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 $x = a \Rightarrow a^2 + 2a = a^2 - \varepsilon \Rightarrow \underline{a = -2}$ ✓
 (حزب دو عنصری است)

۲
 $g(x) = 2x + b \xrightarrow{(r, c)} 3 = \varepsilon + b \rightarrow b = -1$
 $f(x) = \frac{x^2 + a}{2x - b} \xrightarrow{(r, c)} 3 = \frac{\varepsilon + a}{\varepsilon + 1} \rightarrow 3\varepsilon = \varepsilon + a \rightarrow a = 11$
 $\Rightarrow f(1) = \frac{1^2 + a}{2 \cdot 1 - b} \xrightarrow{\substack{a=11 \\ b=-1}} f(1) = \frac{12}{3} = \underline{\varepsilon}$ ✓

۳
 $D_f = \mathbb{R} - \{-1, \varepsilon\} \Rightarrow$ ریشه‌های $x^2 - 2x + 1 = 0$ است
 $\begin{cases} x = -1 : 2 - a + b = 0 \\ x = \varepsilon : 3\varepsilon + \varepsilon a + b = 0 \end{cases} \Rightarrow \begin{cases} 2 - a + b = 0 \\ 4\varepsilon + \varepsilon a + b = 0 \end{cases} \Rightarrow \begin{cases} a = -6 \\ b = -1 \end{cases}$
 $f(1) = \frac{\varepsilon + 1}{2 + a + b} \xrightarrow{\substack{a=-6 \\ b=-1}} f(1) = \frac{\varepsilon}{-12}$ ✓

۴
 $D_f = \mathbb{R} - \{-1\} \Rightarrow$ مخرج دارای ریشه مضامف است
 $-\varepsilon x^2 + ax + b = -\varepsilon(x+1)^2 = -\varepsilon x^2 - 2\varepsilon x - \varepsilon$
 \Downarrow
 $a = -2\varepsilon / b = -\varepsilon \Rightarrow a + b = -3\varepsilon$ ✓

۵
 $D_f = \mathbb{R} - \{1\} \Rightarrow$ تنها ریشه‌ی مخرج عدد یک است
 $\begin{cases} \Delta = 0, x_1 = x_2 = 1 \Rightarrow x^2 + mx + 1 = (x-1)^2 \Rightarrow m = -2 \text{ (I)} \\ \Delta < 0 \Rightarrow \text{ریشه‌ها دارد} \Rightarrow m^2 - \varepsilon < 0 \Rightarrow m^2 < \varepsilon \Rightarrow -2 < m < 2 \text{ (II)} \end{cases}$
 $\text{(I), (II)} \Rightarrow P_m = \underline{[-2, 2]}$ ✓

$$f(x) = \sqrt{\varepsilon - \frac{1}{x^r}} \Rightarrow \varepsilon - \frac{1}{x^r} \geq 0 \rightarrow \varepsilon \geq \frac{1}{x^r} \Rightarrow x^r \geq \frac{1}{\varepsilon}$$

$$x^r \geq \frac{1}{\varepsilon} \Rightarrow \begin{cases} x \geq \frac{1}{\sqrt[r]{\varepsilon}} \\ x \leq -\frac{1}{\sqrt[r]{\varepsilon}} \end{cases} \Rightarrow D_f = \mathbb{R} \setminus \left(-\frac{1}{\sqrt[r]{\varepsilon}}, \frac{1}{\sqrt[r]{\varepsilon}} \right)$$

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$$D_f = \mathbb{R} \Rightarrow mx^r + ymx + 1 \geq 0 \quad (\text{المعادلة التربيعية})$$

$$\textcircled{1} \text{ إذا } \Delta < 0 \Rightarrow \begin{cases} m > 0 \\ \Delta < 0 \Rightarrow \varepsilon m^r - \varepsilon m < 0 \rightarrow m^r - m < 0 \end{cases} \quad \begin{matrix} + \\ - \\ + \\ - \\ + \end{matrix}$$

$$\textcircled{2} \text{ إذا } \Delta = 0 \Rightarrow \varepsilon m^r - \varepsilon m = 0 \Rightarrow \begin{cases} m = 0 \\ m = 1 \end{cases}$$

$$\textcircled{1} \cup \textcircled{2} \Rightarrow D_m = [0, 1]$$

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$$f(x) \begin{cases} \frac{\varepsilon x^r - 1}{x^r - 1} : x \neq 1 \Rightarrow \frac{\varepsilon x^r - 1}{x^r - 1} = 0 \rightarrow \varepsilon x^r - 1 = 0 \rightarrow x^r = \frac{1}{\varepsilon} \rightarrow x = \frac{1}{\sqrt[r]{\varepsilon}} \\ \varepsilon x + k : x = \frac{1}{\sqrt[r]{\varepsilon}} \end{cases}$$

$$g(x) = \varepsilon x + 1 \quad x = \frac{1}{\sqrt[r]{\varepsilon}} \Rightarrow \varepsilon x + k = \varepsilon x + 1 \Rightarrow \varepsilon + k = \varepsilon + 1 \Rightarrow k = 0$$

$$\Rightarrow a + k = \frac{1}{\sqrt[r]{\varepsilon}}$$

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$$f(x) \begin{cases} \frac{ax^r - \varepsilon}{x^r + r} : x \neq -\frac{r}{a} \Rightarrow \frac{ax^r - \varepsilon}{x^r + r} = \mu x - r \\ rax + r : x = -\frac{r}{a} \end{cases}$$

$$g(x) = \mu x + b$$

$$\begin{cases} x \neq -\frac{r}{a} \text{ إذا } \Rightarrow rax - r = rax + b \Rightarrow b = -r \\ x = -\frac{r}{a} \text{ إذا } \Rightarrow rax + r = rax + b \Rightarrow -ra + r = -r - r \Rightarrow a = \mu \end{cases}$$

$$\Rightarrow a - b = \mu - (-r) = d$$

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$$f(x) \begin{cases} \frac{x^r - \varepsilon}{x - r} : x \neq r \Rightarrow \frac{x^r - \varepsilon}{x - r} = x + r \\ \gamma a^r + ax : x = r \end{cases}$$

$$g(x) = x + r$$

$$\begin{cases} x = r \text{ إذا } \Rightarrow \gamma a^r + ax = x + r \Rightarrow \gamma a^r + \gamma a = \gamma + r \Rightarrow a^r + a = r \\ x \neq r \text{ إذا } \Rightarrow x + r = x + r \end{cases}$$

$$\Rightarrow a = -r$$

$$a = 1$$

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