

الف) $y = a^2 \cdot \omega \Rightarrow y \cdot \omega = a^2 \Rightarrow a = \sqrt{y \cdot \omega} \Rightarrow R_f = [-\omega, +\infty)$

ب) $y = a^3 \cdot \omega \Rightarrow a^3 = y \cdot \omega \Rightarrow a = \sqrt[3]{y \cdot \omega} \Rightarrow R_f = [0, +\infty)$

الف) $y = a^2 - f(a) \Rightarrow y = (a-2)^2 \Rightarrow y-2 = (a-2)^2 \Rightarrow a = \sqrt{y-2} + 2 \Rightarrow R_f = [2, +\infty)$

ب) $y = a^2 - \omega a + 1 \Rightarrow a^2 - \omega a + 1 - y = 0 \Rightarrow a = \frac{\omega \pm \sqrt{\omega^2 - 4(1-y)}}{2} = \frac{\omega \pm \sqrt{4\omega - 4(1-y)}}{2}$
 $\Rightarrow a^2 - \omega a + 1 - y = 0 \Rightarrow \Delta \geq 0 \Rightarrow \omega^2 - 4(1-y) \geq 0 \Rightarrow \omega^2 \geq 4(1-y) \Rightarrow \omega \geq 2\sqrt{1-y} \Rightarrow y \geq \frac{1}{4}$

الف) $y = \frac{a^2 + 3}{a^2 - 2} \Rightarrow y(a^2 - 2) = a^2 + 3 \Rightarrow y a^2 - 2y = a^2 + 3 \Rightarrow a^2 - y a^2 = -2y - 3 \Rightarrow a^2(1-y) = -2y - 3$
 $\Rightarrow a^2 = \frac{-2y-3}{1-y} \Rightarrow a = \sqrt{\frac{-2y-3}{1-y}} \Rightarrow R_f = (-\infty, -\frac{3}{2}] \cup (1, +\infty)$

ب) $y = \frac{2|a|+1}{|a|-2} \Rightarrow y(|a|-2) = 2|a|+1 \Rightarrow y|a| - 2y = 2|a|+1 \Rightarrow y|a| - 2|a| = 2y+1 \Rightarrow |a|(y-2) = 2y+1$
 $\Rightarrow |a| = \frac{2y+1}{y-2} \Rightarrow R_f = R - (-\frac{1}{2}, 2]$

$y = \frac{1}{a^2 - f(a)} \Rightarrow y(a^2 - f(a) - 1) = 0 \Rightarrow \Delta \geq 0 \Rightarrow b^2 - 4ac \geq 0 \Rightarrow$

$14y^2 + 4y \geq 0 \Rightarrow y(4y+1) \geq 0 \Rightarrow y \geq -\frac{1}{4} \Rightarrow R_f = [-\frac{1}{4}, +\infty)$

الف) $y = a^2 - 2a + 2 \Rightarrow \min |a = \frac{b}{2a} = \frac{2}{2} = 1 \Rightarrow R_f = [-1, +\infty)$

ب) $-a^2 + 4a + 2 \Rightarrow \max |a = \frac{b}{2a} = \frac{4}{2} = 2 \Rightarrow R_f = (-\infty, 2]$

الف) $y = \sqrt{u^2 - 4u + 4}$ $\min \begin{cases} u = \frac{4}{v} - 1 \\ y = v \end{cases} R_f = \sqrt{[\frac{4}{v}, +\infty)} = [0, +\infty)$

ب) $y = \sqrt{-u^2 + 4u + 4}$ $\max \begin{cases} u = \frac{4}{v} - 1 \\ y = v \end{cases} R_f = \sqrt{(-\infty, 14]} = [0, \sqrt{14}]$

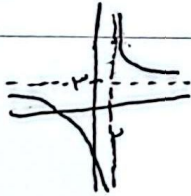
الف) $y = u^2 + 3u^2 + 2u + 1 \Rightarrow R_f = \mathbb{R}$

ب) $y = \sqrt{u^2 + 4u^2 + 4u + 1} \Rightarrow R_f = \sqrt{\mathbb{R}} = [0, +\infty)$

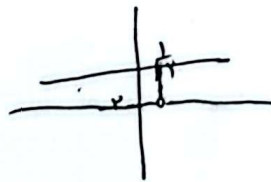
الف) $y = \frac{3u+1}{u-2}$ $R_f = \mathbb{R} - \{3\}$
 $\frac{a}{c} = 3$

ب) $y = \sqrt{\frac{3u+1}{u+3}}$ $R_f = \sqrt{\mathbb{R} - \{3\}} \Rightarrow R_f = [0, +\infty) - \{3\}$

الف) $y = \frac{3u+1}{u-2}$



ب) $y = \frac{4u-2}{1-2u}$ $R_f = \mathbb{R}$



الف) $y = \cos^2 u + \frac{1}{\cos^2 u} \Rightarrow R_f = [2, +\infty)$

ب) $y = 4\sqrt{\frac{u^2+4}{u}} \Rightarrow y = \sqrt{u + \frac{1}{u}} R_f = \sqrt{(-\infty, \frac{1}{4}] \cup [1, +\infty)}$

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