Commands on the TI-83/4 calculator are a big part of this lesson. A few important commands are as follows: (1.) to edit lists: STAT -> EDIT. (2.) to get y1: VARS -> YVARS -> FUNCTION -> Y1. (3.) sequence of x_i's: seq(x_i,i,i_0,i_max,1). (4.) sequence: LIST -> OPS -> SEQ (5.) sum: LIST -> MATH -> SUM. The basic list structure used is below.

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List 1: (L1): x_i's .... use sequence
List 2: (L2): "y1(L1)" .... make sure to enter y1
List 3: (L3): coefficients such as 1, 2, ..., 2, 1
List 4: (L4): "L2*L3"
Home screen: (dx/factor)*sum(L4)

Ch. 7.7

Numerical Integration.

- We have 5 methods of numerical integration already

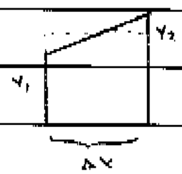
1) Right $R_3 = \Delta x(f(x_1) + f(x_2) + f(x_3))$

Riemann Sum 2) Left $L_3 = \Delta x(f(x_0) + f(x_1) + f(x_2))$

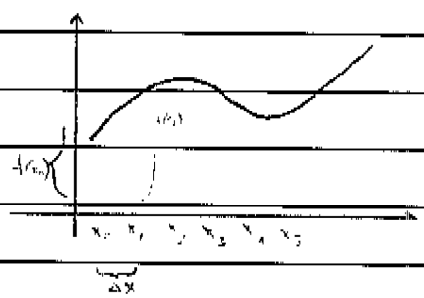
3) Midpoint

* 4) Trapezoidal Rule

* 5) Simpson's Rule.



$$\text{Area} = \Delta x\left(\frac{y_1 + y_2}{2}\right) = \frac{\Delta x}{2}(y_1 + y_2)$$



$$T_5 = \frac{\Delta x}{2}(f(x_0) + f(x_1)) + \frac{\Delta x}{2}(f(x_1) + f(x_2)) + \dots + \frac{\Delta x}{2}(f(x_4) + f(x_5))$$

$$= \frac{\Delta x}{2}(1f(x_0) + 2(f(x_1)) + 2f(x_2) + \dots + 2f(x_4) + 1f(x_5))$$

Ex: 1 Use T_8 to approx $\int_0^2 e^{-x^2}\,dx$

$$T_8 = \frac{.25}{2}(f(0) + 2f(.25) + 2f(.5) + \dots + 2f(1.75) + f(2)) \approx .8817$$

Simpson's Rule:

$$S_8 = \frac{\Delta x}{3}(1f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + \dots + 4f(x_7) + 1f(x_8)) \approx .8821$$

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Section 7.7

EX:2 $\int_1^3 e^{-4x}\,dx = \left[\frac{1}{-4}e^{-4x}\right]_1^3 = \frac{1}{-4}\left(e^{-12} - e^{-4}\right) = .0045773737$ FTofC.

numerical method. fnInt$(Y_1(x), x, 1, 3)$

Trap $T_6 = \frac{\frac{1}{3}}{2}\left(1f(1) + 2f(1+\frac{1}{3}) + 2f(1+\frac{2}{3}) + \dots + 2f(1+\frac{5}{3}) + 1f(3)\right)$.

$\Delta x = \frac{1}{3}$

$x_i = 1 + \frac{i}{3}$

1, 2, 2, ... 2, 1

Simpson's Rule $S_6 = \frac{\frac{1}{3}}{3}\left(1f(1) + 4f(1+\frac{1}{3}) + 2f(1+\frac{2}{3}) \dots + 4f(1+\frac{5}{3}) + 1f(3)\right)$.

1, 4, 2, 4, 2, ... 4, 1.

Left $L_6 = \frac{1}{3}\left(1f(1) + 1f(1+\frac{1}{3}) + 1f(1+\frac{2}{3}) + \dots + f(1+\frac{5}{3}) + 0f(3)\right)$.
($\frac{1}{3}$ = Δx)

Right $R_6 = \frac{1}{3}\left(0f(1) + f(1+\frac{1}{3}) + 1f(1+\frac{2}{3}) + \dots + f(1+\frac{5}{3}) + 1f(3)\right)$.

approx $\int_1^3 e^{-4x}\,dx$ with L_6, R_6, T_6 (average), S_6

L_6: .008287809(?)1 T_6: .0052362247

R_6: .0021846 S_6: .004643421 3

L_2 "$Y_1(L_1)$"

L_3

L_4 "$L_2 * L_3$" * 2nd Quit

2nd stat math |5| (L_4).

error = | exact answer − approx result |

E_T = | exact answer − approx w/ trap rule |

error bounds.

$|E_T| \le \frac{K(b-a)^3}{12N^2}$ N - # of subintervals

(b−a) −

$|E_M| \le \frac{K(b-a)}{24n^2}$

When $|f''(x)| \le k$ on $[a,b]$

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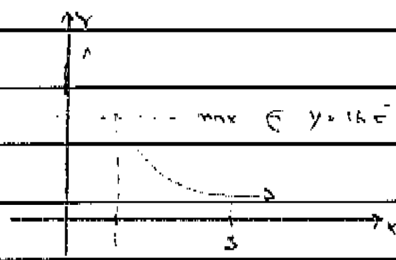
Find K in our example

$f(x) = e^{-4x}$

$f'(x) = -4e^{-4x}$

$f''(x) = 16e^{-4x}$



max @ $y = 16e^{-4(x)} = k$.

$|E_T| = \frac{16e^{-4}(2)^3}{12 \cdot 6^2} = .005427$

Error bound for Simpson's Rule.

$|E_S| \leq \frac{K(b-a)^5}{180n^4}$

where $|f^{4}(x)| \leq K$ on $[a,b]$

$f^{(5)} = -64e^{-4x}$

$f^{(4)} = 256e^{-4x}$ max on $[1,3]$ @ $x=1$

$K = 256e^{-4}$

$|E_S| \leq \frac{256e^{-4}(2)^5}{180 \cdot 6^4} = .000643$