Calculus I **Differentiation and word problems** **Fall 2014**

Discussion session 12 - 2 October 2014

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1. Define the *hyperbolic sine* function to be $\sinh(\theta) = \frac{e^{\theta}-e^{-\theta}}{2}$, and the *hyperbolic cosine* as $\cosh(\theta) = \frac{e^{\theta}+e^{-\theta}}{2}$. Show that $\frac{d}{d\theta}\cosh(\theta) = \sinh(\theta)$ and $\frac{d}{d\theta}\sinh(\theta) = \cosh(\theta)$.

2. A 10-ft ladder is sliding down a wall. The variable h is the height of the ladder's top at time t, and x is the distance of the ladder's bottom from the wall. Suppose that the top is sliding down the wall at a rate of 4 ft/sec. Calculate dx/dt when $h = 6$.

3. (a) Write, in your own words, the definition of a differential equation.

   (b) Which of the following are differential equations? Why?

   a. $f(x) = 2x^3 + 3x - g(f'(x))$

   b. $5 - 2\dfrac{dy}{dx} = 3z^2 + 4z + \dfrac{dw}{dz}$

   c. $\dfrac{du}{dt} - 2u = 0$

   d. $\dfrac{d^2y}{dx^2} - 2a\dfrac{dy}{dx} = a^2 + b^2$