

# Take-Home Quiz 4

Math 131 Section 22

Due Monday, November 7, 2005

I promise to include tanks of water on next week's quiz, but until then...

**Problem 1. (3 points).** Our friend is spending an eternity skiing<sup>1</sup> up and down a mountain, and she notes that her height  $f(t)$  is related to the current time  $t$  by the following function

$$f(t) = t^3 - 3t^2 - 9t + 2.$$

At what times  $t$  are our friend's skis horizontal? After  $t = 100$ , will she be going up or down a hill?

**Problem 2. (6 points).** Define the function  $f : (-\infty, 1) \cup (1, \infty) \rightarrow \mathbb{R}$  by

$$f(x) = \frac{x+1}{x-1}.$$

- (a) Calculate  $f'(x)$  using the rules of differentiation.
- (b) What do you notice about  $f'(x)$  as  $x$  tends to infinity? (In other words, what is  $\lim_{x \rightarrow \pm\infty} f'(x)$ ?)
- (c) Interpret part (b) geometrically.

**Problem 3. (3 points).** Sisyphus is pushing a boulder up a hill. You might expect me to include you in his torment by asking you to differentiate the boulder's height with respect to time. However, your pointless punishment will be to differentiate:

$$f(x) = \frac{(x^2 - 4)(8x^{16} + 32)}{x^{10} + 1}.$$

The powers of two are nice (e.g.,  $8 \cdot 16 = 2^3 \cdot 2^4 = 2^7 = 128$ ), but please don't push the boulder too far by simplifying your answer too much.

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<sup>1</sup>For fun, find another English verb ending in *i*.