1. Finding roots or zeros of a given function or system: i) `A\b` for system of linear equations, ii) `roots([a b c])` for finding roots of a polynomial, iii) `fzero` for solving a single nonlinear equation, based on changing sign in an interval and iv) `fsolve` for solving a system of nonlinear equations.

```
clear all;

p = [1 -10 10];
r = roots(p)                                          % root of the polynomial

p2 = poly(r)                                        % polynomial whose roots are r

syms x
s = solve(p2(1)*x^2+p2(2)*x+p2(3))
double(s)

fun = @(x) p2(1)*x.^2+p2(2)*x+p2(3);
fzero(fun,[1,2])                                     % finding root in an interval

xx=linspace(1,9);
plot(xx,fun(xx),'r-','LineWidth',3);
set(gca,'FontSize',30);
```

2. Write a Matlab script/function to minimize the following function using Lagrange multiplier method: $f(x, y) = x^2y$ with $h(x, y) = x^2 + y^2 = 3$.

```
x0 = [0.5;-0.5;1]
options=optimset('Display','iter');

[x,fval] = fsolve(@objective,x0,options)

function F = objective(x)

F(1) = 2*x(1)*x(2)+2*x(3)*x(1);
F(2) = x(1)^2+2*x(3)*x(2);
F(3) = x(1)^2+x(2)^2-3;
end
```

3. Solve the IVP: $y' = 0.1y, y(0) = 1000$ using Euler's method. Plot the solution in 2D. Find the approximate value of $y(50)$.
   Do the same for $y' = y^2 + t^2, y(0) = 1$ in $[0, 2]$.