Differential Equation Model.

Mass communication refers to newspapers, journals, radio and television.

Discrete Model:

\[ y(i+1) - y(i) = dt \cdot k \cdot (20000 - y(i)) \]

20000 = population size

\[ y(i) = \text{number who know some fact} \]

20000 – y(i) = number who do NOT know

\[ dt = \text{time step} = 1 \]

k = “advertising” proportionality constant.

Continuous Model:

\[ y'(t) = k \cdot (20000 - y(t)). \]
Personal communication refers to discussions with other people.

**Discrete Model:**

\[ y(i+1) - y(i) = dt \cdot c \cdot y(i) \cdot (20000 - y(i)) \]

\[ k = c \cdot y(i) \]

\[ c = \text{“gossip” proportionality constant.} \]

**Continuous Model:**

\[ y'(t) = c \cdot y(t) \cdot (20000 - y(t)). \]
Method of Solution.

Use Matlab’s ode45, which is an implementation of the Runge-Kutta 45 scheme with variable time steps.
Matlab Implementation.

Use the m-files ypinfo.m and info.m.

```matlab
function ypinfo = ypinfo(t,y)
    ypinfo(1) = (.0001)*y(1)*
        (20000 - y(1));

%your name, your student number, lesson number
clear;
yo = [1];
to = 0;
tf = 10;
[t y] = ode45('ypinfo',[to tf],yo);
plot(t,y)
title('your name, your student number, lesson number')
xlabel('time')
ylabel('informed')
```
Find $k$ and $c$ by using the improved Euler method.

Suppose initially $y(0) = 1$, and after one day

$y(1) = 200$.

For the mass communication model we can find $k$ by using $y' = k(20000 - y)$ and the improved Euler method

$$200 - 1 = \frac{1}{2}[1\cdot k^{20000-1} + 1\cdot k \cdot (20000-200)]$$

This gives $k = 0.01$. 
For the personal communication model we find the $c$ by using the logistic differential equation

$$y' = cy(20000 - y)$$

and the improved Euler method

$$200 - 1 = (1/2)[1*c*(1*(20000 - 1) + 1*c*200*(20000 - 200)]$$

This gives $c = .0001$.

The solution for the mass communication model reaches the steady state solution much more slowly than the solution for the personnel communication model. This could explain why commercials try to be very “cute” or “interesting” so that people will talk about them.