Math 115 - Team Homework Assignment #8, Winter 2016

- **Due Date:** April 14 or 15 (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 an accident, an oil pipeline leaks. Let $g(t)$ be the rate (in gallons/hour) at which oil is leaking from the pipeline t hours after the accident. Assume that $g(t)$ is a strictly decreasing function for $0 < t < 24$. Engineers make the following measurements of $g(t)$:

t	1	3	6	8	11
$g(t)$	562	493	421	367	278

   (a) Based on the data provided, find the best possible upper and lower estimates for the total amount of oil that leaked between 1 hour and 11 hours after the accident. *Show your work.*

   (b) Give a practical interpret of the following equation in the context of the problem: $\int_{12}^{15} g(t)dt = 605.$

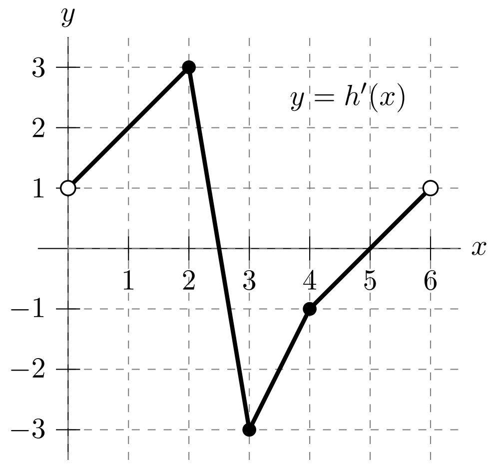
   (c) Give a single mathematical equality involving only the functions g, g', and/or g^{-1} that expresses the following statement:
   From the time the accident occurred until the leak had slowed to an instantaneous rate of 150 gallons per hour, the average rate at which oil leaked from the pipeline was 350 gallons per hour.

2. Note: For this problem, it will be helpful to have already covered Section 6.2 in class.

   (a) Describe the family of functions $f(x)$ such that $f''(x) = 12x^2 + 18x$. (That is, find a formula for this family of functions, and specify any necessary restrictions on any parameter(s) in your formula.)

   (b) Find a function $f(x)$ such that all three of the following hold.
   - $f''(x) = 12x^2 + 18x$
   - $f(1) = 18$
   - $f(-1) = 4$

3. The graph of the **derivative** of a function $h(x)$ is shown below.



Suppose that $h(2) = 3$. Sketch a graph of $h(x)$ for $0 < x < 6$.

In your sketch, be sure that you pay close attention to each of the following:

- where h is/is not differentiable
- where h increasing, decreasing, or constant
- the concavity of the graph of $y = h(x)$
- (whenever possible) the exact value of $h(x)$ at important points, including at each of its critical points and points of inflection