Recall the method of u-substitution for evaluating integrals:

u-Substitution (Change of Variable Method):

If $u = g(x)$ is a differentiable function whose range is and interval I and f is continous on I, then

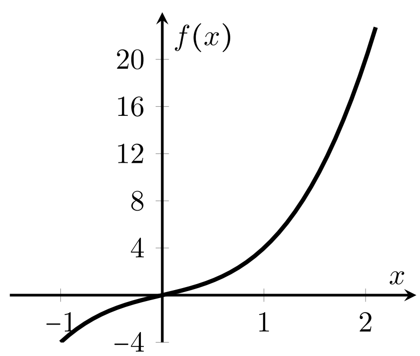
$$\int f(g(x))g'(x)\,dx = \int f(u)\,du$$

To get a better conceptual understanding of what u-substitution is doing to our integrals, we will examine the graphs of an original integral and its transformed u-substitution integral.

1. We will first examine the integral

$$\int_1^2 2x(1+x^2)\,dx.$$

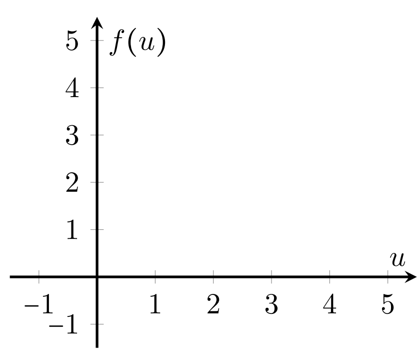
   (a) Shade the area represented by the integral on the graph below:



   (b) Use technology to calculate the area of this region.

   (c) Transform the integral using u-substitution.

   (d) Graph the transformed integral on the axis below. *Pay attention to the axis labels!*



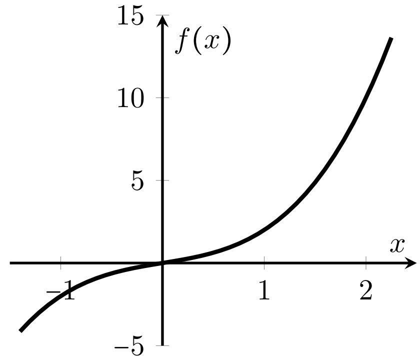
   (e) Calculate the area of this region. How does it compare to the area for $\int_1^2 2x(1+x^2)\,dx$?

Now we will adjust our integral slightly to see if this impacts anything.

2. Now examine the integral

$$\int_1^2 x(1+x^2)\,dx$$

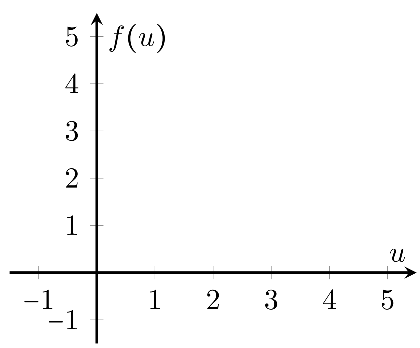
(a) Shade the area represented by the integral on the graph below:



(b) Use technology to calculate the area of this region.

(c) Transform the integral using u-substitution.

(d) Graph the transformed integral on the axis below. *Pay attention to the axis labels!*



(e) Calculate the area of this region. How does it compare to the area for $\int_1^2 x(1+x^2)\,dx$?

3. Using full sentences, write a brief summary of the geometric transformation that occurs to the integral

$$\int_{-1}^{1} 2x^2(3+x^3)^2\,dx$$

when you evaluate it using u-substitution.