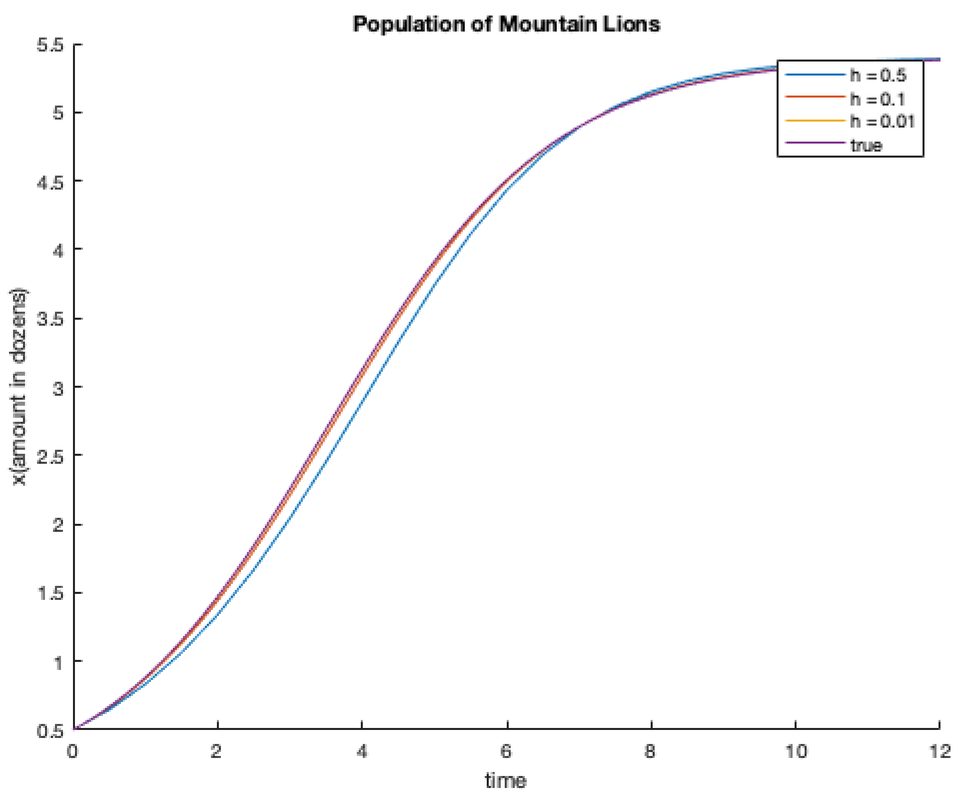
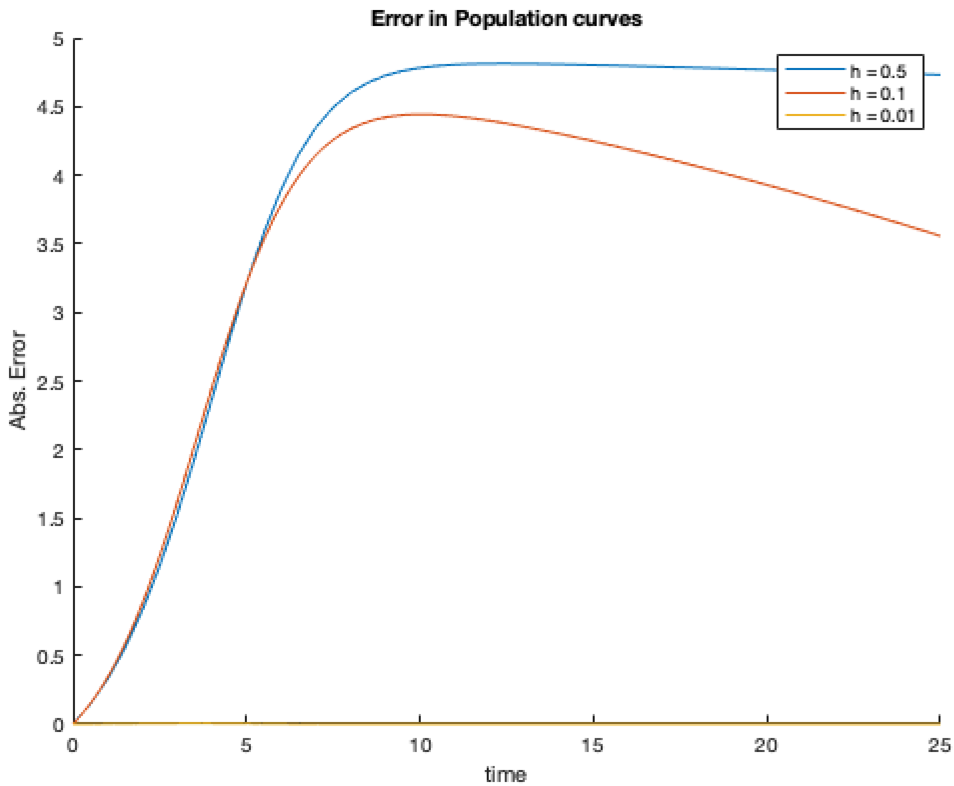
```
% Section 2, Question 3, All parts
% figure 1: deer population Eulers method and actual
% figure 2: Error in Eulers Method
% Section 2, Question 5 (figure 3)
%{
 y_prime = @(t,y) function_definition % y_prime = f(x,y)

h = ;
t = to:h:t_end;
y(1) = yo

for n = 1:(lenght(t)-1)
    y_{n+1} = y_{n} + h*y_prime{t_n,y_n}
end
%}
x_prime = @(t,x) .65*x.*(1-x/5.4);
h1 = .5;
h2 = .1;
h3 = .01;
t1 = 0:h1:25;
t2 = 0:h2:25;
t3 = 0:h3:25;
x1 = zeros(1,length(t1));
x1(1) = .5;
x2 = zeros(1,length(t2));
x2(1) = .5;
x3 = zeros(1,length(t3));
x3(1) = .5;
for n = 1:(length(t1)-1)
    x1(n+1) = x1(n) + h1*x_prime(t1(n),x1(n));
end
for n = 1:(length(t2)-1)
    x2(n+1) = x2(n) + h2*x_prime(t3(n),x2(n));
end
for n = 1:(length(t3)-1)
    x3(n+1) = x3(n) + h3*x_prime(t3(n),x3(n));
end
xo = .5;
r = .65;
lm = 5.4;
t = 0:.01:25;
x = (xo*exp(r*t)*lm)./(lm-xo+(xo*exp(r*t)));

figure(1)
hold on
plot(t1,x1,'LineWidth', .3)
plot(t2,x2,'LineWidth', .4)
plot(t3,x3,'LineWidth', .7)
plot(t,x,'LineWidth', 1)
xlabel('time'), ylabel('x(amount in dozens)'), title("Population of
 Mountain Lions")
legend("h = 0.5","h = 0.1","h = 0.01","true")
```

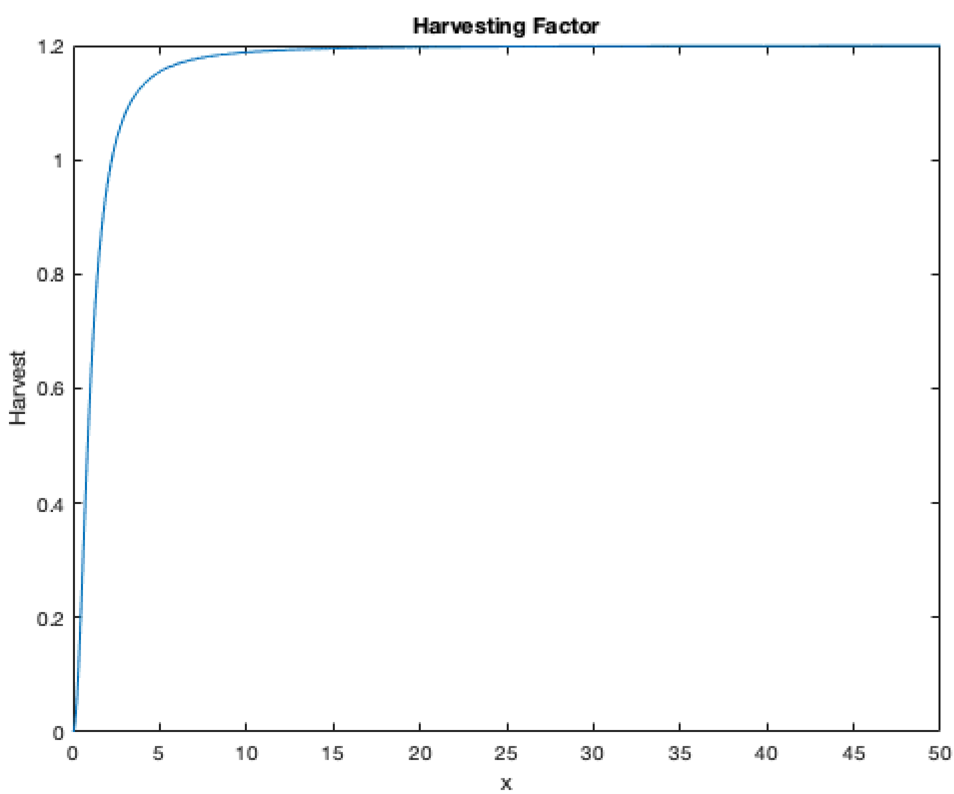
```
axis([0 12 .5 5.5])

hold off
e1 = abs(x(1:51)-x1);
e2 = abs((x(1:251)-x2));
e3 = abs((x-x3));
figure(2)
hold on
semilogy(t1,e1,t2,e2,t3,e3)
xlabel('time'), ylabel('Abs. Error'), title("Error in Population
 curves")
legend("h = 0.5","h = 0.1","h = 0.01")
hold off
% speculate about why the error curves contain downward #spikes#
 around time t = 7.
p = 1.2;
q = 1;
xxx = 0:.01:50;
figure(3)
hx = p*xxx.^2./(q+xxx.^2);
plot(xxx,hx);
xlabel('x'), ylabel('Harvest'), title("Harvesting Factor")

% ANSWER FOR 1:
%{
  L = dozens of animals
  r = 1/t = dozens of animals / time
%}
% ANSWER FOR 2:
% x = (x0*e^(rt)*L)/(L-x0+x0*e^(rt))

% ANSWER FOR 3 C:
%{
3. c) Using step size 0.01 was very accurate, as the error was really
close to being zero. The efficiency of using this step size was not
 much
different from using the larger step sizes, and having the error be as
low as it was makes it more worthwhile to use as an approximation for
the function. Therefore, using a step size of 0.01 was the best
 balance
of numerical accuracy and efficiency.
%}

% ANSWER FOR 4:
%{
Nonlinear, 1st degree, autonomous, constant coefficient. The physical
meaning of autonomy for this equation means that the rate at which the
deer population is changing only depends on the amount of deer and
 mountain
lions, not on the time that passes. If you had a constant population,
 then
the rate at which the population grows won?t change because if you
 have
```

```
more animals, they will have a higher rate of population growth but
 that
does not depend on how much time has passed. As a counterexample, if
 you
had a person who gave birth to one child, as time goes on it will not
 mean
the next time they have a child they will have 2 children, then 3,
 then 4,
they will only have one at a time. Growth in population depends on how
 many
beings there are to create or kill the population, not how much time
 has
passed.
%}

% ANSWER FOR 5:
%{
 As x gets very large, the harvesting factor approaches p. This makes
 sense because mountain lions can only get as many deer has thier
 skill
 level allows.
 As x -> 0. your harvesting factor apporaches zero also. This makes
 sense
 because deer are more rare, amking lions less likely to run into one
 during a hunt.
%}
```





Error in Population curves
Abs. Error
time
h = 0.5
h = 0.1
h = 0.01



Harvesting Factor
Harvest
x

Published with MATLAB® R2018b