Exercise 1

- n! tours

Exercise 2

$-\infty$

Exercise3

$$y = \begin{cases} 1 & x < 0 \\ -1 & x > 0 \end{cases}$$

Exercise4

$y = 0$

- It is continuous, not differentiable.

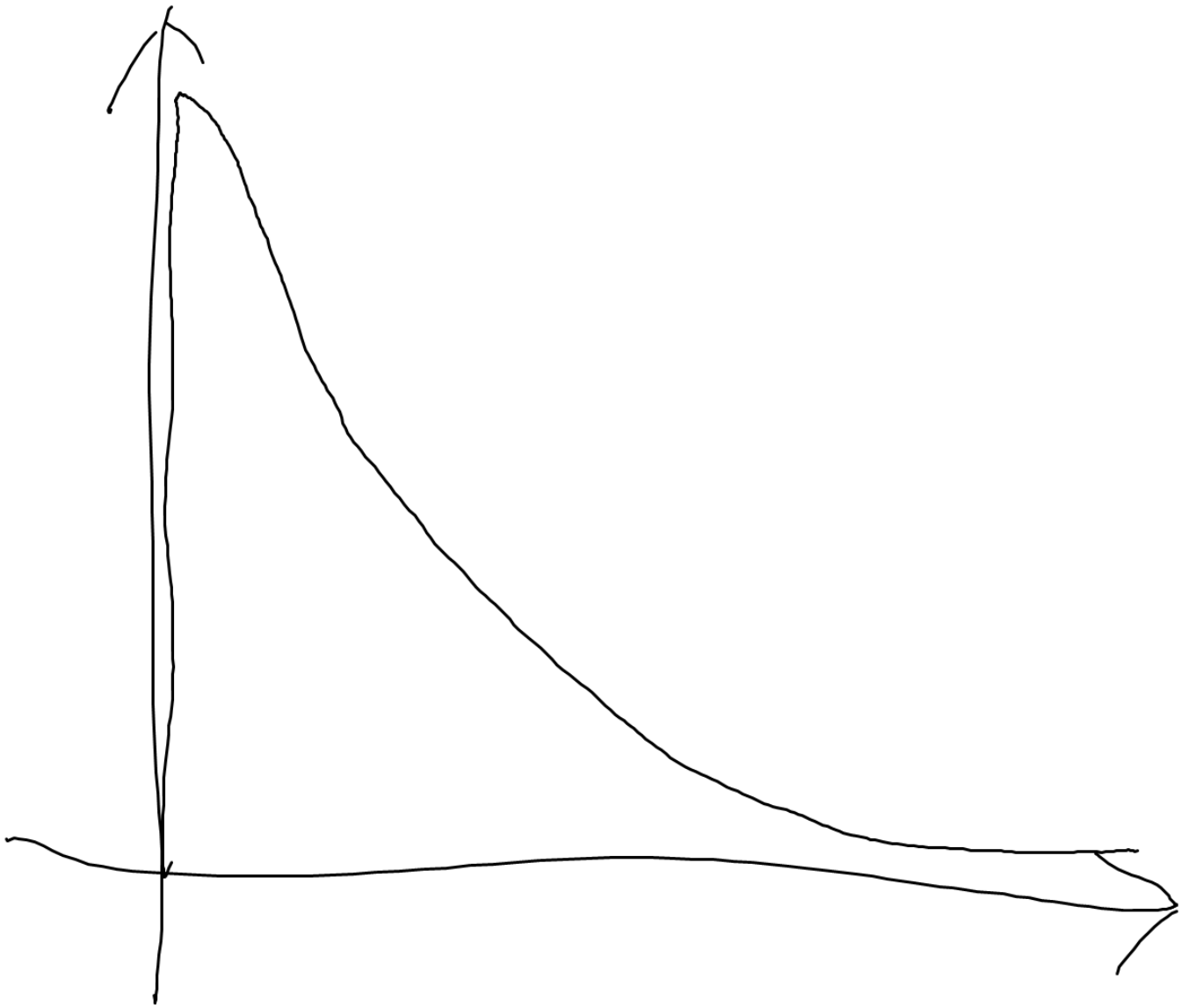
Exercise5

x=0, x=1

Exercise 6

- O(MN)
- best M=6, N=4
    - result = 2.5003

Exercise 7



Exercise 8

M*N evaluations

Exercise 9

$M * N^2$ Evaluations, $M * N^n$ evaluations.

Exercise 10

Bracketing search: x1=4.691358024691359 x2=3.2098765432098757 numFuncEvals=138

Exercise 11:

N=0 bestx=5.555555555555558 bestf=3.2149641975308683 prevBestf=3.2149641975308683

Exercise 12:

c is a weighted average of a and b. So c must be in range [a,b].

Exercise 13:

d-a=rb-ra = r(b-a)

$\frac{d-a}{b-a} = r$

Exercise 14:

fd could be 0.

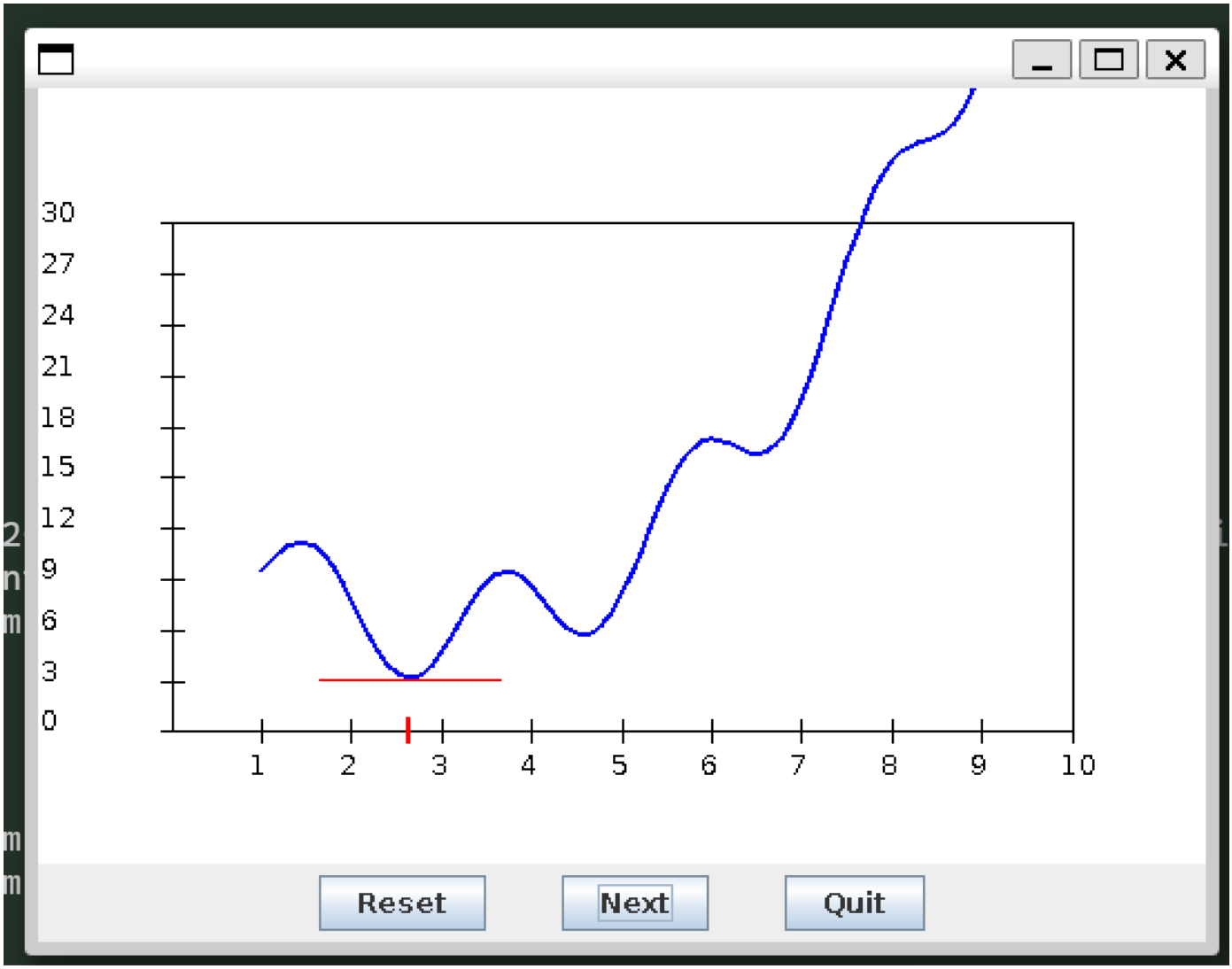
Exercise 15:

c=0.0 c=10.0 bestf=2.5841 numEvals=0

Exercise 16:

- around 100 iters
- step become smaller
- ```
  X:2.484 ,afx:-1.484
  X:3.3744 ,afx:-0.8904000000000001
  X:3.90864 ,afx:-0.5342399999999999
  X:4.229184 ,afx:-0.32054399999999994
  X:4.4215104 ,afx:-0.19232639999999998
  X:4.5369062399999995 ,afx:-0.11539584000000006
  X:4.606143744 ,afx:-0.06923750400000017
  X:4.6476862464 ,afx:-0.041542502400000104
  X:4.67261174784 ,afx:-0.02492550143999992
  X:4.687567048704 ,afx:-0.01495530086399981
  X:4.6965402292224 ,afx:-0.008973180518399815
  X:4.70192413753344 ,afx:-0.005383908311040031
  X:4.705154482520064 ,afx:-0.0032303449866240897
  ```
- The function doesn't converge at α=1, it overshoots over the optimal
- The program can't normally function at α=10

Exercise 17:
  ```



- Yes, it converge at 2.6
- It is also 0.

Exercise 18

Yes, simply f(x)=sin(x)

Exercise 19:

If s is too large, then the derivative is not very precises and can cause over shoot problem or even miss the global minimum.

Exercise 20:

This won't work because it will force x1 and x2 both to move even if the x1 or x2 is already at it's optimal value.

Exercise 21:

$f_1' = 2 * (x_1 - 4.71) + 4(x_1 - 4.71) * (x_2 - 3.2)^2$

$f_2' = 2 * (x_2 - 3.2) + 4(x_1 - 4.71)^2 * (x_2 - 3.2)$

Exercise 22:

$f_1' = \frac{1}{\mu_1}$

$f_2' = \frac{1}{\mu_2}$

Exercise 23:

We will be calculating the gradient based on the new x1, which is not the correct gradient at the moment.

Exercise 24:

```
Gradient descent: after n=542 iterations: x1=4.704951324783355 x2=3.1949999982061064
```

Exercise 25:

X around 0.3 provides best performance

Exercise 26:

It can't find a low derivative, 1000 samples are used.

Exercise 27:

$a_n = \frac{1}{n}$

Exercise 28:

Yes, it works.

Exercise 29:

Gradient descent: x=*0.3070053072136658 f(x)*=1.2150337526719595

Yest, it's about the value produced in exercise 28.