

LESSON 5: NUMERICAL INTEGRATION

Objective 1. To state and use the following rules of numerical integration: Left Endpoint Rule, Right Endpoint Rule, Midpoint Rule, Trapezoid Rule, and Simpson's Rule

Rules

In addition to the Left Endpoint and Right Endpoint Rules already studied:

Midpoint Rule

$$\frac{b-a}{k} \left[f\left(a + \frac{\Delta x}{2}\right) + f\left(a + \frac{3\Delta x}{2}\right) + \dots + f\left(a + \frac{(2k-1)\Delta x}{2}\right) \right]$$

Trapezoid Rule

$$\frac{b-a}{2k} \left[f(a) + 2f(a + \Delta x) + 2f(a + 2\Delta x) + \dots + 2f(a + (k-1)\Delta x) + f(b) \right]$$

Simpson's Rule

$$\frac{b-a}{3k} \left[f(a) + 4f(a + \Delta x) + 2f(a + 2\Delta x) + \dots + 4f(a + (k-1)\Delta x) + f(b) \right]$$

Examples

1. Use the five methods of numerical integration discussed in this lesson to evaluate using $k = 4$ subintervals

- a. $y = x^2 + 1$ on $[0,2]$

- b. $\int_0^1 \sin x^2 dx$

2. Compute (a) and (b) above using the TRAPSIMP program on your graphing utility.