1 Compute the following:

(a) $\int \frac{1}{5z+1}\,dz$ (b) $\int_{-2}^{2} -\sqrt{4-y^2}\,dy$ (c) $\int_0^{2\pi} \cos^2(3\theta)\,d\theta + \int_0^{2\pi} \sin^2(3\theta)\,d\theta$

2 Sometimes when integrating, there are several possible choices for u-substitutions.

Consider the integral

$$\int \frac{x}{1+x^4}\,dx$$

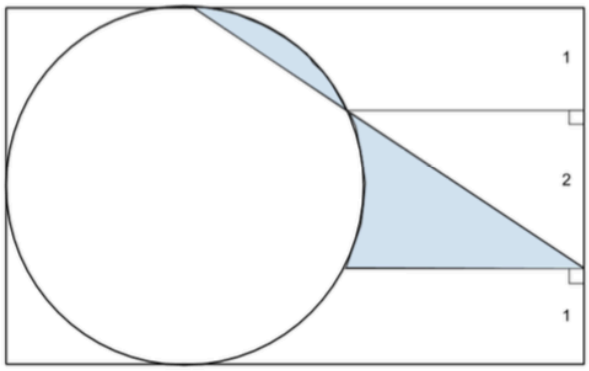
For each of the possible substitutions below, show your work as you try to use them to compute the integral. If they don't work, comment on why not.

(a) $u = 1 + x^4$

(b) $u = x^2$

(c) $u = \sqrt{x}$

3 Consider the shaded region in the image below. The numbers on the right measure the lengths of the vertical line segments. Write an expression using one or more integrals that would compute the shaded area. Explain where each piece of your expression comes from. You do not need to actually compute this area.



4 Let a, b, be positive real numbers. Consider the region in the plane bounded by the curves $y = -ax^2+bx$ and the x-axis.

(a) Sketch a graph of this region. (Hint, factor the quadratic in order to find the roots.)

(b) Let k be a negative real number. Find the volume of the solid generated by revolving this region about the line $y = k$. While computing, draw a clear picture of the solid and method.

(c) Find the volume of the solid generated by revolving this region about the line $x = k$. While computing, draw a clear picture of the solid and method.

(d) True or false: The volume from part (c) is always greater than the volume from part (b).

Can you make an argument without using a calculator that supports your claim?