

Exercise 34

Evaluate the integral.

$$\int_0^3 (2 \sin x - e^x) dx$$

Solution

Split up the integral using the properties of integrals.

$$\begin{aligned} \int_0^3 (2 \sin x - e^x) dx &= \int_0^3 2 \sin x dx - \int_0^3 e^x dx \\ &= 2 \int_0^3 \sin x dx - \int_0^3 e^x dx \end{aligned}$$

Write the integrands as derivatives (page 193 and page 179 for the trigonometric and exponential functions, respectively) and apply the second part of the fundamental theorem of calculus.

$$\begin{aligned} \int_0^3 (2 \sin x - e^x) dx &= 2 \int_0^3 -\frac{d}{dx}(\cos x) dx - \int_0^3 \frac{d}{dx}(e^x) dx \\ &= -2 \int_0^3 \frac{d}{dx}(\cos x) dx - \int_0^3 \frac{d}{dx}(e^x) dx \\ &= -2(\cos x) \Big|_0^3 - (e^x) \Big|_0^3 \\ &= -2(\cos 3 - \cos 0) - (e^3 - e^0) \\ &= -2(\cos 3 - 1) - (e^3 - 1) \\ &= 3 - 2 \cos 3 - e^3 \end{aligned}$$