Worksheet 18: Maxima, Minima, & Hyperbolic Trig

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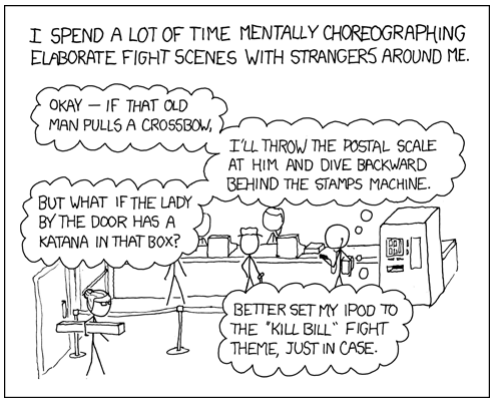

www.xkcd.com

1. Find the derivative:

   (a) $f(x) = \tanh(1 + e^{2x})$

   (b) $g(x) = \sinh(\cosh(x))$

   (c) $y = \operatorname{sech}^{-1}(e^{-x})$

2. What does the extreme value theorem say?

3. What does Fermat's theroem say?

4. ($\star$) Does the converse (reverse the 'if' and 'then' portions) of Fermat's theorem hold? If not, provide a counterexample. If so, explain why.

5. Based on the last three problems, what kinds of points do we need to check in order to find an absolute minimum or maximum?

6. Sketch the following functions by hand and label the local minima, local maxima, and absolute minimum and maximum:

   (a) $f(x) = x^2$, $x \geq 1$

   (b) $g(\theta) = \frac{1}{\theta}$, $1 \leq x \leq 3$

   (c) $y = e^x$

7. List the values you would need to check in order to find all the local minima and maxima:

   (a) $f(t) = 2t^3 + t^2 + 2t$

   (b) $h(p) = \frac{p-1}{p^2+4}$

8. Find the absolute maximum and minimum of the function on the given interval.

   (a) $f(x) = 5 + 54x - 2x^3$, $[0, 4]$

   (b) $h(y) = (y^2 - 1)^3$, $[-1, 2]$