Homework 3 part 1

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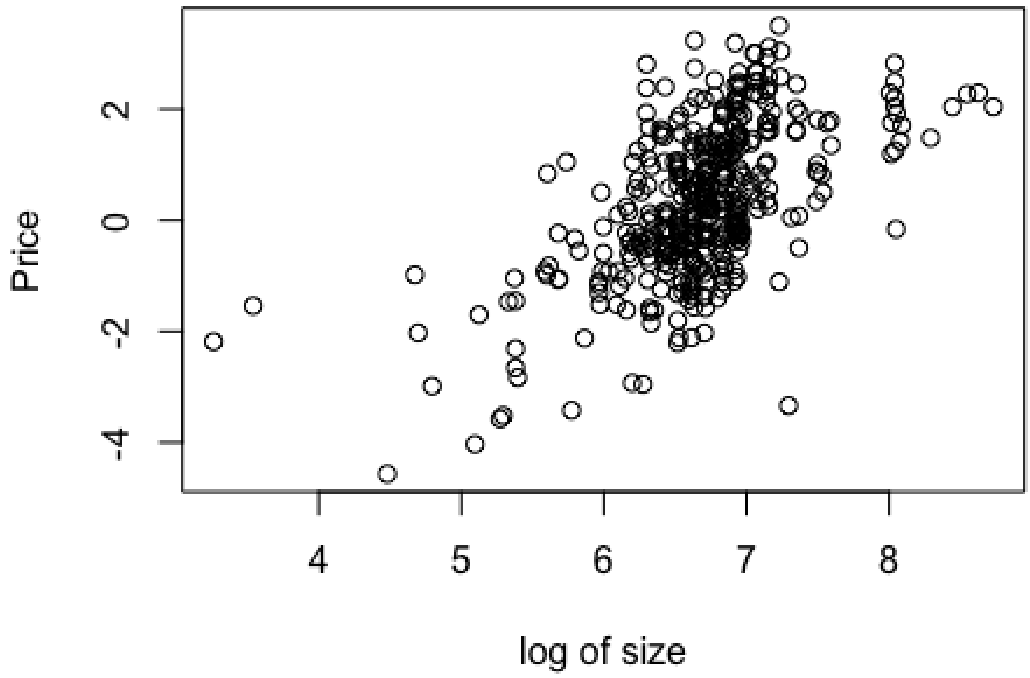
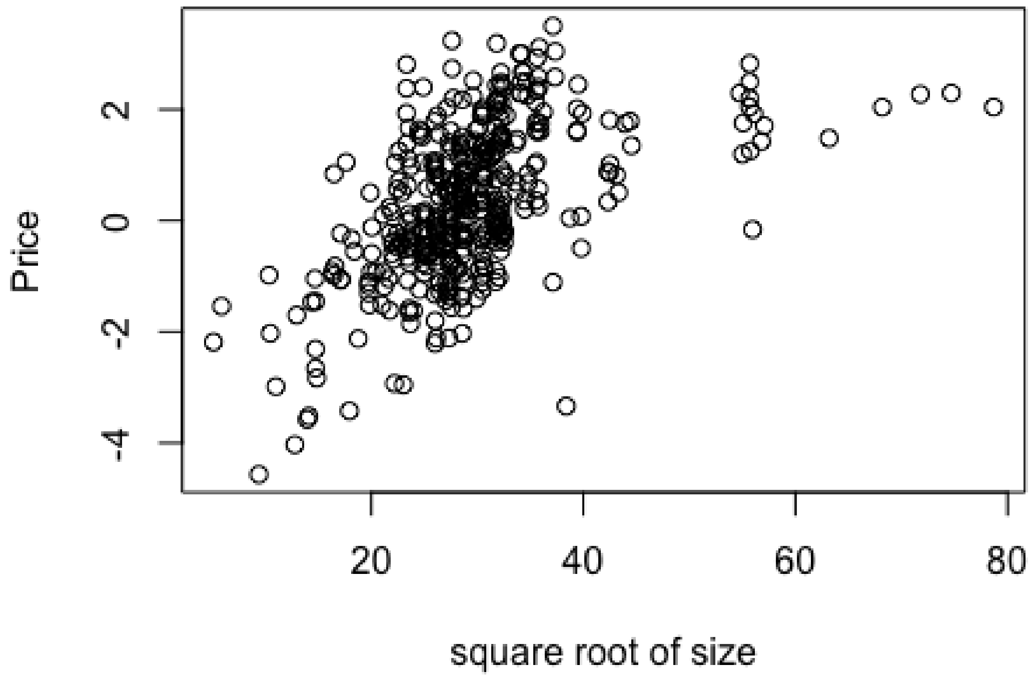
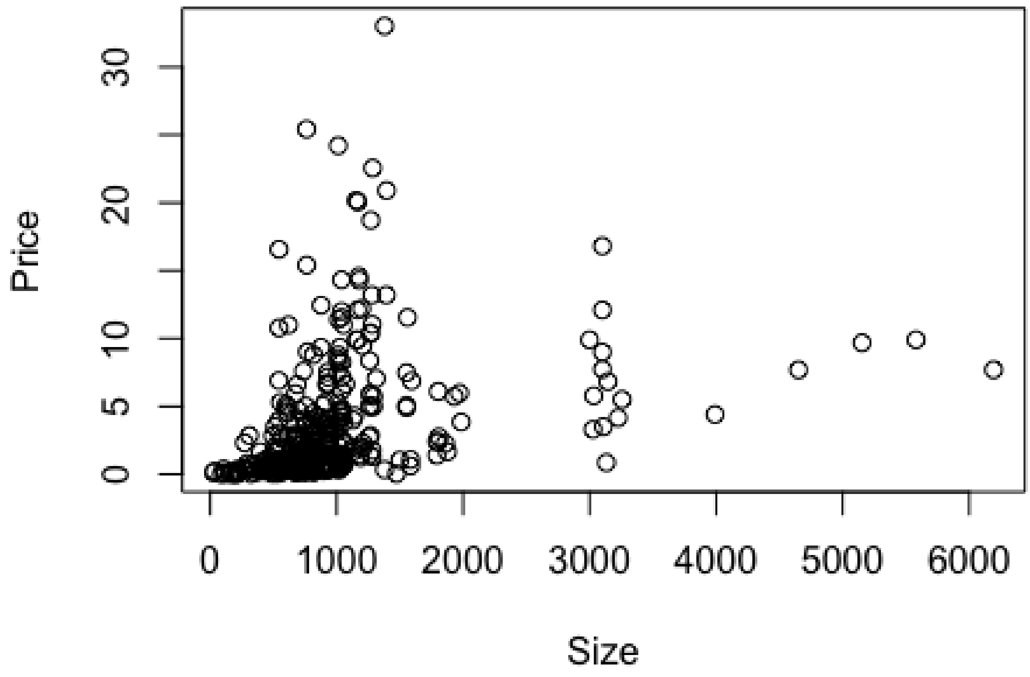
```
library(dplyr)

##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

library(ggplot2)
library(class)
library(caret)

## Loading required package: lattice

monet <- read.csv("~/Downloads/monet.csv")

cor(monet$WIDTH, monet$PRICE)

## [1] 0.3468806

monet$SIZE <- monet$HEIGHT*monet$WIDTH

cor(monet$PRICE, monet$SIZE)

## [1] 0.3472274

monet$logPRICE <- log(monet$PRICE)

monet$logSIZE <- log(monet$SIZE)


plot(monet$logSIZE, monet$logPRICE, xlab = "log of size", ylab = "Price")
```



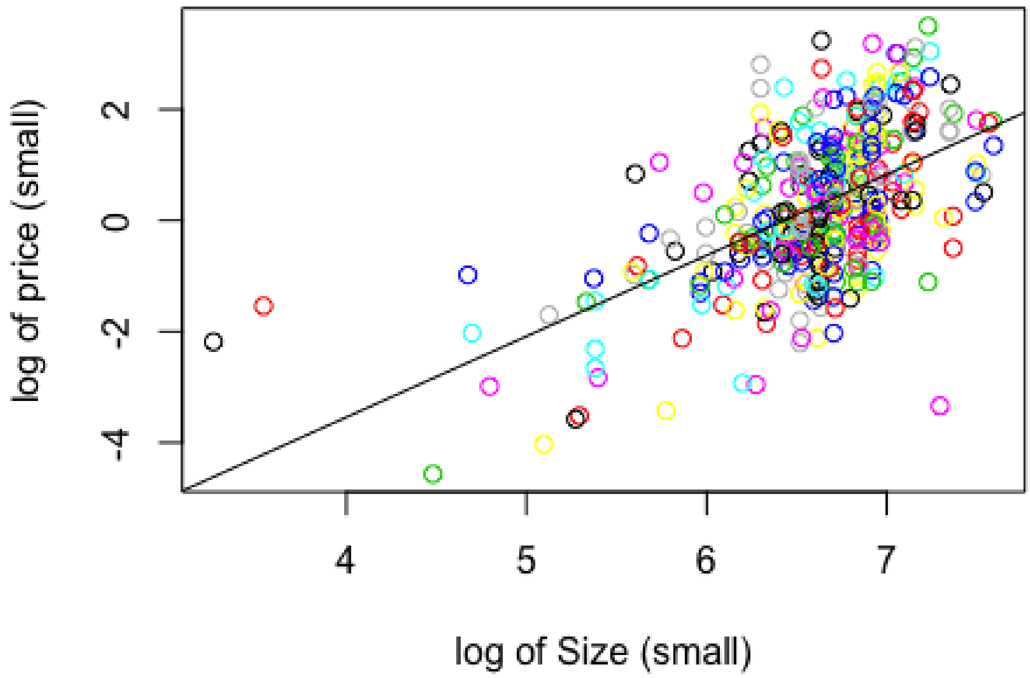
```
monet$sqrtSIZE <- sqrt(monet$SIZE)

plot(monet$sqrtSIZE, monet$logPRICE, xlab = "square root of size", ylab =
"Price")
```



```
plot(monet$SIZE, monet$PRICE, xlab = "Size", ylab = "Price")
```

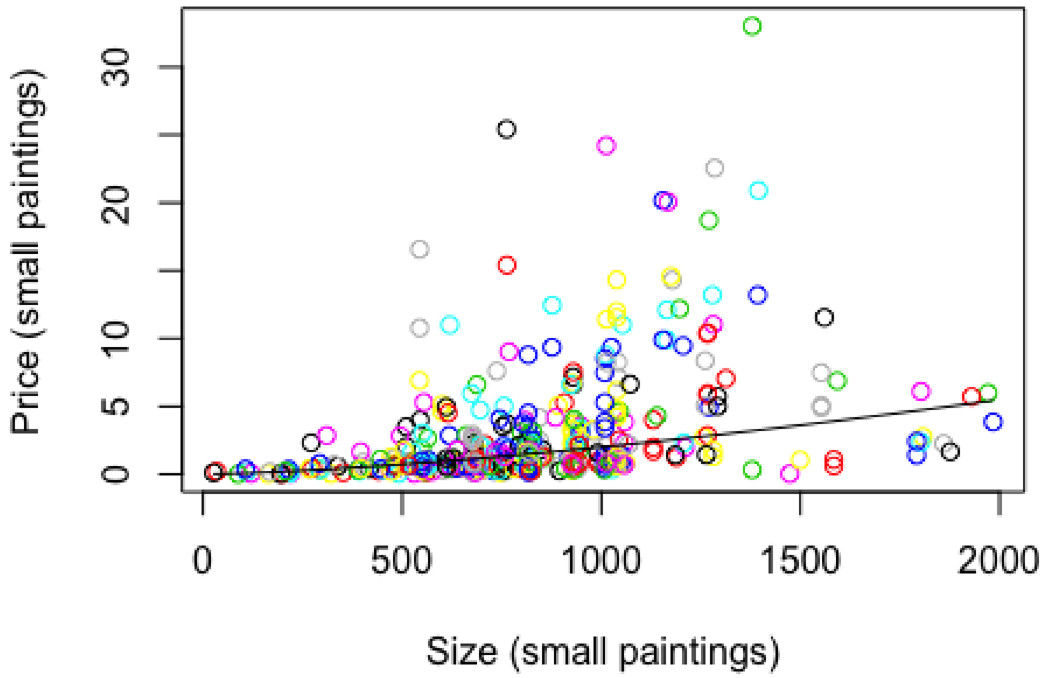


```
monetsmall <- monet %>% filter(SIZE < 2500)
model <- lm(monetsmall$logPRICE~ monetsmall$logSIZE)

a <- model$coefficients[1]
b <- model$coefficients[2]
plot(monetsmall$logSIZE, monetsmall$logPRICE, col =
as.factor(monetsmall$SIZE), xlab = "log of Size (small)", ylab = "log of
price (small)") + abline(model)
```



```
## integer(0)
```

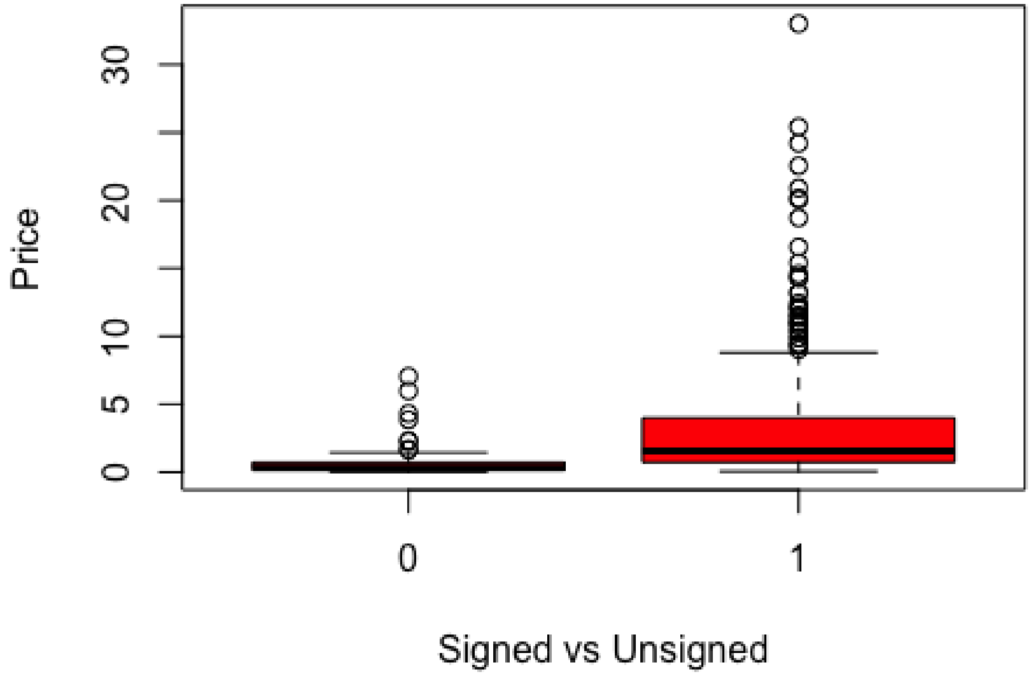
```
plot(monetsmall$SIZE, monetsmall$PRICE, col = as.factor(monetsmall$SIZE),
xlab = "Size (small paintings)", ylab = "Price (small paintings)")
curve(exp(a) * (x ** b), col = "black", add = TRUE)
```



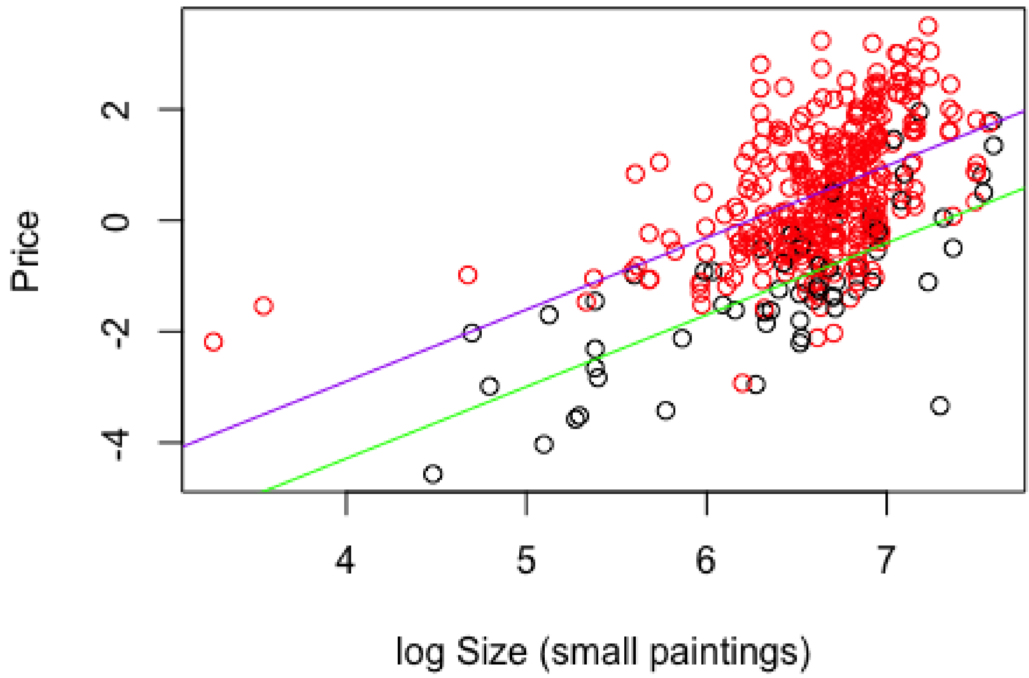
```
# plot(model, which = 1)



summary(model)

##
## Call:
## lm(formula = monetsmall$logPRICE ~ monetsmall$logSIZE)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.5947 -0.7198 -0.0454  0.7294  3.0006
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -9.3695     0.7120  -13.16   <2e-16 ***
## monetsmall$logSIZE   1.4567     0.1073   13.58   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.111 on 411 degrees of freedom
## Multiple R-squared:  0.3097, Adjusted R-squared:  0.308
## F-statistic: 184.4 on 1 and 411 DF,  p-value: < 2.2e-16
```

This model is not very good, given it has an R^2 score of around .30. Typically, a well fitting model would have an R^2 score of above .90, so we have room to improve our model.

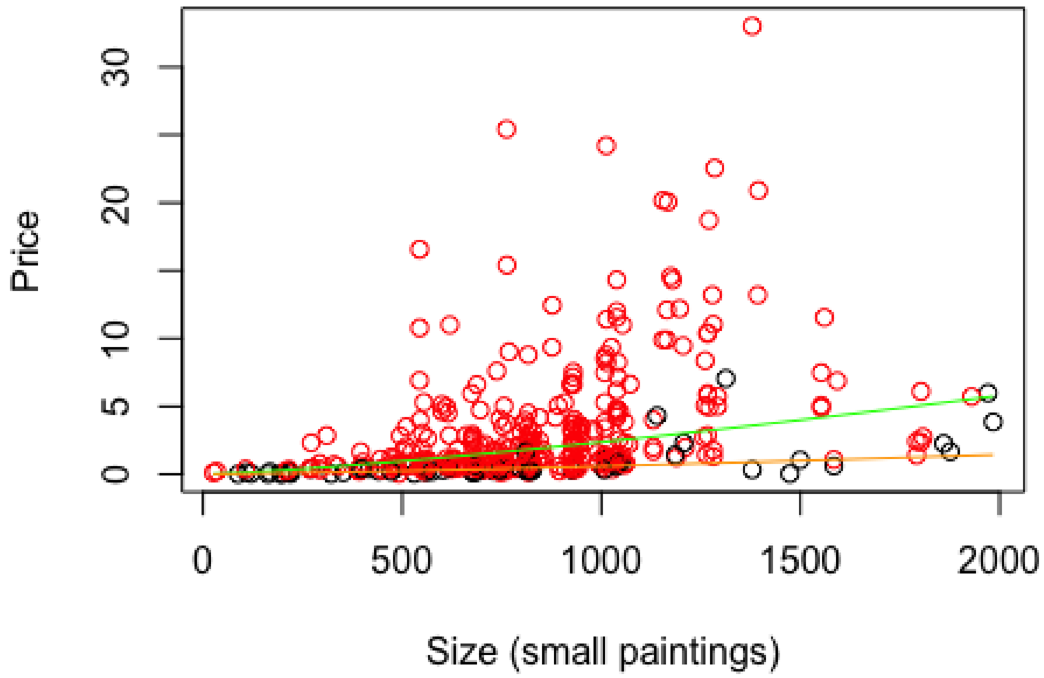
```
modelcomplex <- lm(monetsmall$logPRICE~ monetsmall$logSIZE + 
monetsmall$SIGNED)


a1 <- modelcomplex$coefficients[1]
b1 <- modelcomplex$coefficients[2]
dummy <- modelcomplex$coefficients[3]

boxplot(monetsmall$PRICE ~ monetsmall$SIGNED, col = 
as.factor(monetsmall$SIGNED), xlab = "Signed vs Unsigned", ylab = "Price")
```



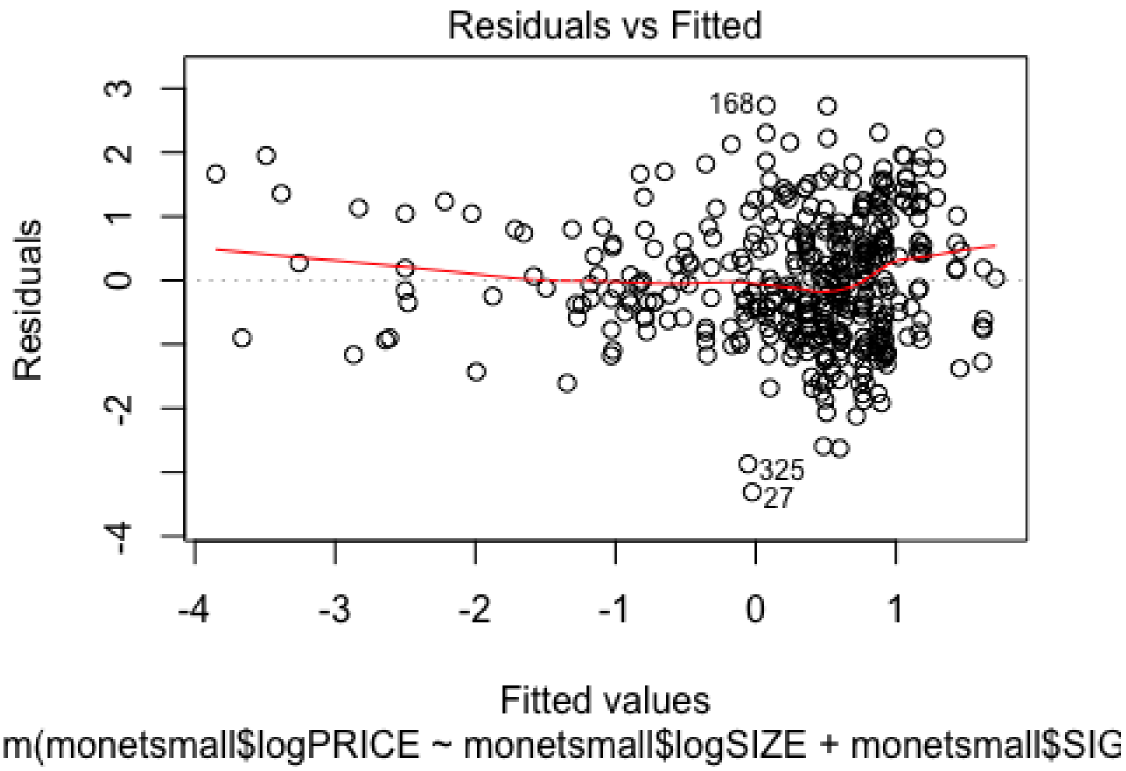
```
plot(monetsmall$logSIZE, monetsmall$logPRICE, col = 
as.factor(monetsmall$SIGNED), xlab = "log Size (small paintings)", ylab = 
"Price")
abline(a1 + dummy, b1, col = "purple" )
abline(a1, b1, col = "green")
```



```
plot(monetsmall$SIZE, monetsmall$PRICE, col = as.factor(monetsmall$SIGNED),
xlab = "Size (small paintings)", ylab = "Price")
curve(exp(a1 +dummy) * (x ** b1), col = "green", add = TRUE)
curve(exp(a1) * (x ** b1), col = "orange", add = TRUE)
```



```
plot(modelcomplex, which = 1)
```



```
summary(modelcomplex)

##
## Call:
## lm(formula = monetsmall$logPRICE ~ monetsmall$logSIZE + monetsmall$SIGNED)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.3111 -0.7461 -0.0872  0.6604  2.7333
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -9.45607    0.63791  -14.82   <2e-16 ***
## monetsmall$logSIZE  1.29263    0.09746   13.26   <2e-16 ***
## monetsmall$SIGNED   1.38753    0.13728   10.11   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.9955 on 410 degrees of freedom
## Multiple R-squared:  0.4474, Adjusted R-squared:  0.4447
## F-statistic:   166 on 2 and 410 DF,  p-value: < 2.2e-16
```

Summary on Multiple regression:

The multiple regression has a better fit than the single regression with an R squared score of .4474. The best model for small painting seems to be a double log transformation. The original, non transformed data is highly skewed and follows no real pattern. By taking the log of both independent and dependent variable, we end up getting a more normally distributed set, so running linear regressions is much more straight forward.