

$$① \lim_{x \rightarrow r^+} \frac{r_{n+1}}{x+1} = \lim_{x \rightarrow r^+} \frac{9}{r} = r \quad \checkmark$$

$$ب) \lim_{x \rightarrow r^-} \frac{r_{n+1}}{x+1} = \lim_{x \rightarrow r^-} \frac{9}{r} = r \quad \checkmark$$

$$ج) \lim_{x \rightarrow r} \frac{r_{n+1}}{x+1} = \lim_{x \rightarrow r} \frac{9}{r} = r \quad \checkmark$$

$$د) \lim_{x \rightarrow 0} \frac{r_{n+1}}{[x]^2} = \lim_{x \rightarrow 0} \frac{r_{n+1}}{x^2} = \infty \quad \checkmark$$

$$⑤ \lim_{x \rightarrow r^-} f(x) - r = 9 \quad \lim_{x \rightarrow r^-} f(r) - r = 9 \quad \checkmark$$

$$\lim_{x \rightarrow r^-} [f(x) - r] = 9 \quad \lim_{x \rightarrow r^-} [1r] - r = 11 - r = 9 \quad \checkmark$$

$$\left[\lim_{x \rightarrow r^-} f(x) - r \right] = 10 \quad \checkmark$$

$$\left[\lim_{x \rightarrow r^-} f(x) - r \right] = 1 \quad \checkmark$$

$$⑥ \lim_{x \rightarrow r^-} \frac{r[x] + 1}{r} = \frac{r+1}{r} = \frac{r}{r} \quad \checkmark$$

$$\lim_{x \rightarrow r^-} \left[\frac{r_{n+1}}{r} \right] = \lim_{x \rightarrow r^-} \left[\frac{1}{r} \right] = \lim_{x \rightarrow r^-} \left[\frac{1}{r} \right] = \frac{1}{r} \quad \checkmark$$

$$\lim_{x \rightarrow r} \frac{r_{n+1}}{r} = \frac{1}{r} \quad \checkmark$$

$$د) \left[\lim_{x \rightarrow r} \frac{r_{n+1}}{r} \right] = \frac{1}{r} \quad \checkmark$$

$$⑦ \text{الف) } \lim_{x \rightarrow 1} \frac{x}{(x-1)(x+1)} = \lim_{x \rightarrow 1} \frac{1}{x-1} \quad \begin{matrix} 1^+ \rightarrow \frac{1}{0^+} = +\infty \\ 1^- \rightarrow \frac{1}{0^-} = -\infty \end{matrix} \quad \checkmark$$

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

$$⑧ \lim_{x \rightarrow r} [-f(x)] = -\lim_{x \rightarrow r} f(x) \quad \checkmark$$

$$ب) \lim_{x \rightarrow (-\frac{1}{r})^-} \left[-\frac{1}{x^2} \right] \quad \checkmark$$

$$x < -\frac{1}{r} \quad x^2 > \frac{1}{r^2} \quad -x^2 < -\frac{1}{r^2}$$

$$-\frac{1}{x^2} > -1r \rightarrow \lim_{x \rightarrow (-\frac{1}{r})^-} = -1r \quad \checkmark$$

$$⑨ \lim_{x \rightarrow 1} [f(x) - r_{n+1} + r] = \quad \checkmark$$

$$x \rightarrow 1 \quad \lim_{x \rightarrow 1} [12x^2 - 12x] = f(x) \rightarrow f'(1) = 0 \quad \checkmark$$

$$ب) \lim_{x \rightarrow 1} [f(x) - r_{n+1} + r] = 0 \quad \checkmark$$

$$\rightarrow f'(x) = 12x^2 - 12x + r \quad \checkmark$$

$$⑩ \lim_{x \rightarrow r} \frac{|x-r|(x^2 + r_{n+1} + r)}{(x-r)(x+r)} \quad \checkmark$$

$$x^+ \rightarrow \frac{(x-r)(x^2 + r_{n+1} + r)}{(x-r)(x+r)} = \frac{1r}{r} = \frac{r}{r} \quad \checkmark$$

$$x^- \rightarrow \frac{-(x-r)(x^2 + r_{n+1} + r)}{(x-r)(x+r)} = -\frac{1r}{r} = -\frac{r}{r} \quad \checkmark$$

$$ب) \lim_{x \rightarrow \alpha} \frac{\sin x}{\sin x} \quad \checkmark$$

$$x^+ \rightarrow \frac{\sin x}{\sin x} = \frac{1}{1} = 1 \quad \checkmark$$

$$x^- \rightarrow \frac{\sin x}{\sin x} = \frac{1}{1} = 1 \quad \checkmark$$

$$⑪ \lim_{x \rightarrow \frac{\pi}{2}} \sqrt{\cos x} \quad \checkmark$$

$$x \rightarrow \frac{\pi}{2} \quad \lim_{x \rightarrow \frac{\pi}{2}} 0 = 0 \quad \checkmark$$

$$ب) \lim_{x \rightarrow \frac{\pi}{2}} \sqrt{x - 2\sqrt{x}} \quad \checkmark$$

$$x \rightarrow 0 \quad \lim_{x \rightarrow 0} 0 = 0 \quad \checkmark$$

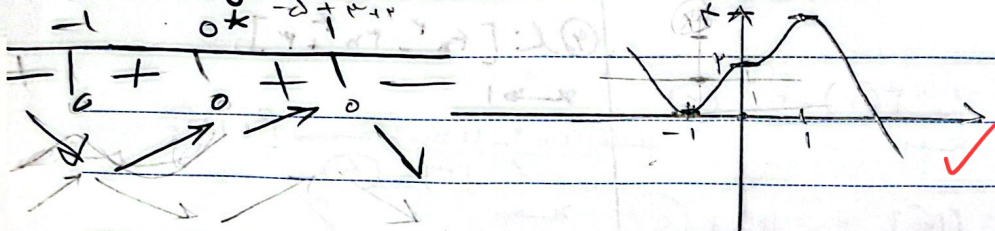
$$x \rightarrow 0 \quad \lim_{x \rightarrow 0} 0 = 0 \quad \checkmark$$

$$x \rightarrow 0 \quad \lim_{x \rightarrow 0} 0 = 0 \quad \checkmark$$

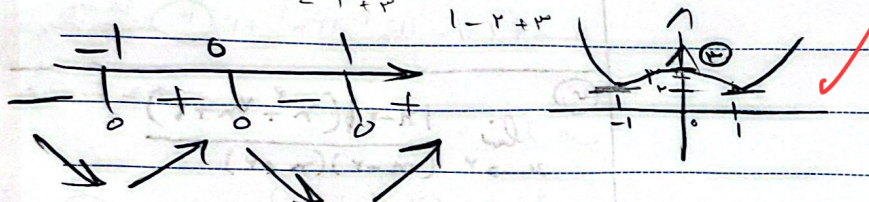
9) ا) $\lim_{x \rightarrow 0^+} \frac{(-1)^{[\sin x]}}{x^r - x^r} \rightarrow \frac{1}{x^r - x^r} \xrightarrow{+1-1+} \frac{1}{0^+} = \infty$ ✓

ب) $\lim_{x \rightarrow r} \frac{x^r - [x^r]}{x - [x]} \xrightarrow{r^+} \frac{x^r - r}{x - r} = x + r = \textcircled{r}$ ✓
 $\xrightarrow{r^-} \frac{x^r - r}{x - r} = \frac{1}{1} = \textcircled{1}$ ✓

10) ا) $y = \ln x^r - \ln x^r + r$ $f'(x) = \ln x^r - \ln x^r$ $\ln x^r (1 - x^r) = \ln x^r (1 - x)(1 + x)$

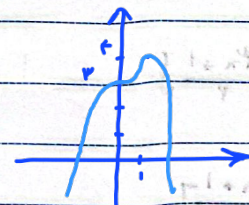
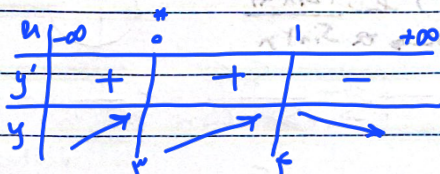


ب) $y = x^r - \ln x^r + r$ $f'(x) = r x^{r-1} - \frac{1}{x}$ $r x (x-1)(x+1) = 0 \Rightarrow x = -1, 1$



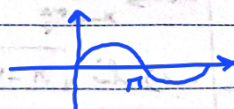
الف) $\lim_{x \rightarrow 1} [f(x^+) - f(x^-)] \rightarrow \lim_{x \rightarrow 1} [r^-] = r$

$y = f(x^+) - f(x^-) + r \rightarrow y' = \ln x^r - \ln x^r \xrightarrow{y'=0} \ln x^r (1 - x) = 0 \rightarrow \begin{cases} x = \infty \\ x = 1 \end{cases}$



ب) $\lim_{x \rightarrow 0} [f(x^+) - f(x^-)] = \begin{cases} \lim_{x \rightarrow 0^+} [r^+] = r \\ \lim_{x \rightarrow 0^-} [r^-] = r \end{cases}$

الف) $\lim_{x \rightarrow \pi} \frac{|\sin x|}{\sin x} \rightarrow \frac{1}{-1} = -1$



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

الف) $\lim_{x \rightarrow \pi} \frac{|\sin x|}{\sin x} = -1$

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

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

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