

حل) $\cos(\frac{\pi}{2} + \pi) \cos(\pi - \frac{\pi}{2}) = \frac{1}{2} \xrightarrow{\cos(x) = \cos(-x)} \cos(\frac{\pi}{2} + \pi) \cos(\frac{\pi}{2} - \pi) = \frac{1}{2}$ K2 (E)

$\frac{\pi}{2} + \pi + \frac{\pi}{2} - \pi = \frac{\pi}{2}$
 $\xrightarrow{\text{مع}} \cos(\pi - \frac{\pi}{2}) = \sin(\frac{\pi}{2} + \pi) \rightarrow \cos(\pi + \frac{\pi}{2}) \sin(\pi + \frac{\pi}{2}) = \frac{1}{2}$

$\frac{1}{r} \sin(r(\pi + \frac{\pi}{2})) = \frac{1}{2} \rightarrow \sin(\frac{\pi}{2} + \pi) = \frac{1}{2} \rightarrow \cos \pi = \frac{1}{2} = \cos(\frac{\pi}{3})$
 $\rightarrow \pi = rKa + \frac{\pi}{r} \rightarrow \boxed{\pi = Ka + \frac{\pi}{r}} \checkmark, \pi = rKa - \frac{\pi}{r} \rightarrow \boxed{\pi = Ka - \frac{\pi}{r}} \checkmark$

ب) $\cos(r\pi - \frac{\pi}{r}) = \sin(-r\pi) \rightarrow \cos(r\pi - \frac{\pi}{r}) = \cos(\frac{\pi}{r} + r\pi)$

① $r\pi - \frac{\pi}{r} = rKa + \frac{\pi}{r} \rightarrow \pi, \pi \rightarrow \text{X}$

② $r\pi - \frac{\pi}{r} = rKa - \frac{\pi}{r} - \pi \rightarrow \pi = rKa + \frac{\pi}{r} - \frac{\pi}{r}$
 $\div \pi \rightarrow \boxed{\pi = \frac{Ka}{r} - \frac{1}{r}} \checkmark$

$\frac{\sin \pi + \sin \pi}{\sin \pi} = \frac{\sin \pi}{\sin \pi} = \cos \pi \xrightarrow{\text{تقريب}} \frac{\sin \pi}{\sin \pi} + \frac{\sin \pi}{\sin \pi} = \cos \pi + \sin \pi$ (E)

$\frac{r \sin \pi \cos \pi + 1}{\sin \pi} = 1 \rightarrow r \cos \pi = 0 \rightarrow \cos \pi = 0 \rightarrow \pi = rKa + \frac{\pi}{r}$
 $\rightarrow \boxed{\pi = Ka + \frac{\pi}{r}} \checkmark$

$\frac{\sin \frac{\pi}{r}}{1 + \cos \frac{\pi}{r}} = \frac{1}{\sin \frac{\pi}{r}} + \frac{\cos \frac{\pi}{r}}{\sin \frac{\pi}{r}} \rightarrow \frac{\sin \frac{\pi}{r}}{1 + \cos \frac{\pi}{r}} = \frac{1 + \cos \frac{\pi}{r}}{\sin \frac{\pi}{r}} \xrightarrow{\frac{\sin x}{1 + \cos x} = \frac{1 - \cos x}{\sin x}} \frac{1 - \cos \frac{\pi}{r}}{\sin \frac{\pi}{r}}$ (E)

$\frac{\sin \frac{\pi}{r}}{1 + \cos \frac{\pi}{r}} = \frac{1 - \cos \frac{\pi}{r}}{\sin \frac{\pi}{r}} = \frac{1 + \cos \frac{\pi}{r}}{\sin \frac{\pi}{r}} \rightarrow \sin \frac{\pi}{r} - \cos \frac{\pi}{r} \sin \frac{\pi}{r} = \sin \frac{\pi}{r} + \sin \frac{\pi}{r} \cos \frac{\pi}{r}$

$\rightarrow \sin \frac{\pi}{r} \cos \pi + \sin \frac{\pi}{r} \cos \pi = 0 \rightarrow \sin \pi = 0 \rightarrow \pi = rKa$
 $\pi = \{-\pi, 0, \pi\} \rightarrow |\pi - 0 - (-\pi)| = \boxed{rKa} \checkmark$

$\cos \pi - \sin \pi \cos \pi = 1 \rightarrow -\sin \pi \cos \pi = 1 - \cos \pi \rightarrow -\sin \pi \cos \pi = \sin \pi$ (V)

$\rightarrow \sin \pi \cos \pi + \sin \pi = 0 \rightarrow \sin \pi (\cos \pi + 1) = 0$

① $\sin \pi = 0 \rightarrow \sin \pi = 0 \rightarrow \pi = rKa \checkmark \rightarrow \pi = \{0, \pi, 2\pi\}$

② $\cos \pi + 1 = 0 \rightarrow \cos \pi = -1 \rightarrow \pi = rKa + \pi \rightarrow \pi = \frac{rKa}{r} + \frac{\pi}{r} \rightarrow \pi = \{\frac{\pi}{r}, \pi, \frac{3\pi}{r}\}$

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$$\frac{1 - \tan x}{1 + \tan x} = \tan^k x \rightarrow \tan^k x + \tan^k x \tan x = 1 - \tan x \quad (1)$$

$$\rightarrow \tan^k x + \tan x = 1 - \tan^k x \tan x \quad \tan^k x = \frac{\tan^k x + \tan x}{1 - \tan^k x \tan x} \quad \tan \varepsilon = 1 = \tan\left(\frac{\pi}{4}\right)$$

$$\rightarrow \varepsilon = K\alpha + \frac{\pi}{\varepsilon} \rightarrow \boxed{x = \frac{K\alpha}{\varepsilon} + \frac{\pi}{\varepsilon}} \quad \checkmark$$

$$\sqrt{1 + \sin^2 x} = \sqrt{r} \cos^k x \xrightarrow{r=1} 1 + \sin^2 x = r \cos^2 x \rightarrow r \cos^2 x - 1 = \sin^2 x \quad (2)$$

$$\cos^2 x = \sin^2 x \rightarrow \tan^2 x = 1 \rightarrow x = K\alpha + \frac{\pi}{\varepsilon} \rightarrow \boxed{x = \frac{K\alpha}{r} + \frac{\pi}{\varepsilon}}$$

$$\rightarrow K = 0, 1 \xrightarrow{x \in [0, \pi]} x = \left\{ \frac{\pi}{\varepsilon}, \frac{\pi}{\varepsilon} + \frac{\pi}{\varepsilon} \right\} \quad \checkmark$$

ii) $\sin^k x - \cos^k x = 1 \xrightarrow{x=1} \cos^k x - \sin^k x = -1$ (3)

بما $(\cos^k x + \sin^k x)(\cos^k x - \sin^k x) = -1 \xrightarrow{\cos^k x + \sin^k x = 1} \cos^k x = -1$

$$\rightarrow x = rK\alpha + \alpha \rightarrow x = K\alpha + \frac{\pi}{\varepsilon} \quad x \in [0, \pi] \quad K = 0, 1 \quad x = \left\{ \frac{\pi}{\varepsilon}, \frac{\pi}{\varepsilon} + \frac{\pi}{\varepsilon} \right\}$$

ب) $\sin^k x - \cos^k x = -1 \xrightarrow{\tan \frac{x}{r} = t} \left(\frac{rt}{1+t^2} \right)^k - \left(\frac{1-t^2}{1+t^2} \right)^k = -1$

$$\rightarrow t = -1 \rightarrow \tan\left(\frac{x}{r}\right) = -1 \rightarrow \frac{x}{r} = K\alpha + \frac{\pi}{\varepsilon} \rightarrow x = rK\alpha + \frac{\pi}{\varepsilon} \quad \checkmark$$

$$t = 0 \rightarrow \tan\left(\frac{x}{r}\right) = 0 \rightarrow \frac{x}{r} = K\alpha \rightarrow x = rK\alpha \quad \checkmark$$

$$x \in [0, \pi] \rightarrow x = \left\{ \frac{\pi}{\varepsilon}, 0, \pi \right\}$$