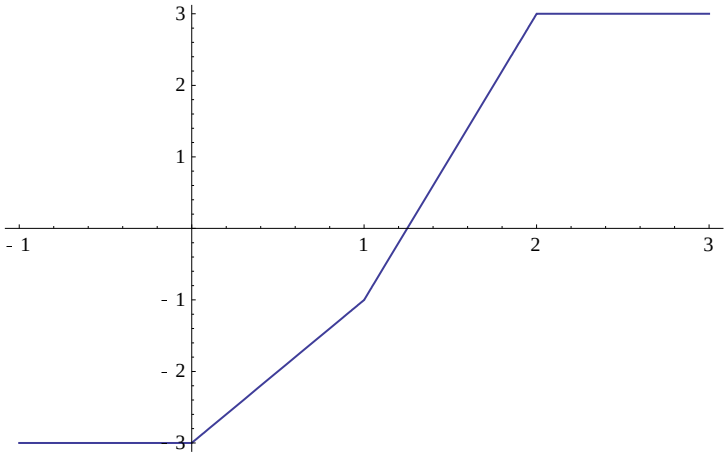
7. $y = |x| + |x-1| - |4-2x|$, what is the maximum and minimum of this function?

y is a piecewise function, so we can rewrite this function as

$$y = \begin{cases} -3, & x \le 0 \\ 2x-3, & 0 < x \le 1 \\ 4x-5, & 1 < x \le 2 \\ 3, & x > 2 \end{cases}$$

It's obvious to see the maximum is 3 and the minimum is -3.



8. $f(x) = \begin{cases} 4x-4, & x \le 1 \\ x^2-4x+3, & x > 1 \end{cases}$ and $g(x) = \log_2 x$, what is the number of intersections of $f(x)$ and $g(x)$?

$f(1) = g(1) = 0$, so $(1, 0)$ is an intersection.

$g(x) > 0$ for all $x > 1$, $f(x) > g(x)$ for some $x > 1$, and $f(x) \le 0$ for $x \in [1, 3]$.

So $f(x)$ and $g(x)$ must intersect at $x > 1$.

$g(x) < 0$ for $0 < x < 1$ and $f(0) = -4$ and $g(2^{-1}) = -1 > f(2^{-1}) = -2$.

So $f(x)$ and $g(x)$ must intersect at $0 < x < 1$.