In[1]:=
```
ClearAll["Global`*"]

dim = 4;
coordinateList = {u, v, x, y};
g = {{0, 1, 0, 0}, {1, 0, 0, 0}, {0, 0, -a[u]^2, 0}, {0, 0, 0, -b[u]^2}};
gInv = Inverse[g];

(* Initialize Γ^μ_νρ as rank 3 tensor *)
tmp[a_, b_, c_] := 0;
Γ = Array[tmp, {dim, dim, dim}];

(* Loop over indices in Γ^μ_νρ *)
Do[
 Do[
  Do[
   Do[
    (* Calculate Γ^μ_νρ *)
    xμ = coordinateList[[μ]];
    xν = coordinateList[[ν]];
    xρ = coordinateList[[ρ]];
    xσ = coordinateList[[σ]];

    Γ[[μ, ν, ρ]] += 1/2 gInv[[μ, σ]] (∂_xν g[[σ, ρ]] + ∂_xρ g[[ν, σ]] - ∂_xσ g[[ρ, ν]]),
    {σ, 1, dim}];

   (* Print nonzero values *)
   If[Γ[[μ, ν, ρ]] == 0, (* Do nothing *),
    Print["Γ"^(xμ)_(xν, xρ), " = ", Γ[[μ, ν, ρ]]], Print["Γ"^(xμ)_(xν, xρ), " = ", Γ[[μ, ν, ρ]]]],

   {ρ, 1, dim}],
  {ν, 1, dim}],
 {μ, 1, dim}]
```

$$\Gamma^{v}{}_{x,x} = a[u]\, a'[u]$$

$$\Gamma^{v}{}_{y,y} = b[u]\, b'[u]$$

$$\Gamma^{x}{}_{u,x} = \frac{a'[u]}{a[u]}$$

$$\Gamma^{x}{}_{x,u} = \frac{a'[u]}{a[u]}$$

$$\Gamma^{y}{}_{u,y} = \frac{b'[u]}{b[u]}$$

$$\Gamma^{y}{}_{y,u} = \frac{b'[u]}{b[u]}$$

In[9]:=
```
(* Initialize R^ρ_σμν as rank 4 tensor *)
tmp[a_, b_, c_, d_] := 0;
R = Array[tmp, {dim, dim, dim, dim}];

(* Loop over indices in R^ρ_σμν *)
Do[
 Do[
  Do[
   Do[
    (* Calculate R^ρ_σμν *)
    xμ = coordinateList[[μ]];
    xν = coordinateList[[ν]];
    xρ = coordinateList[[ρ]];
    xσ = coordinateList[[σ]];

    R[[ρ, σ, μ, ν]] = ∂xμ Γ[[ρ, ν, σ]] - ∂xν Γ[[ρ, σ, μ]] +
      Sum[Γ[[ρ, μ, τ]] × Γ[[τ, ν, σ]] - Γ[[ρ, ν, τ]] × Γ[[τ, μ, σ]], {τ, 1, dim}];

    (* Print nonzero values *)
    If[R[[ρ, σ, μ, ν]] == 0, (* Do nothing *), Print["R"^xρ_xσ,xμ, xν, " = ", R[[ρ, σ, μ, ν]]],
     Print["R"^xρ_xσ,xμ, xν, " = ", R[[ρ, σ, μ, ν]]]],

    {ν, 1, dim}],
   {μ, 1, dim}],
  {σ, 1, dim}],
 {ρ, 1, dim}]
```

$$R^{v}{}_{x,u,x} = a[u]\, a''[u]$$

$$R^{v}{}_{x,x,u} = -a[u]\, a''[u]$$

$$R^{v}{}_{y,u,y} = b[u]\, b''[u]$$

$$R^{v}{}_{y,y,u} = -b[u]\, b''[u]$$

$$R^{x}{}_{u,u,x} = \frac{a''[u]}{a[u]}$$

$$R^{x}{}_{u,x,u} = -\frac{a''[u]}{a[u]}$$

$$R^{y}{}_{u,u,y} = \frac{b''[u]}{b[u]}$$

$$R^{y}{}_{u,y,u} = -\frac{b''[u]}{b[u]}$$

In[12]:=
```
(* Initialize Ricci tensor Ricci_μν as rank 2 tensor *)
tmp[a_, b_] := 0;
Ricci = Array[tmp, {dim, dim}];

(* Loop over indices in Ricci_μν *)
Do[
 Do[
  (* Calculate Ricci_μν *)
  Ricci[[μ, ν]] = Sum[R[[ρ, μ, ρ, ν]], {ρ, 1, dim}];

  (* Print nonzero values *)
  xμ = coordinateList[[μ]];
  xν = coordinateList[[ν]];
  If[Ricci[[μ, ν]] == 0, (* Do nothing *),
   Print["Ricci"xμ, xν, " = ", Ricci[[μ, ν]]], Print["Ricci"xμ, xν, " = ", Ricci[[μ, ν]]]],

  {ν, 1, dim}],
 {μ, 1, dim}]
```

$$Ricci_{u,u} = -\frac{a''[u]}{a[u]} - \frac{b''[u]}{b[u]}$$