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$$\lim_{x\to 0} \frac{\cancel{a^2}+\frac{x^4}{16}-\frac{ax^2}{2}-\cancel{a^2}+x^2}{x^4\left(\left(a-\frac{x^2}{4}\right)+\sqrt{a^2-x^2}\right)}$$

$$x\left(\tan 2x-2x\right)+2x\left(x-\tan x\right)$$

$$\boxed{g(x)} \quad 2^x$$

$$f(x)= f(x) \quad \boxed{f(x)>0}$$

$$1-\frac{a}{2}=0$$

$$l=\frac{1}{32a}$$

$$\frac{1}{b}+b=\frac{2\sin^2\theta}{\pi^2}$$

$$\lim_{x\to 1}\left(\frac{-a+\frac{\sin(x-1)}{x-1}}{1+\frac{\sin(x-1)}{x-1}}\right)^{1+\sqrt{x}}$$

$$\left(\frac{1-a}{2}\right)^2=\frac{1}{4}$$

$$\frac{1-a}{2}=\frac{1}{2}$$

$$\lim_{n\to\infty}\left(\frac{2}{\pi}\cos^{-1}\frac{1}{n}+\frac{2n}{\pi}\left(\cos^{-1}\frac{1}{n}-\frac{\pi}{2}\right)\right)$$

$$\frac{2}{\pi}\cos^{-1}\frac{1}{n}-\frac{2}{\pi}\left(\frac{\sin^{-1}\frac{1}{n}}{\frac{1}{n}}\right)=1-\frac{2}{\pi}$$

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5.

$$\frac{1-\cos\left(\frac{\pi}{2}-\pi x\right)}{\left(\frac{\pi}{2}(1-2x)\right)^2}$$

$$\frac{1-\cos(\pi-2\pi x)}{\left(\pi(1-2x)\right)^2}$$

$\frac{1}{4}$

4.

$$f(x)=\begin{cases} x^2 & x\in[0,1] \\ 2x-x^2. & x\in[-1,0] \end{cases}$$

$\boxed{x-x^2}$

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$$\lim_{x\to 2^-} \frac{4(2^x-4)}{(2^x-4)(2^x+4)}$$

$\boxed{a=1, 2}$

$\boxed{x=1}$ $LHL = \lim_{x\to 1^-} f(\underbrace{f(x)}_{=1+x \to 2^-}) = 3$ $1+x$

$RHL = \lim_{x\to 1^+} f(\underbrace{f(x)}_{\to 2^+}) = 1$ $3-x$

f con f

- $x = a$ g con at $x=a$
- $x = f(a)$ $g(f(x))$

$\exists\, g(x) = f(f(x))$

- $a = 2$
- $f(a) = 2 = 1+a,\ 3-a$

$a = 1,$

$\lim_{x\to 1^-}\left[f(f(x))\right] = 2.$

$[\cdot] = G \cdot I \cdot F$

$\lim_{x\to 1^+}\left[f(f(x))\right] = 0$

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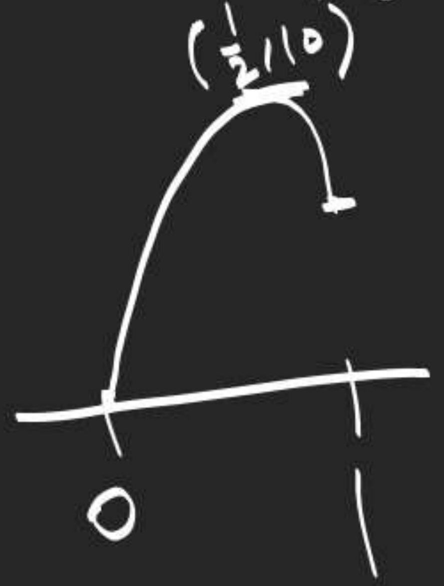
$$\lim_{x\to 1}\left(\lim_{n\to\infty} \frac{1}{1+n\underbrace{\sin^2 \pi x}}\right) = \lim_{x\to 1} 0 = 0.$$

$$f(1) = \lim_{n\to\infty} \frac{1}{1+n\underbrace{\sin^2 \pi}_{=0}} = 1$$



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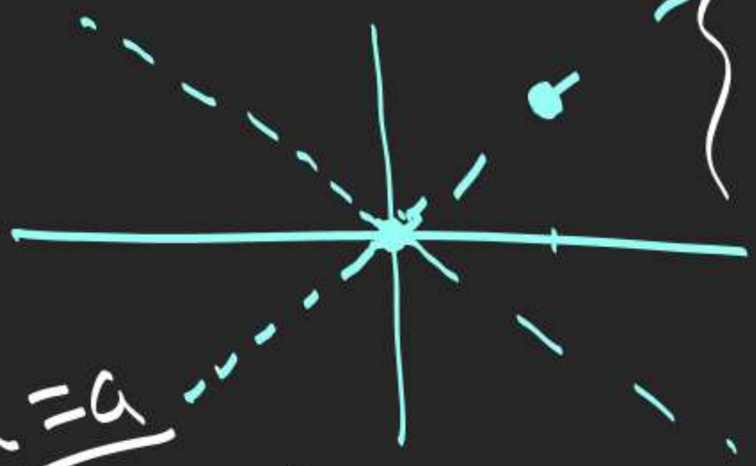
$$f(x) = \begin{cases} x \checkmark & x \in Q \\ -x \checkmark & x \notin Q \end{cases}$$

$x = -x$.



$$\lim_{x \to a} f(x) = \begin{cases} a \\ -a \end{cases}$$

$a = -a \Rightarrow \boxed{a = 0}$

$f(x)$ is discont $\forall x \in R - \{0\}$

Cont. at $x = 0$

$x \in Q$, $x \notin Q$

$$\lim_{x \to 0} f(x) = 0$$

$$f(0) = 0$$

$$\boxed{\Rightarrow f(x) \text{ is cont. at } x = 0}$$

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1. Let $f(x) = \begin{cases} x^2+ax+1 & x \in Q \\ ax^2+2x+b & x \notin Q \end{cases}$ is cont. at $x=1, e$ find a, b.

$$x^2+ax+1 = ax^2+2x+b$$

$$(a-1)x^2+(2-a)x+b-1=0 < \begin{matrix} 1 \\ e \end{matrix}$$

$$\frac{b-1}{a-1} = 1 \cdot e \qquad \frac{a-2}{a-1} = 1+e = 1-\frac{1}{a-1}$$

$$\left(\frac{b-1}{-\frac{1}{e}}\right) = e \Rightarrow \boxed{b=0} \qquad a-1 = -\frac{1}{e} \Rightarrow a = 1-\frac{1}{e}.$$

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$$f(x) = \begin{cases} [x] & x \in Q \\ x & x \notin Q \end{cases}$$

$[\cdot] = G.I.F$

$[x] = x \Rightarrow x \in I.$

$$\boxed{f(x) \text{ is discont. } \forall x \in R}$$

$x = a,\ a \in I$

$RHL = \lim_{x \to a^+} [x]$ or $\lim_{x \to a^+} x$

$= a$ or $a.$

$LHL = \lim_{x \to a^-} [x]$ or $\lim_{x \to a} x$

$= a-1$ or a

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Differentiability ✓

Limits → Ex - 4 (14, 15, 16)

Continuity → Ex - I