

نام و نام خانوادگی مسعودی (مجتبی) پاسخنامه تشریحی تکلیف شماره ۳ کلاس یازدهم A

۲. اثبات کنید که $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} \geq \frac{1}{x+y+z}$ برای هر $x, y, z > 0$

الف) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} - \frac{1}{x+y+z} = \frac{x^2y + y^2x + x^2z + z^2x + y^2z + z^2y - x^2 - y^2 - z^2}{(x+y+z)^2}$

ب) $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} - \frac{1}{x+y+z} = \frac{x^2y + y^2x + x^2z + z^2x + y^2z + z^2y - x^2 - y^2 - z^2}{(x+y+z)^2}$

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الف) $y = \sqrt{[x] - 2} \rightarrow [x] - 2 \geq 0 \rightarrow [x] \geq 2 \rightarrow [x] \in \{2, 3, 4, \dots\}$

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الف) $y = \sqrt{[x - \frac{1}{x}] + [x + \frac{1}{x}]}$

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ا) $\frac{\cot x + 1}{\tan x + 1} \rightarrow \textcircled{1} \sin x \neq 0 \rightarrow x \neq k\pi \quad \textcircled{2} \tan x + 1 \neq 0 \rightarrow \tan x \neq -1 \rightarrow x \neq k\pi - \frac{\pi}{4}$
 $\textcircled{3} \cos x \neq 0 \rightarrow x \neq k\pi + \frac{\pi}{2}$ $D_f = \mathbb{R} - \left\{ k\pi, k\pi - \frac{\pi}{4}, k\pi + \frac{\pi}{2} \right\}$

ب) $y = \sqrt{1 - \epsilon \sin^2 x} = 1 - \epsilon \sin^2 x \geq 0 \rightarrow \epsilon \sin^2 x \leq 1 \rightarrow \sin^2 x \leq \frac{1}{\epsilon}$
 $\frac{1}{\sqrt{\epsilon}} \leq \sin x \leq \frac{1}{\sqrt{\epsilon}}$ $D = \left[k\pi + \frac{\pi}{4}, k\pi + \frac{3\pi}{4} \right]$



ا) $y = \sqrt{r \sin x - 1} \quad r \sin x - 1 \geq 0 \rightarrow \sin x \geq \frac{1}{r}$

$D_f = \left[r k\pi + \frac{\pi}{4}, r k\pi + \frac{3\pi}{4} \right]$



ب) $y = \sqrt{1 - \epsilon \cos^2 x} \rightarrow 1 - \epsilon \cos^2 x \geq 0 \rightarrow \cos^2 x \leq \frac{1}{\epsilon}$

$D_f = \left[r k\pi + \frac{\pi}{2}, r k\pi + \frac{3\pi}{2} \right]$



ا) $\arcsin(x^r + r x + 1) = -1 \rightarrow x^r + r x + 1 \leq -1$ $\textcircled{1} -1 < x^r + r x + 1 \rightarrow x^r + r x + 2 > 0$
 $\textcircled{2} x^r + r x + 1 < 1 \rightarrow x^r + r x < 0$ $\frac{-r}{2} < x < 0$ $\textcircled{3} [r, 0] \rightarrow (-\infty, -r] \cup [-1, +\infty)$
 $D = [-r, -r] \cup [0, 0]$

ب) $\cos y = \sqrt{1 - r x}$

$\textcircled{1} x \leq \frac{1}{r}$ $\textcircled{2} 0 \leq \sqrt{1 - r x} \leq 1 \rightarrow 0 \leq \sqrt{1 - r x} \leq 1 \rightarrow x \leq \frac{1}{r}, x \geq r$

$D = \left[r, \frac{1}{r} \right]$

ا) $y = \log_r (1 - \log_r x)$ $1 - \log_r x > 0 \rightarrow \log_r x < 1 \quad x < r \quad D = (0, r)$

ب) $\log_r (1 - \log_r \frac{1}{r})$

$1 - \log_r \frac{1}{r} > 0 \rightarrow \log_r \frac{1}{r} < 1 \rightarrow x > \frac{1}{r}$

$D = (\frac{1}{r}, +\infty)$

ا) $\int_1^x \epsilon x - x^r - 1 = r^{\epsilon x - x^r} - 1 \geq 0 \rightarrow r^{\epsilon x - x^r} \geq r^r$ $\frac{1}{r} < x < r$
 $\epsilon x - x^r \geq r \rightarrow x^r - \epsilon x + r \leq 0 \quad (x-r)(x-1) \leq 0 \quad D_f = [1, r]$

ب) $\left(\frac{r x + \epsilon}{r x + \epsilon} \right)!$ $\frac{r x + \epsilon}{r x + \epsilon} \in \mathbb{N} \rightarrow r x + \epsilon = r x + \epsilon$

$D_f = \left\{ x \mid x = \frac{\epsilon - \epsilon k}{r k - r}, k \in \mathbb{N} \right\}$ $r x - r x = \epsilon - \epsilon w$ $x = \frac{\epsilon - \epsilon w}{r w - r}$