

$$\text{الف) } \lim_{n \rightarrow p^+} \frac{pn + \omega}{n+1} = \frac{p \times p^+ + \omega}{p^+ + 1} = \frac{q^+}{p^+} = p$$

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$$\text{ب) } \lim_{n \rightarrow p^-} \frac{pn + \omega}{n+1} = \frac{p \times p^- + \omega}{p^- + 1} = \frac{q^-}{p^-} = p$$

$$\text{ج) } \lim_{n \rightarrow p} \frac{pn + \omega}{n+1} = \frac{q}{p} = p$$

$$\text{د) } \lim_{n \rightarrow 0} \frac{pn + v}{[n^p]} = \frac{v}{[0^+]} = \frac{v}{0} = \text{تعریف نشده}$$

$$\text{الف) } \lim_{n \rightarrow p^-} f[n] = p = f(p) - p = q$$

$$\text{ب) } \lim_{n \rightarrow p^+} [fn - p] = [10^-] = q$$

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$$\text{ج) } \left[\lim_{n \rightarrow p^-} fn - p \right] = [10] = 10$$

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

$$\text{الف) } \lim_{n \rightarrow p^-} \frac{p[n] + 1}{p} = \frac{p(p) + 1}{p} = \frac{v}{p}$$

$$\text{ب) } \lim_{n \rightarrow p^-} \left[\frac{pn + 1}{p} \right] = [\omega] = f$$

(۳)

$$\text{ج) } \left[\lim_{n \rightarrow p^-} \frac{pn + 1}{p} \right] = [\omega] = \omega$$

$$\text{د) } \left[\lim_{n \rightarrow p^+} \frac{pn + 1}{p} \right] = [\omega] = \omega$$

تعریف نشده است خارج

$$\text{الف) } \lim_{n \rightarrow 1} \frac{n - \omega}{n^2 - 4n + \omega} = \lim_{n \rightarrow 1} \frac{n - \omega}{(n-1)(n-\omega)}$$

$$n \rightarrow 1^+ \lim_{n \rightarrow 1^+} \frac{n - \omega}{n^2 - 4n + \omega} = \frac{-f}{0^-} = +\infty$$

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$$n \rightarrow 1^- \lim_{n \rightarrow 1^-} \frac{n - \omega}{n^2 - 4n + \omega} = \frac{-f}{0^+} = -\infty$$

تعریف نشده است خارج

$$\text{ب) } \lim_{n \rightarrow p} \frac{n - f}{n^2 - 4n + q} = \lim_{n \rightarrow p} \frac{n - f}{(n-p)^p}$$

$$n \rightarrow p^+ \lim_{n \rightarrow p^+} \frac{n - f}{n^2 - 4n + q} = \frac{-1}{0^+} = -\infty$$

$$n \rightarrow p^- \lim_{n \rightarrow p^-} \frac{n - f}{n^2 - 4n + q} = \frac{-1}{0^+} = -\infty$$

تعریف نشده است خارج

الف) $\lim_{x \rightarrow -\infty} [-x^3] - [\omega x] = \frac{-\infty^+}{-x^+} \rightarrow [9^-] - [1\omega^+] = 1 - (-1\omega) = 2\omega$ (د)
 درنار
 $\frac{-\infty^-}{-x^-} \rightarrow [9^+] - [-1\omega] = 9 - (-1\omega) = 2\omega$

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

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

الف) $\lim_{x \rightarrow 1} [x^3 - x^2 + x] \xrightarrow[\text{داخل عبارت}]{\text{مستقيم عبارت}} 1^3 - 1^2 + 1 = 1 - 1 + 1 = 1$ (د)
 مستقيم راس
 $\begin{array}{c} 0 \quad 1 \rightarrow \\ + \quad + \quad - \\ \uparrow \quad \uparrow \quad \downarrow \end{array}$

$x=1 \Rightarrow \lim_{x \rightarrow 1} [x^3] = \boxed{1}$

ب) $\lim_{x \rightarrow 0} [x^3 - x^2 + x] \xrightarrow[\text{داخل عبارت}]{\text{مستقيم عبارت}} 1^3 - 1^2 + 1 = 1 - 1 + 1 = 1$
 مستقيم راس
 $\begin{array}{c} 0 \quad 1 \\ + \quad + \quad - \\ \uparrow \quad \uparrow \quad \downarrow \end{array}$

$x=0 \Rightarrow \lim_{x \rightarrow 0} [x^3] = \boxed{0}$

الف) $\lim_{x \rightarrow 2} \frac{|x^2 - 1|}{x^2 - 4} \xrightarrow{2^+} \frac{\lim_{x \rightarrow 2^+} x^2 - 1}{x^2 - 4} = \frac{(2-1)(x^2 + x + 1)}{(x-2)(x+2)} = \frac{1}{4} = \frac{1}{4}$ (د)
 درنار

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

ب) $\lim_{x \rightarrow \pi} \frac{|\sin x|}{\sin x} \xrightarrow{\pi^+} \frac{-\sin x}{\sin x \cos x} = \frac{-1}{\cos x} = \frac{-1}{-1} = 1$
 درنار
 $\xrightarrow{\pi^-} \frac{\sin x}{\sin x \cos x} = \frac{1}{\cos x} = \frac{1}{-1} = -1$

۸) الف) $\lim_{x \rightarrow \frac{\pi}{2}} \sqrt{\cos x}$ $\xrightarrow{\frac{0}{0}}$ $\sqrt{0^+} = 0$ حد ندارد
 $\xrightarrow{\frac{0}{0}}$ $\sqrt{0^-}$ تعریف نشده

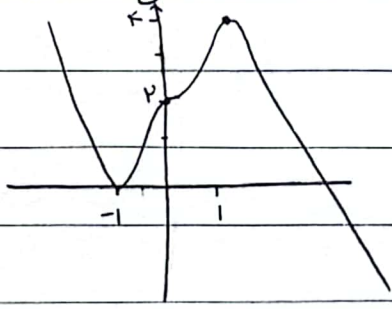
ب) $\lim_{x \rightarrow 0} \sqrt{x - 2\sqrt{x}}$ $\xrightarrow{0^+}$ $\sqrt{\sqrt{x}(\sqrt{x} - 2)}$ $\xrightarrow{\frac{0}{+1-1}}$ $\sqrt{0^-}$ حد ندارد
 $\xrightarrow{0^-}$ $\sqrt{x - 2\sqrt{x}}$ تعریف نشده

۹) الف) $\lim_{x \rightarrow 0^+} \frac{(-1)^{[\sin x]}}{2^x - 2^x} \xrightarrow{[0^+] = 0} \lim_{x \rightarrow 0^+} \frac{(-1)^0}{0^-} = \frac{1}{0^-} = -\infty$
 $\downarrow$
 $- \frac{0}{+} \mid - \mid +$

ب) $\lim_{x \rightarrow 2} \frac{2^x - [x^2]}{x - [x]}$ $\xrightarrow{0^+}$ $\frac{2^x - x}{x - 2} = \frac{(x-2)(x+2)}{(x-2)} = x$ حد ندارد
 $\xrightarrow{0^-}$ $\frac{2^x - x}{x - 1} = \frac{1}{1} = 1$

۱۰) الف) $y = \cos x - x \cos x + x$ $\xrightarrow{\text{مشتق}}$ $y' = -\sin x - \cos x + 1 = 1 - \sin x - \cos x$

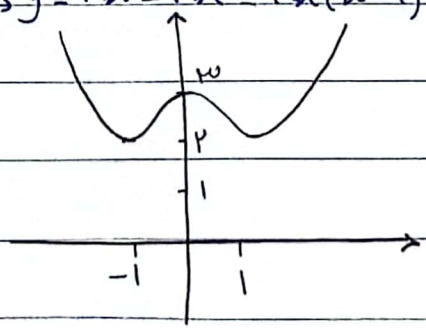
$x = -1 \rightarrow y = 0$ $x = 0 \rightarrow y = 2$
 $x = 1 \rightarrow y = 1$



$\begin{matrix} -1 & 0 & 1 \\ - & + & - \\ \downarrow & \uparrow & \downarrow \end{matrix}$

ب) $y = x^3 - 2x^2 + x$ $\xrightarrow{\text{مشتق}}$ $y' = 3x^2 - 4x + 1 = (3x-1)(x-1)$ $\xrightarrow{-1 \ 0 \ 1}$

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



$\begin{matrix} -1 & 0 & 1 \\ - & + & - \\ \downarrow & \uparrow & \downarrow \end{matrix}$