Math SL EXPLORATION LAB 9

In this assignment, you will be introduced to the concept of an "area function" and begin to understand its origins and its role.

PART A - The Basics

1. Graph the function $f(x) = x^2$ in an appropriate view window.

2. Use your TI-84 to find the "areas under the curve command" ⇒ (2nd CALC 7 for the $\int f(x)dx$ command).

3. Starting with the vertex (so, x = 0), find the area under the curve between:

   a. $x_L = 0$ and $x_U = 0$
   b. $x_L = 0$ and $x_U = 1$
   c. $x_L = 0$ and $x_U = 2$
   d. $x_L = 0$ and $x_U = 3$
   e. $x_L = 0$ and $x_U = 4$
   f. $x_L = 0$ and $x_U = 5$
   g. $x_L = 0$ and $x_U = 6$

4. Record this *x* value as well as the EXACT area value in the following data table.

x coordinate	0 $\int_0^0 f(x)dx$	1 $\int_0^1 f(x)dx$	2 $\int_0^2 f(x)dx$	3 $\int_0^3 f(x)dx$	4 $\int_0^4 f(x)dx$	5 $\int_0^5 f(x)dx$	6 $\int_0^6 f(x)dx$
Area under curve between upper and lower limits							

5. Now use your TI-84 to prepare a scatter plot of the data from the table you've just completed. Show me the scatter plot. Again, as a KEY reminder, what does each data point represent on this scatter plot?

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6. Use an appropriate strategy to determine the equation of the curve that best fits the data set (HINT: it needs to be a PERFECT fit). Record this equation.

7. We will now refer to this new equation as a **area function (AF)** (since we developed it from multiple areas under the curve of the function we started with). So, on the board, record the equation of this **area function**.

8. CONNECTIONS ⇒ you should now see a pattern emerging from our class results that will allow us to predict a generalization about how to determine the equation of the **area function** of this quadratic equation of $y = x^2$. Record you generalization.

PART B - Generalizations

9. Write an equation of a parabola in vertex form; $f(x) = a(x - h)^2 + k$, where a, h, and k are integers. Expand the equation, so that we now have the function in standard form. Write both your equations on the board.

NOTE: I will work forward in this LAB with the equation $f(x) = 2(x - 5)^2 + 4 = 2x^2 - 20x + 54$

10. Find your vertex and axis of symmetry and hence, graph your parabola in an appropriate view window.

11. Use your TI-84 to find the "areas under the curve command" ⇒ (2nd CALC 7 for the $\int f(x)dx$ command).

12. Starting with your vertex (so, x = 5 in my case), find the area under the curve between:

    a. $x_L = 5$ and $x_U = 5$
    b. $x_L = 5$ and $x_U = 6$
    c. $x_L = 5$ and $x_U = 7$
    d. $x_L = 5$ and $x_U = 8$
    e. $x_L = 5$ and $x_U = 9$
    f. $x_L = 5$ and $x_U = 10$
    g. $x_L = 5$ and $x_U = 11$

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13. Record this *x* value as well as the EXACT area value in the following data table.

x coordinate	5 $\int_5^5 f(x)dx$	6 $\int_5^6 f(x)dx$	7 $\int_5^7 f(x)dx$	8 $\int_5^8 f(x)dx$	9 $\int_5^9 f(x)dx$	10 $\int_5^{10} f(x)dx$	11 $\int_5^{11} f(x)dx$
Area under curve between upper and lower limits							

14. Now use your TI-84 to prepare a scatter plot of the data from the table you've just completed. Show me the scatter plot. Again, as a KEY reminder, what does each data point represent on this scatter plot?

15. Use an appropriate strategy to determine the equation of the curve that best fits the data set (HINT: it needs to be a PERFECT fit). Record this equation.

16. We will now refer to this new equation as a **area function (AF)** (since we developed it from multiple areas under the curve of the function we started with). So, on the board, record the equation of your **area function** next to your original quadratic function..

17. CONNECTIONS ⇒ you should now see some patterns emerging from our class data set that will allow us to make a generalization about how to determine the equation of the **area function** of ANY quadratic equation. Record you generalization.