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$$\frac{1}{x-1} = |x-1| \xrightarrow{x-1=t} \frac{1}{t} = |t| \quad x \neq 1 \quad (1)$$

$$\rightarrow \text{if } t > 0 \rightarrow t = |t| \rightarrow \frac{1}{t} = t \rightarrow t^2 = 1 \rightarrow t = 1$$

$$\text{if } t < 0 \rightarrow |t| = -t \rightarrow \frac{1}{t} = -t \rightarrow t^2 = -1 \quad \text{غیر ممکن}$$

$$\text{فقط ایک جواب ہے } t = 1 \rightarrow x - 1 = 1 \rightarrow \boxed{x = 2}$$

$$(2) \quad \left| \frac{x-1}{x} \right| < 2 \quad x \neq 0 \rightarrow -2 < \frac{x-1}{x} < 2 \quad (2)$$

$$\left\{ \begin{array}{l} \frac{x-1}{x} < 2 \rightarrow -\frac{1}{x} < 0 \rightarrow x > 0 \\ \frac{x-1}{x} > -2 \rightarrow \frac{x-1}{x} > 0 \rightarrow x-1 > 0 \rightarrow x > 1 \end{array} \right.$$

$$\frac{x-1}{x} > 0 \rightarrow x-1 > 0 \rightarrow x > 1$$

$$\boxed{x > 1} \Rightarrow \left(\frac{1}{x}, \infty \right)$$

$$(3) \quad \left| \frac{x-2}{x+1} \right| > 1 \quad x+1 \neq 0 \rightarrow x \neq -1 \rightarrow x \neq -\frac{1}{x}$$

$$\left\{ \begin{array}{l} \frac{x-2}{x+1} > 1 \rightarrow \frac{x-2}{x+1} > 0 \rightarrow \frac{-2}{-1+1} \Rightarrow (-\infty, -\frac{1}{2}) \\ \frac{x-2}{x+1} < -1 \rightarrow \frac{x-2}{x+1} < 0 \rightarrow \frac{-2}{-1+1} \Rightarrow (-\frac{1}{2}, \frac{1}{3}) \end{array} \right.$$

$$\Rightarrow \boxed{(-\infty, -\frac{1}{2}) \cup (-\frac{1}{2}, \frac{1}{3})}$$

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$$x(r < |n+r|)$$

(3)

$$\rightarrow \text{if } n+r \geq 0 \rightarrow n \geq -r \rightarrow n^r < n+r \rightarrow n^r - n - r < 0$$

$$\rightarrow (n-r)(n+r) < 0 \rightarrow -r < n < r$$

$$\text{if } n+r < 0 \rightarrow n < -r \quad n^r < -(n+r) \rightarrow n^r + n + r < 0 \rightarrow \text{same}$$

$$\rightarrow -\frac{a}{r} < n - \frac{1}{r} < \frac{a}{r}$$

$$(-r, r) \quad |n - \alpha| < B \rightarrow \alpha = \frac{r + (-r)}{r} = \frac{1}{r}$$

$$y = |n+1| - |n| + |n-r|$$

(4)

$$\text{if } n < -1 \rightarrow y = 1$$

$$\text{if } -1 \leq n < 0 \rightarrow y \leq r + r$$

$$\text{if } 0 \leq n < r \rightarrow y \leq -r + r$$

$$n \geq r \rightarrow y \leq -1$$

$$\rightarrow y_{\max} = r \quad (n \leq 0)$$

$$y_{\min} = -1 \quad (n \geq r)$$

$$\Rightarrow r + (-1) = r$$

$$y = |k n| - r \rightarrow \text{prob: } y = \left| \frac{1}{r}(n+r) \right| - r + 1$$

(a)

$$y = \left| \frac{1}{r}(n+r) \right| - 1$$

$$\left| \frac{1}{r} n \right| - r = \left| \frac{1}{r}(n+r) \right| - 1 \rightarrow \left| \frac{1}{r} n \right| = \left| \frac{1}{r}(n+r) \right| + 1$$

$$\text{if } n \geq 0 \rightarrow \frac{1}{r} n = \frac{1}{r}(n+r) + 1 \rightarrow \frac{1}{r} n = \frac{1}{r} n + r + 1 \rightarrow \text{same}$$

$$\text{if } n < -r \rightarrow -\frac{1}{r} n = -\frac{1}{r}(n+r) + 1 \rightarrow -\frac{1}{r} n = -\frac{1}{r} n - r + 1 \rightarrow \text{same}$$

$$\text{if } -r \leq n < 0 \rightarrow -\frac{1}{r} n = \frac{1}{r}(n+r) + 1 \rightarrow -n = n + r \rightarrow n = -\frac{r}{2}$$

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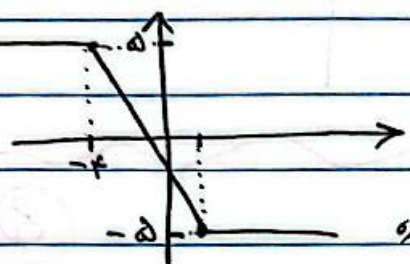
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الف) $f(x) = [|1-x| - |x+1|]$

$|1-x| - |x+1| \rightarrow$

$\begin{array}{c} -1 & 1 \\ |1-x+1| & |1-x-1| & x-1-x-1 \\ \hline \omega & -2x-1 & -2 \end{array}$

$\begin{array}{c|cccc} x & 1 & -1 & -2 & 1 \\ \hline y & -2 & \omega & \omega & -2 \end{array}$



$\Rightarrow R_1 = \{-5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5\}$

ب) $f(x) = \frac{1}{x} - \left[\frac{x+1}{x} \right]$

$\frac{1}{x} - \left[1 + \frac{1}{x} \right] \Rightarrow \frac{1}{x} - \underbrace{\left[\frac{1}{x} \right]}_{[0,1]}$

$R_2 = [-1, 0)$

الف) $y = [2x] - 1$

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

$x \in (-1, 1)$

$\frac{1}{2} < x < 1 \rightarrow 0 = y$

$-2 < -2x < -2$

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

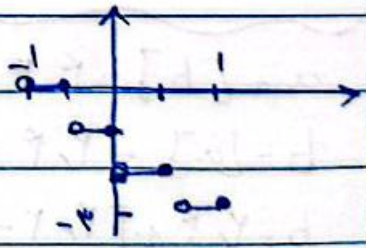
$-2 < -2x < -1$

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

$-1 \leq -2x < 0$

$0 \leq -2x < 1$

$1 \leq -2x < 2$



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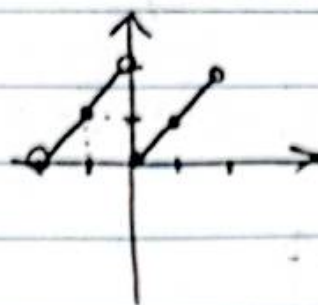
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ب) $y = x - 2 \left[\frac{x}{2} \right] \quad x \in (-2, 2)$

$-2 < x < 0 \rightarrow y = x - 2(-1) = x + 2$

$0 \leq x < 2 \rightarrow y = x - 2(0) = x$



ج) $y = [|x| - 1] \quad x \in [-2, 2]$ ⑧

$x = -2 \rightarrow y = 1$

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

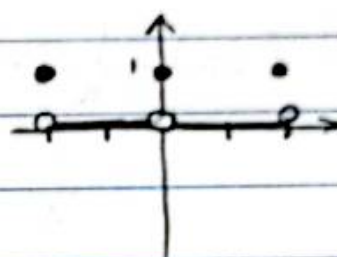
$-2 < x \leq -1 \rightarrow y = 0$

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

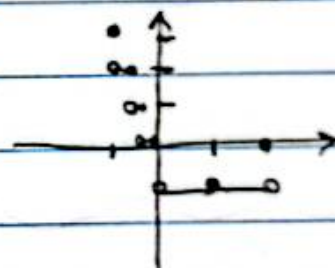
$-1 < x < 0 \rightarrow y = 0$

$x = 2 \rightarrow y = 1$

$x = 0 \rightarrow y = 1$



ب) $y = [x^2 - 2x] \quad x \in [-1, 2]$



$a + [b] = f, r \rightarrow a = f, r - [b]$ ⑨

$b - [a] = r, f \rightarrow b = r, f + [a]$

$b = r, f + [f, r - [b]]$

$a = 1, r, b = 3, f \rightarrow a + b = 1, r + 3, f = [f, r]$

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$$(1+\sqrt{2})^4 + (1-\sqrt{2})^4 = 198$$

(10)

$$(1+\sqrt{2})^4 = [198 - (1-\sqrt{2})^4] = [198 - 0, \dots] = 198$$