Differential Equation Model.

Newton's law of motion then gives the differential equation

$$m\, u_t = -mg + k\, u^2.$$

As time evolves, the speed will approach $u = (mg/k)^{1/2}$.

Method of Solution.

Euler's Numerical Method for Approximating y' = g(t,y) and y(0) given.

$$Y(i+1) = Y(i) + dt*g(i*dt,Y(i)).$$

Improved Euler's Numerical Method for Approximating y' = g(t,y) and y(0) given.

$$Y(i+1) = Y(i) + dt*g(i*dt,Y(i))$$

$$Y(i+1) = Y(i) + dt/2*(g(i*dt,Y(i))+g((i+1)*dt,Y(i+1))).$$

Table: Discretization Errors

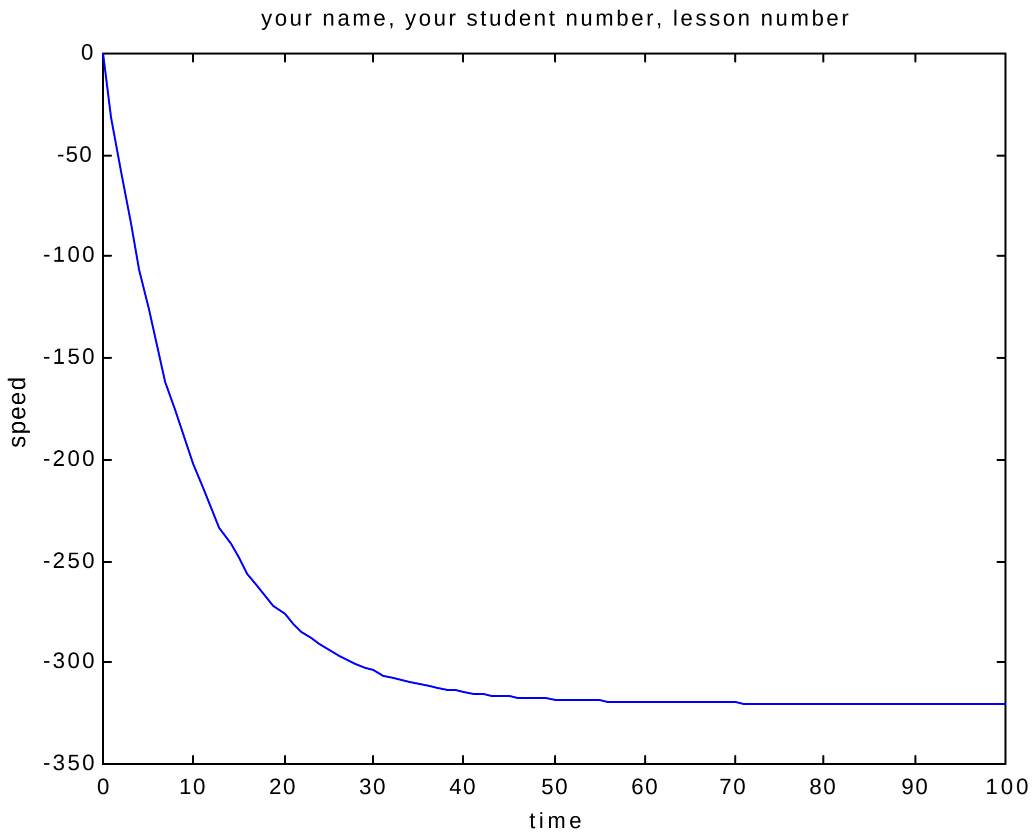
KK	erreul	errimerr
8	3.1152	0.1370
16	1.5347	0.0326
32	0.7571	0.0080
64	0.3761	0.0020

Matlab Implementation.

```
function fmass= fmass(t,y)
  fmass = -32 + .1*abs(y);

%your name, your student number, lesson number
clear;
y(1) = 0.;
T = 100.;
KK = 100
h = T/KK;
t(1)= 0.;
for k = 1:KK
   y(k+1) = y(k) + h*fmass(t(k),y(k));
   t(k+1) = t(k) + h;
   y(k+1) = y(k) + .5*h*(fmass(t(k),y(k)) +
                fmass(t(k+1),y(k+1)));
end
```

```
plot(t,y)
title('your name, your student number, lesson number')
xlabel('time')
ylabel('speed')
```



The second numerical experiment is with the resistive force equal to

$$.1\mathrm{abs}(u) + .001u^2.$$