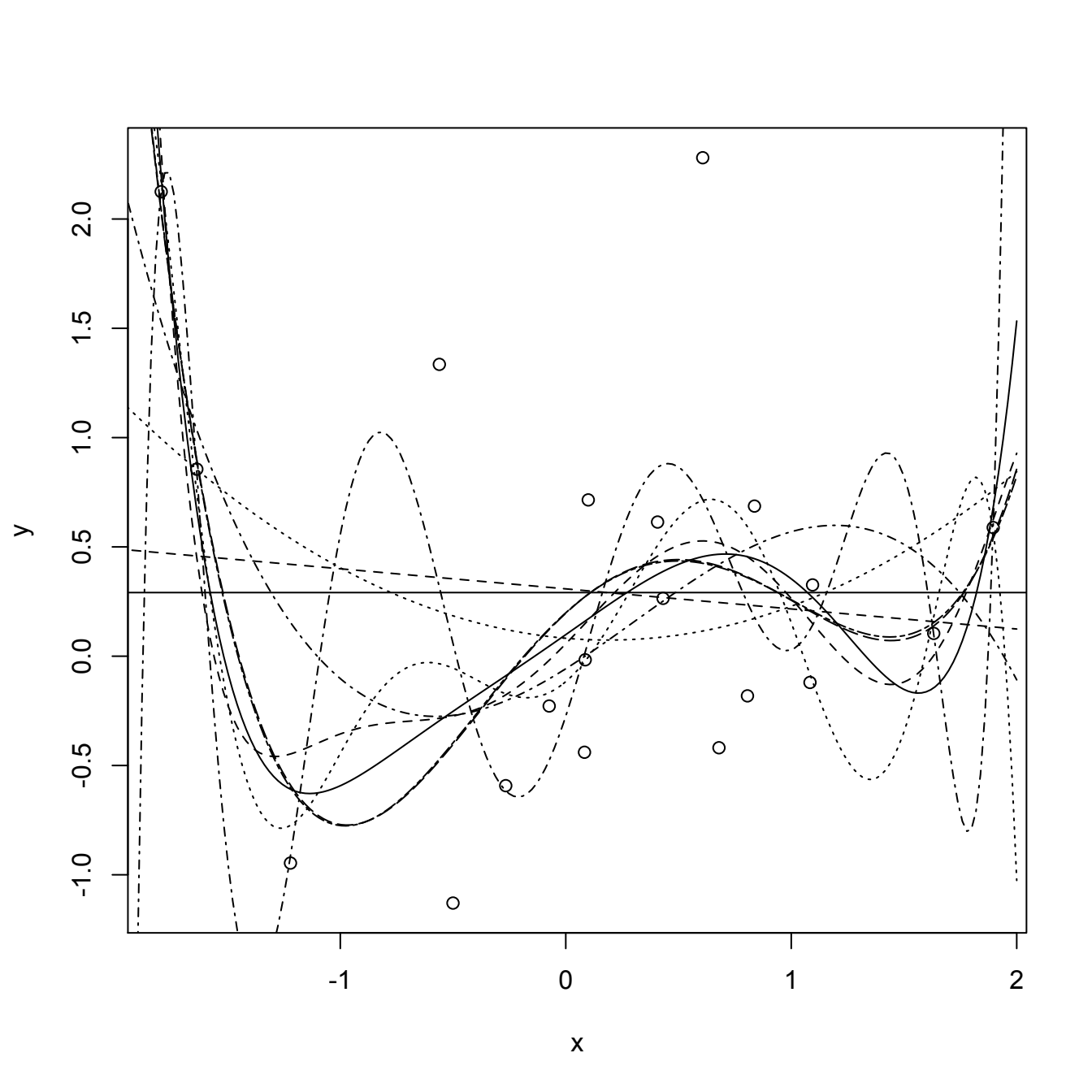
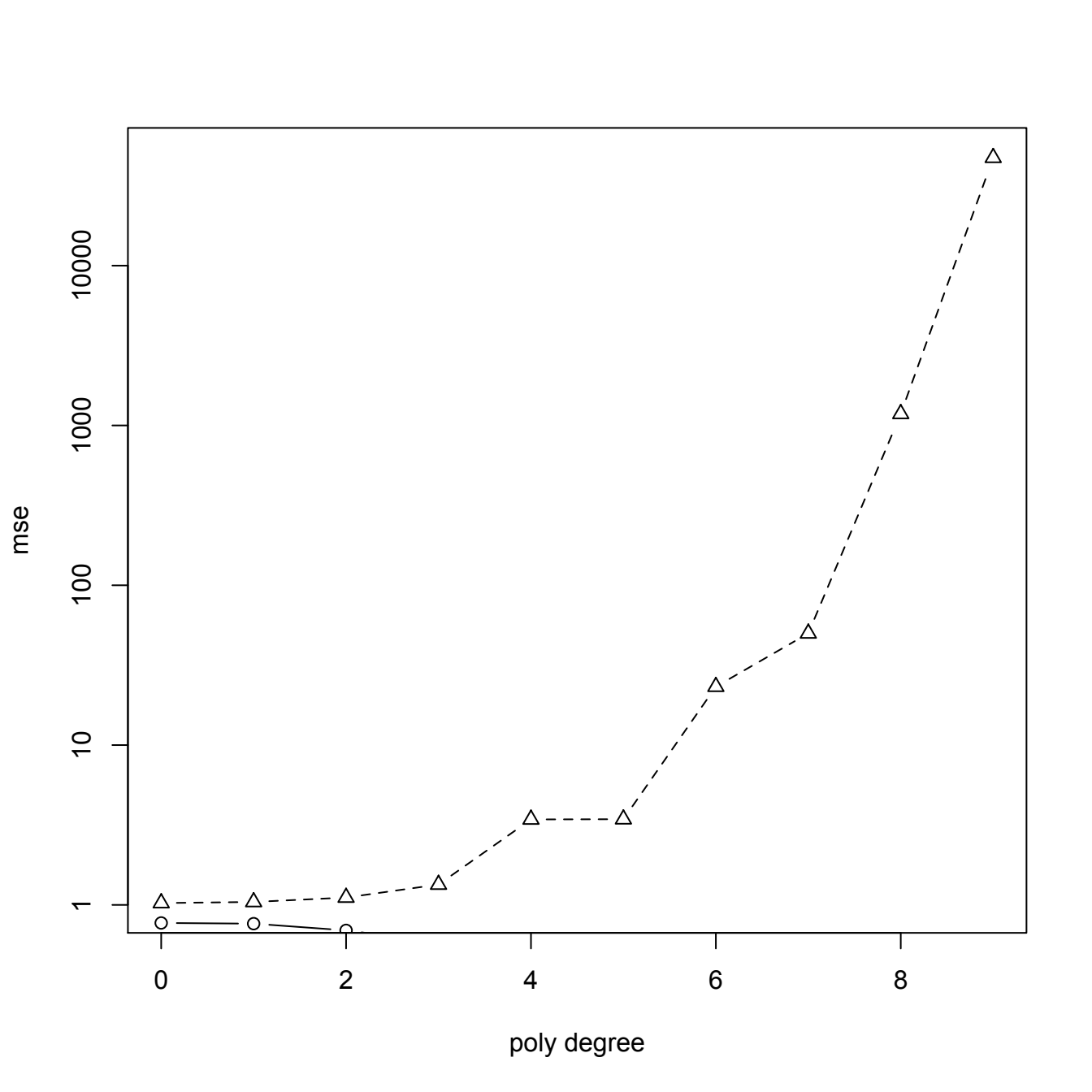
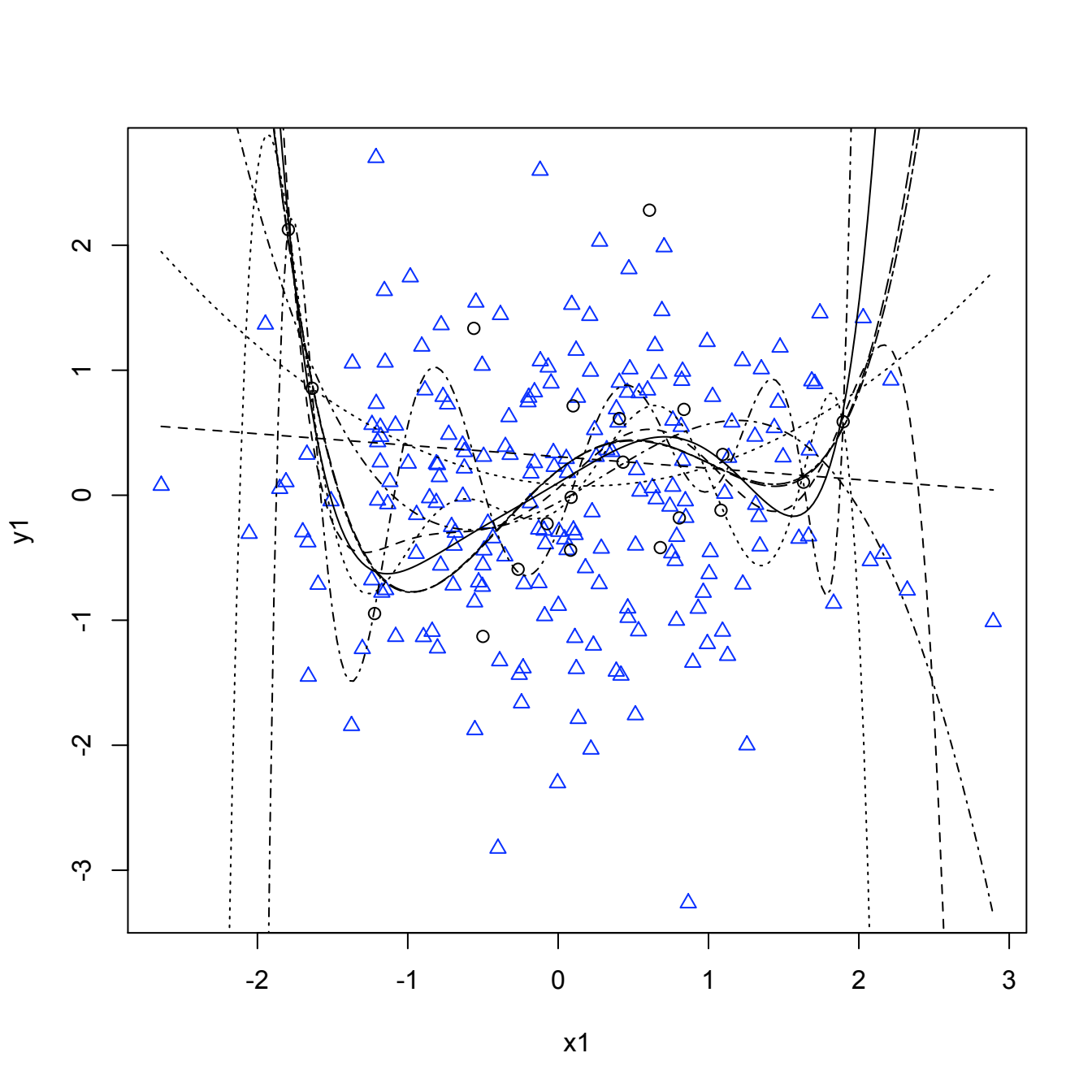
```
## some fake regression data
x = rnorm(20)
y = rnorm(20)
plot(x,y)
y.0 = lm(y ~ 1)
abline(h=y.0$coef[1])
d = seq(-2,2,length=200)

## polynomial fits
for(degree in 1:9){
   fm = lm(y ~ poly(x,degree))
   assign(paste("y",degree,sep="."),fm)
   lines(d,predict(fm,data.frame(x=d)),lty=(degree+1))
   }

## mean squared error in training data
mse = vector(length=10)
for(degree in 0:9){
   fm = get(paste("y",degree,sep="."))
   mse[degree+1]= mean(summary(fm)$residuals^2)
   }
plot(0:9,mse,type="b",xlab="polynomial degree",
ylab="mse")

## some new data from the same model

x1 = rnorm(200); y1=rnorm(200)

## mean squared error on predictions
mse2 = vector(length=10)
for(degree in 0:9){
   fm = get(paste("y",degree,sep="."))
   mse2[degree+1]= mean((predict(fm,data.frame(x=x1))-
y1)^2)
   }
```

```r
plot(0:9, mse2, type="b", xlab="poly degree", ylab="mse",
log="y",pch=2,lty=2)

points(0:9,mse,type="b")

## comparison of new and old data
## (out of sample error)

plot(x1,y1,pch=2,col="blue")
points(x,y)
d1=seq(min(x1),max(x1),length=200)
for(degree in 1:9){
   fm = lm(y ~ poly(x,degree))
   assign(paste("y",degree,sep="."),fm)
   lines(d,predict(fm,data.frame(x=d1)),lty=(degree+1))
   }

## some of the error is due to extrapolation
## try plotting mse1 and mse2 including only test points
## that fall within the original range of the x's
```


y
x
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1
0
1
2


mse
1
10
100
1000
10000
0
2
4
6
8
poly degree


y1
x1
-3
-2
-1
0
1
2
-2
-1
0
1
2
3