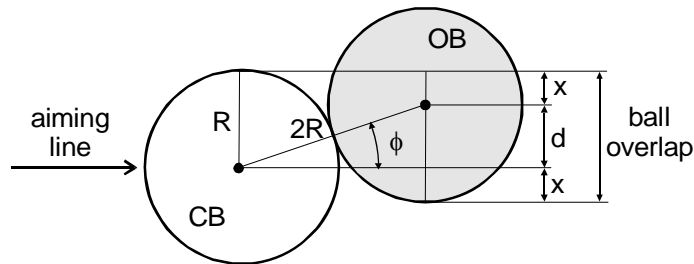




## TP A.23 Ball-hit fraction vs. cut angle

from:  
 “The Illustrated Principles of Pool and Billiards”  
<http://billiards.colostate.edu>  
 by David G. Alciatore, PhD, PE ("Dr. Dave")

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From the figure above, the following equations relate the dimensions  $x$  and  $d$  to the cut angle  $\phi$ :

$$x + d = R$$

$$d = 2R \cdot \sin(\phi)$$

The amount of overlap between the balls, projected in the aiming line direction is  $R+x$ , so the ball-hit fraction ( $f$ ) is:

$$f = \frac{\text{overlap}}{\text{diameter}} = \frac{R + x}{2R} = \frac{2R - d}{2R} = 1 - \sin(\phi)$$

So the relationships between cut angle and ball-hit fraction are:

$$f(\phi) := 1 - \sin(\phi)$$

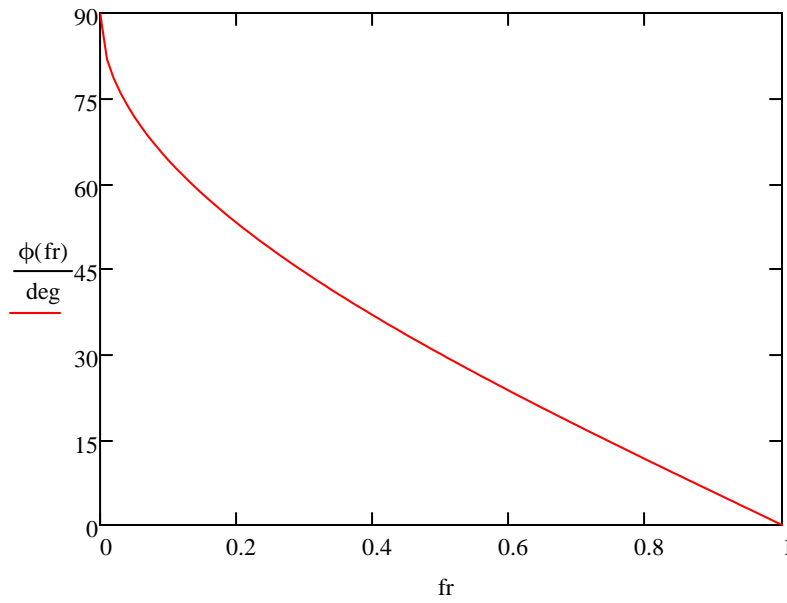
$$\phi(f) := \text{asin}(1 - f)$$

Value ranges for the plots:

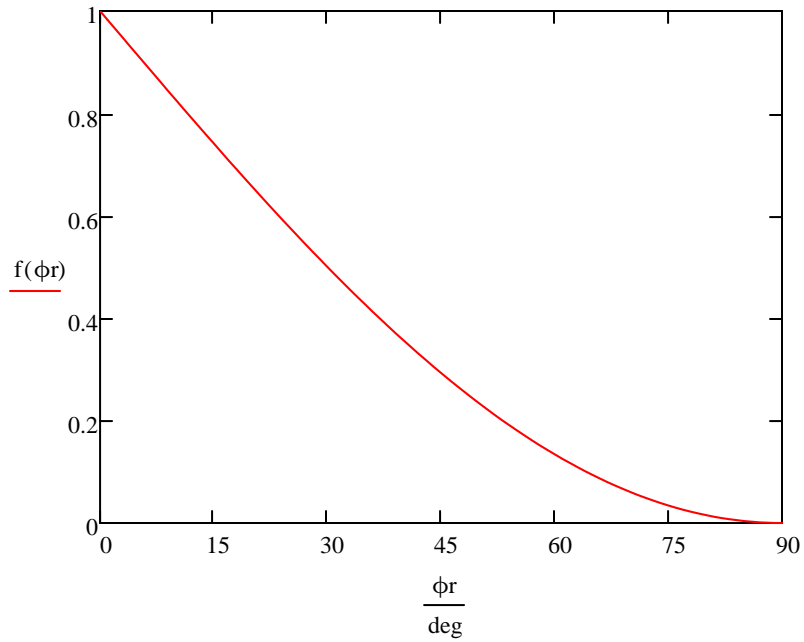
$$f_r := 0, 0.01 \dots 1.0$$

$$\phi_r := 0 \cdot \text{deg}, 1 \cdot \text{deg} \dots 90 \cdot \text{deg}$$

cut angle vs. ball-hit fraction



ball-hit fraction vs. cut angle



Here are some common values:



1/8-ball hit:

$$\phi\left(\frac{1}{8}\right) = 61.045 \text{ deg}$$

1/4-ball hit:

$$\phi\left(\frac{1}{4}\right) = 48.59 \text{ deg}$$

1/2-ball hit:

$$\phi\left(\frac{1}{2}\right) = 30 \text{ deg}$$

3/4 -ball hit:

$$\phi\left(\frac{3}{4}\right) = 14.478 \text{ deg}$$

7/8 -ball hit:

$$\phi\left(\frac{7}{8}\right) = 7.181 \text{ deg}$$