

الف) $f(n) = 2 \sin^2(n + \frac{\pi}{2}) - 1$ $\begin{cases} \sin^2(n) \min: 0 \rightarrow y = -1 \\ \sin^2(n) \max: 1 \rightarrow y = 1 \end{cases} \rightarrow R: [-1, 1]$

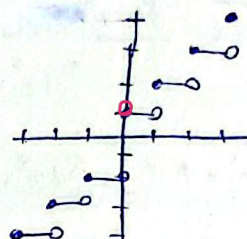
(2)

ب) $g(n) = 3 \cos^2(n) - 4$ $\begin{cases} \cos^2(n) \min = 0 \rightarrow y = -4 \\ \cos^2(n) \max = 1 \rightarrow y = -1 \end{cases} \rightarrow R: [-4, -1]$

1

$y = \frac{n}{|n|} + [n] \rightarrow$

- $-1 \leq n < -2 \rightarrow [n] = -2 \rightarrow -1 - 2 = -3 = y$
- $-2 \leq n < -1 \rightarrow [n] = -1 \rightarrow -1 - 1 = -2 = y$
- $-1 \leq n < 0 \rightarrow [n] = 0 \rightarrow -1 - 0 = -1 = y$
- $0 \leq n < 1 \rightarrow [n] = 0 \rightarrow 1 - 0 = 1 = y$
- $1 \leq n < 2 \rightarrow [n] = 1, n) \rightarrow 1 + 1 = 2 = y$
- $2 \leq n < 3 \rightarrow [n] = 2, n) \rightarrow 1 + 2 = 3 = y$
- $n = 0 \rightarrow [n] = 0 \rightarrow y = 1 + 0 = 1$



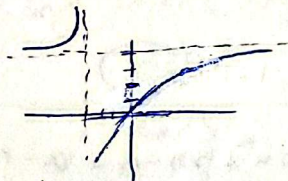
صفر تعریف شده است

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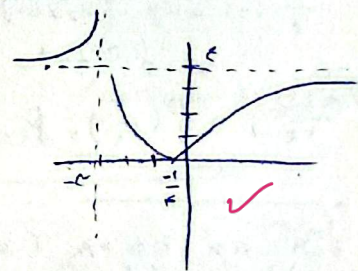
2

$y = \left| \frac{\varepsilon n + 1}{n + c} \right| \rightarrow y = \frac{\varepsilon n + 1}{n + c}$

حداکثر = ε
حداقل = $-c$



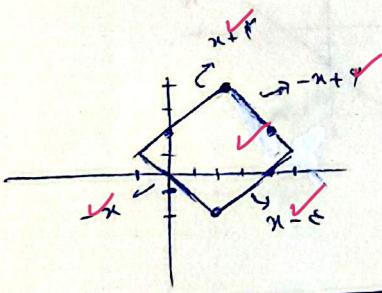
$y = \left| \frac{\varepsilon n + 1}{n + c} \right|$



(2)

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$|n-2| + |y-1| = 3 \rightarrow |y-1| = 3 - |n-2|$



$y-1 = 3 - |n-2| \rightarrow y = 4 - |n-2|$

$y-1 = |n-2| - 3 \rightarrow y = |n-2| - 2$

$\begin{array}{c|c} 3 & 2 \\ \hline \varepsilon + n - 2 & \varepsilon - n + 2 \\ = 2 + \varepsilon & = -n + \varepsilon \end{array}$

$D_f: 3 - |n-2| \geq 0$
 $|n-2| \leq 3 \rightarrow -3 \leq n-2 \leq 3 \rightarrow -1 \leq n \leq 5$

(2)

2

ج) $f(n) = n + \frac{1}{n} + 2\sqrt{n + \frac{1}{n}}$ $\rightarrow D_f: n + \frac{1}{n} \geq 0$

$* n + \frac{1}{n} \in (-\infty, -1] \cup [1, +\infty) \rightarrow n + \frac{1}{n} \in [1, +\infty)$
 $\sqrt{n + \frac{1}{n}} \in [1, +\infty)$

$\rightarrow n + \frac{1}{n} = t: t + 2\sqrt{t} \rightarrow t \min: \sqrt{t} \rightarrow y = 2 + 2\sqrt{t} \rightarrow R_f: [2 + 2\sqrt{t}, +\infty)$

$t = \frac{-b}{2a} = \frac{-2}{2} = -1$

د) $(3 - \sin n)(1 + \sin n) = -\sin^2 n + 2\sin n + 3$ $\begin{cases} \sin n \min = -1 \rightarrow y = -1 - 1 + 3 = 1 \\ \sin n \max = 1 \rightarrow y = -1 + 1 + 3 = 3 \end{cases} \rightarrow R_f: [1, 3]$

$\sin n = \frac{-b}{2a} = \frac{-2}{-2} = 1$

2

$$f(x) = -\frac{1}{x}x + 10 \rightarrow D_f: \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

$$\begin{aligned} \text{مثلاً} \rightarrow & \left(-\frac{1}{x}(1) + 10\right) + \left(-\frac{1}{x}(2) + 10\right) + \dots + \left(-\frac{1}{x}(9) + 10\right) = (9 \times 10) + (-10) = 90 - 10 = 80 \\ \rightarrow & -\frac{1}{x} - \frac{2}{x} - \dots - \frac{9}{x} = -\frac{(1+2+\dots+9)}{x} = -\frac{45}{x} = -10 \end{aligned}$$

$$f(x) = \sqrt{ax^2 + bx + c} \rightarrow D_f: [r, +\infty) \rightarrow a \neq 0$$

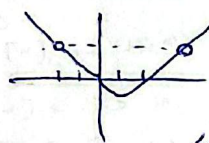
$$bx + c \geq 0$$

$$f(x) = \sqrt{bx + c} \quad f(x) = 1 \quad x \geq -\frac{c}{b} \rightarrow -\frac{c}{b} = r \rightarrow c = -rb$$

$$\sqrt{bx + c} = 1 \rightarrow bx + c = 1 \quad \frac{c = -rb}{b = 1} \quad c = -r$$

$$\rightarrow g(x) = \sqrt{x^2 + 2} \rightarrow R(x^2 + 2): [0, +\infty) \rightarrow [r, +\infty): \mathbb{R}^+$$

$$f(x) = \frac{x^2 - 2x}{x + 2} = \frac{x(x-2)(x+2)}{(x+2)} = x(x-2) = x^2 - 2x \quad x \neq -2 \rightarrow y = \lambda$$



از کتاب می‌خوانیم که در این صورت نقطه‌ای را که در برادر می‌نماید

$$-\frac{\Delta}{2a} = -\frac{-2}{2} = 1 \rightarrow R_f: [-1, +\infty) \quad D_f: \mathbb{R} - \{a, b\} \rightarrow R_f: [c, +\infty)$$

$$f(a) = f(b) \rightarrow \lambda$$

$$x^2 - 2x = \lambda \rightarrow x^2 - 2x - \lambda = 0 \quad (x-2)(x+2) \rightarrow x \neq -2$$

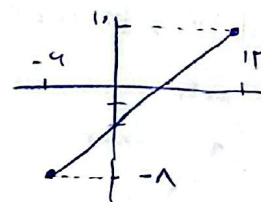
$$\rightarrow f\left(\frac{a+b}{2}\right) = f\left(\frac{r}{-r}\right) = f(-1) = (-1)^2 - 2(-1) = 1 + 2 = 3$$

$$y = \sqrt[n]{x^n + ax^r + bx - \lambda} \quad (1 \leq r < n) \rightarrow x^n + ax^r + bx - \lambda = (x-r)^n = x^n - nx^{n-1} + \dots - \lambda$$

$$a = -n \quad b = nr$$

$$\rightarrow y = \sqrt[n]{(x-r)^n} = x-r \rightarrow D_f: [-4, 12]$$

$$f(-4) = -8 \quad f(12) = 8 \rightarrow R_f: [-8, 8]$$

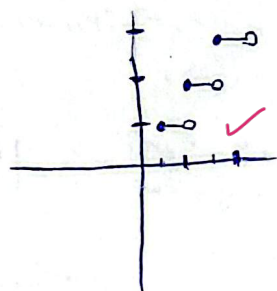


$$y = [x] + \left[x + \frac{1}{r}\right] \quad x \in \left[\frac{1}{r}, r\right)$$

$$\frac{1}{r} \leq x < 1 \rightarrow [x] = 0 \quad \left[x + \frac{1}{r}\right] = 1 \quad y = 1$$

$$1 \leq x < \frac{r}{r} \rightarrow [x] = 1 \quad \left[x + \frac{1}{r}\right] = 1 \quad y = 2$$

$$\frac{r}{r} \leq x < r \rightarrow [x] = 1 \quad \left[x + \frac{1}{r}\right] = r \quad y = r$$



مثلاً (3)