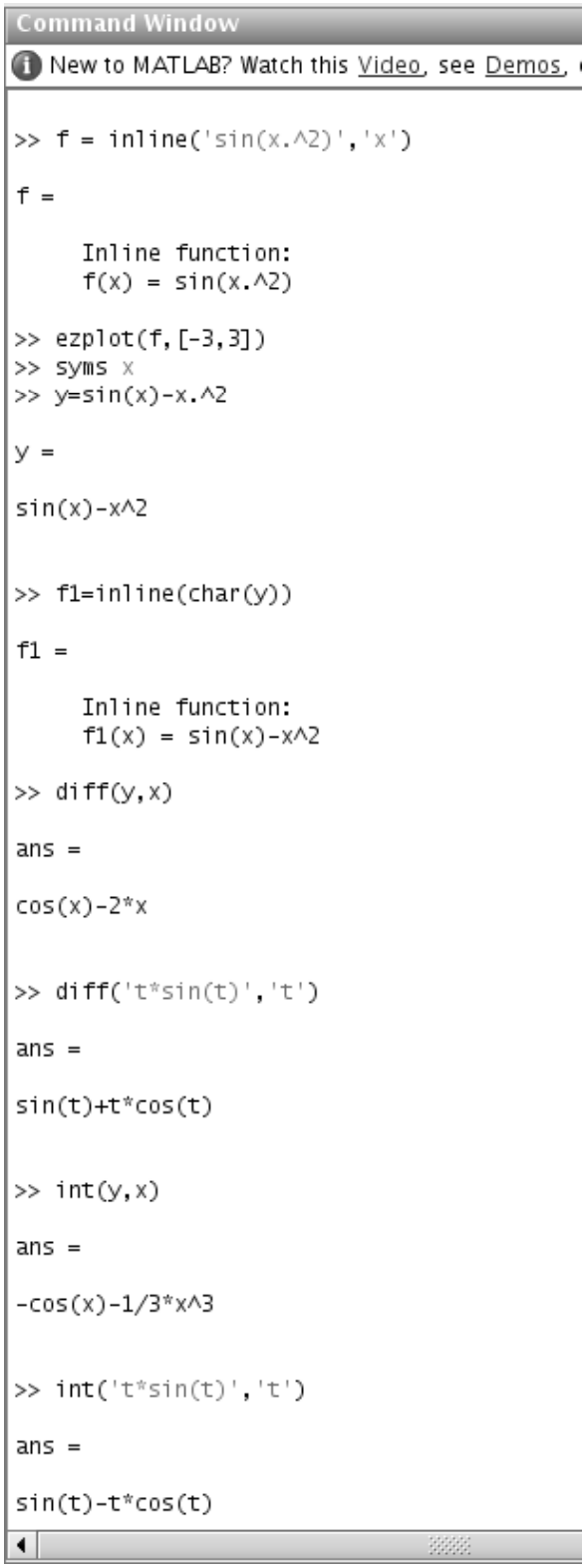
Matlab refresher for ODEs

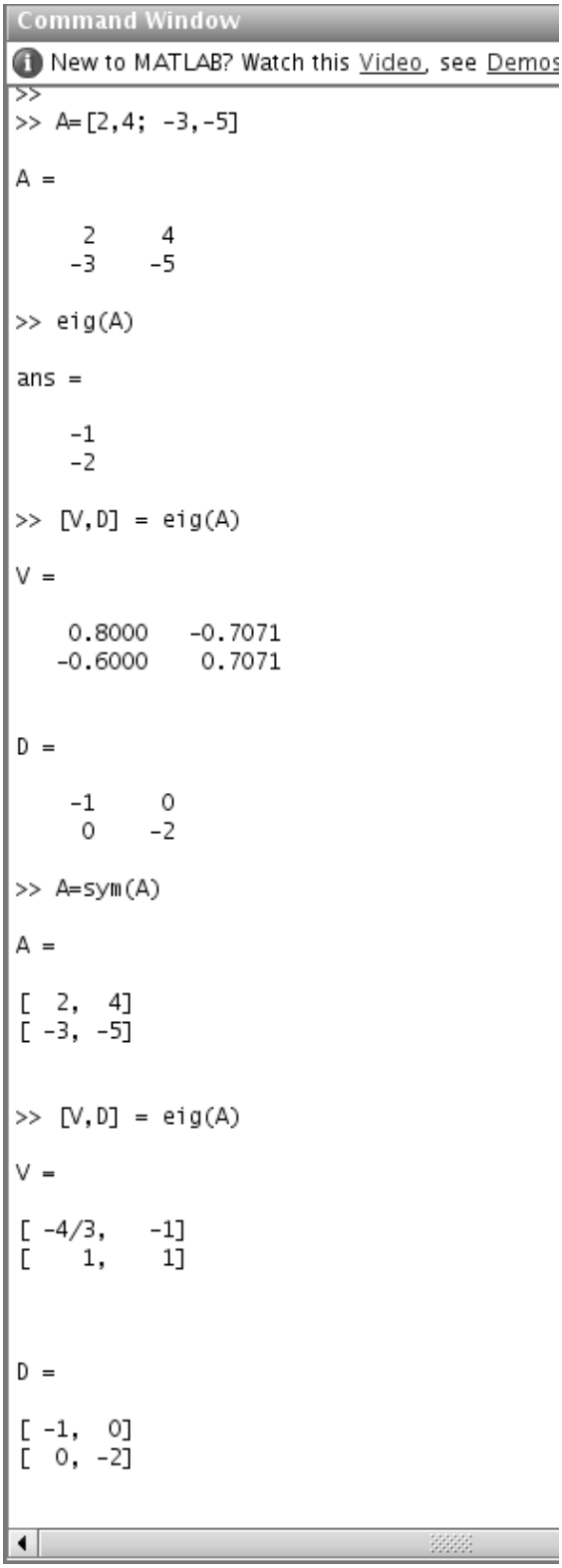
1 General Matlab commands

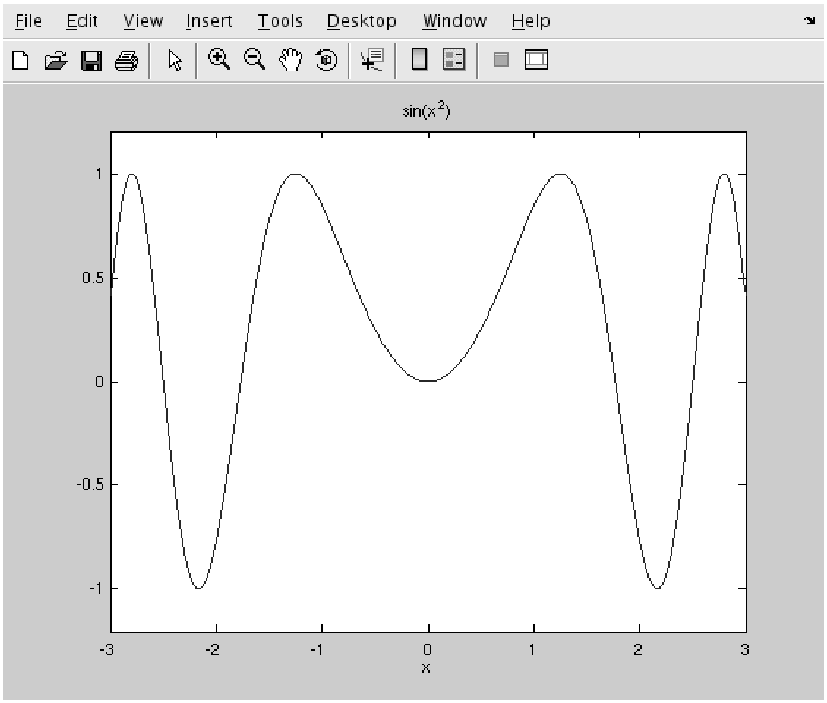
See "Worksheet 1" of "MS125E Experimental Maths".

- Defining the function $f(x) = \sin(x^2)$:
  `f = inline('sin(x.^2)','x')`
- Plotting the function $f(x)$ with x between -3 and 3:
  `ezplot(f,[-3,3])`
- Defining y to be the symbolic expression $\sin(x) - x^2$ with x as a symbolic variable:
  `syms x`
  `y=sin(x)-x.^2`
- Making the symbolic expression into a function f_1, i.e., define the function $f_1(x) = \sin(x) - x^2$:
  `f1=inline(char(y))`
- Differentiate the symbolic expression y with respect to the symbolic variable x (x is not cleared, so still a symbolic variable:
  `diff(y,x)`
- Differentiate the symbolic expression $t\sin(t)$ with respect to the variable t:
  `diff('t*sin(t)','t')`
- Integrate the symbolic expression y with respect to the symbolic variable x:
  `int(y,x)`
- Integrate the symbolic expression $t\sin(t)$ with respect to the variable t:
  `int('t*sin(t)','t')`
- The 2×2 matrix $A = \begin{pmatrix} 2 & 4 \\ -3 & 5 \end{pmatrix}$ is defined by
  `A=[2,4; -3,-5]`
- To make A into a symbolic matrix, use
  `A = sym(A)`
- The eigenvalues of the matrix A are found via (the result is a vector with the eigenvalues of A)
  `eig(A)`
- The eigenvalues and eigenvectors of the matrix A are found via (the i-th columns of V is the eigenvectors with the eigenvalue on the i-th diagonal position of D)
  `[V,D] = eig(A)`

The output of Matlab for the previous command (figure for ezplot is on the next page):







2 Matlab commands for ODEs

See "Worksheets 6 and 7" of "MS125E Experimental Maths".

- Symbolic solving of the ODE $\frac{dy}{dx} = 3y$ with $y(x_0) = y_0$ is done by `dsolve('Dy=3*y','y(x0)=y0','x')`
- Symbolic solving of the ODE $\frac{dy}{dx} = 3x$ with $y(x_0) = y_0$ is done by `dsolve('Dy=3*x','y(x0)=y0','x')`
- The matlab toolbox for plotting direction field of scalar ODE is `dfield7`
- The matlab toolbox for plotting phaseportrait of 2×2 system is `pplane7`