

الف) $\lim_{x \rightarrow 2^+} \frac{x+5}{x+1} = \frac{7}{3} = 3$

ب) $\lim_{x \rightarrow 2} \frac{x+5}{x+1} = 3$

ج) $\lim_{x \rightarrow 2^-} \frac{x+5}{x+1} = 3$

د) $\lim_{x \rightarrow 0} \frac{x+1}{[x]^2} \xrightarrow{x \rightarrow 0^+} \frac{1}{[0]^2} = \frac{1}{0^+} = +\infty$

الف) $\lim_{x \rightarrow 3^-} f[x] - 2 = f[3^-] - 2 = f(2) - 2 = 4$

ب) $\lim_{x \rightarrow 3^-} [f(x) - 2] = [12 - 2] = [10] = 9$

ج) $\lim_{x \rightarrow 3^-} [f(x) - 2] = 10$ د) $\lim_{x \rightarrow 3^+} [f(x) - 2] = 10$

الف) $\lim_{x \rightarrow 3^-} \frac{3[x] + 1}{x} = \frac{3[3^-] + 1}{3} = \frac{3(2) + 1}{3} = \frac{7}{3}$

ب) $\lim_{x \rightarrow 3^-} \left[\frac{3x+1}{x} \right] = \left[\frac{10}{3} \right] = [5] = 5$

ج) $\lim_{x \rightarrow 3^-} \left[\frac{3x+1}{x} \right] = 5$ د) $\lim_{x \rightarrow 3^+} \left[\frac{3x+1}{x} \right] = 5$

الف) $\lim_{x \rightarrow 1} \frac{x-5}{x^2-4x+5} = \lim_{x \rightarrow 1} \frac{1}{x-1} \xrightarrow{x \rightarrow 1^+} \lim_{x \rightarrow 1^+} \frac{1}{x-1} = \frac{1}{0^+} = +\infty$

$\xrightarrow{x \rightarrow 1^-} \lim_{x \rightarrow 1^-} \frac{1}{x-1} = \frac{1}{0^-} = -\infty$ حد ندارد

ب) $\lim_{x \rightarrow 3} \frac{x-4}{x^2-4x+9} = \lim_{x \rightarrow 3} \frac{x-4}{(x-2)^2} \xrightarrow{x \rightarrow 3^+} \lim_{x \rightarrow 3^+} \frac{-1}{0^+} = -\infty$ حد ندارد

$\xrightarrow{x \rightarrow 3^-} \lim_{x \rightarrow 3^-} \frac{-1}{0^+} = -\infty$

الف) $\lim_{x \rightarrow -3} [-2x] - [5x] \rightarrow \lim_{x \rightarrow -3^+} [-2x] - [5x] \xrightarrow{x > -3 \rightarrow -2.9 \rightarrow [x] = -3}$ $1 - (-15) = 16$

$\xrightarrow{x < -3 \rightarrow -3.1 \rightarrow [x] = -4}$ $9 - (-14) = 23$ حد ندارد

در این صحت و راست برابر نیست

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

$x < -\frac{1}{4} \rightarrow x^4 > \frac{1}{16} \rightarrow \frac{1}{x^4} < 16 \rightarrow \frac{1}{x^4} > -14 \rightarrow \lim_{x \rightarrow (-\frac{1}{4})^-} \left[\frac{1}{x^4} \right] = [-14] = -14$

الف) $\lim_{x \rightarrow 1} [4x^3 - 3x^2 + 3]$

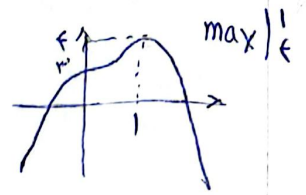
$y = 4x^3 - 3x^2 + 3$

$4-1=3$ است پس در آن $x=1$ max

$y' = 12x^2 - 6x \rightarrow 12x^2(1-2) = 0$



$\lim_{x \rightarrow 1} [4x^3 - 3x^2 + 3] = 3$



ب) $\lim_{x \rightarrow 0} [4x^3 - 3x^2 + 3]$

$\lim_{x \rightarrow 0^+} = 3$ و $\lim_{x \rightarrow 0^-} = 2$

وقتی $x \rightarrow 0$ حد ندارد

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

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

حد ندارد

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

ب) $\lim_{x \rightarrow \pi} \frac{|\sin x|}{\sin x}$

$\lim_{x \rightarrow \pi^+} \frac{-\sin x}{\sin x \cos x} = \lim_{x \rightarrow \pi^+} \frac{-1}{\cos x} = \frac{-1}{-1} = \frac{1}{1}$

حد ندارد

$\lim_{x \rightarrow \pi^-} \frac{\sin x}{\sin x \cos x} = \lim_{x \rightarrow \pi^-} \frac{1}{\cos x} = \frac{1}{-1} = -1$

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

$\lim_{x \rightarrow \frac{\pi}{2}^+} \sqrt{\cos x} = \sqrt{0^+} = 0^+$

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$\lim_{x \rightarrow \frac{\pi}{2}^-} \sqrt{\cos x} = \sqrt{0^-} = 0^-$

زیرادفایان منفی می شود

ب) $\lim_{x \rightarrow 0} \sqrt{x-2\sqrt{x}}$

$\lim_{x \rightarrow 0^+} \sqrt{x-2\sqrt{x}} = \sqrt{0^+ - 2 \cdot 0^+} = \sqrt{-0^+} = 0^-$

با جابجایی حد ندارد

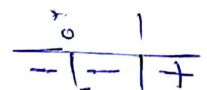
$\lim_{x \rightarrow 0^-} \sqrt{x-2\sqrt{x}} = 0^-$

حد صغیر و راست تن است در حد ندارد

الف) $\lim_{x \rightarrow 1} \frac{(-1)^{\lfloor \sin x \rfloor}}{x^2 - 2x}$

$\lim_{x \rightarrow 1^+} \frac{(-1)^0}{x^2(x-1)} = \frac{1}{0^-} = -\infty$

حد ندارد



ب) $\lim_{x \rightarrow 2} \frac{x^2 - [x^2]}{x - [x]}$

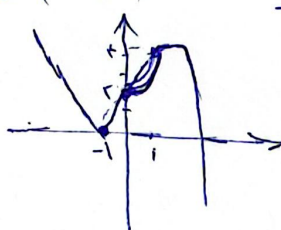
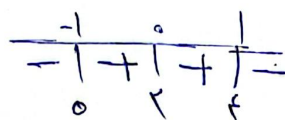
$\lim_{x \rightarrow 2^+} \frac{x^2 - [x^2]}{x - [x]} = \lim_{x \rightarrow 2^+} \frac{x^2 - 4}{x - 2} = \lim_{x \rightarrow 2^+} (x+2) = 4$

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$\lim_{x \rightarrow 2^-} \frac{x^2 - [x^2]}{x - [x]} = \lim_{x \rightarrow 2^-} \frac{x^2 - 1}{x - 1} = 1$

الف) $y = 5x^3 - 3x^2 + 2 \rightarrow y' = 15x^2 - 6x$

$15x^2(1-x) = 0$



ب) $y = x^4 - 2x^2 + 2$

$y' = 4x^3 - 4x$

$4x(x^2 - 1) = 0$

