Quiz 0 **Solutions**, Math 112, Section 1 (Vinroot)

Compute each of the following. Show all of your steps clearly to receive full credit.

1. $\displaystyle\int \frac{\sec^2(\ln(x))}{x}\,dx$

Solution: Use the substitution $u = \ln(x)$, so $du = (1/x)\,dx$. After making the substitution, the integral becomes

$$\int \frac{\sec^2(\ln(x))}{x}\,dx = \int \sec^2(u)\,du = \tan(u) + C = \tan(\ln(x)) + C.$$

Note that we have used the fact that $\sec^2(u)$ is the derivative $\tan(u)$.

2. $\displaystyle\int_0^1 3t\sqrt{1+3t^2}\,dt$

Solution: Substitute $u = 1 + 3t^2$ so that $du = 6t\,dt$, and so $(1/2)\,du = 3t\,dt$. For the limits of integration, when $t = 0$, $u = 1$, and when $t = 1$, $u = 4$. Now the definite integral becomes

$$\int_0^1 3t\sqrt{1+3t^2}\,dt = \int_1^4 \frac{1}{2}\sqrt{u}\,du = \int_1^4 \frac{1}{2}u^{1/2}\,du = \frac{1}{3}u^{3/2}\bigg|_1^4 = \frac{1}{3}4^{3/2} - \frac{1}{3}1^{3/2} = \frac{7}{3}.$$

Note that to compute $4^{3/2}$, we take the square root first to make things easier, that is $4^{3/2} = (4^{1/2})^3 = 2^3 = 8$.