Math 504

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1 Question 1

The Newton's Method Iteration is given by x^1 = x^0 - F(x^0)$^-1$ - g(x^0)
g(x^0) = (2,0)^T
F(x) = $\begin{bmatrix} Fx1x1 & Fx1x2 \\ Fx2x1 & Fx2x2 \end{bmatrix} = \begin{bmatrix} -400(x2 - 3x1^2) - 2 & -400x1 \\ -400x1 & 200 \end{bmatrix}$
Thus, F(x^0) = $\begin{bmatrix} -2 & 0 \\ 0 & 200 \end{bmatrix}$
x^1 = (0 0)^T - $\begin{bmatrix} -2 & 0 \\ 0 & 200 \end{bmatrix}^-1$ * (2 0)^T = (0 0)^T - $\begin{bmatrix} -1/2 & 0 \\ 0 & 1/200 \end{bmatrix}^-1$ * (2 0)^T
= (0 0)^T - (-1 0)^T = (1 0)^T
Now, x^2 = x^1 - F(x^1)$^-1$ - g(x^1) = (1 0)^T - $\begin{bmatrix} 1198 & -400 \\ -400 & 200 \end{bmatrix}^-1$ * (400 -200)^T
= (1 0)^T - $\begin{bmatrix} 1/398 & -1/199 \\ 1/199 & 599/39800 \end{bmatrix}^-1$ * (400 -200)^T = (1 0)^T - (0 -1)^T = (1 1)^T

2 Question 2

f(x) = f(x_0) + f$'$(x$_0$)(x-x_0) + 0.5*f$''$(x$_0$)(x-x_0)^2
The formula is generalised x_t = x_t - f(x_0)/f'(x_0)

2.1 Question 2b

Put initial guess = 0.01
Iteration 1 x1 = 0.009999
Iteration 2
x2 = 0.009998
Iteration 3
x3 = 0.00999
Iteration 4
x4 = 0.009999
Put initial guess 0.001
x0=0.001
Iteration 1

x1 = 9.999E-4
Iteration 2
x2 = 9.999E-4
Iteration 3
x3 =9.999E-4
Iteration 4
x4 = 9.999E-4
This shows that if the starting point is not zero it is not converge to zero

3 Question 3

```
clear
clc
t=linspace(0,4*pi,500);
A=input('Enter A:');
w=input('Enter omega: ');
ph=input('Enter phase: ');
y=@(t)A*sin(w*t+ph);
y1=y(t);
m=max(y1);
dt=t(2)-t(1);
figure
for i=1:499
  p=(y(t(i)+dt)-y(t(i)))/dt;
  plot(t,y1,'b');
  hold on
  axis([0 4*pi -(m*A+4) m*A+4])
  y11=p*((t(i)-1)-t(i))+y(t(i));
  y12=p*((t(i)+1)-t(i))+y(t(i));
  plot([t(i)-1 t(i)+1],[y11 y12],'r-*')
  scatter(t(i),y(t(i)),'b','filled')
  figure_title = ['The derivative at t=', num2str(t(i)), ' is: ', num2str(p)];
  title(figure_title)
  legend('sin(t)','tangent line','point on sin(t)')
  hold off
```