Performing Calculus Using Mathcad
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Introduction

This set of notes will describe how to use some of the features of Mathcad that perform calculus. It is designed to be a "quick start" that will walk you through performing some simple calculus operations (taking derivatives and integral).

1. Open Mathcad. Close the "Tip of the Day". Use the arrow keys to move the Red Cross cursor to about a half inch down and to the left of the top of the edit field.

Creating a Derivative

2. Choose "View/Toolbars/Calculus" from the menu. A small dialog box with various symbols from calculus should appear as shown in figure 1 below.

3. In this exercise you are going to evaluate a second derivative, \( \frac{d^2}{dt^2}(t \cdot \cos(t)) \).

   You will prove that your answer is correct by performing the double integral of your answer. Begin by clicking on the symbol for higher derivatives. It is the second symbol in the first role of symbols on the calculus dialog box. Though
Red Cross cursor will disappear and a derivative with several black box placeholders will appear on the screen.

4. Mathcad shows that information it needs information by showing black boxes as placeholders where you must enter things. The cursor changes to a blue L. Enter the function you are going to differentiate. Type "t*cos(2*t)". The function should appear on the screen which it now looked like figure 2.

Figure 2
Entering the Function To Be Differentiated

5. Now enter the name of the variable to be used in the differentiation. Move the current mouse cursor over the left most black box placeholder in the denominator of the derivative and click the left mouse button. The blue cursor should appear around that box. You can also move the cursor to that box my repeatedly pressing the left arrow key. Type "t". The letter "t" should appear in the denominator as shown in figure 3.

Figure 3
After Step 5

6. There are several ways to move around in a function in Mathcad. You is the right arrow key to move the "L" cursor to the black box where you will enter the order of the derivative. Type "2". The completed function will look like figure 4. Note that the number two appears in both the numerator and the denominator of the derivative.
7. Move the mouse cursor over the left-hand corner of the derivative just below and to the right of the black box that surrounds it. Press and hold the left mouse button while moving the cursor to the lower right. This will cause the entire function to be highlighted in reverse video (white letters on a black background). If you don't get to this the first time, release the mouse button and move the cursor to any place on the white field, and then press the mouse button. Then start over. When you are done the screen should appear as shown in figure 5.

8. Choose "Symbolics/Evaluate/Symbolically" from the menu options. After a second or two the computer will evaluate the function you have highlighted symbolically. The answer will appear in a rectangle just below the derivative, as shown in figure 6.
Evaluating an Integral

9. Now, you will verify that the answer is correct by performing a double integral all on the function that Mathcad has just found. Leave the function for now by pressing "Enter". Move the red cross down a little more by pressing the down arrow key several times. Click the mouse button when the mouse cursor is over the integral without limits symbol from the calculus dialog box, \( \int \). It is the first symbol in the third row of symbols. The red cross will disappear and an integral symbol will appear. Click again to get a second integral. The screen should look like figure 7.
10. You will now enter the variable to be in the placeholders after the letters “d”, "t". Press the right arrow key until the blue “L” cursor is on the black rectangle to the left of the first “d”. The black rectangle should be replaced by a letter "t". Press the right arrow key again and type the letter "t" to define the outer integral. Your worksheet should now look like figure 8.

11. Now, copy the solution to the derivative into the integral function. Move the mouse cursor over the function "− 2 · sin(t) − t · cos(t)” and click the left mouse button. The rectangle around the integrals will disappear and another rectangle will appear around the function.
12. Highlight this entire function. Move the mouse cursor to a point just below and to the right of the upper left-hand corner of the rectangle that highlights the function. Olga left mouse button down while moving the cursor toward the lower right corner of the rectangle. Eventually the entire function will be highlighted. This is the same operation that you did to highlight the double derivative. If you make a mistake move the cursor to some empty spot on your sheet and click the left mouse button. Then, just start over. When you are finished, your sheet should look something like figure 11.

13. Press the "Ctrl" and the "c" keys simultaneously. This copies the function on to the Windows clipboard. Move the mouse cursor until it is over the small black rectangle after the second integral. Press the "Ctrl" and the "v" keys simultaneously. This will copy the contents of the Windows clipboard into the integral. When you're done your sheet should look something like figure 12.
14. Now, you must tell Mathcad what function you want evaluated symbolically. Since you are going to evaluate the entire double integral you must highlight the entire function. As before, move the mouse cursor to a point just below into the right be all that the upper left-hand corner. Press and hold the left mouse button while moving the cursor to the lower right hand corner. Release the button when the entire function is highlighted. If you make a mistake, move the cursor to some empty portion of your sheet and click the mouse button. Then go back and try again. Finally, choose "Symbolics/Evaluate/Symbolically" from the menu options. Once again, the program will do the calculus among likely and display the answer just below the integral. Your sheet should now look like figure 13.