

Math 115 - Team Homework Assignment #5, Winter 2016

- **Due Date:** March 8 or 9 (Your instructor will tell you the exact date and time.)
 - Note: All problem, section, and page references are to the course textbook, which is the 6th edition of *Calculus: Single Variable* by Hughes-Hallett, Gleason, McCallum, et al.
 - Remember to follow the guidelines from the “Doing Team Homework” and “Team HW Tutorial” links in the sidebar of the course website.
 - Do not forget to rotate roles and include a reporter’s page each week.
 - Show ALL your work.
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1. After staying late one night at the Dragonfly Inn, Lorelai goes to Luke’s Diner the next morning. Let $f(h)$ be the amount of coffee (in cups) that Lorelai consumes at the cafe in the morning if she stays h hours after midnight at the inn. Let $w(c)$ be the speed (in words/minute) at which Lorelai speaks if she consumes c cups of coffee.

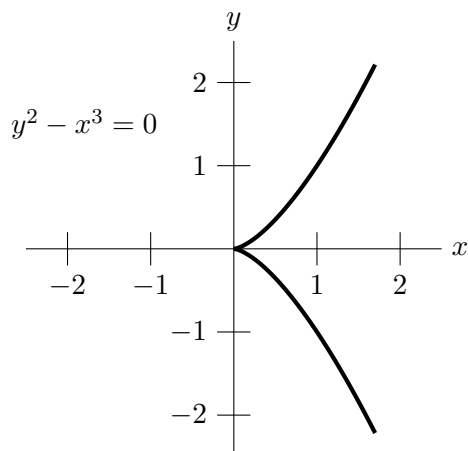
Assume that f is an invertible and differentiable function and suppose that an equation for the tangent line to the graph of $y = f(x)$ at $x = 2$ is $y = 1.5x + 3$. Suppose further that a formula for w is given by $w(c) = 250 + c \ln(c^4 + 1)$.

- (a) Evaluate $w'(1)$ and give a practical interpretation of it in the context of this problem.
- (b) Evaluate $(f^{-1})'(6)$ and give a practical interpretation of it in the context of this problem.
- (c) Let $q(h) = w(f(h))$. Evaluate $q'(2)$ and give a practical interpretation of it in the context of this problem.

2. Let $g(x) = e^{2x+\sin(x)}$.

- (a) Show that g is invertible.
- (b) Find an equation for the tangent line to the graph of $y = g(x)$ at $x = 0$.
- (c) Evaluate $(g^{-1})'(1)$.
- (d) Find an equation for the tangent line to the graph of $y = g^{-1}(x)$ at $x = 1$.

3. The curve given by $y^2 - x^3 = 0$ is sometimes called a cuspidal cubic. A graph of a portion of this curve is shown below.



- (a) Find $\frac{dy}{dx}$ in terms of x and y for the curve given by $y^2 - x^3 = 0$.
- (b) Show that the point $(1, 1)$ is on the curve given by $y^2 - x^3 = 0$.
- (c) Find a formula for the tangent line to the curve $y^2 - x^3 = 0$ at the point $(1, 1)$.
- (d) At what point(s) on the curve $y^2 - x^3 = 0$ is the tangent line perpendicular to the tangent line at $(1, 1)$?