

$$y = (2(x - [\frac{x}{2}]))^2 \quad \text{الف} \quad 0 \leq x - [\frac{x}{2}] < 1 \rightarrow 0 \leq 2(x - [\frac{x}{2}]) < 2 \rightarrow 0 \leq (2(x - [\frac{x}{2}]))^2 < 4 \rightarrow 0 \leq y < 4 \rightarrow R_y: [0, 4] \quad (2)$$

$$\log y = \varepsilon + \sin x \rightarrow y = 10^{\varepsilon + \sin x} \quad \begin{matrix} \min \sin x = -1 \rightarrow y = 10^{\varepsilon - 1} \\ \max \sin x = 1 \rightarrow y = 10^{\varepsilon + 1} \end{matrix} \quad R_y: [10^{\varepsilon - 1}, 10^{\varepsilon + 1}] \quad (2)$$

$$f(x) = \sqrt{\frac{x^2 - 4}{x^2 - 9}} \quad \begin{matrix} \min x = 0 \rightarrow f(x) = \frac{2}{3} \\ \max x = +\infty \rightarrow f(x) = 1 \end{matrix} \quad \text{بر خارج اعداد} \quad (2)$$

$$R_f: \sqrt{(-\infty, \frac{4}{9}] \cup (9, +\infty)} = [0, \frac{2}{3}] \cup (1, +\infty) \quad \begin{matrix} a+b+c = \\ 0 + \frac{2}{3} + 1 = \frac{5}{3} \end{matrix} \quad (2)$$

$$f(x) = x + \frac{1}{x} + 2\sqrt{x + \frac{1}{x}} \quad \text{الف} \quad x + \frac{1}{x} \geq 2 \rightarrow f(x) \geq 2 + 2\sqrt{2} \rightarrow R_f = [2 + 2\sqrt{2}, +\infty) \quad (2)$$

$$(1 - \sin x)(\sin x + 1) = -\sin^2 x + 1 = 0 \rightarrow \begin{matrix} \max \sin x = 1 \rightarrow y = 0 \\ \min \sin x = -1 \rightarrow y = 4 \end{matrix} \quad R_y: [0, 4] \quad (2)$$

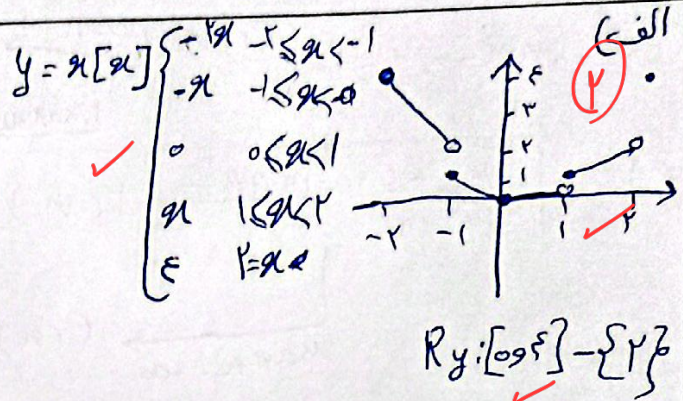
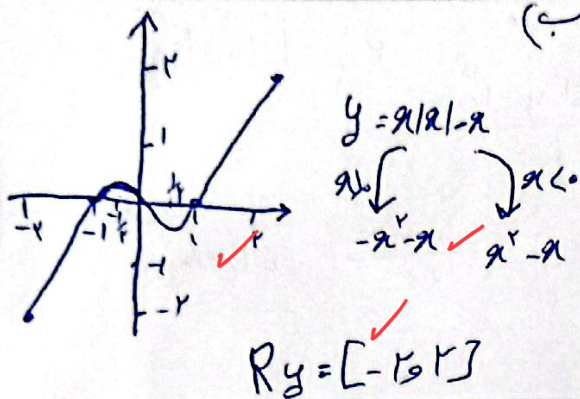
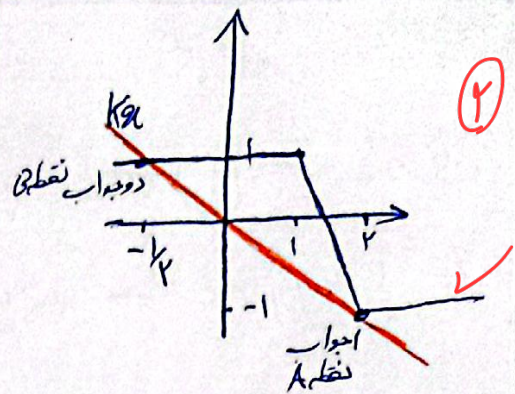
$$\begin{matrix} x=1 \rightarrow f(x) = \frac{1}{2} \\ x=2 \rightarrow f(x) = \frac{1}{4} \\ x=3 \rightarrow f(x) = \frac{1}{9} \\ x=4 \rightarrow f(x) = \frac{1}{16} \\ x=5 \rightarrow f(x) = \frac{1}{25} \\ x=6 \rightarrow f(x) = \frac{1}{36} \\ x=7 \rightarrow f(x) = \frac{1}{49} \\ x=8 \rightarrow f(x) = \frac{1}{64} \\ x=9 \rightarrow f(x) = \frac{1}{81} \end{matrix} \quad R_f: \frac{1}{9} + \frac{1}{16} + \dots + \frac{1}{81} = \frac{1}{9} \quad (2)$$

$$f(x) = \sqrt{bx+c} \quad \begin{matrix} x=2 \rightarrow f(x) = \sqrt{2b+c} = 0 \rightarrow 2b+c=0 \\ x=3 \rightarrow f(x) = \sqrt{3b+c} = 1 \rightarrow 3b+c=1 \end{matrix} \quad \begin{matrix} b=1 \\ c=-2 \end{matrix} \quad (2)$$

$$g(x) = \sqrt{x^2 + 4} \quad \text{الف} \quad \min x = 0 \rightarrow g_{\min} = 2 \rightarrow R_g: [2, +\infty) \quad (2)$$

$$y = kx \xrightarrow{\text{نقطة A}} k = -1 \rightarrow \boxed{k = -1}$$

$$\text{نقطة B: } 1 = -1x \rightarrow x = -1$$



$$y = \frac{x^2 + 1}{x^2 + x} = \frac{x(x+1)}{x(x+1)} \xrightarrow{x \neq -1} y = \frac{x}{x} \rightarrow x = \frac{x}{y} \rightarrow y \neq 0 \text{ و } x \neq -1 \rightarrow y \neq -1$$

$$\rightarrow R_y = \mathbb{R} - \{-1, 0\} \quad a+b = -1$$

$$f(x) = \frac{x - \varepsilon \sqrt{x+1}}{x - 2\sqrt{x+1}} \xrightarrow{\sqrt{x+1} = t} \frac{t^2 - \varepsilon t + 1}{t^2 - 2t + 1} = \frac{(t-1)(t-1)}{(t-1)^2} = \frac{t-1}{t-1} = 1$$

$$0 \leq \sqrt{x} < +\infty \xrightarrow{\sqrt{x} = 0} y = 1$$

$$R_f = (0, 1) \cup [1, +\infty)$$

$$f(x) = \frac{x^3 + 2x^2 - x - 2}{x^2 - 1} = \frac{(x-1)(x+1)(x+2)}{(x-1)(x+1)} \xrightarrow{x \neq 1, x \neq -1} y = x+2$$

$$\rightarrow y \neq 3 \text{ و } y \neq 1 \rightarrow R_f = \mathbb{R} - \{1, 3\} \quad \boxed{1+2=3}$$