**MATH 1351 TI-85 EXERCISE XIII**
**Area estimations with the TI-85**

Name: _____ SID: _____

The idea is to use sums of *left boxes* and sums of *right boxes* to estimate the area under the graph of a positive function **y = f ( x )** , between the values **x = a** and **x = b**. We recall the syntax:

***left box approximation*** **= sum seq(** ***delta-x*** **f ( a + I** ***delta-x*** **) , I , 0 , N-1 , 1)**

***right box approximation*** **= sum seq(** ***delta-x*** **f ( a + I** ***delta-x*** **) , I , 1 , N , 1**) .

Exercise 1. Attach a picture that illustrates the validity of the following statements.

A. If the function **f ( x )** is increasing on the interval [ a , b ], then

*lt box appx < actual area < rt box appx .*

B. If the function **f ( x )** is decreasing on the interval [ a , b ], then

*rt box appx < actual area < lt box appx.*

Thus the possible error in using either approximation is less than | *rt box appx - lt box appx* |.

Exercise 2. Use these ideas to estimate the area under the graph of **y = 1/x** , between **x = 1** and **x = 3.** (Compute the *lt* and *rt box appx's* until their difference is less than .005.) Record your data in the table provided.

| # of boxes | *lt box appx* | *rt box appx* | possible error |
|---|---|---|---|
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| | | | |

Final estimate of the area ( rounded off to 2 decimal places ) is _____

Exercise 3. Estimate the area under the graph of **y = e^(x^2)** , between **x = 0** and **x = 2.** Again record your data in the table provided.

| # of boxes | *lt box appx* | *rt box appx* | possible error |
|---|---|---|---|
| | | | |
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Final estimate of the area ( rounded off to 2 decimal places ) is _____

Exercise 3. Suppose you know that some number is between 1 and 5, but that's all you know about it. What would be your "best" guess as to the number? (That is, knowing only that the number is between 1 and 5, what guess would be guaranteed to minimize the possible error?) ____

We know that the actual area (for an increasing or decreasing, *monotone,* function ) is between *lt box appx* and *rt box appx.* So the "obvious" best guess is half way between them. This will be called the *trapezoidal approximation:*

*trap appx = ( lt box appx + rt box appx ) / 2 .*

Exercise 2' . From the above data, use the *trapezoidal rule* to approximate the area under the graph of **y = 1 / x**, between **x = 1** and **x = 3.** What is the fewest number of "boxes" required to make the *trap appx* within 2 decimal places of the answer you obtained previously? _____

Exercise 3' . From the above data, use the *trapezoidal rule* to approximate the area under the graph of **y = e^(x^2)**, between **x = 0** and **x = 2.** What is the fewest number of "boxes" required to make the *trap appx* within 2 decimal places of the answer you obtained previously? _____

Exercise 4. Compare each of your above approximations with the answer obtained by using the TI-85 numerical integrator directly. It is accessed by choosing **2nd CALC** from the keyboard then **fnInt** from the screen menu. The syntax is

**fnInt( f(x) , x , a , b ) ,**

read "the definite integral of **f (x)** , with respect to **x** form **x = a** to **x = b**."

Exercise 5. Why do you think the above rule is called the *trapezoidal* rule?