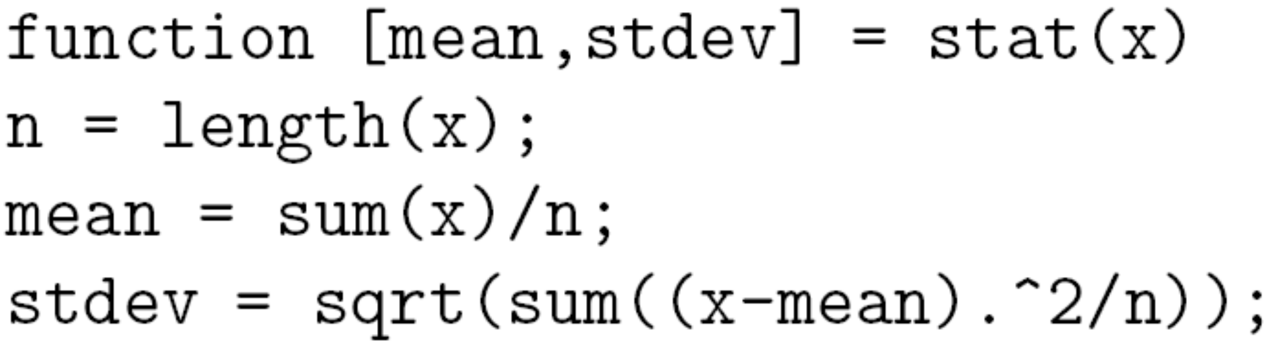
Matlab notes: function files

- Function files are M-files that accept input arguments
- They cannot be run on their own, but can be called by other files
- The name of a function *must* be the same as the name of the file.

Function files



```
function [mean,stdev] = stat(x)
n = length(x);
mean = sum(x)/n;
stdev = sqrt(sum((x-mean).^2/n));
```

- This function file defines a function that calculates the mean and standard deviation of its input vector
- It must be saved as *stat.m*

Calling a function

- Another program, or the Command Window, can call the function file like this:

```
x=[1 2 3 4 5 6];
[u v]=stat(x)
```

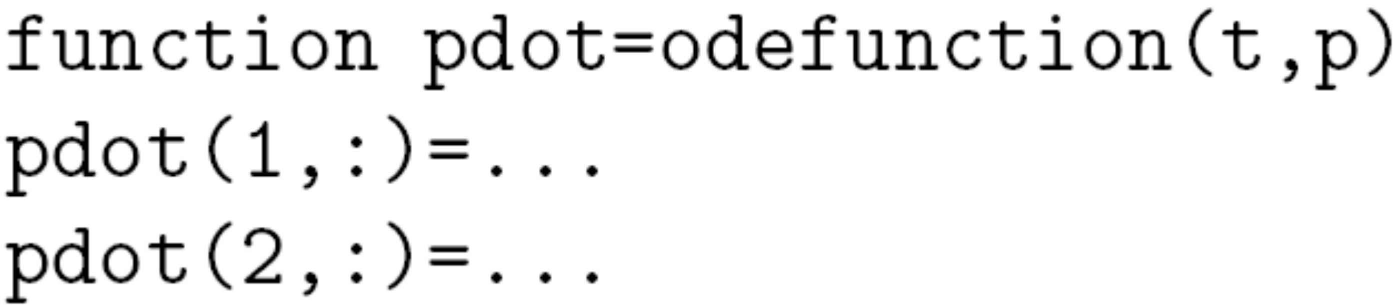
Solving ODEs

We need to specify

- An input variable *y0*
- A range of times *tspan=[t0 tf]*
- A function *odefunction* that evaluates the right side of $y' = f(y)$.

ODE function file

- Our function file is in the form

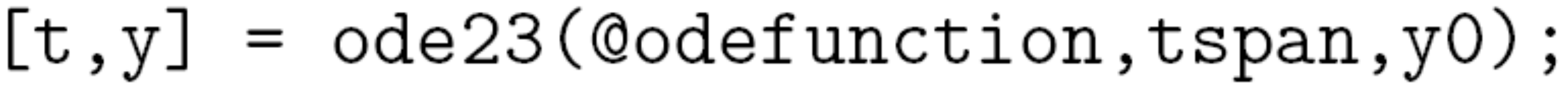


```
function pdot=odefunction(t,p)
pdot(1,:)=...
pdot(2,:)=...
```

- (Don’t forget to save this as *odefunction.m*)

Calling the ODE function

- In our M-file, having specified the initial conditions and range of times, we call the function thusly



```
[t,y] = ode23(@odefunction,tspan,y0);
```

y0 = initial condition
tspan = [t0 tf]

The solution

- The function ode23 produces a matrix whose first column is the range of times and whose remaining columns are the solution of the ODE
- Thus, if you type *plot(t,y)* you’ll have a graph of the solution.

Getting started

- Start Matlab (Programs→Matlab)
- Command window: Click "New File"
- This creates an M-file.

Type this in your M-file

```
%Save this file as powers.m, but don't run it
function y=powers(x)
sqr=x.^2;
cub=x.^3;
y=cub-sqr-x;
```

Calling your figure

- Type this in the command window:

```
x=-2:0.1:2;
plot(x,powers(x))
```

- Now go back and plot your *powers* function over the range $-5 \leq x \leq 5$.

Or you can call within an M-file

- Create this m-file and run it:

```
%abs is a built-in function that creates the
%absolute value of its input
x=-1.5:0.1:2.5;
y=powers(x);
z=abs(y);
plot(x,z)
```

Some more examples

```
x=0.1:0.1:6;          %you don't need to type these
plot(x,sin(x))        %default is blue line
hold on               %allows you to put multiple
                      %graphs on the same figure
plot(x,cos(x),'--r')  %dashed line, red
figure                 %creates a new figure
plot(x,exp(-x),':g')  %dotted line,green,
hold on
plot(x,log(x),'-.k')  %dot-dashed line, black.
```