

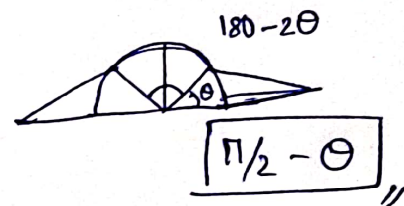
$$P(\theta) = (\cos\theta, \sin\theta) \text{ (some point)}$$

$$A = (-2, 0) \quad B = (2, 0)$$

$$AP(\theta) = \sqrt{(2 - \cos\theta)^2 + \sin^2\theta}$$

Since Both A & B will be equidistant from circle & y axis, one can Exploit the Symmetry here by solving for $\overline{AP} + \overline{PC}$

$$\therefore AP(\theta) = \sqrt{5 - 4\cos\theta}$$



$$\therefore \overline{AP} + \overline{PC} = \sqrt{5 - 4\cos\theta} + \frac{\pi}{2} - \theta = D(\theta)$$

Taking derivative of $D(\theta)$ and $= 0$

$$\Rightarrow \frac{d}{d\theta} D(\theta) = \frac{2\sin\theta}{\sqrt{5 - 4\cos\theta}} - 1 \Rightarrow \frac{2\sin\theta}{\sqrt{5 - 4\cos\theta}} = 1$$

$$\therefore 4\sin^2\theta = 5 - 4\cos\theta$$

$$\therefore 4 - 4\cos^2\theta = 5 - 4\cos\theta$$

$$\Rightarrow 4\cos^2\theta - 4\cos\theta + 1 = 0$$

$$(2\cos\theta - 1)^2 = 0$$

$$\cos\theta = \frac{1}{2}$$

$$\therefore \boxed{\theta = \frac{\pi}{3}}$$

Because of argument b/w $(0, \pi)$ we take $\theta = \frac{\pi}{3}$

$$\therefore D(\theta) = \sqrt{5 - 4 \times \frac{1}{2}} + \frac{\pi}{2} - \frac{\pi}{3}$$

$$D(\theta) = \sqrt{3} + \frac{\pi}{6}$$

since we used symmetry actual answer $\Rightarrow$

$$2D(\theta) = L(\theta) \Rightarrow \boxed{2\sqrt{3} + \frac{\pi}{3}}$$

