2. $\int_0^{\frac{\pi}{12}} sec^2(3x)dx$ (5 points)

First do $\int sec^2(3x)dx$

Let $u = 3x$

$du = 3dx$

$dx = \frac{du}{3}$

so $\int sec^2(3x)\,dx = \int \frac{sec^2 u\,du}{3}$

$= \frac{1}{3}\int sec^2 u\,du$

$= \frac{1}{3}\tan u + C$

$= \frac{1}{3}\tan 3x + C$

so $\int_0^{\frac{\pi}{12}} sec^2(3x)\,dx$

$= \frac{1}{3}\tan 3x \Big|_0^{\frac{\pi}{12}}$

$= \frac{1}{3}\left(\tan\frac{\pi}{4} - \tan 0\right)$

$= \boxed{\frac{1}{3}}$