2. Integration of expressions containing trigonometric functions.

Let the integrand function be the product of sine and cosine in positive integer powers of different parity, for example

$$\int \sin^{2m} x \cdot \cos^{2n+1} x dx .$$

$$\cos x \equiv \frac{1 - \operatorname{tg}^2 \frac{x}{2}}{1 + \operatorname{tg}^2 \frac{x}{2}}$$

$$\cos x = \frac{1 - t^2}{1 + t^2}$$

Prove the table integral:

$$\int \frac{dx}{\sin x} = \ln\left|\operatorname{tg}\frac{x}{2}\right| + C.$$