Particle Swarm Optimizer

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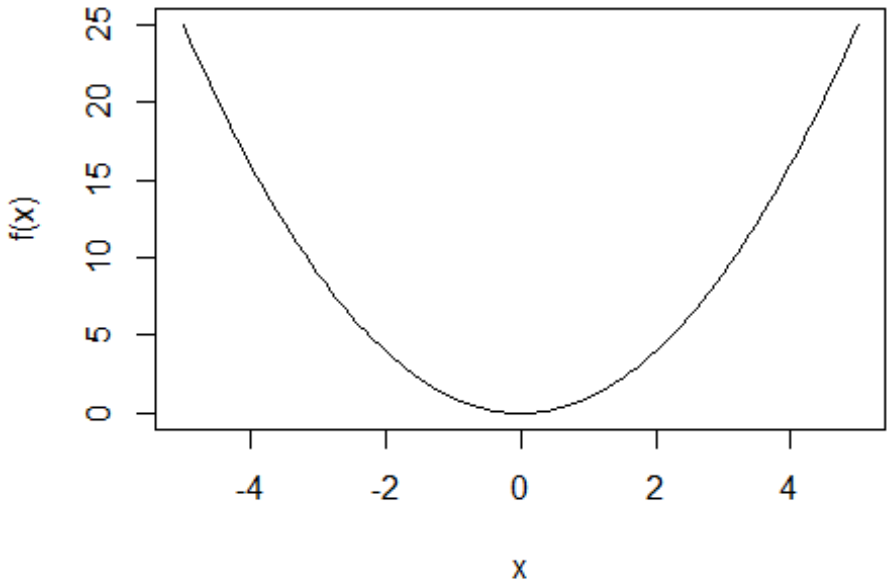
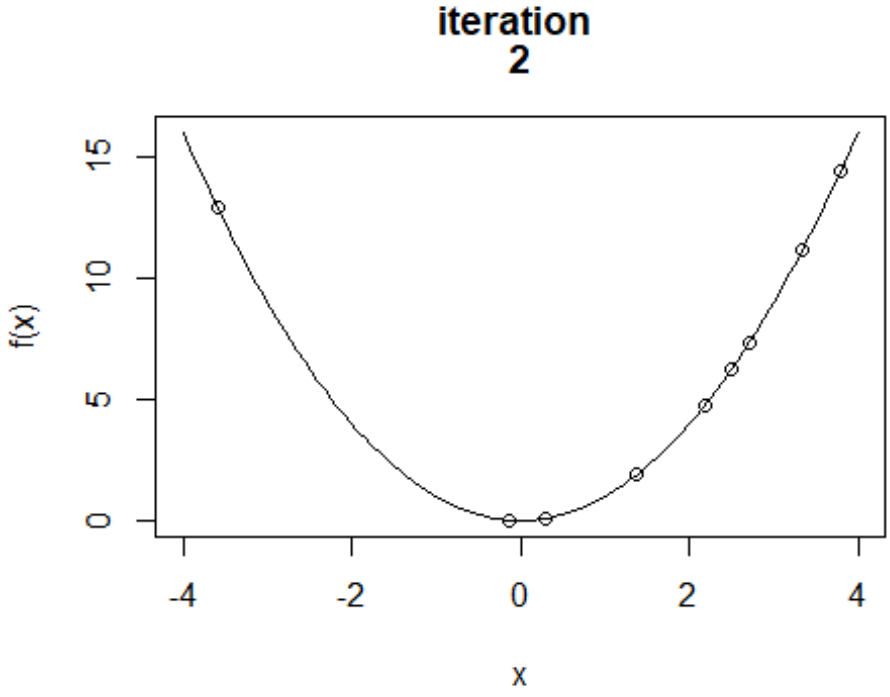
Trying out 2D first

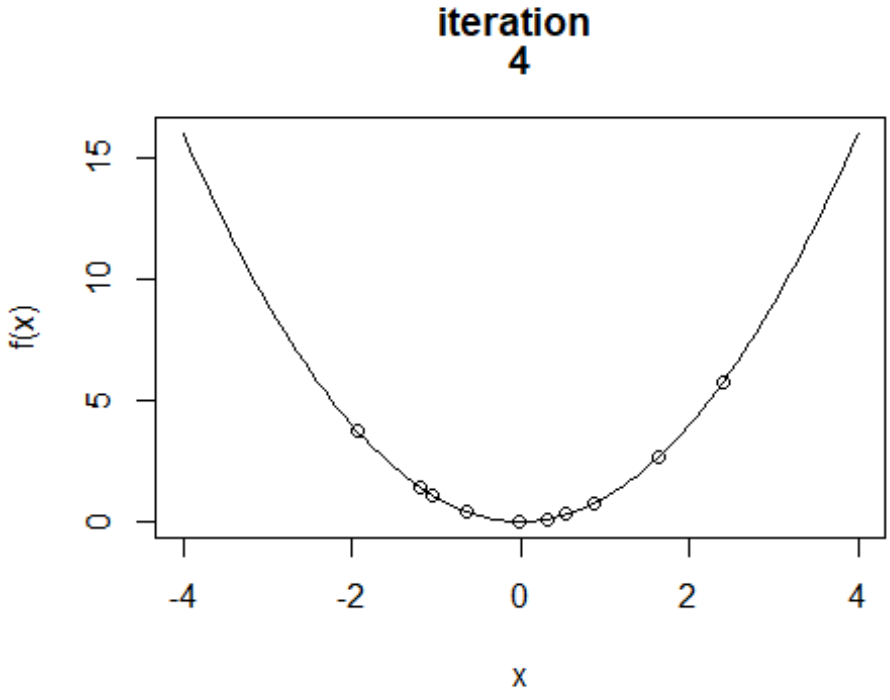
```
set.seed(123)
#Simple function

f <- function(x){
  return(x^2)
}

curve(f(x),-5,5)
```

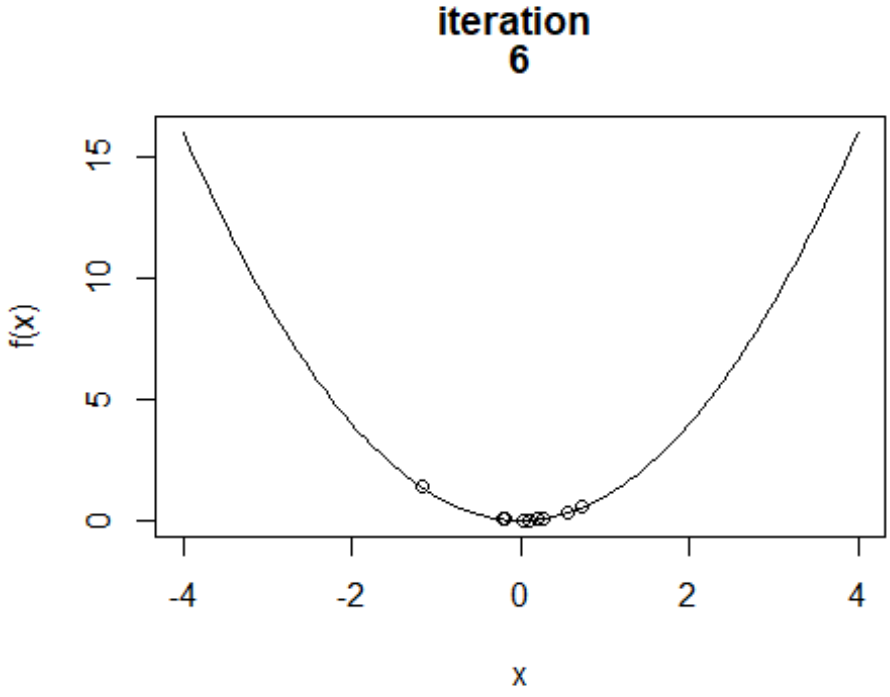


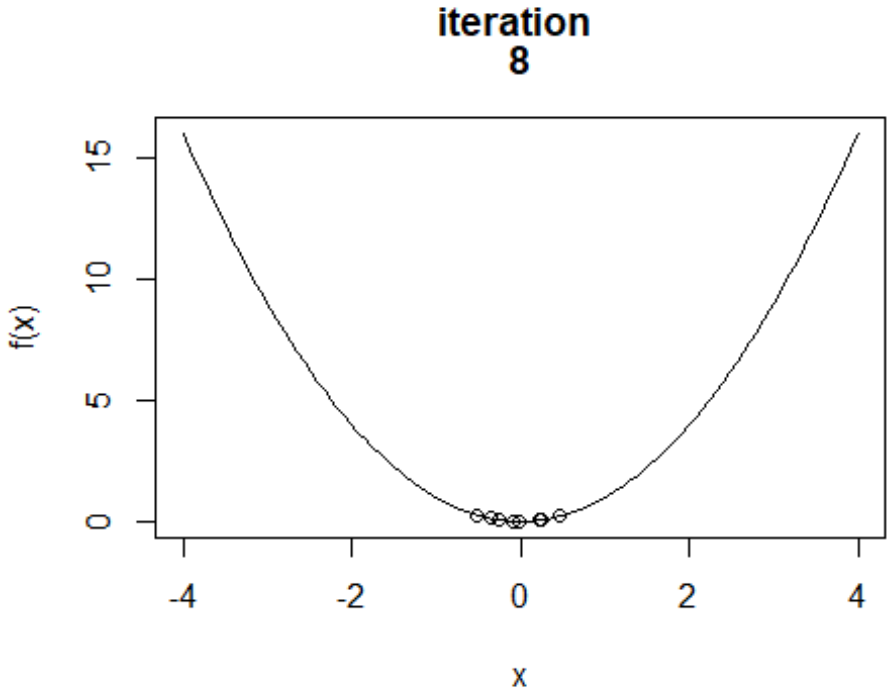

```
swarm <- function(S,lower, upper,omega,phiP,phiG){
  best_swarm <- lower
  #particle positions
  x <- rep(0,S)
  #particle best positions
  p <- rep(0,S)
  #particle velocities
  v <- rep(0,S)
```

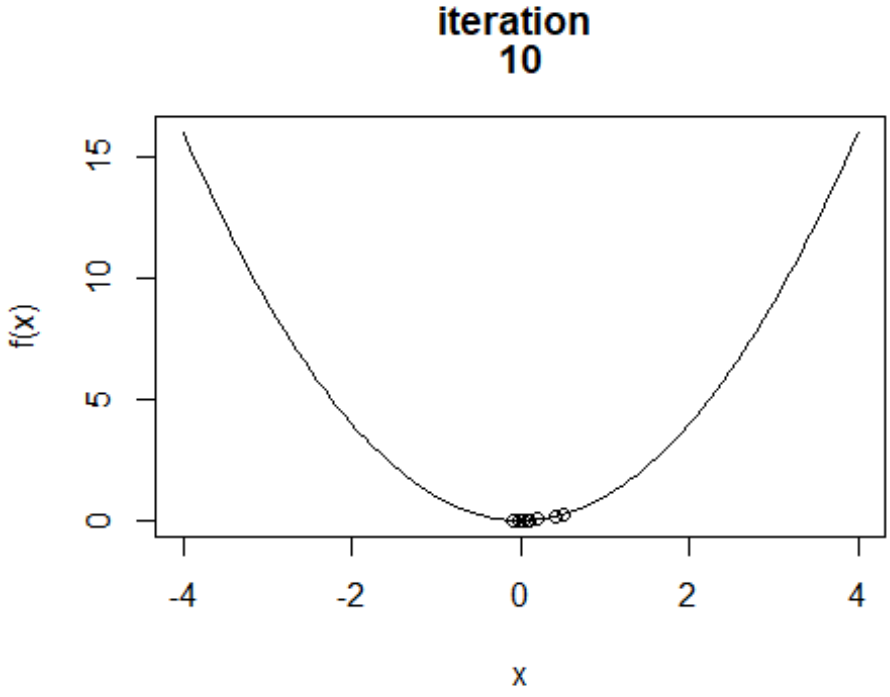
```
  #for each particle i
  for (i in 1:S){
    #initial position
    x[i] <- runif(1,lower,upper)
    p[i] <- x[i]

    if(f(p[i]) < f(best_swarm)){
      best_swarm <- p[i]
    }

    #initial velocity
    v[i] <- runif(1,-abs(upper-lower),abs(upper-lower))
  }
  #print(x)
  #print(p)
  #print(v)
  #print(best_swarm)
  for(j in 1:100){

    for (i in 1:S){
      rp <- runif(1,0,1)
      rg <- runif(1,0,1)

      v[i] <- omega*v[i] + phiP*rp*(p[i]-x[i]) + phiG*rg*(best_swarm-x[i])

      x[i] <- x[i] + v[i]

      if (f(x[i]) < f(p[i])){
        p[i] <- x[i]

        #update best position in the swarm
        if (f(p[i]) < f(best_swarm)){
          best_swarm <- p[i]
        }
      }
    }
    if(j%%2 == 0 && j < 20){
      curve(f,lower,upper,main = c("iteration ",j))
      points(x,f(x))
    }

  }
  cat("best x value: ",best_swarm,"\n")
  cat("minimum: ",f(best_swarm),"\n")
  cat("\n")
}

swarm(10,-4,4,.5,.5,.5)
```

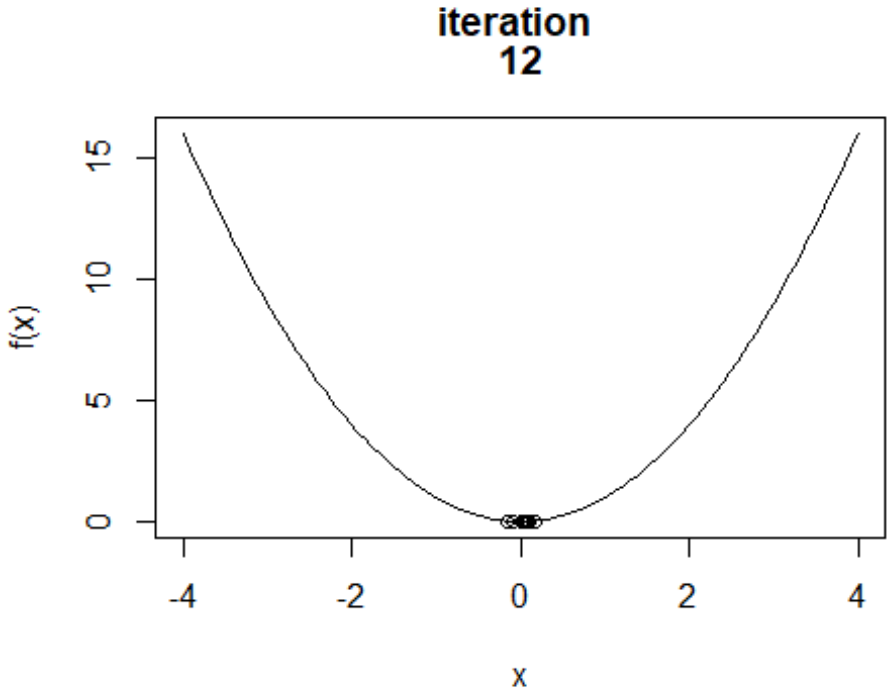

iteration
2
f(x)
0
5
10
15
-4
-2
0
2
4
x

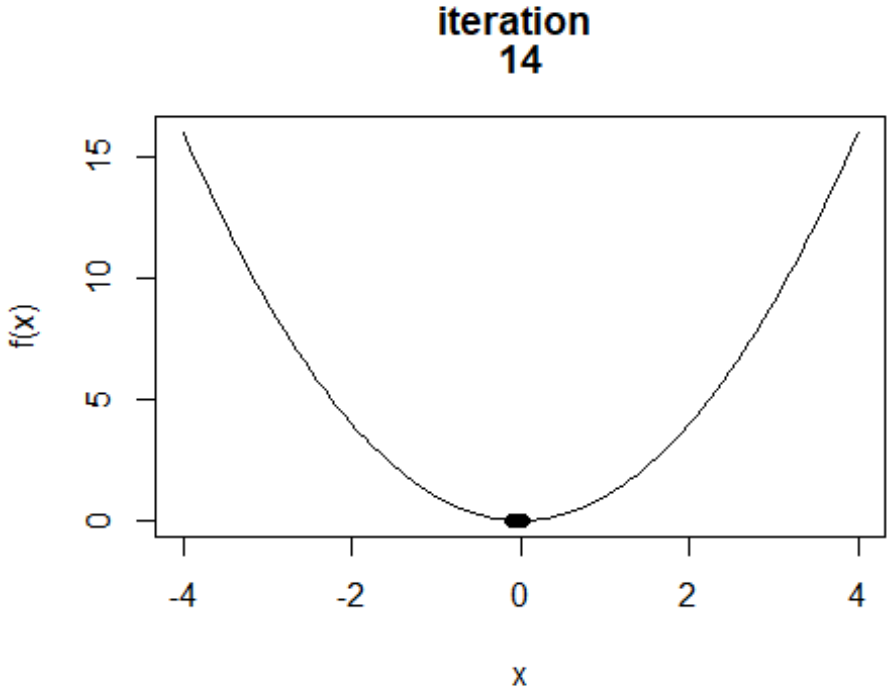

iteration
4
f(x)
0
5
10
15
-4
-2
0
2
4
x

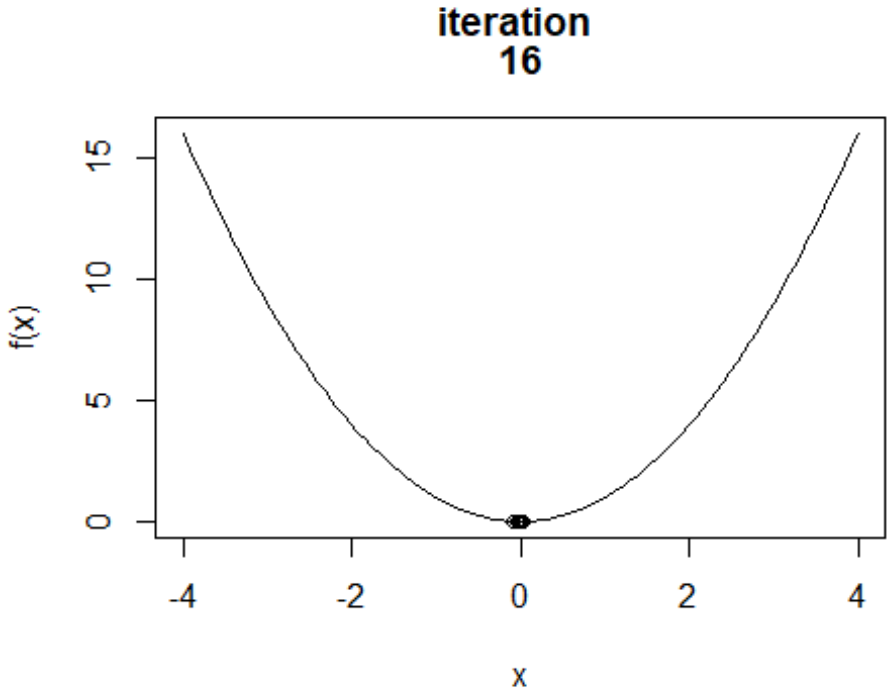

iteration
6
f(x)
0
5
10
15
-4
-2
0
2
4
x

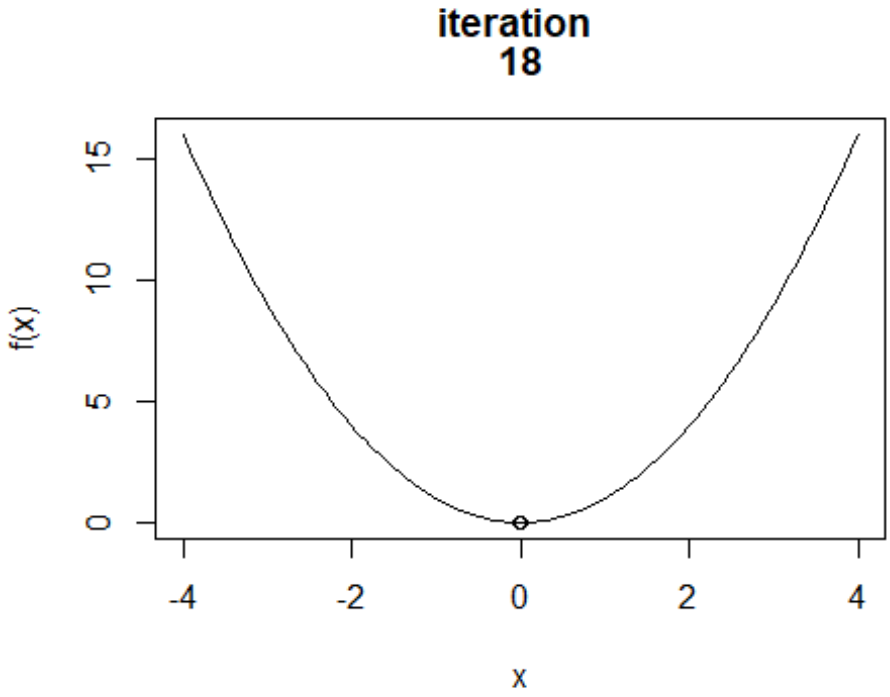

iteration
8
f(x)
0
5
10
15
-4
-2
0
2
4
x


iteration
10
f(x)
0
5
10
15
-4
-2
0
2
4
x

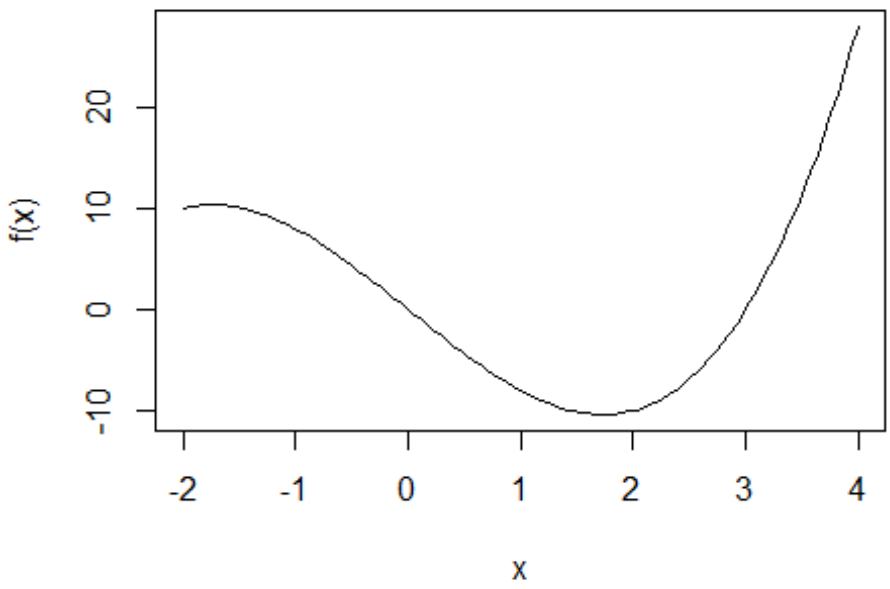

iteration
12
f(x)
0
5
10
15
-4
-2
0
2
4
x


iteration
14
f(x)
0
5
10
15
-4
-2
0
2
4
x

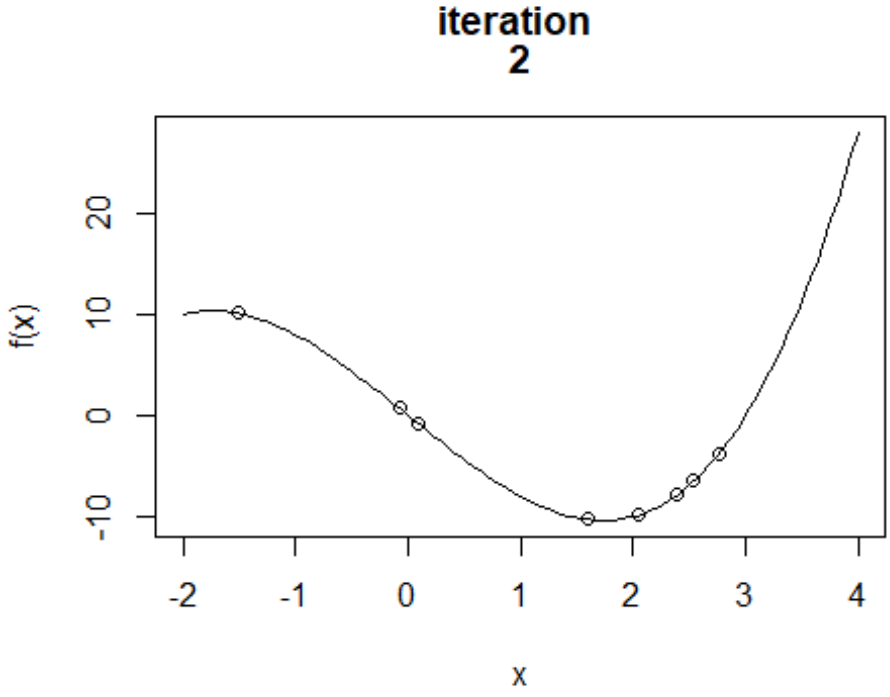

iteration
16
f(x)
0
5
10
15
-4
-2
0
2
4
x

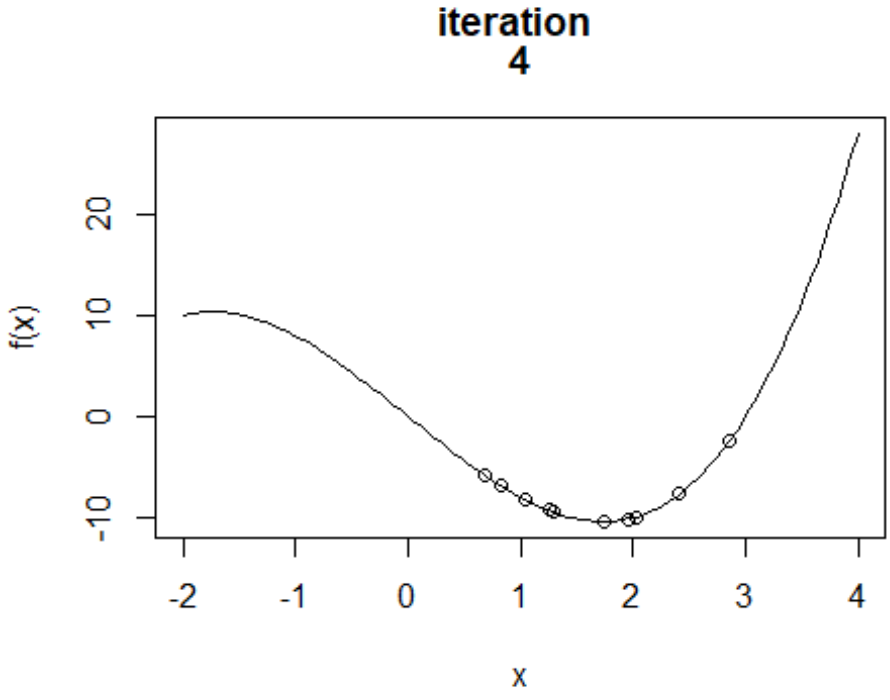


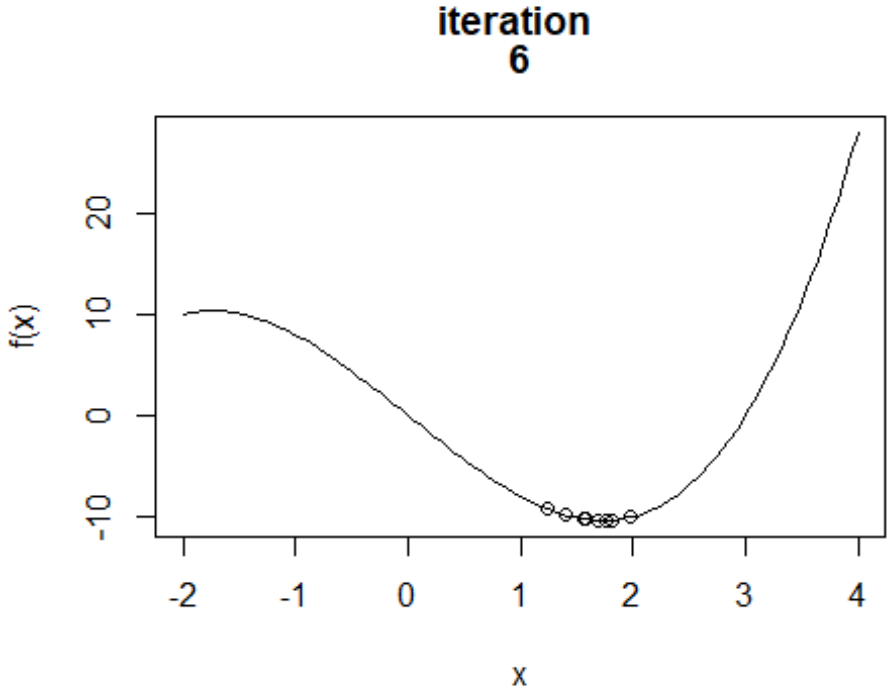

```
## best x value:  -8.493187e-17
## minimum:  7.213423e-33

#more complex function
f <- function(x){
  return(x^3 - 9*x)
}
curve(f,-2,4)
```

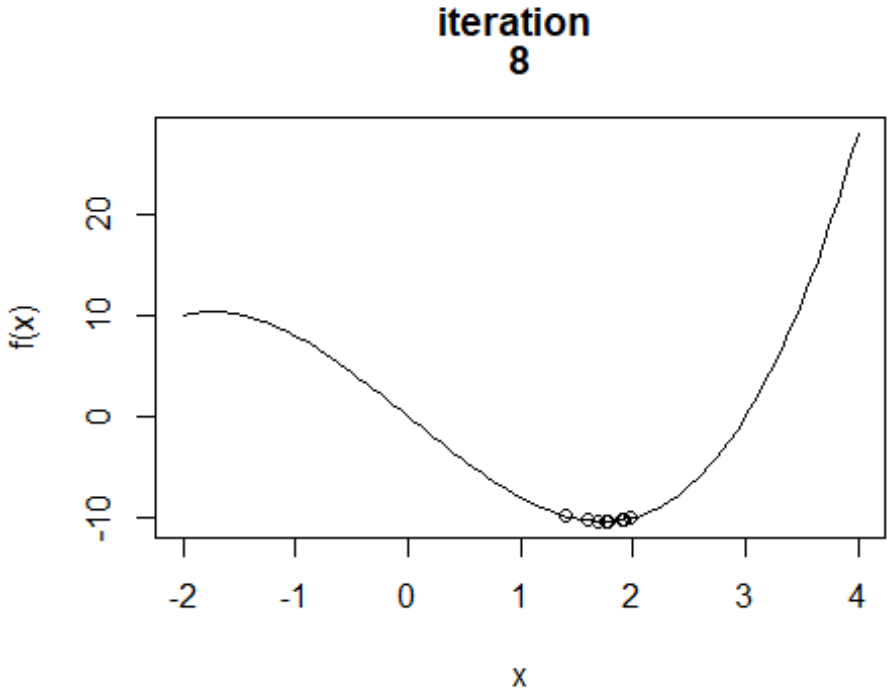


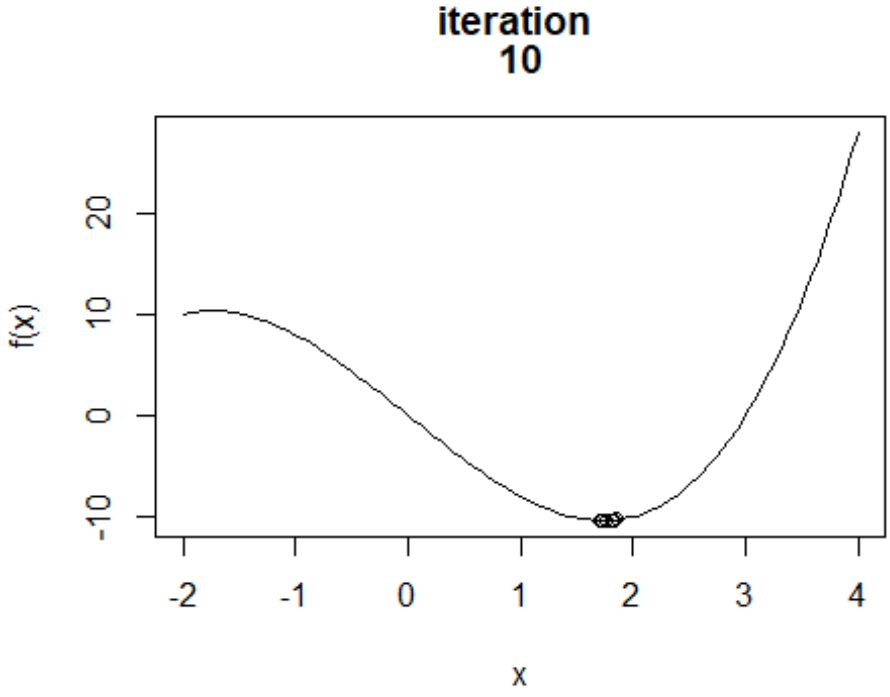

```
swarm(10,-2,4,.5,.5,.5)
```

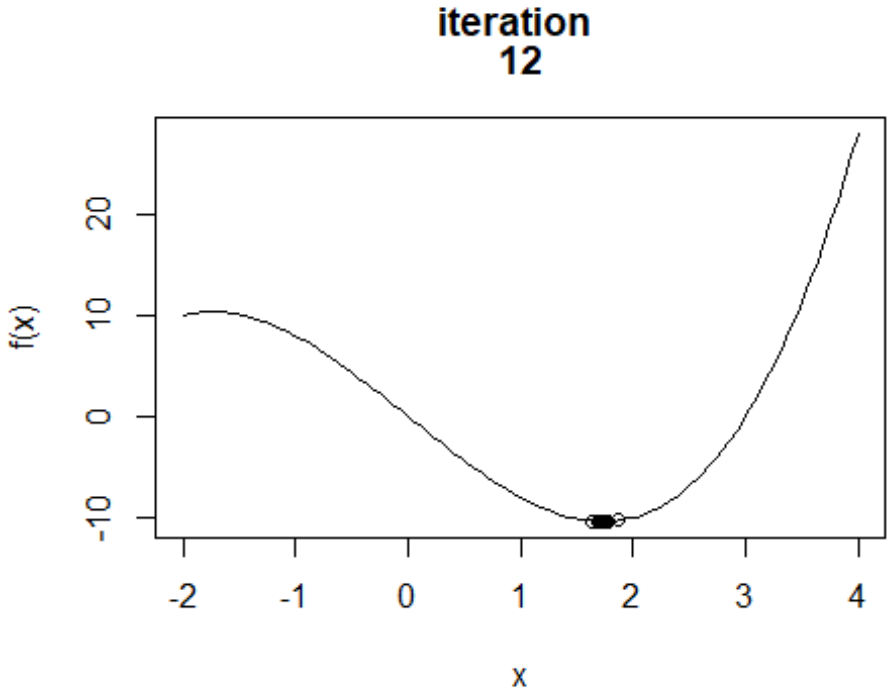

iteration
2
f(x)
20
10
0
-10
-2
-1
0
1
2
3
4
x

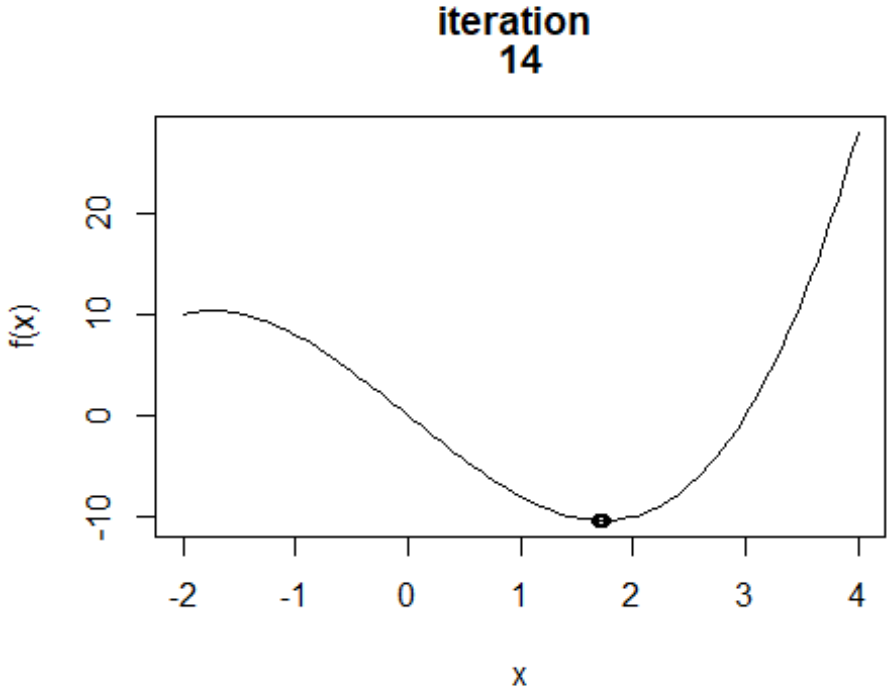

iteration
4
f(x)
20
10
0
-10
-2
-1
0
1
2
3
4
x

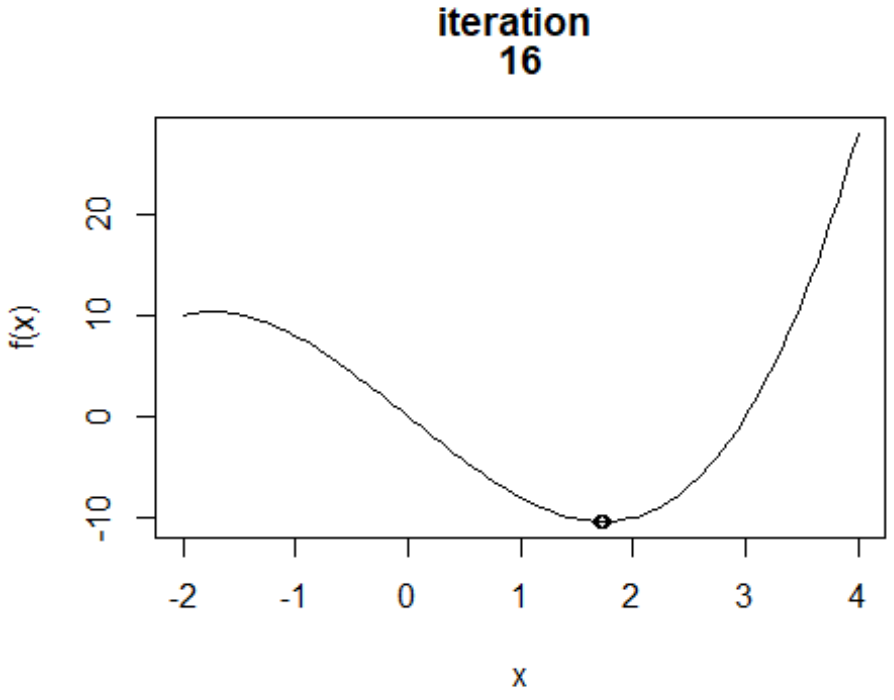

iteration
6
f(x)
20
10
0
-10
-2
-1
0
1
2
3
4
x

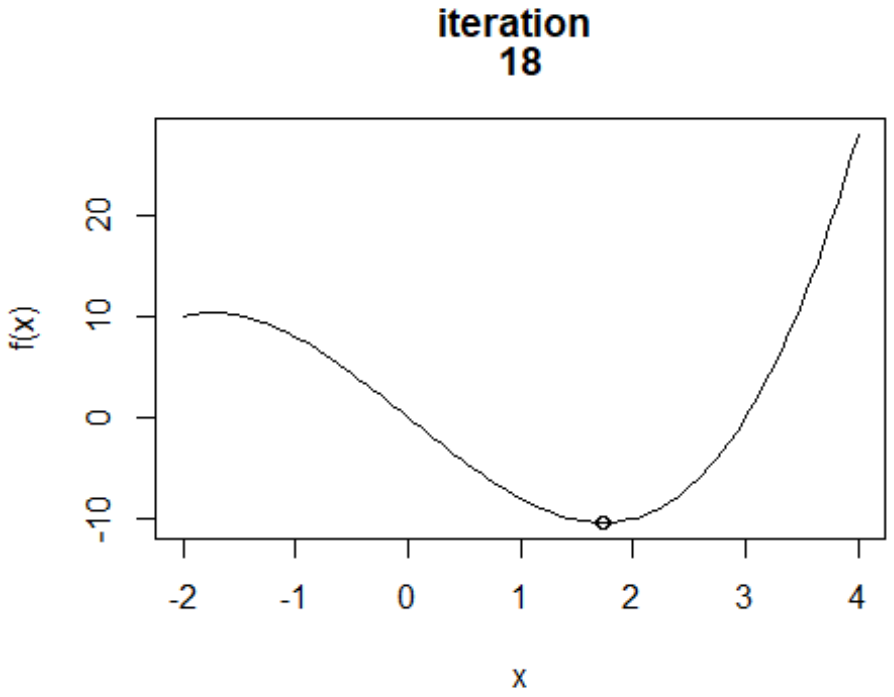

iteration
8
f(x)
20
10
0
-10
-2
-1
0
1
2
3
4
x


iteration
10
f(x)
20
10
0
-10
-2
-1
0
1
2
3
4
x


iteration
12
f(x)
20
10
0
-10
-2
-1
0
1
2
3
4
x


iteration
14
f(x)
20
10
0
-10
-2
-1
0
1
2
3
4
x


iteration
16
f(x)
20
10
0
-10
-2
-1
0
1
2
3
4
x




```
## best x value:  1.732051
## minimum:  -10.3923
```