Waht label to go around cup by proportionally same amount.
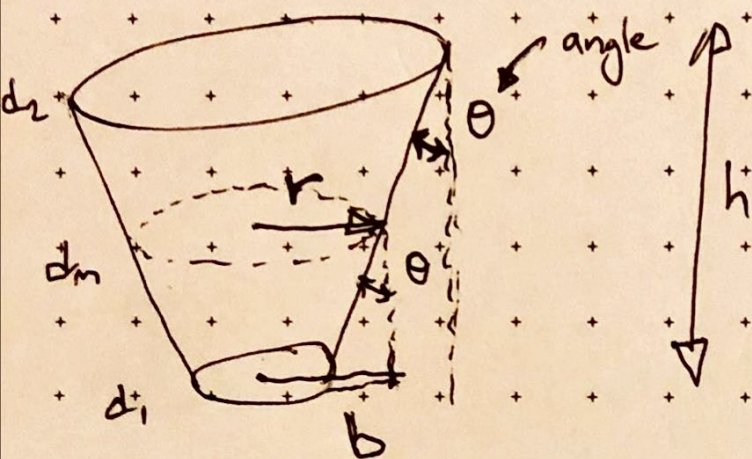
r is radius at label center.

h is label hight

θ is slope angle in radians. so.

$$\theta = \frac{degrees}{180} \times \pi$$

where $\pi = 3.14159...$

$d = 2\pi r$ diameter so to find ratio by where bottom label edge shrinks

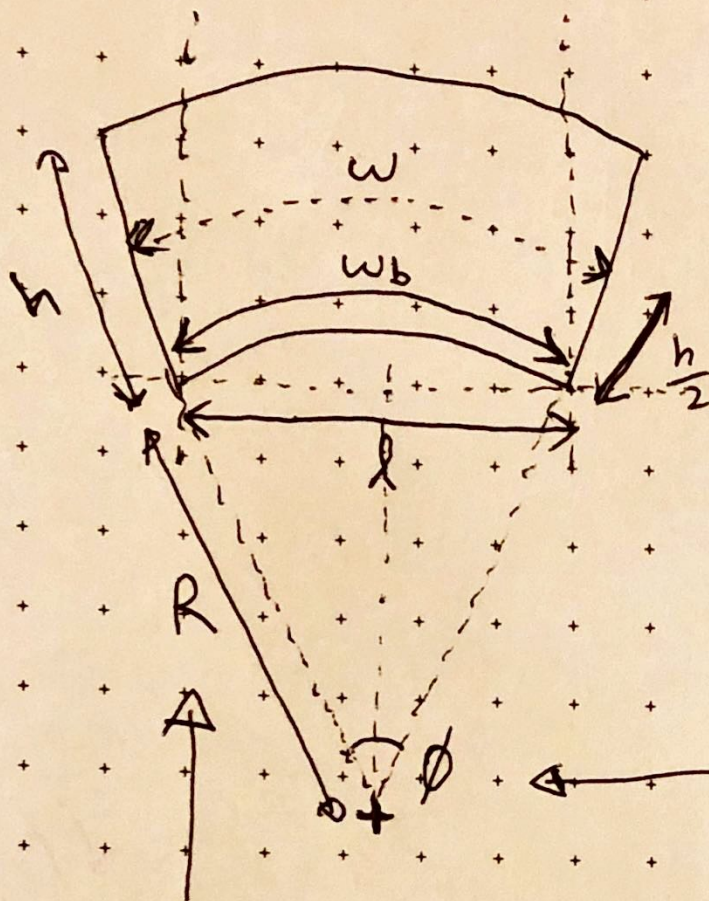$$\frac{d_1}{d_m} = \frac{\cancel{2\pi r}}{\cancel{2\pi (r}} \quad \frac{2\pi (r-b)}{2\pi r} = \frac{r-b}{r}$$

where $b = \frac{h}{2} \tan(\theta)$ by trig

so bottom edge of distorted label is

$$\boxed{W_b = W \times \frac{r - \frac{h}{2}\tan(\theta)}{r}}$$

kikki.K

Find length of box before distortion

$$W_b = R\phi$$

$$W = \left(R + \frac{h}{2}\right)\phi$$

$$W = \left(\frac{W_b}{\phi} + \frac{h}{2}\right)\phi$$

$$W = W_b + \frac{h\phi}{2}$$

$$W - W_b = \frac{h\phi}{2}$$

$$\boxed{2\frac{W - W_b}{h} = \phi}$$

$$W = \left(R + \frac{h}{2}\right)\frac{W_b}{R}$$

$$WR = W_b R + \frac{W_b h}{2}$$

$$WR - W_b R = \frac{hW_b}{2}$$

$$\boxed{R = \frac{hW_b}{2(W - W_b)}}$$

$$\frac{\ell}{2} = \sin\left(\frac{\phi}{2}\right)R$$

$$\boxed{\ell = \frac{hW_b}{W - W_b}\sin\left(\frac{W - W_b}{h}\right)}$$

The length of the label ~~before~~ distortion is applied should be ℓ.

Guessing that `Bend`% is $\frac{\phi}{2}$?

$$\frac{\phi}{2} = \frac{W - W_b}{h} \qquad (0, \frac{\pi}{2}) \qquad \pi = 3.14159\cdots$$

So

$$\boxed{\text{Bend \%} = 2 \times \frac{W - W_b}{h \times \pi} \times 100}$$