الف) $y = x^2 - 5 \to x^2 = y + 5 \to x = \pm\sqrt{y+5} \to y + 5 \geq 0 \to y \geq -5 \to R_f\ [-5, +\infty)$

ب) $y = x^3 + 1 \to x^3 = y - 1 \to x = \sqrt[3]{y-1} \to R_f = \mathbb{R}$

الف) $y = (x-2)^2 + 3 \to x - 2 = \pm\sqrt{y-3} \to x = \pm\sqrt{y-3} + 2 \to y \geq 3$

ب) $y = (x - \frac{5}{2})^2 - \frac{21}{4} \to x = \pm\sqrt{y + \frac{21}{4}} + \frac{5}{2} \quad y \geq -\frac{21}{4}$

الف) $y = \frac{x^2 - 3}{x^2 - 2} \to yx^2 - 2y = x^2 + 3 \to x^2(y-1) = 2y + 3 \to x = \pm\sqrt{\frac{2y+3}{y-1}} \to \frac{2y+3}{y-1}$

$2y + 3 = 0 \quad y = -\frac{3}{2}$

$y - 1 = 0 \quad y = 1$

$\begin{array}{ccccc} + & 0 & - & \| & + \\ & -\frac{3}{2} & & 1 & \end{array}$ $R_f = (-\infty, -\frac{3}{2}] \cup (1, +\infty)$

ب) $y = \frac{2|x| + 1}{|x| - 4} \to y|x| - 4y = 2|x| + 1 \to |x| = \frac{4y+1}{y-2} \to \frac{4y+1}{y-2} \geq 0 \to \begin{array}{ccccc} + & 0 & - & \| & + \\ & -\frac{1}{4} & & 2 & \end{array}$

$R_f = (-\infty, -\frac{1}{4}] \cup (2, +\infty)$

$y = \frac{1}{x^2 - 4x} \to yx^2 - 4yx - 1 = 0 \to x = \frac{4y \pm \sqrt{16y^2 + 4y}}{2y} \to \begin{cases} 2y \neq 0 \to y \neq 0 \\ 16y^2 + 4y \geq 0 \end{cases}$

$4y(4y+1) \to y = -\frac{1}{4}$

$\begin{array}{ccccc} + & 0 & - & 0 & + \\ & -\frac{1}{4} & & 0 & \end{array}$

$R_f = (-\infty, -\frac{1}{4}] \cup (0, +\infty)$

الف) $y = x^2 - 6x + 2 \xrightarrow{a > 0} \begin{cases} -\frac{b}{2a} = \frac{6}{2} = 3 \\ 9 - 18 + 2 = -7 \end{cases} \to R_f = [-7, +\infty)$

ب) $y = -x^2 + 4x + 2 \xrightarrow{a < 0} \begin{cases} -\frac{b}{2a} = \frac{-4}{-2} = 2 \\ -4 + 8 + 2 = y \end{cases} \to R_f = (-\infty, 6]$

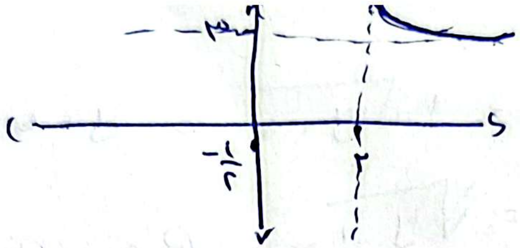
الف) $y = \sqrt{x^2 - 6x + 2} \xrightarrow{a > 0} \begin{cases} \frac{6}{2} = 3 \\ 9 - 18 + 2 = -7 \end{cases} \to \sqrt{[-7, +\infty)} \to [0, +\infty)$

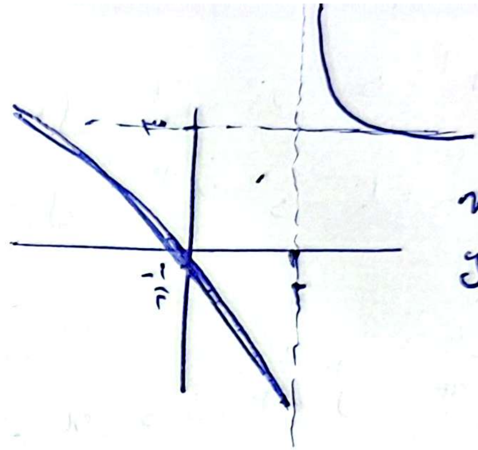
ب) $y = \sqrt{-x^2 + 4x + 10} \xrightarrow{a < 0} \begin{cases} \frac{-4}{-2} = 2 \\ -4 + 8 + 10 = 14 \end{cases} \to R_f = \sqrt{(-\infty, 14]} = [0, \sqrt{14}]$

الف) $y = x^{7?} + 3x^4 + 2x + 1 \to R_f = \mathbb{R}$ ☺ | ب) $y = \sqrt{x^{5?} + 4x^{2?} + 6x + 1} \to R_f = \sqrt{\mathbb{R}} \to R_f = [0, +\infty)$ ☺

الف) $y = \frac{3x+1}{x-2} \to \mathbb{R} - \{\frac{c}{a}\} \to \mathbb{R} - \{3\}$ | ب) $y = \sqrt{\frac{4x+1}{x+3}} \to R_f = \sqrt{\mathbb{R} - \{4\}} = [0, +\infty) - \{2\}$

الف) $y = \dfrac{3x+1}{x-2}$



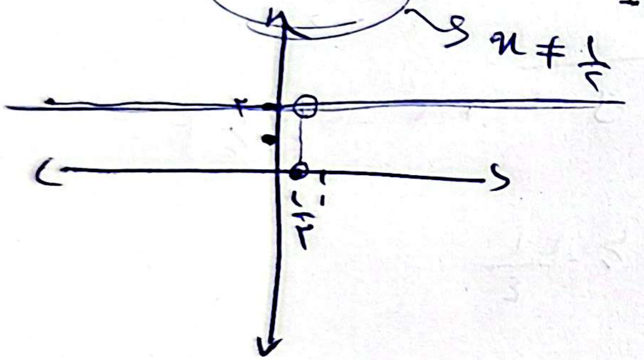


$x = 0$

$y = -\dfrac{1}{2}$

ب) $y = \dfrac{4x-2}{-2x+1} \rightarrow y = \dfrac{2(2x-1)}{-(2x-1)} = -2$

$x \neq \dfrac{1}{2}$



الف $= y = \cos^2 x + \dfrac{1}{\cos^2 x} \rightarrow R_f = [2, +\infty)$

ج) $y = \sqrt[3]{\dfrac{x^2+1}{x}} = \sqrt[3]{x + \dfrac{1}{x}} = \sqrt[3]{(-\infty, -2] \cup [2, +\infty)} =$

$R_f = (-\infty, \sqrt[3]{-2}] \cup [\sqrt[3]{2}, +\infty)$

محمدحسن امیری روشن

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