

## Exercises 7.2

3. Solve the boundary value problem using the Galerkin method and two basis function.

$$\frac{d^2 u}{dx^2} - \frac{du}{dx} = 2x, \quad x \in (0, 1)$$
$$u(0) = 1$$
$$u(1) = 0$$

Compare the results with the analytical solution. Explain why the Galerkin method was able to match the analytical result.

```
clear all
clc
syms x
syms c1
```

```
N1 = x*(x-1);
N2 = 1-x;
u = @(x) c1*N1+N2;
R = @(x) diff((u(x)),2) - diff((u(x))) - 2*x;
w1 = N1;
A = int(R(x)*w1, 0, 1);
c1 = solve (A, c1);
u = @(x) c1*N1+N2;
R = @(x) diff((u(x)),2) - diff((u(x))) - 2*x;
ux = u(x)
```

```
ux = 1 - x
```

```
Rx = R(x)
```

```
Rx = 1 - 2 x
```

```
X = 0:0.01:1;
u = subs (ux,x, X);
R = subs (Rx,x, X);
plot(X,u,X,R)
legend ('y(x)', 'R(x)')
grid on
```

