1

ب) $\lim_{x \to 2^-} F_{x-2}$ ⇒ الف) $\lim_{x \to 2^+} F_{x-2}$

$\lim_{x \to 2^-} F(2^-) - 2 = 8^- - 2 = 6^- = \boxed{6}$ ✓ $\lim_{x \to 2^+} F(2^+) - 2 = 8^+ - 2 = 6^+ = \boxed{6}$

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2

ب) $\lim_{x \to 2^-} F[x] - 2$ الف) $\lim_{x \to 2^+} F[x] - 2$

$\lim_{x \to 2^-} F[1,\omega] - 2 = 4 - 2 = \boxed{1}$ ✓ $\lim_{x \to 2^+} F[2,0] - 2 = F(2) - 2 = \boxed{0}$

---

3

ب) $\lim_{x \to 2^-} [F_{x-2}]$ الف) $\lim_{x \to 2^+} [F_{x-2}]$

$\lim_{x \to 2^-} [F(2)^- - 2] = [8^- - 2]$ ✓ $\lim_{x \to 2^+} [F(2^+) - 2] = [8^+ - 2]$

$\lim_{x \to 2^-} [6^-] = \boxed{5}$ $\lim_{x \to 2^+} [6^+] = \boxed{6}$

---

4

ب) $[\lim_{x \to 2^-} F_{x-2}]$ الف) $[\lim_{x \to 2^+} F_{x-2}]$

$[\lim_{x \to 2^-} F_{x-2}] = [F(2) - 2] = \boxed{6}$ ✓ $[\lim_{x \to 2^+} F_{x-2}] = [F(2^+) - 2] = \boxed{6}$

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5

ب) $\lim_{x \to 2^-} \frac{F_{x-2}}{(x-2)^2} = \frac{9}{(0^-)^2}$ (حد ندارد) الف) $\lim_{x \to 2} \frac{F_{x-2}}{x-2} = \frac{9}{0^2}$ (حد ندارد)

$\lim_{x \to 2^-} \frac{F_{x-2}}{(x-2)^2} = \frac{9}{(0^+)^2} = \boxed{+\infty}$ ✓ $\lim_{x \to 2^+} \frac{F_{x-2}}{x-2} = \frac{9}{0^+} = \boxed{+\infty}$

$\lim_{x \to 2^-} \frac{F_{x-2}}{(x-2)^2} = \frac{9}{(0^-)^2} = \boxed{+\infty}$ $\lim_{x \to 2^-} \frac{F_{x-2}}{x-2} = \frac{9}{0^-} = \boxed{-\infty}$

۵ الف) $\lim_{x\to 3} \frac{\sqrt{x-2}}{x^2-4x+3} = \frac{\sqrt{3-2}}{(3-3)(3-1)} = \frac{1}{0^+} = +\infty$

ب) $\lim_{x\to 3^+} \frac{\sqrt{x-2}}{x^2-4x+3} = \frac{1}{0^+} = +\infty$

پ) $\lim_{x\to 3^-} \frac{\sqrt{x-2}}{x^2-4x+3} = \frac{1}{0^-} = -\infty$

۶ الف) $\lim_{x\to 2^+} \frac{\sqrt{x-2}}{x^2-4x+3} = \frac{0}{(2-3)(2-1)} = 0$

ب) $\lim_{x\to 2^+} \frac{\sqrt{x-2}}{x^2-4x+3} = \frac{0}{0^-} = -\infty$

پ) $\lim_{x\to 2^-} \frac{\sqrt{x-2}}{x^2-4x+3} = \frac{0}{0^+} = +\infty$

۷ الف) $\lim_{x\to 3} \frac{x-3}{x^2-7x+12} = \frac{x-3}{(x-3)(x-4)} = \frac{1}{0^-}$

$\lim_{x\to 3^+} \frac{x-3}{x^2-7x+12} = \frac{1}{0^-} = -\infty$

ب) $\lim_{x\to 3} \frac{x-3}{[x-3]} \Rightarrow$ دارای وجود حدی (حد ندارد)

$\lim_{x\to 3^+} \frac{x-3}{[x-3]} = \frac{1}{0^+} = +\infty$

$\lim_{x\to 3^-} \frac{x-3}{[x-3]} = \frac{1}{-1} = -1$

۸ الف) $\lim_{x\to 3} [x] + [-x]$ (حد ندارد) دارای وجود حدی

$\lim_{x\to 3^+} [x] + [-x] \Rightarrow x > 3 \Rightarrow \begin{cases} x > 3 \\ -x < -3 \end{cases}$

$\Rightarrow [3,0] + [-3,0] = 3 - 4 = -1$

$\lim_{x\to 3^-} [x] + [-x] \Rightarrow x < 3 \Rightarrow \begin{cases} x < 3 \\ -x > -3 \end{cases}$

$\Rightarrow [2,0] + [-2,0] = 2 - 3 = -1$

ب) $\lim_{x\to -3} [-x] + [x]$ (حد ندارد)

$\lim_{x\to -3^+} [-x] + [x] \Rightarrow x > -3 \Rightarrow \begin{cases} x > -3 \\ -x < 3 \end{cases}$

$[2,0] + [-2,0] = 2 - 3 = -1$

$\lim_{x\to -3^-} [-x] + [x] \Rightarrow x < -3 \Rightarrow \begin{cases} x < -3 \\ -x > 3 \end{cases}$

$[3,0] + [-3,0] = 3 - 4 = -1$

۹ الف) $\lim_{x\to 2} [x^2 - 4x]$ دارای وجود حدی

$\lim_{x\to 2^+} [x^2-4x] = [x(x-4)] = [2,1(2,1-4)]$

$= [-3,99] = -4$

$\lim_{x\to 2^-} [x^2-4x] = [x(x-4)] = [1,9(1,9-4)]$

$= [-3,99] = -4$

ب) $\lim_{x\to 2} [4x - x^2]$ (حد ندارد)

$\lim_{x\to 2^+} [4x-x^2] = [x(4-x)] = [2,1(4-2,1)]$

$= [1,99] = 1$

$\lim_{x\to 2^-} [4x-x^2] = [x(4-x)] = [2,9(4-2,9)]$

$= [1,99] = 1$

۱۰ الف) $\lim_{x\to 2} \frac{|x-2|}{x^2-3x+2}$ (حد ندارد)

$\lim_{x\to 2^+} \frac{|x-2|}{(x-2)(x-1)}$

$\lim_{x\to 2^+} \frac{(x-2)}{(x-2)(x-1)} = \frac{1}{x-1} = \frac{1}{2-1} = 1$

$\lim_{x\to 2^-} \frac{|x-2|}{(x-2)(x-1)}$

$\lim_{x\to 2^-} \frac{-(x-2)}{(x-2)(x-1)} = \frac{-1}{x-1} = \frac{-1}{2-1} = -1$

ب) $\lim_{x\to 1} \frac{x-[x]}{x^2-1}$ (حد ندارد) مخرج صفر می‌شود.

$\lim_{x\to 1^+} \frac{x-1}{(x-1)(x+1)} = \frac{1}{x+1} = \frac{1}{2}$

$\lim_{x\to 1^-} \frac{x-0}{(x-1)(x+1)} = \frac{1}{0^-} = -\infty$