

$$y = x(x^2 - 2x + 3)$$

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

$$R_f = \mathbb{R}$$

$$y(x^2 - 2x + 3) = 1 \quad x(x^2 - 2x + 3) = 1 \quad R_f = \mathbb{R} - \{0\}$$

$$x = \frac{1}{x^2 - 2x + 3}$$

2

$$الف) \quad x_{min} = \frac{4}{3} = 1.33$$

$$y_{min} = 4 - 1 + 10 = 13 \quad R_f = [4, +\infty)$$

$$ب) \quad x_{max} = \frac{-4}{-3} = 1.33$$

$$y_{max} = -9 + 18 + 3 = 12 \quad R_f = (-\infty, 12]$$

$$ج) \quad x_{min} = \frac{4}{3} = 1.33$$

$$y_{min} = 4 - 1 - 3 = -1 \quad R_f = [0, +\infty)$$

$$د) \quad x_{max} = \frac{-4}{-3} = 1.33$$

$$y_{max} = 18 - 9 = 9 \quad R_f = [0, 3]$$

3

$$الف) \quad R_f = \mathbb{R}$$

$$ب) \quad R_f = \mathbb{R}$$

$$ج) \quad R_f = [0, +\infty)$$

$$د) \quad R_f = [0, +\infty)$$

4

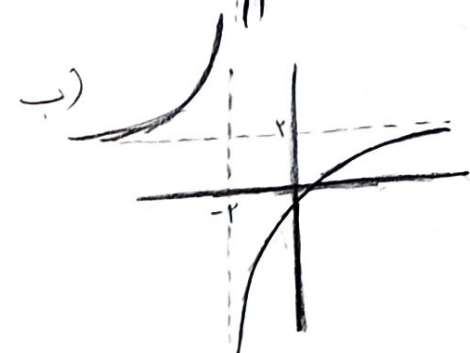
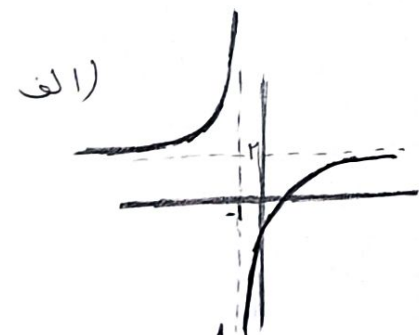
$$الف) \quad R_f = \mathbb{R} - \{3\}$$

$$ب) \quad R_f = \mathbb{R} - \{2\}$$

$$الف) \quad R_f = [0, +\infty) - \{\sqrt{2}\}$$

$$ب) \quad R_f = [0, +\infty)$$

5



الف) $R_f = (-\infty, -2] \cup [2, +\infty)$

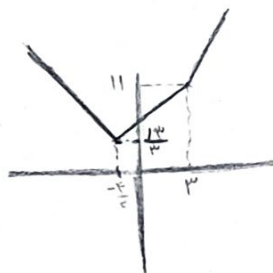
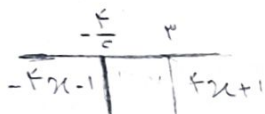
ب) $y = x^c + \frac{1}{x^c} \quad R_f = (-\infty, -2] \cup [2, +\infty)$

ج) $y = \sqrt{x} + \frac{1}{\sqrt{x}} \quad R_f = (-\infty, -2] \cup [2, +\infty)$

د) $R_f = [2, +\infty)$

الف) $\frac{1}{c} \leq x^c + \frac{1}{x^c} \quad R_f = [\frac{1}{c}, +\infty)$
 $\frac{1}{3} \leq x^3 + \frac{1}{x^3}$

ب) $\frac{x^3 + 1}{\sqrt{x^3 + 1}} = \sqrt{x^3 + 1} + \frac{1}{\sqrt{x^3 + 1}} \quad R_f = [\frac{1}{\sqrt{3}}, +\infty)$



الف) $\frac{-1}{-x-1} \leq \frac{1}{x-3} \quad R_f = [c, +\infty)$

ب) $\frac{-1}{-x-1} \leq \frac{1}{x-3} \quad R_f = [-2, +\infty)$