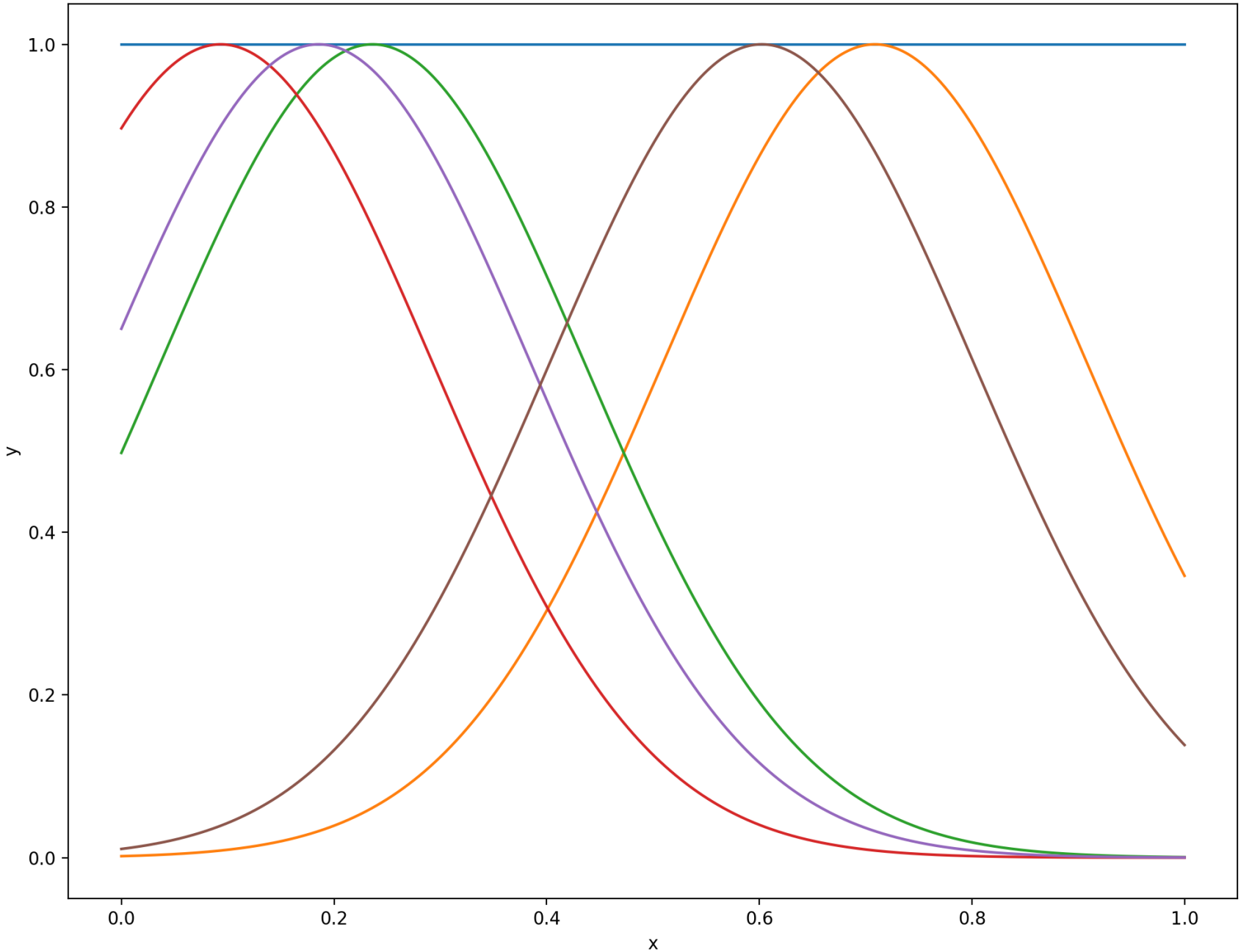
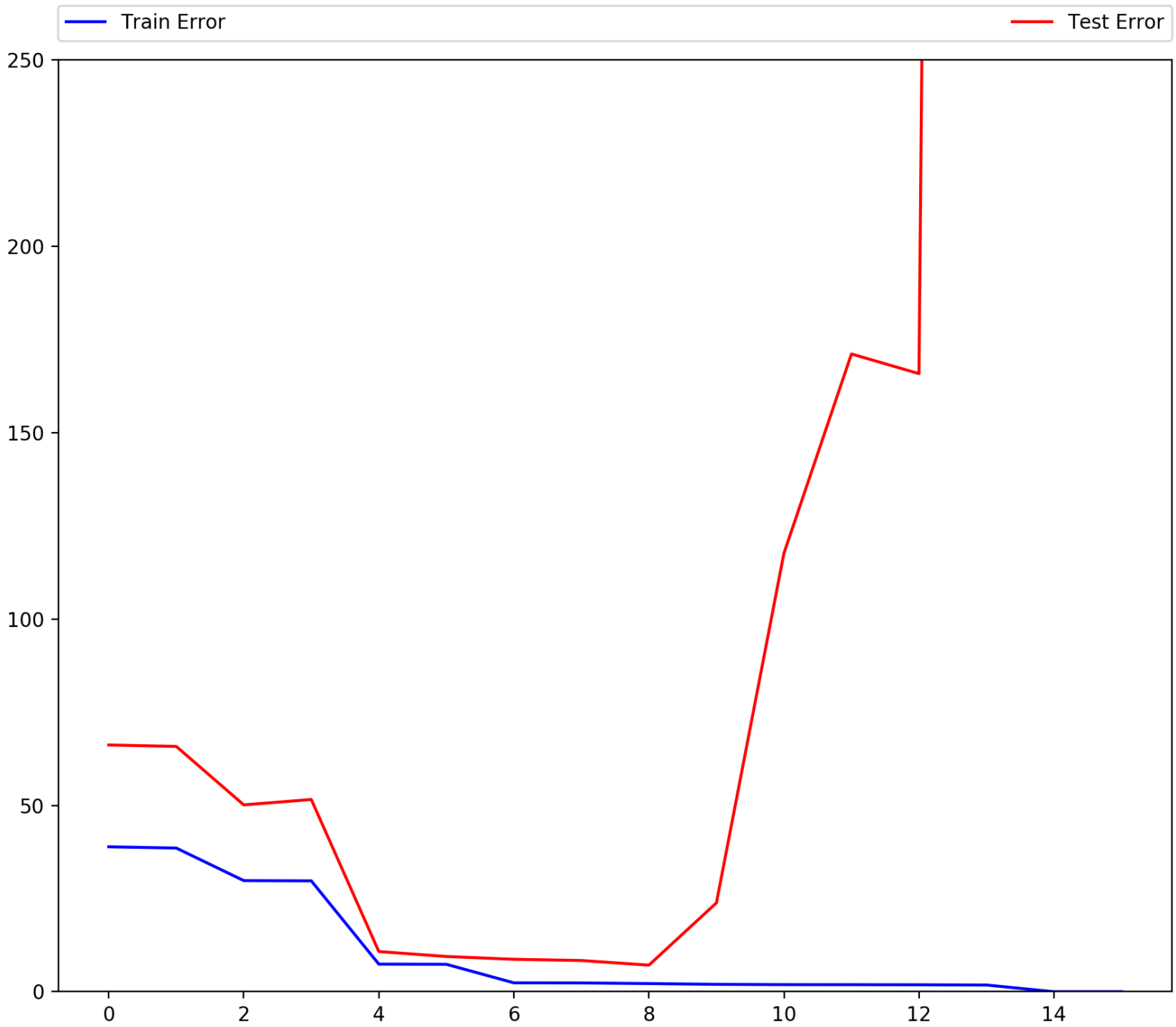
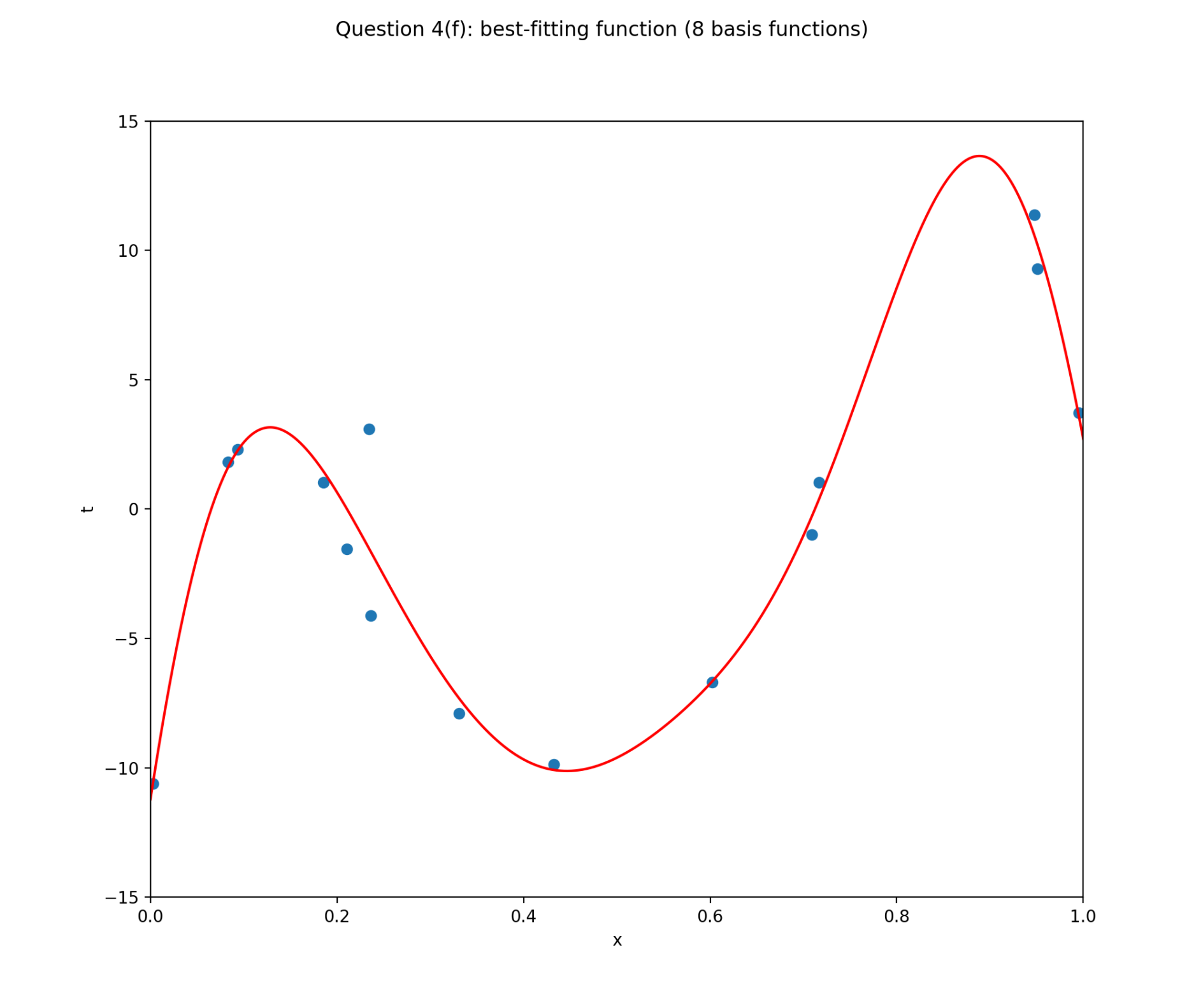
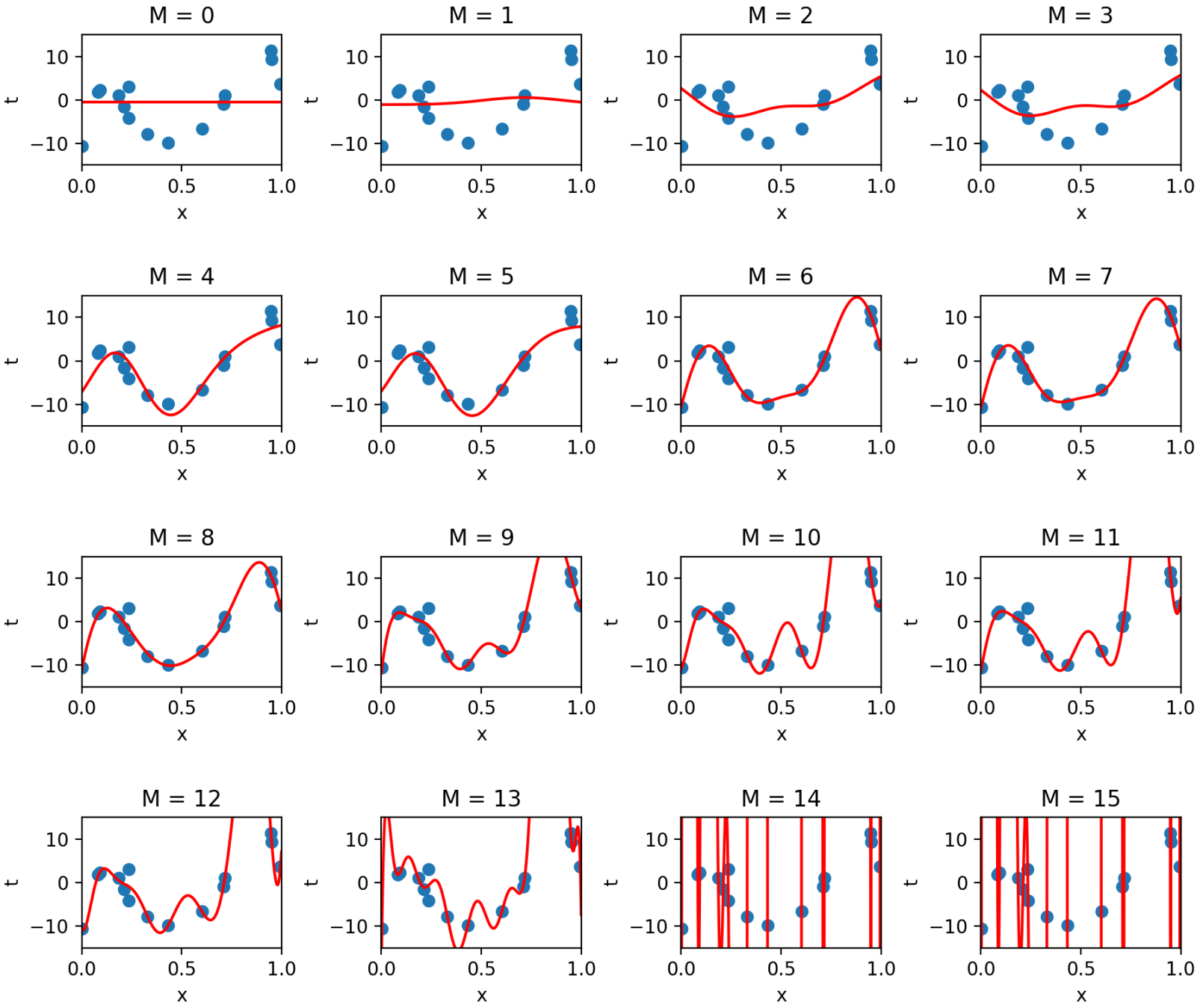
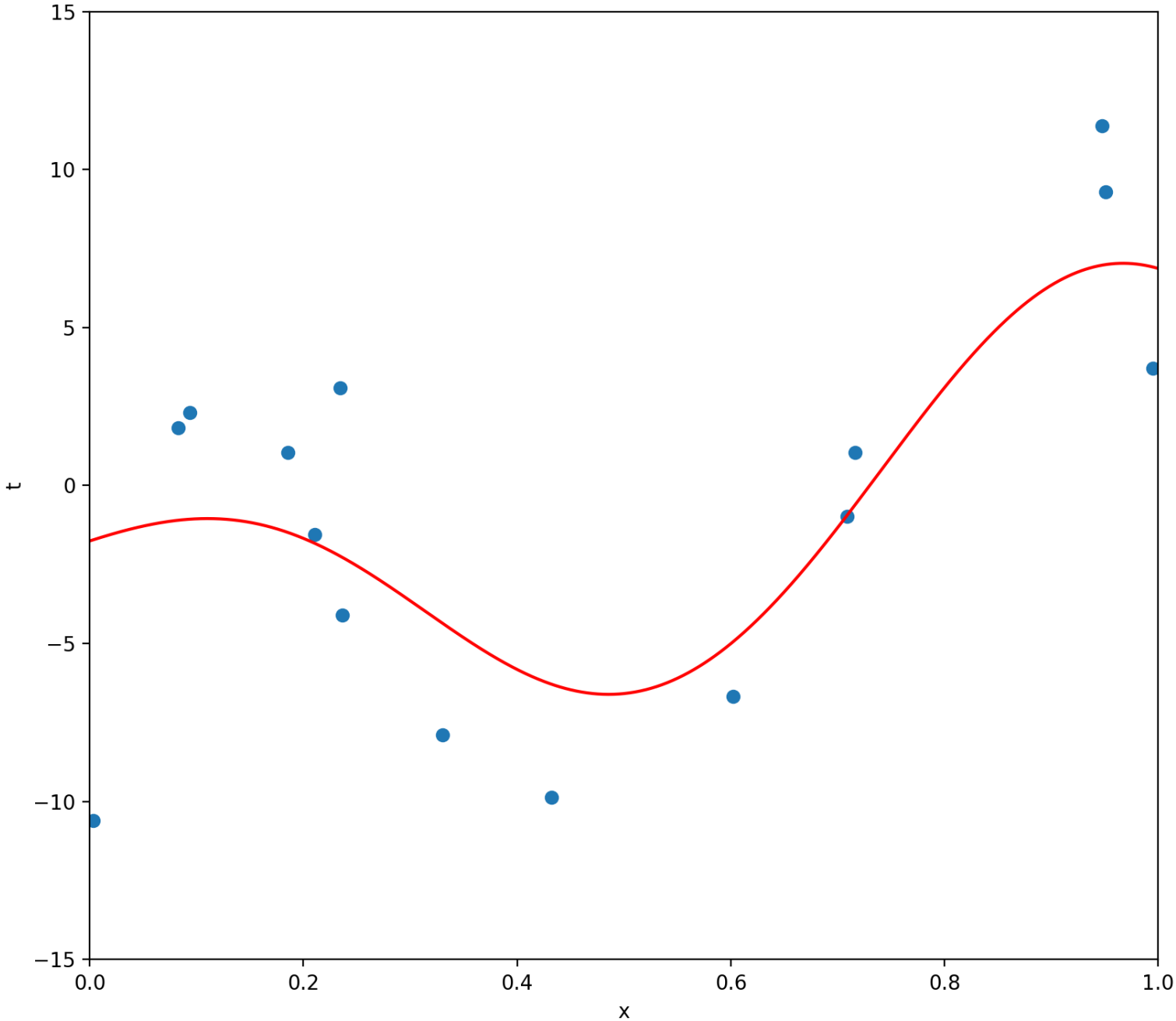
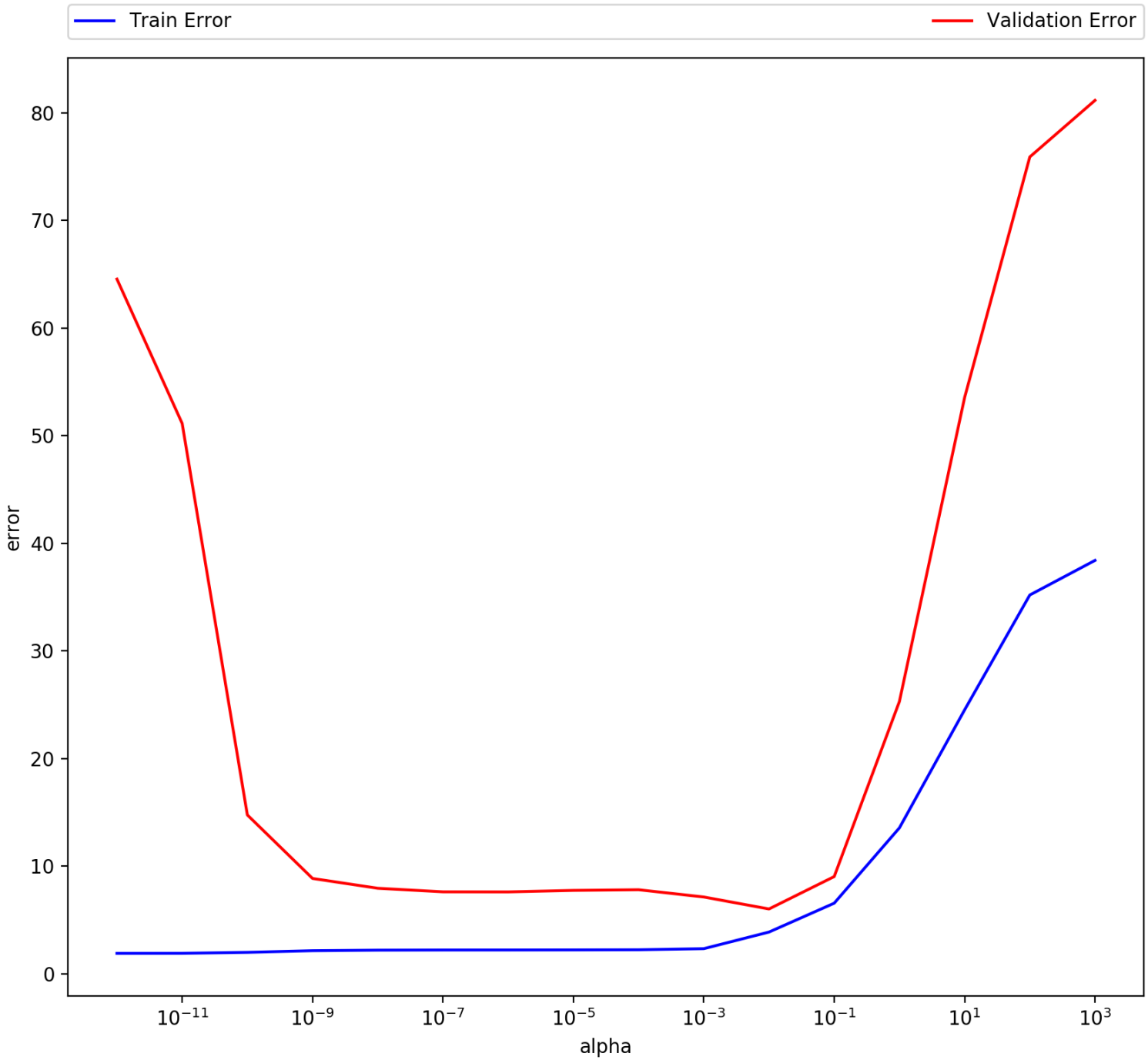

Question 4(b): some basis functions with sigma = 0.2
1.0
0.8
0.6
0.4
0.2
0.0
y
0.0
0.2
0.4
0.6
0.8
1.0
x

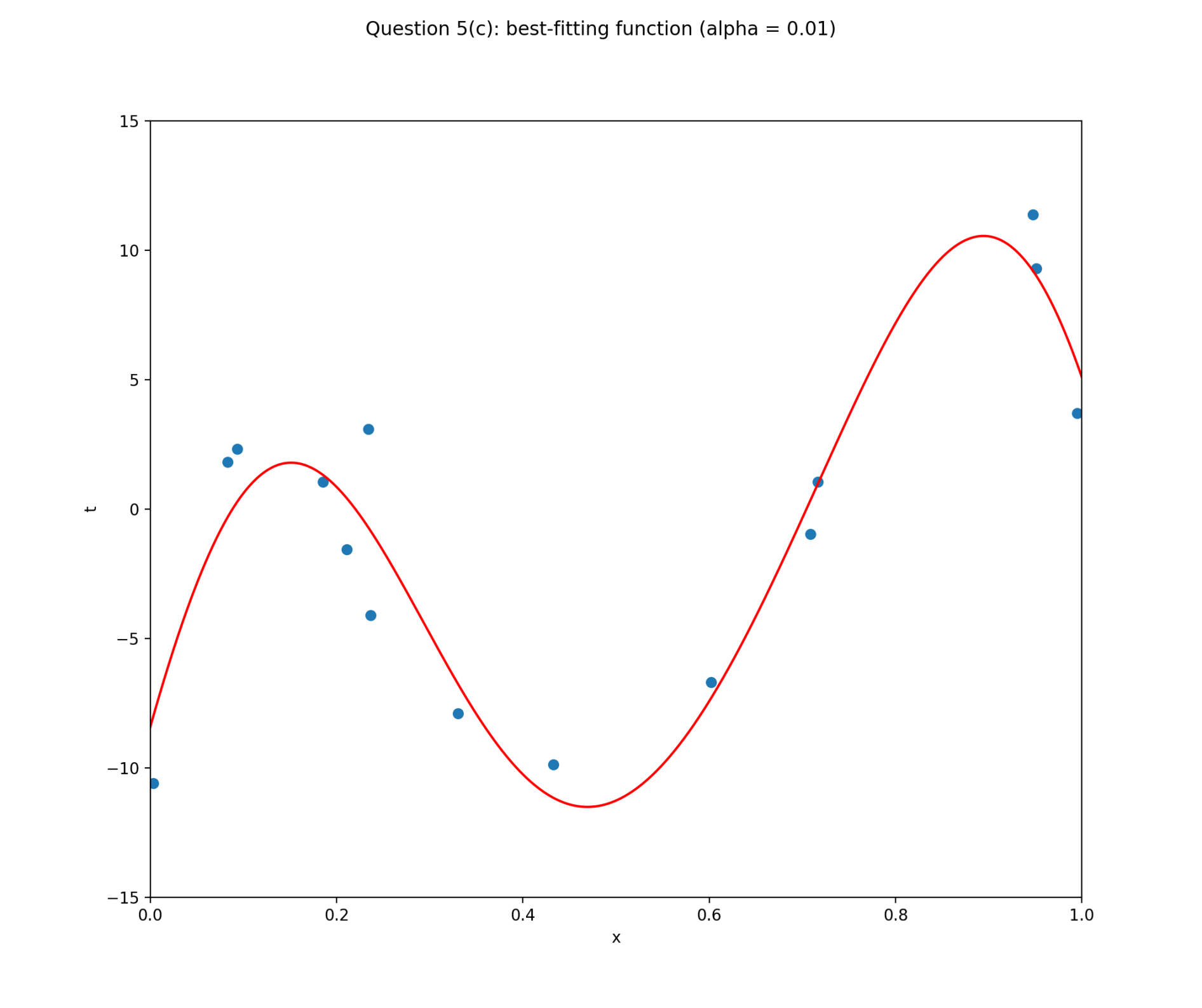

Question 4(f): training and test error
Train Error
Test Error
250
200
150
100
50
0
0
2
4
6
8
10
12
14

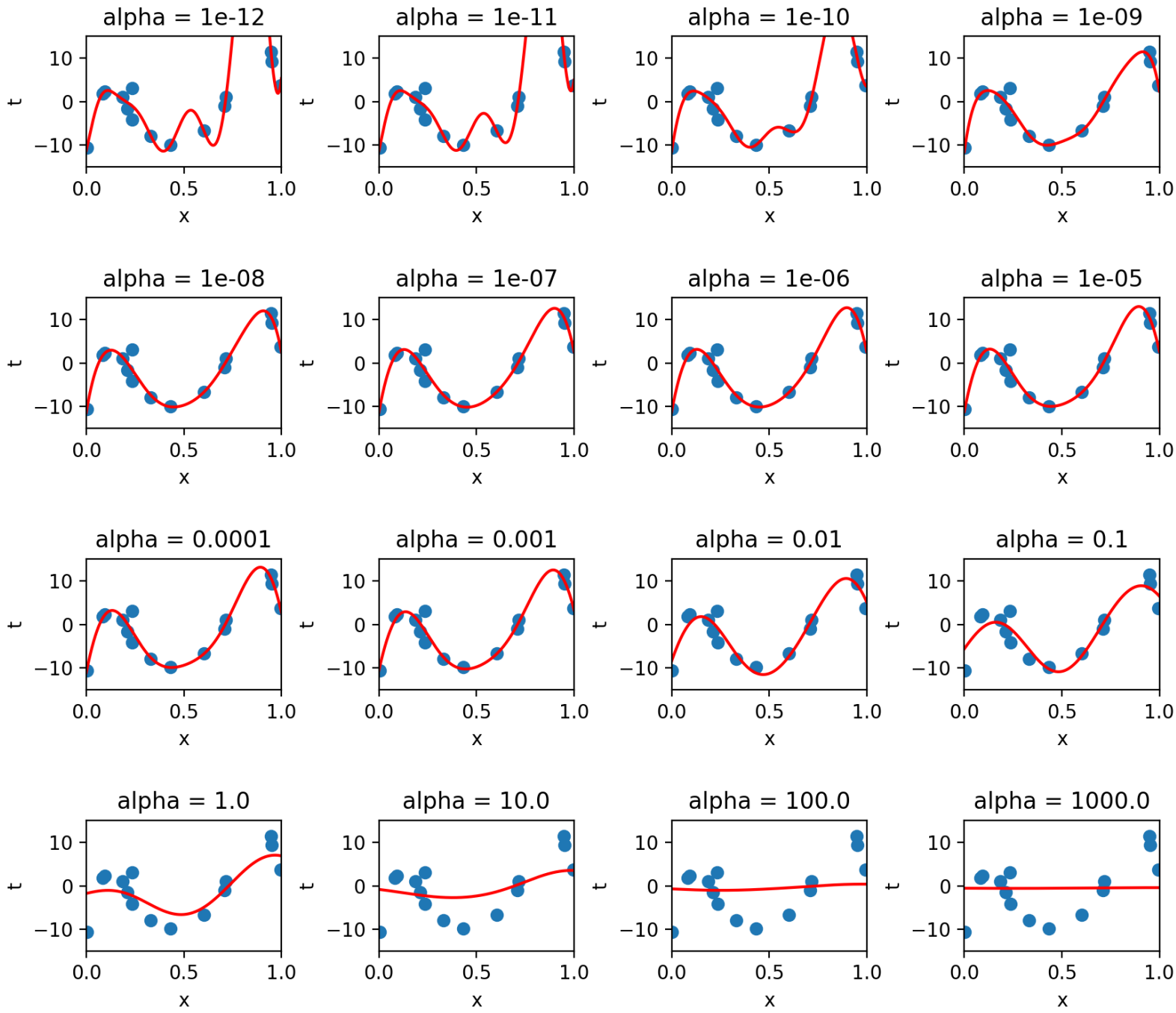

Question 4(f): best-fitting function (8 basis functions)
15
10
5
0
−5
−10
−15
t
0.0
0.2
0.4
0.6
0.8
1.0
x

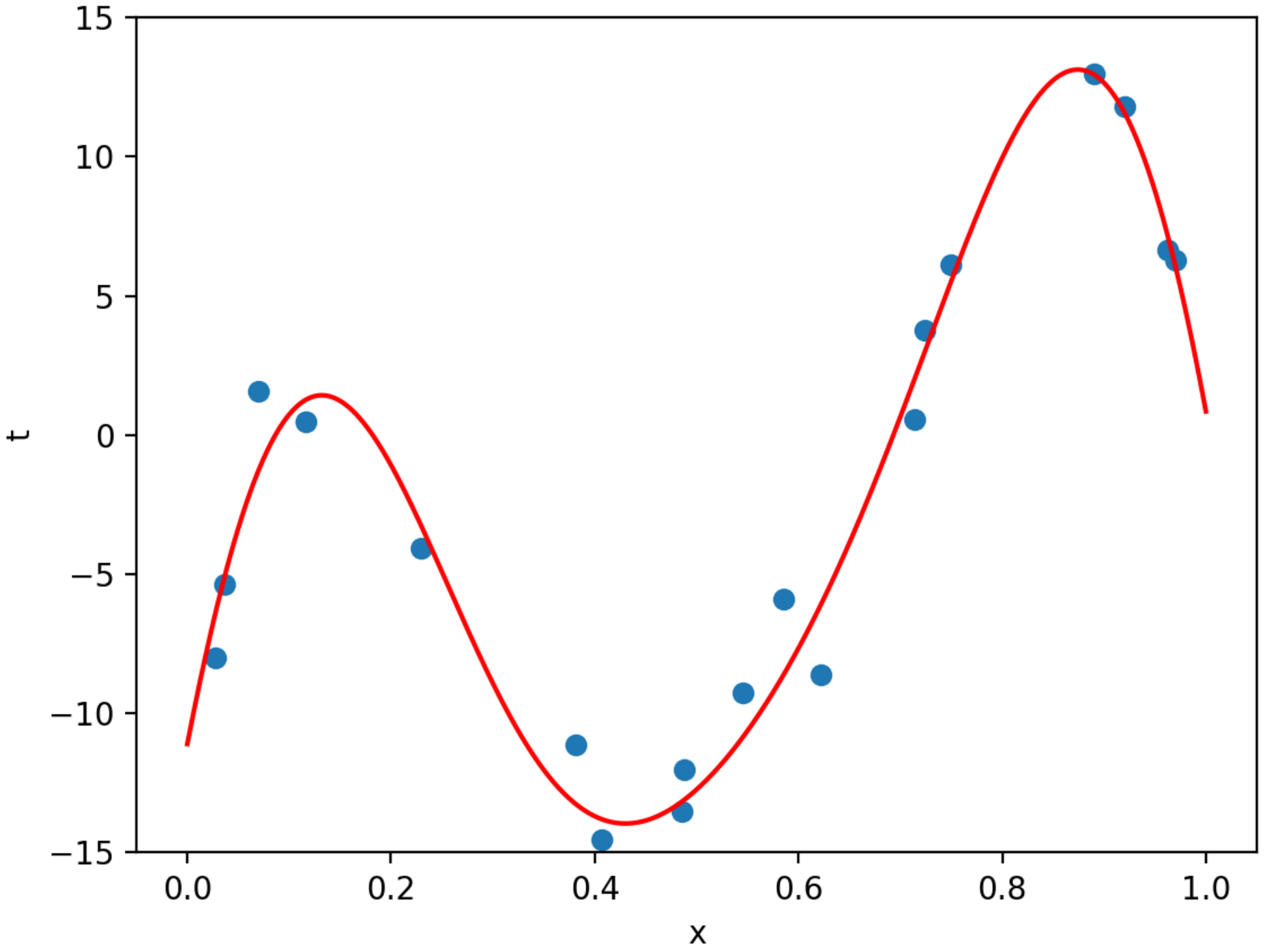

Question 4 (f) Best-Fitting functions with 0-15 basis functions
M = 0
M = 1
M = 2
M = 3
M = 4
M = 5
M = 6
M = 7
M = 8
M = 9
M = 10
M = 11
M = 12
M = 13
M = 14
M = 15
t
x
10
0
−10
0.0
0.5
1.0

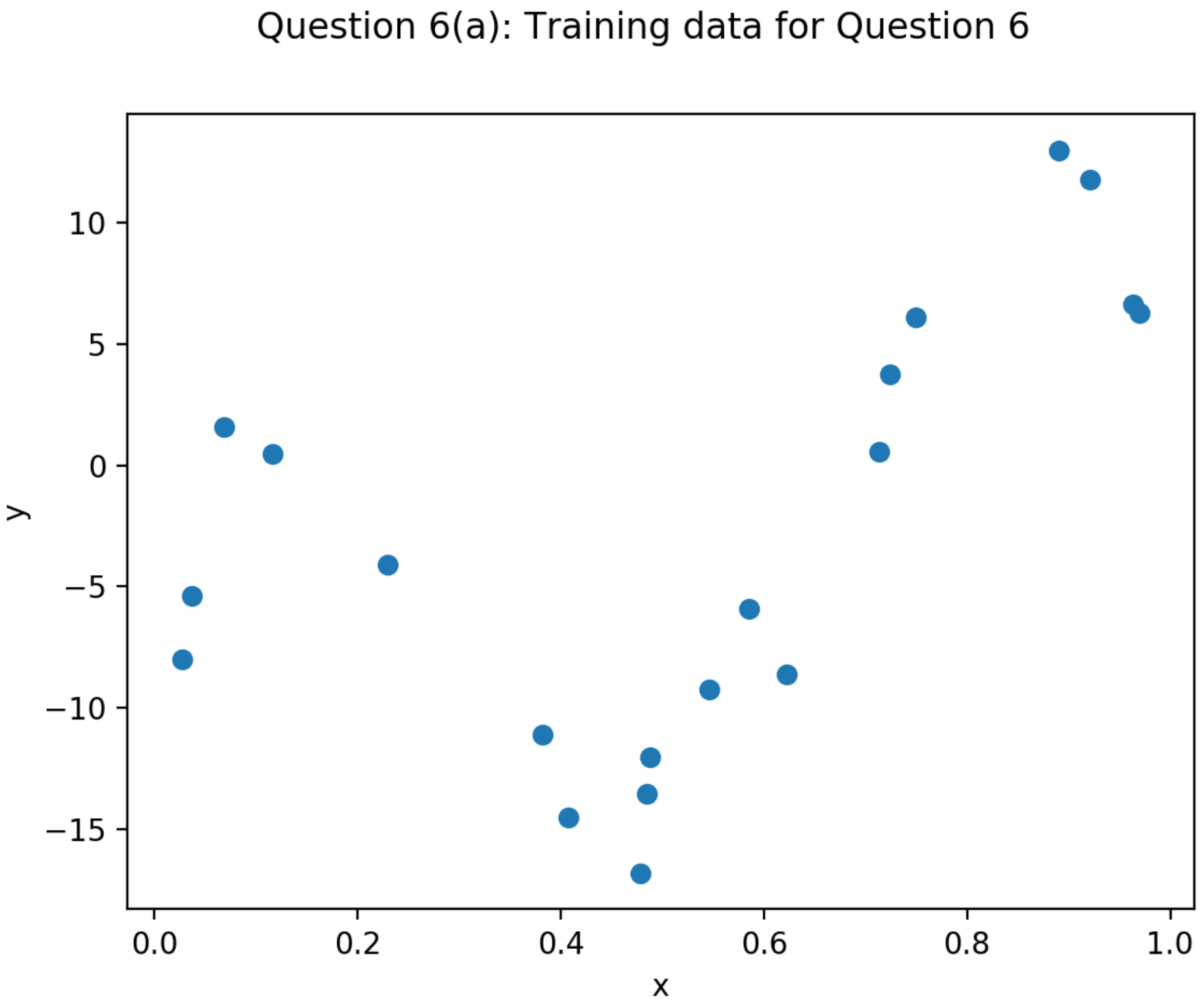

Question 5(b): the fitted function (alpha=1)
15
10
5
0
−5
−10
−15
t
0.0
0.2
0.4
0.6
0.8
1.0
x

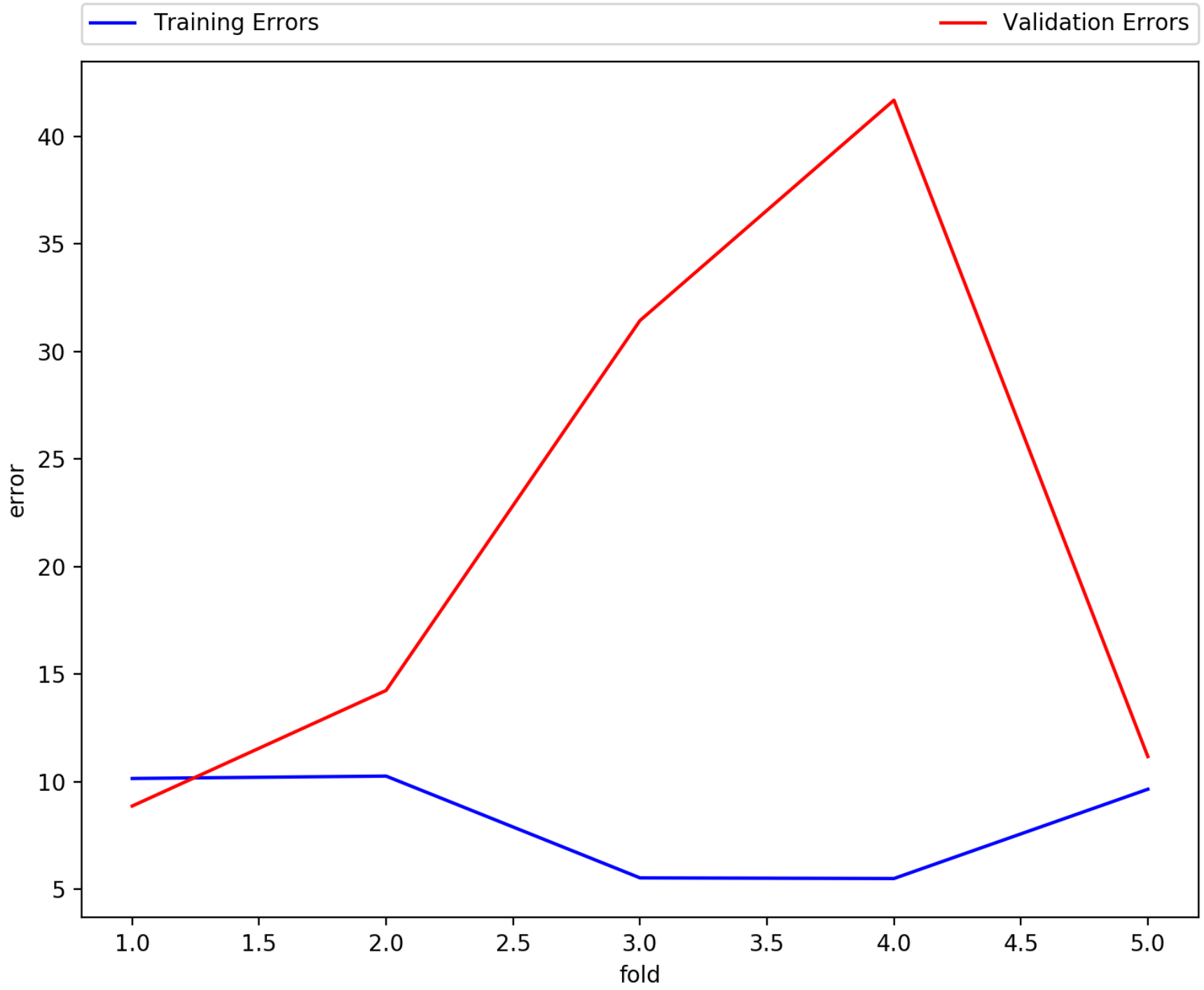

Question 5(c): training and validation error
Train Error
Validation Error
error
alpha
0
10
20
30
40
50
60
70
80
10^{-11}
10^{-9}
10^{-7}
10^{-5}
10^{-3}
10^{-1}
10^{1}
10^{3}

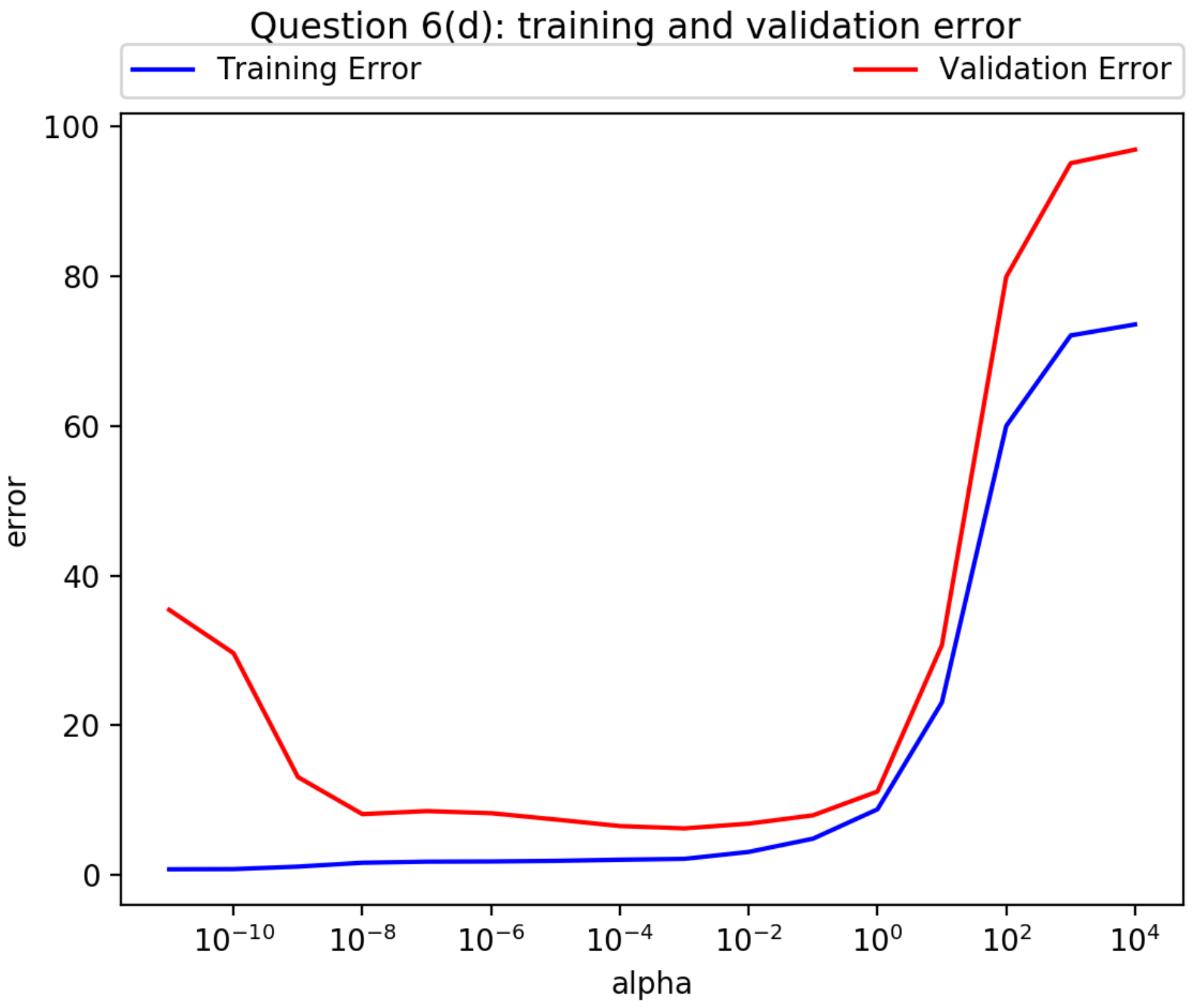

Question 5(c): best-fitting function (alpha = 0.01)
15
10
5
0
−5
−10
−15
t
0.0
0.2
0.4
0.6
0.8
1.0
x

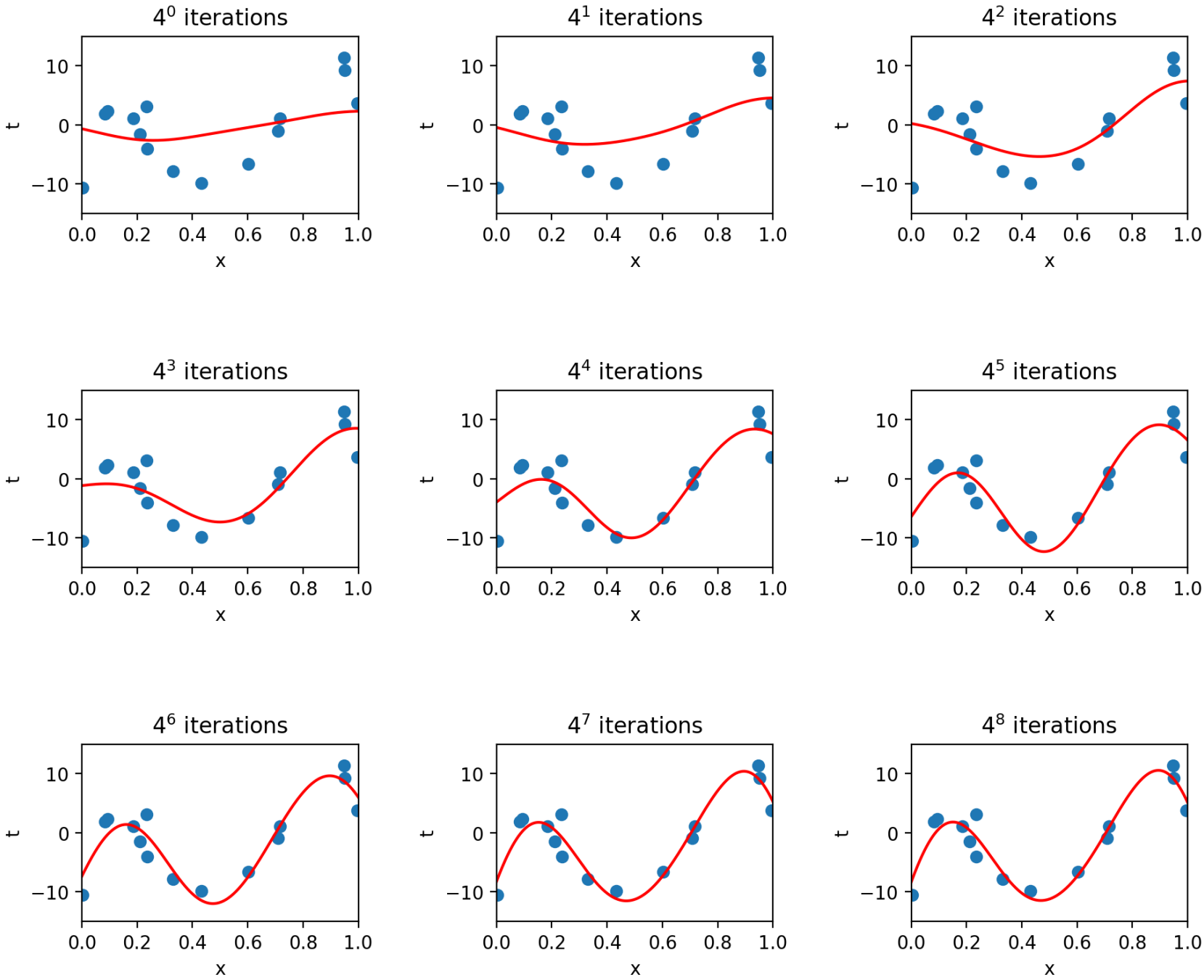

Question 5 (c) Best-Fitting functions for log(alpha)= -12, -11,...,0,1,2,3
alpha = 1e-12
alpha = 1e-11
alpha = 1e-10
alpha = 1e-09
alpha = 1e-08
alpha = 1e-07
alpha = 1e-06
alpha = 1e-05
alpha = 0.0001
alpha = 0.001
alpha = 0.01
alpha = 0.1
alpha = 1.0
alpha = 10.0
alpha = 100.0
alpha = 1000.0
t
x
10
0
−10
0.0
0.5
1.0

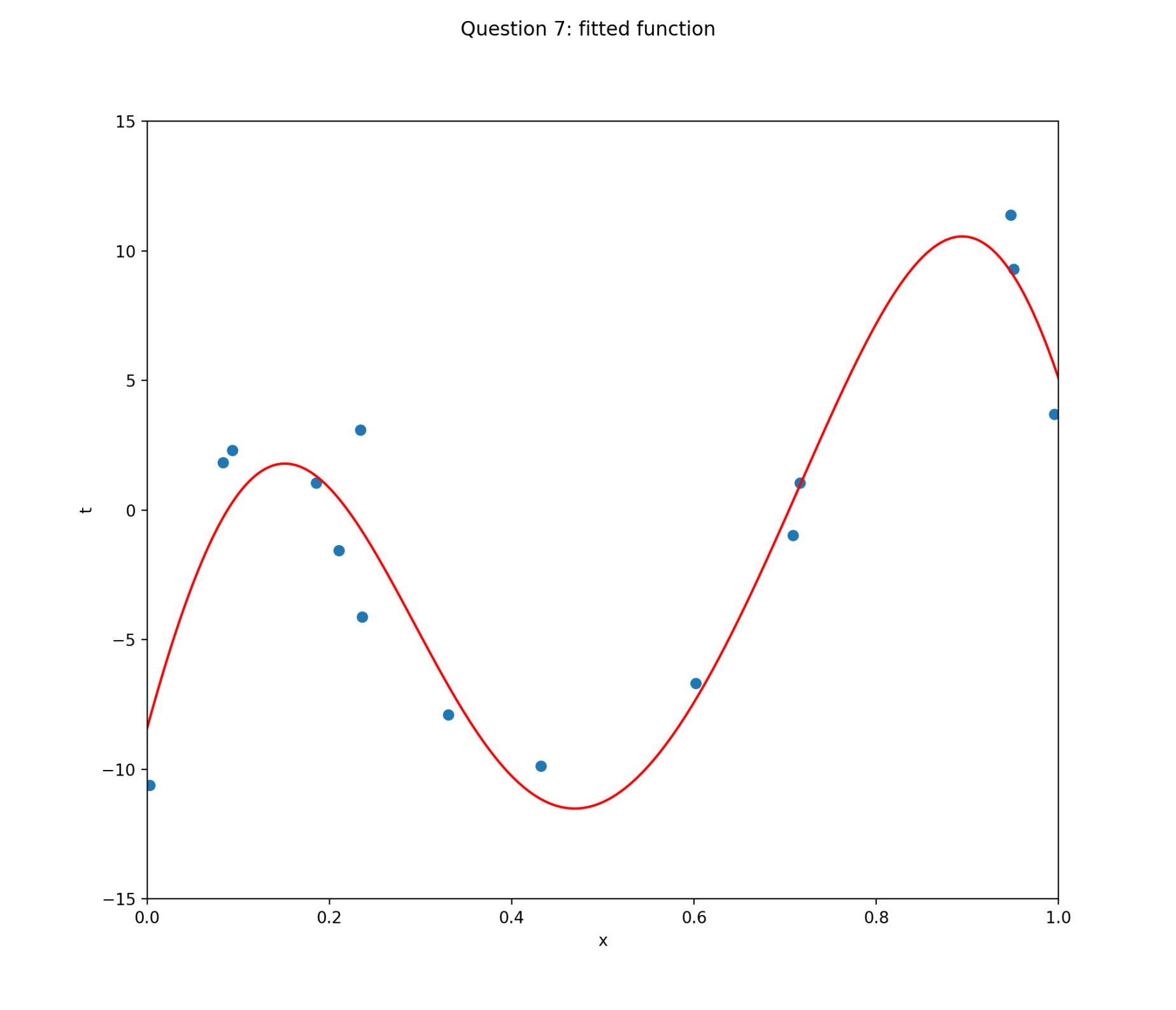

Question 6(d): best-fitting function alpha=0.001
15
10
5
0
−5
−10
−15
t
0.0
0.2
0.4
0.6
0.8
1.0
x

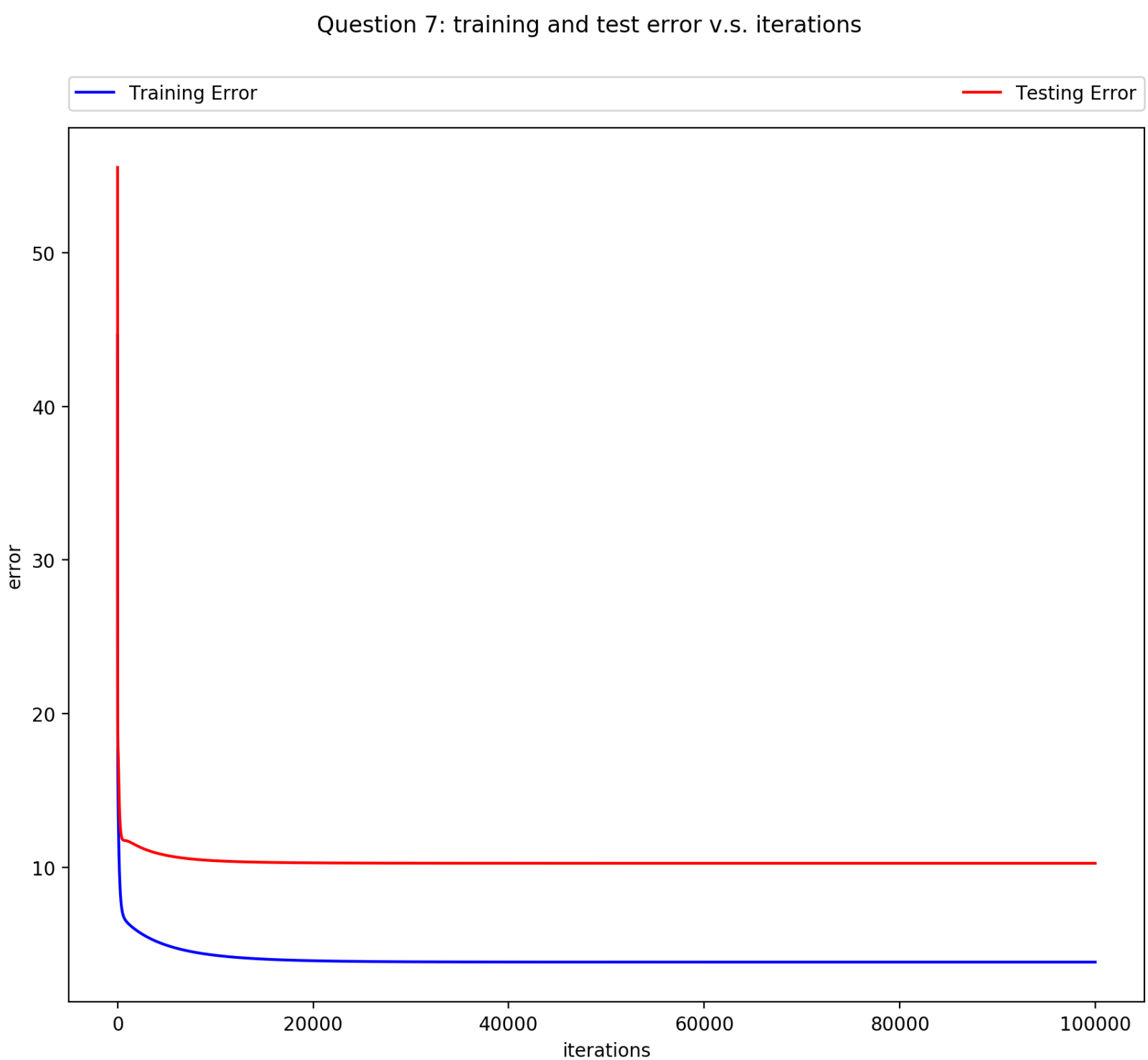

Question 6(a): Training data for Question 6
10
5
0
−5
−10
−15
y
0.0
0.2
0.4
0.6
0.8
1.0
x

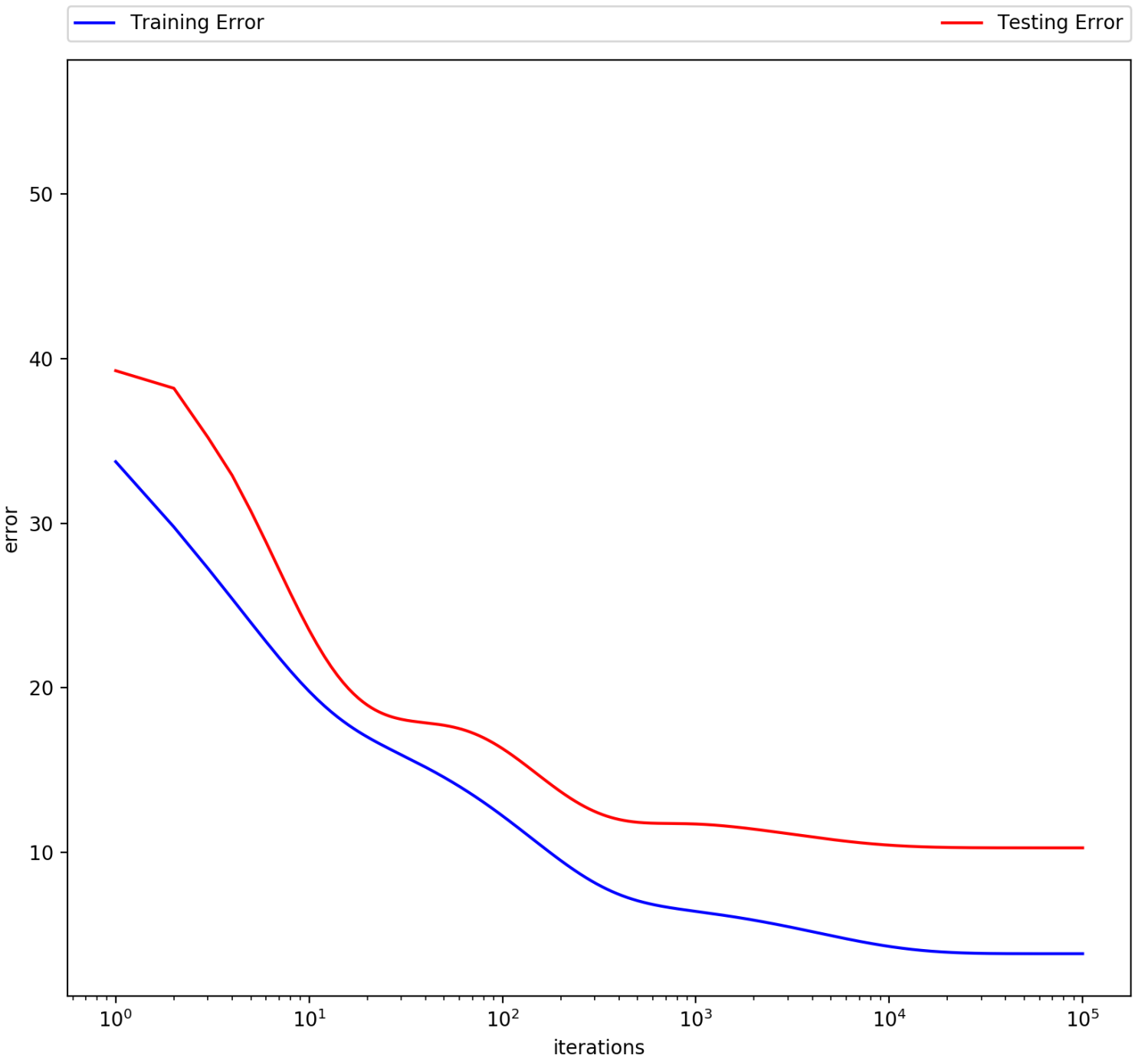

Question 6(c): training and validation errors during cross validation
Training Errors
Validation Errors
error
fold
40
35
30
25
20
15
10
5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

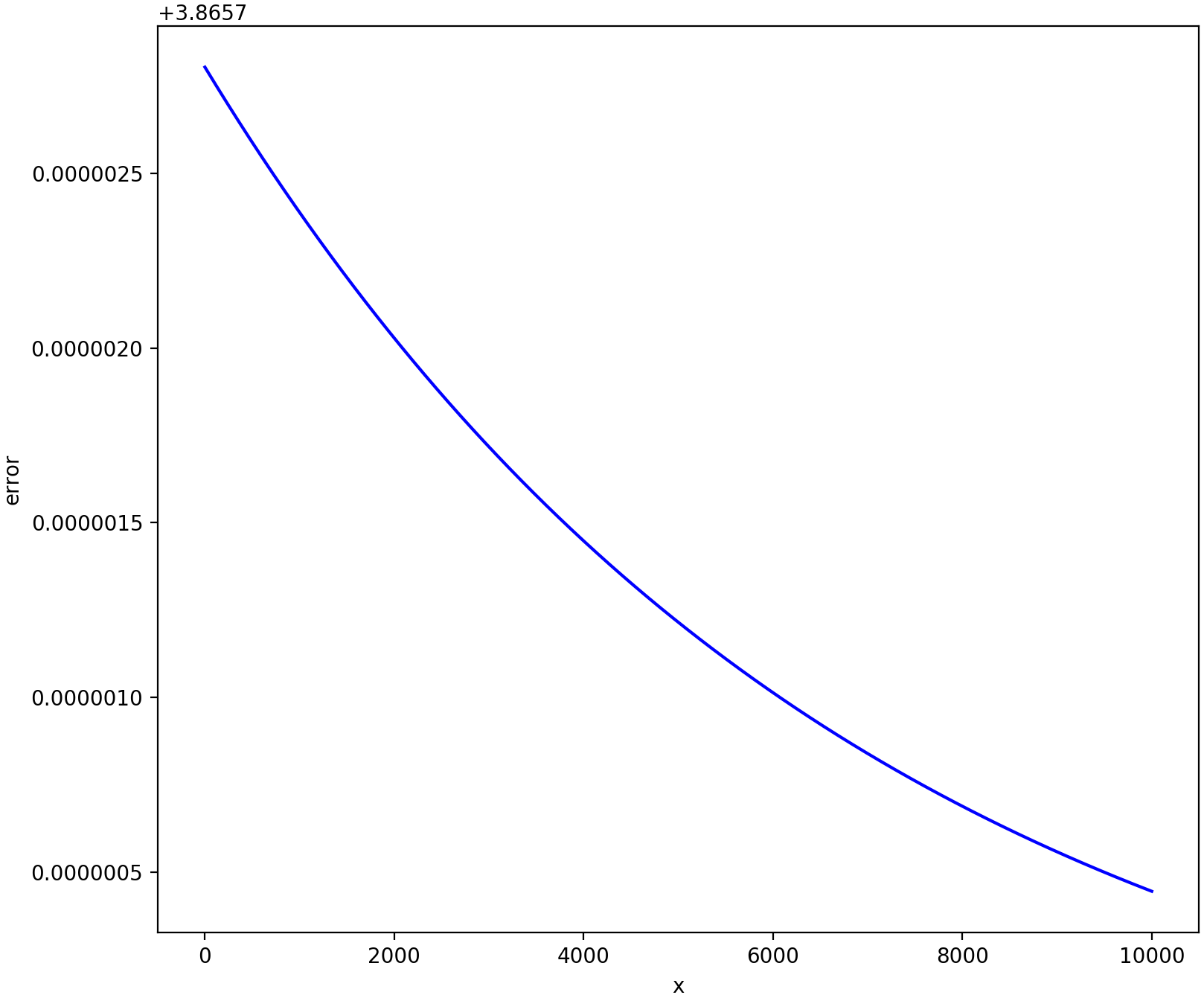

Question 6(d): training and validation error
Training Error
Validation Error
100
80
60
40
20
0
error
10^{-10}
10^{-8}
10^{-6}
10^{-4}
10^{-2}
10^{0}
10^{2}
10^{4}
alpha


Question 7: fitted function as iterations increase
4^0 iterations
4^1 iterations
4^2 iterations
4^3 iterations
4^4 iterations
4^5 iterations
4^6 iterations
4^7 iterations
4^8 iterations
t
x
10
0
−10
0.0
0.2
0.4
0.6
0.8
1.0


Question 7: fitted function
15
10
5
0
−5
−10
−15
t
0.0
0.2
0.4
0.6
0.8
1.0
x


Question 7: training and test error v.s. iterations
Training Error
Testing Error
error
50
40
30
20
10
0
20000
40000
60000
80000
100000
iterations


Question 7: training and test error v.s. iterations (log scale)
Training Error
Testing Error
50
40
30
20
10
error
10^0
10^1
10^2
10^3
10^4
10^5
iterations


Question 7: last 10000 training errors
+3.8657
0.0000025
0.0000020
0.0000015
0.0000010
0.0000005
error
0
2000
4000
6000
8000
10000
x