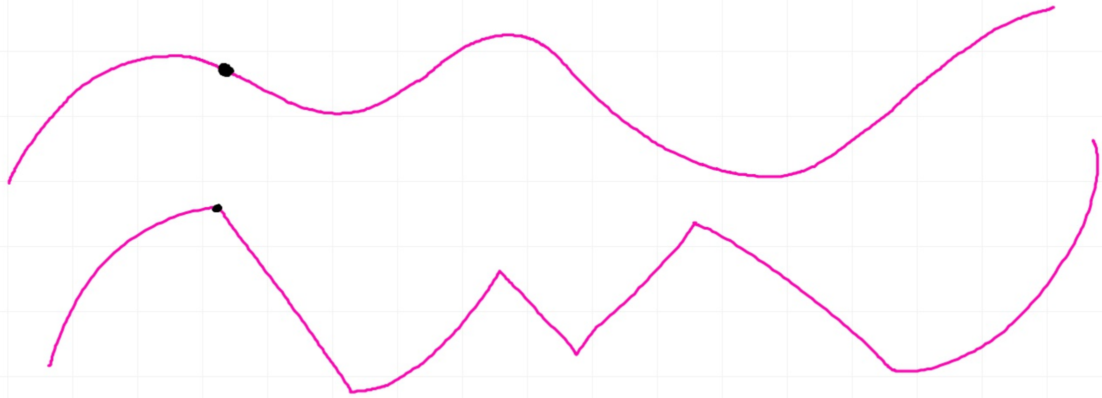
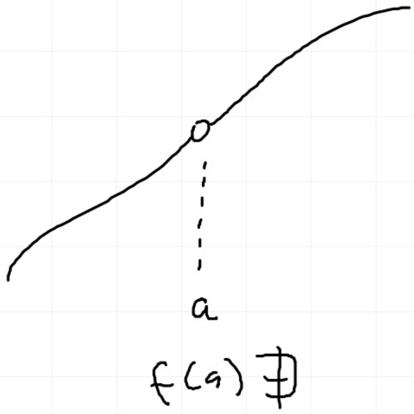
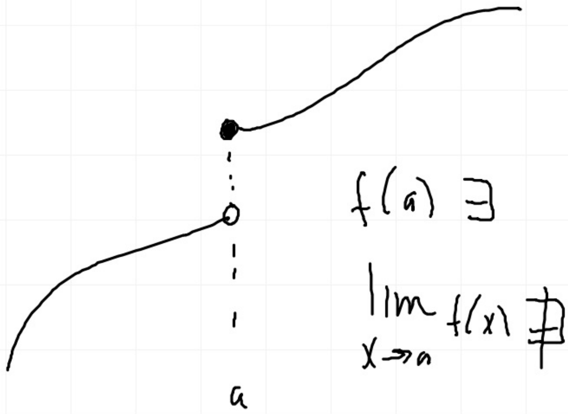
Continuity

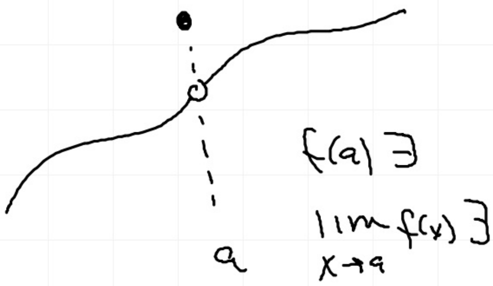
at a number

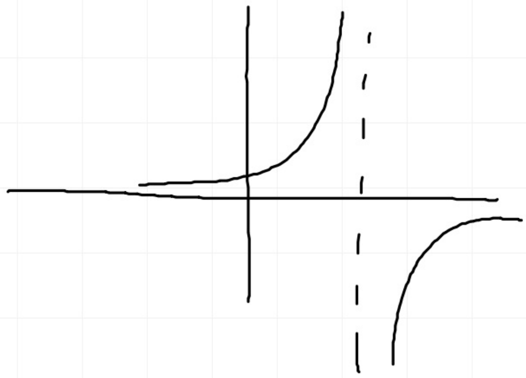
on an interval




a
$f(a) \nexists$


$f(a) \exists$
$\lim_{x \to a} f(x) \nexists$
a


$f(a) \exists$
$\lim_{x \to a} f(x) \exists$
a



f is cont. at $x=a$ iff

$f(a) \exists$

$\lim_{x \to a} f(x) \exists$

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

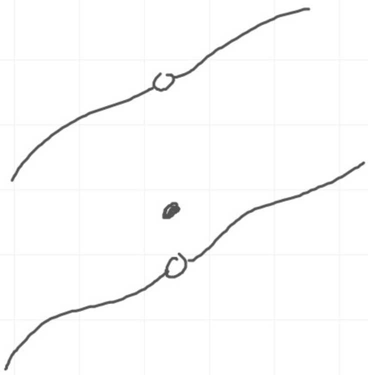
Is $f(x) = \dfrac{x^2+2x-15}{x-3}$ cont. at $x=3$?

<u>Cont test at $x=3$</u>

$f(3) \nexists$ $\therefore$ f is

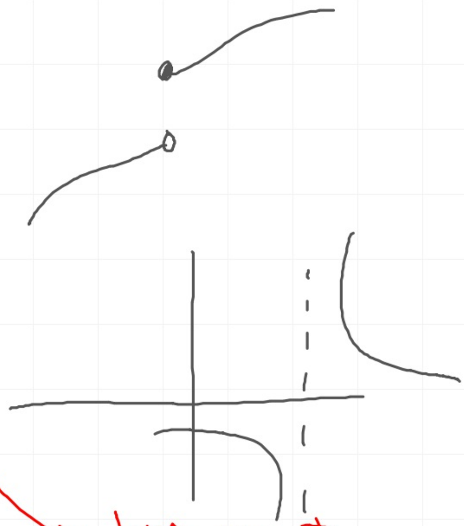
discon. at $x=3$.

Removable disc



if $\lim_{x\to a} f(x)\ \exists$

Essential disc



$\lim_{x\to a} f(x)\ \nexists$

Is $f(x) = \begin{cases} x^2 & x \leq 2 \\ 2x & x > 2 \end{cases}$ cont at $x = 2$?

<u>Cont test at $x = 2$</u>

$f(2) = 4$

$$\left.\begin{aligned} \lim_{x \to 2^+} f(x) &= 4 \\ \lim_{x \to 2^-} f(x) &= 4 \end{aligned}\right\} \therefore \lim_{x \to 2} f(x) = 4$$

$\therefore$ f is cont at $x = 2$ because

$f(2) = \lim_{x \to 2} f(x)$.

Is $f(x) = \begin{cases} x^2 - 9 & x \le 7 \\ 5 + x & x > 7 \end{cases}$ cont at $x = 7$?

<u>Cont test at $x = 7$</u>

$f(7) = 40$

$$\left.\begin{array}{l} \lim\limits_{x \to 7^+} f(x) = 12 \\ \lim\limits_{x \to 7^-} f(x) = 40 \end{array}\right\} \therefore \lim\limits_{x \to 7} f(x) \nexists$$

$\therefore$ f is discon. at $x = 7$ because $\lim\limits_{x \to 7} f(x) \nexists$.

Determine if $f(x) = \begin{cases} x^2-49 & x \leq -7 \\ 49-x^2 & -7 < x < 7 \\ 5-x & x \geq 7 \end{cases}$ is cont $\forall x$.

<u>Cont test at $x=-7$</u>

$f(-7) = 0$

$$\left.\begin{aligned} &\lim_{x\to -7^+} f(x) = 0 \\ &\lim_{x\to -7^-} f(x) = 0 \end{aligned}\right\} \therefore \lim_{x\to -7} f(x) = 0$$

$\therefore$ f is cont at $x=-7$

because $f(-7) = \lim_{x\to -7} f(x)$.

<u>Cont test at $x=7$</u>

$f(7) = -2$

$$\left.\begin{aligned} &\lim_{x\to 7^+} f(x) = -2 \\ &\lim_{x\to 7^-} f(x) = 0 \end{aligned}\right\} \therefore \lim_{x\to 7} f(x) \nexists$$

$\therefore$ f is discon at $x=7$

because $\lim_{x\to 7} f(x) \nexists$.

For what value of b will $f(x)=\begin{cases} \frac{x^2-25}{x-5} & x \neq 5 \\ b & x=5 \end{cases}$

be cont at $x=5$?

<u>Cont test at $x=5$</u>

$$f(5)=b$$

$$\lim_{x \to 5} f(x) = 10$$

for f to be cont. at $x=5 \rightarrow b=10$.

Determine if $f(x) = \frac{x^2+2x-15}{x-3}$ is cont at $x=3$. If disc. determine if discon is removable or essential. If removable, redefine f so that it is cont at $x=3$.

Cont test at $x=3$

$f(3) \nexists \therefore f$ is discon. at $x=3$.

Removable | Essen

The discon is removable because $\lim_{x\to 3} f(x) = 8$.

Redefine f

$$f(x) = \begin{cases} \frac{x^2+2x-15}{x-3} & x \neq 3 \\ 8 & x = 3 \end{cases}$$

$$f(x) = \frac{x-5}{x-3}$$

Is f cont on $[3,5]$ no

$(3,5)$ yes

$(-2,3]$ no

$(1,8)$ no