**TP A.21**  
Comparison of bisector-point and double-angle-bisect draw systems

supporting:  
“The Illustrated Principles of Pool and Billiards”  
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ball radius: \( R := 1.125 \text{ in} \)

Note - the change in cue ball angle \( \theta_c \) (e.g., see TP A.20) is related to the bisector angle \( \theta \) according to:

\[
\theta_c = 180 \cdot \text{deg} - 2 \cdot \theta - \beta
\]
From the triangle formed by $C$, $P$, and the perpendicular from $P$ to $OC$,

\[
\tan(\beta) = \frac{R \cdot \sin(\theta)}{d - R \cdot \cos(\theta)}
\]

\[
\beta(\theta, d) := \text{atan2}(d - R \cdot \cos(\theta), R \cdot \sin(\theta))
\]

Applying the law of sines to triangle $OGP$ gives:

\[
\frac{\sin(180 \cdot \text{deg} - (\theta + \beta))}{2 \cdot R} = \frac{\sin(\phi + \beta)}{R}
\]

\[
\phi(\theta, d) := \text{asin}\left(\frac{\sin(\theta + \beta(\theta, d))}{2}\right) - \beta(\theta, d)
\]

The double-angle-bisect system (see Bob Jewett's October, 1995 BD article) predicts:

\[
\phi_{\text{dab}}(\theta) := \frac{\theta}{2}
\]

Here's how the methods compare for two different CB-OB distances:

\[
\begin{align*}
    d_1 & := 1 \cdot \text{ft} \\
    d_2 & := 6 \cdot \text{ft} \\
    \theta & := 0 \cdot \text{deg} \ldots 60 \cdot \text{deg}
\end{align*}
\]

So the two systems agree fairly well for small cut angle shots. There is more disagreement at bigger cut angles, especially when the distance between the CB and OB is large.