

Handwritten signature/initials

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$$\begin{aligned} -x \{ f(-x) - x f(x) &= r|x| + 1 \\ f(x) + x f(-x) &= r|-x| + 1 \end{aligned}$$

(2)

$$\begin{cases} -x f(-x) + x^r f(x) = -r|x| - 1 \\ x f(-x) + f(x) = r|-x| + 1 \end{cases}$$

$$\begin{aligned} -x^r f(x) + f(x) &= -r|x| + r|-x| + 1 - x \\ \rightarrow (x^r + 1) f(x) &= -r|x| + r|-x| - x + 1 \end{aligned}$$

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

$$f(x) = \begin{cases} \frac{-rx^r + x + 1}{x^r + 1} & x \geq 0 \\ \frac{+rx^r - rx + 1}{x^r + 1} & x < 0 \end{cases}$$

$$f(x) + f(0) = x^r - \epsilon x + \gamma \quad x=0 \rightarrow r f(0) = \gamma \rightarrow f(0) = \epsilon$$

(1)

$$\rightarrow f(x) = x^r - rx + \epsilon \quad x=x^r \rightarrow \boxed{f(x^r) = x^r - rx^r + \epsilon}$$

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

$$x = \frac{y - 1 \pm \sqrt{y^r - ry + 1 - \epsilon y + \Lambda}}{r} \quad \Delta \geq 0 \rightarrow y^r - 4y - V \geq 0$$

$$y^r - 4y - V = 0 \rightarrow (y - V)(y + 1) = 0 \rightarrow \begin{cases} y = -1 \\ y = V \end{cases} \quad \begin{matrix} -1 & V \\ +\phi & -\phi + \end{matrix}$$

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

$$الف) y = rx^r - \alpha x + 1$$

$$\min \left| \begin{aligned} \frac{-b}{ra} &= \frac{\delta}{\epsilon} \\ r \times \frac{ra}{rs} - \frac{ra}{\epsilon} + 1 &= \frac{-1V}{\Lambda} \end{aligned} \right.$$

(3)

$$R_y = \left[\frac{-1V}{\Lambda}, +\infty \right)$$

$$ب) y = \sqrt{-x^r + \epsilon x}$$

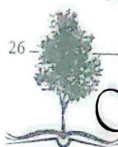
$$\max \left| \begin{aligned} \frac{r}{-9 + 1\Lambda - \alpha} &= \epsilon \\ R_y &= \sqrt{(-\infty, \epsilon]} \end{aligned} \right.$$

$$R_y = [0, r]$$

$$ج) y = \sqrt{x^r - \epsilon x^r + \epsilon x + 1}$$

$$د) \rightarrow R_y = \sqrt{\mathbb{R}} \rightarrow R = [0, +\infty)$$

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2) $y = \log(x^2 - 4x + 1)$ $\rightarrow R_y = \mathbb{R}$

3) $y = \frac{x+1}{x-4}$ $R_y = \mathbb{R} - \left\{\frac{c}{a}\right\} \rightarrow R_y = \mathbb{R} - \left\{\frac{c}{r}\right\}$ (2)

4) $y = \sqrt{\frac{x+1}{x-1}}$ $R_y = \sqrt{\mathbb{R} - \{1\}} \rightarrow R_y = [0, +\infty) - \{1\}$

5) $y = \frac{x^2+5}{\sqrt{x^2+5}} = \frac{x^2+5}{\sqrt{x^2+5}} + \frac{1}{\sqrt{x^2+5}} = \sqrt{x^2+5} + \frac{1}{\sqrt{x^2+5}}$

6) $\min_{x=0} \rightarrow \sqrt{5} + \frac{1}{\sqrt{5}} = \sqrt{5} + \frac{\sqrt{5}}{5} = \frac{6\sqrt{5}}{5}$ $R_y = \left[\frac{6\sqrt{5}}{5}, +\infty\right)$

7) $y = x^2 + \frac{1}{x^2+5}$ $\min_{x=0} \rightarrow 0 + \frac{1}{5} = \frac{1}{5}$ $R_y = \left[\frac{1}{5}, +\infty\right)$

8) $y = \frac{3x^2+5}{x^2-1} \rightarrow yx^2 - y = 3x^2 + 5$
 $\rightarrow (y-3)x^2 = y+5 \rightarrow x^2 = \frac{y+5}{y-3}$

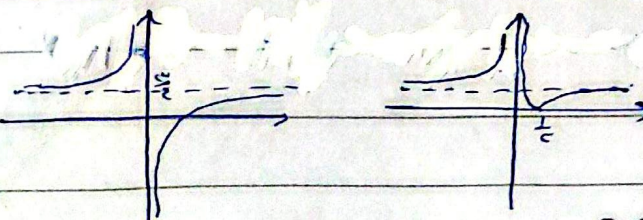
$\rightarrow x = \pm \sqrt{\frac{y+5}{y-3}}$ $\frac{y+5}{y-3} \geq 0$ $\frac{-5}{+3} \leq \frac{y}{-3} \leq \frac{-5}{-3}$ $R_y = (-\infty, -\frac{5}{3}] \cup (\frac{5}{3}, +\infty)$

9) $y = \frac{3x^2+5}{x^2-1}$ $\xrightarrow{x=0} y = -5$
 $\xrightarrow{x \rightarrow \pm\infty} y = 3$ $R_y = (-\infty, -5] \cup (3, +\infty)$

10) $f(x) = \frac{x \sin x + 5}{\sin x - 3}$ $\begin{cases} \sin x = 1 \rightarrow \frac{4}{-2} = -2 \\ \sin x = -1 \rightarrow \frac{4}{-4} = -1 \\ \frac{c}{a} = 3 \rightarrow X \end{cases}$ $R_f = [-2, -\frac{1}{3}]$ (V)

11) $y = \left| \frac{x-1}{x} \right|$

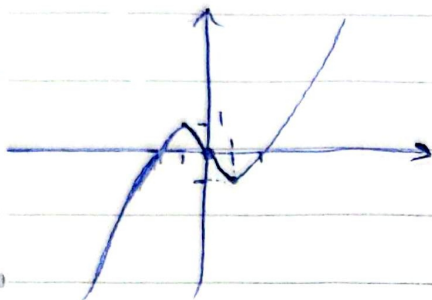
$R_y = [0, +\infty)$



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$$y = \sqrt{\frac{9x-18}{-1+5x}} = \sqrt{\frac{9(x-2)}{5(x-2)}} = \frac{3}{\sqrt{5}} \quad R_y = \left\{ \frac{3}{\sqrt{5}} \right\}$$

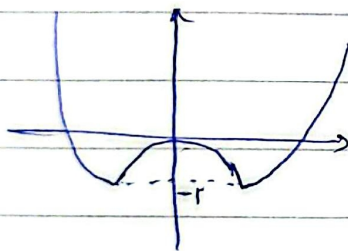
$$y = x/|x| - 1/x \quad y = \begin{cases} x^2 - 1/x & x > 0 \\ 0 & x = 0 \\ -x^2 - 1/x & x < 0 \end{cases}$$



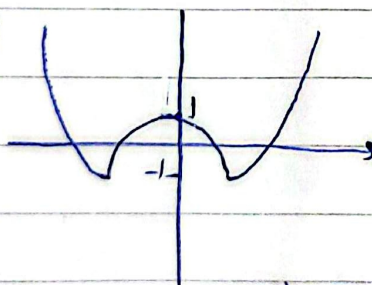
$$R_y = \mathbb{R}$$

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

$$y = f(x)$$



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



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

