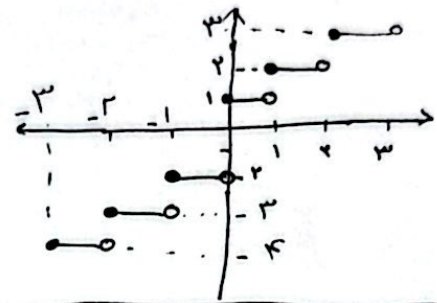


الف) $-1 \leq \sin x \leq 1 \Rightarrow 0 \leq \sin^2 x \leq 1 \Rightarrow 2 \sin^2 x \leq 2$

$\Rightarrow -1 \leq 2 \sin^2 x - 1 \leq 1 \quad R: [-1, 1]$

ب) $-1 \leq \cos^3 x < 1 \Rightarrow -3 \leq 3 \cos^3 x \leq 3 \Rightarrow -4 \leq 3 \cos^3 x - 2 \leq 1$

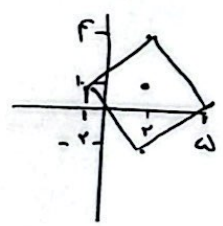
$\begin{cases} x > 0 \rightarrow [x]_+ 1 \\ x < 0 \rightarrow [x]_- 1 \end{cases}$



$y = \frac{f(x)}{x^2} \rightarrow$

$y = \left| \frac{f(x)}{x^2} \right| \rightarrow$

$y = x^2, y = -x^2, y = -x, y = x - 1$



الف) $t = \sqrt{x + \frac{1}{x}} \Rightarrow f(x) = t^2 + 2t$

$\begin{cases} t = \sqrt{x} \rightarrow y = 2\sqrt{x} + 2\sqrt{x} \\ t = +\infty \rightarrow y = +\infty \\ \frac{-b}{2a} = \frac{-2}{2} = -1 \end{cases} \Rightarrow R = [2\sqrt{x}, +\infty)$

ب) $f(x) = -\sin^2 x + 2 \sin x$

$\sin x \leftarrow \begin{matrix} -1 \rightarrow -1 + 2 = 1 \\ 1 \rightarrow -1 + 3 = 2 \\ \frac{-b}{2a} \rightarrow 1 \end{matrix} \Rightarrow R = [0, 2]$

$$\left. \begin{aligned} f(1) &= -\frac{1}{3} + 1 \\ f(2) &= -\frac{2}{3} + 1 \\ &\vdots \\ f(9) &= -\frac{9}{3} + 1 \end{aligned} \right\} \rightarrow 9 \cdot 1 \cdot \bullet - \frac{9 \cdot 9}{3} = 9 - 18 = -9 \quad (2)$$

$$\begin{aligned} \text{تابع زوجي بالحد } \Rightarrow a=0 & \quad f(2)=0, f(3)=1 \\ \Rightarrow \begin{cases} 2b+c=0 \\ 3b+c=1 \end{cases} \Rightarrow b=1, c=-2 \end{aligned} \quad (3)$$

$$\Rightarrow g(x) = \sqrt{x^2 + 4} \rightarrow \text{graph} \Rightarrow R = \sqrt{[4, +\infty)} = [2, +\infty)$$

$$f(x) = \frac{x(x+2)(x-2)}{x+2} = x(x-2) = x^2 - 2x, x \neq -2 \quad (4)$$

$$x^2 - 2x \neq \infty \Rightarrow x \neq \infty \Rightarrow D = \mathbb{R} - \{-2, \infty\} \Rightarrow \begin{aligned} a &= -2 \\ b &= \infty \end{aligned}$$

$$\downarrow$$

$$\text{graph} \rightarrow R = [-1, +\infty) \Rightarrow c = -1 \Rightarrow f\left(\frac{a-b}{2c}\right) = f(-1) = 3$$

$$y = \sqrt[3]{(x-2)^3} = \sqrt{x^2 - 4x + 4} \Rightarrow a = -4, b = 12 \quad (5)$$

$$D = [-4, 12]$$

$$y = x^2 \rightarrow \mathbb{R} \begin{cases} x=4 \rightarrow y=16 \\ x=12 \rightarrow y=144 \end{cases} \Rightarrow [-16, 144]$$

$$\frac{1}{2} \leq x < 1 \rightarrow \{x\} = 0, \{x + \frac{1}{2}\} = 1$$

$$1 \leq x < \frac{3}{2} \rightarrow \{x\} = 1, \{x + \frac{1}{2}\} = 2$$

$$\frac{3}{2} \leq x < 2 \rightarrow \{x\} = 2, \{x + \frac{1}{2}\} = 3$$

