Multiple-Choice Test – Gauss Quadrature Rule
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1. $\int_5^{10} f(x)dx$ is exactly

    (A) $\int_{-1}^{1} f(2.5x+7.5)dx$

    (B) $2.5\int_{-1}^{1} f(2.5x+7.5)dx$

    (C) $5\int_{-1}^{1} f(5x+5)dx$

    (D) $5\int_{-1}^{1} (2.5x+7.5)f(x)dx$

2. For a definite integral of any third order polynomial, the two-point Gauss quadrature rule will give the same results as the

    (A) 1-segment trapezoidal rule
    (B) 2-segment trapezoidal rule
    (C) 3-segment trapezoidal rule
    (D) Simpson's 1/3 rule

3. The value of $\int_{0.2}^{2.2} xe^{x}dx$ by using the two-point Gauss quadrature rule is most nearly

    (A) 11.672
    (B) 11.807
    (C) 12.811
    (D) 14.633

4. A scientist uses the one-point Gauss quadrature rule based on getting exact results of integration for functions $f(x)=1$ and x. The one-point Gauss quadrature rule approximation for $\int_a^b f(x)dx$ is

(A) $\frac{b-a}{2}\left[f(a)+f(b)\right]$

(B) $(b-a)f\left(\frac{a+b}{2}\right)$

(C) $\frac{b-a}{2}\left[f\left(\frac{b-a}{2}\left\{-\frac{1}{\sqrt{3}}\right\}+\frac{b+a}{2}\right)+f\left(\frac{b-a}{2}\left\{\frac{1}{\sqrt{3}}\right\}+\frac{b+a}{2}\right)\right]$

(D) $(b-a)f(a)$

5. A scientist develops an approximate formula for integration as

$\int_a^b f(x)dx \approx c_1 f(x_1),$ where $a \le x_1 \le b$

The values of c_1 and x_1 are found by assuming that the formula is exact for functions of the form $a_0 x + a_1 x^2$. The resulting formula would therefore be exact for integrating

(A) $f(x)=2$

(B) $f(x)=2+3x+5x^2$

(C) $f(x)=5x^2$

(D) $f(x)=2+3x$

6. You are asked to estimate the water flow rate in a pipe of radius 2 m at a remote area location with a harsh environment. You already know that velocity varies along the radial location, but you do not know how it varies. The flow rate Q is given by

$$Q=\int_0^2 2\pi rVdr$$

To save money, you are allowed to put only two velocity probes (these probes send the data to the central office in New York, NY via satellite) in the pipe. Radial location, r is measured from the center of the pipe, that is $r = 0$ is the center of the pipe and $r = 2\mathrm{m}$ is the pipe radius. The radial locations you would suggest for the two velocity probes for the most accurate calculation of the flow rate are

(A) 0, 2
(B) 1, 2
(C) 0, 1
(D) 0.42, 1.58