

---

```
% hw1.m
clear all; close all; clc;

% sample function
u = @(x1,x2) sin(2.*pi.*x1).*cos(6.*pi.*x2);

% mesh the rectangle [0,1] x [2,3] with 20 / 60 subintervals in
% x1-/x2-direction, respectively
msh = meshRectangle([0,1,2,3], [20,60]);

% evaluate u on msh and draw a surface plot
figure, grid on
surf(msh.X1, msh.X2, u(msh.X1,msh.X2));

% axis labels
textargs = {'fontsize',24,'interpreter','latex'};
xlabel('$x_1$', textargs{:});
ylabel('$x_2$', textargs{:});
zlabel('$\sin(2\pi x_1)\cos(6\pi x_2)$', textargs{:});

% set background to white
set(gcf, 'color', 'w');

% save figure to pdf
export_fig hw1_figure -transparent -pdf
```

*Published with MATLAB® R2015a*

---

```

function [ msh ] = meshRectangle( x, N )
%MESHRECTANGLE Meshes a two-dimensional rectangular domain.
% This function takes two input variables:
%   x:  1 × 4 array
%        Defines the coordinates of the rectangle
%        [x(1),x(2)] × [x(3),x(4)]
%   N:  1 × 2 array
%        Specifies that the domain is to be divided into N(1)/N(2)
%        subintervals in the x1/x2-direction, respectively
%
% This function returns one output variable:
%   msh (structure with the following fields):
%       X1: (N(2)+1) × (N(1)+1) array containing x1 at each gridpoint
%       X2: (N(2)+1) × (N(1)+1) array containing x2 at each gridpoint
%       N:  a copy of the input variable of the same name
%       h:  1 × 2 array which contains the width of the subintervals
%           in the x1 and x2-direction

% h is the width of each side of the domain divided by the number of
% points on each side:
h = [x(2)-x(1), x(4)-x(3)]./N;

% X1, X2 are output by the meshgrid function, which essentially just
% reshapes and replicates the (linearly spaced) input row-vectors
% along the appropriate dimensions
x1 = linspace(x(1),x(2),N(1)+1);
x2 = linspace(x(3),x(4),N(2)+1);
[X1,X2] = meshgrid(x1,x2);

% Finally, assemble the output struct msh
msh = struct( ...
    'X1', X1, ... % array of x1 values at each gridpoint
    'X2', X2, ... % array of x2 values at each gridpoint
    'N',  N,  ... % number of subintervals in each direction
    'h',  h   ... % grid spacing in each direction
);

end

```

*Published with MATLAB® R2015a*