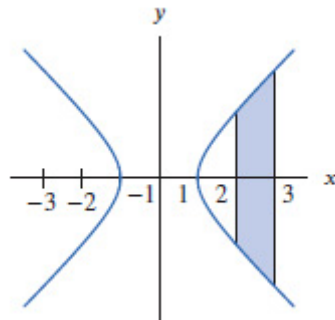
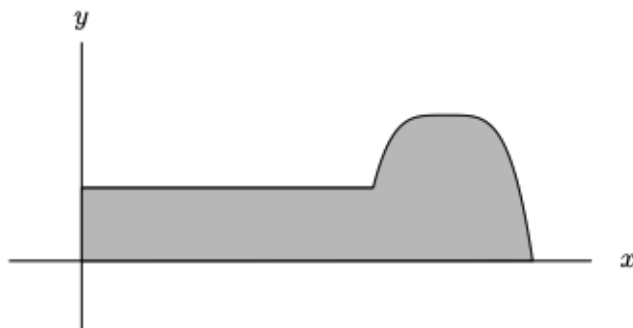


1. Write the length of one arch of $y = \sin x$.
2. Sketch the region bounded by $x = 2$ and $x = y^2 - 2$.
 - (a) Find the length of a vertical slice and a horizontal slice.
 - (b) Write integrals for the volume of a solid obtained by rotating the region around
 - i. $x = -4$
 - ii. $y = 5$
 - (c) Write an integral for the volume of the solid with base in the shape of the region above and
 - i. square cross sections
 - ii. semi-circular cross sections
3. Consider the hyperbola $x^2 - y^2 = 1$ in the figure below.



- (a) The shaded region $2 \leq x \leq 3$ is rotated around the x -axis. What is the volume generated?
- (b) What is the arc length with $y \geq 0$ from $x = 2$ to $x = 3$?

2. [13 points] Fred is designing a plastic bowl for his dog, Fido. Fred makes the bowl in the shape of a solid formed by rotating a region in the xy -plane around the y -axis. The region, shaded in the figure below, is bounded by the x -axis, the y -axis, the line $y = 1$ for $0 \leq x \leq 4$, and the curve $y = -(x - 5)^4 + 2$ for $4 \leq x \leq 2^{1/4} + 5$. Assume the units of x and y are inches.



- a. [7 points] Write an expression involving one or more integrals which gives the volume of plastic needed to make Fido's bowl. What are the units of your expression?
- b. [6 points] Fred wants to wrap a ribbon around the bowl before he gives it to Fido as a gift. The figure below depicts the cross section of the bowl obtained by cutting it in half across its diameter. The thick solid curve is the ribbon running around this cross section, and the dotted curve is the outline of the cross section which is not in contact with the ribbon. Write an expression involving one or more integrals which gives the length of the thick solid curve in the figure (the length of ribbon Fred needs to wrap the bowl).



4.