

الف) $y^3 = 2x^2 - 1$ $\Rightarrow$ $y_1^3 = 2x_1^2 - 1$ $x_1 = x_2$ $\Rightarrow$ $y_1^3 = y_2^3 \Rightarrow y_1 = y_2$ ✓ تابع است
 $y^3 = 2x^2 - 1$

ب) $y^3 + y = 3x^2 - 1$ $\Rightarrow$ $y_1^3 + y_1 = 3x_1^2 - 1$ $x_1 = x_2$ $\Rightarrow$ $y_1^3 + y_1 = y_2^3 + y_2 \Rightarrow$ ✓ تابع است
 $y^3 + y = 3x^2 - 1$
 $(y_1 - y_2)(y_1^2 + y_1 y_2 + y_2^2 + y_1 + y_2 + 1) = 0$
 $\Rightarrow y_1 - y_2 = 0 \Rightarrow y_1 = y_2$
 $y_1^3 + y_1 y_2 + y_2^3 + y_1 + y_2 + 1 = 0$
 $y_1^3 - y_2^3 + y_1 - y_2 = 0$
 $(y_1 - y_2)(y_1^2 + y_1 y_2 + y_2^2 + y_1 + y_2 + 1) = 0$

الف) $y = x^2 - 1$ $\Rightarrow$ $y_1 = x_1^2 - 1$ $x_1 = x_2$ $\Rightarrow$ $y_1 = y_2$ ✓ تابع است
 $y = x^2 - 1$

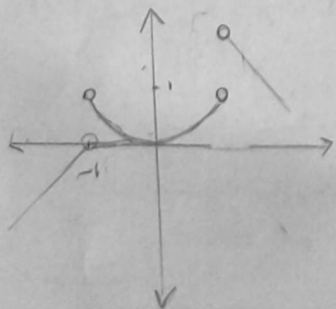
ب) $x = 0 \Rightarrow |y| + 0 \times y = 0^2 + 1 \rightarrow |y| = 1 \Rightarrow y = 1$ X تابع نیست
 $y^3 + x^3 = 2x - 1$ $\Rightarrow$ $y_1^3 + x_1^3 = 2x_1 - 1$ $x_1 = x_2$ $\Rightarrow$ $y_1^3 = y_2^3 \Rightarrow y_1 = y_2$ ✓ تابع است

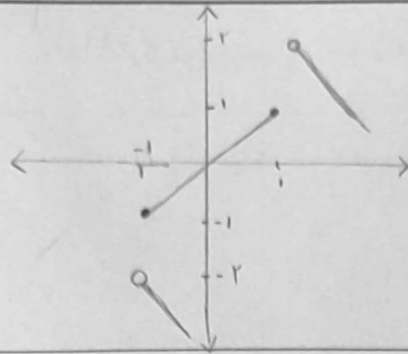
ج) $\sqrt[3]{y} + \sqrt{x} = 2$ $\Rightarrow$ $\sqrt[3]{y_1} + \sqrt{x_1} = 2$ $x_1 = x_2$ $\Rightarrow$ $\sqrt[3]{y_1} = \sqrt[3]{y_2} \Rightarrow y_1 = y_2$ ✓ تابع است
 $\sqrt[3]{y} + \sqrt{x} = 2$

الف) $\tan \frac{\pi}{3} \rightarrow \frac{\pi}{3} = 60^\circ \Rightarrow \left| \frac{1}{\sqrt{3}} \rightarrow \cos \right. \quad \tan = \frac{\sqrt{3}}{\frac{1}{\sqrt{3}}} = \sqrt{3}$
 $\left. \frac{\sqrt{3}}{\sqrt{3}} \rightarrow \sin \right|$
 ب) $\cot \frac{\sqrt{\pi}}{4} \rightarrow \frac{\sqrt{\pi}}{4} = 45^\circ \Rightarrow \left| -\frac{\sqrt{3}}{\sqrt{3}} \rightarrow \cos \right. \quad \cot = \frac{-\frac{\sqrt{3}}{\sqrt{3}}}{-\frac{1}{\sqrt{3}}} = \sqrt{3}$
 $\left. -\frac{1}{\sqrt{3}} \rightarrow \sin \right|$
 ج) $\tan 33^\circ \rightarrow 33^\circ \Rightarrow \left| \frac{\sqrt{3}}{\sqrt{3}} \rightarrow \cos \right. \quad \tan = \frac{-\frac{1}{\sqrt{3}}}{\frac{\sqrt{3}}{\sqrt{3}}} = -\frac{1}{\sqrt{3}}$
 $\left. -\frac{1}{\sqrt{3}} \rightarrow \sin \right|$
 د) $\cot 11^\circ \rightarrow 11^\circ \Rightarrow \left| -1 \rightarrow \cos \right. \quad \cot = \frac{-1}{\frac{-1}{\sqrt{3}}} = \sqrt{3}$
 $\left. 0 \rightarrow \sin \right|$

الف) $\sin \alpha = \frac{1}{\sqrt{2}} \Rightarrow \alpha = 2k\pi + \frac{\pi}{4}, 2k\pi - \frac{\pi}{4}$

ب) $\cos \alpha = \frac{\sqrt{2}}{2} \Rightarrow \alpha = 2k\pi + \frac{\pi}{4}, 2k\pi - \frac{\pi}{4}$





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الف) $y = (x-2)(x-3)(x-4)$ $\begin{array}{c} 2 \quad 3 \quad 4 \\ - \phi + \phi - \phi + \end{array}$

$x-2=0 \rightarrow x=2$ $x-3=0 \rightarrow x=3$
 $x-4=0 \rightarrow x=4$

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ب) $y = (x-2)(x-3)^2(x-4)$ $\begin{array}{c} 2 \quad 3^* \quad 4 \\ + \phi - \phi - \phi + \end{array}$

$x-2=0 \rightarrow x=2$
 $(x-3)^2=0 \rightarrow x-3=0 \rightarrow x=3$
 $x-4=0 \rightarrow x=4$

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الف) $y = \frac{(x-2)(x-4)}{x-3}$ $\begin{array}{c} 2 \quad 3 \quad 4 \\ - \phi + \phi - \phi + \end{array}$

$x-3 \rightarrow 3$

$x-2=0 \rightarrow x=2$ $x-4=0 \rightarrow x=4$
 $x-3=0 \rightarrow x=3$

ب) $y = \frac{(x-2)(x-4)}{(x-3)^2}$ $\begin{array}{c} 2 \quad 3^* \quad 4 \\ + \phi - \phi - \phi + \end{array}$

$\hookrightarrow 3$

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الف) $y = \frac{x^3 - 3x^2 + 2x}{x^2 + x - 2}$ $\begin{array}{c} x^3 - 3x^2 + 2x \\ - x^2 + x^2 \\ \hline x^2 - 3x + 2 \\ - x^2 + x \\ \hline -2x + 2 \\ + 2x - 2 \\ \hline 0 \end{array}$ $\begin{array}{c} x-1 \\ x^2+x-2 \\ \hline x^2+x-2 \\ \hline 0 \end{array}$ $\begin{array}{c} 1 \quad 2 \quad 3 \\ + \phi - \phi - \phi + \end{array}$

$x^3 - 3x^2 + 2x = (x-1)(x^2 + x - 2) = (x-1)(x+2)(x-1)$
 $\hookrightarrow 1 \quad \hookrightarrow 2$

ب) $y = \frac{x^3 - 3x^2 + 2x}{x^2 - 4x + 4}$ $\begin{array}{c} 1^* \quad 2 \quad 3 \\ + \phi + \phi - \phi + \end{array}$

$\hookrightarrow (x-1)(x-2)$
 $\hookrightarrow 1 \quad \hookrightarrow 2$

الف) $\frac{x^2 - x^2}{x^2 + x + 2} = y$ $x^2 + x + 2: \Delta = b^2 - 4ac \rightarrow a=1, b=1, c=2 \Rightarrow \Delta = 1 - (4 \times 1 \times 2) = -7$
 $\Delta < 0$ پس هیچ ریشه ای ندارد
 $0 = x^2 - x^2 \Rightarrow x^2(x^2 - 1) = 0 \Rightarrow x^2 = 0 \rightarrow x = 0^*$
 $\Rightarrow x^2 - 1 = 0 \Rightarrow x^2 = 1 \Rightarrow x = \pm 1$ $\begin{array}{c} -1 \quad 0^* \quad 1 \\ + \phi - \phi - \phi + \end{array}$

ب) $\frac{x^2 + 3x + 4}{x^2 + 2x + 3} = y$ $\Delta: b^2 - 4ac = 9 - 12 = -3$
 $\Delta < 0$ پس هیچ ریشه ای ندارد
 $\Delta: 4 - 12 = -8$ $\Delta < 0$ پس هیچ ریشه ای ندارد
 $\rightarrow$ این عبارت متواتر است