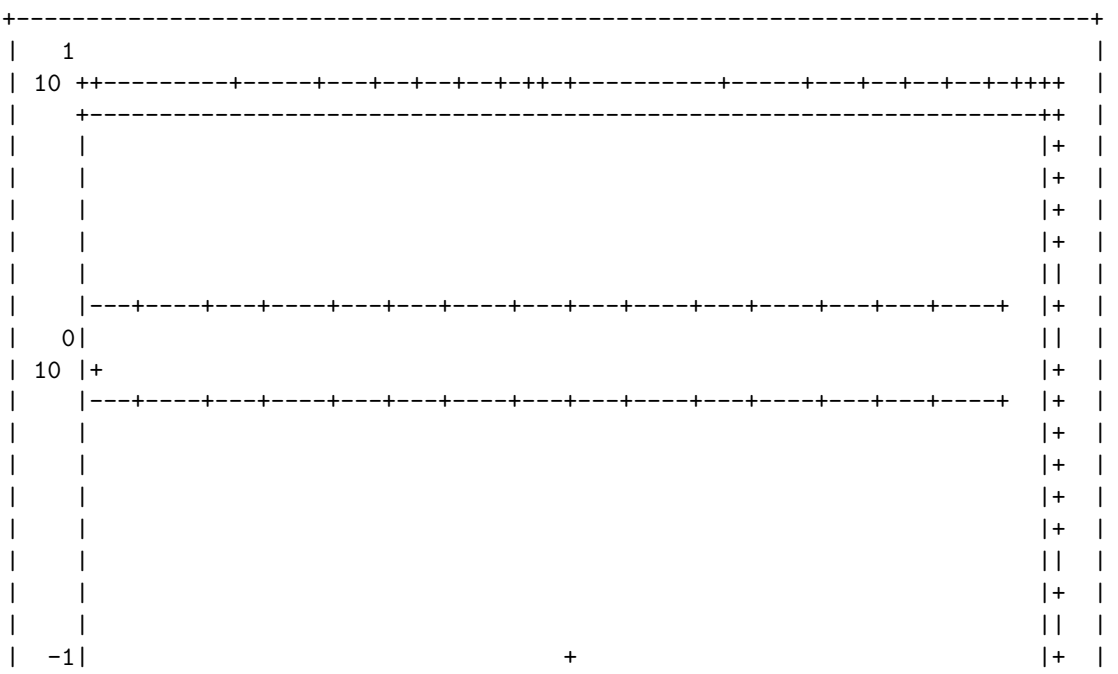
Math 578 Assignment 1

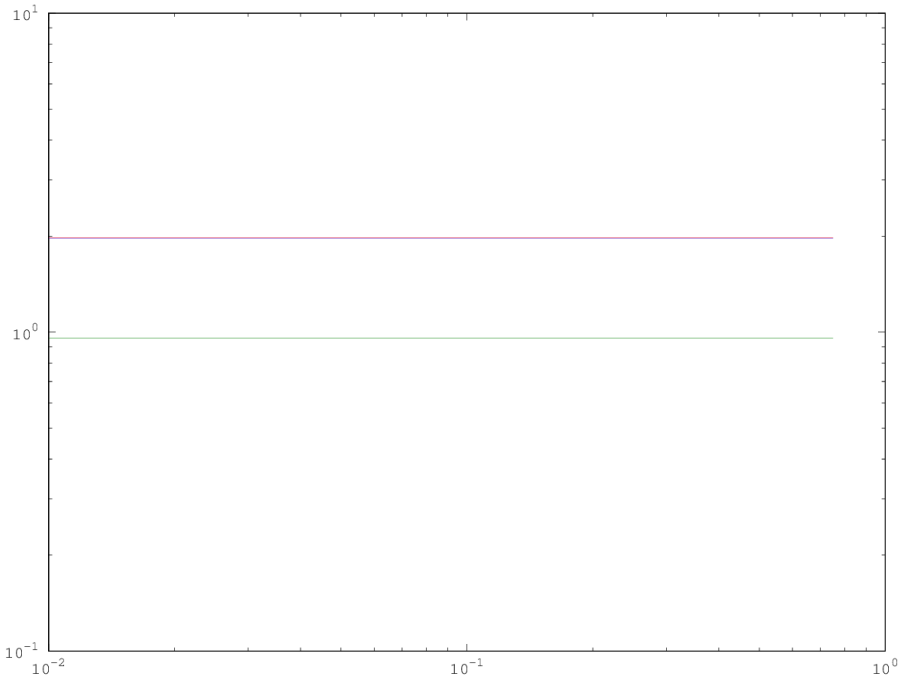
Dan Anderson - 260457325 - Fall 2016

Question 2

```
name = sign
slope = 0
slope =   -9.9777e-17
slope = 0
errors =

 Columns 1 through 8:

   1.96952   1.96952   1.96952   1.96952   1.96952   1.96952   1.96952   1.96952
   0.95742   0.95742   0.95742   0.95742   0.95742   0.95742   0.95742   0.95742
   1.97611   1.97611   1.97611   1.97611   1.97611   1.97611   1.97611   1.97611

 Columns 9 through 16:

   1.96952   1.96952   1.96952   1.96952   1.96952   1.96952   1.96952   1.96952
   0.95742   0.95742   0.95742   0.95742   0.95742   0.95742   0.95742   0.95742
   1.97611   1.97611   1.97611   1.97611   1.97611   1.97611   1.97611   1.97611
```

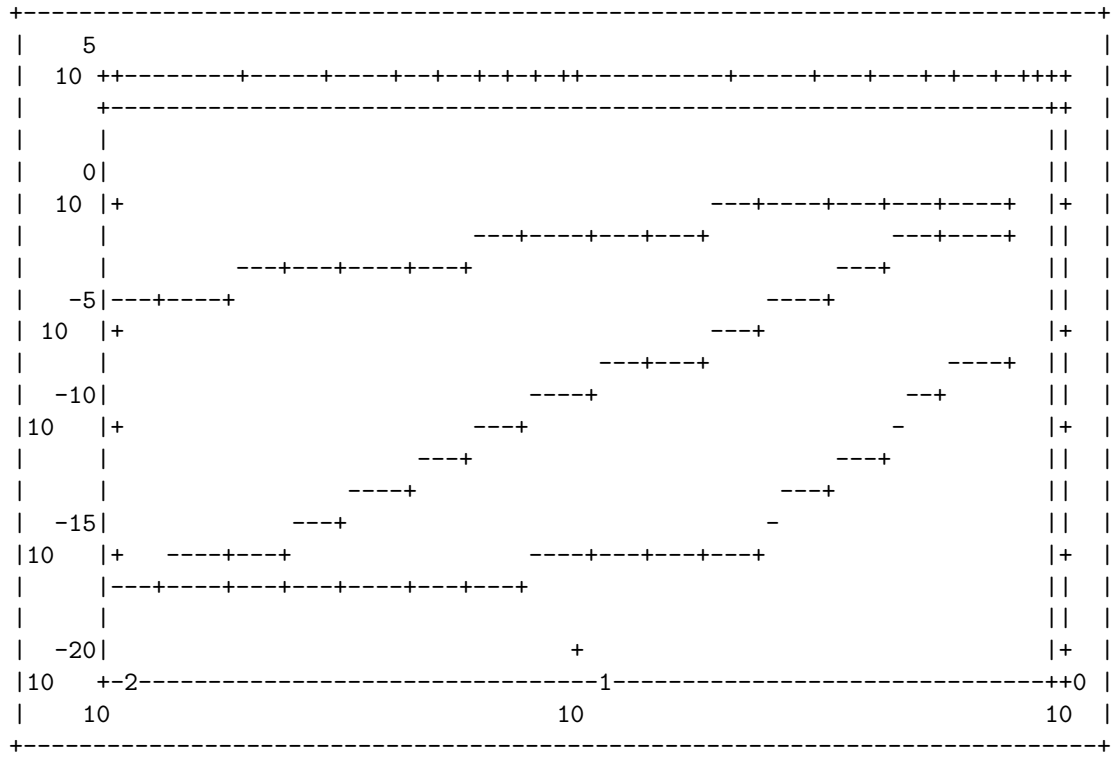


```
|10  +-2----------------------------------1-------------------------------++0 |
|   10                                    10                                10  |
+-------------------------------------------------------------------------------+
```

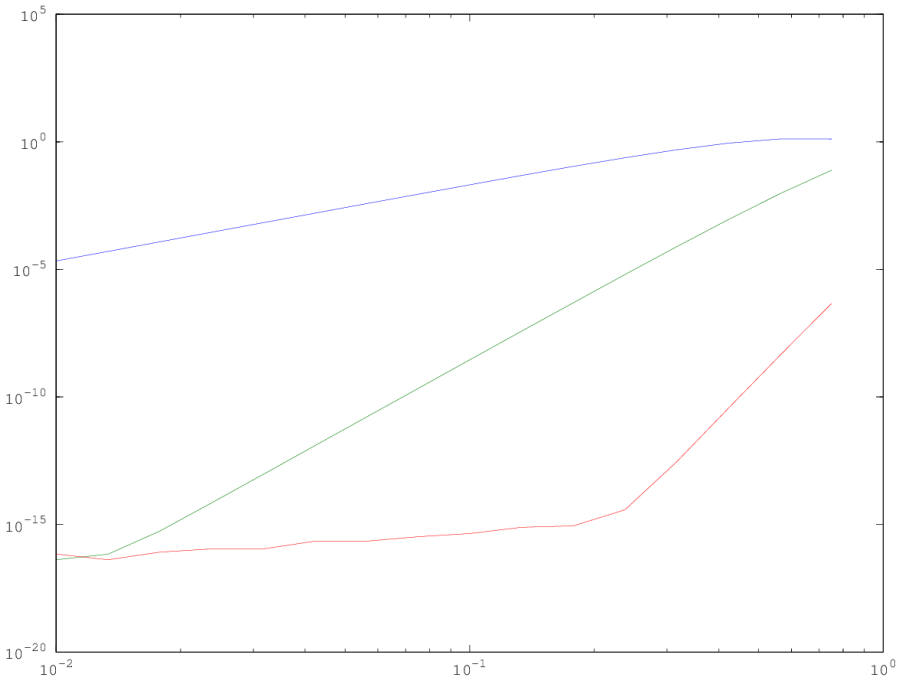



```
name = sin
slope =  2.7211
slope =  8.6071
slope =  4.2321
errors =

 Columns 1 through 6:

   1.2809e+00   1.2917e+00   8.8581e-01   4.8614e-01   2.3751e-01   1.0859e-01
   7.6976e-02   9.2269e-03   8.9211e-04   7.6998e-05   6.2473e-06   4.8985e-07
   4.6168e-07   4.2350e-09   3.5580e-11   2.8511e-13   3.7748e-15   8.8818e-16

 Columns 7 through 12:

   4.7898e-02   2.0716e-02   8.8621e-03   3.7680e-03   1.5966e-03   6.7525e-04
   3.7685e-08   2.8684e-09   2.1703e-10   1.6366e-11   1.2319e-12   9.2593e-14
   7.7716e-16   4.4409e-16   3.3307e-16   2.2204e-16   2.2204e-16   1.1102e-16
```

```
 Columns 13 through 16:

   2.8527e-04   1.2046e-04   5.0861e-05   2.1466e-05
   7.0222e-15   5.5511e-16   6.9389e-17   4.1633e-17
   1.1102e-16   8.3267e-17   4.1633e-17   6.9389e-17
```

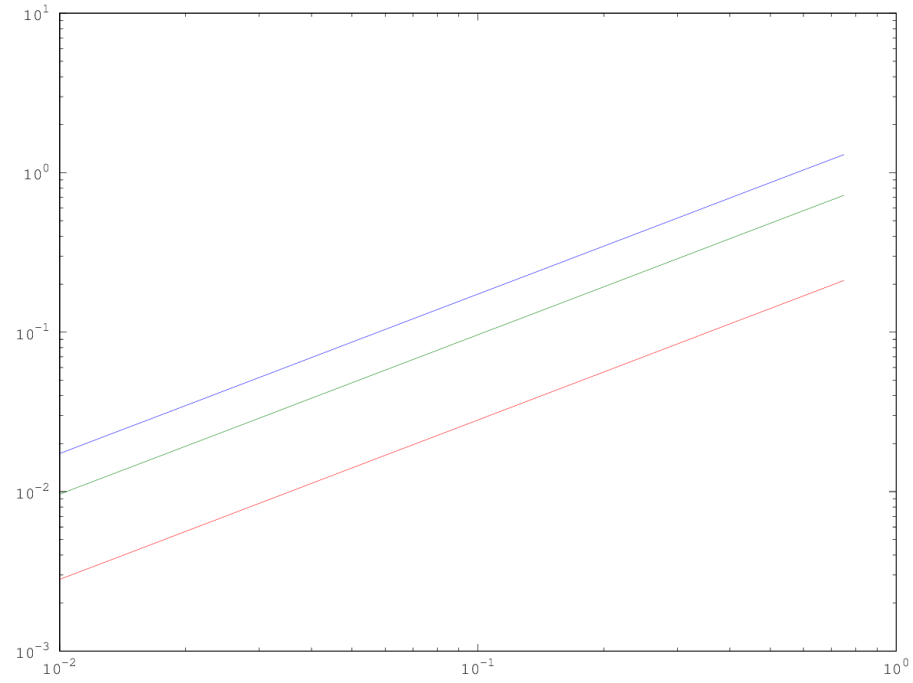



```
name = abs
slope =  1.0000
slope =  1.0000
slope =  1.0000
errors =

 Columns 1 through 6:

   1.2989805   0.9742353   0.7306765   0.5480074   0.4110055   0.3082542
   0.7220995   0.5415746   0.4061810   0.3046357   0.2284768   0.1713576
   0.2110511   0.1582883   0.1187163   0.0890372   0.0667779   0.0500834

 Columns 7 through 12:
```



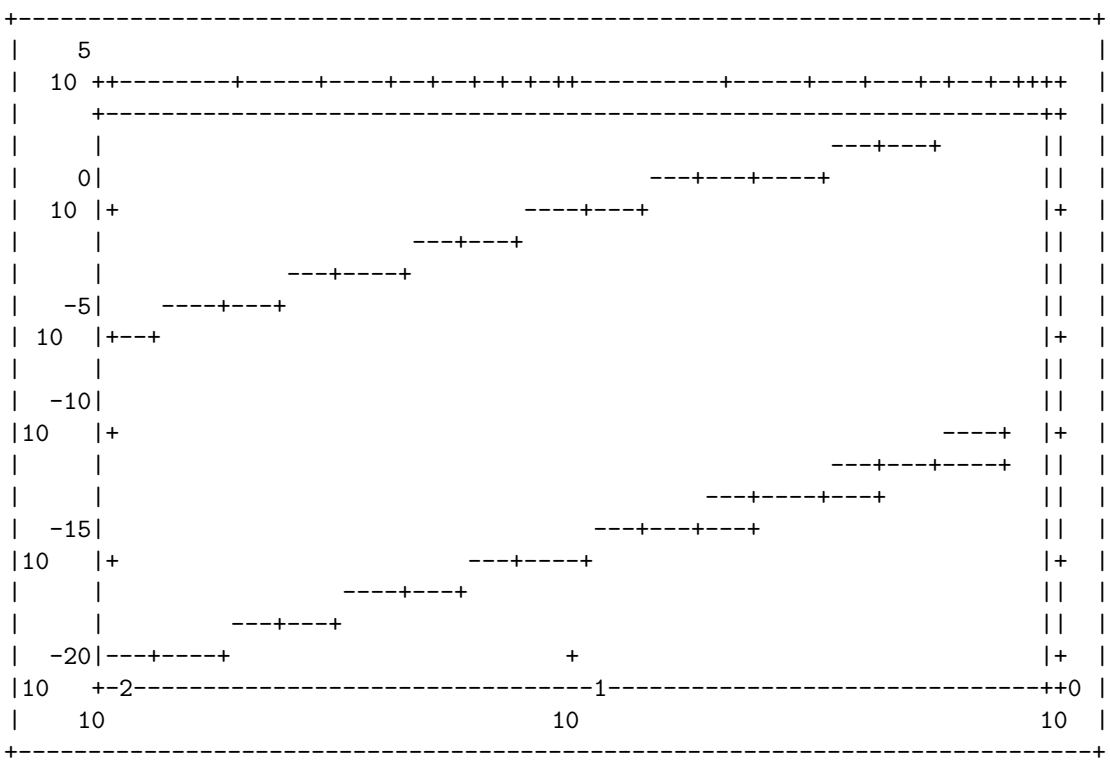

```
   0.2311906   0.1733930   0.1300447   0.0975335   0.0731502   0.0548626
   0.1285182   0.0963886   0.0722915   0.0542186   0.0406640   0.0304980
   0.0375626   0.0281719   0.0211289   0.0158467   0.0118850   0.0089138

 Columns 13 through 16:

   0.0411470   0.0308602   0.0231452   0.0173589
   0.0228735   0.0171551   0.0128663   0.0096497
   0.0066853   0.0050140   0.0037605   0.0028204
```

```
+--------------------------------------------------------------------------+
|   1                                                                      |
| 10 ++---------+-----+---+--+--+--+-++-+----------+-----+---+--+--+--+++   |
|    +-------------------------------------------------------------------++  |
|    |                                                                   |+  |
|    |                                                                   |+  |
|   0|                                                             ----+ ||  |
| 10 |+                                                       ---+---+----+ |+  |
|    |                                                   ----+    ---+     |+  |
|    |                                          ----+---+----+---+         |+  |
|  -1|                               ---+---+----+---+             ----+  |+  |
|10  |+                        ----+    ---+             ---+---+       |+  |
```



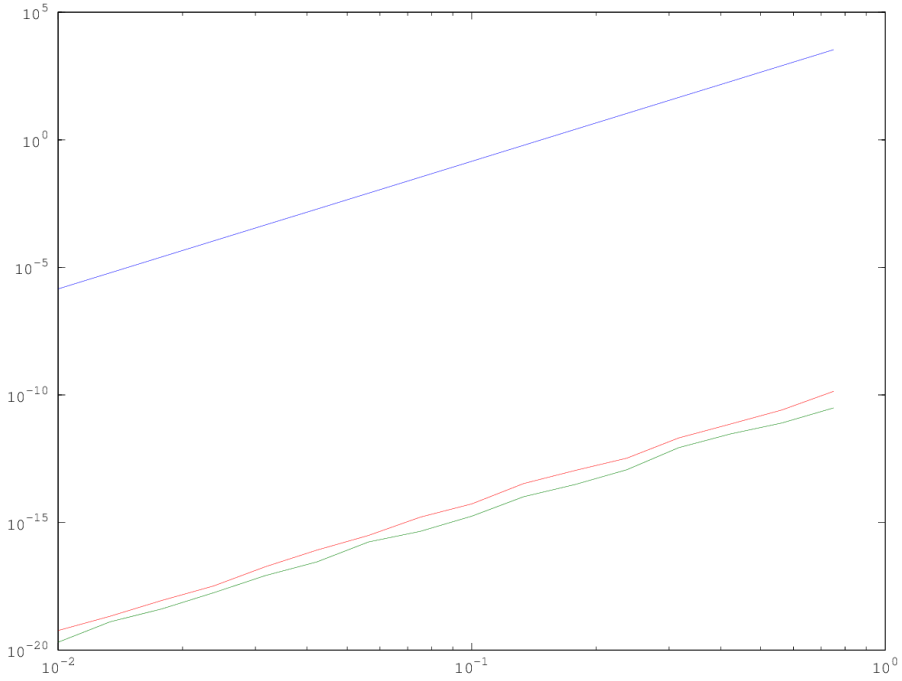

```
name = quintic
slope =  5.0000
slope =  4.8916
slope =  5.0121
errors =

 Columns 1 through 6:

   3.4020e+03   8.0731e+02   1.9158e+02   4.5462e+01   1.0788e+01   2.5602e+00
```

```
   3.0923e-11   7.9581e-12   2.9559e-12   8.5265e-13   1.1724e-13   3.1086e-14
   1.3824e-10   2.5807e-11   7.1907e-12   2.0606e-12   3.3396e-13   1.0969e-13

 Columns 7 through 12:

   6.0754e-01   1.4417e-01   3.4213e-02   8.1188e-03   1.9266e-03   4.5720e-04
   1.0214e-14   1.7764e-15   4.5103e-16   1.7260e-16   2.8623e-17   8.2941e-18
   3.3640e-14   5.3846e-15   1.6237e-15   3.1225e-16   8.3267e-17   1.8431e-17

 Columns 13 through 16:

   1.0850e-04   2.5746e-05   6.1097e-06   1.4499e-06
   1.7618e-18   4.1335e-19   1.2875e-19   2.0752e-20
   3.2526e-18   8.8769e-19   2.1345e-19   5.9292e-20
```

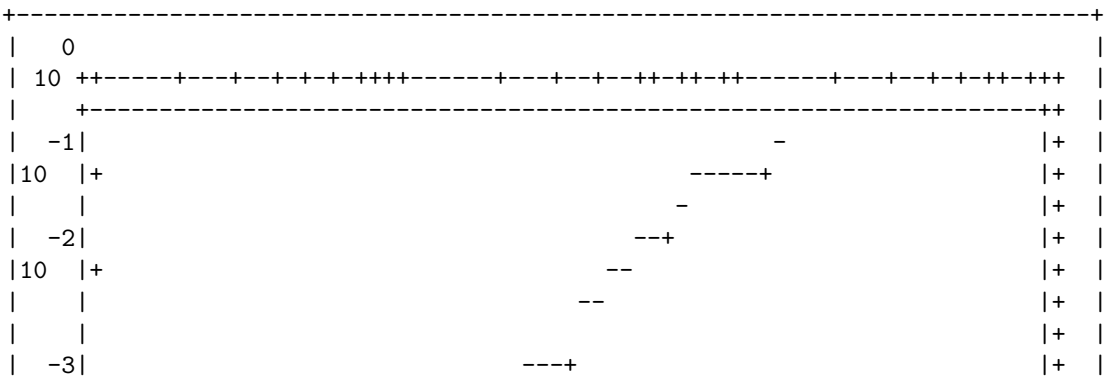


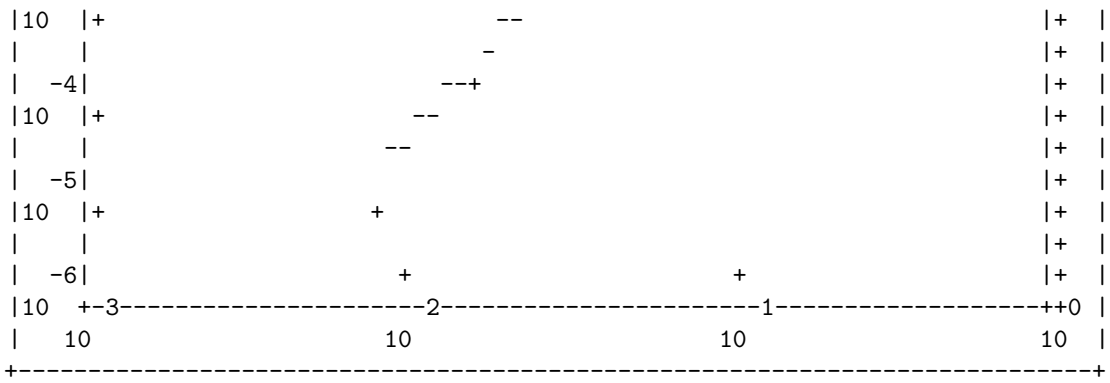
Question 3

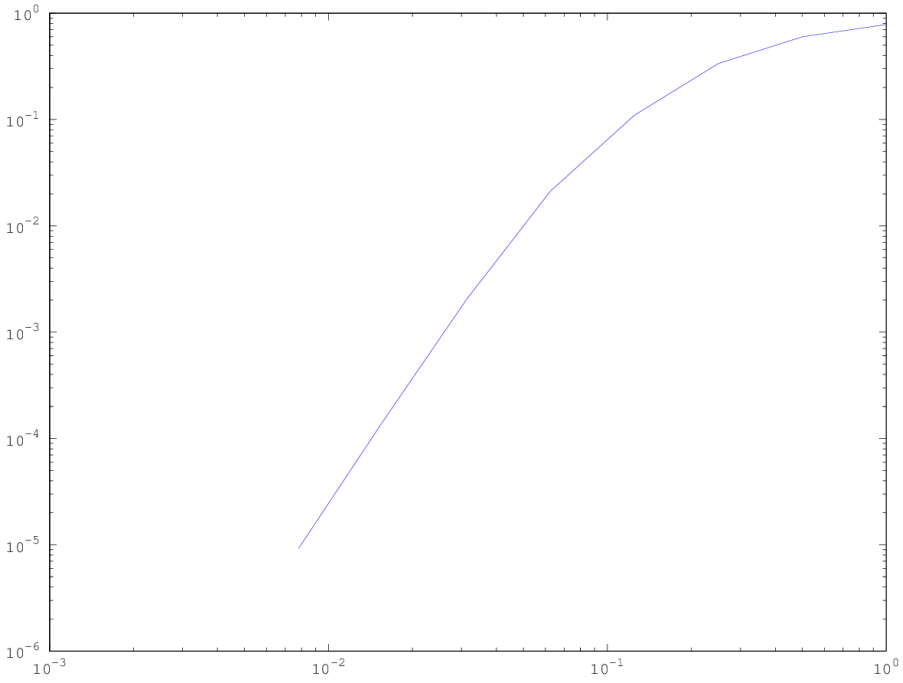
```
chebyORequidist = equidist
deg =  2
```




```
errors =

 Columns 1 through 6:

   7.8366e-01   5.9990e-01   3.3651e-01   1.0967e-01   2.1216e-02   2.0238e-03

 Columns 7 and 8:

   1.4284e-04   9.2145e-06
```

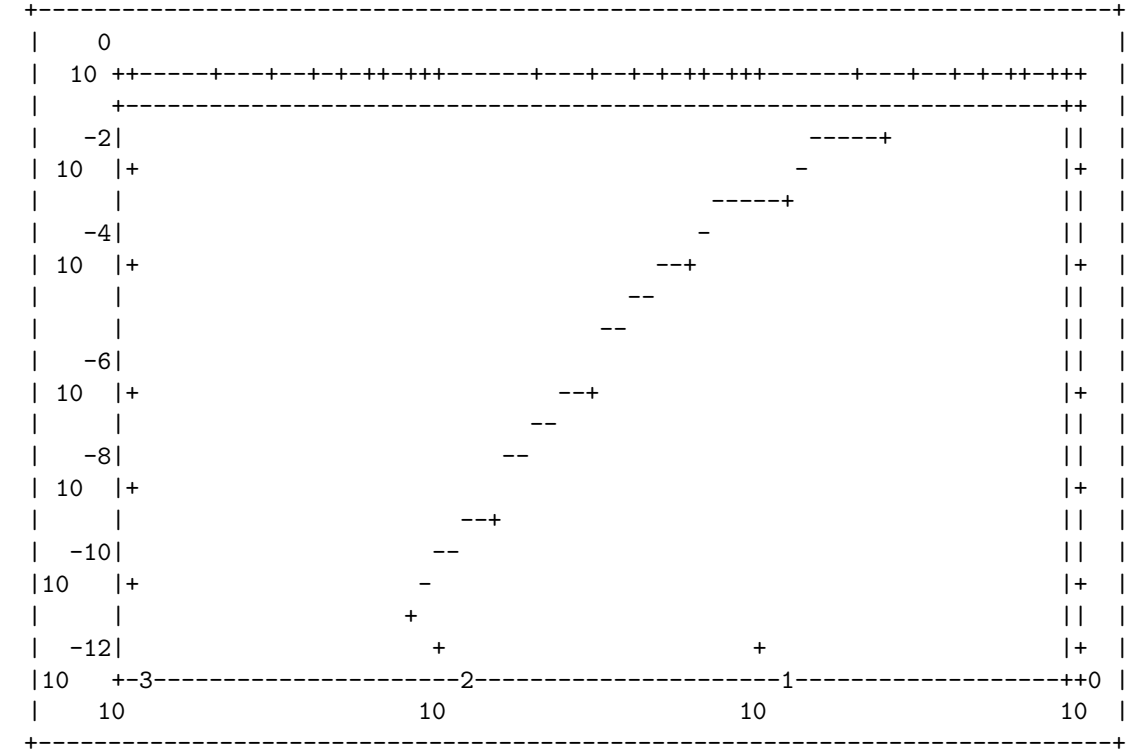




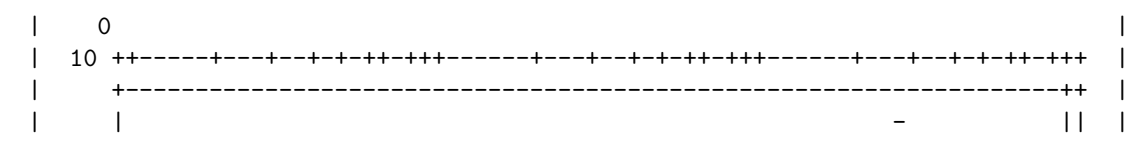


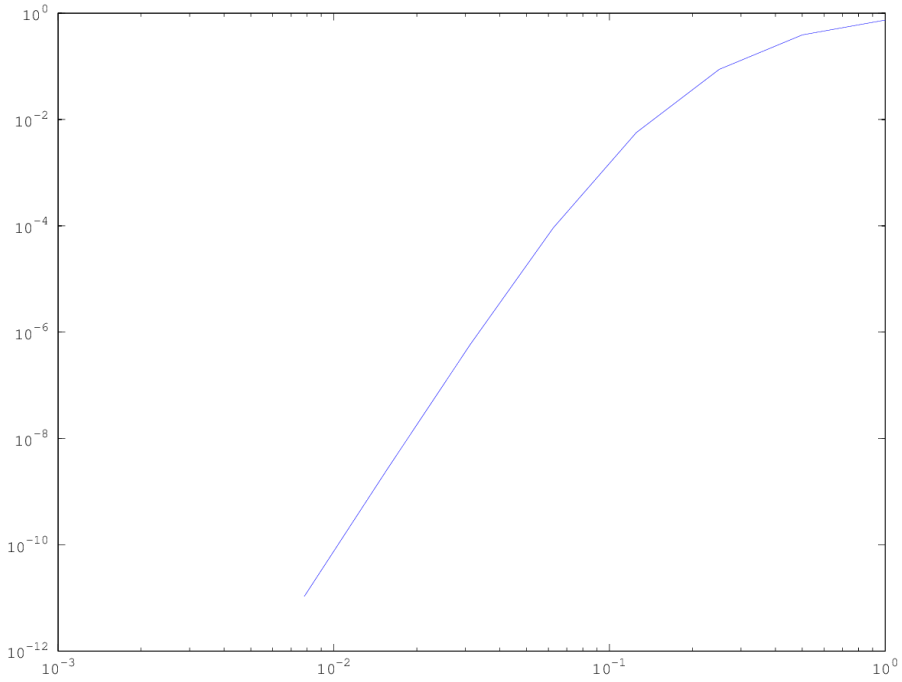

```
chebyORequidist = equidist
deg =  7
errors =

 Columns 1 through 6:

   7.4327e-01   3.9059e-01   8.7943e-02   5.6849e-03   9.1388e-05   5.8748e-07

 Columns 7 and 8:
```

```
   2.6401e-09   1.0700e-11
```



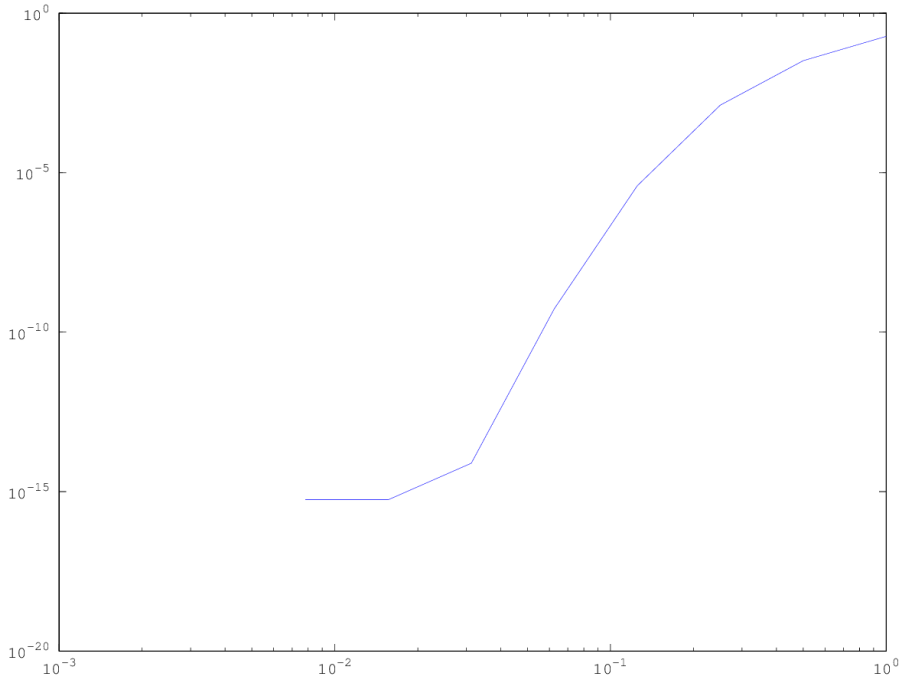

```
chebyOREquidist = equidist
deg =  16
errors =

 Columns 1 through 6:

   1.8882e-01   3.2580e-02   1.3095e-03   3.8888e-06   5.4007e-10   7.7716e-15

 Columns 7 and 8:

   5.5511e-16   5.5511e-16
```



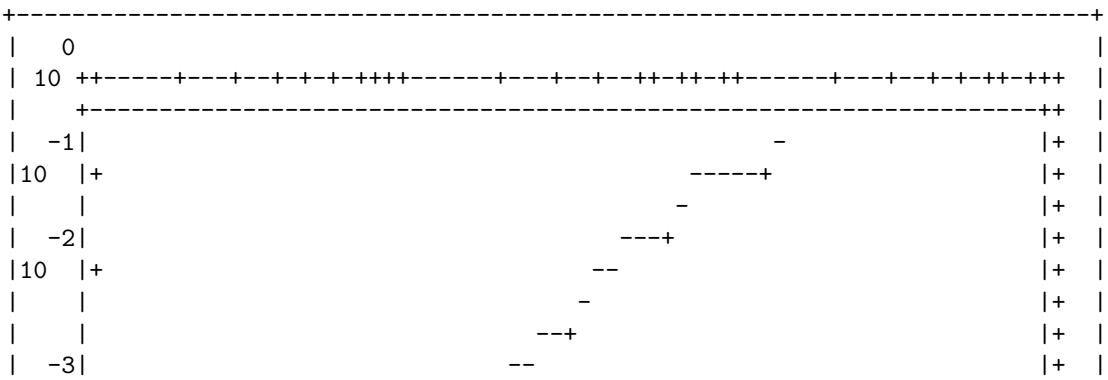


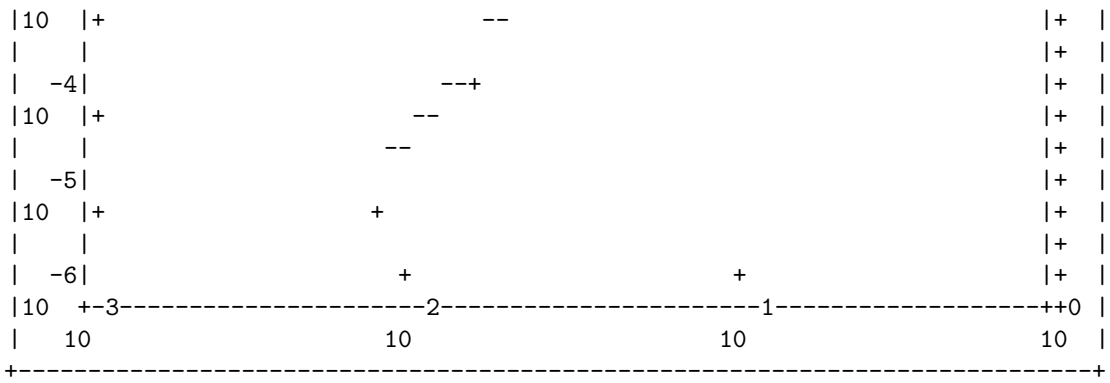

```
|      |                                                 -----+           ||   |
|   -5 |                                                 -                ||   |
| 10   |+                                                  --+             |+   |
|      |                                                    --            ||   |
|      |                                                   --             ||   |
|  -10 |                                                                  ||   |
|10    |+                                                    --+          |+   |
|      |                                                   --             ||   |
|      |                                                 --               ||   |
|      |                                                                  ||   |
|  -15 |                                        ------+                   ||   |
|10    |+                     +-----+                                     |+   |
|      |                                                                  ||   |
|      |                                                                  ||   |
|      |                                                                  ||   |
|  -20 |                        +                        +                |+   |
|10    +-3----------------------2------------------------1-----------------++0  |
|     10                       10                       10                10   |
+-------------------------------------------------------------------------------+
```

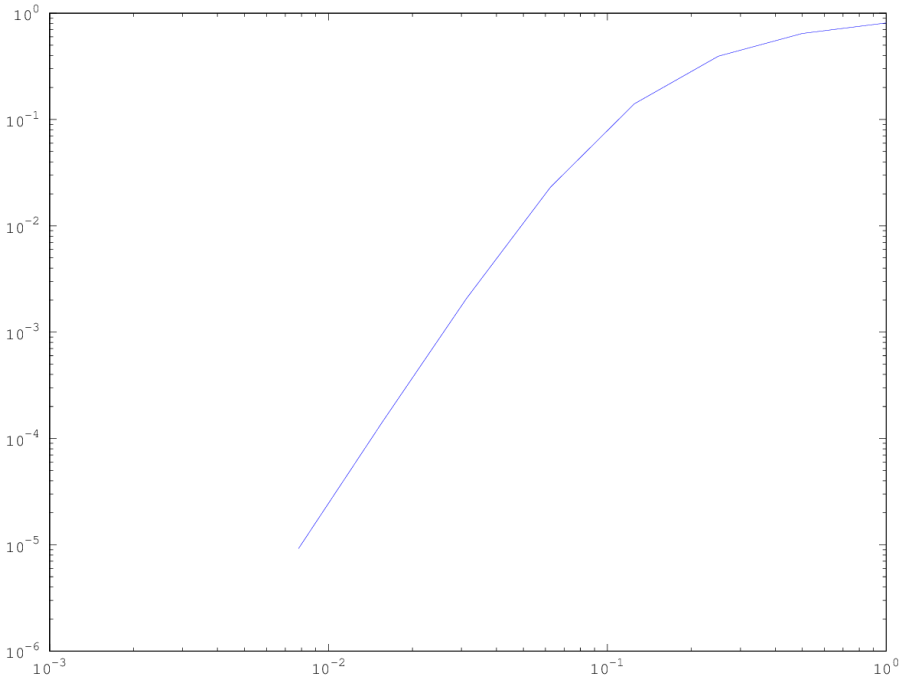
```
chebyORequidist = cheby
deg =  2
```




```
errors =

 Columns 1 through 6:

   8.0957e-01   6.4491e-01   3.9445e-01   1.4045e-01   2.3066e-02   2.0714e-03

 Columns 7 and 8:

   1.4353e-04   9.2139e-06
```

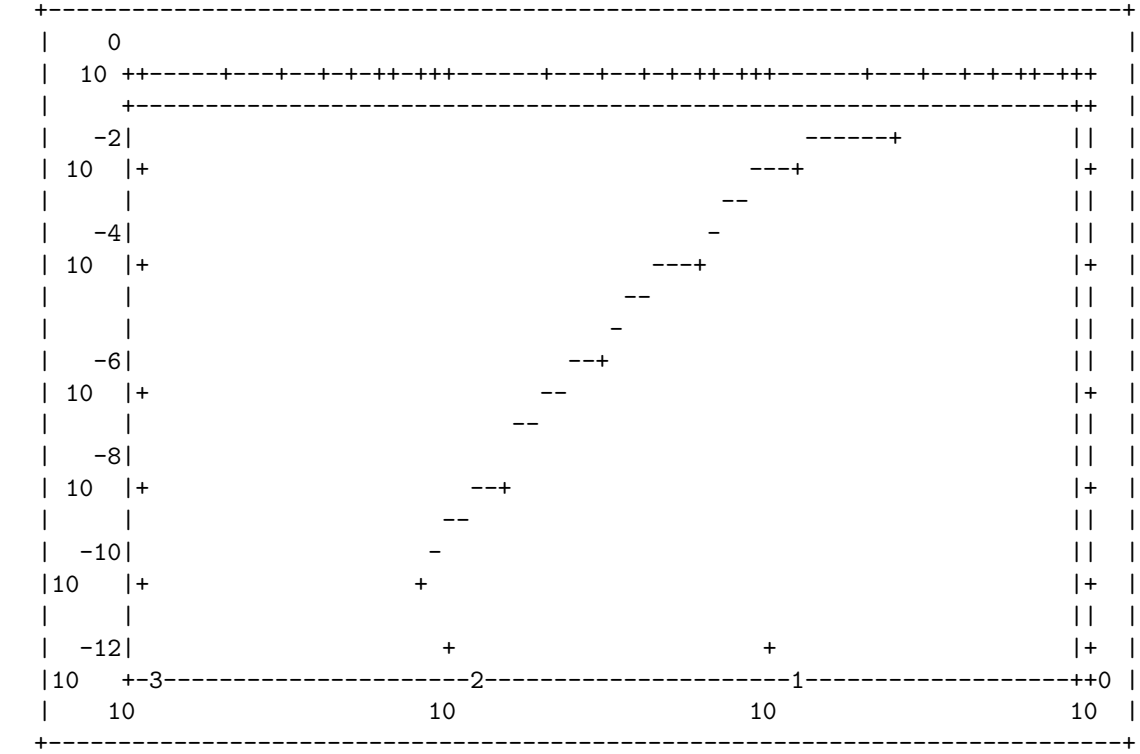




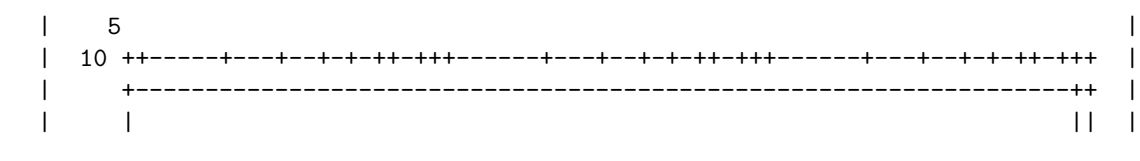


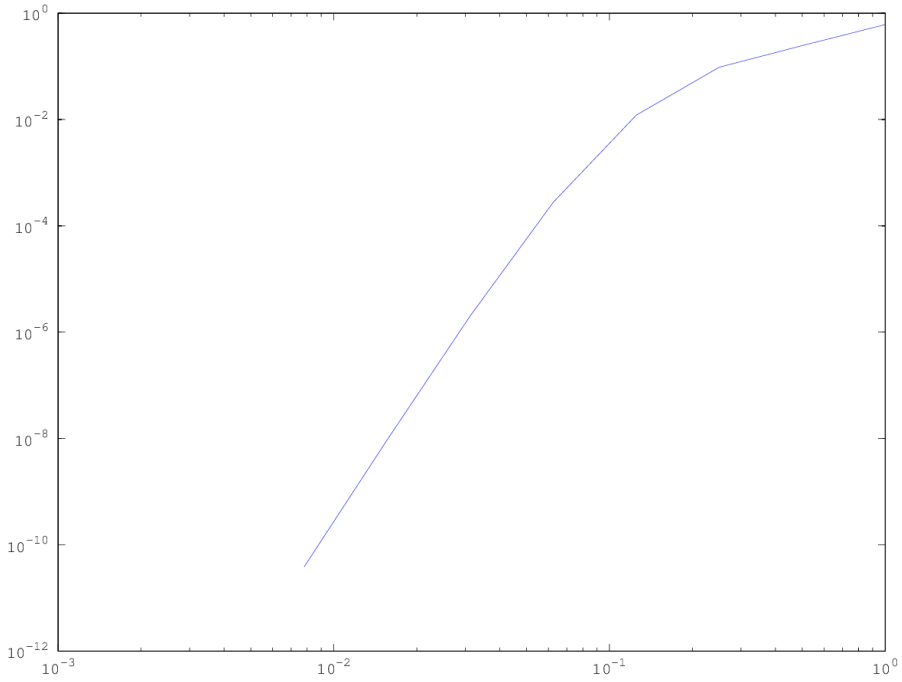

```
chebyOREquidist = cheby
deg =  7
errors =

 Columns 1 through 6:

   6.1306e-01   2.4631e-01   9.6406e-02   1.2113e-02   2.7710e-04   2.0345e-06

 Columns 7 and 8:
```

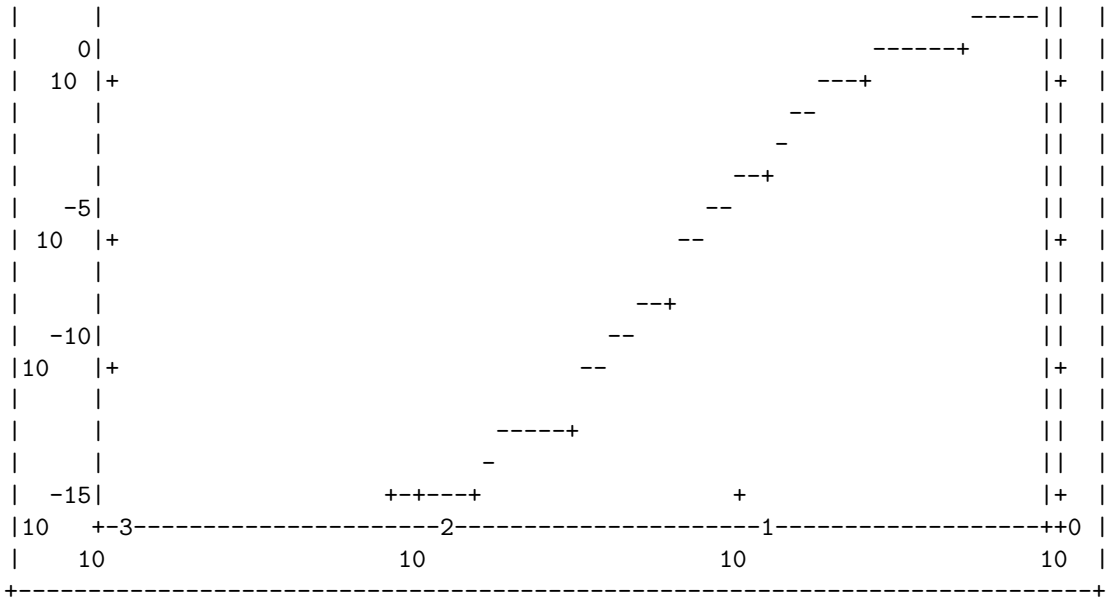
```
   9.4982e-09   3.8854e-11
```

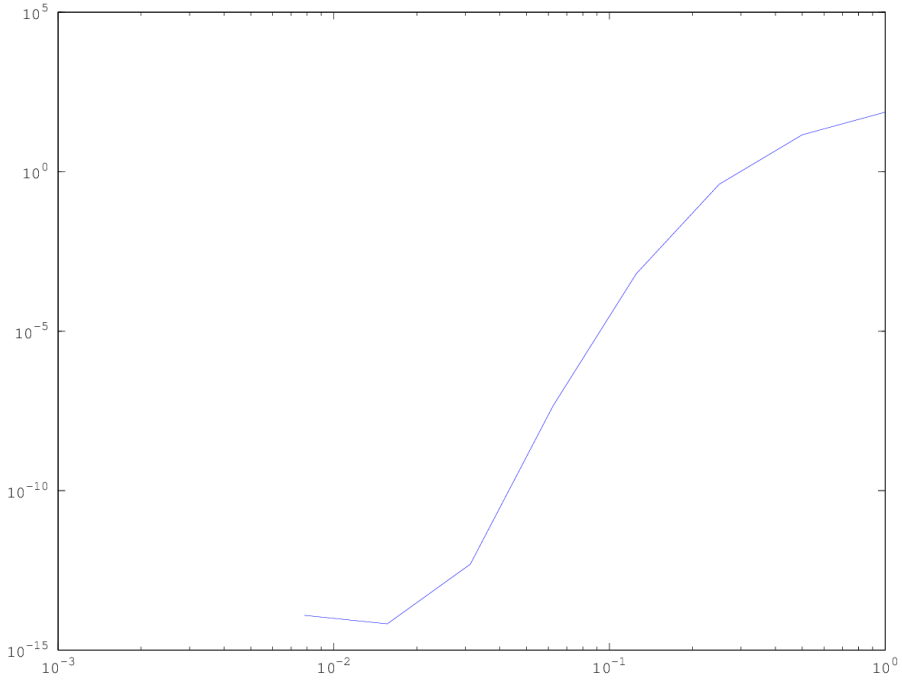



```
chebyORequidist = cheby
deg =  16
errors =

 Columns 1 through 6:

   7.3637e+01   1.4373e+01   4.0398e-01   6.3266e-04   4.6669e-08   4.9316e-13

 Columns 7 and 8:

   6.6613e-15   1.2323e-14
```




10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-12}
10^{-3}
10^{-2}
10^{-1}
10^{0}

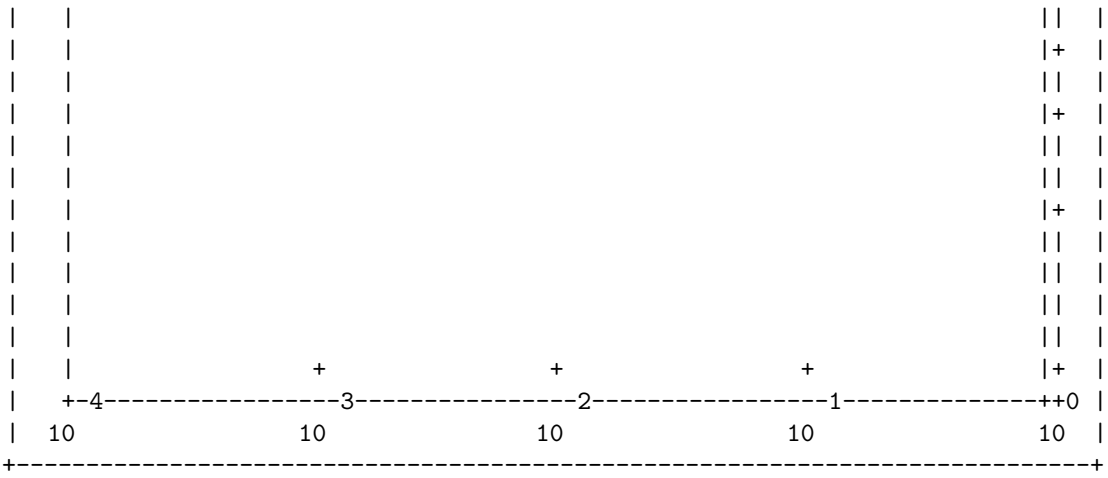

0
10
-5
10
-10
10
-15
10
-3
2
1
0
10
10
10
10



Question 4

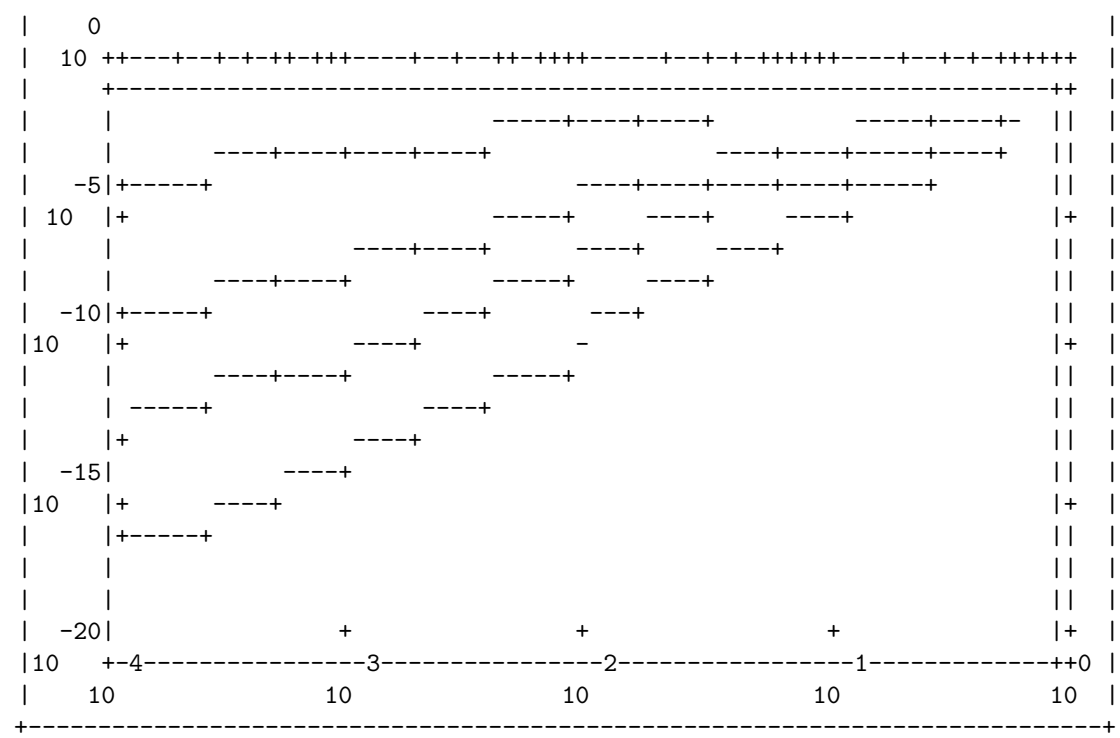
```
func = sign
method = nearest
slope = NaN
method = linear
slope =  0.012206
method = spline
slope =  0.014586
method = pchip
slope =  0.018865
method = cubic
slope =  0.018865
```

```
+------------------------------------------------------------------------------+
|  0                                                                           |
|10 ++---+--+--++-+++++----+--+-+-+-++++-----+--+-+-++-+++-----+--+-+-++++++  |
|   +------------------------------------------------------------------------++  |
|   | +                                                                      |+  |
|   |                                                                        |+  |
|   |                                                                        |+  |
|   |                                                                        ||  |
|   |                                                                        |+  |
```

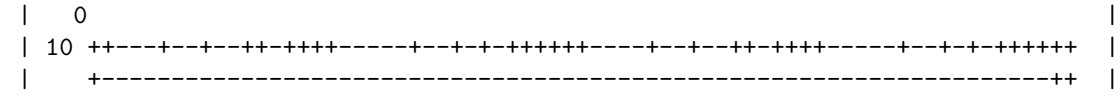


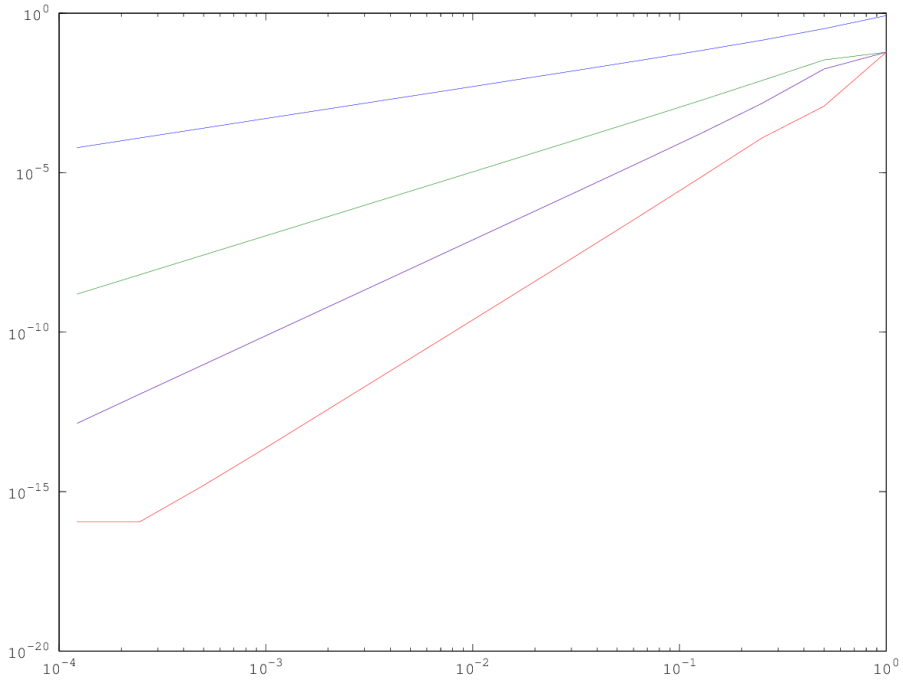

```
func = sin
method = nearest
slope =  1.0366
method = linear
slope =  1.9932
method = spline
```

```
slope =  3.9070
method = pchip
slope =  3.0194
method = cubic
slope =  3.0194
```



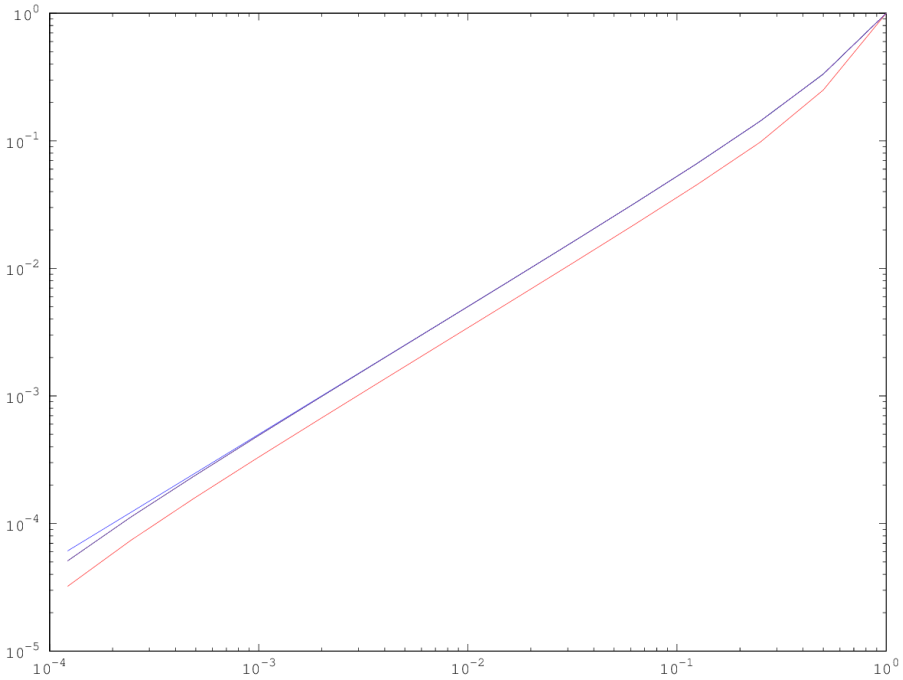

```
func = abs
method = nearest
slope =  1.0445
method = linear
slope =  1.0567
method = spline
slope =  1.0812
method = pchip
slope =  1.0567
method = cubic
slope =  1.0567
```





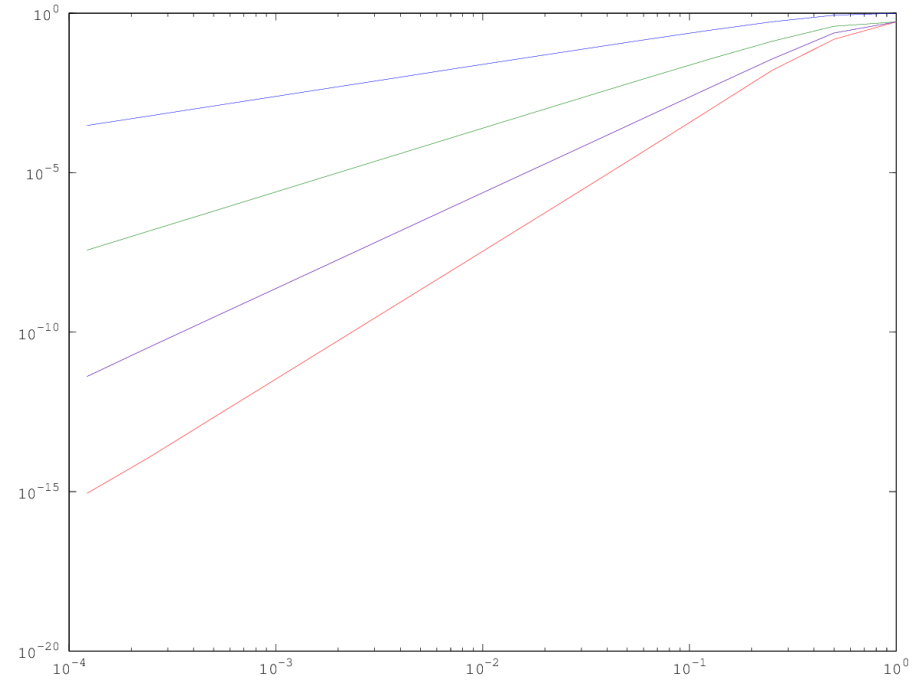

```
|    |                                                          -----+   |+  |
|  -1|                                                        ----+-     |+  |
|10  |+                                                    ---+----+     |+  |
|    |                                                   ----+           |+  |
|    |                                              ----+                |+  |
|  -2|                                          -----+                   ||  |
|10  |+                                    ----+-                        |+  |
|    |                                ----+----+                         |+  |
|  -3|                          ----+----+                               |+  |
|10  |+                   ----+----+                                      |+  |
|    |                 -----+                                            |+  |
|    |            ----+                                                  |+  |
|  -4|       ----+                                                       |+  |
|10  |+ ----+-                                                           |+  |
|    | +----+                                                            |+  |
|    | +                                                                 |+  |
|  -5|               +                 +               +                 |+  |
|10  +-4----------------3-----------------2----------------1--------------++0 |
|   10               10                10              10                10  |
+-------------------------------------------------------------------------+
```

```
func = quintic
```



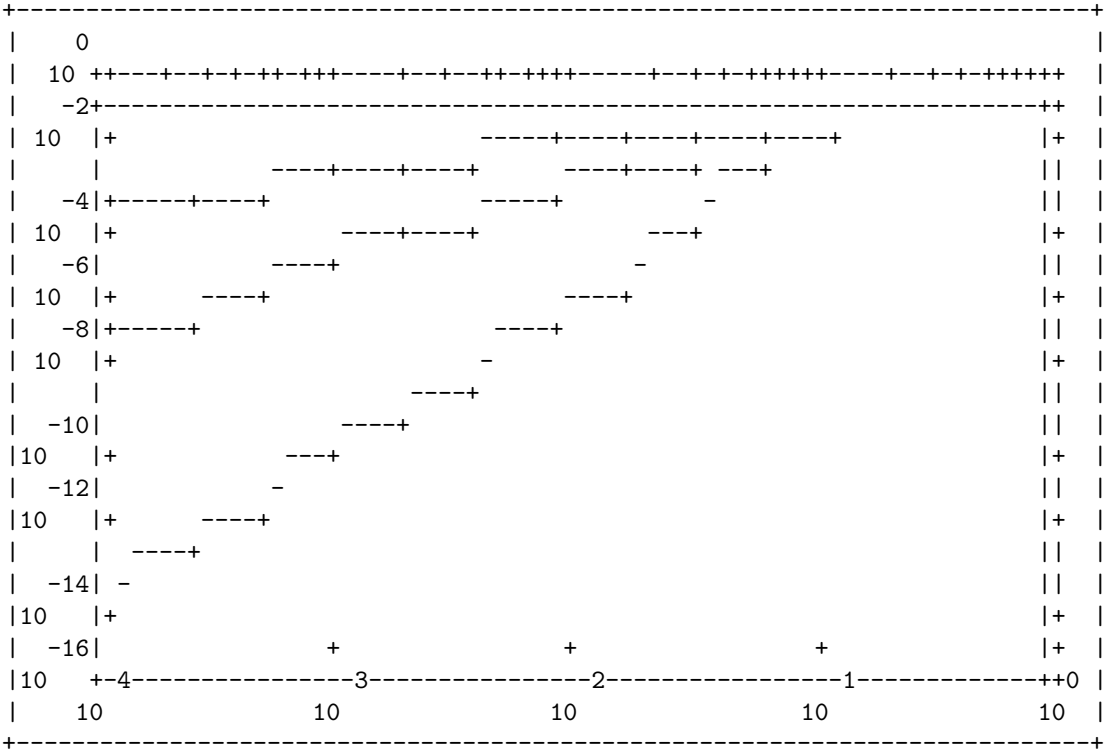

```
method = nearest
slope =  0.94455
method = linear
slope =  1.9127
method = spline
slope =  3.9146
method = pchip
slope =  2.9338
method = cubic
slope =  2.9338
```

```
+--------------------------------------------------------------------------------+
|    0                                                                           |
|  10 ++---+--+-+-++-+++----+--+--++-++++-----+--+-+-++++++----+--+-+-++++++  |
|     +-------------------------------------------------------------------++  |
|     |            ----+----+----+-----+     ----+----+----+-----+        ||  |
|     |+-----+----+                     ----+     ----+----+              ||  |
|   -5|                      ----+-----+     ----+----+                   ||  |
| 10  |+           ----+----+           ----+----+                        |+  |
|     | -----+----+               -----+ ---+                             ||  |
|     |+                ----+----+      -                                  ||  |
|  -10|            ----+          -----+                                  ||  |
|10   |+      ----+          ----+                                        |+  |
```




```
func = cauchy
method = nearest
slope =  0.97095
method = linear
slope =  1.8937
method = spline
slope =  3.8578
method = pchip
slope =  1.8951
```

```
method = cubic
slope =  1.8951
```



Question 5

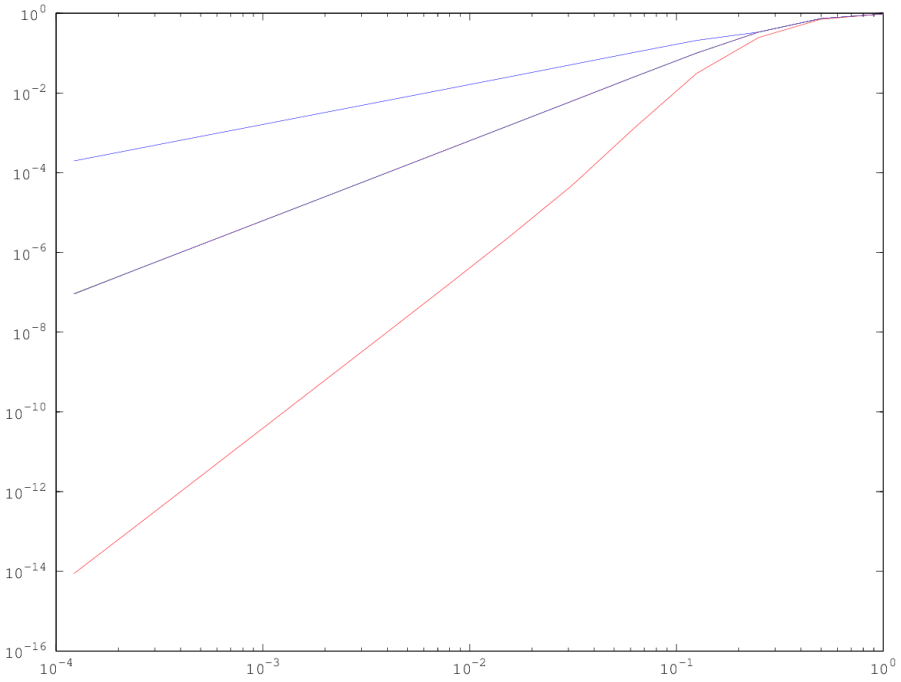
Part 1

$$A = \begin{bmatrix} A1 & 1 & 1 & 1 \\ 3 & 2 & 1 & 0 \\ -1 & 1 & -1 & 1 \\ 3 & -2 & 1 & 0 \end{bmatrix}$$

$$A^1 = \frac{1}{4} \begin{bmatrix} A1 & 1 & 1 & 1 \\ 3 & 2 & 1 & 0 \\ -1 & 1 & -1 & 1 \\ 3 & -2 & 1 & 0 \end{bmatrix}$$

Part 2

Part 3


10^{0}
10^{-2}
10^{-4}
10^{-6}
10^{-8}
10^{-10}
10^{-12}
10^{-14}
10^{-16}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}