

1. Compute the following integrals:

(a)  $\int \frac{\cos x}{1 - \sin x} dx$

(b)  $\int \frac{x}{\sqrt{1 - 2x^2}} dx$

(c)  $\int_{-1}^0 t(t + 1)^{11} dt$

2. Find the area bounded between the curves  $y = x$  and  $y = x^2 - 6$  from  $x = 0$  to  $x = 5$ .

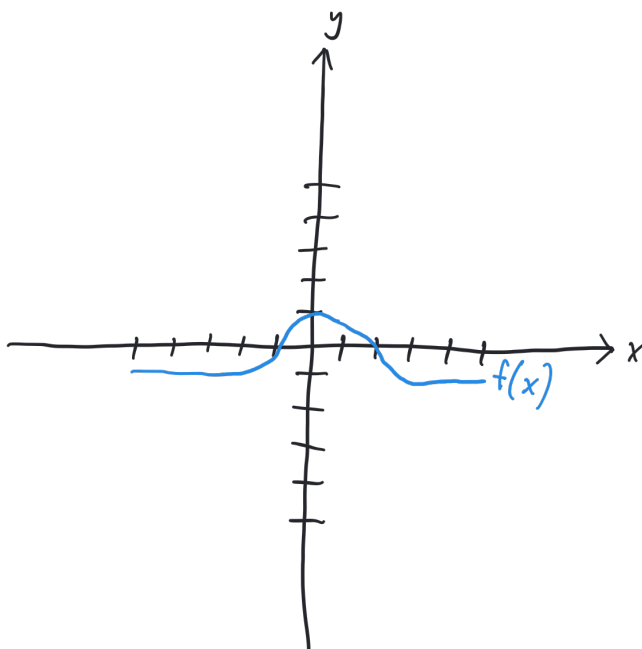
3. Consider the region bounded by  $y = x^2 - 4x$  and the  $x$ -axis.

(a) What's the volume of this region rotated around the  $x$ -axis?

(b) What's the volume of this region rotated around the axis  $y = 1$ ?

4. Consider the pyramid whose base is a  $1 \times 1$  square and whose top vertex is at height 1 above the square. Find its volume using an integral.

5. Consider the graph of  $f$  shown below:



Let  $g(x) = \int_0^x f(t) dt$ .

Find  $g(0)$ ,  $g'(0)$ , and  $g'(2)$ . Sketch  $g(x)$ .

6. The concentration of live virus in a petri dish declines exponentially over the course of a day. After  $t$  hours, the concentration of virus is  $e^{-3t}$  times its original level.

What is the average level of virus throughout the day (i.e., from time  $t = 0$  to  $t = 24$ )?