$\int e^x \sin x\, dx$

$$\int e^x \sin x\, dx$$

$$u = e^x \qquad dv = \sin x\, dx$$

$$du = e^x\, dx \qquad v = -\cos x$$

$$\int e^x \sin x\, dx = e^x(-\cos x) - \int -\cos x\left(e^x\right)dx$$

$$= -e^x \cos x + \int e^x \cos x\, dx$$

$$u = e^x \qquad dv = \cos x\, dx$$

$$du = e^x\, dx \qquad v = \sin x$$

$$\int e^x \sin x\, dx = e^x(-\cos x) - \int -\cos x\left(e^x\right)dx$$

$$= -e^x \cos x + \left(e^x \sin x - \int \sin x\left(e^x\right)dx\right)$$

$$\int e^x \sin x\, dx = -e^x \cos x + e^x \sin x - \int e^x \sin x\, dx$$

$$+\int e^x \sin x\, dx \qquad\qquad +\int e^x \sin x\, dx$$

$$2\int e^x \sin x\, dx = -e^x \cos x + e^x \sin x + c$$

$$\int e^x \sin x\, dx = \frac{-e^x \cos x + e^x \sin x + c}{2}$$