

$$\text{الف) } \underbrace{x^2 - 5x - 4 = 0}_x \rightarrow x^2 - 5x - 4 = (x-9)(x+5) = 0 \rightarrow \begin{cases} x_1 = \frac{9}{4} = \frac{9}{4} \\ x_2 = \frac{-5}{4} = -\frac{5}{4} \end{cases}$$

$$\text{ب) } \underbrace{3x^2 - 11x - 4 = 0}_x \rightarrow x^2 - 11x - 4 = (x-9)(x+1) = 0 \rightarrow \begin{cases} x_1 = \frac{9}{3} = 3 \\ x_2 = \frac{-1}{3} \end{cases}$$

$$\text{ج) } \underbrace{5x^2 - 8x - 3 = 0}_x \rightarrow x^2 - 8x - 12 = (x-6)(x+2) = 0 \rightarrow \begin{cases} x_1 = \frac{6}{5} = \frac{6}{5} \\ x_2 = \frac{-2}{5} = -\frac{2}{5} \end{cases}$$

$$\text{د) } \underbrace{2x^2 - 5x - 12 = 0}_x \rightarrow x^2 - 5x - 12 = (x-1)(x+3) = 0 \rightarrow \begin{cases} x_1 = \frac{1}{2} = \frac{1}{2} \\ x_2 = \frac{-3}{2} = -\frac{3}{2} \end{cases}$$

$$\text{الف) } x^2 - 5x - 12 = (x-7)(x+2) = 0 \rightarrow x_1 = 7, x_2 = -2$$

$$\text{ب) } 2x^2 + 5x + 3 = 0 \xrightarrow{a+c=b} x_1 = -1, x_2 = -\frac{c}{a} = -\frac{3}{2}$$

$$\text{ج) } x^2 + 2x + 3 = 0 \rightarrow \Delta = b^2 - 4ac = 4 - 12 = -8 < 0 \rightarrow \text{ریشه حقیقی ندارد}$$

$$\text{د) } 3x^2 + 2x - 2 = 0 \rightarrow x = \frac{-b \pm \sqrt{\Delta}}{2a} = \frac{-2 \pm \sqrt{4 + 24}}{6} \rightarrow x_1 = \frac{-2 + \sqrt{28}}{6}, x_2 = \frac{-2 - \sqrt{28}}{6}$$

$$A = \{1, 2, 3\} \quad B = \{2, 3\}$$

$$A \times B = \{(1, 2), (1, 3), (2, 2), (2, 3), (3, 2), (3, 3)\} \quad B^c = \{(2, 2), (2, 3), (3, 2), (3, 3)\}$$

$$A \times B - B^c = \{(1, 2), (1, 3)\}$$

$$\text{الف) } f(x) = \{(3, m^2), (2, 1), (-3, m), (-2, m), (3, m+2), (m, 4)\}$$

$$m^2 = m + 2 \rightarrow m^2 - m - 2 = (m-2)(m+1) = 0 \rightarrow \begin{matrix} m_1 = 2 \\ \text{غلط} \end{matrix}, \begin{matrix} m_2 = -1 \\ \checkmark \end{matrix}$$

$$\text{ب) } g(x) = \{(3, m^2), (2, 1), (m, 4), (3, m+2), (-2, m), (-1, 3)\}$$

$$m^2 = m + 2 \rightarrow \begin{matrix} m_1 = 2 \\ \text{غلط} \end{matrix}, \begin{matrix} m_2 = -1 \\ \text{غلط} \end{matrix}$$

$$f(x) = \{(1, a^2), (1, 3a-2), (a^2, 3a+2)\}$$

$$a^2 = 3a-2 \rightarrow a^2 - 3a + 2 = 0 \xrightarrow{\text{جمع فاکتور}} (a-1)(a-2) = 0 \rightarrow a=1, a=2$$

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$$f(x) = \begin{cases} x^2-1 & x \leq 1 \\ ax+b & 1 \leq x \leq 2 \\ x^2 & x \geq 2 \end{cases}$$

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$$\left. \begin{array}{l} \text{if } x=1 \rightarrow 1-1 = a+b \Rightarrow a+b=0 \\ \text{if } x=2 \rightarrow 2^2 = 2a+b \Rightarrow 2a+b=4 \end{array} \right\} a=-1, b=1 \rightarrow ax+b = -x+1$$

$$f(x) = \begin{cases} 2x-3 & x \geq k \\ \varepsilon-3x & x \leq k \end{cases}$$

$$2k-3 = \varepsilon-3k \rightarrow 5k = \varepsilon+3 \rightarrow k = \frac{\varepsilon+3}{5}$$

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چون y با x نزد است $\rightarrow$ تابع نیست X $y^3 - 9y = x^2 - 4x + 3$ الف

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ب) $|x| + |y| = 3$ $\rightarrow$ مثال حقیقی: $x=1 \rightarrow y = \pm 2$ X تابع نیست

ج) $|y| = \sqrt{1 - \cos x}$ $\rightarrow$ مثال حقیقی: $x=90^\circ \rightarrow \cos x = 0 \rightarrow y = \pm 1$ X تابع نیست

د) $y^2 + x^2 + 2x + 1 = 0 \rightarrow y^2 + (x+1)^2 = 0$ به انی اعداد حقیقی، سمت چپ همیشه

منفی یا 0 است. $(-1, 0)$: تابع یک نقطه $\rightarrow$ تابع است $\checkmark$

الف) $\sqrt[3]{y} + x^2 = 2x-2 \rightarrow \sqrt[3]{y} = -x^2 + 2x-2$

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$$\left. \begin{array}{l} \sqrt[3]{y_1} = -x_1^2 + 2x_1 - 2 \\ \sqrt[3]{y_2} = -x_2^2 + 2x_2 - 2 \end{array} \right\} \xrightarrow{x_1=x_2} \sqrt[3]{y_1} = \sqrt[3]{y_2} \rightarrow y_1 = y_2 \quad \checkmark \text{ تابع است}$$

ب) $y^2 + 2y = 5x$

$$\left. \begin{array}{l} y_1^2 + 2y_1 = 5x_1 \\ y_2^2 + 2y_2 = 5x_2 \end{array} \right\} \xrightarrow{x_1=x_2} y_1^2 + 2y_1 = y_2^2 + 2y_2 \rightarrow y_1^2 - y_2^2 = 2y_2 - 2y_1$$

$$\rightarrow (y_1 - y_2)(y_1 + y_2 + 2) + 2(y_1 - y_2) = 0 \rightarrow (y_1 - y_2)(y_1 + y_2 + y_2 + 2) = 0$$

$$\rightarrow \left\{ \begin{array}{l} y_1 - y_2 = 0 \rightarrow y_1 = y_2 \\ y_1^2 + y_1(y_2 + 2) + y_2^2 + 2 = 0 \rightarrow \Delta = y_2^2 - 4(y_2 + 2) = y_2^2 - 4y_2 - 8 = -3y_2 - 8 < 0 \end{array} \right. \quad \checkmark \text{ تابع است}$$

۷ هر عددی می تواند باشد $\rightarrow$ if $x=0$ تابع نیست $x \sin y = y \sin x$ (الف)

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$$\rightarrow \sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} = 2 \quad \text{if } \sqrt{\frac{x}{y}} = a \quad \rightarrow a + \frac{1}{a} = 2 \rightarrow a^2 - 2a + 1 = 0$$

$$\rightarrow (a-1)^2 = 0 \rightarrow a = 1$$

$$\rightarrow \sqrt{\frac{x}{y}} = 1 \rightarrow \frac{x}{y} = 1 \rightarrow x = y \quad \checkmark \text{ تابع است}$$

به ازای $(x > 0)$ فقط یک y داریم