Example

Find $x'(t)$ if

$$x(t) = \frac{2 \sin t - 1}{\tan t}.$$ 

Solution: We could use the quotient rule at the outset, but it might be easier to simplify the fraction first. Note that

\[
x(t) = 2 \frac{\sin t}{\tan t} - \frac{1}{\tan t} \\
= 2 \sin t \cdot \frac{\cos t}{\sin t} - \cot t \\
= 2 \cos t - \cot t.
\]

It follows then that

$$x'(t) = -2 \sin t + \csc^2 t.$$