Revised 8/4/15   Name: _____

Calculus II

Maple Lab #2: Definite Integrals and U-substitution

Maple is a Computer Algebra System (CAS). In other words, it is a computer program that will perform all kinds of algebra and calculus computations, in addition to all kinds of graphing that can be done on a graphing calculator. The main purpose of this lab is to get an understanding of how substitution of a variable for a function (or a function for a variable) works in the integration process.
(Notice step 17 on the last page - the lab must be complete and correct before it can be turned in. Please feel free to get help from the lab aide at any time. If you are not doing the lab at the Math Computer Lab at Academic Success Center, indicate where you did it in the indicated space. You will be contacted if the lab is not complete and correct.)

Command Line
Type: **Directions and explanation:**

1. Starting Maple:
    Double click on the Maple 17 Icon on the desktop or in the program list.

h := proc(x) 9 - x^2 end;   2. Remember, in the last lab we worked with the function
    $h(x) = 9 - x^2$. That proc(x) command on the left
    is a way to define a function. The function just defined here
    is $h(x) = 9 - x^2$.

f := proc(t) t^4 end;
                                         3. The function defined there is $f(t) = t^4$.

Int(f(t),t);   4. The output from Maple is _____.

                                         5. If you change from an upper case "I" to a lower case "i" the
                                             output from Maple becomes

                                             _____

                                             What is missing? _____

                                         6. Now, differentiate the integral. What do you get?

diff(int(f(t),t),t);   _____

Explain that answer. _____

_____

int(f(t),t=1..5);

7. This statement has Maple perform the following:

$$\int_1^5 t^4 dt.$$

   What is the answer? _____

diff(int(f(t),t=1..5),t);

8. Now we are asking Maple to differentiate the integral.

9. Explain Maple's output. _____

_____

_____

int(f(t),t=1..h(x));

10. Now, we are letting the function h(x) be the upper limit of integration.

11. What is Maple's response to $\int_1^{h(x)} t^4 dt$? _____

   Explain. _____

   _____

diff(int(f(t),t=1..h(x)),x);

12. Now, differentiate the above integral. What is Maple's response? Explain why the derivative of the integral is not the same as the original function.

   _____

_____

_____

13. Now find the derivative of $\int_2^{h(x)} t^4 dt$. Explain the relationship between this answer and the answer to 12.

h := proc(x) sin(x) end;

Int(f(t),t=1..h(x));

int(f(t),t=1..h(x));

14. Now, we are letting the function sin(x) be the upper limit of
    integration.

15. What is Maple's response to $\int_{1}^{\sin(x)} t^4 dt$? _____

    Explain. _____

    _____

diff(int(f(t),t=1..h(x)),x);

16. Now, differentiate the above integral. What is Maple's response?
    Explain why the derivative of the integral is not the same as the
    original function.

    _____

    _____

    _____

17. This lab is complete and correct.

    _____   _____
    lab aide   date

18. How long did it take you to complete this lab? _____

                                            Strongly agree   strongly disagree
19. Doing this lab gave me a better understanding of integration.

                                                5   4   3   2   1

20. Comments . . .?