```
> ?grtensorII
> readlib(grii);
```

proc() end

```
> grtensor();
```

GRTensorII Version 1.70 (R5)

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Developed by Peter Musgrave, Denis Pollney and Kayll Lake

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Latest version available from: http://astro.queensu.ca/~grtensor/

```
> makeg( rn );


Makeg 2.0: GRTensor metric/basis entry utility

To quit makeg, type 'exit' at any prompt.

Do you wish to enter a 1) metric [g(dn,dn)],
                       2) line element [ds],
                       3) non-holonomic basis [e(1)...e(n)], or
                       4) NP tetrad [l,n,m,mbar]?

> 1
Error in input. Please try again.

> 1;
Enter coordinates as a LIST (e.g. [r,theta,phi,t]):
> [t,r,theta,phi];
Is the metric  1) Diagonal, or
               2) Symmetric?
> 1;
Enter g[t,t]:
> -(1 - (2*M)/r + Q^2/r^2);
Enter g[r,r]:
> (1 - (2*M)/r + Q^2/r^2)^(-1);
Enter g[theta,theta]:
> r^2;
Enter g[phi,phi]:
> r^2*sin(theta)^2;


If there are any complex valued coordinates, constants or functions
for this spacetime, please enter them as a SET ( eg. { z, psi } ).

Complex quantities [default={}]:
>
{}
```

The values you have entered are:

$$Coordinates = [t, r, \theta, \phi]$$

Metric:

$$g_{a\ b} = \begin{bmatrix} -1 + 2\frac{M}{r} - \frac{Q^2}{r^2} & 0 & 0 & 0 \\ 0 & \frac{1}{1 - 2\frac{M}{r} + \frac{Q^2}{r^2}} & 0 & 0 \\ 0 & 0 & r^2 & 0 \\ 0 & 0 & 0 & r^2 \sin(\theta)^2 \end{bmatrix}$$

```
You may choose to 0) Use the metric WITHOUT saving it,
                  1) Save the metric as it is,
                  2) Correct an element of the metric,
                  3) Re-enter the metric,
                  4) Add/change constraint equations,
                  5) Add a text description, or
                  6) Abandon this metric and return to Maple.
```

```
> 0
Error in input. Please try again.
```

```
> 0;
Calculated ds for rn (.002000 sec.)
```

$$Default\ spacetime = rn$$

For the rn spacetime:

Coordinates

$$x(up)$$

$$x^a = [t, r, \theta, \phi]$$

Line element

$$ds^2 = \left(-1 + 2\frac{M}{r} - \frac{Q^2}{r^2}\right) dt^2 + \frac{dr^2}{1 - 2\frac{M}{r} + \frac{Q^2}{r^2}} + r^2\ d\theta^2 + r^2 \sin(\theta)^2\ d\phi^2$$

```
makeg() completed.
> grcalc(R(up,up,dn,dn));
Calculated detg for rn (.005000 sec.)
Calculated g(up,up) for rn (.016000 sec.)
Calculated g(dn,dn,pdn) for rn (.017000 sec.)
Calculated Chr(dn,dn,dn) for rn (.013000 sec.)
Calculated R(dn,dn,dn,dn) for rn (.053000 sec.)
Calculated R(up,up,dn,dn) for rn (.056000 sec.)
```

$$CPU\ Time = .166$$

```
> grdisplay(_);
```

For the rn spacetime:

Mixed Riemann

$$R^{t\ r}{}_{t\ r} = \frac{2\,M\,r - 3\,Q^2}{r^4}$$

$$R^{t\ \theta}{}_{t\ \theta} = -\frac{M\,r - Q^2}{r^4}$$

$$R^{t\ \phi}{}_{t\ \phi} = -\frac{M\,r - Q^2}{r^4}$$

$$R^{r\ \theta}{}_{r\ \theta} = -\frac{M\,r - Q^2}{r^4}$$

$$R^{r\ \phi}{}_{r\ \phi} = -\frac{M\,r - Q^2}{r^4}$$

$$R^{\theta\ \phi}{}_{\theta\ \phi} = \frac{2\,M\,r - Q^2}{r^4}$$