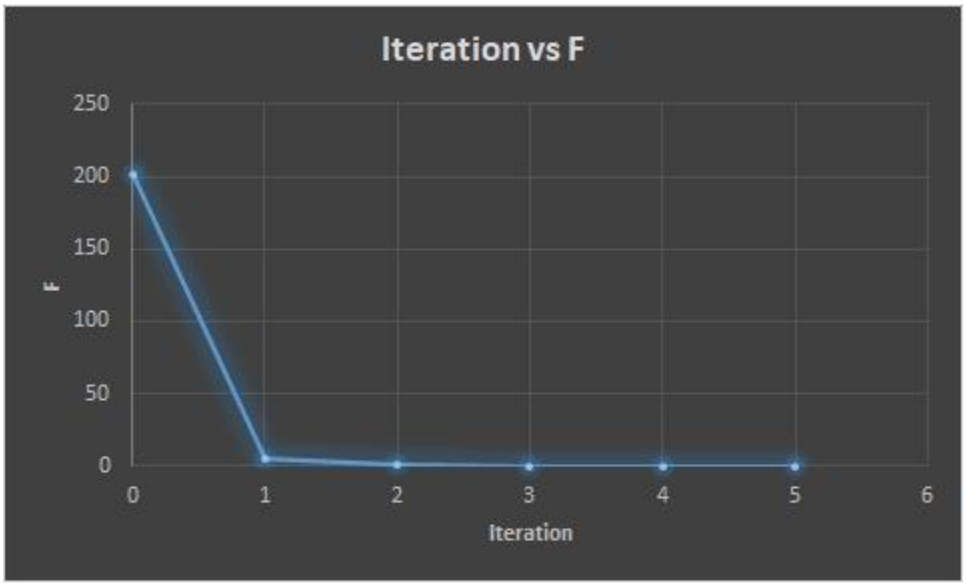
Problem-01

$$f(x) = \sum_{i=1}^{d} \mathrm{i} * x_i^2$$

$$f(x^*) = 0, @x^* = (0,0 \ldots \ldots ,0,0)$$

Initial guess 1

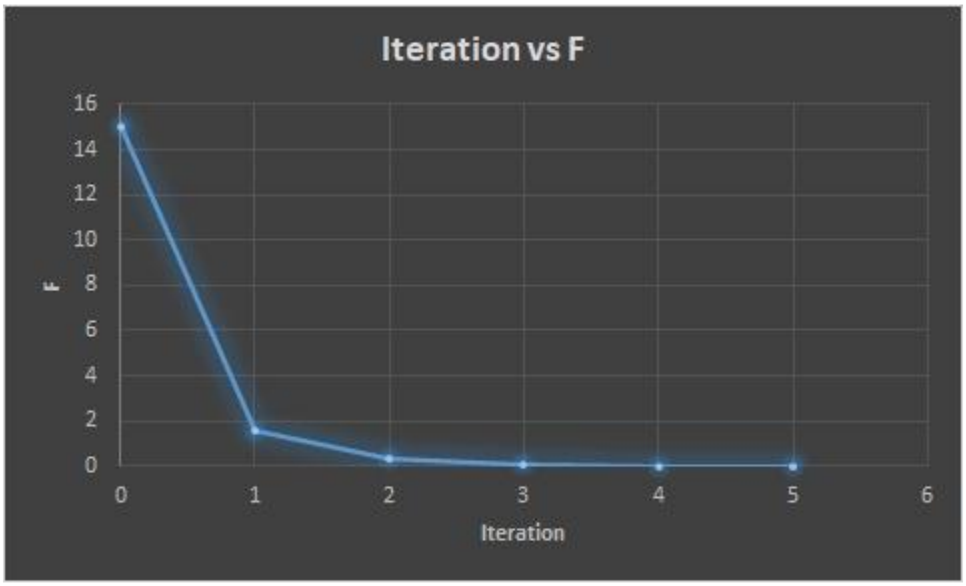
```
x0 =

     2
     1
     2
     1
     6


optimumvalue =

   1.0e-07 *

   -0.4068
   -0.0257
   -0.0435
   -0.1234
    0.0249
```



Initial guess 2

```
x0 =

     1
     1
     1
     1
     1


optimumvalue =

   1.0e-08 *

  -0.3343
   0.1097
  -0.0186
   0.0264
  -0.0147
```

itr#	function value
0	15
1	1.556
2	0.316
3	0.067
4	0.009
5	0



Problem-02

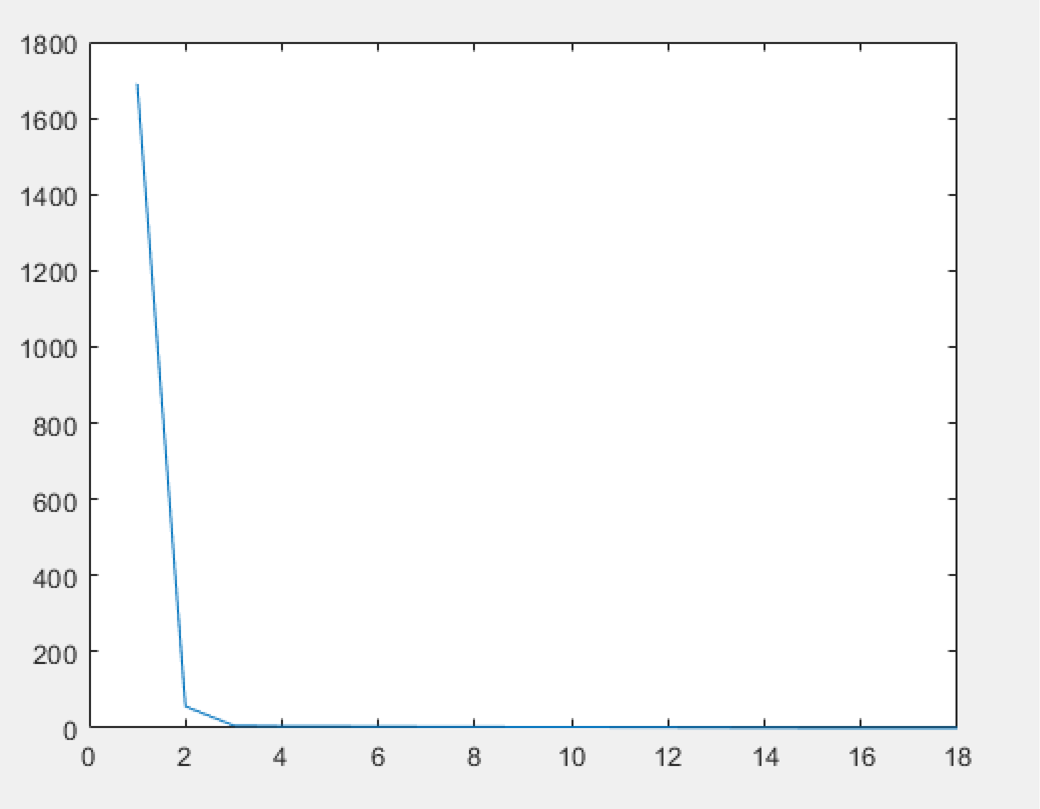
$$f(x\quad) = \sum_{i=1}^{d-1} 100 * \left(\mathrm{x}_{\mathrm{i+1}} - x_{\mathrm{i}}^{2}\right)^{2} - (\mathrm{x}_{\mathrm{i}} - 1)^{2}$$

$$f(x^{*}) = 0, @x^{*} = (1,1 \ldots \ldots ,1,1)$$

Initial guess 1

```
x0 =

   -2.0000
    1.5000
   -1.0000
```

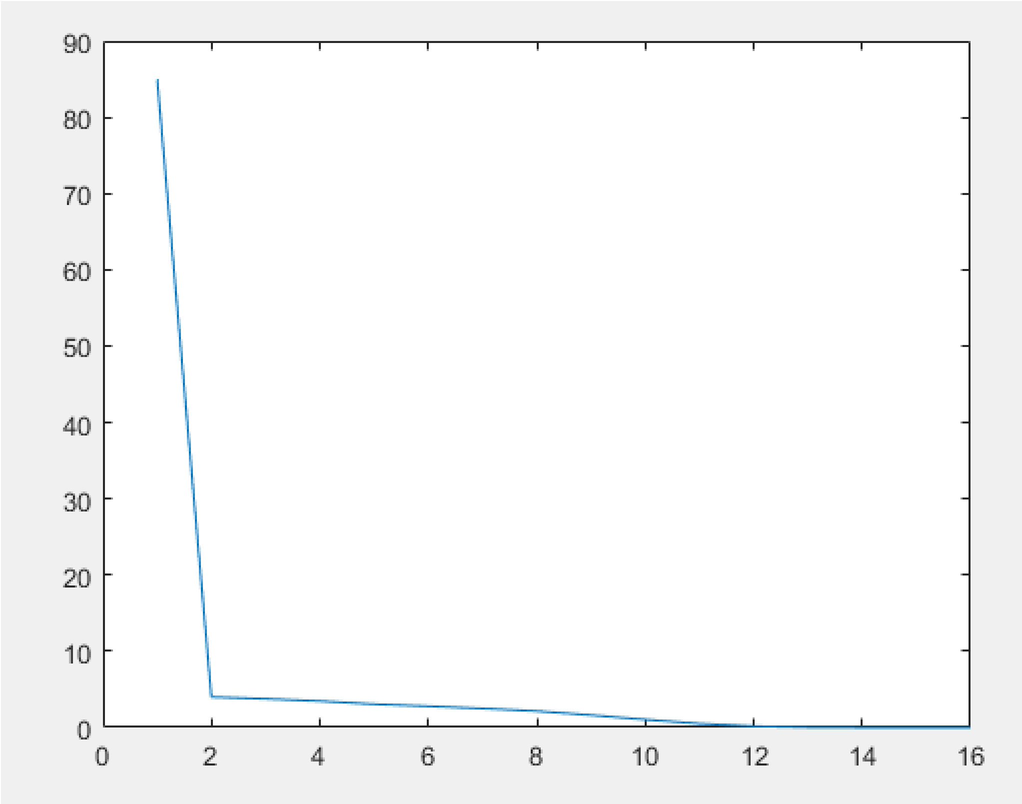
```
optimumvalue =

    0.9998
    0.9995
    0.9991
```



Initial guess 2

```
x0 =

   -1.0000
    1.0000
    1.9000
```

```
optimumvalue =

    0.9999
    0.9998
    0.9996
```



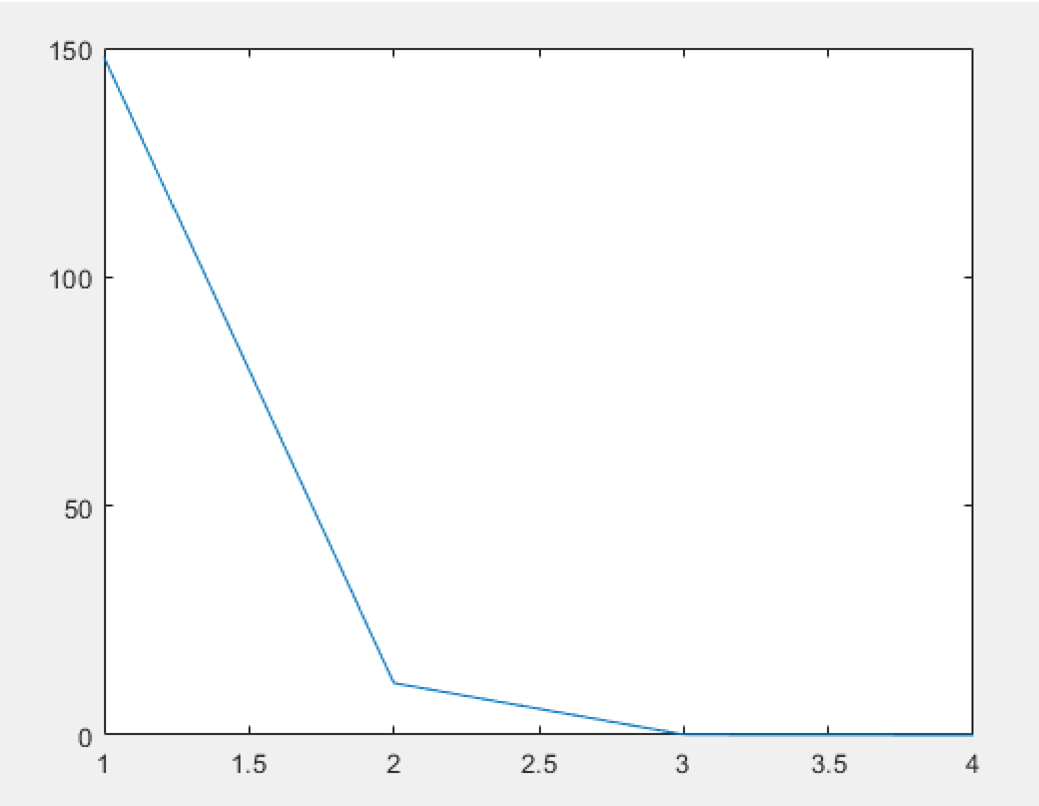
Problem 3

$$f(x\quad) = (x_1 - 1)^2 + \sum_{i=2}^{d} i * \left(2 * x_i^2 - x_{i-1}\right)^2$$

$$f(x^*) = 0, @x^* = \left(2^{\frac{-(2^i-2)}{2^i}}\right), \text{for } i = 1,2 \ldots . d$$

Initial guess 1

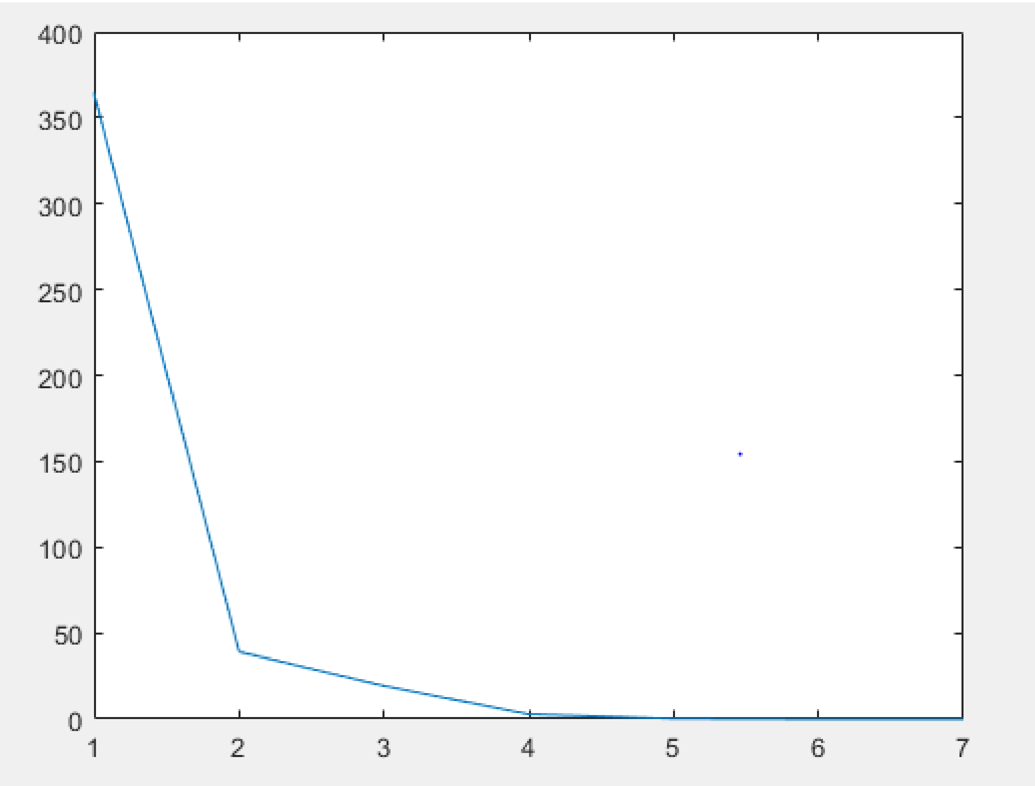
```
x0 =

     2
     1
     2
     1


optimumvalue =

    1.0007
    0.7075
    0.5948
    0.5454
```



Initial guess 2

```
x0 =

   -2.0000
    1.5000
   -1.0000
    1.9000
```

```
optimumvalue =

    1.0000
    0.7071
    0.5946
    0.5453
```



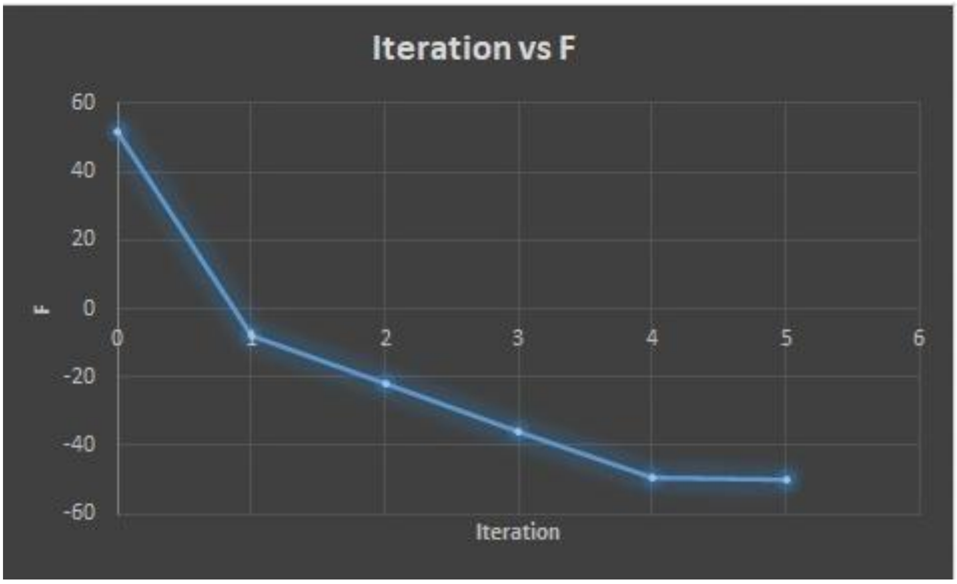
Problem 4

$$f(x) = \sum_{\mathrm{i}=1}^{d} (\mathrm{x_i} - 1)^2 - \sum_{i=2}^{d} \mathrm{x_i} * \mathrm{x_{i-1}}$$

$$f(x^*) = -\frac{d(d+4)(d-1)}{6}, @x_i = i * (d+1-i), \forall \mathrm{i} = 1,2, \ldots . \mathrm{d}$$

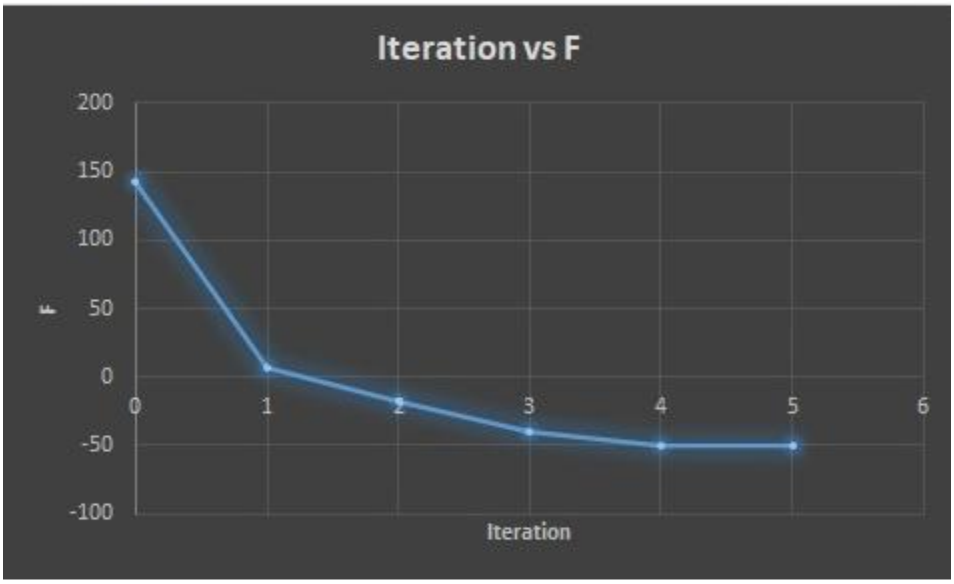
Initial guess 1

```
x0 =

    -1
     2
     3
     4
    -4
     2


optimumvalue =

    6.0000
   10.0000
   12.0000
   12.0000
   10.0000
    6.0000
```



Initial guess 2

```
x0 =

    -2
     2
    -3
     4
    -6
     2


optimumvalue =

    6.0000
   10.0000
   12.0000
   12.0000
   10.0000
    6.0000
```



Problem-05

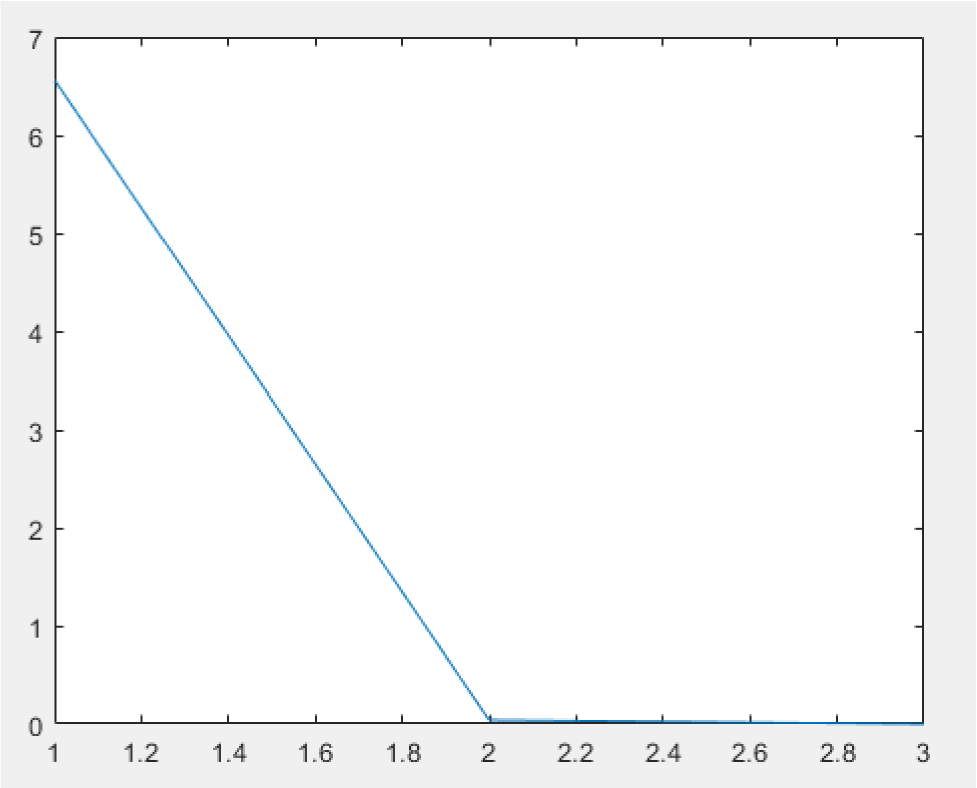
$$f(x) = \sum_{i=1}^{d} x_i^2 + \left(\sum_{i=1}^{d} 0.5 * i * x_i \right)^2 + \left(\sum_{i=1}^{d} 0.5 * i * x_i \right)^4$$

$$f(x^*) = 0, @x^* = (0,0 \ldots \ldots ,0,0)$$

Initial guess 1

```
x0 =

   -2.0000
    1.5000
```

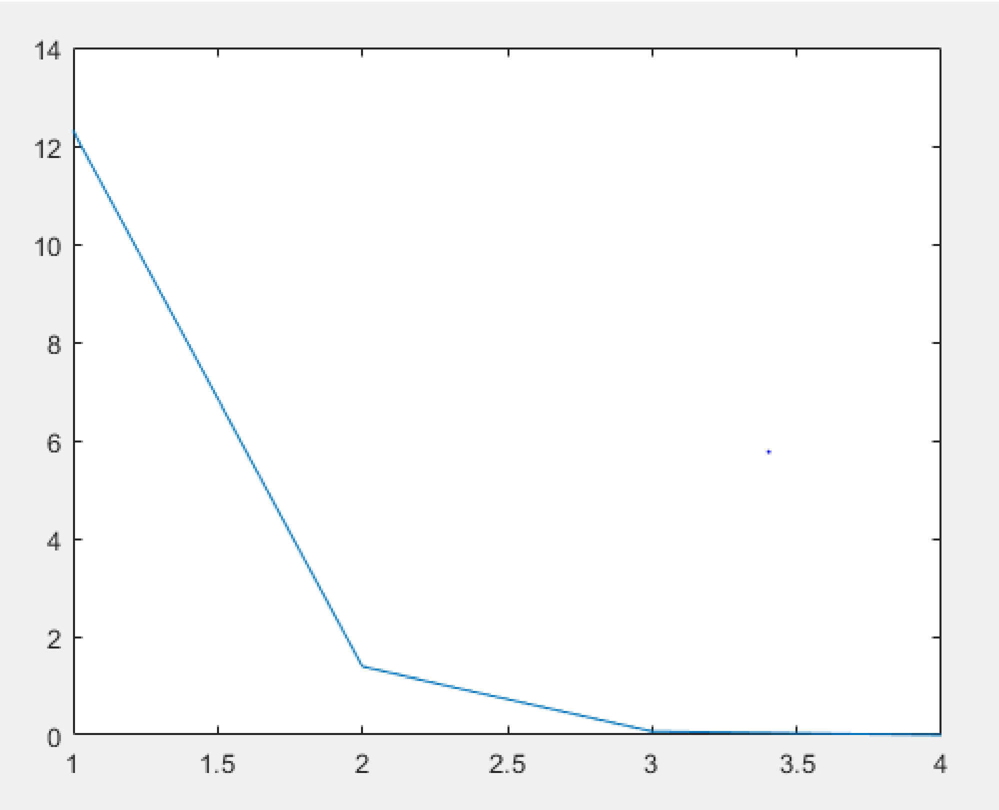
```
optimumvalue =

   1.0e-10 *

   -0.3990
   -0.6105
```



Initial guess 2

```
x0 =

    -1
     2
```

```
optimumvalue =

   1.0e-06 *

   -0.1106
    0.0491
```



Conclusions

If epsilon value is small then accuracy will better but the number of iteration will be increase and vice versa.

The initial guess as much closer to the minima of the function it will converges very fast and iterations required will be less.

In the starting convergence will be fast but later it will slow.