

# Math 1A: Quiz 6

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You must always justify your answers. This means: show your work, show it neatly, and when in doubt, use words (and pictures!) to explain your reasoning. No justification = no points.

1. (5 pts) Find  $y'$  in terms of  $x$  and  $y$ :

$$\ln(x + y) = \arctan(\sinh x) + xy^2$$

Perform any obvious simplifications — remember the hyperbolic Pythagorean formula — but don't be worried by a messy answer.

Don't forget to do problem 2, on the other side of this sheet.

2. (5 pts) When a ball (or you on a bicycle) rolls up the side of a parabolic hill, three things can happen: either it runs out of energy before it gets to the top, and so gets as far as it can and then starts rolling back down; or it has more than enough energy to clear the top of the hill and start rolling down the other side; or it has precisely the amount of energy needed to exactly reach the top. In this last situation, it's a physics fact that: **the velocity of the ball is proportional to the distance to the top of the hill**. Let's say that at time  $t = 0$ , the distance  $f(0)$  from the top of the hill is exactly 2 meters, and that the ball at this time is traveling at one meter per minute. At what time  $t$  (in minutes) will the ball be precisely one meter from the top of the hill? (Hint: your answer should not be negative.)

3. (bonus) What was your favorite topic from the past week of Calculus (chain rule, implicit differentiation, logarithms, inverse-trigonometric functions, hyperbolic functions, physics exercises, exponential growth, linear approximation, differentials, etc.)? Describe the topic is, and why you like it.