

TRIG IDENTITIES WITH \tan AND \sec

Recall $\sec = \frac{1}{\cos}$, $\tan = \frac{\sin}{\cos}$. We have the following set of identities:

- (1) $1 + \tan^2 u = \sec^2 u$
- (2) $(\tan u)' = \sec^2 u$
- (3) $(\sec u)' = \sec u \tan u$

These set of identities are particularly useful when integrating powers of \tan and \sec , as in $\int \tan^n x dx$ and $\int \sec^n x dx$ which are the subject of section 8.3. Identity (1) is also the reason why we make the special substitution $x = \tan u$ every time we encounter the expression $\sqrt{1+x^2}$, since

$$x = \tan u \Rightarrow \sqrt{1+x^2} = \sec u$$

Also, keep in mind that dx gets transformed as well when making the substitution, for example

$$x = \tan u \Rightarrow dx = \sec^2 u du$$

and the reason for that is identity (2).