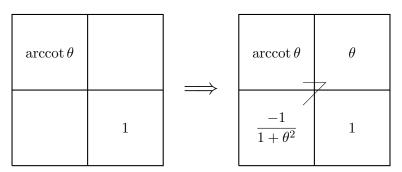
Check-In 01/16. (*True/False*) Given $\int_0^\pi e^{\sin x} \cos x \ dx$, the u-substitution $u = \sin x$ transforms this integral into $\int_0^\pi e^u \ du$.

Solution. The statement is *false*. If $u=\sin x$, then $du=\cos x\,dx$. So indeed, this u-substitution would transform the integral $\int e^{\sin x}\cos x\,dx$ into the integral $\int e^u\,du$. However with definite integrals, one needs to remember to transform the limits as well. If x=0, then $u=\sin(0)=0$. If $x=\pi$, then $u=\sin(\pi)=0$. Therefore, the correct substitution is $\int_0^\pi e^{\sin x}\cos x\,dx=\int_0^0 e^u\,du=0$.

Check-In 01/21. (*True/False*) To integrate $\int \operatorname{arccot} \theta \, d\theta$, one can use integration-by-parts by choosing $u = \operatorname{arccot} \theta$ and dv = 1.

Solution. The statement is *true*. Using LIATE, it is likely that the choice of $u = \operatorname{arccot} \theta$ will work. With 'nothing left' in the integrand, this means that dv = 1. We fill in our box as follows:



Then using the 'Rule of 7', we find that...

$$\int \operatorname{arccot} \theta \, d\theta = \theta \operatorname{arccot} \theta - \int \frac{-\theta}{1 + \theta^2} \, d\theta = \theta \operatorname{arccot} \theta + \int \frac{\theta}{1 + \theta^2} \, d\theta$$

Using the *u*-substitution $u=1+\theta^2$, we see that $\int \frac{\theta}{1+\theta^2} d\theta = \frac{1}{2} \ln|1+\theta^2| + C$. Therefore, we have... $\int \operatorname{arccot} \theta \, d\theta = \theta \operatorname{arccot} \theta + \frac{1}{2} \ln|1+\theta^2| + C$