

$$\frac{1}{u^2} + \frac{1}{(1-u)^2} \leq \frac{140}{9} \Rightarrow \frac{(1-u)^2 + u^2}{u^2(1-u)^2} \leq \frac{140}{9} \Rightarrow (1-u)^2 + u^2 \leq (140/9)u^2(1-u)^2 \Rightarrow (1-u)^2 + u^2 \leq (140/9)u^2(1-u)^2$$

$$\Rightarrow \frac{(1-u)^2 + u^2}{(1-u)^2} \leq \frac{140}{9} \Rightarrow 1 + \frac{u^2}{(1-u)^2} \leq \frac{140}{9} \Rightarrow \frac{u^2}{(1-u)^2} \leq \frac{139}{9} \Rightarrow \frac{u}{1-u} \leq \sqrt{\frac{139}{9}} \Rightarrow \frac{u}{1-u} \leq \frac{\sqrt{139}}{3}$$

$$\Rightarrow 9(1-u) \geq 140u \Rightarrow 9 - 9u \geq 140u \Rightarrow 9 \geq 149u \Rightarrow u \leq \frac{9}{149}$$

$$u = \frac{-1 \pm \sqrt{1}}{2} \Rightarrow u_1 = 0, u_2 = -1 \Rightarrow \begin{cases} u - u^2 \leq \frac{1}{4} \Rightarrow u^2 - u + \frac{1}{4} \leq 0 \Rightarrow (u - \frac{1}{2})^2 \leq 0 \Rightarrow u = \frac{1}{2} \\ u - u^2 \geq -\frac{1}{4} \Rightarrow u^2 - u - \frac{1}{4} \geq 0 \Rightarrow (u - \frac{1}{2})^2 \geq 1 \Rightarrow u \leq -1 \text{ or } u \geq 1 \end{cases}$$

$$S_1 + S_2 = 1 + 1 = 2 \Rightarrow \boxed{2} \rightarrow \text{وحدی است}$$

$$-u^2 + 2u - 1 \geq 0 \Rightarrow u^2 - 2u + 1 \leq 0 \Rightarrow (u-1)^2 \leq 0 \Rightarrow u = 1 \Rightarrow \sqrt{-u^2 + 2u - 1} = 0$$

$$-u^2 + 2u - 1 \geq 0 \Rightarrow (-u^2 + 2u - 1) + (2u - 1) \geq 0 \Rightarrow -u^2 + 4u - 2 \geq 0 \Rightarrow (u-2)^2 \geq 2 \Rightarrow u \leq 2 - \sqrt{2} \text{ or } u \geq 2 + \sqrt{2}$$

$$u \leq -1 \text{ or } u \geq 1 \Rightarrow \begin{matrix} u & -1 & 0 & 1 & 2 \\ f(u) & -2 & -1 & 0 & 2 \end{matrix} \Rightarrow \begin{cases} u \leq -1 \\ u \geq 1 \end{cases}$$

$$\Rightarrow [1, \infty) \cup (-\infty, -1] \cup [2, \infty) \Rightarrow D = \{1\} \Rightarrow u = 1$$

$$y = |u+1| + |u-1| \Rightarrow u < -1 \Rightarrow \begin{cases} -u-1 \\ u-1 \end{cases} \Rightarrow y = -2u \Rightarrow u < -1 \Rightarrow y > 2$$

$$-1 < u < 1 \Rightarrow y = 2 \Rightarrow u > 1 \Rightarrow \begin{cases} u+1 \\ u-1 \end{cases} \Rightarrow y = 2u \Rightarrow u > 1 \Rightarrow y > 2$$

$$-2 \leq u < 1 \Rightarrow y = 2 \Rightarrow \frac{1-u}{u} = 2 \Rightarrow 1-u = 2u \Rightarrow u = \frac{1}{3} \Rightarrow y = \frac{4}{3}$$

$$\Rightarrow y = \frac{4}{3} \Rightarrow u = \frac{1}{3} \Rightarrow \sqrt{(u_A - u_B)^2 + (y_A - y_B)^2} \Rightarrow \sqrt{(\frac{1}{3} - 0)^2 + (\frac{4}{3} - 0)^2} \Rightarrow \sqrt{\frac{17}{9}} \Rightarrow \frac{\sqrt{17}}{3}$$

$$y = \sqrt{u^2 - 2u + 1} \Rightarrow u^2 - 2u + 1 = (u-1)^2 \Rightarrow y = |u-1| \Rightarrow y = |u-1|$$

$$\Rightarrow f(u) = \begin{cases} u-1 & u \geq 1 \\ 1-u & u < 1 \end{cases} \Rightarrow f(u) = g(u) \Rightarrow u-1 = \frac{1}{u} \Rightarrow u^2 - u - 1 = 0 \Rightarrow u = \frac{1 \pm \sqrt{5}}{2}$$

$$u \geq 1 \Rightarrow A(1, 4) \Rightarrow u < 1 \Rightarrow -u+1 = \frac{1}{u} \Rightarrow -u^2 + u - 1 = 0 \Rightarrow u^2 - u + 1 = 0 \Rightarrow u = \frac{1 \pm \sqrt{-3}}{2}$$

$$B(0, 2) \Rightarrow u = 0 \Rightarrow g(u) = 1 \Rightarrow f(u) = 1 \Rightarrow g(u) > f(u) \Rightarrow A(0, 2), B(1, 4), C(1, 0)$$

$$|AB| \Rightarrow \sqrt{(u_A - u_B)^2 + (y_A - y_B)^2} \Rightarrow \sqrt{(0-1)^2 + (2-4)^2} \Rightarrow \sqrt{5} \Rightarrow \frac{1}{\sqrt{5}} \Rightarrow \frac{\sqrt{5}}{5}$$

$$\frac{1}{u} + \frac{1}{u+1} = \frac{1}{0} \Rightarrow \frac{1}{u} + \frac{1}{u+1} = \frac{1}{0} \Rightarrow \frac{1}{u} + \frac{1}{u+1} = \frac{1}{0} \Rightarrow \frac{1}{u} + \frac{1}{u+1} = \frac{1}{0}$$

$$\Rightarrow (u+1)(u-1) = 0 \Rightarrow u = 1 \Rightarrow u = 1$$