

1. (5 points) Integrate using u-substitution

$$\int \frac{\csc^2(2x)}{\sqrt{2 + \cot(2x)}} dx.$$

**Solution:** We first let

$$u = 2 + \cot(2x).$$

and then we take the derivative at get:

$$du = -2 \csc^2(2x) dx.$$

$$-\frac{1}{2} du = \csc^2(2x) dx.$$

After that we substitute our  $x$  and  $dx$  with their respective  $u$  terms to get:

$$= \frac{1}{-2} \int \frac{1}{\sqrt{u}} du.$$

Now we have to integrate

$$= -\frac{1}{2} \int u^{-1/2} du.$$

$$= -\frac{1}{2} \frac{u^{1/2}}{\frac{1}{2}} + C$$

$$= -\sqrt{u} + C$$

Finally we replace our  $u$  back with what it used to be:

$$\int \frac{\csc^2(2x)}{\sqrt{2 + \cot(2x)}} dx = -\sqrt{2 + \cot^2 2x} + C$$