1e) $M = \oint \rho^{**} \cdot ds \longrightarrow \left\| \frac{dr(\theta)}{d\theta} \right\| . d\theta$

$\frac{dr(\theta)}{d\theta} = \frac{d}{d\theta} \left(a \cdot \cos\theta \, (1+\cos\theta),\ a \sin\theta \, (1+\cos\theta) \right)$

$= \left(a \sin\theta \left(-1-2\cos(\theta)\right),\ \left(2\cos(\theta)^2 + \cos(\theta) - 1\right) a \right) d\theta$

$M = \int_0^{\pi} \frac{dr(\theta)}{d\theta} . d\theta$

now $\left\| \frac{dr(\theta)}{d\theta} \right\| d\theta$

$\Rightarrow ds = \sqrt{2} \sqrt{a^2 (1+\cos\theta)}$

$= \int_0^{\pi} ds = 4a \text{ cngu}(a)$

$\rightarrow M_x = \frac{1}{4a \text{ cngu}(a)} \cdot \int_0^{\pi} ds \cdot \bar{x} = \frac{4a}{5}$, with $\bar{x} = a\cos\theta \, (1+\cos\theta)$

$\rightarrow M_y = \frac{1}{4a \text{ cngu}(a)} \cdot \int_0^{\pi} ds \cdot \bar{y} = \frac{4a}{5}$, with $\bar{y} = a\sin\theta \, (1+\cos\theta)$

$\Rightarrow \left(\frac{4a}{5}, \frac{4a}{5} \right)$