} {16^2 k^2 + 3} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} H^7 - 232 \sqrt{g H^{13}} \right) H^7 - 232 \sqrt{g H^{13}} H^7 - 232 \sqrt{g$ k^2+3\right)} U^3\right) k^6+9 \left(-2672 \sqrt{3} g^2 U H^6+g U^2 \left(4384 \sqrt{g H \left(H^2 $k^2+3\right)=5997 \sqrt{3} U\right)+5997 \sqrt{3} U\right)$ $H^{13} \left(H^2 k^2+3\right)\right) \ k^4+27 \left(-2703 \right) \ yrt{3} g^2 U H^4-4070 \ grt{3} g U^3$ $H^3+928 \cdot qrt{g H^5 \left(H^2 k^2+3\right) U^4+4515 \cdot grt{g^3 H^7 \left(H^2 k^2+3\right) U^2+372}$ $\$ \sqrt{g^5 H^9 \left(H^2 k^2+3\right)\right) \k^2+81 \left(232 \sqrt{g H \left(H^2 k^2+3\right)} U^4+g $H \left(1527 \right) + 1061(1527 \right) + 1061(1527 \right) + 1071(1527 \right) + 1071($ $\$ \sqrt{g^5 H^5 \left(H^2 k^2+3\right)}\right)\right)\right) \text{dt}^4}{23040 \left(\sqrt{g H} \left(H^2 L^2 + 1)\right)} $k^2+3\right)^{1/2}\right)+O\left(\frac{dt}{5}\right)+O\left(\frac{dt}{5}\right)$

Out[197]=

$$\begin{aligned} & \text{Out} \text{[198]=} \quad \text{EA} \text{ ||} \quad \left\{ \left\{ 1 + \frac{i \, e^{\frac{i \, \text{dx} \, \mathbf{k}}{2}} \left(1 - e^{-i \, \text{dx} \, \mathbf{k}} \right) \left(-1 + e^{i \, \text{dt} \, \mathbf{w}} \right) \, \mathbf{H}^2 \, \mathbf{k}^3 \, \mathbf{U} \, \mathrm{Csc} \left[\frac{\mathrm{dx} \, \mathbf{k}}{2} \right]}{6 + 2 \, \mathrm{H}^2 \, \mathbf{k}^2} \right\}, \\ & \quad \left\{ \frac{i \, e^{\frac{i \, \text{dx} \, \mathbf{k}}{2}} \left(1 - e^{-i \, \text{dx} \, \mathbf{k}} \right) \left(-1 + e^{i \, \text{dt} \, \mathbf{w}} \right) \, \mathbf{k} \, \left(\mathbf{g} \, \mathbf{H} \, \left(3 + \mathbf{H}^2 \, \mathbf{k}^2 \right) - 3 \, \mathbf{U}^2 \right) \, \mathrm{Csc} \left[\frac{\mathrm{dx} \, \mathbf{k}}{2} \right]}{2} \right\}, \\ & \quad \left\{ \frac{i \, e^{\frac{i \, \text{dx} \, \mathbf{k}}{2}} \left(1 - e^{-i \, \text{dx} \, \mathbf{k}} \right) \left(-1 + e^{i \, \text{dt} \, \mathbf{w}} \right) \, \mathbf{k} \, \left(\mathbf{g} \, \mathbf{H} \, \left(3 + \mathbf{H}^2 \, \mathbf{k}^2 \right) - 3 \, \mathbf{U}^2 \right) \, \mathrm{Csc} \left[\frac{\mathrm{dx} \, \mathbf{k}}{2} \right]}{2} \right\}, \\ & \quad \left\{ \frac{i \, e^{\frac{i \, \text{dx} \, \mathbf{k}}{2}} \left(1 - e^{-i \, \text{dx} \, \mathbf{k}} \right) \left(-1 + e^{i \, \text{dt} \, \mathbf{w}} \right) \, \mathbf{k} \, \left(6 + \mathbf{H}^2 \, \mathbf{k}^2 \right) \, \mathbf{U} \, \mathrm{Csc} \left[\frac{\mathrm{dx} \, \mathbf{k}}{2} \right]}{\left(6 + 2 \, \mathbf{H}^2 \, \mathbf{k}^2 \right) \, \mathbf{w}} \right\} \right\} \right\} \end{aligned}$$

Out[199]= EA || \left(

\begin{array}{cc}

 $\frac{i e^{\frac{i \cdot (1-e^{-i \cdot (1-e^{$ $w \rightarrow H^2 U \csc \left(\frac{dx}{k}{2} \right) \\ k^3 \left(H^2 K^2 + 6 \right) \\ w + 1$ & $\frac{i e^{\left(\frac{i e^{\left(\frac{1-e^{-i \cdot k} k}{dx} k}\right) \left(1-e^{-i \cdot k}\right) \cdot \left($ $w\}$ right) H k \csc \left(\frac{\text{dx} k}{2}\right)}{2 \left(\frac{k^2 H^3}{3}+H\right) w} \\

 $\label{eq:linear_line$ $\left(H^2 k^2+3\right) -3 U^2\right) \csc\left(H^2 k^2+3\right) \left(H^2 k^2+6\right)$ $w\} \& \frac{i e^{\frac{i \cdot k}{2}} \left(1 - e^{-i \cdot k} k\right) \left($ $k \left(H^2 k^2 + 6 \right) U \left(\frac{4x}{k}^2 \right) \left(H^2 k^2 + 6 \right) w + 1 \left(H^2 k^2 + 6 \right)$

\end{array}

\right)

$$\begin{aligned} & \text{Outpoings} \quad \text{Eart} \, \| \, \left\{ \left\{ \frac{i \sqrt{3} \, k \sqrt{g \, \text{H}(3 + \text{HF} \, \text{E})}}{3 + \text{HF}^{2} \, k^{2}} + \frac{i \sqrt{3} \, k \sqrt{g \, \text{H}(3 + \text{HF} \, \text{E})}}{3 + \text{HF}^{2} \, k^{2}} - i \, k \, \text{U} \right\}^{\frac{1}{3}} dt^{2} - \frac{1}{24} \left[-\frac{i \sqrt{3} \, k \sqrt{g \, \text{H}(3 + \text{HF} \, \text{E})}}{3 + \text{HF}^{2} \, k^{2}} - i \, k \, \text{U} \right]^{\frac{1}{3}} dt^{2} - \frac{1}{24} \left[-\frac{i \sqrt{3} \, k \sqrt{g \, \text{H}(3 + \text{HF} \, \text{E})}}{3 + \text{HF}^{2} \, k^{2}} - i \, k \, \text{U} \right]^{\frac{1}{3}} dt^{2} + O[dt]^{\frac{1}{3}} dt^{2} + O[dt]^{\frac{1}{3}} dt^{2} + O[dt]^{\frac{1}{3}} \right] dt^{2} + O[dt]^{\frac{1}{3}} dt^$$

Out[201]= Eerr || \left(

\begin{array}{cc}

```
k^2+3\right\right) + k^4+O\left(\frac{dt}^4+O\left(\frac{dt}^5\right)\right) + k^2+3 + k^4+O\left(\frac{dt}^5\right) + k^2+3 + k^2+3
                                                                                                                                                                                       \label{left} $$U^2 k^4-9 g H k^4\right) \text{$$\left(t^2 k^2+3\right)^2}+O\left(t^2 k^5\right)^2}+O\left(t^2 k^5\right)^2. $$
                                                                                                                                                                                       \label{eq:linear_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_continuous_con
                                                                                                                                                                                       k^2+3\right)+\frac{3}{g}H k^5}{16\left(H^2 k^2+3\right)\right)+\frac{3}{g}H k^5}{16\left(H^2 k^2+3\right)}\right)
                                                                                                                                                                                       \text{dx}^3+\left(\frac{i \left(13 H^6 U k^{11}+116 H^4 U k^9+351 H^2 U k^7+405 U k^5\right)
                                                                                                                                                                                       \text{text}_{dt}_{240 \left( H^2 k^2 + 3\right)^3} + \frac{10}{400} \, H^6 U^2 k^{12} + 135 g H^5 k^{10} + 387 H^4 U^2 k^{10} + 135 g H^5 k^{10} + 387 H^4 U^2 k^{10} + 135 g H^5 k^{10} + 387 H^4 U^2 k^{10} + 135 g H^5 k^{10} + 387 H^4 U^2 k^{10} + 135 g H^5 k^{10} + 387 H^4 U^2 k^{10} + 135 g H^5 k^{10} + 387 H^4 U^2 k^{10} + 135 g H^5 k^{10} + 135 g
                                                                                                                                                                                       U^2 k^{10}+837 g H^3 k^8+297 H^2 U^2 k^8-351 U^2 k^6+1161 g H k^6\right) \text{dt}^2}{1440}
                                                                                                                                                                                       \left(\frac{dt}{5}\right) \cdot \left(\frac{
                                                                                                                                                                                       & \left(-\frac{3 i k \text{dt}}{H^2 k^2+3}-\frac{3 \left(k^2 U\right) \text{text}}{H^2 k^2+3}-\frac{3 \left(k^2 U\right) \text{text}}{H^2 k^2+3}\right)
                                                                                                                                                                                       i k^3 {2 \left( H^2 k^2 + \sinh^2 \right) \text{ text} } \text{ i k^3 } {2 \left( H^2 k^2 + \sinh^2 \right) \text{ text} } \text{ text} \text{ dt} + \frac{3 k^4 U \left( H^2 \right) }{4 \left( H^2 \right) } \text{ text} \text{ dt} 
                                                                                                                                                                                       \label{left} $$k^2+3\right)^2+O\left(\frac{dt}^5\right)\right) \cdot \left(\frac{dt}^5\right) \cdot \left(\frac{dt}^2}{8\left(\frac{dt}^2}\right)^2+\left(\frac{dt}^2\right)^2} \right) \cdot \left(\frac{dt}^2\right) \cdot \left(\frac{dt}^2}{2} + \frac{dt}^2\right) \cdot \left(\frac{dt}^2\right)^2 + \frac{dt}^2\right) \cdot \left(\frac{dt}^2\right) \cdot \left(\frac{dt}^2
                                                                                                                                                                                       k^2+3\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)+O\left(\frac{dt}^5\right)
                                                                                                                                                                                       \left(H^2 k^2+3\right)^3+\frac{4t}{240}
                                                                                                                                                                                       \left(\frac{4x}^4+O\left(\frac{4x}^5\right)^3\right)+O\left(\frac{4x}^5\right) 
                                                                                                         \left(-\frac{k^2 U}{e^2 L^3}-\frac{k^2 U}{e^2 L^3}\right)
                                                                                                                                                                                       g H-3 U^2right) \text{dt}^2{H^2 k^2+3}+O\left(\text{dt}^5\right)\right)\right)+\left(-\frac{i \left(g
                                                                                                                                                                                       H^5 k^7+6 g H^3 k^5+3 H^2 U^2 k^5+18 U^2 k^3+9 g H k^3\right) \text{dt}}{12 \left(H^2
                                                                                                                                                                                       k^2+3\right)^2}+\frac{\left(-2 g H^5 U k^8-12 g H^3 U k^6-9 U^3 k^4-18 g H U k^4\right)}
                                                                                                                                                                                       \label{left} $$ \operatorname{dt}^2_{12 \left(H^2 k^2+3\right)^2}+O\left(\frac{t}{t}\right)^2\right) \operatorname{dt}^2\left(\frac{dt}^5\right) \operatorname{dt}^2\left(\frac{dx}^2+\left(-\frac{1}{8}\right)\right)^2}+O\left(\frac{dt}^5\right)^2\right) = O(t)^2 + O
                                                                                                                                                                                       \label{eq:hamiltonian} H \ k^4 + \frac{dt}{+ \frac{h
                                                                                                                                                                                       k^2+3\left(\frac{1}{3} H^7 k^{11}+117 g H^5 k^9-H^4 h^2\right)
                                                                                                                                                                                       \label{eq:local_property} $$U^2 k^9 + 351 g H^3 k^7 + 54 U^2 k^5 + 351 g H k^5 \right] \left( \frac{1}{240 \left( \frac{1}{2} k^2 + 3\right)^3} + \frac{1}{240 \left( \frac{1}{2} k^2 + 3\right)^3} + \frac{1}{240 \left( \frac{1}{2} k^2 + 3\right)^3} \right) \right) \left( \frac{1}{2} k^2 + \frac{1}{2} k^2 +
                                                                                                                                                                                       g H^7 U k^{12}-135 H^4 U^3 k^{10}+657 g H^5 U k^{10}-837 H^2 U^3 k^8+1971 g H^3 U k^8-1161
                                                                                                                                                                                       U^3 k^6 + 1971 g H U k^6 \left( \frac{dt}^2}{1720} \left( \frac{k^2 + 3 \right)}{1972} + \frac{k^2 + 3 \right)}{1972} H U k^6 \left( \frac{dt}^5 \right) \left( \frac{k^2 + 3 \right)}{1972} H U k^6 \left( \frac{dt}^5 \right) \left( \frac{k^2 + 3 \right)}{1972} H U k^6 \left( \frac{dt}^5 \right) \left( \frac{k^2 + 3 \right)}{1972} H U k^6 \left( \frac{k^2 + 3 \right)
                                                                                                                                                                                       \t (x)^4 + O\left( \frac{dx}^5 \right) & \left( \frac{1}{x} \right) & \left( \frac{dx}^5 \right) & \left( \frac{dx}^5 \right) & \left( \frac{dx}^6 \right) & 
                                                                                                                                                                                       \label{left} $$ \operatorname{dt}^2(H^2 k^2+3)-\operatorname{frac}(1)(6) \left( i U k-\operatorname{frac}(i \operatorname{sqrt}(3) \operatorname{sqrt}(g H \operatorname{left}(H^2 k^2+3\operatorname{left}(H^2 k^2
                                                                                                                                                                                        k^2+3\right\right) + k^2+3\right) + k^2+3\right) + k^2+3\left(-i U k-\frac{1}{24} \cdot k^2+3\right) + k^2+3\left(-i U k-\frac{1
                                                                                                                                                                                       k{H^2 k^2+3}right)^4 \text{dt}^4+O\left(\text{dt}^5\right)\right)+\left(-\frac{i} \left(H^4 U k^7+3)^4 \text{dt}^4+O\left(\text{dt}^6)
                                                                                                                                                                                       H^2 U k^5-9 U k^3 + \frac{dt}{12 \left(\frac{h^2 k^2+3\right)^2}+\frac{h^2 U k^5-9 U k^3\right)}{12 \left(\frac{h^2 k^2+3\right)^2}+\frac{h^2 U k^5-9 U k^3\right)^2}
                                                                                                                                                                                       U^2 k^6+9 g H k^4\right) \left(t^2 k^2+3\right) +O\left(t^2 k^
                                                                                                                                                                                       \t \{dx\}^2 + \left(-\frac{1}{8}\right) \left(\frac{4}{t} + \frac{1}{k^5} \left(\frac{4}{t} + \frac{1}{t}\right) \right)
                                                                                                                                                                                       U^2+3 g H \mid (\text{text} \mid h^2 \mid
                                                                                                                                                                                       \text{dx}^3+\left(\frac{i \left(13 H^6 k^{11}+118 H^4 k^9+351 H^2 k^7+297 k^5\right) U
                                                                                                                                                                                       \text{text}_{dt}_{240 \left( H^2 k^2 + 3\right)^3} + \frac{10}{400} \, H^6 U^2 k^{12} + 135 g H^5 k^{10} + 927 H^4 U^2 k^{10} + 135 g H^5 k^{10} + 927 H^4 U^2 k^{10} + 135 g H^5 k^{10} + 927 H^4 U^2 k^{10} + 135 g H^5 k
                                                                                                                                                                                       U^2 k^{10}+837 g H^3 k^8+3645 H^2 U^2 k^8+4293 U^2 k^6+1161 g H k^6\right) \text{dt}^2\{1440
                                                                                                                                                                                       \left(\frac{dt}^5 \right) \cdot \left(\frac{
                                                                                                   \end{array}
                                                                                                 \right)
\ln[202] = \text{KurF} = (\text{fm} * \text{ap} - \text{fp} * \text{am} + \text{am} * \text{ap} * (\text{qp} - \text{qm})) / (\text{ap} - \text{am});
```

 $\texttt{KurFWS} = \texttt{KurF} \ / . \ \texttt{ap} \ \rightarrow \ \texttt{0} \ / . \ \texttt{am} \ \rightarrow \ (\texttt{U} \ - \ \texttt{Sqrt}[\texttt{g} * \texttt{H}]) \ ;$

```
KurFWSeta =
  KurFWS /. fp \rightarrow (H * v + U * Rpp * n) /. fm \rightarrow (H * v + U * Rmp * n) /. qp \rightarrow Rpp * n /.
    qm \rightarrow Rmp * n;
KurFWSeta = KurFWSeta / . v \rightarrow (GGp * G + Gnp * n);
  Kfnnp = FullSimplify[KurFWSeta /. G \rightarrow 0 /. n \rightarrow 1];  
KfnGp = FullSimplify[KurFWSeta /. n \rightarrow 0 /. G \rightarrow 1];
Kfnn = Kfnnp / Rpp \rightarrow Rp / Rmp \rightarrow Rm / GGp \rightarrow GG2 / Gnp \rightarrow Gn2;
\texttt{KfnG} = \texttt{KfnGp} \ / \ . \ \texttt{Rpp} \ \rightarrow \ \texttt{Rp} \ / \ . \ \ \texttt{Rmp} \ \rightarrow \ \texttt{Rm} \ / \ . \ \ \texttt{GGp} \ \rightarrow \ \texttt{GG2} \ / \ . \ \ \texttt{Gnp} \ \rightarrow \ \texttt{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 \rightarrow (U*Rpp*G + U*H*v + g*H*Rpp*n) / .
       fm \rightarrow (U * Rmp * G + U * H * v + g * H * Rmp * n) /. qp \rightarrow Rpp * G /. qm \rightarrow Rmp * G;
KurFWSG = KurFWSG / . v \rightarrow (GGp * G + Gnp * n);
KfGnp = FullSimplify[KurFWSG /. G \rightarrow 0 /. n \rightarrow 1];
KfGGp = FullSimplify[KurFWSG /. n \rightarrow 0 /. G \rightarrow 1];
KfGn = KfGnp /. Rpp → Rp /. Rmp → Rm /. GGp → GG2 /. Gnp → Gn2;
KfGG = KfGGp / . Rpp \rightarrow Rp / . Rmp \rightarrow Rm / . GGp \rightarrow GG2 / . Gnp \rightarrow 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 + Fmat2.Fmat2 / 2;
Eerr = Series[Emat2 - Exp[-I * wAp * dt] * IdentityMatrix[2], \{dx, 0, 4\}, \{dt, 0, 4\}];
EigvFmat2 = Eigenvalues[Fmat2];
RKStep = Log[1 + EigvFmat2 + EigvFmat2 * EigvFmat2 / 2] / (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}]]
                                                                                                                                                                                                                                                                                            ", TeXForm[Fnn2TAr]}]]
                                                  Text[Row[{"Fnn error ||
                                                  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{text}\{Gnp\}\ H+\text{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{i\left(27\,k^3+9\,H^2\,k^5+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}{8}\,k^4\,U\,dt+O[dt]^4\right)dx^3+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^4+O[dx]^
 Out[241]= Fnn error |
                                                            \label{left(-frac{text{dt}}^2 \left( h^2 k^3 U w \right)} {2 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3 \right) - \frac{dt}^3 H^2 k^3 U w^2} {6 \left( h^2 k^2 + 3
                                                                                    \label{left} $$\left(H^2 k^2+3\right)^2+O\left(\frac{4t}^4\right)\right)\right)+O\left(\frac{4t}^4k^7+9H^2\right). $$\left(H^2 k^2+3\right)^2+O\left(\frac{4t}^4k^7+9H^2\right). $$\left(H^2 k^2+3\right)^2+O\left(\frac{4t}^4k^7+9H^2\right). $$\left(H^2 k^2+3\right)^2+O\left(\frac{4t}^4k^2+3H^2\right). $$\left(H^2 k^2+3\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^2+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^2\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right)^2+O\left(\frac{4t}^4k^4+3H^4\right
                                                                                    k^5 + 27 k^3 \mid U \mid (text{dt}) \{12 \mid (text{dt})^2 + O \mid (text{dt})^4 \mid (text{dt}
                                                                                    \left(\frac{1}{8} k^4 U \left(\frac{dt}{+O}\right)\right)\right) + O\left(\frac{1}{8} k^4 U \left(\frac{dt}{+O}\right)\right) + O\left(\frac{dt}{+O}\right)
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Out[243]= $FnG \parallel GGp H$

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

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

 $\label{eq:out[246]=} Out[246]= FnG error || \left(-\frac{3 \text{dt}}^2 (k w)}{2 \left(\frac{k^2+3\right)}-\frac{i \text{dt}}^3 k w^2}{2 \left(\frac{k^2+3\right)}+O\left(\frac{k^2+$

Out[247]=

Out[248]= $FGn \parallel H(gRpp + Gnp U)$

 $\label{eq:output} \mbox{Out} \mbox{[249]= } FGn \ || \ H \ (g \ \text{$text{Rpp}$+$} + \text{$text{Gnp}$} \ U)$

$$\begin{array}{l} \text{Out} [250] = & FGn \; error \; \mid \mid \; \left(-\frac{\left(k\left(3 \; g \; H + g \; H^{3} \; k^{2} - 3 \; U^{2}\right) w\right) \; dt^{2}}{2\left(3 + H^{2} \; k^{2}\right)} - \frac{i \; k\left(3 \; g \; H + g \; H^{3} \; k^{2} - 3 \; U^{2}\right) w^{2} \; dt^{3}}{6\left(3 + H^{2} \; k^{2}\right)} + O[dt]^{4} \right) + \\ & \left(-\frac{i \left(9 \; g \; H \; k^{3} + 6 \; g \; H^{3} \; k^{5} + g \; H^{5} \; k^{7} + 18 \; k^{3} \; U^{2} + 3 \; H^{2} \; k^{5} \; U^{2}\right) \; dt}{12\left(3 + H^{2} \; k^{2}\right)^{2}} + O[dt]^{4} \right) dx^{2} + \left(\frac{1}{8} \; g \; H \; k^{4} \; dt + O[dt]^{4} \right) dx^{3} + O[dx]^{4} \end{aligned}$$

Out[251]= FGn error ||

 $\label{left} $$\left(-\frac{\text{text}dt}^2 \left(H^2 k^2 + 3 g H - 3 U^2\right)\right)_{2 \left(H^2 k^2 + 3 \right)}-\frac{1}{2 \left(H^2 k^2 + 3 \right)}+O\left(H^2 k^2 + 3 \right)}+O\left(H^2 k^2 + 3 \right)_{1}^2 \left(H^2 k^$

g H $k^4 \text{dt}+O\left(\frac{dt}^4\right)+O\left(\frac{dt}^4\right)+O\left(\frac{dt}^4\right)$

Out[252]=

Out[253]= $FGG \parallel (GGp H + Rpp) U$

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

$$\begin{array}{ll} \text{Out} \text{[255]=} & FGG \; error \; \mid \mid \; \left(-\frac{\left(k \left(6 + H^2 \; k^2 \right) \text{U} \; w \right) \, dt^2}{2 \left(3 + H^2 \; k^2 \right)} - \frac{i \; k \left(6 + H^2 \; k^2 \right) \text{U} \; w^2 \; dt^3}{6 \left(3 + H^2 \; k^2 \right)} + O[dt]^4 \right) + \left(-\frac{i \left(-9 \; k^3 + 3 \; H^2 \; k^5 + H^4 \; k^7 \right) \text{U} \; dt}{12 \left(3 + H^2 \; k^2 \right)^2} + O[dt]^4 \right) dx^2 + \\ & \left(\frac{1}{8} \; k^4 \; U \; dt + O[dt]^4 \right) dx^3 + \left(\frac{i \left(297 \; k^5 + 351 \; H^2 \; k^7 + 118 \; H^4 \; k^9 + 13 \; H^6 \; k^{11} \right) U \; dt}{240 \left(3 + H^2 \; k^2 \right)^3} + O[dt]^4 \right) dx^4 + O[dx]^5 \end{array}$$

Out[256]= FGG error ||

Out[258]=

Out[259]= Omega error ||

$$\left\{ \frac{1}{6(3+H^2K^2)} 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) dt^2 + \frac{1}{6(3+H^2K^2)} k^3 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} + (3+H^2\,k^2) \, U \right) \right) dt^2 + \frac{1}{6(3+H^2K^2)} k^3 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} + (3+H^2\,k^2) \, U \right) \right) dt^2 + \frac{1}{6(3+H^2K^2)^2} \left(k^3 \left(\sqrt{3} \sqrt{g \, H \, (3+H^2\,k^2)} + (3+H^2\,k^2) \, U \right) \right) dt^2 + \frac{1}{46(3+H^2K^2)^2} k^3 \left(g \left(-9 \, \sqrt{3} \, \Pi \, \sqrt{g \, H \, (3+H^2\,k^2)} + (3+H^2\,k^2) \, U \right) \right) dt^4 + O[dt]^5 \right) + \frac{1}{46(3+H^2K^2)^2} k^3 \left(g \left(-9 \, \sqrt{3} \, \Pi \, \sqrt{g \, H \, (3+H^2\,k^2)} + 18 \, H^3 \, k^2 \, U + 6 \, H^5 \, k^4 \, U \right) + \frac{1}{46(3+H^2K^2)^2} k^3 \left(g \left(-9 \, \sqrt{3} \, \Pi \, \sqrt{g \, H \, (3+H^2\,k^2)} + 18 \, H^3 \, k^2 \, U + 6 \, H^5 \, k^4 \, U \right) + \frac{1}{46(3+H^2K^2)^2} k^3 \left(g \, H + U \, 2 \, H^6 \, k^6 \, U + 3 \, k^2 \left(7 \, \sqrt{3} \, \sqrt{g \, H^5 \, (3+H^2\,k^2)} + 18 \, H^2 \, U \right) + \frac{1}{46(3+H^2K^2)^2} k^3 \left(g \, H + U \, 2 \, \sqrt{3} \, \sqrt{g \, H \, (3+H^2\,k^2)} + 9 \, H^4 \, U \right) \right) \right) dt^2 + \frac{1}{46(3+H^2K^2)^2} k^3 \left(3 \, g \, H + U \, \left(2 \, \sqrt{3} \, \sqrt{g \, H \, (3+H^2\,k^2)} + 18 \, U + 2 \, H^4 \, k^4 \, U + 2 \, k^2 \left(\sqrt{3} \, \sqrt{g \, H^3 \, (3+H^2\,k^2)} + 6 \, H^2 \, U \right) \right) \right) dt^3 + \frac{1}{46(3+H^2K^2)^2} k^3 \left(3 \, g \, H + U \, \left(2 \, \sqrt{3} \, \sqrt{g \, H \, (3+H^2\,k^2)} + 2 \, \left(3 \, H^2 \, k^2 \right) \, U \right) \right) dt^3 + \frac{1}{46(3+H^2K^2)^2} k^3 \left(3 \, g \, H \, \left(3 \, H^2 \, k^2 \right) + 12 \, H^2 \, U \right) \right) \right) dt^3 + \frac{1}{46(3+H^2K^2)^2} k^3 \left(3 \, g \, H \, \left(3 \, H^2 \, k^2 \right) + 12 \, H^2 \, U \right) \right) dt^2 + \frac{1}{32(3+H^2K^2)^2} k^3 \left(3 \, g \, H \, \left(3 \, g \, H \, \left(3 \, H^2 \, k^2 \right) + 12 \, H^2 \, U \right) \right) \right) dt^2 + \frac{1}{32(3+H^2K^2)^2} k^3 \left(3 \, g \, H \, \left(3 \, H^2 \, k^2 \right) + 12 \, H^2 \, U \right) \right) \right) dt^2 + \frac{1}{32(3+H^2K^2)^2} k^3 \left(3 \, g \, H \, \left(2 \, \sqrt{3} \, \sqrt{g \, H \, \left(3 \, H^2 \, k^2 \right) + 12 \, H^2 \, U \right) \right) \right) dt^2 - \frac{1}{32(3+H^2K^2)^2} k^3 \left(3 \, g \, H \, \left(2 \, \sqrt{3} \, \sqrt{g \, H \, \left(3 \, H^2 \, k^2 \right) + 12 \, H^2 \, U \right) \right) \right) dt^2 - \frac{1}{32(3+H^2K^2)^2} k^3 \left(3 \, \sqrt{g \, H \, \left(3 \, H^2 \, k^2 \right) + 12 \, H^2 \, U \right) \right) dt^2 - \frac{1}{32(3+H^2K^2)^2} k^3 \left(3 \, \sqrt{g \,$$

,

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

$$dt^4 + O[dt]^2 \right) +$$

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

$$U^2 \left(-27 \sqrt{3} \sqrt{g H (3 + H^2 k^2)} + 54 U + 2 H^6 k^6 U - 3 k^2 \left(7 \sqrt{3} \sqrt{g H^3 (3 + H^2 k^2)} - 18 H^2 U \right) -$$

$$2 k^4 \left(2 \sqrt{3} \sqrt{g H^3 (3 + H^2 k^2)} + 54 U + 2 H^6 k^6 U - 3 k^2 \left(7 \sqrt{3} \sqrt{g H^3 (3 + H^2 k^2)} - 18 H^2 U \right) -$$

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

$$\frac{1}{48(3 + H^2 k^2)^3} k^{16} \left(3 g H + U \left(-2 \sqrt{3} \sqrt{g H (3 + H^2 k^2)} + 18 U + 2 H^6 k^4 U - 2 k^2 \left(\sqrt{3} \sqrt{g H^3 (3 + H^2 k^2)} - 6 H^2 U \right) \right) \right)$$

$$dt^3 - \frac{1}{96(3 + H^2 k^2)^3} \left(k^7 \left(3 \sqrt{3} \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2)^2 U \right) \left(3 g H + U \left(-2 \sqrt{3} \sqrt{g H (3 + H^2 k^2)} + (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^4 + O[dt]^5 \right) dt^2 +$$

$$U^2 \left(-15 \sqrt{3} \sqrt{g H (3 + H^2 k^2)} + 18 U + 2 H^4 k^4 U + k^2 \left(-5 \sqrt{3} \sqrt{g H^3 (3 + H^2 k^2)} + 12 H^2 U \right) \right) \right)$$

$$dt^2 - \frac{1}{32(3 + H^2 k^2)^3} \left(k^7 \left(3 g H + U \left(-2 \sqrt{3} \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^2 - \frac{1}{32(3 + H^2 k^2)^3} \left(k^7 \left(3 g H + U \left(-2 \sqrt{3} \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^2 - \frac{1}{32(3 + H^2 k^2)^3} \left(k^7 \left(3 g H + U \left(-2 \sqrt{3} \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right) \right)$$

$$dt^3 - \frac{1}{34(3 + H^2 k^2)} \left(k^7 \left(3 \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^3 - \frac{1}{34(3 + H^2 k^2)} \left(k^7 \left(3 \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^3 - \frac{1}{34(3 + H^2 k^2)} \left(k^7 \left(3 \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^3 - \frac{1}{34(3 + H^2 k^2)} \left(k^7 \left(3 \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^3 - \frac{1}{34(3 + H^2 k^2)} \left(k^7 \left(3 \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^3 - \frac{1}{34(3 + H^2 k^2)} \left(k^7 \left(3 \sqrt{g H (3 + H^2 k^2)} + 2 (3 + H^2 k^2) U \right) \right) \right)$$

$$dt^3 - \frac{1}{34(3 + H^2 k^2)} \left(k^7 \left(3 \sqrt{g H (3 + H^$$

$$\begin{array}{c} (1) \\ 16 \left(459 \sqrt{g\,H\,(3+H^2\,k^2)} \ U^3 + 153\,k^4 \sqrt{g\,H^9\,(3+H^2\,k^2)} \ U^3 + 17\,k^6 \sqrt{g\,H^{13}\,(3+H^2\,k^2)} \ U^3 + 9\,k^2 \left(88 \sqrt{g^3\,H^7\,(3+H^2\,k^2)} \ U + 51 \sqrt{g\,H^5\,(3+H^2\,k^2)} \ U^3\right)\right) dt^2\right) / \\ (11520 \sqrt{g\,H} \ (3+H^2\,k^2)^{7/2}\right) - \frac{1}{3840 (3+H^2\,k^2)^4} i^4 k^8 \left(54\,g^2\,H^2\,(81+62\,H^2\,k^2+10\,H^4\,k^4) + 84\,H^8\,k^8\,U^4 + 243\,U^3 \left(-39\,\sqrt{3}\,\sqrt{g\,H\,(3+H^2\,k^2)} + 28\,U\right) + 36\,k^4\,U^3 \left(-85\,\sqrt{3}\,\sqrt{g\,H^9\,(3+H^2\,k^2)} + 126\,H^4\,U\right) + 4\,k^6\,U^3 \left(-83\,\sqrt{3}\,\sqrt{g\,H^3\,(3+H^2\,k^2)} + 252\,H^6\,U\right) - \\ 9\,k^2 \left(600\,\sqrt{3}\,\sqrt{g^3\,H^7\,(3+H^2\,k^2)} \ U + 1039\,\sqrt{3}\,\sqrt{g\,H^5\,(3+H^2\,k^2)} \ U^3 - 1008\,H^2\,U^4\right) + \\ 3\,g\,H\,U\,\left(13\,500\,H^2\,k^2\,U + 472\,H^6\,k^6\,U + 27\left(-97\,\sqrt{3}\,\sqrt{g\,H\,(3+H^2\,k^2)} + 504\,U\right) - \\ 4\,k^4 \left(71\,\sqrt{3}\,\sqrt{g\,H^9\,(3+H^2\,k^2)} - 1101\,H^4\,U\right)\right)\right) dt^3 - \frac{1}{23040} \frac{1}{\sqrt{g\,H}\,(3+H^2\,k^2)^{15/2}} \\ \left(k^9\left(\sqrt{3}\,\sqrt{g\,H\,(3+H^2\,k^2)} - (3+H^2\,k^2)\,U\right)\right) \left(4\,k^8\,U^3\left(-239\,\sqrt{3}\,g\,H^9 + 58\,\sqrt{g\,H^{17}\,(3+H^2\,k^2)} \ U\right) + \\ 27\,k^2\left(372\,\sqrt{g^5\,H^9\,(3+H^2\,k^2)} - 2703\,\sqrt{3}\,g^2\,H^4\,U + 4515\,\sqrt{g^3\,H^7\,(3+H^2\,k^2)} \ U^2 - \\ 4070\,\sqrt{3}\,g\,H^3\,U^3 + 928\,\sqrt{g\,H^5\,(3+H^2\,k^2)} \ U^4 + g\,H^5 \\ U^2\left(4384\,\sqrt{g\,H\,(3+H^2\,k^2)} - 2672\,\sqrt{3}\,g^2\,H^6\,U + 1392\,\sqrt{g\,H^9\,(3+H^2\,k^2)} \ U^4 + g\,H^5 \\ U^2\left(4384\,\sqrt{g\,H\,(3+H^2\,k^2)} - 5997\,\sqrt{3}\,U\right)\right) + 81\left(157\,\sqrt{g^5\,H^5\,(3+H^2\,k^2)} - 1033\,\sqrt{3}\,U\right)\right) - \\ 12\,k^6\,U\left(213\,\sqrt{3}\,g^2\,H^8 - 232\,\sqrt{g\,H^{13}\,(3+H^2\,k^2)} \ U^4 + g\,H\,U^2\left(1527\,\sqrt{g\,H\,(3+H^2\,k^2)} - 1033\,\sqrt{3}\,U\right)\right) - \\ g\,H^7\,U\left(-349\,\sqrt{g\,H\,(3+H^2\,k^2)} + 979\,\sqrt{3}\,U\right)\right)\right) dt^4 + O[dt]^5\right) dx^4 + O[dx]^5\right)$$

Out[260]= Omega error ||

 $\left(\frac{k^3 \left(\frac{k^3 \left(\frac{k^2 + 3\right)} U + \sqrt{3} \left(\frac{k^2 + 3\right)} \right)}{1 + 2 k^2 + 3 \left(\frac{k^2 + 3\right)} \right)}\right)}$ $\left(\left(\frac{H^2 k^2+3\right)}{U+2 \sqrt{3}}\right) + \left(\frac{H^2 k^2+3\right)}{\left(\frac{H^2 k^2+3\right)}{U+2 \sqrt{3}}\right)}$ $\label{left(H^2 k^2+3\left(H^2 k^2+3\right) U+2 sqrt{3} sqrt{g H+U \left(H^2 k^2+3\right) U+2 sqrt{3} sqrt{g H+U (H^2 k^2+3\right) U+2 sqrt{3} sqrt{g H+U (H^2 k^2+3) U+2 sqrt{4} sqrt{$ $\label{left(H^2 k^2+3\left|right(k^5 \left(\frac{1}{4}\right)^3\right|} \left(\frac{4}{3}\right)^2 + \frac{1}{4}\left(\frac{1}{4}\right)^2 +$ $k^2+3\right\in U+\sqrt{3} \operatorname{left}(H^2 k^2+3\right)$ $k^2+3\right) U+2 \sqrt{3} \left(H \left(H^2 k^2+3\right)\right) \right) \left(H^2 \left(H^2 k^2+3\right) \right) \left(H^2 k^2+3\right) \left(H^2 k^2+$ $k^2+3\right)^4+O\left(\frac{dt}^5\right)^2+O\left(\frac{dt}^$ $\label{eq:left_hamiltonian} $$ \left(\frac{h^2 k^2+3 \cdot (h^2 k^2+3 \cdot h^2)}{24 \cdot (h^2 k^2+3 \cdot h^2)^2} + \frac{k^5 \cdot (h^6 U k^6+2 k^2+3 \cdot h^2)}{2} \right) $$$ $\left(9 U H^4+2 \right) \left(18 U H^2+3\right) \left(18 U H^2+3\right) \left(18 U H^2+7 \right) \left(18 U H^2+7 \right)$ $H^5 \left(H^2 k^2+3\right) \$ \quad \ $\left(6 \, k^4 \, U \, H^5 + 18 \, k^2 \, U \, H^3 - 9 \, \right) \, \left(1 \, H^2 \, k^2 + 3 \right) \, H\right) \, \left(1 \, k^2 \, U \, H^3 - 9 \, \right) \, \left(1 \, H^2 \, k^2 + 3 \right) \, H\right) \, H\right) \, \left(1 \, H^3 - 9 \, H^3 - 9$ $\label{left(H^2 k^2+3\wedge ight)^3} + \frac{k^6 \left(3 g H+U \left(\frac{4^2 k^2+3 \right) U+2 \left(\frac{4}{3} \right) }{16} \right)}{16}$ $H \left(H^2 k^2+3\right)\right)\right)$ $\label{eq:left(H^2 k^2+3\left(H^2 k^2+3\right)} $$\left(H^2 k^2+3\right) \ k^2+18 \ U+3 \ sart{3} \ sart{g H \left(H^2 k^2+3\right) \ h} \right) $$$

 $\t text{dt}^3{48 \left(H^2 k^2+3\right)}^3-\frac{k^2+3\left(k^7 \left(k^7 \left(H^2 k^2+3\right)\right)^2 U-3 \left(k^7 \left(k^7 \left(H^2 k^2+3\right)\right)^2 U-3 \left(H^2 k^2+3\right)^2 U-3$ $H \left(H^2 k^2 + 3 \right) \left(g H + U \left(H^2 k^2 + 3 \right) U + 2 \right) + H \left(H^2 k^2 + 3 \right) \left(H^2 k^2 + 3 \right) \left(H^2 k^2 + 3 \right) \right) + H \left(H^2 k^2 + 3 \right) \left(H^2 k^2 +$ $\label{eq:linear_continuity} $$ k^2+3\right)\right) $$ k^2+3\right) $$ k^2+3\left(k^2+3$ $\text{dx}^2+\left(\frac{1}{16} i k^4 \left(\frac{U+\sqrt{3} \sqrt{g H}{h^2 k^2+3}\right)\right)} + \frac{k^6}{16}$ $\left(\frac{4^4 U k^4 + \left(12 U H^2 + \frac{3}{sqrt}\right) \left(14 U k^4 + \left(14 U H^2 + \frac{3}{sqrt}\right) \left(14 U k^4 + \frac{14 U H^2 + \frac{3}{sqrt}}{14 U H^2 + \frac{3}{sqrt}}\right) \left(14 U k^4 + \frac{14 U H^2 + \frac{3}{sqrt}}{14 U H^2 + \frac{3}{sqrt}}\right) \left(14 U k^4 + \frac{14 U H^2 + \frac{3}{sqrt}}{14 U H^2 + \frac{3}{sqrt}}\right) \left(14 U k^4 + \frac{14 U H^2 + \frac{3}{sqrt}}{14 U H^2 + \frac{3}{sqrt}}\right) \left(14 U k^4 + \frac{14 U H^2 + \frac{3}{sqrt}}{14 U H^2 + \frac{3}{sqrt}}\right) \left(14 U k^4 + \frac{14 U H^2 + \frac{3}{sqrt}}{14 U H^2 + \frac{3}{sqrt}}\right) \left(14 U k^4 + \frac{3}{sqrt}\right) \left(14 U k^4 + \frac{3}{sqrt}\right)$ $\$ \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right) U^2+3 g H \left(4 \left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H} \left(H^2 k^2+3\right) U+\sqrt{3} \sqrt{g H} $H \left(H^2 k^2+3\right)\right) \left(H^2 k^2+3\right)^2 -\frac{1}{4}$ $g H+U \left(\frac{H^2 k^2+3\right) + U+2 \left(\frac{H^2 k^2+3\right)}{1} \right)$ g H+U \left(2 \left(H^2 k^2+3\right) U+3 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)\right)\right)\right)\right) $\label{left} $$ \left(\frac{dt}^3}{32 \left(\frac{h^2 k^2+3\right)^2}-\frac{k^8 \left(\frac{h^2 k^2+3\right)} U+\sqrt{4} H}{2} \right) - \frac{h^2 k^2+3\left(\frac{h^2 k^2+3\right)}{2} - \frac{h^2 k^2+3\left(\frac{h^2 k^2+3\right)}{2} + \frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\right)}{2} + \frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\right)}{2} + \frac{h^2 k^2+3\left(\frac{h^2 k^2+3\right)}{2} + \frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\right)}{2} + \frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\right)}{2} + \frac{h^2 k^2+3\left(\frac{h^2 k^$ $\left(H^2 k^2+3\right)\right)$ $\label{eq:continuity} $$ k^2+3\right)\right)^2 \left(k^2+3\right)^3+O\left(k^$ $\label{eq:left} $$ \left(\frac{dx}^3 + \left(\frac{k^5 \left(3 \right)^3 + 124 H^2 k^2 + 177 \right)}{104 \left(\frac{3}{3} g H \left(\frac{20 H^4 k^4 + 124 H^2 k^2 + 177 \right)}{104 H^2 k^2 + 124 H^2 k^2 + 177 \right)} \right) $$$ $H^9 \left(H^2 k^2+3\right) k^4+6 \left(H^2 k^2+3\right) k^2+9 \left(H^2 k^2+3\right) k^2+9$ $k^2+3\right)$ Uright) $\{1920 \left(\frac{4^7}{2} \right) - \frac{4^7}{2} \right)$ \left(27 \sqrt{3} g^2 \left(20 H^4 k^4+124 H^2 k^2+167\right) H^2+g U \left(764 \sqrt{3} H^6 U k^6+24 \left(293 \sqrt{3} U H^4+84 \sqrt{g H^9 \left(H^2 k^2+3\right)}\right) k^4+21429 \sqrt{3} H^2 $U \ k^2+81 \ \left(\frac{17 \ sqrt{g H \left(\frac{h^2 k^2+3\right\right)}}{H+16 \ left(17 \ sqrt{g H})}}\right) + 16 \ h^2 + 16$ $H^{13} \left(H^2 k^2+3\right) U^3 k^6+153 \left(H^2 k^2+3\right) U^3 k^4+9 \left(H^2 k^2+3\right) U^3 k^4+9 \left(H^2 k^2+3\right) U^3 k^4+9 \left(H^2 k^2+3\right) U^3 k^4+9 U^3 k$ $\$ \\ \sqrt{g H^5 \\ left(H^2 k^2+3\\ right)\} U^3+88 \\ sqrt{g^3 H^7 \\ left(H^2 k^2+3\\ right)\} U\\ right) k^2+459 $H^{13} \left(H^2 k^2+3\right)\right) k^6+36 U^3 \left(126 U H^4+85 \right) \sqrt{13} \left(H^2 k^2+3\right)$ $k^2+3\left(1008 H^2 U^4+1039 \right) + 1008 H^2 U^4+1039 + 1008 H^2 U^4+$ $\ \sqrt{3} \ M^7 \left(H^2 \ A^2+3\right) U\right) U\right) k^2+54 g^2 H^2 \left(10 \ H^4 \ A^4+62 \ H^2\right) (10 \ H^2 \ A^2+62 \ H^2) H^2 \left(10 \ H^4 \ A^4+62 \ H^2\right) H^2 \left(10 \ H^4 \ A^4 \ H^4\right) H^2 \left(10 \ H^4 \ A^4 \ H^4\right) H^2 \left(10 \ H^4 \ H^4\right) H^2 \left(10 \ H^4 \ H^4\right) H^2 \left(10 \ H^4\right) H^2$ k^2+81\right)+243 U^3 \left(28 U+39 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)+3 g H U \left(472 H^6 U k^6+4 \left(1101 U H^4+71 \sqrt{3} \sqrt{g H^9 \left(H^2 k^2+3\right)\right) k^4+13500 H^2 U $k^2+3\right) + \frac{k^9 \left(\left(\frac{h^2 k^2+3\right) U+\sqrt{3} \left(\frac{H^2 k^2+3\right)}{1+\sqrt{3} \left(\frac{H^2 k^2+3\right)}\right)}\right)}{h^2} + \frac{h^2 k^2+3\left(\frac{h^2 k^2+3\right) U+\sqrt{3} \left(\frac{H^2 k^2+3\right)}{1+\sqrt{3} \left(\frac{H^2 k^2+3\right)}{1$ \left(4 U^3 \left(239 \sqrt{3} g H^9+58 \sqrt{g H^{17} \left(H^2 k^2+3\right)} U\right) k^8+12 U \left(213 \sqrt{3} g^2 H^8+g U \left(979 \sqrt{3} U+349 \sqrt{g H \left(H^2 k^2+3\right)}\right) H^7+232 \sqrt{g $H^{13} \left(H^2 k^2 + 3\right) U^3 \right) U^3 \right) U^3 \right) H^{6+9} \left(H^2 k^2 + 3\right) U^3 \right)$ $U+4384 \sqrt{H^2 k^2+3\right} U+4384 \sqrt{H^2 k^2+3\right} U^4+180$ \sqrt{g^5 H^{13} \left(H^2 k^2+3\right)\right) k^4+27 \left(2703 \sqrt{3} g^2 U H^4+4070 \sqrt{3} g $U^3 H^3 + 928 \sqrt{g H^5 \left(\frac{H^2 k^2 + 3\right)} U^4 + 4515 \sqrt{g^3 H^7 \left(\frac{H^2 k^2 + 3\right)}} U^4 + 4515 \sqrt{g^3 H^7 \left(\frac{H^2 k^2 + 3\right)}}$ $U^2+372 \cdot g^5 H^9 \cdot (H^2 k^2+3\right) \cdot h^2 \cdot (H^2 k^2+3\right) \cdot h^2 + 1 \cdot (H^2 k^2+3\right) \cdot h^2 \cdot h$ $U^4+g H \left(1033 \right) + 1527 \left(g H \left(1^2 k^2+3\right)\right) + 1527 \left(g H \left(1^2 k^2+3\right)\right) + 1527 \left(g H \left(1^2 k^2+3\right)\right)$ $H^2 U+157 \left(\frac{6^5 H^5 \left(H^2 k^2+3\right)}{\sinh(H^2 k^2+3\right)} \right)$ $\left(\left(\frac{H^2 k^2+3\right)}{U-\sqrt{3} \sqrt{3} \right) + \left(\frac{H^2 k^2+3\right)}\right) \left(\frac{H^2 k^2+3\right)}{U-\sqrt{3} \left(\frac{H^2 k^2+3\right)}}\right)$ $k^2+3\right) U-2 \sqrt{3} \sqrt{9 H \left(H^2 k^2+3\right)}\right) text{dt}^2{6 \left(H^2 k^2+3\right)}\right)$ $k^2+3\right)^2+\frac{1}{2}+\frac{1}{2} +\frac{1}{2} +$ $\label{left(H^2 k^2+3\wedge ight)^2} \operatorname{left(H^2 k^2+3\wedge ight)^2}-\operatorname{left(k^5 \left(\left(H^2 k^2+3\right)\right)} \operatorname{left(H^2 k^2+3\wedge ight)^2}-\operatorname{left(h^2 k^2+3\wedge ight)^2}-\operatorname{left(h^2$

 $k^2+3\right) U-\sqrt{3} \left(H+U\right) H+U \left(H^2 k^2+3\right) right} \ 10^3 \left(H+U\right) H+U \left(H^2 k^2+3\right) right} \ 10^3 \ 1$ $k^2+3\right) U-2 \sqrt{3} \sqrt{4}{20 \left(H^2 k^2+3\right)\right)} \left(H^2 k^2+3\right) \left(H^2 k^2+3\right)$ $k^2+3\left(\frac{4}{5}\right)^4+O\left(\frac{4}{5}\right)^5\right)+\left(\frac{4}{3}\left(\frac{4}{3}\right)^2+3\left(\frac{$ $\$ \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)}\right)}\right)}{24 \left(H^2 k^2+3\right)^2}+\frac{k^5 \left(\frac{1}{2} (1-x)^2 + \frac{1}{2} (1-x)^2 + \frac{1}{2 $H^6 U k^6-2 \left(\sqrt{3} \right)^9 \left(H^9 \left(H^2 k^2+3\right) -9 H^4 U \right) k^4-3 \left(\sqrt{3} \right)$ $\$ \sqrt{g H^5 \left(H^2 k^2+3\right)}-18 H^2 U\right) k^2+54 U-27 \sqrt{3} \sqrt{g H \left(H^2 L^2 + 24 L^2 k^2+3\right)\right) U^2+3 g \left(2 k^4 U H^5+6 k^2 U H^3+3 \sqrt{3} \sqrt{g H \left(H^2 k^2+3\right)} $H \cdot (H^2 k^2+3\right) \cdot (H^2 k^2+3\right) \cdot (H^2 k^2+3\right) \cdot (H^2 k^2+3) \cdot (H^2 k^$ $\label{eq:linear_line$ $\left(\frac{3} \right) \left(\frac{4^2 \ln(4^2 k^2 + 3 \right)}{6^2 k^2 + 3 \right) - 6^2 U \right) \left(\frac{3^2 k^2 + 3 \ln(k^2 k^2 + 3 \ln(k$ $k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(h^2 k^2+3\left(\frac{h^2 k^2+3\left(\frac{h^2 k^2+3\left(h^2 k^2+3\left(h^2+3\left(h^2 k^2+3\left(h^2 k^2+3\left(h^2 k^2+3\left(h^2 k^2+3\left(h^2+3\left(h^2+3\left(h^2+3\left(h^2+3\left(h^2+3\left(h^2+3h^2+3\left(h^2+3h^2+3h^2+3h^2+3h^2+3h^2}h^2h^$ $\label{left(H^2 k^2+3\wedge ight)^2+3 sqrt{3} sqrt{g } H \left(H^2 k^2 + 3\wedge ight \right) \left(g H+U \left(H^2 k^2 + 3\wedge ight \right) \right) \left(g H+U \left(H^2 k^2 + 3\wedge$ $k^2+3\left(U-2 \right) U-2 \left(H^2 \left(H^2 \left(H^2 \right) \right) \right) \left(H^2 \left(H^2 \right) \right) \\$ $\label{left} $$k^2+3\right)^4}+O\left(\frac{dt}^5\right)\right) \text{ text}_dx^2+\left(\frac{1}{16} i k^4 \left(\frac{3} \sqrt{3} \right)\right) $$$ $H_{H^2 k^2+3}=2 U\right) + \frac{i k^6 \left(U^2 \left(U^2 \left(H^4 U k^4+\left(H^2 U^2 \left(H^4 U k^4+\left(H^2 U^2 \left(H^4 U k^4+\left(H^2 U^2 H^4 U k^4+\left(H^4 U k^4+H^4 U k^4+H^4\right)H^4 U k^4+H^4\right)H^4 H^4 U k^4+H^4\right)\right)}{H^4 U k^4+H^4 U k^4+H^4$ $H^5 \left(H^2 k^2+3\right) + L-15 \left(H$ $H \left(\frac{3} \left(\frac{4^2 k^2 + 3 \right)}{4^2 k^2 + 3 \right) - 4 \left(\frac{k^2 k^2 + 3 \right) + 4 \left($ $\left(H^2 k^2+3\right) - \left(H^2 k^2+3\right$ $k^8 \left(\frac{h^2 k^2+3\right) - \frac{h^2 k^2+3}{h^2 k^2+3}$ $\label{left} $\left(\left(\frac{H^2 k^2+3\right)} U-2 \right)^2 + \left(\frac{H^2 k^2+3\right)}\right)^2 \left(\frac{H^2 k^2+3\right)^2}{\theta}. $$$ $\left(H^2 k^2+3\right)^3+O\left(\left(text\left(dt\right)^5\right)\right)\right) \$ g H \left(20 H^4 k^4+124 H^2 k^2+177\right)-104 \left(\sqrt{g H^9 \left(H^2 k^2+3\right)} k^4+6 $\$ \sqrt{g H^5 \left(H^2 k^2+3\right)} k^2+9 \sqrt{g H \left(H^2 k^2+3\right)}\right) U\right)}{1920} k^2+167 \right) H^2+g U \left(764 \sqrt{3} H^6 U k^6-24 \left(84 \sqrt{g H^9 \left(H^2 k^2+3 \right)}-293 $\sqrt{3} H^4 U \right) k^4+21429 \sqrt{4} L^2 U k^2+81 \left(267 \right) U-232 \right] H^2 U k^2+81 \left(267 \right) L-232 \right]$ $k^2+3\right) \left(H^2 k^2+3\right) \ U^3 k^6+153 \left(H^13 \right) \ U^3 k^6+153 \right) \ U^3 k^6+153 \left(H^2 k^2+3\right) \ U^3 k^6+153 \right) \ U^3 k^6+153 \left(H^3 k^2+3\right) \ U^3 k^4+153 \left(H^3 k^2+153 \left(H$ $H^9 \left(H^2 k^2 + 3 \right) U^3 k^4 + 9 \left(51 \right) H^5 \left(H^2 k^2 + 3 \right) U^3 + 8 \left(51 \right)$ $H^7 \left(H^2 k^2+3\right) U\right) U\right) H^7 \left(H^2 k^2+3\right) U^3\right)$ $\text{dt}^2_{11520 \ \ H} \left(\frac{h^2 k^2+3 \right)^{7/2}}-\frac{k^8 \left(44 h^8 U^4 k^8+4 U^3 \right)^{7/2}}{h^7}$ \left(252 H^6 U-83 \sqrt{3} \sqrt{g H^{13} \left(H^2 k^2+3\right)}\right) k^6+36 U^3 \left(126 H^4 $U-85 \sqrt{4-9} \left(H^2 k^2+3\right)\right) + k^4-9 \left(1008 H^2 U^4+1039 \right)$ k^2+54 g^2 H^2 \left(10 H^4 k^4+62 H^2 k^2+81\right)+243 U^3 \left(28 U-39 \sqrt{3} \sqrt{g H $\left(H^2 k^2 + 3\right) \right) + 3 g H U \left(472 H^6 U k^6 - 4 \left(1 \right) \right) + 3 g H U \left(472 H^6 U k^6 - 4 \right) \right)$ k^2+3\right)}-1101 H^4 U\right) k^4+13500 H^2 U k^2+27 \left(504 U-97 \sqrt{3} \sqrt{g H \left(H^2 $\label{left} $$ k^2+3\right\right)\right) \left(k^2+3\right)\right) \left(k^2+3\right)^4-\frac{1}{2} \left(k^9 \left(k^9 \right) \right) \left(k^3+3\right)^4-\frac{1}{2} \left(k^9 \left(k^9 \right) \right) \left(k^3+3\right) \left(k^3+3$ $\left(H^2 k^2+3\right) -\left(H^2 k^2+3\right) -\left(H^2 k^2+3\right) \right) \le H^{17}$ $\left(\frac{H^2 k^2+3 \right) U-239 \right) k^2 H^9\right) k^8-12 U \left(\frac{213 \right) y^2 H^8+g U \left(\frac{479}{100} \right) k^8-12 U \left(\frac{213 \right) y^2 H^8+g U \left(\frac{479}{100} \right) k^8-12 U \left(\frac{4$ $\sqrt{3} U-349 \operatorname{f}(H^2 k^2+3\right)/right) H^7-232 \operatorname{f}(H^13) \left(H^2 k^2+3\right)$ U^3\right) k^6+9 \left(-2672 \sqrt{3} g^2 U H^6+g U^2 \left(4384 \sqrt{g H \left(H^2 k^2+3\right)}-5997

\sqrt{3} U\right) H^5+1392 \sqrt{g H^9 \left(H^2 k^2+3\right)} U^4+180 \sqrt{g^5 H^{13} \left(H^2 $k^2+3\right) + k^4+27 \left(-2703 \right) + k^4+27 \left(-2703$ $H^5 \left(H^2 k^2 + 3 \right) U^4 + 4515 \left(H^2 k^2 + 3 \right) U^2 + 372 \left(H^5 \right) U^2 + 372 \left($ $H^9 \left(H^2 k^2+3\right) h^2 + 1 \left(H^2 k^2+3\right) U^4+g H$ \left(1527 \sqrt{g H \left(H^2 k^2+3\right)}-1033 \sqrt{3} U\right) U^2-883 \sqrt{3} g^2 H^2 U+157 $\$ \sqrt{g^5 H^5 \left(H^2 k^2+3\right)\right)\right) \text{dt}^4\{23040 \left(\sqrt{g H} \left(H^2 k^2+3\right)\right)\right)}

Out[261]=

$$\begin{aligned} & \text{Out} [262] = & \text{ 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) \, \text{H}^2 \, \text{k}^3 \, \text{U} \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{6 + 2 \, \text{H}^2 \, \text{k}^2 \right) \, \text{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) \, \text{H} \, k \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{2 \left(\text{H} + \frac{\text{H}^3 \, k^2}{3} \right) \, \text{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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right]}{2} \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 \, \text{H} \, \left(3 + \text{H}^2 \, \, k^2 \right) - 3 \, \text{U}^2 \right) \, \text{Csc} \left[\frac{\text{dx} \, k}{2} \right] \, \right\} \, \right\} \, \\ & \left\{ \frac{i \, e^{\frac{i \, \text{dx} \, k}}{2} \, \left(1 - e^{-i \, \text{dx} \,$$

Out[263]= EA || \left(

\begin{array}{cc}

 $\frac{i e^{\frac{1}{2}} \left(1-e^{-i \text{text}dx} k\right) \left(1-e^{i \cdot text}dx\right) \left(1$ w\right) $H^2 U \csc \left(\frac{dx}{k}{2}\right) k^3}{\left(2 H^2 k^2 + 6\right) w} + 1$ & $\frac{i e^{\left(i \cdot \left(x \cdot \left(dx\right) k\right)} \left(1-e^{-i \cdot \left(x \cdot \left(dx\right) k\right) \cdot \left(1-e^{-i \cdot \left(x \cdot \left(dx\right) k\right$ $w\}$ right) $H \ \csc \left(\frac{dx}{k}^2\right)^{2}\left(\frac{k^2 H^3}{3}+H\right) w} \$

 $\frac{i e^{fac_i \cdot ext_dx} k}{2}} \left[\frac{-i \cdot text_dx}{k} \right] \left[\frac{-1 + e^{i \cdot text_dx} w}{right} \right]$ $\label{left} $$\left(H^2 k^2+3\right)-3 U^2\right) \csc \left(\frac{dx}{k}^2\right) \left(H^2 k^2+6\right) \csc \left(\frac{dx}{k}^2\right) \csc \left(\frac{dx}{$ w & $\frac{i e^{\frac{i + e^{i \cdot k}}{2}} \left(1 - e^{-i \cdot k} \right) \left(1 - e^{i \cdot k$ $k \left(\frac{h^2 k^2+6\right) U \csc \left(\frac{dx}{k} \right) }{\left(\frac{h^2 k^2+6\right) W}{1 + \frac{h^2 k^2+6\right) W}}$

\end{array}

\right)

$$\begin{aligned} & \text{Degree} \quad \text{Eerr} \, \| \, \left\{ \left\{ \frac{i \sqrt{3} \, k \sqrt{g \, H(3 \, \text{H}^{2} \, k^{2})} \, ds}{3 \, \text{H}^{2} \, k^{2}} + \frac{\sqrt{3} \, k \sqrt{g \, H(3 \, \text{H}^{2} \, k^{2})} \, ds}{3 \, \text{H}^{2} \, k^{2}} - i \, k \, U \right\}^{3} dt^{3} - \frac{1}{24} \left(-\frac{i \sqrt{3} \, k \sqrt{g \, H(3 \, \text{H}^{2} \, k^{2})}}{3 \, \text{H}^{2} \, k^{2}} - i \, k \, U \right)^{4} dt^{4} + O[dt]^{5} \right) + \\ & \left(-\frac{i (27 \, k^{3} \, \text{H}^{2} \, k^{2})^{2} \, k^{2} \, k^{2} \, \text{H}^{2} \, k^{2} \, \text{H}^{2} \, k^{2}} \, dt^{2} + O[dt]^{5} \right) dt^{2} + O[dt]^{5} \right) dt^{2} + \\ & \left(\frac{1}{8} \, k^{4} \, U \, dt + \left(-\frac{34 \, g \, H^{2} \, k^{2}}{3 \, k^{2} \, k^{2} \, k^{2} \, H^{2} \, k^{2}} \right) \frac{3 \, H^{2} \, k^{2}}{3 \, k^{2} \, k^{2} \, H^{2} \, k^{2}} + O[dt]^{5} \right) dt^{2} + O[dt]^{5} \right) dt^{3} + \\ & \left(\frac{1}{8} \, k^{4} \, U \, dt + \left(-\frac{34 \, g \, H^{2} \, k^{2}}{3 \, k^{2} \, k^{2} \, k^{2} \, H^{2} \, k^{2}} \right) \frac{3 \, H^{2} \, k^{2}}{3 \, k^{2} \, H^{2} \, k^{2}} \right) dt^{2} + O[dt]^{5} \right) dt^{3} + \\ & \left(\frac{1}{8} \, k^{4} \, U \, dt + \left(-\frac{34 \, g \, H^{2} \, k^{2}}{3 \, k^{2} \, H^{2} \, k^{2}} \right) \frac{3 \, H^{2} \, k^{2}}{3 \, k^{2} \, H^{2} \, k^{2}} \right) dt^{2} + O[dt]^{5} \right) dt^{2} + O[dt]^{5} \right) dt^{3} + \\ & \left(\frac{1}{2} \, k^{2} \, k^{2} \, U^{2} \, dt^{2} \, k^{2} \, k^{2} \, U^{2} + 287 \, H^{2} \, k^{2} \, U^{2} + 278 \, H^{2} \, k^{2} \, U^{2} + 278 \, H^{2} \, k^{2} \, U^{2} \right) dt^{2} + O[dt]^{5} \right) dt^{2} + O[dt]^{5} \right) dx^{4} + O[dx]^{5}, \\ & \left(-\frac{34 \, k^{2} \, k^{2} \, U^{2} \, k^{2}}{3 \, k^{2} \, k^{2}} + O[dt]^{5} \right) \left(-\frac{34 \, k^{2} \, k^{2} \, k^{2}}{3 \, k^{2} \, k^{2}} + O[dt]^{5} \right) dt^{2} + \left(\frac{34 \, k^{2} \, U^{2} \, k^{2}}{3 \, k^{2} \, k^{2}} \right) dt^{2} + O[dt]^{5} \right) dx^{4} + O[dx]^{5} \right) dx^{2} + O[dx]^{5} \right) dx^{4} + O[dx]^{5} dx^{4} + O[dx]^{5} \right) dx^{2} +$$

Out[265]= Eerr || \left(

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 $k^2+3\left(\frac{dt}^5\right)+\left(\frac{dt}^6\right)$ $\left(H^4 k^7 + 9 H^2 k^5 + 27 k^3\right) U \left(H^2 k^2 + 3\right) - \left(H^2 k^2 + 3\right) - \left(H^2 k^3 + 9 H^2 k^5 + 27 k^3\right) = 12 \left(H^2 k^3 + 12 H^2 k^5 +$ $H^4 U^2 k^8 + 12 H^2 U^2 k^6 + 36 U^2 k^4 - 9 g H k^4 \right) \text{dt}^2{24 \left(H^2 U^2 k^6 + 36 U^2 k^4 - 9 g H k^4 \right)}$ H^2 U^2 k^7}{8 \left(H^2 k^2+3\right)}-\frac{3 i g H k^5}{16 \left(H^2 k^2+3\right)}\right) \text{dt}^2+O\left(\text{dt}^5\right)\right) \text{dx}^3+\left(\frac{i \left(13 H^6 U k^{11}+116 H^4 U k^9+351 H^2 U k^7+405 U k^5\right) \text{dt}}{240 \left(H^2 k^2+3\right)^3}+\frac{\left(73 H^6)}{100} U^2 k^{12}+135 g H^5 k^{10}+387 H^4 U^2 k^{10}+837 g H^3 k^8+297 H^2 U^2 k^8-351 U^2 $k^6+1161 \text{ g H } k^6 \text{ hight} \text{ text} dt^2_{1440} \left(\frac{k^2 k^2+3 \right)^3}+O\left(\frac{k^4}{5}\right)^3 \right)$ $\label{left} $$ \left(\frac{dx}^4 + O\left(\frac{dx}^5 \right) & \left(-\frac{3 i k \text{ } text{dt}}{H^2 k^2 + 3} - \frac{3 \left(\frac{k^2}{H^2 k^2 + 3} - \frac{3 i k}{H^2 k^2 + 3} \right) \right) $$$ $U = U + (t^2) + (t^$ $k^2+3\right)^2+\frac{3 i k^3}{2 \left(\frac{4t}{^2} \right)^2}$ $\label{left} $$\left(H^2 k^2+3\right)^2+O\left(\frac{dt}^5\right)\right) \cdot \left(H^2 k^2+3\right)^2+O\left(\frac{dt}^2\right)^2+$ $\left(H^2 k^2+3\right) + O\left(\frac{dt}^5\right) + O\left($ \text{dt}}{240 \left(H^2 k^2+3\right)^3}+\frac{\left(45 H^4 U k^{10}+279 H^2 U k^8+387 U k^6\right)} $\t x_{dt}^2_{240 \left(H^2 k^2+3\right)} + O\left(t_{t}^2_{t}^5\right) \right) \t x_{dx}^4 + O\left(t_{t}^2_{t}^5\right) \right) \t x_{dx}^4 + O\left(t_{t}^2_{t}^5\right) \t x_$ $\left(-\frac{k^2 U}{e^2 u^3+3g^2 u^2\right) + 2k^2+3} - \frac{k^2 U}{e^2 u^3+3g^2 u^3+3g^2 u^3}$ $U^2\right) \left(\frac{dt}^2}{H^2 k^2+3} + O\left(\frac{dt}^5\right) + \left(\frac{dt}^5\right) + \left(\frac{dt}^5\right)$ $k^5+3 H^2 U^2 k^5+18 U^2 k^3+9 g H k^3 \right] 12 \left[4t \right$ g H^5 U k^8-12 g H^3 U k^6-9 U^3 k^4-18 g H U k^4\right) \text{dt}^2}{12 \left(H^2 $k^2+3\left(\frac{1}{8} g H k^4 \left(\frac{1}{6}\right)\right)\right) + O\left(\frac{1}{8} g H k^4 \left(\frac{1}{6}\right)\right)\right)$ $H^3 U k^7 - 3 U^3 k^5 + 6 g H U k^5 \right] \left(\frac{1}{2} 8 \left(\frac{h^2 k^2 + 3 \right)} + O\left(\frac{dt}{5} \right) \right) \right)$ $\text{text} dx^3 + \text{left} (\frac{13 \text{ g H}^7 \text{ k}^{11}} + 117 \text{ g H}^5 \text{ k}^9 - \text{H}^4 \text{ U}^2 \text{ k}^9 + 351 \text{ g H}^3 \text{ k}^7 + 54$ $k^{12}-135 H^4 U^3 k^{10}+657 g H^5 U k^{10}-837 H^2 U^3 k^8+1971 g H^3 U k^8-1161 U^3$ $k^6+1971 \text{ g H U } k^6 \text{ hight} \text{ text} dt^2 {720 \left(h^2 k^2+3 \right)^3} + O\left(\text{text} dt \right)^5 \right) \text{ text} dt^2 + O\left(h^2 k^2+3 \right) + O\left(h^2 k^2+$ $\t (\sqrt{dx}^4 + O\left(\frac{dx}^5\right) \le \left(\frac{dx}^4 + O\left(\frac{dx}^5\right) \le \left(\frac{dx}^4 + O\left(\frac{dx}^4\right) \le \frac{dx}^4 + O\left(\frac{dx}^4\right) \le O$ $U + \frac{dt}{H^2 k^2 + 3} + \frac{3k^2 \sqrt{3 k^2 + 3 + \frac{3k^2 u^2 + 3k^2 u^2 + 3k^2$ $\text{dt}^2_{H^2 k^2+3}-\frac{1}{6} \left(i \ U \ -\frac{1}{4} \right) + \frac{1}{6} \left(i \ U \ -\frac{1}{4} \right) + \frac{1}{4} \left(i \ V \ -\frac{1}{4} \right) + \frac{1}{4}$ $k^2+3\right\right) + k^2+3\right) + k^2+3\right) + k^2+3\left(-i U k-\frac{1}{24} \cdot k^2+3\right) + k^2+3\left(-i U k-\frac{1$ $k}{H^2 k^2+3}\right)^4 \text{ kext}{dt}^4+O\left(\text{text}{dt}\right)^5\right) + \left(\text{left}(-\frac{i}{h^4 U k^7+3} + \frac{i}{h^2 U k^7+3} + \frac{i}{h^4 U k^7+3}$ $H^2 U k^5-9 U k^3 + \frac{dt}{12 \left(\frac{h^2 k^2+3\right)^2}+\frac{h^2 U k^5-9 U k^3\right)}{12 \left(\frac{h^2 k^2+3\right)^2}+\frac{h^2 U k^5-9 U k^3\right)^2}$ $U^2 k^6+9 g H k^4\right) \left(t^2 k^2+3\right) +O\left(t^2 k^$ $\label{eq:linear_continuity} $$ \operatorname{dx}^2+\left(\frac{1}{8} k^4 U \right) -\frac{i k^5 \left(\frac{1}{4} K^5 \right)}{1} e^{2} k^2 U^2+12 U^2+3 g H\right)$$ \left(13 H^6 k^{11}+118 H^4 k^9+351 H^2 k^7+297 k^5\right) U \text{dt}}{240 \left(H^2 $k^2+3\right)^3+\frac{10}{+927}H^4U^2k^{10}+837$ g H^3 k^8+3645 H^2 U^2 k^8+4293 U^2 k^6+1161 g H k^6\right) \text{dt}^2{{1440 \left(H^2 $k^2+3\right) + O\left(text{dt}^5\right) \cdot text{dx}^4+O\left(text{dx}^5\right) \cdot text{dx}^6$

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