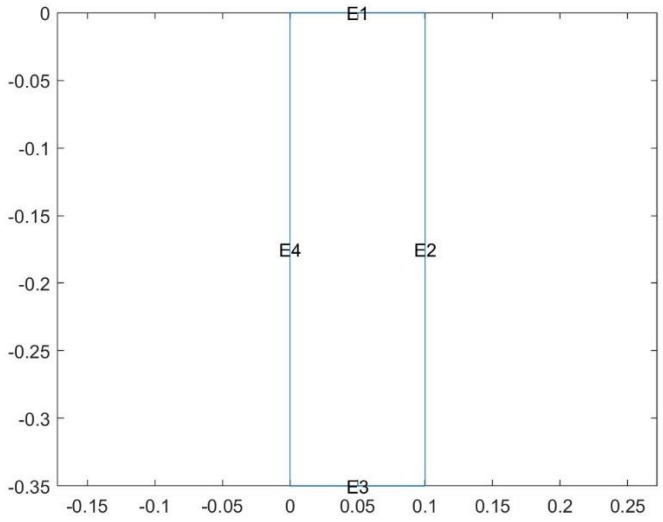
```
clf;
clear;
tlist=[2,10,15,25,60]; % Create list of time in seconds to grab a snapshot


%-------------------------------------------------------------------------
% Steps
%-------------------------------------------------------------------------
% 1. Create transient PDE model
% 2. Create geometry and import into model
% 3. Define thermal properties
% 4. Define ICs and BCs
% 5. Generate Mesh
% 6. Solve the PDE
% 7. Plot the PDE
%-------------------------------------------------------------------------


% Create transient pde model
% Source: https://www.mathworks.com/help/pde/ug/pde.thermalmodel.html
model1=createpde(1);
thermalmodel=createpde('thermal','transient');
%-------------------------------------------------------------------------


% Create rectangular geometry
% Source: https://www.mathworks.com/help/pde/ug/create-geometry-at-the-command-line.html
rect1=[3 4 0 0.1 0.1 0 0 0 -0.35 -0.35]';
%-------------------------------------------------------------------------


% Import geomtry to thermal model, and plotting geometry for edge reference
% Source: https://www.mathworks.com/help/pde/ug/pde.pdemodel.geometryfromedges.html
ns=char('rect1');
ns=ns';
sf='rect1';
```

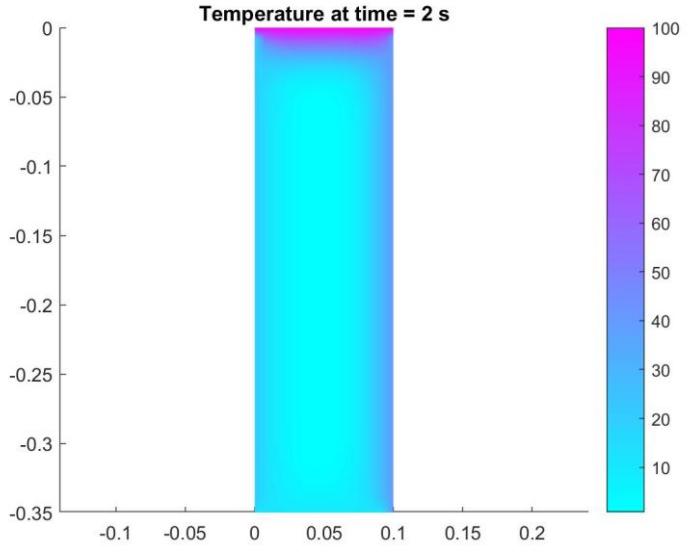
```
g=decsg(rect1,sf,ns);
pg=geometryFromEdges(thermalmodel,g);
figure (1)
pdegplot(thermalmodel,'Edgelabels','on');
axis equal
%--------------------------------------------------------------------------


% Defining alpha (Thermal diffusivity) as ThermalConductivity/(MassDensity X SpecificHeat)
% Function source: https://www.mathworks.com/help/pde/ug/pde.thermalmodel.thermalproperties.html
thermalProperties(thermalmodel,'ThermalConductivity',0.0001,'MassDensity',1','SpecificHeat',1);
%--------------------------------------------------------------------------


% Defining boundary conditions
% Source: https://www.mathworks.com/help/pde/ug/pde.thermalmodel.thermalbc.html#bvhtzlo-RegionType
thermalBC(thermalmodel,'Edge',1,'Temperature',100);
thermalBC(thermalmodel,'Edge',2,'Temperature',40);
thermalBC(thermalmodel,'Edge',3,'Temperature',10);
thermalBC(thermalmodel,'Edge',4,'Temperature',20);
%--------------------------------------------------------------------------


% Defining initial condition, generating mesh, and plotting
% Source: https://www.mathworks.com/help/pde/ug/pde.thermalmodel.thermalic.html#bvhtznb-RegionType
thermalIC(thermalmodel,0);
generateMesh(thermalmodel);

for n=1:length(tlist)
    % Create a matrix of solutions for each time from tlist
    result(n)=solve(thermalmodel,0:0.1:tlist(n));

        % Plot only for the first 4 times as required by the question
        if n<5
            figure (n+1)
            pdeplot(thermalmodel,'XYData',result(n).Temperature(:,end))
```

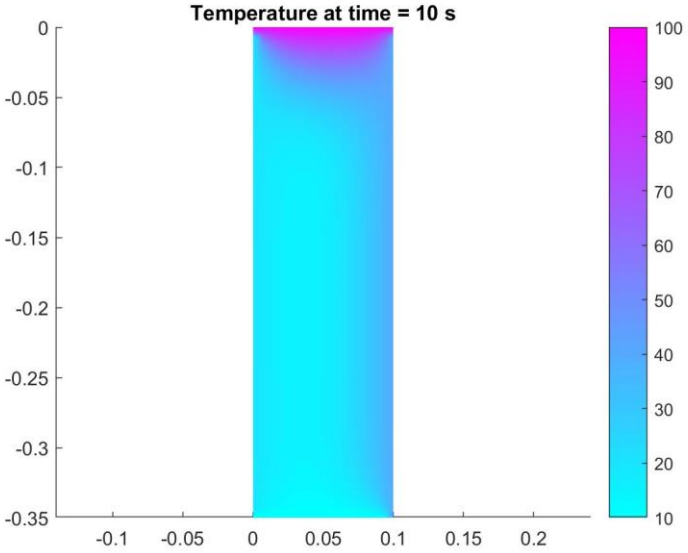
```
            tstring = ['Temperature at time = ', num2str(tlist(n)),' s'];
            title(tstring)
            axis equal
 end
end
%-------------------------------------------------------------------------


% Repeat the above steps for a steady state model
% Error involved as steady state solution depends only on ThermalConductivity
% which was assumed to be same as ThermalDiffusivity
% Sources: Same as transient state
model2=createpde(1);
thermalmodel2=createpde('thermal','steadystate');
pg2=geometryFromEdges(thermalmodel2,g);
thermalProperties(thermalmodel2,'ThermalConductivity',0.0001);
thermalBC(thermalmodel2,'Edge',1,'Temperature',100);
thermalBC(thermalmodel2,'Edge',2,'Temperature',40);
thermalBC(thermalmodel2,'Edge',3,'Temperature',10);
thermalBC(thermalmodel2,'Edge',4,'Temperature',20);
generateMesh(thermalmodel2);
result2=solve(thermalmodel2);
figure(6)
pdeplot(thermalmodel2,'XYData',result2.Temperature(:,end))
tstring2 = ['Temperature at steady state'];
title(tstring2)
axis equal
%-------------------------------------------------------------------------


% Interpolate Temperature at specific X,Y, and t
% Source for interpolation function:
% https://www.mathworks.com/help/pde/ug/pde.steadystatethermalresults.interpolatetemperature.html
X = [0.04 0.06 0.07 0.09];
Y = [-0.3 -0.25 -0.2 -0.15];
t = [15 60];
```

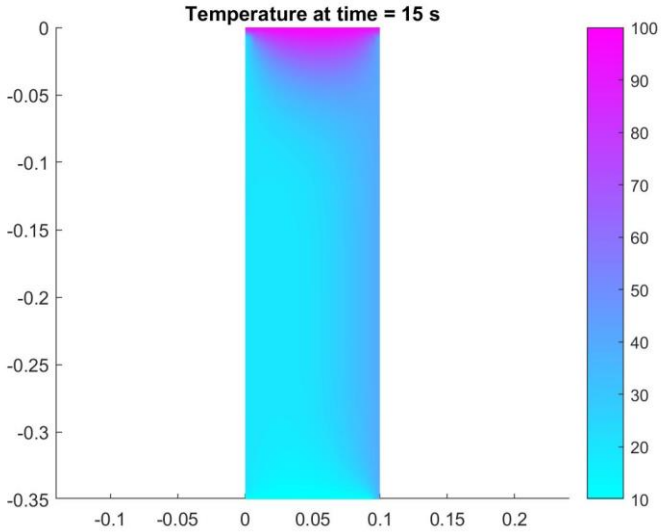
```
l=1;
diary infal.dat
fprintf('   X       Y       t      T\n');
for i=1:1:length(X)
    for j=1:2
    Tintrp1(l) = interpolateTemperature(result(5),X(i),Y(i),t(j));
    fprintf('%0.2f   %0.2f   %0.2f   %0.2f\n',[X(i) Y(i) t(j) Tintrp1(l)]);
    q=l+1;
    l=q;
    end
end
diary off
%-----------------------------------------------------------------------
```

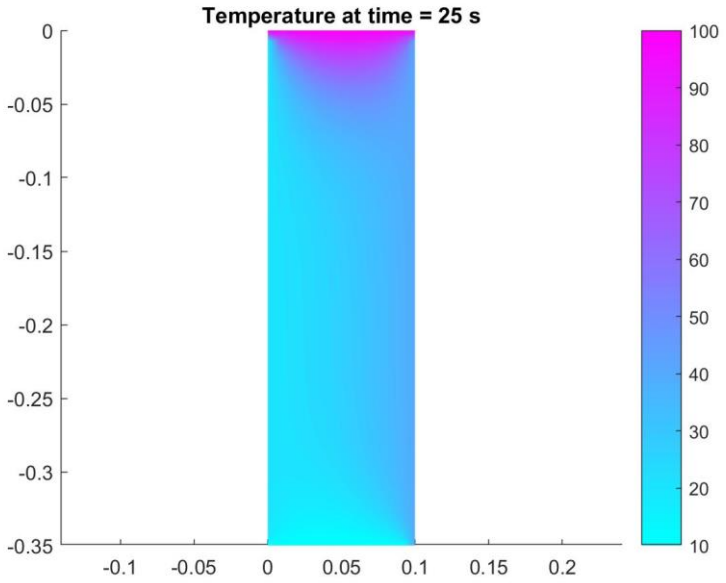
```
>> infal_1
   X       Y       t      T
0.04   -0.30   15.00   0.38
0.04   -0.30   60.00   8.74
0.06   -0.25   15.00   0.68
0.06   -0.25   60.00   11.40
0.07   -0.20   15.00   2.93
0.07   -0.20   60.00   16.13
0.09   -0.15   15.00   22.13
0.09   -0.15   60.00   31.00
```

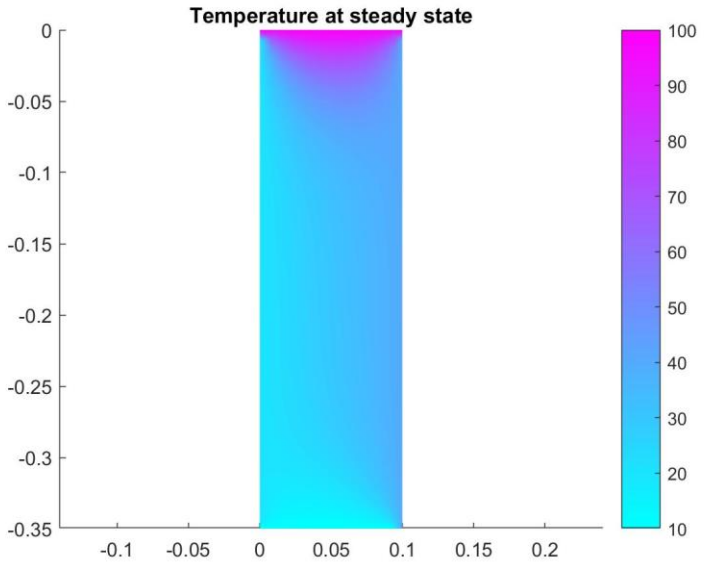

E1
E2
E3
E4
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.15
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25


Temperature at time = 2 s
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.1
-0.05
0
0.05
0.1
0.15
0.2
100
90
80
70
60
50
40
30
20
10


Temperature at time = 10 s
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.1
-0.05
0
0.05
0.1
0.15
0.2
100
90
80
70
60
50
40
30
20
10


Temperature at time = 15 s
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.1
-0.05
0
0.05
0.1
0.15
0.2
100
90
80
70
60
50
40
30
20
10


Temperature at time = 25 s
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.1
-0.05
0
0.05
0.1
0.15
0.2
100
90
80
70
60
50
40
30
20
10


Temperature at steady state
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.1
-0.05
0
0.05
0.1
0.15
0.2
100
90
80
70
60
50
40
30
20
10