CSC 2262, Spring 2020, lab 1a

An artillery shell is fired from the top of a cliff of height h, with a muzzle velocity v_0 at an angle θ with respect to the horizontal, toward a target at a horizontal distance x from the bottom of the cliff. The firing angle θ that will permit the shell to hit the target is given by the equation

$$h\cos^2\theta + \frac{x}{2}\sin(2\theta) - \frac{gx^2}{2v_0^2} = 0$$

where h = 250 m, x = 775 m and g = 9.81 m/s^2 .

The time t that the shell is in the air, and the maximum height of the shell with respect to the ground, y_{max}, are given by

$$t = \frac{v_0 \sin\theta}{g} + \sqrt{\frac{v_0^2 \sin^2\theta}{g^2} + \frac{2h}{g}}$$

$$y_{max} = h + \frac{v_0^2 \sin^2\theta}{2g}$$

Write a MATLAB program that uses Newton's Method to calculate both values of θ that will enable the shell to hit the target. Then use these calculated values of θ to calculate t and y_{max} according to the above formulas. Scan the θ axis from 0° to 90° in steps of 1° to look for solutions for θ. Print θ (in degrees), t and y_{max}.

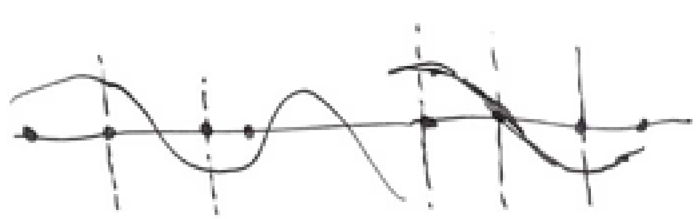
The program will call a function named newton that implements Newton's Method.

The output of this program should look like this:

```
v0 = 75   theta = 30.22533   t = 11.95915   ymax = 322.65297
v0 = 75   theta = 41.89597   t = 13.88220   ymax = 377.84703

v0 = 80   theta = 18.78204   t = 10.23237   ymax = 283.81497
v0 = 80   theta = 53.33926   t = 16.22491   ymax = 459.90849

v0 = 85   theta = 13.05294   t =  9.35948   ymax = 268.78382
v0 = 85   theta = 59.06836   t = 17.73810   ymax = 520.95172
```



CSC 2262, Spring 2020, Lab 1b

A polynomial P is given by

$$P = 728x^4 - 8249x^3 + 33660x^2 - 57996x + 34992$$

Write a MATLAB program to calculate and print the roots of the polynomial P (the values of x where the polynomial is zero). Call the function newton to calculate the roots. Scan the x axis from 0 to 5 in steps of .1 to look for the roots. Use 1e-7 as the accuracy factor.

The output of this program should look like this:

```
x = 1.38462
x = 2.57143
x = 3.37500
x = 4.00000
```