Trig Substitutions for Math 230

William Green

Handy Little Table:

Form Appearing in Integral	u	du	Identity to use
$a^2 - u^2$	$u = asin\theta$	$du = acos\theta d\theta$	$1 - sin^2\theta = cos^2\theta$
$a^2 + u^2$	$u = atan\theta$	$du = asec^2\theta d\theta$	$1 + tan^2\theta = sec^2\theta$
$u^2 - a^2$	$u = asec\theta$	$du = atan\theta sec\theta d\theta$	$sec^2\theta - 1 = tan^2\theta$

Always draw your triangle so you can substitute back from θ to your original variable! Note that if you remember that there are only three trig substitutions that we use, we can draw the triangle for each substitution and determine which form of $\pm u^2 \pm a^2$ we need to use this type of substitution on.

For example, if we draw the triangle for the substitution $u = a\sin\theta$ we find that one of the legs of the triangle has length $\sqrt{a^2 - u^2}$,

If we draw the triangle for the substitution $u = a\tan\theta$ we find that the hypotenuse of the triangle has length $\sqrt{a^2 + u^2}$.

If we draw the triangle for the substitution $u = a\sec\theta$ we find that one of the legs of the triangle has length $\sqrt{u^2 - a^2}$, if we draw the triangle for the substitution