For "gearing" outside English, the sliding velocity of the point of contact between the cue ball and object ball must be 0, so:

\[
v_C = \mathbf{v} \cdot \sin(\phi) - \mathbf{\omega} \cdot R = 0\tag{1}\]

where \( R \) is the radius of the cue ball. So, using the definition of spin-rate factor (SRF) from TP A.12,

\[
SRF = \frac{\mathbf{\omega}}{\mathbf{R} \cdot \sin(\phi)}\tag{2}
\]
From TP A.25, the percent English required to achieve this SRF is:

$$PE = \frac{4}{5} \cdot SRF \cdot 100\% = \frac{4}{5} \cdot \sin(\phi) \cdot 100\%$$

(3)

The following plot summarizes how much English is required for "gearing" outside English for various cut angles:

$$\phi := 0\text{-deg, } 1\text{-deg, } 90\text{-deg}$$

$$PEg(\phi) := \frac{4}{5} \cdot \sin(\phi) \cdot 100\%$$

For a half-ball hit:

$$\phi := 30\text{-deg} \quad PEg(\phi) = 40\%$$

So, with a half-ball hit, anything less than 40% English will be less than "gearing" and will throw the OB to the right, and anything more than 40% English will result in excess outside English, causing throw to the left.
Here are the percentage-english amounts required for other standard ball-hit fractions:

From TP 1.23:

\[
\phi(f) := \arcsin(1 - f) \quad f(\phi) := 1 - \sin(\phi)
\]

\[
\begin{align*}
    f & := 0 & f = 0\% & \phi(f) = 90\text{-deg} & \text{PE}(f) = 80\% \\
    f & := \frac{1}{4} & f = 25\% & \phi(f) = 48.59\text{-deg} & \text{PE}(f) = 60\% \\
    f & := \frac{1}{2} & f = 50\% & \phi(f) = 30\text{-deg} & \text{PE}(f) = 40\% \\
    f & := \frac{3}{4} & f = 75\% & \phi(f) = 14.478\text{-deg} & \text{PE}(f) = 20\% \\
    f & := 1 & f = 100\% & \phi(f) = 0\text{-deg} & \text{PE}(f) = 0\%
\end{align*}
\]

From the data and equations above, it is clear that the percentage english required for gearing outside english (no throw) is 80% of 1 minus the ball-hit fraction:

\[
\text{PE}_g = 0.8(1 - f)
\]

It is easy to visualize the amount of tip offset needed to create gearing outside English for any cut angle using the technique described and illustrated below.

From Equation 3 in TP A.12, and Equation 2 above, the tip offset \((x)\) required for gearing outside English is:

\[
x = \frac{2}{5} \cdot R \cdot \text{SPF} = \frac{2}{5} R \cdot \sin(\phi) = \frac{2}{5} R \left( \frac{L}{R} \right) = \frac{2}{5} L
\]

where \(L\) is the distance between the line of aim and the line-of-centers point (see the diagram at the top of this document and the diagram below). Therefore, the required tip offset is 40% \((2/5)\) of the distance from the aiming line to the line-of-centers point on the front of the CB. The following diagram illustrates how this technique is applied at the table: