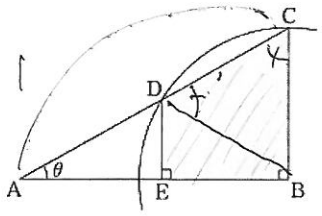
※ 2018년 10월 시행 교육청 고3 수학 가형 17번.



$\overline{AC}=1$, $\angle BAC=\angle CAB=\theta$. $\therefore \overline{CB}=\sin\theta$. $\overline{DB}=\sin\theta$.

$\triangle DBC$는 이등변삼각형이므로 ($\overline{DB}=\overline{CB}$) $\angle DCB=\angle CDB=\frac{\pi}{2}-\theta$.

$\therefore \angle DBC=2\theta$, $\angle DBE=\frac{\pi}{2}-2\theta$.

빗금친 부분은 등변사다리꼴이므로 $S(\theta)=\overline{EB}\times\frac{(\overline{DE}+\overline{CB})}{2}$.

$\overline{DE}=\sin\theta\times\sin(\frac{\pi}{2}-2\theta)$, $\overline{EB}=\sin\theta\times\cos(\frac{\pi}{2}-2\theta)$.

$$\therefore \lim_{\theta\to 0+}\frac{S(\theta)}{\theta^3}=\lim_{\theta\to 0+}\frac{1}{\theta^3}\times\sin\theta\times\sin2\theta\times\frac{(\sin\theta\cos2\theta+\sin\theta)}{2}$$

$$=\lim_{\theta\to 0+}\frac{\sin^3\theta}{\theta^3}\times 2\cos\theta\times\frac{(\cos2\theta+1)}{2}=1\times2\times\frac{2}{2}=2\ //$$

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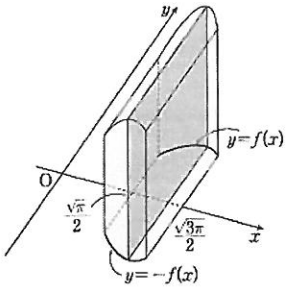

$$\int_{\frac{\sqrt{\pi}}{2}}^{\frac{\sqrt{3\pi}}{2}} \{2f(x)\}^2 dx \ (\because f(x)>0) = \int_{\frac{\sqrt{\pi}}{2}}^{\frac{\sqrt{3\pi}}{2}} 4x\sin(x^2)\,dx$$

$x^2 = t$ 라 하면 $2x\,dx = dt$. $x = \frac{\sqrt{\pi}}{2} \to t = \frac{\pi}{4}$, $x = \frac{\sqrt{3\pi}}{2} \to t = \frac{3\pi}{4}$.

$$\therefore 2\times\int_{\frac{\pi}{4}}^{\frac{3\pi}{4}} \sin t\,dt = 2\times\left[-\cos t\right]_{\frac{\pi}{4}}^{\frac{3\pi}{4}} = 2\times\left(-\cos\frac{3}{4}\pi + \cos\frac{\pi}{4}\right)$$

$$= 2\times\left(\cos\frac{\pi}{4} + \cos\frac{\pi}{4}\right) = 2\sqrt{2} \ //$$

$(\because \cos\frac{3}{4}\pi = \cos(\pi - \frac{\pi}{4}) = -\cos\frac{\pi}{4}$.