Homework Code - 3

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Question 1.

Output for Newton's method.

```
>> hw3a
ans =
    'Error is 1.0679491924   '
ans =
    'Error is 0.2036634781   '
ans =
    'Error is 0.0107140844   '
ans =
    'Error is 0.0000329338   '
ans =
    'Error is 0.0000000003   '
ans =
    'Error is 0.0000000000   '
ans =
    'Approximate root of  x^2 - 2.0 is 1.7320508076
     '
ans =
    'Error in    root of  x^2 - 2.0 is 2.2204460493e-16
     '
```

Question 2.

Output for modified Newton's method.

```
>> hw3b
ans =
    'Error is 1.0679491924   '
ans =
    'Error is 0.5839491924   '
ans =
    'Error is 0.3475635924   '
ans =
    'Error is 0.2150839872   '
ans =
    'Error is 0.1359505963   '
ans =
    'Error is 0.0870076718   '
ans =
    'Error is 0.0561102967   '
ans =
    'Error is 0.0363582832   '
ans =
    'Error is 0.0236312120   '
ans =
    'Error is 0.0153892766   '
ans =
    'Error is 0.0100345918   '
ans =
    'Error is 0.0065484379   '
ans =
    'Error is 0.0042757043   '
ans =
    'Error is 0.0027927287   '
ans =
    'Error is 0.0018245192   '
ans =
    'Error is 0.0011921543   '
```

```
ans =
    'Error is 0.0007790378    '
ans =
    'Error is 0.0005091105    '
ans =
    'Error is 0.0003327235    '
ans =
    'Error is 0.0002174537    '
ans =
    'Error is 0.0001421208    '
ans =
    'Error is 0.0000928867    '
ans =
    'Error is 0.0000607089    '
ans =
    'Error is 0.0000396784    '
ans =
    'Error is 0.0000259332    '
ans =
    'Error is 0.0000169496    '
ans =
    'Error is 0.0000110781    '
ans =
    'Error is 0.0000072405    '
ans =
    'Error is 0.0000047323    '
ans =
    'Error is 0.0000030930    '
ans =
    'Error is 0.0000020215    '
ans =
    'Error is 0.0000013213    '
ans =
    'Error is 0.0000008636    '
```

```
ans =
    'Error is 0.0000005644   '
ans =
    'Error is 0.0000003689   '
ans =
    'Error is 0.0000002411   '
ans =
    'Error is 0.0000001576   '
ans =
    'Error is 0.0000001030   '
ans =
    'Error is 0.0000000673   '
ans =
    'Error is 0.0000000440   '
ans =
    'Error is 0.0000000288   '
ans =
    'Error is 0.0000000188   '
ans =
    'Error is 0.0000000123   '
ans =
    'Error is 0.0000000080   '
ans =
    'Error is 0.0000000052   '
ans =
    'Error is 0.0000000034   '
ans =
    'Error is 0.0000000022   '
ans =
    'Error is 0.0000000015   '
ans =
    'Error is 0.0000000010   '
ans =
    'Error is 0.0000000006   '
```

```
ans =
    'Error is 0.0000000004    '
ans =
    'Error is 0.0000000003    '
ans =
    'Error is 0.0000000002    '
ans =
    'Error is 0.0000000001    '
ans =
    'Error is 0.0000000001    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
```

```
ans =
    'Error is 0.0000000000    '
ans =
    'Error is 0.0000000000    '
ans =
    'Approximate root of  x^2 - 2.0 is 1.7320508076
     '
ans =
    'Error in root of  x^2 - 2.0 is 1.9384494010e-13
     '
```

Question 3.

α can be approximated with some iteration errors from Newton's method. It agrees with our prediction that Newton's method has quadratic convergence.

$$e_{n-1} = 0.2036634781$$
$$e_n = 0.0107140844$$
$$e_{n+1} = 0.0000329338$$
$$\alpha \approx \frac{\log(0.0000329338/0.0107140844)}{\log(0.0107140844/0.2036634781)} = 1.96\cdots \approx \boxed{2}$$