1

$\frac{3}{2}K$ 180° 0°

∞ 270° 270°

0 2π $K: \{(x,y) \in \mathbb{R}^2$ s.t. $x = R\cos\varphi,\ y = R\sin\varphi\ \forall \varphi \in [0, 2\pi)\}$

~~Kx~~ $\mapsto x$ $K_c: \{(x,y) \in \mathbb{R}^2$ s.t. $x = R_c\cos\varphi,\ y = R_c\sin\varphi + y_c'\ \forall\varphi\}$

$y_c' = y_c/2$ with y_c correction

Where do K & K_c intersect?

$$R\sin\varphi = R_c\sin\varphi + y_c'$$

$$(R - R_c)\sin\varphi = y_c'$$

$$\Rightarrow \sin\varphi = \frac{y_c'}{R - R_c}$$

2

Set $\varphi = 2\pi - \frac{30}{360}\cdot 2\pi \cong 5{,}76$

st correction takes place during 60° of the circle

$\sin(\varphi = 5{,}76)$ ~~...~~ $\approx -0{,}5$

$R\sin\varphi = R_c\sin\varphi + y_c'$

$R\sin\varphi - y_c' = R_c\sin\varphi$

$$\boxed{R_c = R - \frac{y_c'}{\sin\varphi}} = ~~R - \frac{y_c'}{0{,}1}~~$$

$$= ~~R - \frac{y_c}{0{,}2}~~$$

$$R_c = R + \frac{y_c}{1}$$

3

1. Decide where the new center of the circle K' will be.
2. Calculate y_c and the direction φ_c.
3. Calculate R_c by $R_c =$ ~~...~~ $R + y_c$.
4. Find Bank angle corresponding to R_c.
5. At $\varphi = \varphi_c - \frac{90+30}{360}\cdot 2\pi$ set new bank angle.
6. At $\varphi = \varphi_c$ ~~+~~ $\frac{90-30}{360}\cdot 2\pi$ set old bank angle.

$$\boxed{R = c\cdot\frac{v^2}{\tan(\beta)}}$$ β: bank angle

4

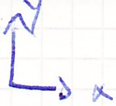
Step 4:

~~...~~ $\tan\beta_R' = c\cdot\frac{v^2}{R}$ $\rightsquigarrow$ $\boxed{\beta_R' = \mathrm{atan}\left(c\cdot\frac{v^2}{R}\right)}$

~~$\tan\beta$~~

$$\boxed{\beta = \frac{\beta'}{2\pi}\cdot 360}$$

eg ~~If~~ $y_c = 2R \Rightarrow R_c = 2R$, $\beta' = \mathrm{atan}\left(c\frac{v^2}{2R}\right)$



$x^2 + y^2 + R^2 = 0$

$\rightarrow (x-R)^2 + (y-R)^2 + R^2 = 0$

$K: \quad x = R\cos\varphi$

$\quad\;\; y = R\sin\varphi \qquad \varphi \in [0, 2\pi]$

Find K_c with $R_c > R$ s.t.

eg $R_c = \frac{3}{2}R$, begin connection at 180°

end — " — 0°

eg $R_c = \infty$ begin at 270°

end at 270° $t > t_{CS}$

$\beta = 20 \rightarrow R = 430\,m$

$c = 430 \cdot \tan 20° = 157$

$\beta = 45, \quad R = \frac{157}{\tan 45°} = 157$ ✓

$\boxed{c = 160}$

At $v = 60$ knots, Turnradius = ~~...~~ ~~167 m~~ 165 m

$\beta = \cancel{40}\,45°$

$R = \frac{c}{\tan\beta}$

$\cancel{165} = 165 \cdot \tan \cancel{\beta}\, 45° = c$

$c = 165$

Expected: $\beta = 30$

$R = \frac{165}{\tan 30°} = 286\,m$

measured: 275 m

$c = 275 \cdot \tan 30° = 159$

Exp. $\beta = 20$

$R = \frac{155}{\tan 20°} = 437\,m$