

# CREATING AND USING FUNCTIONS

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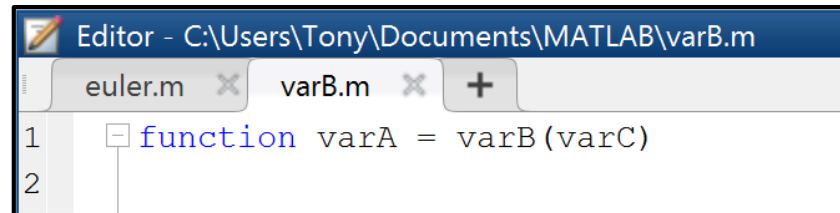


# USER-DEFINED FUNCTIONS

- Just like built-in MATLAB functions, user-defined functions have:
  - One or more inputs
  - One or more outputs
  - Case sensitive
- Different to built-in MATLAB functions, user-defined functions:
  - Can only be called from current directories

# HOW TO CREATE A FUNCTION

- Start a new m-file (script file)
  - Declare it as a function with a function header
- The function header declaration  
`function outputs = function_name(inputs)`



The image shows a screenshot of the MATLAB Editor window. The title bar reads "Editor - C:\Users\Tony\Documents\MATLAB\varB.m". There are two tabs open: "euler.m" and "varB.m", with a "+" button to add more. The "varB.m" tab is active. The editor shows two lines of code: line 1 is "function varA = varB(varC)" and line 2 is empty. The word "function" is blue, "varA" is black, "=" is black, "varB" is black, and "(varC)" is black.

## FUNCTION: $\sin(x) \cdot \cos(x) \cdot \tan(x)$

- How can we better program the following code?

```
%% sct example without user-defined functions
x = 5;
y1 = sin(x)*cos(x)*tan(x) ...
    + sin(x^2)*cos(x^2)*tan(x^2) ...
    + sin(x^3)*cos(x^3)*tan(x^3);

z1 = sin(x^5)*cos(x^5)*tan(x^5) ...
    + sin(x^4)*cos(x^4)*tan(x^4) ...
    + sin(x^3)*cos(x^3)*tan(x^3);

w1 = y1 + z1
```

- We can create a function to compute  $\sin(x) \cdot \cos(x) \cdot \tan(x)$

## FUNCTION: $\sin(X) \cdot \cos(X) \cdot \tan(X)$

- Identify the input(s) and output(s)
- Primary aim of a function is to calculate the output(s)!

```
%% sct example without user-defined functions
```

```
x = 5;
```

```
y1 = sin(x)*cos(x)*tan(x) ...  
    + sin(x^2)*cos(x^2)*tan(x^2) ...  
    + sin(x^3)*cos(x^3)*tan(x^3);
```

```
z1 = sin(x^5)*cos(x^5)*tan(x^5) ...  
    + sin(x^4)*cos(x^4)*tan(x^4) ...  
    + sin(x^3)*cos(x^3)*tan(x^3);
```

```
w1 = y1 + z1
```

```
function output = sct(input)
```

```
% Name, date, ID
```

```
% comments
```

```
% comments
```

```
output = sin(input)*cos(input)*tan(input);
```

## FUNCTION: $\sin(x) \cdot \cos(x) \cdot \tan(x)$

- We have now written the function but how do we use it?
  - Simply call it like you would any other function (e.g.  $\sin(x)$ )

%% sct example without user-defined functions

```
x = 5;  
y1 = sin(x)*cos(x)*tan(x) ...  
    + sin(x^2)*cos(x^2)*tan(x^2) ...  
    + sin(x^3)*cos(x^3)*tan(x^3);
```

```
z1 = sin(x^5)*cos(x^5)*tan(x^5) ...  
    + sin(x^4)*cos(x^4)*tan(x^4) ...  
    + sin(x^3)*cos(x^3)*tan(x^3);
```

```
w1 = y1 + z1
```

```
function output = sct(input)
```

```
% Name, date, ID
```

```
% comments
```

```
% comments
```

```
output = sin(input)*cos(input)*tan(input);
```

%% sct example with user-defined functions

```
x = 5;  
y2 = sct(x) + sct(x^2) + sct(x^3);  
z2 = sct(x^5) + sct(x^4) + sct(x^3);
```

```
w2 = y2 + z2
```

# CALLING FUNCTIONS

- Functions should be called by separate m-files
  - **DO NOT** run functions
  - Ensure that the current directory contains the function being called
- Just like built-in functions, all input arguments must be specified when calling a function

```
%% This m-file calls upon your function file named sct
x = 5;
y2 = sct(x) + sct(x^2) + sct(x^3);
z2 = sct(x^5) + sct(x^4) + sct(x^3);

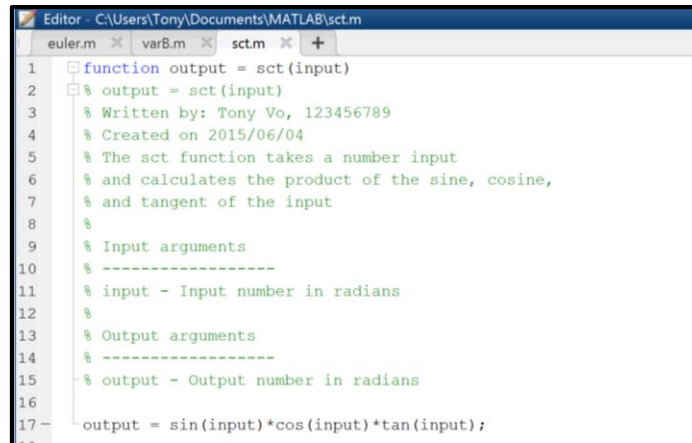
w2 = y2 + z2
```

```
function output = sct(input)
% Name, date, ID
% comments
% comments

output = sin(input)*cos(input)*tan(input);
```

# FUNCTION DOCUMENTATION

- Include the following information **AFTER** the function declaration
  - Function, declaration without the word "function"
  - Name, ID and date and description of what the function does
  - Description of the input argument and outputs



```
Editor - C:\Users\Tony\Documents\MATLAB\sct.m
euler.m  varB.m  sct.m  +
1  function output = sct(input)
2  % output = sct(input)
3  % Written by: Tony Vo, 123456789
4  % Created on 2015/06/04
5  % The sct function takes a number input
6  % and calculates the product of the sine, cosine,
7  % and tangent of the input
8  %
9  % Input arguments
10 % -----
11 % input - Input number in radians
12 %
13 % Output arguments
14 % -----
15 % output - Output number in radians
16
17 output = sin(input)*cos(input)*tan(input);
```





- Function documentation is important
  - Function header information is displayed through the help function

```
Command Window
>> help sct
output = sct(input)
Written by: Tony Vo, 123456789
Created on 2015/06/04
The sct function takes a number input
and calculates the product of the sine, cosine,
and tangent of the input

Input arguments
-----
input - Input number in radians

Output arguments
-----
output - Output number in radians

fx>> |
```

# FUNCTION NAMES

- Function names should be self documenting
  - Naming the **SinTaylor** function as **CosTaylor** is a bad idea...
- Make sure to use the same name for the function and the file
  - The **SinTaylor** function must be saved as **SinTaylor.m**
- Avoid using function names that collide with built-in MATLAB functions (e.g. sin, sqrt, plot, etc.)
  - Use the prefix "my" to avoid collisions (e.g. MySin, MySqrt, etc.)

# USER-DEFINED FUNCTIONS

- Remember, function files are black boxes
- In function files:
  - Do not use fprintf or disp
  - Do not plot
  - Do not ask for an input prompt
  - Do not use clear all; close all; clc; commands
  - Do not overwrite existing MATLAB functions
  - Do suppress everything!
  - Do document your code appropriately

- Function header declaration
- Creating function files
- Using function files
- Documenting and naming function files
- Why can't you click "run" on a function file?