

الف) $y = \frac{|x|+1}{|x|-2}$
 $\frac{aD+b}{cD+d}$ ✓

$\max_{|x| \rightarrow +\infty} y \rightarrow 1 \Rightarrow R_f = (-\infty, -\frac{1}{2}] \cup (1, +\infty)$
 $\min_{|x|=0} y = -\frac{1}{2}$
 قابليت ضرب
 شون منفج را دارد ✓

ب) $y = \frac{x^2+1}{|x|}$
 $y = |x| + \frac{1}{|x|}$

$a+\frac{1}{a} \geq 2 \quad (a>0)$
 $|x| + \frac{1}{|x|} \geq 2 \Rightarrow R_f = [2, +\infty)$

$y = \frac{x^2+2x-2}{x+3}$

✓
 $x^2 + (2-y)x - 2 - 3y = 0$

$x = \frac{y-2 \pm \sqrt{(y-2)^2 - 4(-2-3y)}}{2} \rightarrow y^2 + 4y + 12 \geq 0$
 $(y+2)(y+6) \geq 0$
 $\frac{-4}{1+4-\frac{1}{4}} \rightarrow R_f = (-\infty, -6] \cup [-2, +\infty)$

$f(x) = \frac{x^2-x+\frac{1}{x}}{x^2-x+1} = 1 - \frac{\frac{1}{x}}{x^2-x+1}$

$x^2-x+1 \neq 0$
 دلتا مساوی ۰ قرار
 $\Delta = -3 < 0$ ✓

$x^2-x+1 \xrightarrow{x \rightarrow \frac{1}{x}} [\frac{1}{x}, +\infty) \rightarrow -\frac{1}{x(x^2-x+1)} \xrightarrow{x \rightarrow 0} (-\infty, 0)$

$1 - \frac{1}{x(x^2-x+1)} \rightarrow R_f = [0, 1)$
 $D_f = \mathbb{R}$

الف) $y = \sqrt{-x^2+x-1} = \sqrt{(-\infty, 3]} \rightarrow R_f = [0, \sqrt{3}]$ ✓

$-x^2+x-1 \xrightarrow{x \rightarrow \pm\infty} R = (-\infty, 3]$

ب) $y = \sqrt[3]{x^2-4x} = \sqrt[3]{[-\infty, +\infty)} \rightarrow R_f = [-2, +\infty)$ ✓
 $x^2-4x \xrightarrow{x \rightarrow \pm\infty} R = [-\infty, +\infty)$

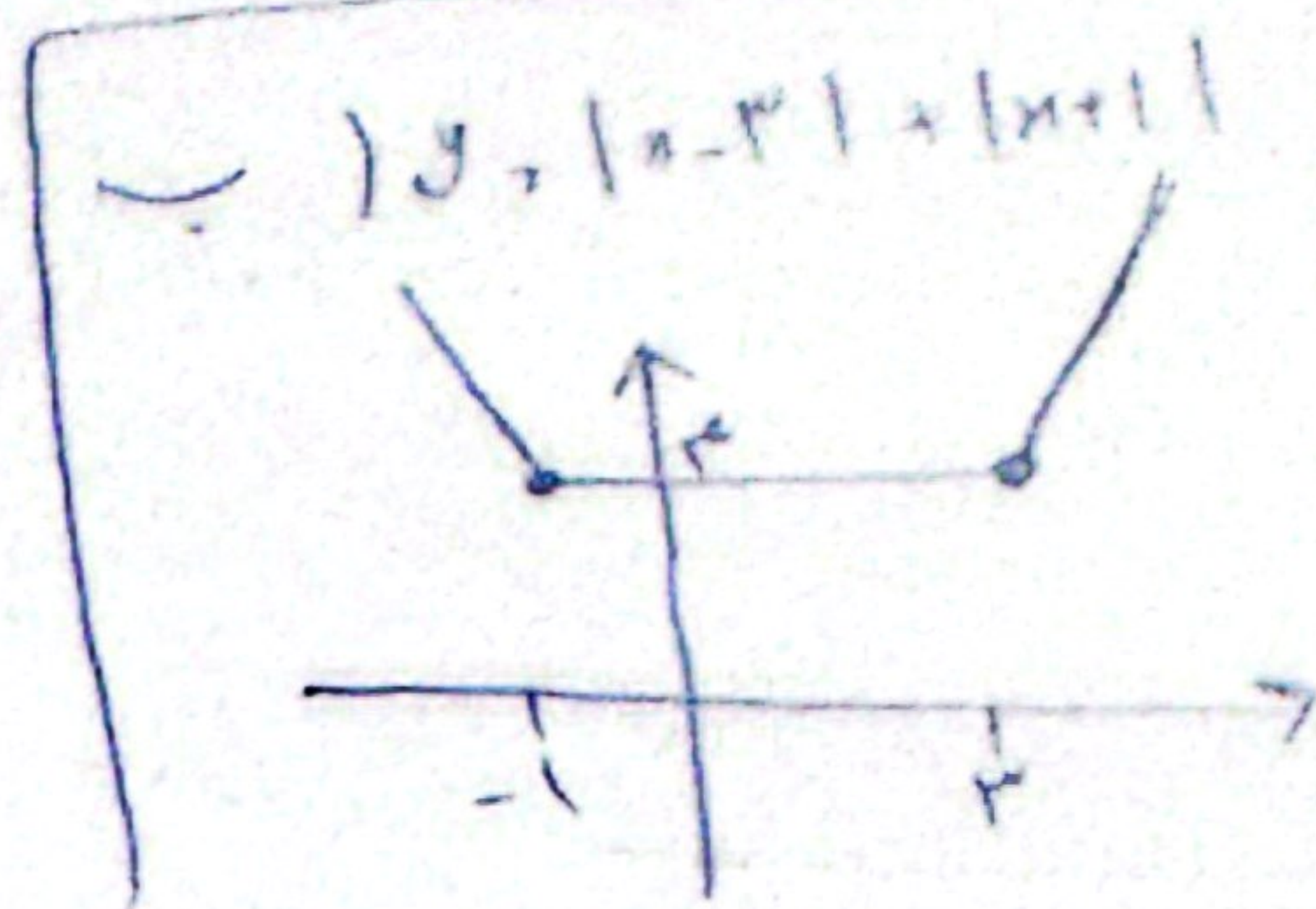
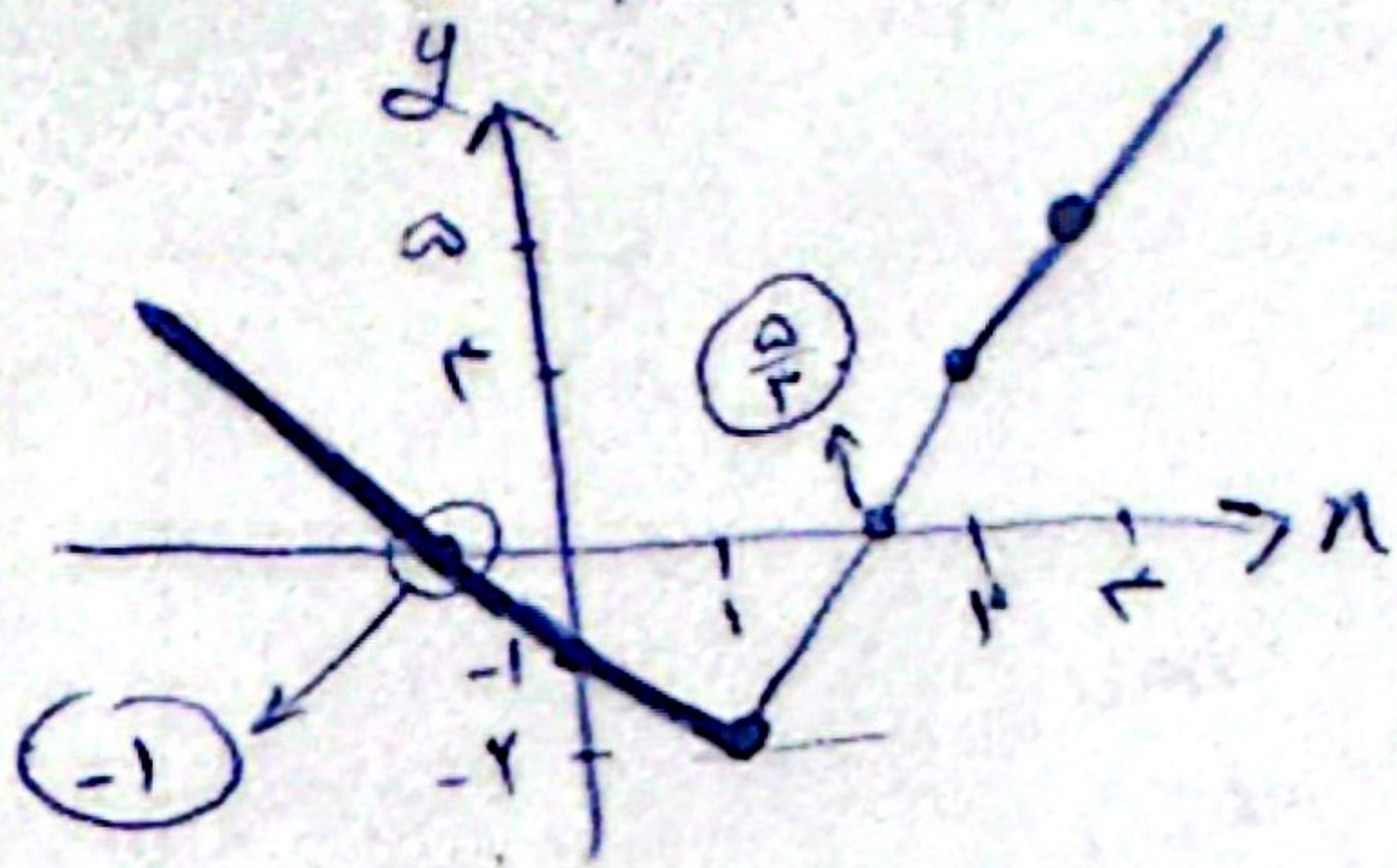
الف) $y = \lg(x^2-x+1)$

$x^2-x+1 \xrightarrow{\text{دلتا منفی}} R = \mathbb{R}$

$\rightarrow \lg(-\infty, +\infty) \rightarrow \lg(0, +\infty) \rightarrow R_f = \mathbb{R}$ ✓

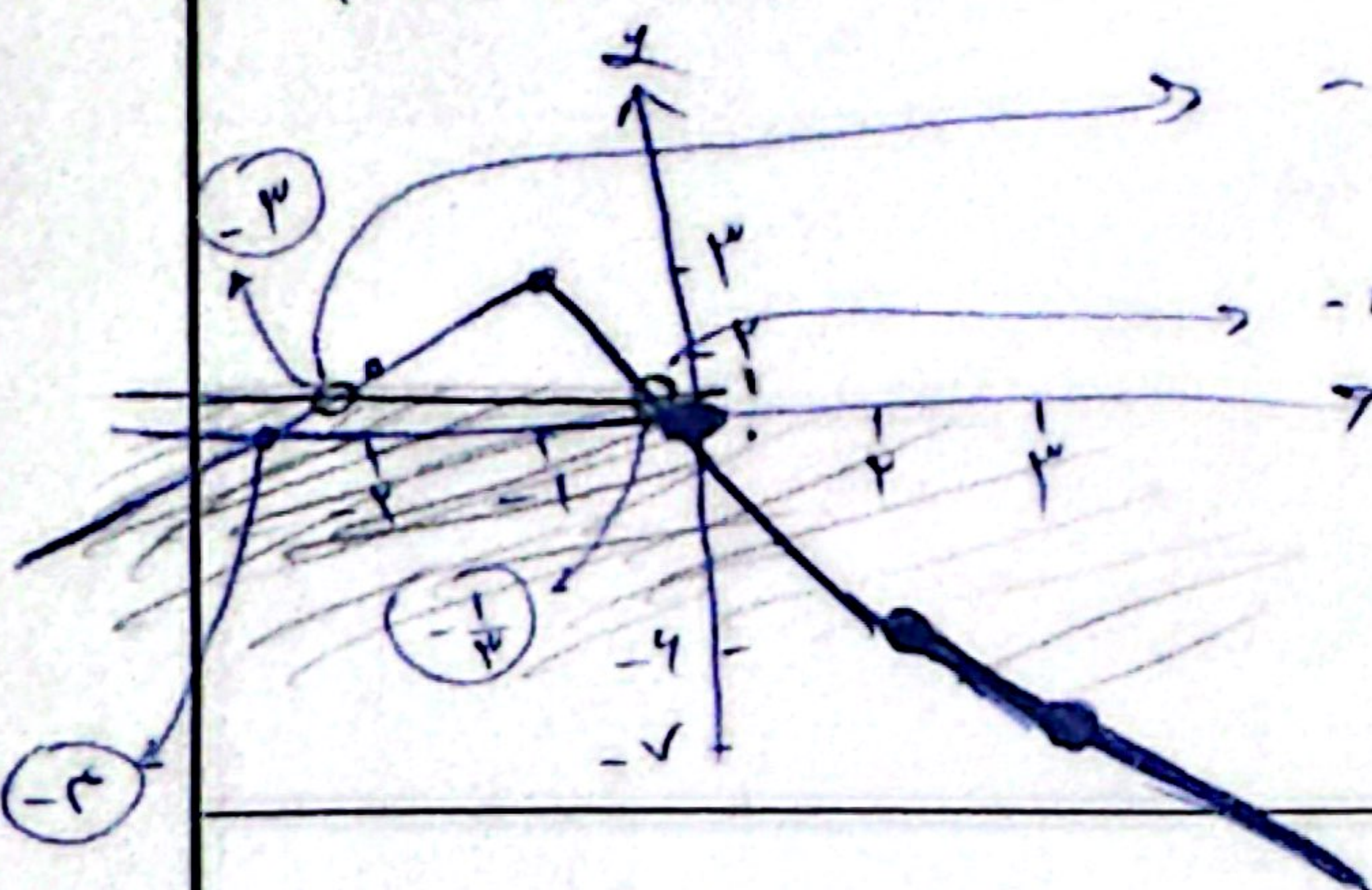
ب) $y = \lg(\frac{x^2+1}{x}) \rightarrow \lg \frac{x^2+1}{x} \xrightarrow{x \rightarrow \pm\infty} \lg \frac{1}{x} \rightarrow R_f = [1, +\infty)$
 $\lg(-\infty, -2]$ چون α

ii) $y = |x-2| - |x-3| \rightarrow R_f = [-1, +\infty)$



$R_f = [-1, +\infty)$

$|x-2| - |x+1| \leq 1$



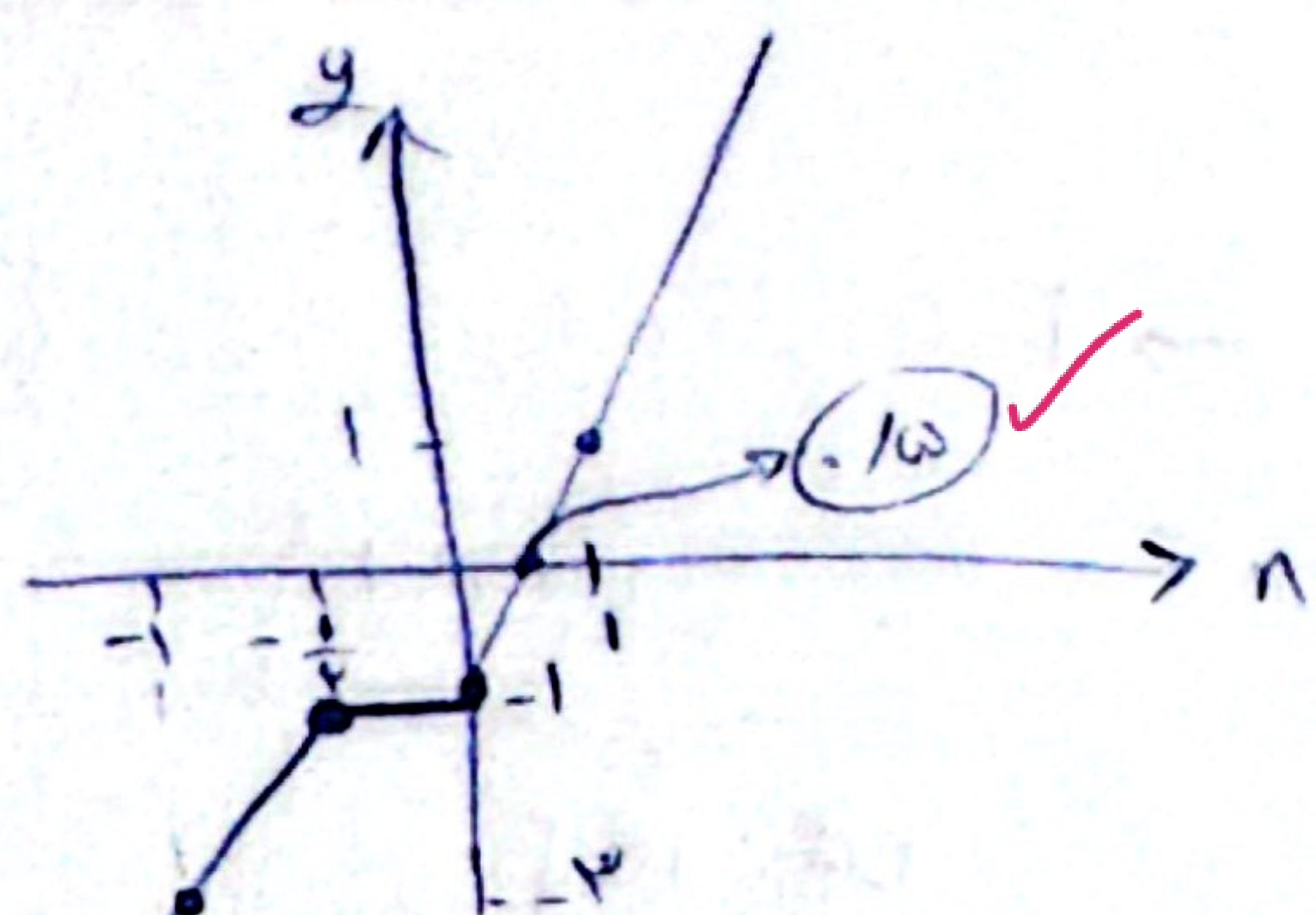
$-x+2+x+1 \leq 1$
 $x \leq -2$

$-x+2-x-1 \leq 1$
 $x \geq -1$

$x \in (-\infty, -2] \cup [-1, +\infty)$

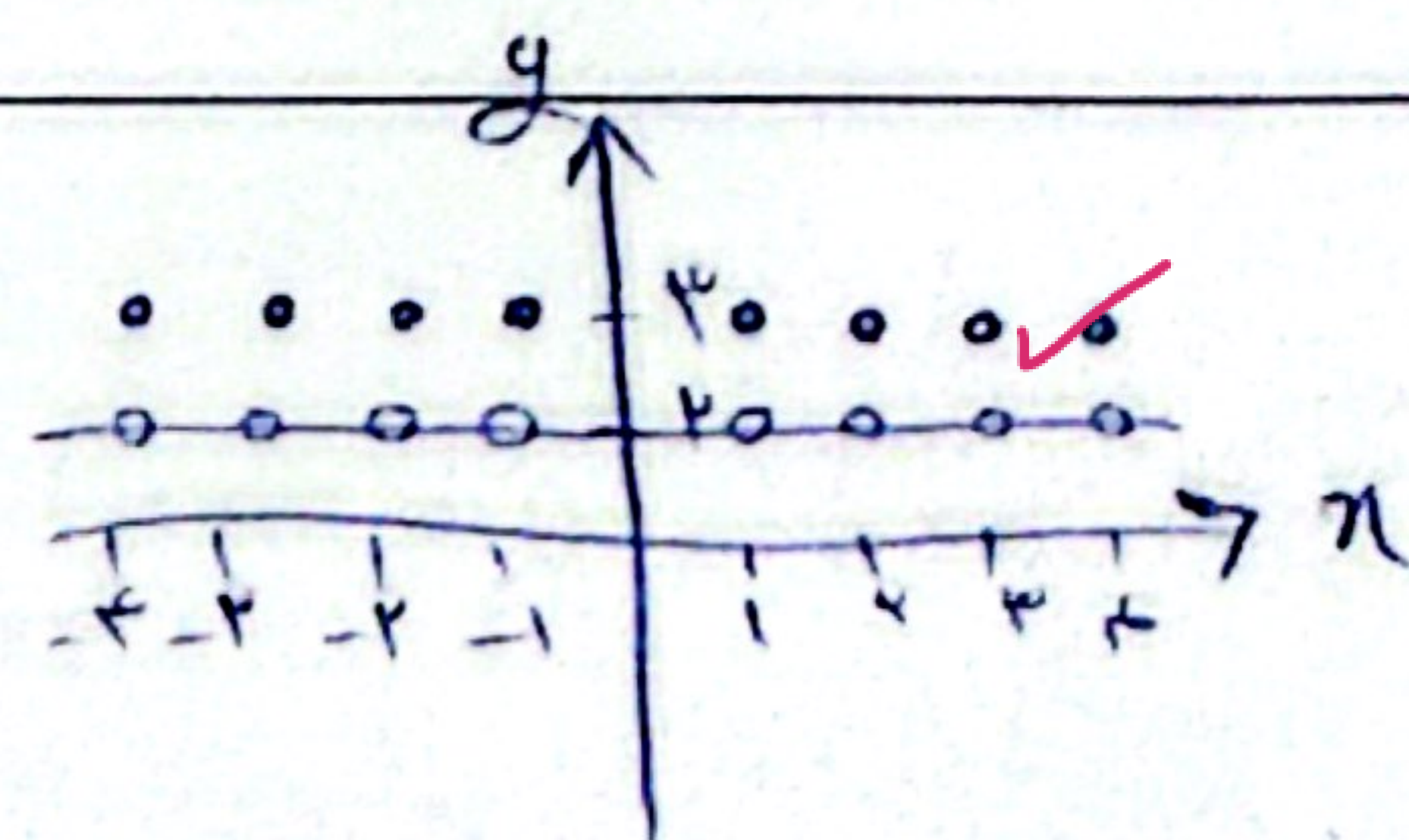
$y = |x-2| + |x+1|$

$R_f = \mathbb{R}$



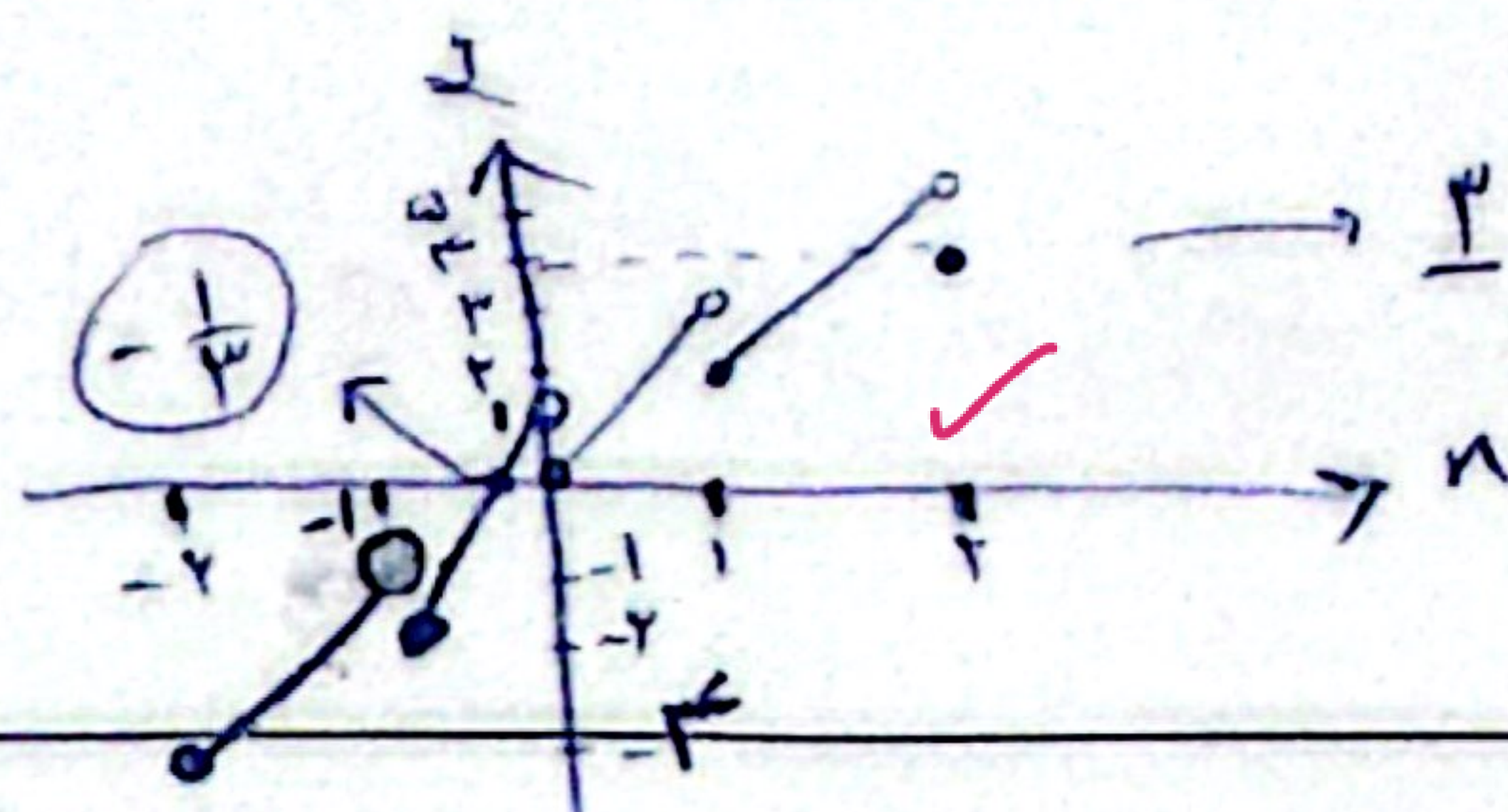
iii) $y = [x] + [3-x] = [x] + [-x] + 3$

$R_f = \{1, 2, 3\}$



iv) $y = [x]$

$-1 \leq x < 0$ $y = -1$
 $0 \leq x < 1$ $y = 0$
 $1 \leq x < 2$ $y = 1$
 $2 \leq x < 3$ $y = 2$



$R_f = \mathbb{Z}$

$R_f = [-1, \infty)$

v) $y = \sin^2 x - \sin x + 1$

$\sin x = 1 \rightarrow y = 1$
 $\sin x = -1 \rightarrow y = 1$
 $\sin x = \frac{1}{2} \rightarrow y = \frac{3}{4}$

$R_f = [\frac{3}{4}, 1]$

vi) $y = \sin^2 x + \sin^2 x + 1$

$\sin^2 x = 1 \rightarrow y = 2$
 $\sin^2 x = 0 \rightarrow y = 1$
 $\sin^2 x = \frac{1}{4} \rightarrow y = \frac{5}{4}$

$R_f = [1, 2]$