3.4.a

$$I = \int_0^{\pi} e^x \cdot \cos x\, dx = \int_0^{\pi} f(x)\,dx$$

$$f'(x) = \frac{d}{dx} e^x \cdot \cos x = e^x \cdot \cos x - e^x \sin x$$
$$= e^x (\cos x - \sin x)$$

$f'(\underset{a}{0}) = 1 \qquad f'(\underset{b}{\pi}) = -e^{\pi} \qquad f(0) = 1 \qquad f(\pi) = -e^{\pi}$

$$I = \int_0^{\pi} e^x \underset{u}{\cos x}\, dx = \int_0^{\pi} e^x \sin(x)\,dx + e^x \cdot \cos x$$

$dv = e^x dx \rightarrow v = \int e^x dx = e^x \qquad \int u\,dv = uv - \int v\,du$

$$\int_0^{\pi} e^x \sin x\, dx = e^x \sin x - \int_0^{\pi} e^x \cos x\, dx$$

$$\rightarrow \int_0^{\pi} e^x \cos x\, dx = e^x (\sin x + \cos x) - \int_0^{\pi} e^x \cos x\, dx$$

$$\rightarrow 2\int_0^{\pi} e^x \cos x\, dx = e^x (\sin x + \cos x)$$

$$I = \int_0^{\pi} e^x \cos x\, dx = \frac{e^x}{2} (\sin x + \cos x) + \text{Const}\Big|_0^{\pi}$$

$$= -\frac{1}{2} - \frac{e^{\pi}}{2} = -\frac{1}{2}(e^{\pi} + 1)$$

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