$$f(x) = \frac{3x^2-13x-10}{|x-5|} = \begin{cases} \frac{3x^2-13x-10}{x-5} & \text{if } x \ge 5 \\ -\left(\frac{3x^2-13x-10}{x-5}\right) & \text{if } x < 5 \end{cases}$$

$$|x-5| = \begin{cases} x-5 & \text{if } x-5 \ge 0 \\ -(x-5) & \text{if } x-5 < 0 \end{cases} = \begin{cases} x-5 & \text{if } x \ge 5 \\ -(x-5) & \text{if } x < 5 \end{cases}$$

$$3x^2-13x-10 = (3x+2)(x-5)$$

$a=3, b=-13, c=-10$

$$\Rightarrow b^2-4ac = (-13)^2-4(3)(-10)$$
$$= 169+120$$
$$= 289 = 17^2$$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{+13 \pm 17}{2(3)} = \frac{13 \pm 17}{6} \begin{cases} \frac{30}{6} = 5 \\ \frac{-4}{6} = -\frac{2}{3} \end{cases}$$

$$\Rightarrow 3x^2-13x-10 = 3(x-5)\left(x+\tfrac{2}{3}\right) = (x-5)(3x+2)$$

$$\Rightarrow f(x) = \begin{cases} \frac{(3x+2)(x-5)}{x-5} & \text{if } x \ge 5 \\ -\frac{(3x+2)(x-5)}{x-5} & \text{if } x < 5 \end{cases} = \begin{cases} 3x+2 & \text{if } x \ge 5 \\ -(3x+2) & \text{if } x < 5 \end{cases}$$

$(x \neq 5)$

$$\Rightarrow f(x) \xrightarrow{x \to 5^+} 3(5)+2 = 17$$

$$f(x) \xrightarrow{x \to 5^-} -(3(5)+2) = -17$$

The left- & right-hand limits disagree $\Rightarrow$

$\lim_{x\to 5} f(x) \nexists$.

$$\lim_{x\to 5^-} f(x) = -17 \neq 17 = \lim_{x\to 5^+} f(x) \Rightarrow \lim_{x\to 5} f(x) \nexists.$$

$\lim_{x\to 5}$ bad

IVT question

$\lim(f+g) = \lim f + \lim g$

$f(x) = \frac{1}{4}\cdot 2^x - x^2 + 4x - 3$ is cnt$^{\underline{s}}$ on $\mathbb{R}$

b/c $f(x) =$ poly + exponential + cnt$^{\underline{s}}$ + cnt$^{\underline{s}}$ = cnt$^{\underline{s}}$

$f(0) = \frac{1}{4}\cdot 2^0 - 0^2 + 4(0) - 3 = \frac{1}{4} - 3 = \frac{1-12}{4} = -\frac{11}{4} < 0$

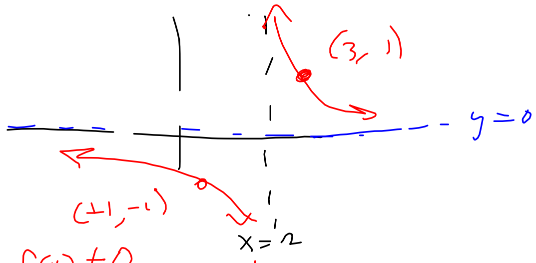
$f(2) = \frac{1}{4}\cdot 2^2 - 2^2 + 4(2) - 3 = 1 - 4 + 8 - 3 = 2 > 0$

$\Longrightarrow \exists\, c \in (0,2) \ni f(c) = 0$, i.e.

$f(0) = -\frac{11}{4} < 0 < f(2) = 2$ & continuity

$\Longrightarrow$ IVT holds.

I cheated you of EVT



$f(x) = \frac{1}{x-2}$ isn't cnt$^{\underline{s}}$ on $[0, 4]$

$f(1) = -1$

$f(3) = +1$ but $f(x) \neq 0$ eval. Nevah.

B2 $\sqrt{2x+2h} - \sqrt{2x} = \sqrt{2h}$

$\sqrt{a+b} = \sqrt{a} + \sqrt{b}$

$5 = \sqrt{25} = \sqrt{16+9} = \sqrt{16} + \sqrt{9} = 4+3 = 7$

$\overline{a+bi} = a-bi$

$\sqrt{x}$:

$$\left(\frac{\sqrt{x+h} - \sqrt{x}}{h}\right)\left(\frac{\sqrt{x+h} + \sqrt{x}}{\sqrt{x+h} + \sqrt{x}}\right) = \frac{x+h-x}{h(\sqrt{x+h} + \sqrt{x})}$$

$(a-b)(a+b) = a^2 - b^2$

$\overline{\sqrt{a} + \sqrt{b}} = \sqrt{a} - \sqrt{b}$

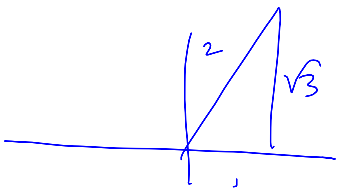
$$\frac{h}{h(\sqrt{x+h} + \sqrt{x})} = \frac{1}{\sqrt{x+h} + \sqrt{x}} \xrightarrow{h \to 0} \frac{1}{\sqrt{x} + \sqrt{x}} = \boxed{\frac{1}{2\sqrt{x}} = f'(x)}$$

$(h \neq 0)$

Find an equation of the tangent line

to $f(x) = \sin(x)$ @ $x = \frac{\pi}{3}$

$f(\frac{\pi}{3}) = \frac{\sqrt{3}}{2} = y_1$, $x_1 = \frac{\pi}{3}$



$f'(x) = \cos(x)$

$f'(\frac{\pi}{3}) = \frac{1}{2} = m$

Linearization of f @ $x = \frac{\pi}{3}$

= Tangent line to $f(x)$ @ $x = \frac{\pi}{3}$

is $y = m(x - x_1) + y_1$

$= \frac{1}{2}(x - \frac{\pi}{3}) + \frac{\sqrt{3}}{2} = L_{\frac{\pi}{3}}(x)$

Use it to approximate

$\sin(62^\circ) = \sin((62^\circ)(\frac{\pi}{180^\circ}))$

So $L_{\frac{\pi}{3}}(62^\circ) = \frac{1}{2}(\frac{62\pi}{180} - \frac{\pi}{3}) + \frac{\sqrt{3}}{2}$

$= \frac{1}{2}(\frac{2\pi}{180}) + \frac{\sqrt{3}}{2} = \frac{1}{2}[\frac{\pi}{90} + \sqrt{3}]$

$\approx$