

الف) $\lim_{n \rightarrow r^+} \left(\frac{r_n + 5}{n+1} \right) = \frac{r(r) + 5}{r+1} = \frac{9}{2} = 4.5$

نصف ما -1

ب) $\lim_{n \rightarrow r^-} \left(\frac{r_n + 5}{n+1} \right) = \frac{r(r) + 5}{r+1} = 4.5$

ج) $\lim_{n \rightarrow r} \left(\frac{r_n + 5}{n+1} \right) = \frac{r(r) + 5}{r+1} = 4.5$

د) $\lim_{n \rightarrow 0} \frac{r_n + 7}{[n^2]} \xrightarrow{+} \frac{r(0) + 7}{[0^+]} = \frac{7}{0^+} = \infty$

$\xrightarrow{-} \frac{r(0) + 7}{[0^-]} = \frac{7}{0^-} = -\infty$

الف) $\lim_{n \rightarrow 3^-} \{n\} - 2$ $n < 3 \rightarrow [n] = 2$

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$= \{3\} - 2 = 1$ جواب

ب) $\lim_{n \rightarrow 3^-} \{n - 2\} = 1$ جواب

$n < 3 \rightarrow \{n\} < 3$
 $\{n - 2\} < 1$
 $\{n - 2\} = 0$

ج) $\left[\lim_{n \rightarrow 3^-} \{n - 2\} \right] \Rightarrow \lim_{n \rightarrow 3^-} \{n - 2\} = 1 \rightarrow [1] = 1$ جواب

د) $\left[\lim_{n \rightarrow 3^+} \{n - 2\} \right] \Rightarrow \lim_{n \rightarrow 3^+} \{n - 2\} = 1 \rightarrow [1] = 1$ جواب

الف) $\lim_{n \rightarrow 3^-} \frac{r[n]+1}{r} = \frac{r(3)+1}{r} = \left(\frac{7}{2}\right)$ جواب

نکته: $\frac{7}{2}$
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$n < 3 \rightarrow [n] = 2$

ب) $\lim_{n \rightarrow 3^-} \left[\frac{r_{n+1}}{r} \right] = \left(4 \right)$ جواب

نکته

$n < 3 \rightarrow r_n < 9 \rightarrow r_{n+1} < 10 \rightarrow \frac{r_{n+1}}{r} < 5 \rightarrow \left[\frac{r_{n+1}}{r} \right] = 4$

ج) $\left[\lim_{n \rightarrow 3^-} \frac{r_{n+1}}{r} \right] \rightarrow \lim_{n \rightarrow 3^-} \frac{r_{n+1}}{r} = \frac{r(3)+1}{r} = 5$
 $\left[\lim_{n \rightarrow 3^-} \frac{r_{n+1}}{r} \right] = [5] = \left(5 \right)$ جواب

د) $\left[\lim_{n \rightarrow 3^+} \frac{r_{n+1}}{r} \right] \rightarrow \lim_{n \rightarrow 3^+} \frac{r_{n+1}}{r} = \frac{r(3)+1}{r} = 5$
 $\left[\lim_{n \rightarrow 3^+} \frac{r_{n+1}}{r} \right] = [5] = \left(5 \right)$ جواب

الف) $\lim_{n \rightarrow 1} \frac{n-5}{n^2-4n+5} \rightarrow \frac{1-5}{1-4+5} = \frac{-4}{2} = -2$

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$n^2-4n+5 = (n-1)(n-5)$

$\lim_{n \rightarrow 1^+} \frac{1-5}{1-4+5} = \frac{-4}{2} = -2$
 $\lim_{n \rightarrow 1^-} \frac{1-5}{1-4+5} = \frac{-4}{2} = -2$

حد ندارد

$\frac{1}{+} \mid \frac{5}{-}$
 $+ \mid - \mid +$

ب) $\lim_{n \rightarrow 3} \frac{n-4}{n^2-4n+9} \rightarrow \frac{3-4}{9-12+9} = \frac{-1}{6} = -\frac{1}{6}$

$\lim_{n \rightarrow 3^+} \frac{3-4}{9-12+9} = \frac{-1}{6} = -\frac{1}{6}$
 $\lim_{n \rightarrow 3^-} \frac{3-4}{9-12+9} = \frac{-1}{6} = -\frac{1}{6}$

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$n^2-4n+9 \rightarrow (n-2)^2$
 همواره مثبت است

الف) $\lim_{n \rightarrow -3} [-3n] - [\Delta n]$

یکه
-2

$-3^+ \rightarrow n > -3 \rightarrow -3n < 9 \rightarrow [-3n] = 8$
 $n > -3 \rightarrow \Delta n > -15 \rightarrow [\Delta n] = -15$
 $8 - (-15) = 23$

د

$-3^- \rightarrow n < -3 \rightarrow -3n > 9 \rightarrow [-3n] = 9$
 $n < -3 \rightarrow \Delta n < -15 \rightarrow [\Delta n] = -16$
 $9 - (-16) = 25$

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ب) $\lim_{n \rightarrow (-\frac{1}{2})^-} [\frac{-1}{n^2}] \rightarrow n < -\frac{1}{2} \rightarrow n^2 > \frac{1}{4} \rightarrow \frac{1}{n^2} < 4$
 $\rightarrow \frac{-1}{n^2} > -4 \rightarrow [\frac{-1}{n^2}] = -4$

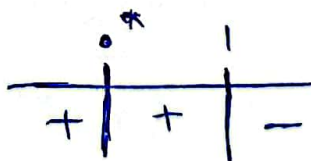
جواب

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

-4

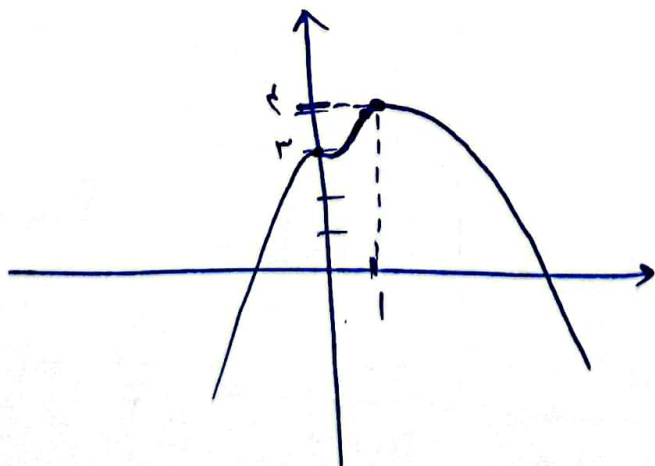
$y = n^3 - 3n^2 + 3$

$y' = 3n^2 - 6n = 3n(1-n)$



د

$\lim_{n \rightarrow 1^-}$ $\lim_{n \rightarrow 1^+}$



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

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

حد دارد

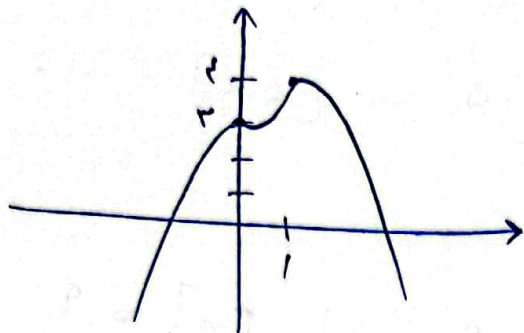
$$b) \lim_{n \rightarrow 0} [r n^r - r n^r + r]$$

محدود

$$y' = 1r n^r - 1r n^r = 1r n^r (1-n)$$

$$\begin{array}{c|c|c} & 0 & 1 \\ \hline + & + & - \end{array}$$

$$\left| \frac{1}{\epsilon} \right| \quad \left| \frac{1}{r} \right|$$



$$\lim [r n^r - r n^r + r] \xrightarrow{+} [r^+] = r$$

$$\xrightarrow{-} [r^-] = r$$

محدود

$$\lim_{n \rightarrow r} \frac{|n^r - 1|}{n^r - 1}$$

-V

$$\xrightarrow{r^+} n > r \rightarrow n^r > 1 \rightarrow n^r - 1 > 0 \rightarrow |n^r - 1| = n^r - 1$$

$$\rightarrow \lim_{n \rightarrow r} \frac{n^r - 1}{n^r - 1} = \frac{(n-r)(n^r + r n + 1)}{(n-r)(n+r)} = \frac{1+1+1}{1} = 3$$

$$\xrightarrow{r^-} n < r \rightarrow n^r < 1 \rightarrow n^r - 1 < 0 \rightarrow |n^r - 1| = 1 - n^r$$

$$\lim_{n \rightarrow r} \frac{1 - n^r}{n^r - 1} = \frac{(1-n)(1+n^r + r n)}{(n-r)(n+r)} = \frac{-1}{1} = -1$$

محدود

$$b) \lim_{n \rightarrow \infty} \frac{|\sin n|}{\sin n}$$

$$\xrightarrow{r^+} n > r \rightarrow \sin n < 0 \rightarrow |\sin n| = -\sin n$$

$$\lim_{n \rightarrow \infty} \frac{-\sin n}{\sin n} = \frac{-1}{1} = -1$$

نکته: $\xrightarrow{n^-} n < n \rightarrow \sin n > 0 \rightarrow |\sin n| = \sin n$

$$\lim_{n \rightarrow 2} \frac{\cancel{\sin x}}{\cancel{2 \sin n \cos n}} = \frac{1}{2 \cos n} = \frac{1}{2(-1)} = \left(\frac{-1}{2} \right) \text{ حد ندارد}$$

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

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$$\xrightarrow{\frac{\pi}{2}^+} n > \frac{\pi}{2} \rightarrow \cos n < 0 \rightarrow \lim_{n \rightarrow \frac{\pi}{2}^+} \sqrt{\cos n} = 0$$

حد ندارد

$$\xrightarrow{\frac{\pi}{2}^-} n < \frac{\pi}{2} \rightarrow \cos n > 0 \rightarrow \text{تعریف نشده است زیرا زیر رادیکال منفی شود.}$$

ب) $\lim \sqrt{n - 2\sqrt{n}} \rightarrow \sqrt{n - 2\sqrt{n}} = \sqrt{\sqrt{n}(\sqrt{n} - 2)} \rightarrow \frac{+}{+} \frac{+}{-} \frac{+}{+}$

$$\xrightarrow{0^+} \text{تعریف نشده است زیرا در ۰+، زیر رادیکال بزرگتر منفی شود.}$$

حد ندارد

$$\xrightarrow{0^-} \text{تعریف نشده است زیرا زیر رادیکال منفی شود.}$$

الف) $\lim_{n \rightarrow 0^+} \frac{(-1)^{[\sin n]}}{n^3 - n^2}$

$$n > 0 \rightarrow \sin n > 0$$

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$$[\sin n] = 0$$

$$\lim_{n \rightarrow 0^+} \frac{(-1)^0}{n^3 - n^2} = \frac{1}{0^-} = -\infty \text{ جواب}$$

$$n^3 - n^2 \rightarrow \frac{0^+}{-} \frac{+}{+} \frac{+}{+}$$

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

محدود

$$2^+ \rightarrow n > 2 \rightarrow n^2 > 4 \rightarrow [n^2] = 4 \quad [n] = 2$$

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

$$2^- \rightarrow n < 2 \rightarrow n^2 < 4 \rightarrow [n^2] = 3 \quad [n] = 1$$

$$\lim_{n \rightarrow 2^-} \frac{n^2 - 3}{n - 1} = \frac{4 - 3}{2 - 1} = 1$$

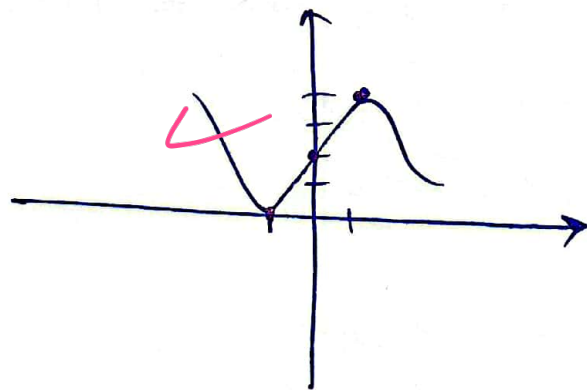
محدود

$$الف) y = 2n^3 - 3n^2 + 2$$

$$y' = 6n^2 - 6n = 6n^2(1 - n)$$

$$\begin{array}{c|c|c|c} -1 & 0 & 1 & \\ \hline - & + & + & - \end{array}$$

$$\begin{array}{c|c|c} 1 & 0 & -1 \\ \hline 2 & 2 & 0 \end{array}$$



د

$$ب) y = n^3 - 2n^2 + 3$$

$$y' = 3n^2 - 4n = 3n(n - \frac{4}{3})$$

$$\begin{array}{c|c|c|c} -1 & 0 & 1 & \\ \hline - & + & - & + \end{array}$$

$$\begin{array}{c|c|c} 1 & 0 & -1 \\ \hline 2 & 2 & 2 \end{array}$$

