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الف) $\lim_{n \rightarrow 2^+} \frac{2n+8}{n+1} = \frac{2(2)+8}{2+1} = \frac{9}{3} = 3$

ب) $\lim_{n \rightarrow 2^-} \frac{2n+8}{n+1} = \frac{2(2)+8}{2+1} = \frac{9}{3} = 3$

ج) $\lim_{n \rightarrow 2} \frac{2n+8}{n+1} = \frac{2(2)+8}{2+1} = \frac{9}{3} = 3$

د) $\lim_{n \rightarrow 0} \frac{2n+7}{[n^2]}$
 $\xrightarrow[n \rightarrow 0^+]{n > 0} \frac{2n+7}{0^+} = \frac{7}{0^+} = \infty$
 $\xrightarrow[n \rightarrow 0^-]{n < 0} \frac{2n+7}{0^+} = \frac{7}{0} = \infty$

چون مقدار ندارد

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الف) $\lim_{n \rightarrow 2^-} f[n] - 2 \rightarrow [n] = 2$
 $f \times 2 - 2 = 4$

ب) $\lim_{n \rightarrow 2^-} [2n-2] = [4(2)-2] = [10^-] = 9$

ج) $\left[\lim_{n \rightarrow 2^-} 2n-2 \right] = [10] = 10$
 $f(2) - 2 = 10$

د) $\left[\lim_{n \rightarrow 2^+} 2n-2 \right] = [10] = 10$

الف) $\lim_{n \rightarrow 2} \frac{2[n]+1}{2} = \frac{2[2^-]+1}{2} = \frac{(2 \times 1)+1}{2} = \frac{3}{2}$

ب) $\lim_{n \rightarrow 2} \left[\frac{2n+1}{2} \right] = \left[\frac{2 \times 2^-+1}{2} \right] = [0^-] = 0$

ج) $\left[\lim_{n \rightarrow 2^-} \frac{2n+1}{2} \right] = [0] = 0$

د) $\left[\lim_{n \rightarrow 2^+} \frac{2n+1}{2} \right] = [0] = 0$

ملاحظه می‌شود

$\lim_{n \rightarrow 2} \frac{2(2)+1}{2} = 0$

الف) $\lim_{n \rightarrow 1} \frac{n-5}{n^2-4n+8} = \frac{n-5}{(n-1)(n-8)}$
 $\xrightarrow[n \rightarrow 1^+]{1^+} \frac{1-5}{0^-} = +\infty$
 $\xrightarrow[n \rightarrow 1^-]{1^-} \frac{1-5}{0^+} = -\infty$

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ب) $\lim_{n \rightarrow 3} \frac{n-4}{n^2-9n+9} = \frac{n-4}{(n-3)(n-3)}$
 $\xrightarrow[n \rightarrow 3^+]{1^+} \frac{3-4}{0^+} = \frac{-1}{0^+} = -\infty$
 $\xrightarrow[n \rightarrow 3^-]{1^-} \frac{3-4}{0^+} = \frac{-1}{0^+} = -\infty$

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$$الف) \lim_{x \rightarrow 2^+} [-3x] - [5x] =$$

$$\begin{array}{l} x \rightarrow 2^+ \\ x > 2 \\ 3x > 6 \\ -3x < -6 \\ [3x] = 6 \\ [5x] = 10 \end{array}$$

$$\begin{array}{l} [-3x] = 6 \\ \lim_{x \rightarrow 2^+} [-3x] - [5x] \\ [5x] = 10 \\ = 6 - 10 = -4 \end{array}$$

$$ب) \lim_{x \rightarrow -\frac{1}{4}^-} \left[\frac{-1}{x^4} \right]$$

$$x \rightarrow -\frac{1}{4}^-$$

$$x < -\frac{1}{4}$$

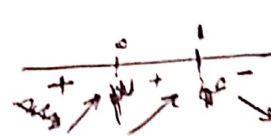
$$\frac{1}{x} > -4 \rightarrow \frac{1}{x^4} < 16$$

$$\frac{-1}{x^4} > -16$$

$$\lim_{x \rightarrow (-\frac{1}{4})^-} \left[\frac{-1}{x^4} \right] = [-16^+] = -16$$

$$ج) \lim_{x \rightarrow 1} [x^3 - x^2 + x]$$

$$\rightarrow \text{منقح} \rightarrow f'(x) = -12x^2 + 12x - 12x(x-1)$$



$$x = 1 \rightarrow f(1) - f(1) + 1 = 1$$

$$[f^-] = 1$$

$$د) \lim_{x \rightarrow 0} [x^3 - x^2 + x]$$

$$x \rightarrow 0$$

$$\text{منقح} \rightarrow f'(x) = -12x^2 + 12x - 12x(x-1)$$

$$x = 0 \Rightarrow f(0) - f(0) + 0 = 0$$

$$[f^+] = 0$$

$$\lim_{x \rightarrow 2} \frac{|x^3 - 1|}{x^2 - 4}$$

حل اول

$$x \rightarrow 2^+$$

$$\frac{x^3 - 1}{x^2 - 4} = \frac{(2)^3 - 1}{(2)^2 - 4} = \frac{7}{0}$$

$$\text{Hop} \rightarrow \frac{3x^2}{2x} = \frac{3(2)}{2(2)} = \frac{3}{2}$$

$$x \rightarrow 2^-$$

$$\frac{-(x^3 - 1)}{x^2 - 4}$$

$$= \frac{-(x^3 - 1)(x^2 + 4x + 4)}{(x^2 - 4)(x^2 + 4x + 4)} = \frac{-12}{4} = -3$$

نتیجه

$$ه) \lim_{x \rightarrow 0} \frac{|\sin x|}{\sin x}$$

$$x \rightarrow 0^+$$

$$\frac{-\sin x}{x \sin x \cos x} = \frac{-1}{x \cos x} = \frac{-1}{x(-1)} = \frac{1}{x}$$

نتیجه

$$x \rightarrow 0^-$$

$$\frac{\sin x}{x \sin x \cos x} = \frac{1}{x \cos x} = \frac{1}{x(-1)} = -\frac{1}{x}$$

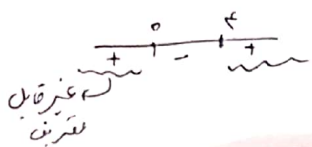
الف) $\lim_{x \rightarrow \frac{\pi}{2}} \sqrt{\cos x}$

$x \rightarrow \frac{\pi}{2}^+ \quad \cos x > 0$
 $\sqrt{0^+} = 0$
 $x \rightarrow \frac{\pi}{2}^- \quad \cos x < 0$
 $\sqrt{0^-} \rightarrow 0$

حد ندارد

ب) $\sqrt{x-2\sqrt{x}}$ $\Rightarrow$ $x \rightarrow 0^+$ $\frac{0^+}{0^+}$ تقریب شده حد ندارد

فرض کنیم $x > 0$
 زیر رادیکال با هم جمع
 $x - 2\sqrt{x} > 0$
 $\sqrt{x}(\sqrt{x} - 2) > 0$

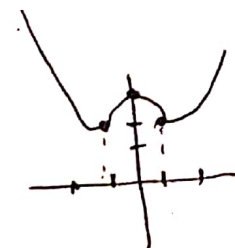
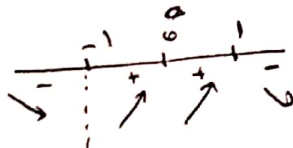


الف) $\frac{(-1)^{[\sin x]}}{x^3 - x^2} = \frac{1}{x^2 - x^2} = \frac{1}{x^2(x-1)} = \frac{1}{0^-} = -\infty$ حد ندارد

ب) $\frac{x^2 - [x^2]}{x - [x]}$
 $x \rightarrow 2$
 $x > 2 \rightarrow \frac{x^2 - 4}{x - 2} = \frac{(x-2)(x+2)}{(x-2)} = x+2 = 4$
 $x < 2 \rightarrow \frac{x^2 - 4}{x - 2} = \frac{4 - x^2}{2 - x} = \frac{(2-x)(2+x)}{(2-x)} = 2+x = 4$

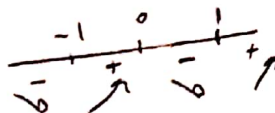
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$y = 6x^3 - 4x^2 + x \rightarrow y' = -12x^2 + 8x = -12x^2 \frac{(x^2+1)}{(x-1)(x+1)}$



$x=1 \rightarrow y = 6(1) - 4(1) + 1 = 3$
 $x=0 \rightarrow y = 6(0) - 4(0) + 0 = 0$
 $x=-1 \rightarrow y = 6(-1) - 4(-1) + (-1) = -1$

ج) $y = x^3 - 2x^2 + x \rightarrow y' = 3x^2 - 4x = 3x(x-1)$ ($x \neq 1$)



$x=1 \rightarrow y = 1 - 2 + 1 = 0$
 $x=0 \rightarrow y = 0 - 0 + 0 = 0$
 $x=-1 \rightarrow y = -1 - 2 - 1 = -4$