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Summary of translation

The conclusion we arrived at, stated below, is true for a any function.

Theorem

If $g(x) = f(x-h)+k$ for every number x in the domain of f, then function g is function f translated $|h|$ units horizontally and $|k|$ units vertically.

The translation is

$$\begin{cases} \text{right h units,} & \text{if} \quad h > 0 \\ \text{left h units,} & \text{if} \quad h < 0 \\ \text{up k units,} & \text{if} \quad k > 0 \\ \text{down k units,} & \text{if} \quad k < 0 \end{cases}$$

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You will often see $y-k = f(x-h)$ or sometimes $g(x)-k = f(x-h)$ instead of $g(x) = f(x-h)+k$.

Questions

[1] Notice that $g(x) = \frac{1}{x-3}$ and $f(x) = \frac{1}{x}$ produce different values for the same argument. For example, $f(4) = \frac{1}{4}$ but $g(4) = 1$. In fact, there is no x for which $f(x) = g(x)$. In what sense is g simply f translated to an different location?

[2] Suppose $g(x) = \frac{3}{x}$ and $f(x) = \frac{1}{x}$. Is g a translation of f?

[3] Suppose $g(x) = \frac{2}{x}$, $f(x) = \frac{1}{x}$, and $h(x) = \frac{2}{x-7} - 3$. Is g more like f or more like h?

[4] Suppose $g(x) = \frac{-4x+17}{x-5}$. Show that g is f translated where $f : f(x) = \frac{-3}{x}$.

* The notation "$f : f(x) = \frac{1}{x}$" means "The function f defined by $f(x) = \frac{1}{x}$."