Andere Kugelkoordinaten:

$\boxed{x^\mu}$

$x^0 = r.$

$x^1 = a.$

$x^2 = b.$

$\boxed{g_{\mu\nu}}$

$g_{00} = \dfrac{b^2 r^2 \sin(\frac{a}{r})^2 + b^2 a^2 \cos(\frac{a}{r})^2 + a^2 r^2 \sin(\frac{a}{r})^2 + r^4 \sin(\frac{a}{r})^2 - 2b^2 ar \cos(\frac{a}{r}) \sin(\frac{a}{r})}{r^4 \sin(\frac{a}{r})^2}.$

$g_{01} = -\dfrac{b^2 a \cos(\frac{a}{r})^2 + ar^2 \sin(\frac{a}{r})^2 - b^2 r \cos(\frac{a}{r}) \sin(\frac{a}{r})}{r^3 \sin(\frac{a}{r})^2}.$

$g_{02} = \dfrac{b(a\cos(\frac{a}{r}) - r\sin(\frac{a}{r}))}{r^2 \sin(\frac{a}{r})}.$

$g_{10} = -\dfrac{b^2 a \cos(\frac{a}{r})^2 + ar^2 \sin(\frac{a}{r})^2 - b^2 r \cos(\frac{a}{r}) \sin(\frac{a}{r})}{r^3 \sin(\frac{a}{r})^2}.$

$g_{11} = \dfrac{r^2 \sin(\frac{a}{r})^2 + b^2 \cos(\frac{a}{r})^2}{r^2 \sin(\frac{a}{r})^2}.$

$g_{12} = -\dfrac{b\cos(\frac{a}{r})}{r\sin(\frac{a}{r})}.$

$g_{20} = \dfrac{b(a\cos(\frac{a}{r}) - r\sin(\frac{a}{r}))}{r^2 \sin(\frac{a}{r})}.$

$g_{21} = -\dfrac{b\cos(\frac{a}{r})}{r\sin(\frac{a}{r})}.$

$g_{22} = 1.$

$\boxed{\sqrt{} = \sqrt{-\det(g_{\mu\nu})}}$

$\sqrt{} = i.$

$\boxed{g^{\mu\nu}}$

$g^{00} = 1.$

$g^{01} = \dfrac{a}{r}.$

$g^{02} = \dfrac{b}{r}.$

$g^{10} = \dfrac{a}{r}.$

$g^{11} = \dfrac{a^2 + r^2}{r^2}.$

$g^{12} = \dfrac{br\cos(\frac{a}{r}) + ba\sin(\frac{a}{r})}{r^2 \sin(\frac{a}{r})}.$

$g^{20} = \dfrac{b}{r}.$

$g^{21} = \dfrac{br\cos(\frac{a}{r}) + ba\sin(\frac{a}{r})}{r^2 \sin(\frac{a}{r})}.$

$g^{22} = \dfrac{r^2 \sin(\frac{a}{r})^2 + b^2 \sin(\frac{a}{r})^2 + b^2 \cos(\frac{a}{r})^2}{r^2 \sin(\frac{a}{r})^2}.$

$\boxed{\Gamma^\sigma_{\mu\nu}}$

$\Gamma^0_{00} = -\dfrac{b^2 r^2 \sin(\frac{a}{r})^2 + b^2 a^2 \cos(\frac{a}{r})^2 + a^2 r^2 \sin(\frac{a}{r})^2 - 2b^2 ar \cos(\frac{a}{r}) \sin(\frac{a}{r})}{r^5 \sin(\frac{a}{r})^2}.$

$\Gamma^0_{01} = \dfrac{b^2 a \cos(\frac{a}{r})^2 + ar^2 \sin(\frac{a}{r})^2 - b^2 r \cos(\frac{a}{r}) \sin(\frac{a}{r})}{r^4 \sin(\frac{a}{r})^2}.$

$\Gamma^0_{02} = \dfrac{br\sin(\frac{a}{r}) - ba\cos(\frac{a}{r})}{r^3 \sin(\frac{a}{r})}.$

$\Gamma^0_{10} = \dfrac{b^2 a \cos(\frac{a}{r})^2 + ar^2 \sin(\frac{a}{r})^2 - b^2 r \cos(\frac{a}{r}) \sin(\frac{a}{r})}{r^4 \sin(\frac{a}{r})^2}.$

$\Gamma^0_{11} = -\dfrac{r^2 \sin(\frac{a}{r})^2 + b^2 \cos(\frac{a}{r})^2}{r^3 \sin(\frac{a}{r})^2}.$

$\Gamma^0_{12} = \dfrac{b\cos(\frac{a}{r})}{r^2 \sin(\frac{a}{r})}.$

$\Gamma^0_{20} = \dfrac{br\sin(\frac{a}{r}) - ba\cos(\frac{a}{r})}{r^3 \sin(\frac{a}{r})}.$

$\Gamma^0_{21} = \dfrac{b\cos(\frac{a}{r})}{r^2 \sin(\frac{a}{r})}.$

$\Gamma^0_{22} = -\dfrac{1}{r}.$

$\Gamma^1_{00} = -\dfrac{b^2 a^3 \cos(\frac{a}{r})^2 \sin(\frac{a}{r}) + a^3 r^2 \sin(\frac{a}{r})^3 - 2b^2 a^2 r \cos(\frac{a}{r}) \sin(\frac{a}{r})^2 + b^2 a^2 r \cos(\frac{a}{r}) \sin(\frac{a}{r})^3 + b^2 ar^2 \sin(\frac{a}{r})^3 + b^2 r^3 \cos(\frac{a}{r}) \sin(\frac{a}{r})^2 - 2b^2 ar^2 \cos(\frac{a}{r})^2 \sin(\frac{a}{r})}{r^6 \sin(\frac{a}{r})^3}.$

$\Gamma^1_{01} = \dfrac{b^2 ar \cos(\frac{a}{r})^3 + a^2 r^2 \sin(\frac{a}{r})^3 + b^2 a^2 \cos(\frac{a}{r})^2 \sin(\frac{a}{r}) - b^2 ar \cos(\frac{a}{r}) \sin(\frac{a}{r})^2 - b^2 r^2 \cos(\frac{a}{r})^2 \sin(\frac{a}{r})}{r^5 \sin(\frac{a}{r})^3}.$

$\Gamma^1_{02} = \dfrac{br^2 \cos(\frac{a}{r}) \sin(\frac{a}{r}) - bar \cos(\frac{a}{r})^2 - ba^2 \cos(\frac{a}{r}) \sin(\frac{a}{r}) + bar \sin(\frac{a}{r})^2}{r^4 \sin(\frac{a}{r})^2}.$

$\Gamma^1_{10} = \dfrac{b^2 ar \cos(\frac{a}{r})^3 + a^2 r^2 \sin(\frac{a}{r})^3 + b^2 a^2 \cos(\frac{a}{r})^2 \sin(\frac{a}{r}) - b^2 ar \cos(\frac{a}{r}) \sin(\frac{a}{r})^2 - b^2 r^2 \cos(\frac{a}{r})^2 \sin(\frac{a}{r})}{r^5 \sin(\frac{a}{r})^3}.$

$\Gamma^1_{11} = -\dfrac{ar^2 \sin(\frac{a}{r})^3 + b^2 a \cos(\frac{a}{r})^2 \sin(\frac{a}{r}) + b^2 r \cos(\frac{a}{r})^3}{r^4 \sin(\frac{a}{r})^3}.$

$\Gamma^1_{12} = \dfrac{ba \cos(\frac{a}{r}) \sin(\frac{a}{r}) + br \cos(\frac{a}{r})^2}{r^3 \sin(\frac{a}{r})^2}.$

$\Gamma^1_{20} = \dfrac{br^2 \cos(\frac{a}{r}) \sin(\frac{a}{r}) - bar \cos(\frac{a}{r})^2 - ba^2 \cos(\frac{a}{r}) \sin(\frac{a}{r}) + bar \sin(\frac{a}{r})^2}{r^4 \sin(\frac{a}{r})^2}.$

$\Gamma^1_{21} = \dfrac{ba \cos(\frac{a}{r}) \sin(\frac{a}{r}) + br \cos(\frac{a}{r})^2}{r^3 \sin(\frac{a}{r})^2}.$

$\Gamma^1_{22} = -\dfrac{a\sin(\frac{a}{r}) + r\cos(\frac{a}{r})}{r^2 \sin(\frac{a}{r})}.$

$\Gamma^2_{00} = \dfrac{2b^3 ar \cos(\frac{a}{r}) \sin(\frac{a}{r})^3 - b^3 r^2 \sin(\frac{a}{r})^4 + 2b^3 ar \cos(\frac{a}{r})^3 \sin(\frac{a}{r}) - b^3 a^2 \cos(\frac{a}{r})^2 \sin(\frac{a}{r})^2 - b^3 r^2 \cos(\frac{a}{r})^2 \sin(\frac{a}{r})^2 - b^3 a^2 \cos(\frac{a}{r})^4}{r^6 \sin(\frac{a}{r})^4}.$

$\Gamma^2_{01} = \dfrac{b^3 a \cos(\frac{a}{r})^4 - b^3 r \cos(\frac{a}{r})^3 \sin(\frac{a}{r}) + b^3 a \cos(\frac{a}{r})^2 \sin(\frac{a}{r})^2 - b^3 r \cos(\frac{a}{r}) \sin(\frac{a}{r})^3}{r^5 \sin(\frac{a}{r})^4}.$

$\Gamma^2_{02} = \dfrac{b^2 r \cos(\frac{a}{r})^2 \sin(\frac{a}{r}) - b^2 a \cos(\frac{a}{r})^3 + b^2 r \sin(\frac{a}{r})^3 - b^2 a \cos(\frac{a}{r}) \sin(\frac{a}{r})^2}{r^4 \sin(\frac{a}{r})^3}.$

$\Gamma^2_{10} = \dfrac{b^3 a \cos(\frac{a}{r})^4 - b^3 r \cos(\frac{a}{r})^3 \sin(\frac{a}{r}) + b^3 a \cos(\frac{a}{r})^2 \sin(\frac{a}{r})^2 - b^3 r \cos(\frac{a}{r}) \sin(\frac{a}{r})^3}{r^5 \sin(\frac{a}{r})^4}.$

$\Gamma^2_{11} = \dfrac{b^3 \cos(\frac{a}{r})^4 + b^3 \cos(\frac{a}{r})^2 \sin(\frac{a}{r})^2}{r^4 \sin(\frac{a}{r})^4}.$

$\Gamma^2_{12} = \dfrac{b^2 \cos(\frac{a}{r}) \sin(\frac{a}{r})^2 + b^2 \cos(\frac{a}{r})^3}{r^3 \sin(\frac{a}{r})^3}.$

$\Gamma^2_{20} = \dfrac{b^2 r \cos(\frac{a}{r})^2 \sin(\frac{a}{r}) - b^2 a \cos(\frac{a}{r})^3 + b^2 r \sin(\frac{a}{r})^3 - b^2 a \cos(\frac{a}{r}) \sin(\frac{a}{r})^2}{r^4 \sin(\frac{a}{r})^3}.$

$\Gamma^2_{21} = \dfrac{b^2 \cos(\frac{a}{r}) \sin(\frac{a}{r})^2 + b^2 \cos(\frac{a}{r})^3}{r^3 \sin(\frac{a}{r})^3}.$

$\Gamma^2_{22} = -\dfrac{b\cos(\frac{a}{r})^2 + b\sin(\frac{a}{r})^2}{r^2 \sin(\frac{a}{r})^2}.$

$\boxed{R_{\mu\nu}}$

$R_{00} = 0.$
$R_{01} = 0.$
$R_{02} = 0.$
$R_{10} = 0.$
$R_{11} = 0.$
$R_{12} = 0.$
$R_{20} = 0.$
$R_{21} = 0.$
$R_{22} = 0.$

$\boxed{R^{\mu}_{\nu}}$

$R^{0}_{0} = 0.$
$R^{0}_{1} = 0.$
$R^{0}_{2} = 0.$
$R^{1}_{0} = 0.$
$R^{1}_{1} = 0.$
$R^{1}_{2} = 0.$
$R^{2}_{0} = 0.$
$R^{2}_{1} = 0.$
$R^{2}_{2} = 0.$

$\boxed{R}$

$R = 0.$

$\boxed{G^{\mu}_{\nu}}$

$G^{0}_{0} = 0.$
$G^{0}_{1} = 0.$
$G^{0}_{2} = 0.$
$G^{1}_{0} = 0.$
$G^{1}_{1} = 0.$
$G^{1}_{2} = 0.$
$G^{2}_{0} = 0.$
$G^{2}_{1} = 0.$
$G^{2}_{2} = 0.$

$\boxed{G}$

$G = 0.$

$\boxed{G^{\mu}_{\nu;\mu} = 0}$

$G^{\mu}_{0;\mu} = 0.$
$G^{\mu}_{1;\mu} = 0.$
$G^{\mu}_{2;\mu} = 0.$

$\boxed{g^{\mu\nu}\,\Gamma^{\lambda}_{\mu\nu} = 0?}$

$g^{\mu\nu}\,\Gamma^{0}_{\mu\nu} = -2\frac{b^{4}a^{2}\cos(\frac{a}{r})^{4}}{r^{7}\sin(\frac{a}{r})^{4}} - 3\frac{b^{2}}{r^{3}} + 4\frac{b^{4}a\cos(\frac{a}{r})}{r^{6}\sin(\frac{a}{r})} - 2\frac{b^{2}a^{2}}{r^{5}} - 4\frac{b^{2}\cos(\frac{a}{r})^{2}}{r^{3}\sin(\frac{a}{r})^{2}} - \frac{b^{4}a^{4}\cos(\frac{a}{r})^{4}}{r^{9}\sin(\frac{a}{r})^{4}} - 3\frac{a^{2}}{r^{3}} - 7\frac{b^{2}a^{2}\cos(\frac{a}{r})^{2}}{r^{5}\sin(\frac{a}{r})^{2}} - 2\frac{b^{2}a^{4}\cos(\frac{a}{r})^{2}}{r^{7}\sin(\frac{a}{r})^{2}} + 4\frac{b^{4}a\cos(\frac{a}{r})^{3}}{r^{6}\sin(\frac{a}{r})^{3}} - 2\frac{b^{4}\cos(\frac{a}{r})^{2}}{r^{5}\sin(\frac{a}{r})^{2}} - 2\frac{1}{r} - \frac{b^{4}\cos(\frac{a}{r})^{4}}{r^{5}\sin(\frac{a}{r})^{4}} + 10\frac{b^{2}a\cos(\frac{a}{r})}{r^{4}\sin(\frac{a}{r})} - \frac{a^{4}}{r^{5}} - \frac{b^{4}}{r^{5}} + 4\frac{b^{4}a^{3}\cos(\frac{a}{r})^{3}}{r^{8}\sin(\frac{a}{r})^{3}} + 4\frac{b^{2}a^{3}\cos(\frac{a}{r})}{r^{6}\sin(\frac{a}{r})} - 6\frac{b^{4}a^{2}\cos(\frac{a}{r})^{2}}{r^{7}\sin(\frac{a}{r})^{2}}.$

$g^{\mu\nu}\,\Gamma^{1}_{\mu\nu} = -2\frac{b^{4}\cos(\frac{a}{r})^{3}}{r^{5}\sin(\frac{a}{r})^{3}} - \frac{b^{2}a^{4}\cos(\frac{a}{r})^{3}}{r^{7}\sin(\frac{a}{r})^{3}} + 2\frac{b^{4}a\cos(\frac{a}{r})^{2}}{r^{6}\sin(\frac{a}{r})^{2}} - 2\frac{b^{2}a^{3}}{r^{6}} - 5\frac{b^{2}a^{2}\cos(\frac{a}{r})^{2}}{r^{5}\sin(\frac{a}{r})^{3}} - 3\frac{b^{2}\cos(\frac{a}{r})^{3}}{r^{3}\sin(\frac{a}{r})^{3}} - 2\frac{b^{4}a^{2}\cos(\frac{a}{r})^{5}}{r^{7}\sin(\frac{a}{r})^{5}} + 9\frac{b^{2}a^{2}\cos(\frac{a}{r})}{r^{5}\sin(\frac{a}{r})} + 2\frac{b^{4}a^{3}\cos(\frac{a}{r})^{4}}{r^{8}\sin(\frac{a}{r})^{4}} - 3\frac{b^{2}\cos(\frac{a}{r})}{r^{3}\sin(\frac{a}{r})} - \frac{b^{4}\cos(\frac{a}{r})}{r^{5}\sin(\frac{a}{r})} - \frac{b^{4}a^{4}\cos(\frac{a}{r})^{5}}{r^{9}\sin(\frac{a}{r})^{5}} - 3\frac{a^{3}}{r^{4}} + 4\frac{b^{2}a^{4}\cos(\frac{a}{r})}{r^{7}\sin(\frac{a}{r})} + 4\frac{b^{2}a\cos(\frac{a}{r})}{r^{4}\sin(\frac{a}{r})^{2}} - \frac{a^{5}}{r^{6}} - 2\frac{b^{4}a^{2}\cos(\frac{a}{r})^{3}}{r^{7}\sin(\frac{a}{r})^{3}} - 2\frac{a}{r^{2}} - \frac{b^{4}\cos(\frac{a}{r})^{5}}{r^{5}\sin(\frac{a}{r})^{5}} - 6\frac{b^{4}a^{3}\cos(\frac{a}{r})^{2}}{r^{8}\sin(\frac{a}{r})^{2}} - 3\frac{b^{2}a}{r^{4}} - 2\frac{b^{2}a^{5}\cos(\frac{a}{r})^{2}}{r^{8}\sin(\frac{a}{r})^{2}} - \frac{\cos(\frac{a}{r})}{r\sin(\frac{a}{r})} + 4\frac{b^{4}a^{4}\cos(\frac{a}{r})^{3}}{r^{9}\sin(\frac{a}{r})^{3}} - \frac{b^{4}a}{r^{6}} + 3\frac{b^{4}a\cos(\frac{a}{r})^{4}}{r^{6}\sin(\frac{a}{r})^{4}} + 4\frac{b^{4}a^{2}\cos(\frac{a}{r})}{r^{7}\sin(\frac{a}{r})} - 5\frac{b^{2}a^{3}\cos(\frac{a}{r})^{2}}{r^{6}\sin(\frac{a}{r})^{2}} - \frac{b^{4}a^{5}\cos(\frac{a}{r})^{4}}{r^{10}\sin(\frac{a}{r})^{4}}.$

$g^{\mu\nu}\,\Gamma^{2}_{\mu\nu} = 8\frac{b^{3}a\cos(\frac{a}{r})}{r^{5}\sin(\frac{a}{r})} + 8\frac{b^{3}a\cos(\frac{a}{r})^{3}}{r^{7}\sin(\frac{a}{r})^{3}} - \frac{b^{5}a^{4}\cos(\frac{a}{r})^{6}}{r^{10}\sin(\frac{a}{r})^{6}} - 3\frac{b^{3}a^{4}\cos(\frac{a}{r})^{3}}{r^{4}\sin(\frac{a}{r})^{4}} - 3\frac{b^{3}}{r^{4}} + 4\frac{b^{3}a^{3}\cos(\frac{a}{r})^{3}}{r^{9}\sin(\frac{a}{r})^{3}} + 2\frac{b^{3}a^{3}\cos(\frac{a}{r})}{r^{7}\sin(\frac{a}{r})^{3}} - 3\frac{b^{5}\cos(\frac{a}{r})^{2}}{r^{6}\sin(\frac{a}{r})^{4}} - 8\frac{b^{3}a^{2}\cos(\frac{a}{r})^{4}}{r^{8}\sin(\frac{a}{r})^{4}} + 2\frac{b^{3}a^{3}\cos(\frac{a}{r})}{r^{7}\sin(\frac{a}{r})} - 6\frac{b^{5}a^{2}\cos(\frac{a}{r})^{2}}{r^{8}\sin(\frac{a}{r})^{2}} - 2\frac{b^{5}a^{2}\cos(\frac{a}{r})^{6}}{r^{8}\sin(\frac{a}{r})^{6}} - \frac{b\cos(\frac{a}{r})^{2}}{r^{2}\sin(\frac{a}{r})^{2}} - \frac{b^{3}a^{4}\cos(\frac{a}{r})^{4}}{r^{9}\sin(\frac{a}{r})^{4}} + 8\frac{b^{3}a\cos(\frac{a}{r})^{3}}{r^{5}\sin(\frac{a}{r})^{3}} - \frac{b^{5}a^{4}\cos(\frac{a}{r})^{4}}{r^{10}\sin(\frac{a}{r})^{4}} + 4\frac{b^{5}a^{3}\cos(\frac{a}{r})^{5}}{r^{7}\sin(\frac{a}{r})^{5}} - \frac{b^{3}a^{4}\cos(\frac{a}{r})^{2}}{r^{8}\sin(\frac{a}{r})^{2}} + 4\frac{b^{5}a^{3}\cos(\frac{a}{r})^{5}}{r^{9}\sin(\frac{a}{r})^{5}} - \frac{b^{5}\cos(\frac{a}{r})^{6}}{r^{6}\sin(\frac{a}{r})^{6}} + 4\frac{b^{5}a\cos(\frac{a}{r})^{5}}{r^{7}\sin(\frac{a}{r})^{5}} - 5\frac{b^{3}a^{2}\cos(\frac{a}{r})^{4}}{r^{6}\sin(\frac{a}{r})^{4}} - 3\frac{b^{5}\cos(\frac{a}{r})^{4}}{r^{6}\sin(\frac{a}{r})^{4}} - \frac{b}{r^{2}} - 6\frac{b^{5}a^{2}\cos(\frac{a}{r})^{2}}{r^{8}\sin(\frac{a}{r})^{2}} - \frac{b^{3}a^{2}}{r^{6}} - 6\frac{b^{5}\cos(\frac{a}{r})^{2}}{r^{4}\sin(\frac{a}{r})^{2}} - \frac{b^{5}}{r^{6}}.$