Part I (due at the beginning of class Friday, January 12)

NOTE: Do Part II before Part I this time (at least question 2) and the reading may be smoother. In Calculus Volume 2, read Section 2.1: Areas between Curves (the section ends at "Key Equations" after which there are exercises—you don't need to read or do the exercises).

Remember that what you turn in for Part I should have 3 parts, as mentioned in the syllabus:

(a) Your responses to the reading questions below.

(b) Your own questions/comments on the reading.

(c) The amount of time you spent on Part I (including the time spent reading).

Reading Questions

1. When finding area between two curves, why do we need to use the absolute value when the functions cross (as in the subsection "Areas of Compound Regions")? What is that doing geometrically? Feel free to illustrate your answer with a picture or two.
2. When might we want to integrate with respect to y instead of with respect to x? As in, can you draw a picture or give an example of two functions for which it could be easier to integrate with respect to y to find the area between them instead of integrating with respect to x (at least over a particular interval)?
3. Not a question on the reading, but a thing to do: fill out this office hours survey before class Friday.

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Part II: Exercises (prepare for class Friday, January 12)

1. Problem 2 on the Hyperbolic Functions handout. A hint for (c): $9x^2 = (3x)^2$. A hint for (d): $x^2 - 4 = 4\left(\frac{x^2}{4} - 1\right)$.
2. This is a warmup activity for our next topic—I strongly recommend you do this problem before doing the reading in Part I. Suppose we want to find the area between the functions $f(x) = 5 - (x-1)^2$ and $g(x) = 4 - x$.

   (a) Find the points where the graphs of f and g intersect.

(b) Sketch an accurate graph of f and g, labeling the curves by name and the intersection points with ordered pairs.

(c) Find and evaluate an integral expression that represents the area between $y = f(x)$ and the x-axis on the interval between the intersection points of f and g.

(d) Find and evaluate an integral expression that represents the area between $y = g(x)$ and the x-axis on the interval between the intersection points of f and g.

(e) What is the area between f and g between their intersection points?

(f) How can we find this area using one integral?

Part III: Homework Problems (due Wednesday, January 17 at the beginning of class)

1. A power cable hanging between two towers forms the catenary curve described by the equation

$$y = a \cosh \frac{x}{a}.$$

If the distance between the towers is $2b$, find the slope of the cable at the point where the cable meets the tower on the left. Hint: if you think of graphing the function with the y-axis placed exactly between the two towers, then you can determine the coordinates of the point where the cable meets the tower on the left.

2. Consider the integral $\int \cosh x \sinh x \, dx$.

(a) Find this integral using a u substitution with $u = \cosh x$.

(b) Find this integral using a u substitution with $u = \sinh x$.

(c) Your answers for (a) and (b) should be different, but you did the same problem. How can we account for the difference? Hint: consider identities.