Fig. 12.7 Illustration of Gauss-Legendre formula

Example 12.8

Compute $\int_{-1}^{1} e^x \, dx$ using two-point Gauss-Legendre formula

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$$I = \int_{-1}^{1} \exp(x) \, dx$$

$$= f(x_1) + f(x_2)$$

where x_1 and x_2 are Gaussian quadrature points and are given by

$$x_1 = -\frac{1}{\sqrt{3}} = -0.5773502$$

$$x_2 = +\frac{1}{\sqrt{3}} = 0.5773502$$

Therefore,

$$I = \exp(-0.5773502) + \exp(0.5773502)$$

$$= 0.5613839 + 1.7813122$$

$$= 2.3426961$$