In[1]:=
```
ClearAll["Global`*"]
coordinateList = {t, r, ϕ, θ};

(* Define Schwarzschild metric gμν *)
```
$$g = \begin{pmatrix} -\left(1-\frac{rs}{r}\right) & 0 & 0 & 0 \\ 0 & \left(1-\frac{rs}{r}\right)^{-1} & 0 & 0 \\ 0 & 0 & r^2 & 0 \\ 0 & 0 & 0 & r^2\,\text{Sin}[\theta]^2 \end{pmatrix};$$
```
(* Initialize Γ^μ_νρ as rank 3 tensor *)
tmp[a_, b_, c_] := 0;
Γ = Array[tmp, {4, 4, 4}];

(* Loop over indices in Γ^μ_νρ *)
Do[
 Do[
  Do[
   Do[
    xμ = coordinateList[[μ]];
    xν = coordinateList[[ν]];
    xρ = coordinateList[[ρ]];
    xσ = coordinateList[[σ]];
```
$$\Gamma[[\mu,\nu,\rho]] \mathrel{+}= \frac{1}{2}\,(\text{Inverse}[g])[[\sigma,\mu]]\,(\partial_{x\nu}\,g[[\rho,\sigma]] + \partial_{x\rho}\,g[[\nu,\sigma]] - \partial_{x\sigma}\,g[[\nu,\rho]]),$$
```
    {σ, 1, 4}],
   {ρ, 1, 4}],
  {ν, 1, 4}],
 {μ, 1, 4}];

Print["Γ^r_νρ = ", MatrixForm[FullSimplify[Γ[[2]]]]];
```
$$\Gamma^{r}{}_{\nu\rho} = \begin{pmatrix} \frac{(r-rs)\,rs}{2\,r^3} & 0 & 0 & 0 \\ 0 & -\frac{rs}{2\,r^2-2\,r\,rs} & 0 & 0 \\ 0 & 0 & -r+rs & 0 \\ 0 & 0 & 0 & (-r+rs)\,\text{Sin}[\theta]^2 \end{pmatrix}$$

In[8]:=

```
(* Simplify differential equation obtained from geodesic equation *)
```

$$\text{FullSimplify}\left[rpp + \frac{rs\,(r - rs)}{2\,r^3}\left(\left(1 - \frac{rs}{r}\right)^{-2} rp^2 + \left(1 - \frac{rs}{r}\right)^{-1} r^2\right) - \frac{rs}{2\,r^2 - 2\,r\,rs}\,rp^2 + (rs - r)\right]$$

Out[8]=

$$-r + rpp + \frac{3\,rs}{2}$$