Integration

$$I = 4\int_0^1 \sqrt{1-x^2}\,dx$$

As difficult a problem as thou finding quadrature of a circle

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1

One Point Rule

A scientist would derive one-point Gauss Quadrature rule based on getting exact results for integration for the function $g(x) = a_0 + a_1 x$. The one-point rule approximation for the general integral $\int_a^b f(x)dx$ is _____

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

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

$(b-a)f(a)$

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3

Two-Point Gauss Quadrature Rule

$$\int_a^b f(x)dx \approx c_1 f(x_1) + c_2 f(x_2)$$

Let it be exact for $a_0 + a_1 x + a_2 x^2 + a_3 x^3$

$$\int_a^b f(x)dx \approx c_1 f(x_1) + c_2 f(x_2)$$

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

4

One-Point Gauss Quadrature Rule

$$\int_a^b f(x)dx \approx c_1 f(x_1)$$

Let it be exact for $a_0 + a_1 x$

$$\int_a^b f(x)dx \approx c_1 f(x_1)$$

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

Could Gauss have derived the formula by letting it be exact for $a_0 + a_1 x + a_2 x^2$?

Could Gauss have derived the formula by letting it be exact for $a_1 x + a_2 x^2$?

5

A 2-point Gauss quad rule will give the exact definite integral value of the following integrands. Choose all that apply.

$6x^4$

$2x$

$2 + 3x + 3x^2 + 5x^3 + 6x^4$

$2 + 3x + 3x^2 + 5x^3$

$2 + 5x^2$

$5x^3$

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6

Which of these represents a single application of the trapezoidal rule of integration? Choose all that apply.

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7

In Gauss quadrature rule, the number of function evaluations for the 8-point rule is

8

9

17

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8

For integrating any third order polynomial, the two-point Gauss quadrature rule will give you the same results as

- 1-segment trapezoidal rule
- 2-segment trapezoidal rule
- 3-segment trapezoidal rule
- none of the above

9

In Gauss quadrature rule, the number of function evaluations for the 8-point rule is

- 8
- 9
- 17

10

What is the highest order of polynomial that can be integrated exactly by a 5-point Gauss quadrature rule?

11

A function is being integrated from a lower limit of 2 to an upper limit of 10. A person is willing to only give you the value of the function at only two points. Which two points would you choose? Separate the answers with a comma

12

$\int_5^{10} f(x)dx$ **is exactly**

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

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13

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14