Composition: Feed output from one function into another

$f \circ g = f(g(x))$

f has to eat what g spits out.

$\mathcal{D}(f \circ g) = \{x \mid x \in \mathcal{D}(g) \text{ and } g(x) \in \mathcal{D}(f)\}$

$f(x) = \frac{1}{x+2}$, $g(x) = \sqrt{3x-1}$

$\Rightarrow f \circ g = f(g(x)) = \frac{1}{g(x)+2}$

$= \frac{1}{\sqrt{3x-1}+2}$

$f(\text{☺}) = \frac{1}{\text{☺}+2}$

$f(\Delta) = \frac{1}{\Delta+2}$

$f(me) = \frac{1}{me+2}$

$\mathcal{D}(f \circ g) = \{x \mid x \in \mathcal{D}(g) \text{ and } g(x) \in \mathcal{D}(f)\}$

$= \{x \mid x \in [\frac{1}{3}, \infty) \text{ and } \sqrt{3x-1} \neq -2\}$

Needs analysis.

$\sqrt{3x-1} = -2$ is impossible

But $\sqrt{3x-1} \geq 0$ Always

No restriction, so $\mathcal{D}(f \circ g) = [\frac{1}{3}, \infty)$

Principal square root $\sqrt{} \geq 0$ always

One last example

$f(x) = \frac{1}{x-2}$, $g(x) = \sqrt{3x-1}$

$\mathcal{D}(f \circ g) = \{x \mid x \in \mathcal{D}(g) \text{ and } g(x) \in \mathcal{D}(f)\}$

$= \{x \mid x \in [\frac{1}{3}, \infty) \text{ and } \sqrt{3x-1} \neq 2\}$

$A = B \Rightarrow A^2 = B^2$

$\sqrt{3x-1} \neq 2$

$3x - 1 \neq 4$

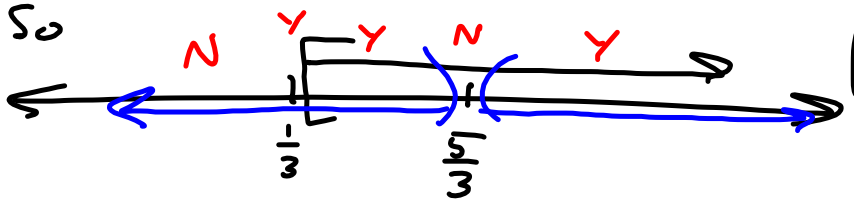
$3x \neq 5$

$x \neq \frac{5}{3}$

AND

$\mathcal{D}(f) = \mathbb{R} \setminus \{2\}$

So



$= [\frac{1}{3}, \frac{5}{3}) \cup (\frac{5}{3}, \infty)$