## Useful Trigonometric Identities for MA 114

The following are some trig identities that are particularly helpful for integration problems. You should know these for the exam.

- Pythagorean Theorem Identities. The second and third identities here can be derived from the first by dividing by $\sin ^{2}(x)$ or $\cos ^{2}(x)$. These are useful for any integral involving trig functions or trig substitutions.

$$
\begin{aligned}
& -\sin ^{2}(x)+\cos ^{2}(x)=1 \\
& -\tan ^{2}(x)+1=\sec ^{2}(x) \\
& -1+\cot ^{2}(x)=\csc ^{2}(x)
\end{aligned}
$$

- Double Angle Formulas The second two of these identities are usually useful for integrating expressions with an even power of $\sin (x)$ and $\cos (x)$. The first two are usually useful for simplifying your final answer and converting back to the original variable in a trig substitution problem. Sometimes the second two are also useful for the integration step, though this is rarer.

$$
\begin{aligned}
& -\sin (2 x)=2 \sin (x) \cos (x) \\
& -\cos (2 x)=\cos ^{2}(x)-\sin ^{2}(x)=2 \cos ^{2}(x)-1=1-2 \sin ^{2}(x) \\
& -\sin ^{2}(x)=\frac{1}{2}(1-\cos (2 x)) \\
& -\cos ^{2}(x)=\frac{1}{2}(1+\cos (2 x))
\end{aligned}
$$

You can derive the third and fourth identities above from the second one by rearranging.

