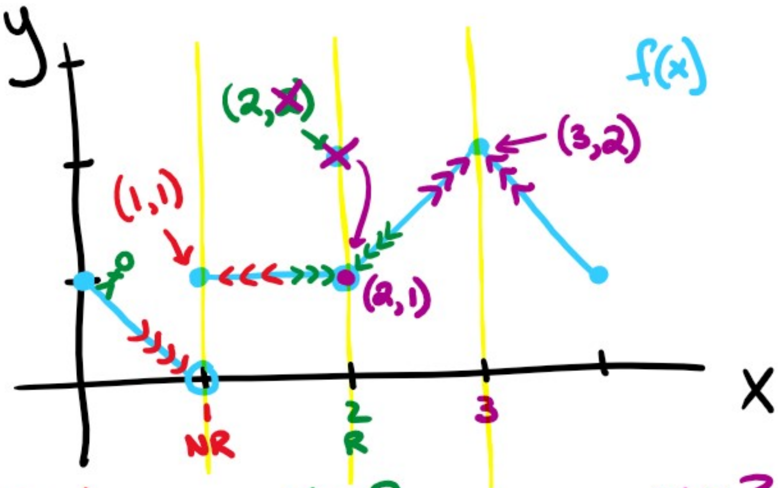
The function $f(x)$ is <u>continuous</u> at the point $x = c$ if and only if $\lim_{x \to c} f(x) = f(c)$.

(limit value as $x \to c$) (function value when $x = c$)



$x = 1$	$x = 2$	$x = 3$
$f(1) = \underline{1}$	$f(2) = \underline{2}$	$f(3) = \underline{2}$
$\lim_{x \to 1} f(x) = \underline{\text{DNE}}$	$\lim_{x \to 2} f(x) = \underline{1}$	$\lim_{x \to 3} f(x) = \underline{2}$
NOT SAME	NOT SAME	SAME!
Cont? No	Cont? No	Cont? Yes
$x=1$ is a NR discontinuity because lim DNE	$x=2$ is a R disc. because lim exists →	Redefine $f(2) = \underline{1}$

Discontinuity - a point (x-value) at which a function is not continuous $\lim_{x \to c} f(x) \neq f(c)$

Non-Removable (NR) Discontinuities → $\lim_{x \to c} f(x) = \text{DNE}$

vs.

Removable (R) Discontinuities → $\lim_{x \to c} f(x)$ exists but does not equal $f(c)$

↳ Redefine/Extend $f(x)$ to make the function continuous at this point continuous at this point

Steps

① Set denominator equal to zero and solve for x

② Factor the numerator:

R: If the factor is in top & bottom

NR: If the factor is only in bottom

ex Identify the x-values of all discontinuities of:

$$f(x) = \frac{x^3-6x^2+8x}{x^2+9x-22} = \frac{x\cancel{(x-2)}(x-4)}{\cancel{(x-2)}(x+11)}$$

① $(x-2)(x+11)=0$

$x-2=0$ $\quad$ $x+11=0$

$\boxed{x=2}$ $\quad$ $\boxed{x=-11}$

② $\frac{x=2}{\text{R or NR}}$ $\quad$ $\frac{x=-11}{\text{R or NR}}$

Steps a-k problems

① Set denominator equal to zero and solve for x (a-value)

② Factor/cancel then plug in a-value for x (k-value)

ex

$$f(x) = \begin{cases} \frac{x^2-144}{x-12}, & x \neq 12 \\ k, & x = 12 \end{cases}$$

① $x-12=0$

$x=12$ $\Rightarrow$ $\boxed{a=12}$

② $\frac{x^2-144}{x-12} \rightarrow \frac{(x+12)\cancel{(x-12)}}{\cancel{x-12}} \rightarrow x+12 \rightarrow 12+12$

$\boxed{k=24}$