## Differential Equation Model.

$y(t + dt) - y(t) \approx dt*c*(ysur - y(t))$.

dt = change in time

c = insulation proportionality constant

ysur = given surrounding temperature

y(t) = temperature.

Let dt go to zero to get

$y' = c(ysur - y)$.

## Method of Solution.

Use the substitution method z = ysur – y.

For example,

$y' = (1/26)(70.0 - y)$ and $y(0) = 200$.

Let $z = 70. - y$ to get

$-z' = (1/26)z$ and $z(0) = 70 – 200 = -130$.

So, $z(t) = -130e^{(-t/26)}$ and $y(t) = 70 + 130e^{(-t/26)}$.

## Matlab Implementation.

1. Use function file temp.m

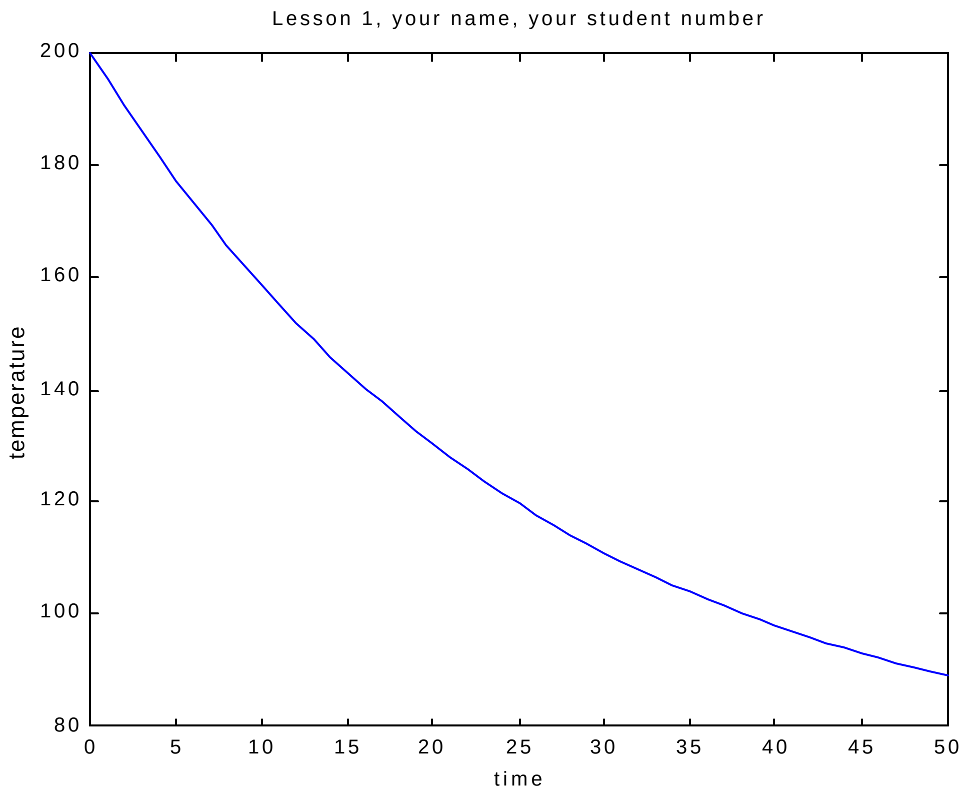
```
function temp = temp(t)
    temp =  70 + 130*exp(-t/26);
```

Now the temperature function can be easily evaluated:

```
EDU» temp(1)
ans =
195.0949

EDU» temp(2)
ans =
190.3749
```

2. Use loops.

```
EDU» clear;              % This clears the memory.

EDU» for i = 0:50        % This starts the loop.
time(i+1) = i;
y(i+1) = temp(i);
end

EDU» plot(time,y)                  %  Plots the graph.
EDU» title('Lesson 1, your name, your student
number')
EDU» xlabel('time')
EDU» ylabel('temperature')
```


Lesson 1, your name, your student number
temperature
time
200
180
160
140
120
100
80
0
5
10
15
20
25
30
35
40
45
50

3. Use m-file cooling.m.

```
% Lesson 1, your name, your student number
clear;                  % This clears the memory.
for i = 0:50            % This starts the loop from time
                        = 0 to 50.
   time(i+1) = i;
   y(i+1) = temp(i);
end
plot(time,y)            %  Plots the graph and inserts
                        title and labels.
title('Lesson 1, your name, your student number')
xlabel('time')
ylabel('temperature')
```

Now the above calculations can be executed by a single command at the Matlab prompt by just typing cooling.