

الف) $\min f_n = -1$ $\max f_n = 1$ $R_{f(n)} = [-1, 1]$

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ب) $g(x) = 3 \cos^3 x - 4$ $-1 \leq \cos x \leq 1$ $R_{f(n)} = [-7, -1]$

$-3 \leq x < -2 \rightarrow y = -2$

$-2 \leq x < -1 \rightarrow y = -3$

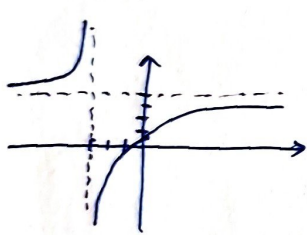
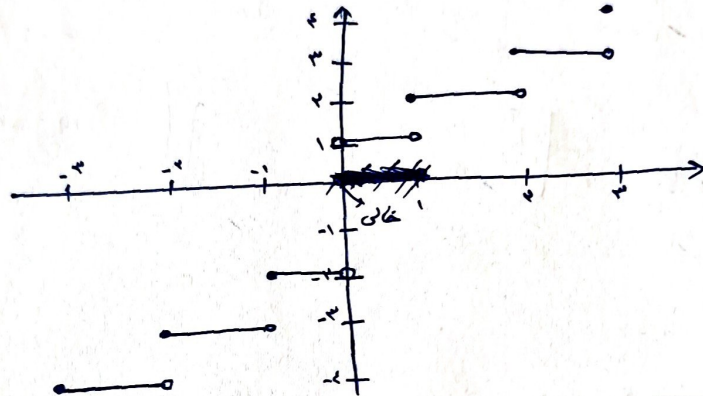
$-1 \leq x < 0 \rightarrow y = -2$

$0 \leq x < 1 \rightarrow y = 1$

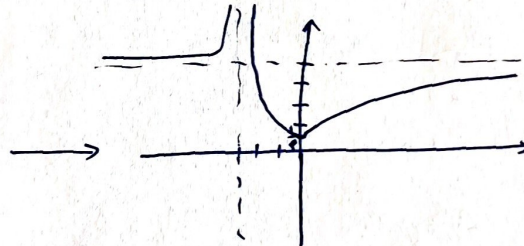
$1 \leq x < 2 \rightarrow y = 2$

$2 \leq x < 3 \rightarrow y = 3$

$x = 3 \rightarrow y = 2$



$y = \frac{x+1}{x+3}$



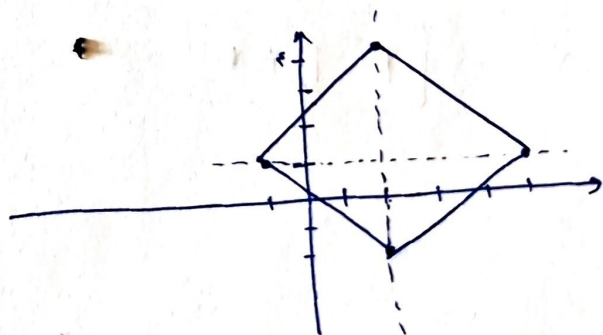
$y = \left| \frac{x+1}{x+3} \right|$

$x > 2, y > 1 \rightarrow x + y = 7 \rightarrow y = -x + 7$

$x > 2, y < 1 \rightarrow x - y = 4 \rightarrow y = x - 4$

$x < 2, y > 1 \rightarrow -x + y = 2 \rightarrow y = x + 2$

$x < 2, y < 1 \rightarrow -x - y = 0 \rightarrow y = -x$



$\sqrt{x + \frac{1}{x}} = t$ $f(x) = t^2 + 2t$ $y' = \frac{2t}{2t} = \frac{2}{2} = 1$

$x + \frac{1}{x} \geq 2 \leq x + \frac{1}{x} \leq -2 \rightarrow x + \frac{1}{x} \geq 2 \rightarrow \min f_n = 2 + 2\sqrt{2} \rightarrow R_{f(n)} = [2 + 2\sqrt{2}, +\infty)$

$y = -\sin^4 x + 2 \sin x + 3 = -(\sin x - 1)^2 + 4$

$\min y \Rightarrow \sin x = -1 \rightarrow y = 0$

$\max y \Rightarrow \sin x = 1 \rightarrow y = 4$

$\rightarrow R = [0, 4]$

$$D = \{1, 2, 3, \dots, 8, 9\}$$

$$f_1 + f_2 + \dots + f_9 = (9 \times 10) + \left(-\frac{1}{9}\right) \left(\frac{9 \times 10}{9}\right) = \boxed{V\omega}$$

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$\rightarrow$ ~~معكول $f(x) = \sqrt{ax^2 + bx + c} = a(x - \frac{b}{2a})^2$ $\rightarrow f(0) = 1 \rightarrow a = 1$~~
 $\rightarrow$ ~~$f(x) = \sqrt{x^2 - 4x + 4} \rightarrow a = 1, b = -4, c = 4$~~
 $\rightarrow$ ~~$g(x) = \sqrt{-x^2 + 4x - 4}$~~
 $\rightarrow$ ~~$y_s = \frac{-b}{2a} = \frac{-(-4)}{2(-1)} = \frac{4}{-2} = -2$~~
 $\rightarrow$ ~~$R_{g(x)} = (-\infty, \frac{4}{-1}]$~~
 $\rightarrow$ ~~$D = (0, +\infty) \rightarrow a = 0$ (خطي) $\rightarrow 2b + c = 0 \rightarrow 2b + c = 4 \rightarrow b = 1, c = -2$~~
 $\rightarrow$ ~~$g(x) = \sqrt{x^2 + 2} \rightarrow D_f = [2, +\infty)$~~

V

$$f_x = \frac{x(x+2)(x-2)}{x+2} = x(x-2)$$

$$x(x-2) = 1 \rightarrow x = 2 \rightarrow a, b = 2, -2$$

$$f = x^2 - 2x \quad y_s = \frac{-b}{2a} = \frac{-(-2)}{2(1)} = \frac{2}{2} = 1 \rightarrow R = [-1, +\infty) - \{1\} \rightarrow c = -1$$

$$f\left(\frac{2-2}{-1}\right) = f(-1) = \boxed{3}$$

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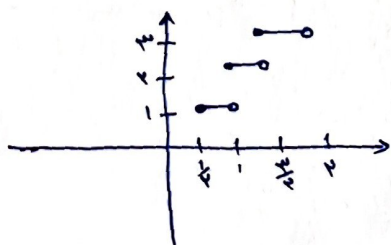
$$y = \sqrt[3]{(x-2)^3} = \sqrt[3]{x^3 - 6x^2 + 12x - 8} \rightarrow a = -6, b = 12$$

$$D = [-2, 13] \Rightarrow R = [-1, 10]$$

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$$\frac{1}{4} \leq x < \frac{5}{4} \rightarrow \left\lfloor x + \frac{1}{4} \right\rfloor = 1 \rightarrow y = \lfloor x \rfloor + 1 \quad \begin{cases} \frac{1}{4} \leq x < 1 \rightarrow y = 1 \\ 1 \leq x < \frac{5}{4} \rightarrow y = 2 \end{cases}$$

$$\frac{5}{4} \leq x < 2 \rightarrow \left\lfloor x + \frac{1}{4} \right\rfloor = 2 \rightarrow y = \lfloor x \rfloor + 2 \rightarrow \frac{5}{4} \leq x < 2 \rightarrow y = 3$$



(خطي, 63)

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