

دوازدهم سپر

مکمل معقول

$$\left. \begin{aligned} f(-x) - x f(x) &= 2|x| + 1 \Rightarrow x f(-x) - x^2 f(x) = 2x|x| + x \\ f(x) + x f(-x) &= 2|x| + 1 \Rightarrow f(x) + x f(-x) = 2|x| + 1 \end{aligned} \right\} \Rightarrow f(x) = \frac{-2x^2 + x + 1}{x^2 + 1}$$

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

$$(x^2 + 1) f(x) = 2|x| - 2x|x| + 1 - x$$

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

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

$$f(x) + f(0) = x^2 - 2x + 4 \xrightarrow{x=0} 4 \Rightarrow f(0) = 4$$

$$f(x) = x^2 - 2x + 4$$

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$$y = \frac{x^2 + x + 1}{x - 1} \Rightarrow yx - y = x^2 + x + 1 \Rightarrow x^2 + (1-y)x + y + 1 = 0$$

$$\Delta = (1-y)^2 - 4(y+1) \geq 0$$

$$y = \frac{1 \pm \sqrt{1 - 4y - 4}}{2}$$

$$R_f = (-\infty, -1] \cup [1, +\infty)$$

$$\frac{-1 \pm \sqrt{1 - 4y - 4}}{2}$$

$$y = \frac{x^2 - 2x + 1}{x + 1} \Rightarrow \frac{-b}{a} = \frac{2}{1} = 2$$

$$x(\frac{2a}{b}) = \frac{2a}{b} + 1$$

$$-\frac{2a}{b} + \frac{1}{a} = -\frac{14}{a} \Rightarrow R_f = [-\frac{14}{a}, +\infty)$$

$$y = \sqrt{-x^2 + 4x - 4}$$

$$\frac{-b}{a} = \frac{4}{1} = 4$$

$$-4 + 4 - 4 = -4 \Rightarrow R_f = [0, 4]$$

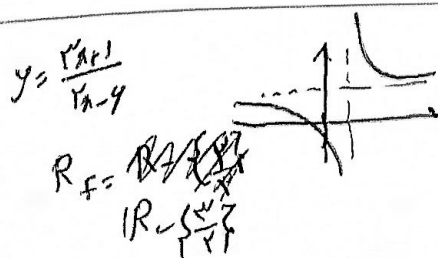
$$y = \sqrt{x^2 - 4x + 4}$$

$$R_f = [0, +\infty)$$

$$y = \log(x^2 - 4x + 4)$$

$$R_f = \mathbb{R}$$

$$R_f = (1, 2) \cup (2, 4) \cup (4, +\infty)$$



$$y = \frac{x+1}{x-4} \quad [0, +\infty) \cup \{4\}$$

-d

$$y = \frac{x^r + c}{x^r + r}$$

$$\sqrt{x^r + r} = t \quad \text{تعیین می‌کنیم } t \geq \sqrt{r} \quad \min t = \sqrt{r}$$

$$\frac{x^r + r}{x^r + r} + \frac{1}{x^r + r} \Rightarrow t + \frac{1}{t} \geq r \quad \sqrt{r} + \frac{1}{\sqrt{r}} = \frac{r + 1}{\sqrt{r}} \quad R_f = \left[\frac{r + 1}{\sqrt{r}} + \infty \right)$$

$$y = x^r + \frac{1}{x^r + r} \rightarrow \frac{x^r + r}{x^r + r} + \frac{1}{x^r + r} - r$$

$$t + \frac{1}{t} \geq r \xrightarrow{\text{m.l.a}} x^r + \frac{1}{x^r} \geq r \rightarrow R_f = \left[\frac{1}{r} + \infty \right)$$

تعیین می‌کنیم
محدود

$$y = \frac{x^r + c}{x - 1}$$

$$\Rightarrow y x^r - y = c x^r + c$$

$$R_f = (-\infty -f] \cup [r + \infty)$$

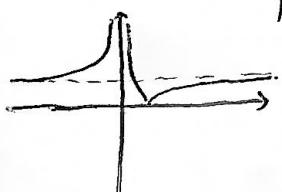
$$(x - y) x^r + c y = 0$$

$$x = \sqrt{-c(x - y)(c + y)} \Rightarrow \sqrt{-c\lambda + cy + cy^r} \quad \frac{-r}{1 - r}$$

$$\min = -f \Rightarrow \text{مخرج می‌تواند صفر شود} \Rightarrow (-\infty -f] \cup [r + \infty)$$

$$\frac{r \sin x + r}{\sin x - r} \xrightarrow{\max} 1 \rightarrow -r \quad \xrightarrow{\min} -1 \rightarrow -\frac{1}{r} \Rightarrow [-r - \frac{1}{r}]$$

$$y = \left| \frac{r(x-1)}{r_2} \right|$$



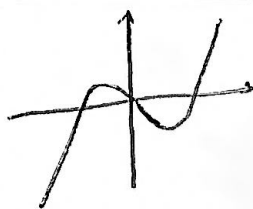
$$R_f = [r + \infty)$$

$$y = \sqrt{\frac{9x - 11}{-11 + 9x}} = \sqrt{\frac{9(x-1)}{9(x-1)}} = \frac{r}{r}$$

$$R_f = \left\{ \frac{r}{r} \right\}$$

$$y = x|x| - 2x$$

$$\frac{x^2 - 2x}{x^2 - 2x}$$



$$R_f = \mathbb{R}$$

$$y = |f(|x|) + 1|$$

$$f(|x| + 1)$$

