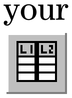
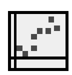
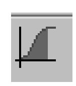
EXPLORATIONS

Activity 15

Area Under the Curve

Given any function, the area under its graph from some fixed value to any other value creates a new function. This function is related to the original function by integral calculus. In this activity, the general rule for the integral of polynomials will be examined.

Exploration

1. Open a new TI InterActive! document. Title this document **Area Under the Curve**. Add your name and the date.
2. Select List  to open the List Editor.
3. In the Data Editor, select Graph . Enter **L1** in the first field and **L2** in the second field.
4. Click on the f(x) tab and enter **f(x): = x** in the first text box. Click on Close.
5. In the Graph window, select Calculate Numerical Integral . Enter **0** as the Lower Limit and **1** as the Upper Limit. Click on Calculate. Record the Numerical Integral value in the table on the next page.
6. Click on Copy to copy the area under the curve from 0 to 1. Click on the Data Editor to bring it to the front and enter the upper limit in cell 1 of L1 and paste  the numerical integral into cell 1 of L2.
7. Click on the Calculate Numerical Integral dialog box to make it active.

8. Repeat steps 5, 6, and 7, using the values below for the upper limit.

Upper Limit	**Numerical Integral**
1	
2	
3	
4	
-1	
-2	
-3	
-4	

9. What is the value of the numerical integral when the upper limit is 0? Why?

10. If the upper limit is greater than the lower limit, what happens to the value of the numerical integral as the upper limit increases in value? Why?

11. If the upper limit is less than the lower limit what happens to the value of the numerical integral as the upper limit decreases in value? Why?

12. Close the Calculate Integral box by clicking on Cancel. Click on Functions and in the second text box enter a guess for the points plotted as g(x):= *your guess*. Record your best fit below.

13. In the third text box, enter the numerical integral as **h(x): = FnInt(f(x), x, 0, x).** How does this function compare to your guess?

14. Given the function *g(x)* or *h(x)* , how could the original function *f(x)* be obtained?

15. Click on Save to Document in the Data Editor and in the Graph window. Save this document as **integrals.tii**. Print a copy of this document.

Additional Exercises

For each of the following functions, use the directions from steps 1 through 13 to find a mathematical model for the integral of each function. Adjust the window as needed to see the graphs.

1. $f(x) = 3x^2$

Upper Limit	Numerical Integral
0	
1	
2	
3	
4	
5	
-1	
-2	
-3	
-4	
-5	

Model for Integral ______________________________

2. $f(x) = 3x^3$

Upper Limit	Numerical Integral
0	
1	
2	
3	
4	
5	
-1	
-2	
-3	
-4	
-5	

Model for Integral ______________________________

3. $f(x) = 2x^4$

Upper Limit	Numerical Integral
0	
1	
2	
3	
4	
5	
$^-1$	
$^-2$	
$^-3$	
$^-4$	
$^-5$	

Model for Integral ____

4. Based upon the results above, given the function $f(x) = ax^n$ what would be the function that would model the area under the curve data?

____

____