Maple versus MATLAB syntax

Maple (by Maplesoft) and MATLAB (by MathWorks) are software that allow a user to formulate and solve many mathematical and scientific problems. While Maple and MATLAB can do many of the same tasks, broadly speaking, the strengths of Maple are *symbolic* computation and the strengths of MATLAB are *numeric* computation. Taken together, Maple and MATLAB are a powerful combination.

1 Plotting

Plotting of explicit and implict functions as well as parametric functions is shown to illustate the similarity of Maple and MATLAB.

- Plot a mathematical function of the form $y = f(x)$:

```
Maple:
|> f:=x->x^2:
|> g:=x->sin(x):
|> plot([g(x),f(x)],x=0..5,color=[red,black],thickness=[1,3],linestyle=[solid,dash],labels=[X,Y]);

Result 1: Plots the expression g(x) as a thin, red, solid line on the same axes
as the expression f(x) which is a thick, black, dashed line over the x interval 0 to 5

MATLAB:
>> x=0:0.1:5;
>> plot(x,x.^2,'-k',x,sin(x),'--r')
>> xlabel('X')
>> ylabel('Y')
or
>> x=0:0.1:5;
>> plot(x,x.^2,'-k','LineWidth',3)
>> hold on
>> plot(x,sin(x),'--r','LineWidth',1)
>> xlabel('X')
>> ylabel('Y')

Result 2: same as Result 1
```

- Plot the function z=f(x,y) side–by–side with its contour (implicit) plot f(x,y)=c.

```
Maple:
|> with(plots):
|> f:=(x,y)->x^2+y^2:
|> P:=array(1..2):
|> P[1]:=plot3d(f(x,y),x=-3..3,y=-3..3):
|> P[2]:=implicitplot([seq(f(x,y)=c,c=1..10)],x=-3..3,y=-3..3):
|> display(P);
or
|> with(plots):
|> f:=(x,y)->sin(x)+cos(y):
|> P:=array(1..2):
|> P[1]:=plot3d(f(x,y),x=-3..3,y=-3..3,axes=boxed,scaling=constrained):
|> P[2]:=contourplot(f(x,y),x=-3..3,y=-3..3,contours=10,scaling=constrained):
|> display(P);

Result 3: Plots z=f(x,y) over a square side--by--side with 10 of its contours

MATLAB:
>> [x,y]=meshgrid[-3:0.1:3,-3:0.1,3];
>> subplot(1,2,1)
>> z=sin(x)+cos(y)
```

```
>> surf(x,y,z)
>> axis square
>> subplot(1,2,2)
>> contour(x,y,z,10)
>> axis square

Result 4: same as Result 3
```

- Plot a 2D or 3D parametric curve r(t)=[x(t),y(t)] or r(t)=[x(t),y(t),z(t)].

```
Maple:
|> restart:
|> with(plots):
|> x:=t->cos(t):
|> y:=t->sin(t):
|> z1:=t->t:
|> z2:=t->1:
|> plot([x(t),y(t),t=0..2*Pi]);
|> spacecurve({[x(t),y(t),z1(t)],[x(t),y(t),z2(t)]},t=0..2*Pi,
               color=red,linestyle=solid,thickness=3);

Result 5: Clear Maple's memory (restart:) and plot a circle,
a helix and a circle, in 2D and 3D, respectively.

MATLAB:
>> clear all
>> t=[0:0.1:6*pi];
>> x=cos(t);
>> y=sin(t);
>> z1=t;
>> z2=0.*t+1
>> plot(x,y)
>> plot3(x,y,z1,'-r','LineWidth',3)
>> hold on
>> plot3(x,y,z2)
```

2 Symbolics

Maple specializes in symbolic computations. Given Maple's design and its symbolic strengths, the course Calculus with Symbolic Computation (MTH1000) will utilize Maple for its symbolic computation needs.

```
Maple:
|> f:=x->sin(x):
|> diff(f(x),x$2); #computes the second derivative of f(x), f''(x)
|> (D@@2)(f)(x); #also computes the second derivative of f(x), f''(x)
|> (D@@2)(f)(2); #computes the second derivative evaluated at x=2, f''(2)
|> int(f(x),x); #computes the antiderivative of f(x)
|> int(f(x),x=0..1); #computes the definite integral of f(x) from x=0 to x=1
```

3 Numerics

More on this topic later as needed.