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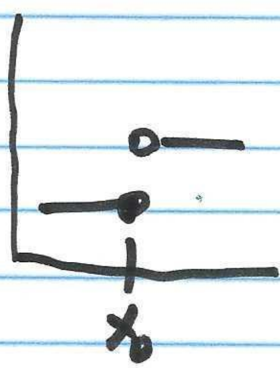
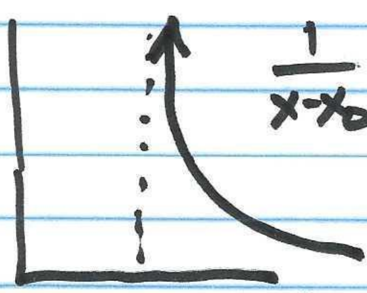
§ 3.2 Continuity

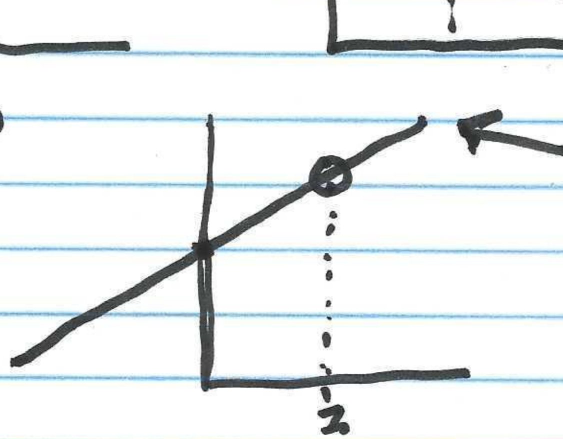
Given $f(x)$ we say it is continuous @ x_0 if:

1) $f(x_0)$ exists
2) $\lim_{x \to x_0} f(x)$ is a limit that exists
3) Results of 1) & 2) must be equal

If f is not continuous @ x_0, we say it is discontinuous there.







$$f(x) = \frac{\overbrace{x^2-4}^{(x-2)(x+2)}}{x-2}$$

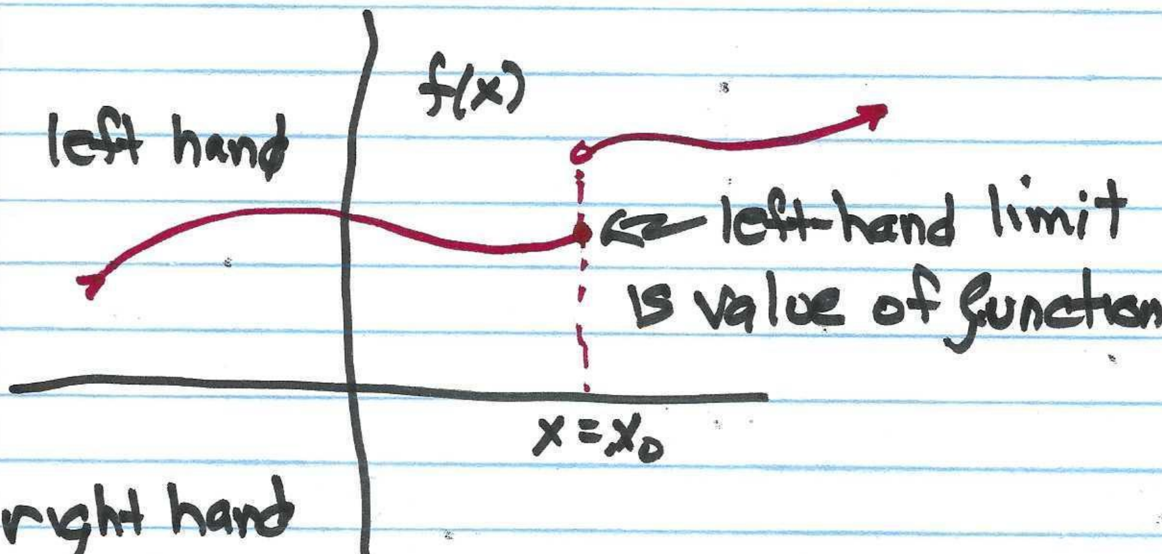
For our purposes, a function is continuous on an interval if you can draw its graph without lifting your pencil

removable discontinuity:

redefine function @ "bad" point

$$\hat{f} = \begin{cases} \dfrac{x^2-4}{x-2} & \text{if } x \neq 2 \\ 4 & \text{if } x = 2 \end{cases}$$

$\lim\limits_{x \to x_0^-}$ left hand



$\lim\limits_{x \to x_0^+}$ right hand

lateral or one-sided limit

3 $\dfrac{x^2-3x+4}{(x-4)(x+1)}$

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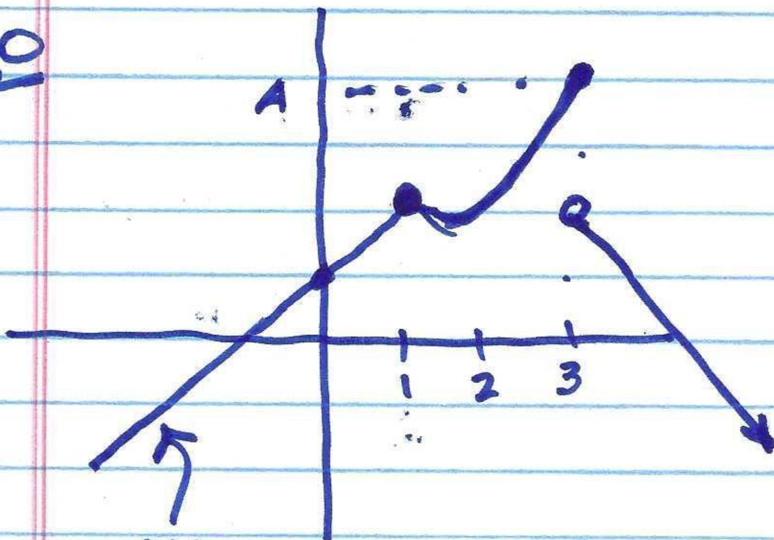
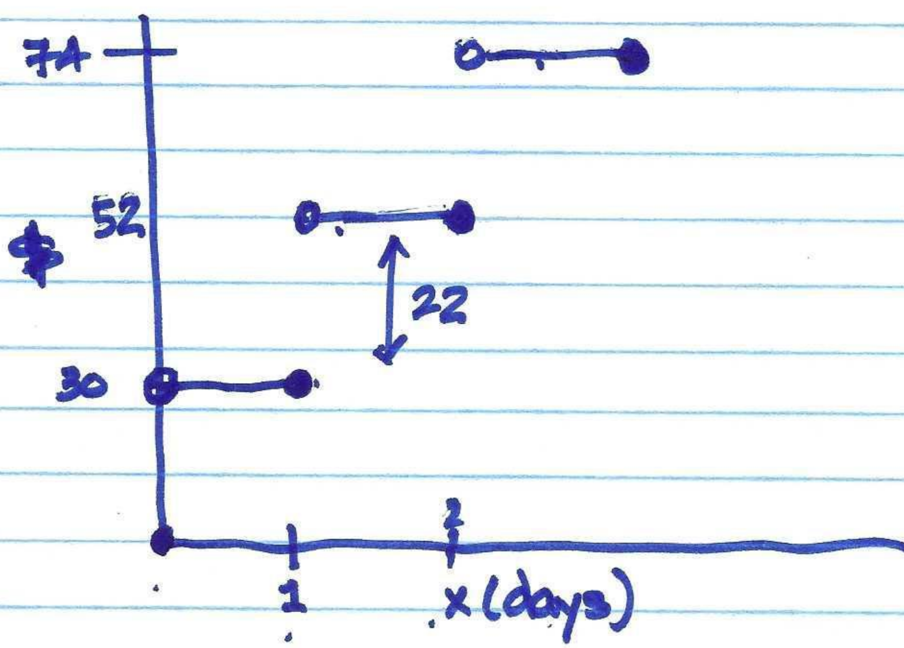


$f(x) = 5-x$
if $x>3$

$x<1$

$f(x) = x+1$

So $\lim\limits_{x\to 1} f(x) = 2$



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#15 $f(x) = \frac{5+x}{x(x-2)}$ $a = 0, 2$

#18 $f(x) = \frac{x^2-25}{x+5} = \frac{\cancel{(x+5)}(x-5)}{\cancel{x+5}}$ $\lim_{x \to -5}$ exists

$f(x)$ DNE

#37

$$f(x) = \begin{cases} kx^2 & \text{if } x \le 2 \\ x+k & \text{if } x > 2 \end{cases}$$

find k so that f(x) is continuous @ 2

$kx^2 = x + k$ @ $x = 2$

$k \cdot 2^2 = 2 + k \Rightarrow 4k = k + 2$

$3k = 2$

or $k = \frac{2}{3}$

#38 $$g(x) = \begin{cases} x^3+k & \text{if } x \le 3 \\ kx-5 & \text{if } x > 3 \end{cases}$$

#38 cont'd.

$$27+k = 3k-5$$

$$32 = 2k \Rightarrow \underline{k=16}$$

#47 $\lim_{x\to 6} P(x) = 500$ $\lim_{x\to 10^-} P(x) = 1500$

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