

Trigonometric Substitution

$$\int \frac{dx}{\sqrt{a^2 - x^2}}$$

$$x = a \sin(\theta), \quad dx = a \cos(\theta) d\theta, \quad \theta = \arcsin\left(\frac{x}{a}\right)$$

Trigonometric Substitution

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \int \frac{a \cos(\theta) d\theta}{\sqrt{a^2 - a^2 \sin^2(\theta)}} \quad (1)$$

$$\begin{aligned} &= \int \frac{a \cos(\theta) d\theta}{\sqrt{a^2(1 - \sin^2(\theta))}} \\ &= \int \frac{a \cos(\theta) d\theta}{\sqrt{a^2 \cos^2(\theta)}} \\ &= \int d\theta = \theta + C \quad (2) \\ &= \arcsin\left(\frac{x}{a}\right) + C \end{aligned}$$