# Why Does U-Substitution Work?

RECALL: (Chain Rule)

$$D\, f(g(x)) = f'(g(x)) \cdot g'(x).$$

Then we can say that

$$\int f'(g(x))\, g'(x)\, dx = f(g(x)) + C.$$

Or we can do it this way:

$$\int f'(g(x))\, g'(x)\, dx$$

$$\left(\text{Let } u = g(x) \xrightarrow{D} du = g'(x)\, dx\right)$$

$$= \int f'(u)\, du$$

$$= f(u) + C$$

$$= f(g(x)) + C$$