

الف) $\lim_{x \rightarrow 2^+} \frac{2x+2}{x+1} \rightarrow \frac{6}{3} = \textcircled{3} \checkmark$

ب) $\lim_{x \rightarrow 2^-} \frac{2x+2}{x+1} \rightarrow \frac{6}{3} = \textcircled{3} \checkmark$

ج) $\lim_{x \rightarrow 2} \frac{2x+2}{x+1} \rightarrow \frac{6}{3} = \textcircled{3} \checkmark$

د) $\lim_{x \rightarrow 0} \frac{2x+7}{[x]}$

0^+	$\frac{7}{[0^+]} \rightarrow x$	$\checkmark$
0^-	$\frac{7}{[0^-]} \rightarrow x$	$\checkmark$

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

ب) $\lim_{x \rightarrow 2^-} [f[x] - 2] \rightarrow \textcircled{4} \checkmark$

ج) $\left[\lim_{x \rightarrow 2^-} f[x] - 2 \right] \rightarrow \textcircled{10} \checkmark$

د) $\left[\lim_{x \rightarrow 2^+} f[x] - 2 \right] \rightarrow \textcircled{10} \checkmark$

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

ب) $\lim_{x \rightarrow 2^-} \left[\frac{3x+1}{2} \right] \rightarrow \textcircled{5} \checkmark$

ج) $\left[\lim_{x \rightarrow 2^-} \frac{3x+1}{2} \right] \rightarrow \textcircled{5} \checkmark$

د) $\left[\lim_{x \rightarrow 2^+} \frac{3x+1}{2} \right] \rightarrow \textcircled{5} \checkmark$

الف) $\lim_{x \rightarrow 1} \frac{x-4}{x^2-4x+4} \rightarrow \frac{x-4}{(x-4)(x-1)} \rightarrow \frac{1}{x-1}$ $\begin{matrix} 1^+ \\ 1^- \end{matrix} \rightarrow \begin{matrix} \frac{1}{0^+} \rightarrow +\infty \\ \frac{1}{0^-} \rightarrow -\infty \end{matrix}$ حد ندارد ✓ (15)

ب) $\lim_{x \rightarrow 3} \frac{x-4}{x^2-4x+4} \rightarrow \frac{x-4}{(x-3)(x-3)}$ $\begin{matrix} 3^+ \\ 3^- \end{matrix} \rightarrow \begin{matrix} \frac{-1}{0^+} \rightarrow -\infty \\ \frac{-1}{0^-} \rightarrow +\infty \end{matrix}$ حد ندارد. (15)

الف) $\lim_{x \rightarrow -3} [-3x] - [4x]$ $\begin{matrix} -3^+ \\ -3^- \end{matrix} \rightarrow \begin{matrix} 1 - (-12) = 13 \\ 9 - (-12) = 21 \end{matrix}$ حد ندارد ✓ (15)

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

الف) $\lim_{x \rightarrow 1} [5x^3 - 3x^2 + 3] \rightarrow (3)$

$3x^3 + 5x^2 + 3 \xrightarrow[\text{مشتق برابر}]{\text{مشتق}} -12x^2 + 10x \rightarrow -12x^2(x-1)$

$\begin{matrix} 1^+ \\ 1^- \end{matrix} \rightarrow x=1 \rightarrow y=3$
 $[3^-] = (3)$ ✓

ب) $\lim_{x \rightarrow 0} [5x^3 - 3x^2 + 3] \rightarrow$ حد ندارد

$3x^3 + 5x^2 + 3 \xrightarrow[\text{مشتق برابر}]{\text{مشتق}} -12x^2 + 10x \rightarrow -12x^2(x-1)$

$\begin{matrix} 0^+ \\ 0^- \end{matrix} \rightarrow \begin{matrix} 3 \\ 3 \end{matrix}$
 $x=0 \rightarrow y=3 \rightarrow \begin{matrix} [3^+] = 3 \\ [3^-] = 3 \end{matrix}$ ✓

(V)

$$\text{a)} \lim_{x \rightarrow 2} \frac{|x^2 - 1|}{x^2 - 4} \rightarrow \frac{0}{0}$$

$$\xrightarrow{2^+} \frac{(x-2)(x+2)}{(x+2)(x-2)} \rightarrow \frac{1}{1} = 1$$

در حد

$$\xrightarrow{2^-} \frac{-(x-2)(x+2)}{(x-2)(x+2)} \rightarrow \frac{-1}{1} = -1$$

$$\text{ب)} \lim_{x \rightarrow \pi} \frac{|\sin x|}{\sin^2 x} \rightarrow \frac{0}{0}$$

$$\xrightarrow{\pi^+} \frac{-\sin x}{2 \sin x \cos x} \rightarrow \frac{-1}{-2} = \frac{1}{2}$$

در حد

$$\xrightarrow{\pi^-} \frac{\sin x}{2 \sin x \cos x} \rightarrow \frac{1}{-2} = -\frac{1}{2}$$

(A)

$$\text{a)} \lim_{x \rightarrow \frac{\pi}{2}} \sqrt{\cos x} \xrightarrow{\frac{\pi}{2}^+} \sqrt{0^+} \rightarrow 0$$

در حد

$$\xrightarrow{\frac{\pi}{2}^-} \cos x < 0 \rightarrow X$$

$$\text{ب)} \lim_{x \rightarrow 0} \sqrt{x-1} \sqrt{x} \xrightarrow{0^+} \sqrt{x} (\sqrt{x-1})$$

$$\xrightarrow{0^+} \frac{1}{\sqrt{x-1}} \rightarrow \infty = X$$

$$\xrightarrow{0^-} \infty = X$$

(9)

$$\text{a)} \lim_{x \rightarrow 0^+} \frac{(-1)^{[\sin x]}}{x^2 - x^2} \xrightarrow{[\sin x]} \sin x \rightarrow x \rightarrow \sin x = 0 \rightarrow (-1)^0 = 1$$

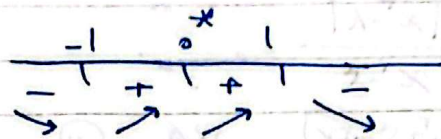
$$\rightarrow \frac{1}{0^-} \rightarrow -\infty$$

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

در حد

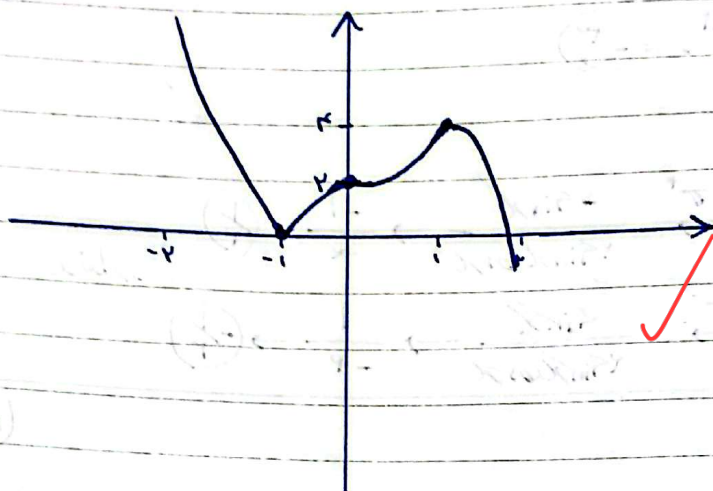
$$\xrightarrow{2^-} \frac{x^2 - 4}{x - 1} \rightarrow \frac{1}{1} = 1$$

الف) $y = 2x^3 - 3x^2 + 2$



(10)

$\rightarrow -3x^2 + 2x + 2 \xrightarrow{\text{مشتق}} -6x + 2 \rightarrow -2(3x - 1) \rightarrow -2(x-1)(x+1)$



ب) $y = x^3 - 2x^2 + 3 \xrightarrow{\text{مشتق}} 3x^2 - 4x \rightarrow x(3x - 4) \rightarrow x(x+1)(x-1)$

