(3) Polars

$$\cancel{\sin}\ \tan\varphi = \frac{y}{1-x} = \frac{r\sin\theta}{1-r\cos\theta}$$

$\cancel{\sin(\varphi)} =$

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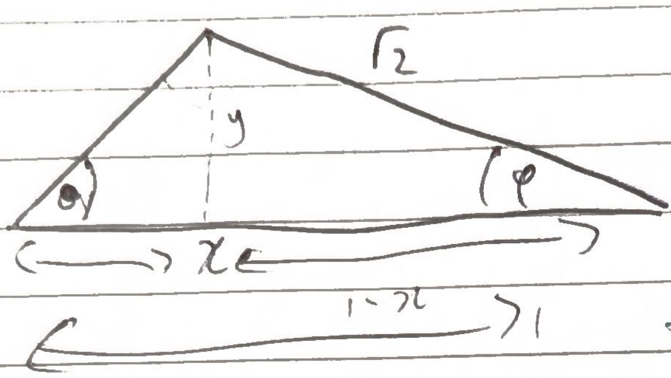
$$\sin(\varphi) = \frac{r_2\sin(\theta)}{r_1}$$



$$r_2^2 = (1-x)^2 + y^2$$
$$= (1-r\cos(\theta))^2 + r^2\sin^2\theta$$
$$= 1 + r^2\cos^2(\theta) + r^2\sin^2(\theta) - 2r\cos\theta$$
$$= 1 + r^2 - 2r\cos\theta$$

$$r_2 = \sqrt{r_1^2 + 1 - 2r_1\cos(\theta)}$$

Area Circles $= \cancel{\frac{\pi r_1^2}{4}} \quad \frac{\pi}{4}(r_1^2 + r_2^2) = \frac{\pi}{4}(r^2+1+r^2-2r\cos\theta)$

$$= \frac{\pi}{4}(2r^2+1-2r\cos\theta) \quad ①$$

$$A = \frac{1}{2}r^2\theta - \frac{1}{2}r^2\cos(\theta)\sin(\theta) +$$
$$\frac{1}{2}r_2^2\varphi - \frac{1}{2}r_2^2\cos(\varphi)\sin(\varphi)$$

$$= \frac{1}{2}r^2\theta - \frac{1}{2}r^2\cos\theta\sin\theta + \frac{1}{2}(1+r^2-2r\cos\theta)\tan^{-1}\left(\frac{r\sin\theta}{1-r\cos\theta}\right)$$
$$-\frac{1}{2}(1+r^2-2r\cos\theta)\frac{1-r\cos\theta}{\sqrt{1+r^2-2r\cos\theta}} \cdot \frac{r\sin\theta}{\sqrt{1+r^2-2r\cos\theta}}$$

$$\left.\begin{aligned}&= \frac{1}{2}r^2\theta - \frac{1}{2}r^2\cos\theta\sin\theta + \frac{1}{2}(1+r^2-2r\cos\theta)\tan^{-1}\left(\frac{r\sin\theta}{1-r\cos\theta}\right)\\ &-\frac{1}{2}(1-r\cos\theta)r\sin\theta\end{aligned}\right\} ②$$

$x = r\cos\theta \qquad J = r$

$y = r\sin\theta$

$$\int_0^{\pi/4} d\theta \int_0^{\frac{1}{\sin\theta+\cos\theta}} dr \qquad \int_0^{\pi/4}\int_0^{\frac{1}{\sin\theta+\cos\theta}} (① - ②)\, r\, dr\, d\theta$$

$y = -x+1$

$\Rightarrow r\sin\theta = -r\cos\theta + 1 \Rightarrow r(\sin\theta+\cos\theta) = 1$