$restart : with(Physics) :$
$Setup(mathematicalnotation = true)$

$$[mathematicalnotation = true] \tag{1}$$

$Setup(coordinates = X)$

** Partial match of 'coordinates' against keyword 'coordinatesystems'*

Default differentiation variables for d_, D_ and dAlembertian are: $\{X = (x1, x2, x3, x4)\}$

Systems of spacetime Coordinates are: $\{X = (x1, x2, x3, x4)\}$

$$[coordinatesystems = \{X\}] \tag{2}$$

$g\_[\ ]$

$$g_{\mu,\nu} = \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \tag{3}$$

$Geodesics(tensornotation)$

$$\frac{d^2}{d\tau^2} X^{\mu}(\tau) \tag{4}$$

$Geodesics(\ )$

$$\left[\frac{d^2}{d\tau^2} x4(\tau) = 0, \frac{d^2}{d\tau^2} x3(\tau) = 0, \frac{d^2}{d\tau^2} x2(\tau) = 0, \frac{d^2}{d\tau^2} x1(\tau) = 0\right] \tag{5}$$

$Geodesics(output = solutions)$

$$\{x1(\tau) = \_C1\,\tau + \_C2, x2(\tau) = \_C3\,\tau + \_C4, x3(\tau) = \_C5\,\tau + \_C6, x4(\tau) = \_C7\,\tau + \_C8\} \tag{6}$$

$g\_[sc]$

Systems of spacetime Coordinates are: $\{X = (r, \theta, \phi, t)\}$

Default differentiation variables for d_, D_ and dAlembertian are: $\{X = (r, \theta, \phi, t)\}$

The Schwarzschild metric in coordinates $[r, \theta, \phi, t]$

Parameters: $[m]$

$$g_{\mu,\nu} = \begin{bmatrix} \frac{r}{-r + 2m} & 0 & 0 & 0 \\ 0 & -r^2 & 0 & 0 \\ 0 & 0 & -r^2 \sin(\theta)^2 & 0 \\ 0 & 0 & 0 & \frac{r - 2m}{r} \end{bmatrix} \tag{7}$$

$Geodesics(tensornotation)$

$$\frac{d^2}{d\tau^2} X^{\mu}(\tau) + \Gamma^{\mu}{}_{\alpha,\nu} \left(\frac{d}{d\tau} X^{\nu}(\tau)\right)\left(\frac{d}{d\tau} X^{\alpha}(\tau)\right) \tag{8}$$

Geodesics( )

$$\left[\frac{d^2}{d\tau^2}\phi(\tau) = -\frac{2\left(\frac{d}{d\tau}\phi(\tau)\right)\left(r(\tau)\left(\frac{d}{d\tau}\theta(\tau)\right)\cos(\theta(\tau)) + \left(\frac{d}{d\tau}r(\tau)\right)\sin(\theta(\tau))\right)}{r(\tau)\sin(\theta(\tau))},\right. \tag{9}$$

$$\frac{d^2}{d\tau^2}\theta(\tau) = \frac{\sin(\theta(\tau))\cos(\theta(\tau))\left(\frac{d}{d\tau}\phi(\tau)\right)^2 r(\tau) - 2\left(\frac{d}{d\tau}r(\tau)\right)\left(\frac{d}{d\tau}\theta(\tau)\right)}{r(\tau)},$$

$$\frac{d^2}{d\tau^2}r(\tau) = \frac{1}{(-r(\tau)+2\,m)\,r(\tau)^3}\left(4\left(-\frac{r(\tau)}{2}+m\right)^2 r(\tau)^3\,(\cos(\theta(\tau))\right.$$

$$-1)\,(\cos(\theta(\tau))+1)\left(\frac{d}{d\tau}\phi(\tau)\right)^2 - 4\left(-\frac{r(\tau)}{2}+m\right)^2 r(\tau)^3\left(\frac{d}{d\tau}\theta(\tau)\right)^2$$

$$\left.+4\,m\left(-\frac{r(\tau)}{2}+m\right)^2\left(\frac{d}{d\tau}t(\tau)\right)^2 - m\left(\frac{d}{d\tau}r(\tau)\right)^2 r(\tau)^2\right), \frac{d^2}{d\tau^2}t(\tau) =$$

$$\left.-\frac{2\,m\left(\frac{d}{d\tau}r(\tau)\right)\left(\frac{d}{d\tau}t(\tau)\right)}{r(\tau)\,(r(\tau)-2\,m)}\right]$$

theta(tau) = `*`(Pi, `^`(2,-1))

$$\theta(\tau) = \frac{\pi}{2} \tag{10}$$