21.1 Evaluate the following integral:

$$\int_0^{\pi/2} (8 + 4\cos x)\, dx$$

(a) analytically; **(b)** single application of the trapezoidal rule; **(c)** multiple-application trapezoidal rule, with $n = 2$ and 4; **(d)** single application of Simpson's 1/3 rule; **(e)** multiple-application Simpson's 1/3 rule, with $n = 4$; **(f)** single application of Simpson's 3/8 rule; and **(g)** multiple-application Simpson's rule, with $n = 5$. For each of the numerical estimates **(b)** through **(g)**, determine the percent relative error based on **(a)**.

21.2 Evaluate the following integral:

$$\int_0^3 \left(1 - e^{-x}\right) dx$$

(a) analytically; **(b)** single application of the trapezoidal rule; **(c)** multiple-application trapezoidal rule, with $n = 2$ and 4; **(d)** single application of Simpson's 1/3 rule; **(e)** multiple-application Simpson's 1/3 rule, with $n = 4$; **(f)** single application of Simpson's 3/8 rule; and **(g)** multiple-application Simpson's rule, with $n = 5$. For each of the numerical estimates **(b)** through **(g)**, determine the percent relative error based on **(a)**.

21.3 Evaluate the following integral:

$$\int_{-2}^{4} (1 - x - 4x^3 + 2x^5)\, dx$$

(a) analytically; **(b)** single application of the trapezoidal rule; **(c)** composite trapezoidal rule, with $n = 2$ and 4; **(d)** single application of Simpson's 1/3 rule; **(e)** Simpson's 3/8 rule; and **(f)** Boole's rule. For each of the numerical estimates **(b)** through **(f)** determine the percent relative error based on **(a)**.

21.4 Integrate the following function analytically and using the trapezoidal rule, with $n = 1$, 2, 3, and 4:

$$\int_1^2 (x + 1/x)^2\, dx$$

Use the analytical solution to compute true percent relative errors to evaluate the accuracy of the trapezoidal approximations.

21.5 Integrate the following function both analytically and using Simpson's rules, with $n = 4$ and 5. Discuss the results.

$$\int_{-3}^{5} (4x - 3)^3\, dx$$