

This exam is CLOSED NOTES and CLOSED BOOK. There are NO CALCULATORS allowed. To get full credit you must show all work neatly in the space provided on the test paper.

1. (40 pts) Evaluate the following integrals.

a.  $\int \frac{s}{(1+s^2)^3} ds$

b.  $\int \sin(x) \cos^2(x) dx.$

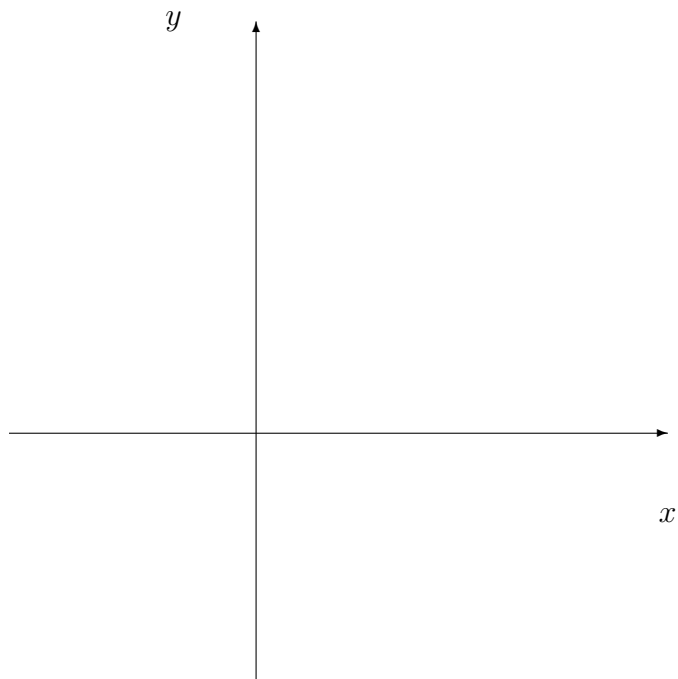
c.  $\int_0^1 x^2(1-x^3)^{1/3} dx$

d.  $\int \frac{3-u}{u} du$

2. (10 pts.) Suppose  $f(x)$  is a function defined on  $[0, 5]$  such that  $\int_0^4 f(x) dx = -3$ ,  $\int_1^3 f(x) dx = 1$ ,  $\int_2^4 f(x) dx = 5$ , and  $\int_2^5 f(x) dx = 0$ .

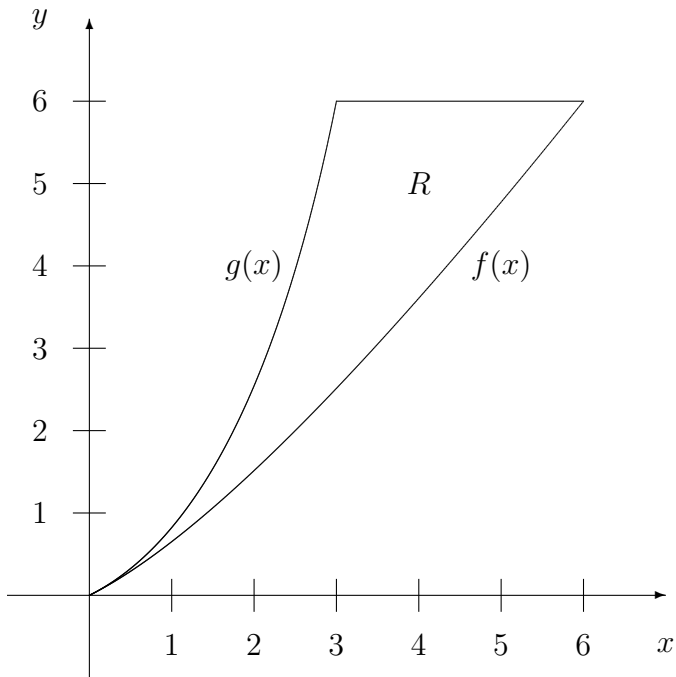
What is the average value of  $f(x)$  on the interval  $[0, 5]$ ?

3. (10 pts.) a) Sketch the region between the graphs of  $y = (x - 1)^2$  and  $y = 5 - x^2$ .



b) Compute the area between the curves.

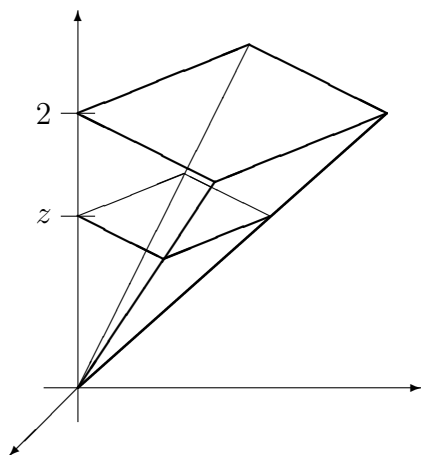
4. (8 pts.) Consider the region  $R$  below bounded by the graphs of  $f(x)$  and  $g(x)$ , and  $y = 6$ , ( $f(0) = g(0) = 0$ , and  $f(6) = 6$  and  $f(3) = 6$ ). Suppose  $y = f(x)$  has inverse  $x = f^{-1}(y)$  and  $y = g(x)$  has inverse  $x = g^{-1}(y)$ .



a. Express the area between  $f(x)$ ,  $g(x)$  and  $y = 6$  as a definite integral (or integrals) with respect to  $x$ .

b. Express the same area as a definite integral (or integrals) with respect to  $y$ .

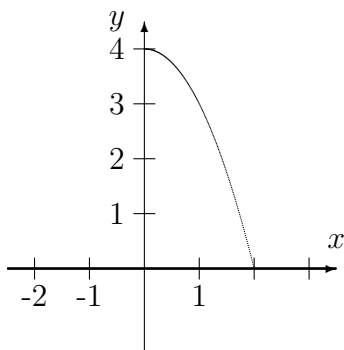
5.(8 pts.) Consider the solid object pictured below. Suppose that the cross section of the object at height  $z$  is a square with diagonal  $3z/2$ . What is the volume of the object.



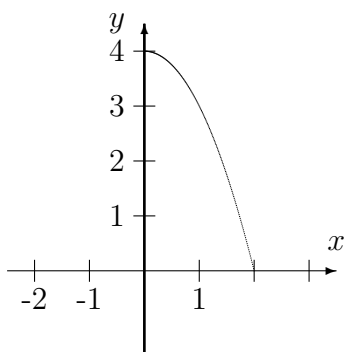
6.(24 pts.) Consider the region sketched below, which is bounded above by  $y = 4 - x^2$ , below by the  $x$  axis and the the left by the  $y$  axis. For each of the rotation axes below, set up the integral which gives the volume of rotation about that axis *with respect to  $x$* . In each case determine the shape of the volume element (disk, washer or shell) and indicate its dimensions.

[All integrals with respect to  $x$ . Do NOT evaluate these integrals.]

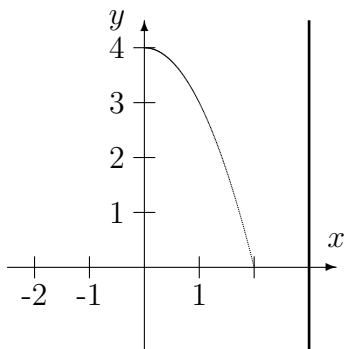
a. The  $x$ -axis:



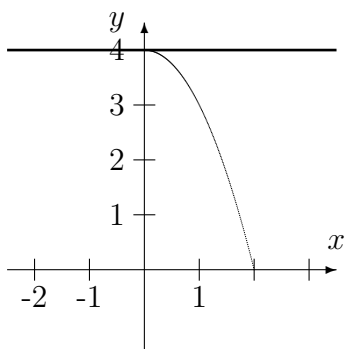
b. The  $y$  axis



c. The line  $x = 3$ .



d. The line  $y = 4$ .



Prob	Pts
1	
2	
3	
4	
5	
6	
Total	