Description

This document explains, how to calculate the bezier points for complete circles. These can be drawn with the Rcurve command from the lapdf.sty. If the weight of the point $P_1$ is $w = \cos(\alpha)$, where $\alpha$ is the angle between $P_0P_1$ and $P_1P_2$, then the conic will be a circular arc, if also both length $P_0P_1$ and $P_1P_2$ are equal.

We have to smothly join several of these arcs together, to get a full circle. Only in the case of two segments, we have have to use one negative weight. In all other cases we only have positive weights. In all of the following calculations and drawings we assume, that the center of the circle lies at the origin.
We always put $P_0$ at the bottom of the circle and all other points follow counterclockwise. This is the general procedure for circle construction with rational quadratic bezier curves (see picture):

1. Set the radius $r$.
2. Set the number of bezier segments $n$.
3. Calculate $\alpha = \frac{360^\circ}{2n}$.
4. Calculate outer radius $R = \frac{r}{\cos(\alpha)}$.
5. Calculate all even bezier points $P_{2i} = \left(\frac{+r \cdot \sin(2i \cdot \alpha)}{-r \cdot \cos(2i \cdot \alpha)}\right)$ for $i = 0 \ldots n$.
6. Calculate odd bezier points $P_{2i+1} = \left(\frac{+R \cdot \sin((2i + 1) \cdot \alpha)}{-R \cdot \cos((2i + 1) \cdot \alpha)}\right)$ for $i = 0 \ldots n - 1$.

You can control your calculations, if you check your endpoint $P_{2n}$. This point is equal with $P_0$. All curves are drawn with the \texttt{Rmoveto()} and \texttt{Rcurveto()} combination.
Circle with $2n + 1 = 5$ points ($w_{2n} = 1$ and $w_{2n+1} = \pm \cos(60^\circ) = \pm 0.5$).

Circle with $2n + 1 = 7$ points ($w_{2n} = 1$ and $w_{2n+1} = \cos(60^\circ) = 0.5$).

3 Segments
Circle with \(2n + 1 = 9\) points \((w_{2n} = 1\) and \(w_{2n+1} = \cos(45^\circ) = 0.707)\).

Circle with \(2n + 1 = 11\) points \((w_{2n} = 1\) and \(w_{2n+1} = \cos(36^\circ) = 0.809)\).
6 Segments

Circle with \(2n + 1 = 13\) points (\(w_{2n} = 1\) and \(w_{2n+1} = \cos(30^\circ) = 0.866\)).

7 Segments

Circle with \(2n + 1 = 15\) points (\(w_{2n} = 1\) and \(w_{2n+1} = \cos(25.71^\circ) = 0.901\)).