Multiple-Choice Test

Chapter 07.04
Romberg Rule

1. If I_n is the value of integral $\int_a^b f(x)dx$ using n-segment trapezoidal rule, a better estimate of the integral can be found using Richardson's extrapolation as
   (A) $I_{2n} + \frac{I_{2n} - I_n}{15}$
   (B) $I_{2n} + \frac{I_{2n} - I_n}{3}$
   (C) I_{2n}
   (D) $I_{2n} + \frac{I_{2n} - I_n}{I_{2n}}$

2. The estimate of an integral of $\int_3^{19} f(x)dx$ is given as 1860.9 using 1-segment trapezoidal rule. Given $f(7) = 20.27$, $f(11) = 45.125$, and $f(14) = 82.23$, the value of the integral using 2-segment trapezoidal rule would most nearly be
   (A) 787.32
   (B) 1072.0
   (C) 1144.9
   (D) 1291.5

3. The value of an integral $\int_a^b f(x)dx$ given using 1, 2, and 4 segments trapezoidal rule is given as 5.3460, 2.7708, and 1.7536, respectively. The best estimate of the integral you can find using Romberg integration is most nearly
   (A) 1.3355
   (B) 1.3813
   (C) 1.4145
   (D) 1.9124

4. Without using the formula for one-segment trapezoidal rule for estimating $\int_a^b f(x)dx$ the true error, E_t can be found directly as well as exactly by using the formula

$$E_t = -\frac{(b-a)^3}{12} f''(\xi),\ a \le \xi \le b$$

for

(A) $f(x) = e^x$
(B) $f(x) = x^3 + 3x$
(C) $f(x) = 5x^2 + 3$
(D) $f(x) = 5x^2 + e^x$

5. For $\int_a^b f(x)dx$, the true error, E_t in one-segment trapezoidal rule is given by

$$E_t = -\frac{(b-a)^3}{12} f''(\xi),\ a \le \xi \le b$$

The value of ξ for the integral $\int_{2.5}^{7.2} 3e^{0.2x}dx$ is most nearly

(A) 2.7998
(B) 4.8500
(C) 4.9601
(D) 5.0327

6. Given the velocity vs. time data for a body

t (s)	2	4	6	8	10	25
v (m/s)	0.166	0.55115	1.8299	6.0755	20.172	8137.5

The best estimate for distance covered in meters between $t = 2$ s and $t = 10$ s by using Romberg rule based on trapezoidal rule results would be

(A) 33.456
(B) 36.877
(C) 37.251
(D) 81.350

For a complete solution, refer to the links at the end of the book.