About Spherical Cycloids

See also the ATOs for Spherical Ellipses and for Planar Rolling Curves, e.g. Astroid, Cardioid

Spherical Definition
(in analogy to planar case)

The spherical ellipses demonstrated already how definitions from planar Euclidean geometry can be repeated on the sphere; the demo illustrates that also spherical evolutes are analogous to the planar ones. Rolling curves, spherical cycloids, provide more such examples: simply let one spherical circle *roll* (on the inside or the outside) along another spherical circle. Here *roll* means that the arclengths (= angle at the center times sine of the spherical radius) of corresponding arcs of the two circles agree. The true rolling curves are obtained by looking at the curve traced out by one point of the rolling circle, but, just as in the plane, one may also look at the traces of other points on a fixed radius, inside or outside the rolling circle — choose bb different from 1 in the Settings Menu, Set Parameters Dialog.

The rolling construction is illustrated by choosing *Show Rolling Circle* in the Action Menu.
Rolling curves have a very simple tangent construction. The point of the rolling circle which is in contact with the base curve has velocity zero – just watch cars going by. This means that the connecting segment (which is a piece of a great circle of the sphere) from this point of contact of the wheel to the endpoint of the (great circle) drawing stick is the (great circle) radius of the momentary rotation. The tangent of the curve drawn by the drawing stick is therefore orthogonal to this momentary radius. The 3DXM-demo draws the rolling curve and shows its tangents.
One can observe, for all spherical curves (in 3DXM: Viviani, Spherical Ellipses, Spherical Cycloids, Loxodrome), that the osculating circles lie on the sphere of the spherical curve by choosing *Show Osculating Circle* in the Action Menu. To understand this, note, that the osculating circle lies in the osculating plane (Action Menu!) and, of course, no circle in a given osculating plane can be a better approximation of the curve than the intersection of this plane with the sphere on which the curve lies.