MTH 1420, SPRING 2012
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LAB 1 : AREA UNDER A CURVE

1. Introduction

The goal of this lab is to look at some different methods of calculating the area under a curve, using approximation, exact calculation, graphing calculators, and also different tools online. Make sure to *show all of your work* wherever it is appropriate.

Area 1: The area under the curve $f(x) = \frac{3}{4}x + 1$, between the x-values of 0 and 4.

Exercises:

(1) Using 4 subintervals, calculate R_4, L_4, and M_4. For each one, sketch a graph of the function and draw in the approximating rectangles. State if it looks like an overestimate or an underestimate.
(2) Use the limit definition to calculate $\int_0^4 (\frac{3}{4}x + 1)dx$ exactly. Show your work.
(3) Use an indefinite integral (that is, an antiderivative) to calculate the area under the curve (You will learn how to do this in section 5.3, so skip this question for now. You can finish it this weekend once we have covered that material).
(4) Use formulas from geometry to calculate the area. Make sure to explain what you are doing.
(5) Using a TI-89, you can follow these instructions to find the definite integral (there are probably ways to do it with other graphing calculators, but I don't know those as well): Go to the main screen. Type in 2nd 7 to get the integral sign, then type in $(\frac{3}{4}x + 1, x, 0, 4)$, then Enter to get your answer.
(6) Google "online integration calculator with limits", and go to one of the websites. Follow the instructions for how to integrate the function. Write down which site you went to and what the answer was that they gave you.
(7) Use the online calculator Sage. Go to the website http://www.sagenb.org/ . You will first need to click on the right to create a username and password. Once you have done this you can log in, then click on "create a new worksheet". If it asks you to name the worksheet, call it "Lab 1". You should now have a box you can type in, go ahead and enter

    integrate(3/4*x+1, x, 0,4)

    and click on "evaluate". The 'integrate' command tells it what to do, then you enter the function (note that you have to put in the * for multiplication, if you forget that it will give you a syntax error), the variable of integration, then the limits of integration.

Area 2: The area under the curve $f(x) = \sqrt{4-(x-3)^2}$, between the x-values of 1 and 5.

Exercises:

(1) Calculate M_4. Sketch the curve and the approximating rectangles as well. Show your work.
(2) Calculate the exact area using a formula from geometry. Show your work.
(3) Try to use an indefinite integral (that is, an antiderivative) to calculate the area under the curve. This should not be possible for you at this point, try to explain why. We will learn how to find indefinite integrals of this type in Section 5.7.
(4) Use a graphing calculator to find the area.
(5) Use a website (other than sage) to find the area. State which website you use and what the answer is.
(6) Do the same calculation on Sage.