Comments about MATLAB for Calculus [1]

- MATLAB can be purchased from *The Software Distribution Office* that is located in 3240 Torgersen Hall. See Student Software Distribution for more information. Engineering students will have MATLAB in their software bundle. All other majors need to purchase MATLAB. It will be ±$44 [2] for the MATLAB license which will be valid for as long as the student is enrolled at VT. The student will have access to annual updates at not extra charge.

- Initially the Symbolic Math Toolbox will be most useful for Calculus.

- There are excellent tutorials on the MathWorks website. First register at the MathWorks website, http://www.mathworks.com, before going to tutorials. Under the option *I want to ...* select the option that you are interested in. I suggest watching the first few minutes of *Getting Started with MATLAB*. This video provides an introduction to using MATLAB in just over five minutes. Syntax and helpful shortcuts are demonstrated. The Symbolic Toolbox is not addressed in this tutorial and pointers to a basic introduction follows.

- One can access the Symbolic Toolbox from the command window or use MuPad. I will recommend using the command window initially since the notebook interface in MuPad, Figure 1, gives students access to functionality that you may want to manage or withhold.

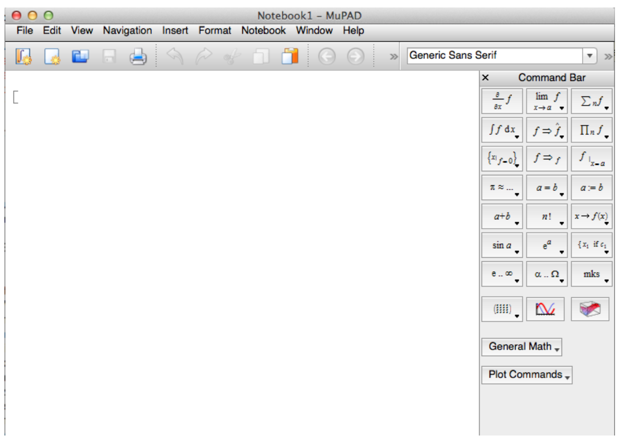


Figure 1: MuPad interface.

- To learn how to use the Symbolic Toolbox, open MATLAB, choose the Help tab, indicated by "?". See Figure 2.

[1] MATLAB 2014(a) has been used.
[2] Kathy Williams will let as know when the price has been determined for fall 2014

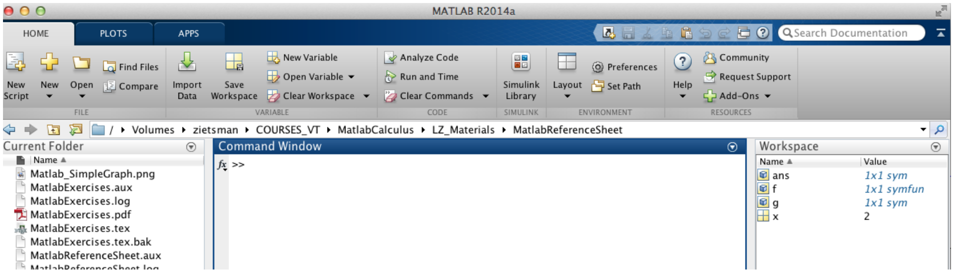


Figure 2: Help function indicated by "?".

A list with the toolboxes that you have access to will appear. See Figure 3 for an example.

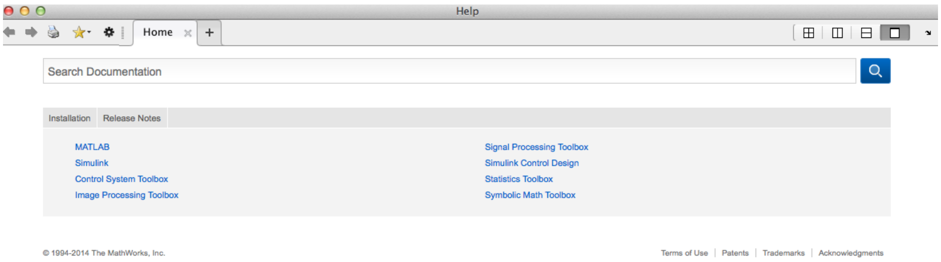


Figure 3: All the toolboxes that you have access to will appear.

Now choose Symbolic Toolbox to obtain the window in Figure 4.

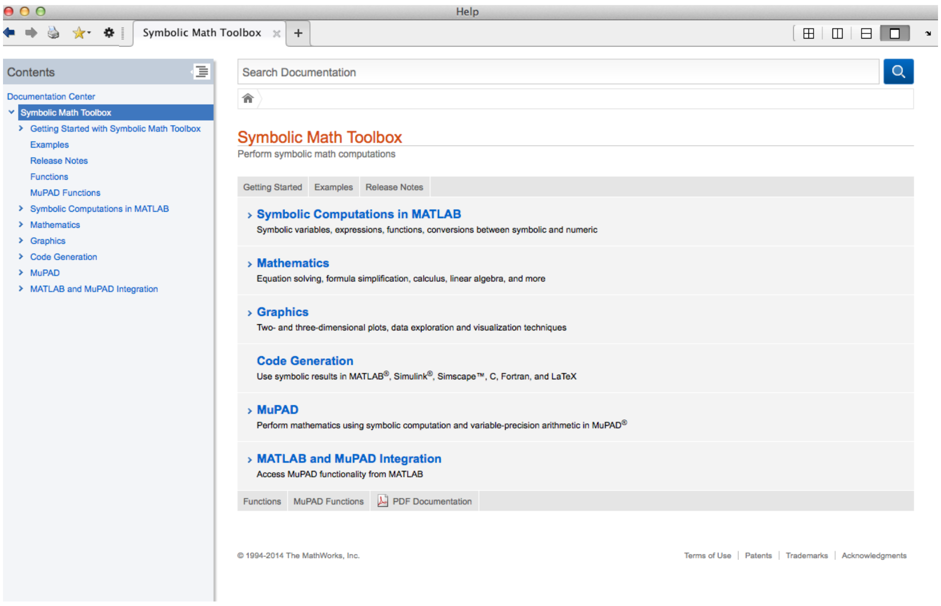


Figure 4: Documentation related to the Symbolic Toolbox.

By choosing *Examples* under *Documentation Center* on the left, the topics in Figure 5 will appear.

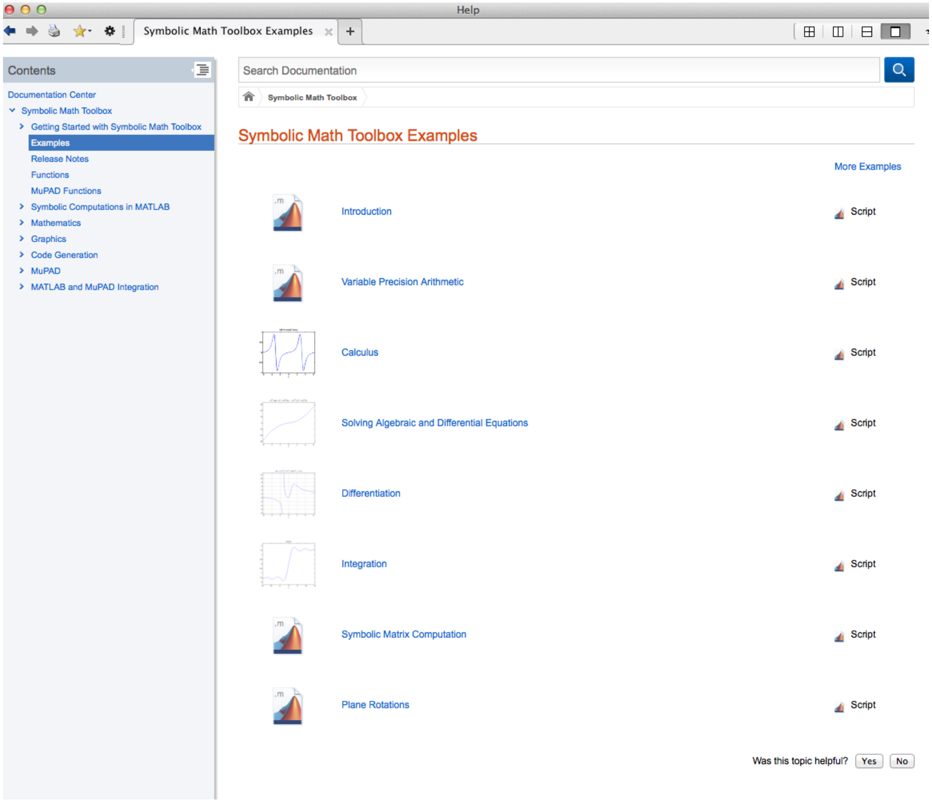


Figure 5: The Calculus option will be of interest.

Contents

- Declare x to be a symbolic variable
- Define a function f
- Plot f on a default interval [-2pi,2pi]
- Opens another figure window
- Plot f on the interval [0,10]
- Plot both f and a grid on one axis.
- Define g to be the first derivative of f with respect to x.
- Plot f and g on the same axis
- Evaluate f at x=2
- Determine limits
- Integration: Indefinite integral

Declare x to be a symbolic variable

```
syms x
```

Define a function f

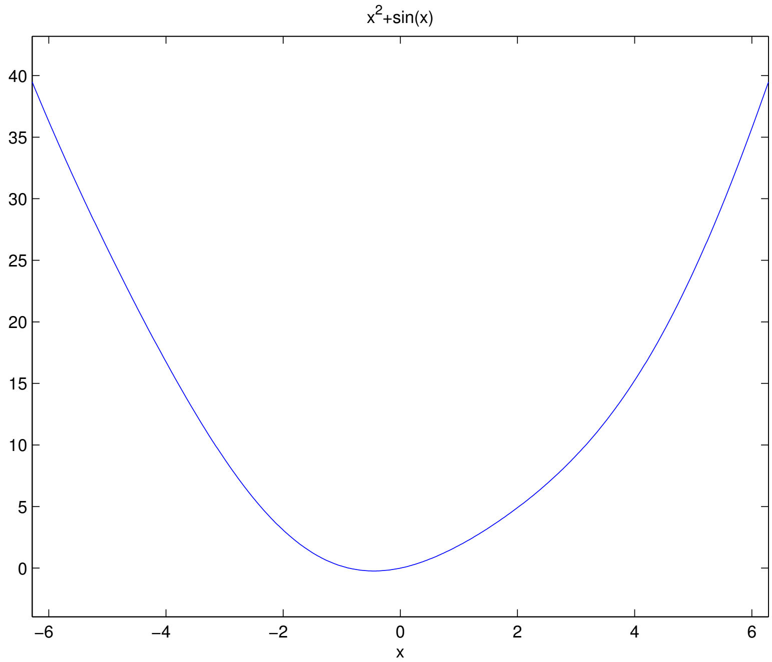
```
%Note the period that allows componentwise calculations. This will ne
%needed when MATLAB plots the function.

f=@(x) x.^2+sin(x)
```

```
f =

    @(x)x.^2+sin(x)
```

```
%Suppress output to command window by using semi-colon:

f=@(x) x.^2+sin(x);
```

Plot f on a default interval $[-2\pi, 2\pi]$

```
ezplot(f)
```

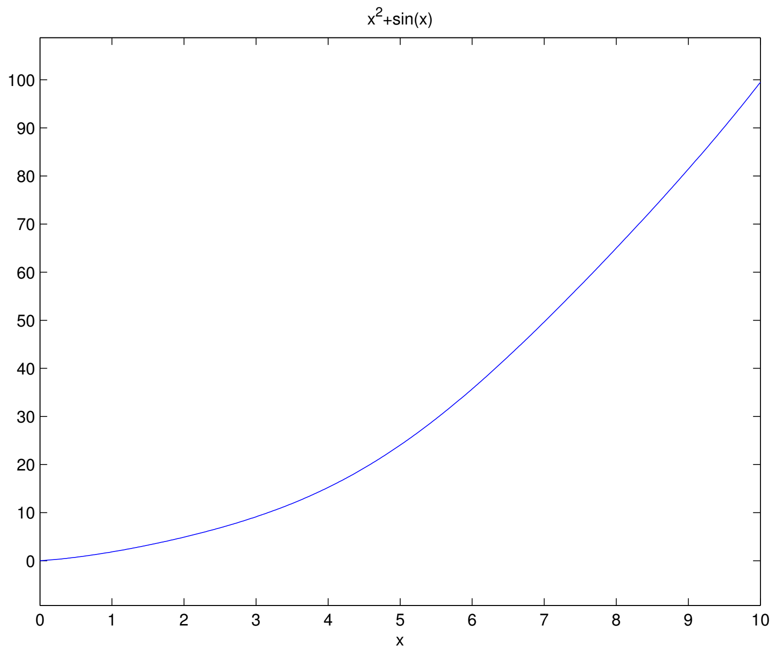


Opens another figure window

```
figure
```

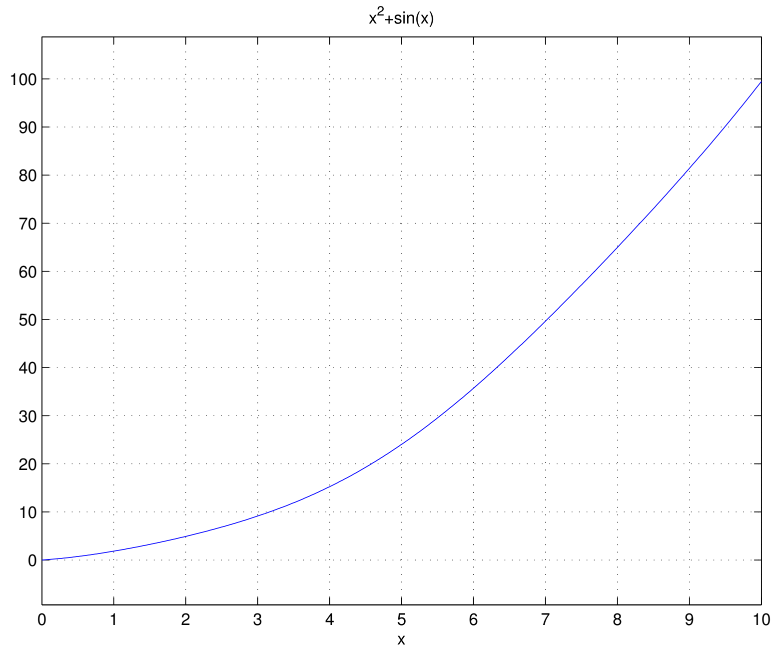
Plot f on the interval [0,10]

```
ezplot(f,[0,10])
```



Plot both f and a grid one one axis.

```
figure
ezplot(f,[0,10])
%To add a graph to your current graph
hold on
% To add grid lines to the current axes.
grid
% returns to the default mode whereby PLOT commands erase
%   the previous plots and reset all axis properties before drawing
%    new plots.
hold off
```



Define g to be the first derivative of f with respect to x.

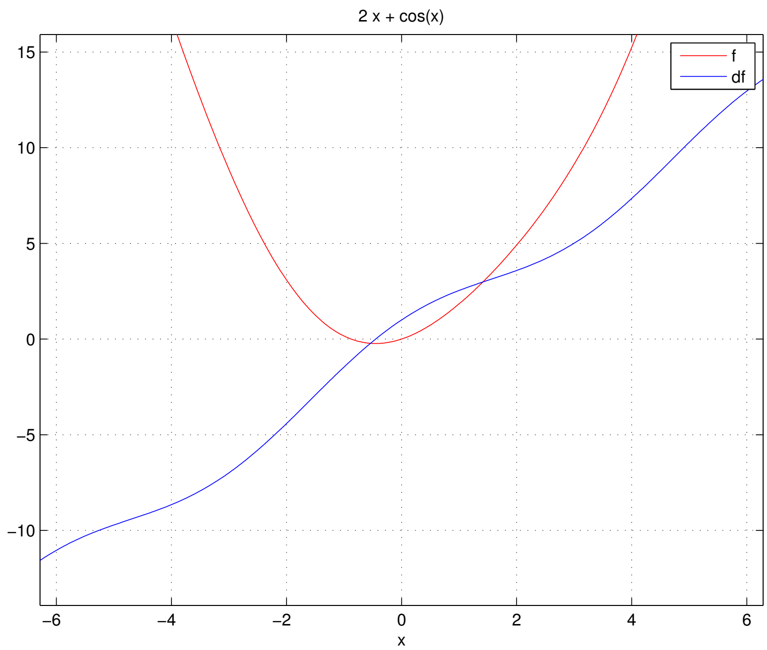
```
g=diff(f,x)

%Define G to be the first derivative of f with respect to x.

G=diff(f,x,2)
```

```
g =

2*x + cos(x)


G =

2 - sin(x)
```

Plot f and g on the same axis

```
figure

f1=ezplot(f);set(f1,'Color','r')
```

```
hold on
f2=ezplot(g);set(f2,'Color','b')
legend('f','df')
grid
hold off
```



Evaluate f at x=2

```
f(2)
```

```
ans =

    4.9093
```

Determine limits

```
limit(f,x,1)

%Answer is symbolic.
%To evaluate use double precision
```

```
ans =

sin(1) + 1


double(limit(f,x,1))

ans =

    1.8415


%Left and Right limits

limit(f,x,.5,'left')

ans =

sin(1/2) + 1/4
```

Integration: Indefinite integral

```
int(f,x)

%Definite integral

int(f,x,[-2*pi,2*pi])

ans =

x^3/3 - cos(x)


ans =

(16*pi^3)/3
```

- For any (student related) MATLAB licensing questions or installation problems, contact Kathy Williams at kathyw@vt.edu or 231-7836.