

الف) $\lim_{n \rightarrow 2^+} \frac{2n+1}{n+1} = \frac{2 \times 2 + 1}{2+1} = \frac{5}{3} = \frac{5}{3}$ ✓

ب) $\lim_{n \rightarrow 2^-} \frac{2n+1}{n+1} = \frac{2 \times 2 + 1}{2+1} = \frac{5}{3} = \frac{5}{3}$ ✓

ج) $\lim_{n \rightarrow 2} \frac{2n+1}{n+1} = \frac{2 \times 2 + 1}{2+1} = \frac{5}{3} = \frac{5}{3}$ ✓

د) $\lim_{n \rightarrow 0} \frac{2n+1}{[n^2]} = \frac{2 \times 0 + 1}{[0^+]} = \frac{1}{0} = \infty$ ✓

الف) $\lim_{n \rightarrow 3^-} [2n] - 2 = [2 \times 3^-] - 2 = 4$ ✓

ب) $\lim_{n \rightarrow 3^-} [2n-2] = n < 3 \rightarrow 2n < 6 \rightarrow 2n-2 < 4 \Rightarrow [4^-] = 3$ ✓

ج) $\left[\lim_{n \rightarrow 3^-} (2n-2) \right] = \left[\lim_{n \rightarrow 3^-} 2 \times 3^- - 2 \right] = [4^-] = 3$ ✓

الف) $\lim_{n \rightarrow 3^-} \frac{[2n] + 1}{2} = \frac{[2 \times 3^-] + 1}{2} = \frac{[4^-] + 1}{2} = \frac{4}{2} = 2$ ✓

ب) $\lim_{n \rightarrow 3^-} \left[\frac{2n+1}{2} \right] = n < 3 \rightarrow 2n < 6 \rightarrow 2n+1 < 7 \rightarrow \frac{2n+1}{2} < \frac{7}{2} \Rightarrow \lim [] = 3$ ✓

ج) $\left[\lim_{n \rightarrow 3^-} \frac{2n+1}{2} \right] = \left[\lim_{n \rightarrow 3^-} \frac{2 \times 3^- + 1}{2} \right] = [4^-] = 3$ ✓

الف) $\lim_{n \rightarrow 1} \frac{n-1}{n^2-4n+4} = \frac{-1}{0^-} \xrightarrow{n \rightarrow 1^+} \frac{(n-1)(n-1)}{+|-|+} \Rightarrow \frac{-1}{0^-} = +\infty$ ✓

ب) $\lim_{n \rightarrow 1} \frac{n-1}{n^2-4n+4} = \frac{-1}{0^+} \xrightarrow{n \rightarrow 1^+} \frac{-1}{0^+} = -\infty$ ✓

الف) $\lim_{n \rightarrow -3} [-2n] - [10n] \xrightarrow{n \rightarrow -3^+} n > -3 \rightarrow -n < 3 \rightarrow -2n < 6$
 $\xrightarrow{n \rightarrow -3^-} n < -3 \rightarrow -n > 3 \rightarrow -2n > 6$
 $[9^-] - [-10^+] = +9 - (-10) = 19$
 $[9^+] - [-10^-] = 9 - (-10) = 19$ ✓

ب) $\lim_{n \rightarrow (-\frac{1}{2})^-} \left[\frac{1}{n^2} \right] = n < -\frac{1}{2} \rightarrow n^2 > \frac{1}{4} \rightarrow \frac{1}{n^2} < 4 \rightarrow \frac{1}{n^2} > -14 \rightarrow [-14^+] = -14$ ✓

الف) $\lim_{n \rightarrow 1} [2n^2 - 2n^2 + 2] \neq f'(n) = 4n - 4n^2 \quad 4n^2(1-n)$
 $= \lim_{n \rightarrow 1} [2] = 2$ ✓

ب) $\lim_{n \rightarrow 0} [2n^2 - 2n^2 + 2] \neq f'(n) = 4n - 4n^2 \quad 4n^2(1-n)$
 $\lim_{n \rightarrow 0^-} [2n^2 - 2n^2 + 2] = [2^-] = 2$ ✓

$\lim_{n \rightarrow 0^+} [2n^2 - 2n^2 + 2] = [2^+] = 2$ ✓

با توجه به تعیین علامت مشتق تابع منهای علامت این علامت را باید در علامت منهای علامت قرار داد.

با توجه به تعیین علامت مشتق آن منهای علامت را باید در علامت قرار داد.

الف) $\lim_{n \rightarrow r} \frac{n^r - 1}{n^r - r}$ $\xrightarrow{n \rightarrow r^+} \frac{n^r - 1}{n^r - r} = \frac{(n-r)(n^r + rn + \epsilon)}{(n-r)(n+r)} = \frac{1r}{r} = 1$ ✓

$n^r - 1 = (n-r)(n^r + rn + \epsilon)$ $\xrightarrow{n \rightarrow r^-} \frac{-(n^r - 1)}{n^r - r} = \frac{-(n-r)(n^r + rn + \epsilon)}{(n-r)(n+r)} = \frac{-1r}{r} = -1$ ✓

ب) $\lim_{n \rightarrow \pi} \frac{|\sin n|}{\sin 2n} = \frac{|\sin n|}{2 \sin n \cos n}$ $\xrightarrow{n \rightarrow \pi^+} \sin n < 0 \Rightarrow \frac{-\sin n}{2 \sin n \cos n} = \frac{-1}{2 \times (-1)} = \frac{1}{2}$ ✓
 $\xrightarrow{n \rightarrow \pi^-} \sin n > 0 \Rightarrow \frac{\sin n}{2 \sin n \cos n} = \frac{1}{2 \times (-1)} = -\frac{1}{2}$ ✓

الف) $\lim_{n \rightarrow \frac{\pi}{2}} \sqrt{\cos n}$ $\xrightarrow{n \rightarrow \frac{\pi}{2}^+} \sqrt{\cos(\frac{\pi}{2}^+)} = \sqrt{0^+} = 0$ ✓
 $\xrightarrow{n \rightarrow \frac{\pi}{2}^-} \sqrt{\cos(\frac{\pi}{2}^-)} = \sqrt{0^-} = 0$ ✓

ب) $\lim_{n \rightarrow 0} \sqrt{n - 2\sqrt{n}}$ $\xrightarrow{n \rightarrow 0^+} \sqrt{0^+ - 2\sqrt{0^+}} \Rightarrow 0$ ✓ $n - 2\sqrt{n} \geq 0 \Rightarrow n \geq 4 \Rightarrow n^r \geq \epsilon n$
 $\xrightarrow{n \rightarrow 0^+} \sqrt{0^+ - 2\sqrt{0^+}} \Rightarrow 0$ ✓ $n^r - \epsilon n \geq 0 \Rightarrow n \geq \frac{\epsilon}{1-\epsilon}$ ✓

الف) $\lim_{n \rightarrow 0^+} \frac{(-1)^{[\sin n]}}{n^r - n^r}$ $n > 0 \Rightarrow \sin n > 0 \Rightarrow [\sin n] = 0$ $\frac{(-1)^0}{0^-} = \frac{1}{0^-} = -\infty$ ✓

ب) $\lim_{n \rightarrow r} \frac{n^r - [n^r]}{n - [n]}$ $\xrightarrow{n \rightarrow r^+} n > r \rightarrow n^r > r \Rightarrow \frac{n^r - r}{n - r} = \frac{(n-r)(n+r)}{n-r} = n+r = r$ ✓
 $\xrightarrow{n \rightarrow r^-} n < r \rightarrow n^r < r \Rightarrow \frac{n^r - r}{n - r} = \frac{r - r}{r - r} = 1$ ✓

الف) $y = \omega n^r - 2n^\omega + r$ $y' = 1\omega n^{r-1} - 2\omega n^{\omega-1}$ $1\omega n^r(1-n^r)$ $\frac{-1}{-1} + \frac{0}{1} + \frac{1}{1} = 0$ ✓
 $f(-1) = 0$
 $f(0) = r$
 $f(1) = r$

ب) $y = n^r - 2n^r + r$ $y' = r n^{r-1} - 2r n^{r-1}$ $r n(n^r - 1)$ $\frac{-1}{-1} + \frac{0}{1} + \frac{1}{1} = 0$ ✓
 $f(-1) = f(1) = r$
 $f(0) = r$