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① $y^3 - x = 2x^2 \Rightarrow y^3 = 2x^2 + x \Rightarrow y^3 = y^2 \Rightarrow y_1 = y_2$ تابع است ✓
 $y^3 = 2x^2 + x \Rightarrow y^3 = y^2 \Rightarrow y_1 = y_2$

② $|y| + x^2 = x + 3$ If $x=1$ $|y| = 3 \Rightarrow y = \pm 3$ تابع نیست ✓

③ $\sqrt{x-f} + |y-2| = 0 \Rightarrow$ هر دو منفی هستند $x=f$ $y=2$ (f, 2) تابع است ✓
 منفی منفی

④ $x = \cos y$ If $x=0 \Rightarrow \cos y = 0 \Rightarrow y = \frac{\pi}{2}, \frac{3\pi}{2}$ تابع نیست ✓

الف) $\frac{x+f}{x^2-fx}$ $x^2-fx=0 \Rightarrow x(x-f)=0 \Rightarrow x=f$ $Df = R - \{f\}$ ✓

ب) $\frac{x+f}{x^2-vx+16}$ $x^2-vx+16=0 \Rightarrow \Delta = f^2-64 \Rightarrow \Delta < 0$ ریشه ندارد $\Rightarrow Df = R$ ✓

ج) $\frac{x+f}{x^2+x+f}$ $x^2+x+f=0 \Rightarrow \Delta = 1-4f \Rightarrow \Delta < 0$ ریشه ندارد $\Rightarrow Df = R$ ✓

د) $\frac{x+f}{x^2-fx^2}$ $x^2-fx^2=0 \Rightarrow x^2(x^2-f)=0 \Rightarrow x^2(x-2)(x+2)=0 \Rightarrow Df = R - \{-2, 0, 2\}$ ✓

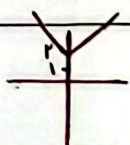
الف) $\sqrt{6-x} + \sqrt{x-2} \Rightarrow 6-x \geq 0 \Rightarrow x \leq 6$ $x-2 \geq 0 \Rightarrow x \geq 2$ $Df = [2, 6]$ ✓
 $x-2 \geq 0 \Rightarrow x \geq 2$

ب) $\frac{3x+1}{x^2+1}$ $x^2+1=0 \Rightarrow x^2=-1$ غیر ممکن $\Rightarrow Df = R$ ✓

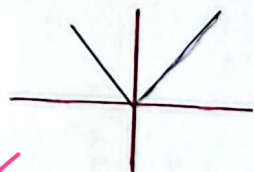
ج) $\frac{\sqrt{x-2}}{x-f}$ $x-2 \geq 0 \Rightarrow x \geq 2$ $x \neq f$ $Df = [2, \infty) - \{f\}$ ✓

د) $\frac{2x+3}{|x|+x^2}$ $|x|+x^2=0 \Rightarrow x=0$ $Df = R - \{0\}$ ✓

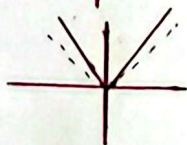
الف) $y = |x| + 2$



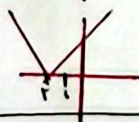
$y = |x|$



ب) $y = 2|x|$

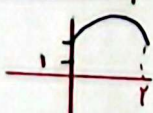


ج) $y = |x+2|$

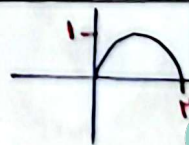


د) $y = |x+2| + 3$

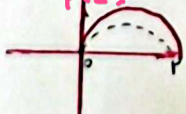
الف) $f(x) + 2$



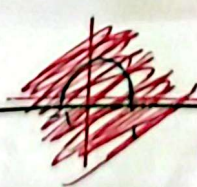
$f(x)$



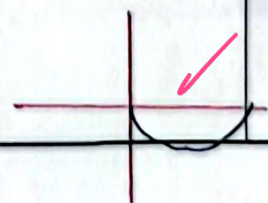
ب) $2f(x)$



ج) $f(x-1)$



د) $-f(x)$



$$Y = (x-2)(x-3)(x-4) \quad P(x) \begin{array}{c|ccc} & 2 & 3 & 4 \\ \hline & - & + & - & + \end{array} \quad \checkmark$$

$$x \begin{array}{c} \swarrow 2 \\ \searrow 3 \\ \swarrow 4 \end{array}$$

$$Y = (x-2)(x-3)^2(x-4) \quad P(x) \begin{array}{c|ccc} & 2 & 3 & 4 \\ \hline & + & - & + & + \end{array} \quad \checkmark$$

$$x \begin{array}{c} \swarrow 2 \\ \searrow 3 \\ \swarrow 3 \\ \searrow 4 \end{array}$$

الف) $\frac{(x-2)(x-4)}{x-3} \quad x \begin{array}{c} \swarrow 2 \\ \searrow 3 \\ \swarrow 4 \end{array} \quad P(x) \begin{array}{c|ccc} & 2 & 3 & 4 \\ \hline & - & + & - & + \end{array} \quad \checkmark$

ب) $\frac{(x-2)(x-4)}{(x-3)^2} \quad x \begin{array}{c} \swarrow 2 \\ \searrow 3 \\ \swarrow 3 \\ \searrow 4 \end{array} \quad P(x) \begin{array}{c|ccc} & 2 & 3 & 4 \\ \hline & + & - & + & + \end{array} \quad \checkmark$

الف) $\frac{x^3 - 3x + 2}{x-3} \Rightarrow \frac{(x-1)(x-2)}{(x-3)} \quad x \begin{array}{c} \swarrow 1 \\ \searrow 2 \\ \swarrow 3 \end{array} \quad P(x) \begin{array}{c|ccc} & 1 & 2 & 3 \\ \hline & - & + & - & + \end{array} \rightarrow \begin{array}{c|ccc} & -2 & 1 & 3 \\ \hline & + & - & - & + \end{array} \quad \checkmark$

ب) $\frac{x^3 - 3x + 2}{x^2 - 4x + 3} \Rightarrow \frac{(x-1)(x-2)}{(x-1)(x-3)} \quad x \begin{array}{c} \swarrow 1 \\ \searrow 2 \\ \swarrow 3 \end{array} \quad P(x) \begin{array}{c|ccc} & 1 & 2 & 3 \\ \hline & + & - & - & + \end{array} \quad \checkmark$

الف) $\frac{x^3 - x^2}{x^2 - 4x + 3} = \frac{x^2(x-1)(x+1)}{(x-1)(x-3)} \quad x \begin{array}{c} \swarrow 1 \\ \searrow 1 \\ \swarrow 3 \end{array} \quad P(x) \begin{array}{c|ccc} & -1 & 0 & 1 & 3 \\ \hline & + & - & - & + \end{array} \quad \checkmark$

ب) $\frac{x^2 + 3x + 4}{x^2 + 2x + 3} = \frac{x^2 + 3x + 4}{x^2 + 2x + 3} \Rightarrow \Delta = 9 - 16 \Rightarrow \Delta < 0$ ریشه ندارد
 $\Rightarrow \Delta = 4 - 12 \Rightarrow \Delta < 0$ ریشه ندارد

الف) $\sqrt{\frac{x^3 - 1}{x^2 - x}} \quad x^3 - 1 = 0 \Rightarrow x^3 = 1 \Rightarrow x = 1$
 $x^2 - x = 0 \Rightarrow x(x-1) = 0 \Rightarrow x = 0, 1$
 $P(x) \begin{array}{c|ccc} & -1 & 0 & 1 \\ \hline & + & - & + & + \end{array}$
 $DF = (-\infty, -1) \cup (0, 1) \cup (1, \infty)$

ب) $\sqrt{\frac{x^2 - 16}{x^2 - 4x + 4}} \quad x^2 - 16 = 0 \Rightarrow x^2 = 16 \Rightarrow x = \pm 4$
 $(x-1)(x-4) = 0 \Rightarrow x = 1, 4$
 $P(x) \begin{array}{c|ccc} & -4 & 1 & 4 \\ \hline & + & - & - & + \end{array}$
 $DF = [-\infty, -4] \cup (0, 1) \cup (4, \infty)$