$$\int 2 \sin x \cos x \, dx$$

Solution 1

Use $u = \sin x$, so $du = \cos x \, dx$. Then

$$\int 2 \sin x \cos x \, dx = 2 \int u \, du = 2 \frac{u^2}{2} + C = (\sin x)^2 + C.$$

Solution 2

Use $u = \cos x$, so $du = -\sin x \, dx$. Then

$$\int 2 \sin x \cos x \, dx = -2 \int u \, du = -2 \frac{u^2}{2} + C = -(\cos x)^2 + C.$$

Solution 3

Take the trig identity $\sin 2x = 2 \sin x \cos x$ to rewrite the integral:

$$\int 2 \sin x \cos x \, dx = \int \sin 2x \, dx.$$

Then, by substituting $u = 2x$, we have $du = 2 \, dx$, so the integral above is equal to

$$\frac{1}{2} \int \sin u \, du = -\frac{1}{2} \cos u + C = -\frac{1}{2} \cos 2x + C.$$