

الف) $y^3 = 2x^2 - 1 \Rightarrow y_1 = 2x_1^2 - 1 \Rightarrow y_1 = y_2 \Rightarrow y_1 = y_2$ (1)

ب) $y^3 + y = 2x^2 - 1 \Rightarrow \begin{cases} y_1^3 + y_1 = 2x_1^2 - 1 \\ y_2^3 + y_2 = 2x_2^2 - 1 \end{cases} \Rightarrow y_1^3 + y_1 = y_2^3 + y_2 \Rightarrow y_1^3 - y_2^3 + y_1 - y_2 = 0$
 $(y_1 - y_2)(y_1^2 + y_1 y_2 + y_2^2 + y_1 + y_2) = 0$
 $y_1 = y_2$
 $\Rightarrow (y_1 - y_2)(y_1^2 + y_1 y_2 + y_2^2 + y_1 + y_2) = 0 \Rightarrow \frac{-b \pm \sqrt{\Delta}}{2a} = \frac{-y_2 \pm \sqrt{y_2^3 - 4y_2 - 4}}{2(1)}$

$\Rightarrow \frac{-y_2 \pm \sqrt{y_2^3 - 4y_2 - 4}}{2} = \frac{-y_2 \pm \sqrt{y_2^3 - 4y_2 - 4}}{2} \Rightarrow \Delta < 0 \Rightarrow y_1 = y_2$ (2)

الف) $y = x^2 - 1 \Rightarrow y_1 = x_1^2 - 1 \Rightarrow y_1 = y_2 \Rightarrow y_1 = y_2$ (3)

ب) $|y| + xy = x^2 + 1 \Rightarrow |y_1| + x_1 y_1 = x_1^2 + 1 \Rightarrow |y_1| + x_1 y_1 = |y_2| + x_2 y_2$
 $|y_1| + x_1 y_1 = |y_2| + x_2 y_2 \Rightarrow x_1 = x_2 \Rightarrow |y_1| = |y_2| \Rightarrow y_1 = \pm y_2$

ج) $y^3 + x = 2x - 1 \Rightarrow y^3 = x + 2x - 1 \Rightarrow y_1^3 = x_1 + 2x_1 - 1 \Rightarrow y_1^3 = 3x_1 - 1 \Rightarrow y_1^3 = y_2^3 \Rightarrow y_1 = y_2$

د) $\sqrt[3]{y} + \sqrt[3]{x} = 2 \Rightarrow \sqrt[3]{y_1} + \sqrt[3]{x_1} = 2 \Rightarrow \sqrt[3]{y_1} = 2 - \sqrt[3]{x_1} \Rightarrow \sqrt[3]{y_1} = \sqrt[3]{y_2} \Rightarrow y_1 = y_2$ (4)

الف) $\tan \frac{\pi}{3} \rightarrow \frac{-\frac{1}{2}}{\frac{\sqrt{3}}{2}} = -\frac{1}{\sqrt{3}} \rightarrow \tan \frac{\pi}{3} = \frac{\sin \frac{\pi}{3}}{\cos \frac{\pi}{3}} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \sqrt{3} (\frac{\pi}{3} = 60^\circ)$ (5)

ب) $\cot \frac{\sqrt{\pi}}{6} \rightarrow \frac{1}{\sqrt{3}}$ (6)

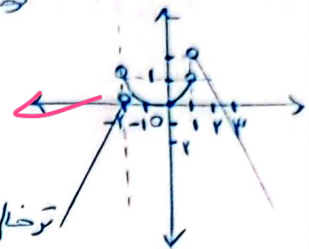
ج) $\tan 330^\circ \rightarrow \frac{-\frac{\sqrt{3}}{2}}{\frac{1}{2}} = -\frac{\sqrt{3}}{1} = -\sqrt{3}$

د) $\cot 180^\circ \rightarrow \frac{-1}{0} \Rightarrow \text{undefined}$

الف) $\sin a = \frac{1}{2} \Rightarrow a = 30^\circ, 150^\circ \Rightarrow \frac{\pi}{6}, \frac{5\pi}{6}$ (7)

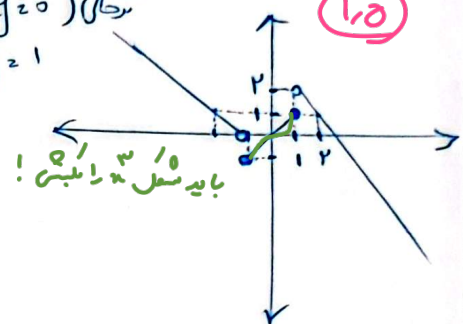
ب) $\cos a = \frac{\sqrt{2}}{2} \Rightarrow a = 45^\circ, 315^\circ \Rightarrow \frac{\pi}{4}, \frac{7\pi}{4}$ (8)

$$f(x) = \begin{cases} -2x+1 & x > 1 \rightarrow y = -2x+1 \Rightarrow (x=1, y=2) \text{ تداخل} \\ x^2 & -1 < x < 1 \rightarrow y = x^2 \Rightarrow (x=1, y=1) \text{ و } (x=-1, y=1) \text{ تداخل} \\ x+1 & x < -1 \rightarrow y = x+1 \Rightarrow (x=-1, y=0) \text{ تداخل} \end{cases} \quad (5)$$



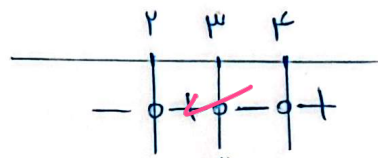
$$f(x) = \begin{cases} -x+3 & x > 1 \rightarrow y = -x+3 \Rightarrow (x=1, y=2) \text{ تداخل} \\ x^3 & -1 < x < 1 \rightarrow y = x^3 \Rightarrow (x=1, y=1) \text{ و } (x=-1, y=-1) \text{ تداخل} \\ -x-1 & x < -1 \rightarrow y = -x-1 \Rightarrow (x=-1, y=0) \text{ تداخل} \end{cases} \quad (6)$$

$x=-2, y=1$



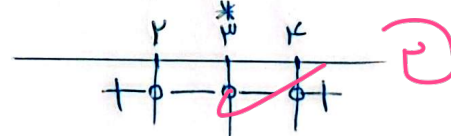
الف) $y = (x-2)(x-3)(x-4)$

$\downarrow \quad \downarrow \quad \downarrow$
۲ ۳ ۴



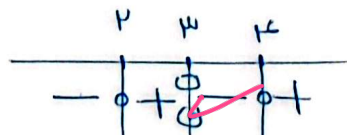
ب) $y = (x-2)(x-3)^2(x-4)$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
۲ ۳ ۳ ۴



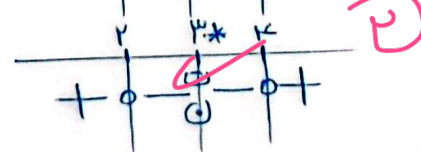
الف) $y = \frac{(x-2)(x-4)}{x-3}$

$\downarrow \quad \downarrow \quad \downarrow$
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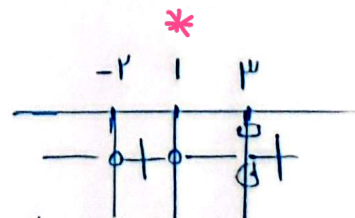
ب) $y = \frac{(x-2)(x-4)^2}{(x-3)^2}$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
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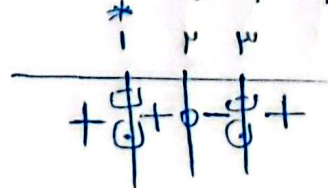
الف) $y = \frac{x^3 - 3x^2 + 2}{x^2 - 3} \rightarrow x^3 - 3x^2 + 2 = -2 \Rightarrow x^3 = 3x^2 - 2$

$\downarrow \quad \downarrow \quad \downarrow$
۲ ۳ ۴



ب) $y = \frac{x^2 - 3x + 2}{x^2 - 4x + 3} = \frac{(x-1)(x-2)}{(x-1)(x-3)}$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
۱ ۲ ۳ ۴



الف) $y_2 = \frac{n^4 - n^2}{n^2 + n + 2} = \frac{(n^2)^2 - n^2}{(n^2 + n + 2)}$ $\rightarrow \Delta < 0$

دقت!

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-1	*	0	-
-	+	+	+
+	-	-	+

عبارت مثبت $\Rightarrow$ $(1, 0)$

ب) $y_2 = \frac{n^4 + 3n^2 + 2}{n^2 + 2n + 3}$ $\Delta < 0, a > 0 \rightarrow +$

الف - 10

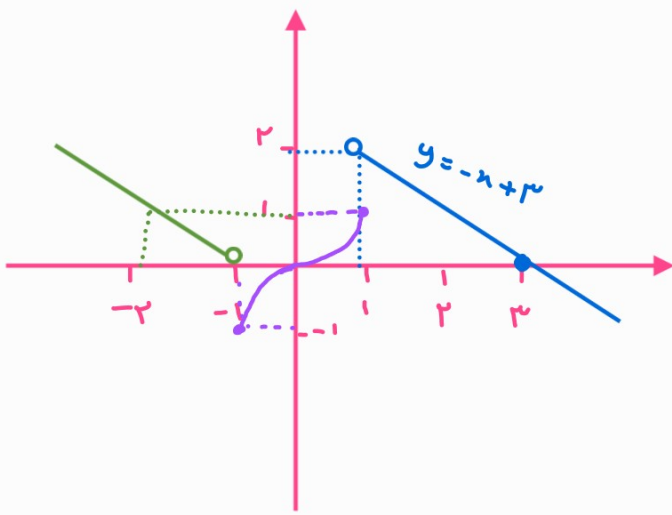
$y = \frac{n^4 - n^2}{n^2 + n + 2} = \frac{n^2(n^2 - 1)}{n^2 + n + 2} = \frac{n^2(n-1)(n+1)}{n^2 + n + 2}$

صفر منفی $\leftarrow$ $n^2(n-1)(n+1)$

صفر مثبت $\leftarrow$ $n^2 + n + 2$

-1	*	0	-
+	-	-	+

۴-



۹- الف) $y = \frac{x^3 - 3x + 2}{x - 3}$ $\rightarrow$ $= \frac{(x-1)(x^2 + x - 2)}{x - 3} = \frac{(x-1)(x+2)(x-1)}{x - 3}$

مجموعه این صفرات پس بر $x-1$ منقسم پذیرات!

-2	*	3
+	-	-
+	-	+