

Trigonometric Substitution ($a > 0$)

1. For integrals involving $\sqrt{a^2 - u^2}$, let

$$u = a \sin \theta$$

Then $\sqrt{a^2 - u^2} = a \cos \theta$, where

$$-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$$

2. For integrals involving $\sqrt{a^2 + u^2}$, let

$$u = a \tan \theta$$

Then $\sqrt{a^2 + u^2} = a \sec \theta$, where

$$-\frac{\pi}{2} < \theta < \frac{\pi}{2}$$

3. For integrals involving $\sqrt{u^2 - a^2}$, let

$$u = a \sec \theta$$

Then $\sqrt{u^2 - a^2} = \pm a \tan \theta$, where

$$0 \leq \theta < \frac{\pi}{2} \text{ or } \frac{\pi}{2} < \theta \leq \pi.$$

Use the positive value if $u > 0$ and the negative value if $u < -a$.