1. DifferentialGeometry

`DifferentialGeometry` is a package included with recent versions of Maple. Once Maple is started, load `DifferentialGeometry` by typing the following command:

```
with(DifferentialGeometry):with(Tensor):
```

Start by choosing coordinates with a command of the form:

```
DGsetup([theta,phi],M):
```

where M is an arbitrary name for the spacetime. Among other things, this will define corresponding 1-forms *dtheta*, *dphi*. To work in a coordinate basis, simply define the metric with a command of the form:

```
g:=r^2*dtheta &t dtheta + r^2*sin(theta)^2*dphi &t dphi;
```

(where `&t` denotes the tensor product), after which you can calculate the connection `Christoffel(g)`, or proceed directly to calculate tensors such as `RicciTensor(g)` or `EinsteinTensor(g)`.

The results of any of these computations are given in explicit tensor form, with basis vectors and basis 1-forms attached. For example, the result of `Christoffel(g)` might contain a term of the form "`dtheta D_dphi dphi`"; the coefficient of this term is $\Gamma^{\phi}{}_{\theta\phi}$ (note the unusual order of the indices here).

To work with an orthonormal frame, *after* defining coordinates as above, specify the basis with a command of the form:

```
Q:=FrameData([r*dtheta,r*sin(theta)*dphi],N);
```

where N is the (new) name of the spacetime using the new basis, and Q can be any temporary name. Now switch to this basis with the command:

```
DGsetup(Q,[E],[s]);
```

where E and s are the desired names for the basis vectors ($\{E1, E2\}$) and basis 1-forms ($\{s1, s2\}$), respectively.

> An explicit list ($[E, F]$ can be given instead of a base letter ($[E]$). In either case, the names given must not correspond to any existing objects.

Redefine the metric in terms of the new basis:

```
h:=evalDG(s1 &t s1 + s2 &t s2);
```

after which you can simply compute in terms of h. The components of the connection 1-forms are contained in `Christoffel(h)`; the coefficient of "`s1 E2 s2`" would be $\Gamma^{\phi}{}_{\theta\phi}$.