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Solving a Complicated System of Equations

Using the Symbolic Math Toolbox, any nonlinear system of equations can be solved.

These will be the two nonlinear equations:

$$x_1{}^3 - \frac{e^{2x_2}}{3} = \left(x_2{}^2 - x_1\right)^2 - 1 \quad \textbf{and} \quad x_2\sin(x_1) + e^{x_1} + 3 = 0$$

First, a function must be created that looks like this:

function F = SOE2(x)

F(1) = (x(1)^3) - ((exp(2*x(2)))/2) - (((x(2)^2)-x(1))^2) + 1;

F(2) = x(2)*sin(x(1)) + (exp(x(1))) + 3 ;

The fsolve() function will use an iterative process to find x1 and x2 by first setting both equal to 0.

```
fun = @SOE2;
x0 = [0,0];
x = fsolve(fun,x0);
```

```
No solution found.

fsolve stopped because the problem appears regular as measured by the gradient,
but the vector of function values is not near zero as measured by the
value of the function tolerance.

<stopping criteria details>
```

Thus the solution looks like this:

```
fprintf('The solution to the nonlinear SOE is x(1) = %f and x(2) = %f',x);
```

```
The solution to the nonlinear SOE is x(1) = -0.690654 and x(2) = 0.282838
```