Evidencia 3

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2022-10-31

```
df <- read.csv('precios_autos.csv')
str(df)
```

```
## 'data.frame':    205 obs. of  21 variables:
##  $ symboling       : int  3 3 1 2 2 2 1 1 1 0 ...
##  $ CarName         : chr  "alfa-romero giulia" "alfa-romero stelvio" "alfa-romero Quadrifoglio" "aud:
##  $ fueltype        : chr  "gas" "gas" "gas" "gas" ...
##  $ carbody         : chr  "convertible" "convertible" "hatchback" "sedan" ...
##  $ drivewheel      : chr  "rwd" "rwd" "rwd" "fwd" ...
##  $ enginelocation  : chr  "front" "front" "front" "front" ...
##  $ wheelbase       : num  88.6 88.6 94.5 99.8 99.4 ...
##  $ carlength       : num  169 169 171 177 177 ...
##  $ carwidth        : num  64.1 64.1 65.5 66.2 66.4 66.3 71.4 71.4 71.4 67.9 ...
##  $ carheight       : num  48.8 48.8 52.4 54.3 54.3 53.1 55.7 55.7 55.9 52 ...
##  $ curbweight      : int  2548 2548 2823 2337 2824 2507 2844 2954 3086 3053 ...
##  $ enginetype      : chr  "dohc" "dohc" "ohcv" "ohc" ...
##  $ cylindernumber  : chr  "four" "four" "six" "four" ...
##  $ enginesize      : int  130 130 152 109 136 136 136 136 131 131 ...
##  $ stroke          : num  2.68 2.68 3.47 3.4 3.4 3.4 3.4 3.4 3.4 3.4 ...
##  $ compressionratio: num  9 9 9 10 8 8.5 8.5 8.5 8.3 7 ...
##  $ horsepower      : int  111 111 154 102 115 110 110 110 140 160 ...
##  $ peakrpm         : int  5000 5000 5000 5500 5500 5500 5500 5500 5500 5500 ...
##  $ citympg         : int  21 21 19 24 18 19 19 19 17 16 ...
##  $ highwaympg      : int  27 27 26 30 22 25 25 25 20 22 ...
##  $ price           : num  13495 16500 16500 13950 17450 ...
```

```
library(readxl)
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(GGally)
```

```
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg   ggplot2
```

```
library(Hmisc)
```

```
## Loading required package: lattice
```

```
## Loading required package: survival
```

```
## Loading required package: Formula
```

```
##
## Attaching package: 'Hmisc'
```

```
## The following objects are masked from 'package:dplyr':
##
##     src, summarize
```

```
## The following objects are masked from 'package:base':
##
##     format.pval, units
```

```
library(corrplot)
```

```
## corrplot 0.92 loaded
```

```
library(PerformanceAnalytics)
```

```
## Loading required package: xts
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
##
## Attaching package: 'xts'
```

```
## The following objects are masked from 'package:dplyr':
##
##     first, last
```

```
##
## Attaching package: 'PerformanceAnalytics'


## The following object is masked from 'package:graphics':
##
##     legend
```

```
cuantitativas <- df[c(1,7,8,9,10,11,14,15,16,17,18,19,20,21)]
rcorr(as.matrix(cuantitativas))
```

```
##                 symboling wheelbase carlength carwidth carheight curbweight
## symboling            1.00     -0.53     -0.36    -0.23     -0.54      -0.23
## wheelbase           -0.53      1.00      0.87     0.80      0.59       0.78
## carlength           -0.36      0.87      1.00     0.84      0.49       0.88
## carwidth            -0.23      0.80      0.84     1.00      0.28       0.87
## carheight           -0.54      0.59      0.49     0.28      1.00       0.30
## curbweight          -0.23      0.78      0.88     0.87      0.30       1.00
## enginesize          -0.11      0.57      0.68     0.74      0.07       0.85
## stroke              -0.01      0.16      0.13     0.18     -0.06       0.17
## compressionratio    -0.18      0.25      0.16     0.18      0.26       0.15
## horsepower           0.07      0.35      0.55     0.64     -0.11       0.75
## peakrpm              0.27     -0.36     -0.29    -0.22     -0.32      -0.27
## citympg             -0.04     -0.47     -0.67    -0.64     -0.05      -0.76
## highwaympg           0.03     -0.54     -0.70    -0.68     -0.11      -0.80
## price               -0.08      0.58      0.68     0.76      0.12       0.84
##                 enginesize stroke compressionratio horsepower peakrpm citympg
## symboling            -0.11  -0.01            -0.18       0.07    0.27   -0.04
## wheelbase             0.57   0.16             0.25       0.35   -0.36   -0.47
## carlength             0.68   0.13             0.16       0.55   -0.29   -0.67
## carwidth              0.74   0.18             0.18       0.64   -0.22   -0.64
## carheight             0.07  -0.06             0.26      -0.11   -0.32   -0.05
## curbweight            0.85   0.17             0.15       0.75   -0.27   -0.76
## enginesize            1.00   0.20             0.03       0.81   -0.24   -0.65
## stroke                0.20   1.00             0.19       0.08   -0.07   -0.04
## compressionratio      0.03   0.19             1.00      -0.20   -0.44    0.32
## horsepower            0.81   0.08            -0.20       1.00    0.13   -0.80
## peakrpm              -0.24  -0.07            -0.44       0.13    1.00   -0.11
## citympg              -0.65  -0.04             0.32      -0.80   -0.11    1.00
## highwaympg           -0.68  -0.04             0.27      -0.77   -0.05    0.97
## price                 0.87   0.08             0.07       0.81   -0.09   -0.69
##                 highwaympg price
## symboling             0.03 -0.08
## wheelbase            -0.54  0.58
## carlength            -0.70  0.68
## carwidth             -0.68  0.76
## carheight            -0.11  0.12
## curbweight           -0.80  0.84
## enginesize           -0.68  0.87
## stroke               -0.04  0.08
## compressionratio      0.27  0.07
## horsepower           -0.77  0.81
## peakrpm              -0.05 -0.09
## citympg               0.97 -0.69
```

```
## highwaympg              1.00 -0.70
## price                  -0.70  1.00
##
## n= 205
##
##
## P
##              symboling wheelbase carlength carwidth carheight curbweight
## symboling               0.0000    0.0000    0.0008   0.0000    0.0010
## wheelbase    0.0000               0.0000    0.0000   0.0000    0.0000
## carlength    0.0000    0.0000               0.0000   0.0000    0.0000
## carwidth     0.0008    0.0000    0.0000              0.0000    0.0000
## carheight    0.0000    0.0000    0.0000    0.0000              0.0000
## curbweight   0.0010    0.0000    0.0000    0.0000   0.0000
## enginesize   0.1311    0.0000    0.0000    0.0000   0.3388    0.0000
## stroke       0.9011    0.0211    0.0642    0.0087   0.4309    0.0155
## compressionratio 0.0104 0.0003   0.0233    0.0093   0.0002    0.0303
## horsepower   0.3126    0.0000    0.0000    0.0000   0.1204    0.0000
## peakrpm      0.0000    0.0000    0.0000    0.0015   0.0000    0.0001
## citympg      0.6101    0.0000    0.0000    0.0000   0.4886    0.0000
## highwaympg   0.6223    0.0000    0.0000    0.0000   0.1255    0.0000
## price        0.2543    0.0000    0.0000    0.0000   0.0883    0.0000
##              enginesize stroke compressionratio horsepower peakrpm citympg
## symboling    0.1311     0.9011 0.0104              0.3126   0.0000  0.6101
## wheelbase    0.0000     0.0211 0.0003              0.0000   0.0000  0.0000
## carlength    0.0000     0.0642 0.0233              0.0000   0.0000  0.0000
## carwidth     0.0000     0.0087 0.0093              0.0000   0.0015  0.0000
## carheight    0.3388     0.4309 0.0002              0.1204   0.0000  0.4886
## curbweight   0.0000     0.0155 0.0303              0.0000   0.0001  0.0000
## enginesize              0.0035 0.6801              0.0000   0.0004  0.0000
## stroke       0.0035            0.0075              0.2486   0.3329  0.5485
## compressionratio 0.6801 0.0075                     0.0033   0.0000  0.0000
## horsepower   0.0000     0.2486 0.0033                       0.0610  0.0000
## peakrpm      0.0004     0.3329 0.0000              0.0610           0.1050
## citympg      0.0000     0.5485 0.0000              0.0000   0.1050
## highwaympg   0.0000     0.5317 0.0001              0.0000   0.4396  0.0000
## price        0.0000     0.2575 0.3328              0.0000   0.2241  0.0000
##              highwaympg price
## symboling    0.6223     0.2543
## wheelbase    0.0000     0.0000
## carlength    0.0000     0.0000
## carwidth     0.0000     0.0000
## carheight    0.1255     0.0883
## curbweight   0.0000     0.0000
## enginesize   0.0000     0.0000
## stroke       0.5317     0.2575
## compressionratio 0.0001 0.3328
## horsepower   0.0000     0.0000
## peakrpm      0.4396     0.2241
## citympg      0.0000     0.0000
## highwaympg              0.0000
## price        0.0000
```

```
round(cor(cuantitativas),2)
```

```
##                symboling wheelbase carlength carwidth carheight curbweight
## symboling           1.00     -0.53     -0.36    -0.23     -0.54      -0.23
## wheelbase          -0.53      1.00      0.87     0.80      0.59       0.78
## carlength          -0.36      0.87      1.00     0.84      0.49       0.88
## carwidth           -0.23      0.80      0.84     1.00      0.28       0.87
## carheight          -0.54      0.59      0.49     0.28      1.00       0.30
## curbweight         -0.23      0.78      0.88     0.87      0.30       1.00
## enginesize         -0.11      0.57      0.68     0.74      0.07       0.85
## stroke             -0.01      0.16      0.13     0.18     -0.06       0.17
## compressionratio   -0.18      0.25      0.16     0.18      0.26       0.15
## horsepower          0.07      0.35      0.55     0.64     -0.11       0.75
## peakrpm             0.27     -0.36     -0.29    -0.22     -0.32      -0.27
## citympg            -0.04     -0.47     -0.67    -0.64     -0.05      -0.76
## highwaympg          0.03     -0.54     -0.70    -0.68     -0.11      -0.80
## price              -0.08      0.58      0.68     0.76      0.12       0.84
##                enginesize stroke compressionratio horsepower peakrpm citympg
## symboling           -0.11  -0.01            -0.18       0.07    0.27   -0.04
## wheelbase            0.57   0.16             0.25       0.35   -0.36   -0.47
## carlength            0.68   0.13             0.16       0.55   -0.29   -0.67
## carwidth             0.74   0.18             0.18       0.64   -0.22   -0.64
## carheight            0.07  -0.06             0.26      -0.11   -0.32   -0.05
## curbweight           0.85   0.17             0.15       0.75   -0.27   -0.76
## enginesize           1.00   0.20             0.03       0.81   -0.24   -0.65
## stroke               0.20   1.00             0.19       0.08   -0.07   -0.04
## compressionratio     0.03   0.19             1.00      -0.20   -0.44    0.32
## horsepower           0.81   0.08            -0.20       1.00    0.13   -0.80
## peakrpm             -0.24  -0.07            -0.44       0.13    1.00   -0.11
## citympg             -0.65  -0.04             0.32      -0.80   -0.11    1.00
## highwaympg          -0.68  -0.04             0.27      -0.77   -0.05    0.97
## price                0.87   0.08             0.07       0.81   -0.09   -0.69
##                highwaympg price
## symboling            0.03 -0.08
## wheelbase           -0.54  0.58
## carlength           -0.70  0.68
## carwidth            -0.68  0.76
## carheight           -0.11  0.12
## curbweight          -0.80  0.84
## enginesize          -0.68  0.87
## stroke              -0.04  0.08
## compressionratio     0.27  0.07
## horsepower          -0.77  0.81
## peakrpm             -0.05 -0.09
## citympg              0.97 -0.69
## highwaympg           1.00 -0.70
## price               -0.70  1.00
```

```
rcorr(as.matrix(cuantitativas))
```

```
##                symboling wheelbase carlength carwidth carheight curbweight
## symboling           1.00     -0.53     -0.36    -0.23     -0.54      -0.23
## wheelbase          -0.53      1.00      0.87     0.80      0.59       0.78
```

```
## carlength            -0.36     0.87      1.00      0.84      0.49      0.88
## carwidth             -0.23     0.80      0.84      1.00      0.28      0.87
## carheight            -0.54     0.59      0.49      0.28      1.00      0.30
## curbweight           -0.23     0.78      0.88      0.87      0.30      1.00
## enginesize           -0.11     0.57      0.68      0.74      0.07      0.85
## stroke               -0.01     0.16      0.13      0.18     -0.06      0.17
## compressionratio     -0.18     0.25      0.16      0.18      0.26      0.15
## horsepower            0.07     0.35      0.55      0.64     -0.11      0.75
## peakrpm               0.27    -0.36     -0.29     -0.22     -0.32     -0.27
## citympg              -0.04    -0.47     -0.67     -0.64     -0.05     -0.76
## highwaympg            0.03    -0.54     -0.70     -0.68     -0.11     -0.80
## price                -0.08     0.58      0.68      0.76      0.12      0.84
##                enginesize stroke compressionratio horsepower peakrpm citympg
## symboling           -0.11  -0.01            -0.18       0.07    0.27   -0.04
## wheelbase            0.57   0.16             0.25       0.35   -0.36   -0.47
## carlength            0.68   0.13             0.16       0.55   -0.29   -0.67
## carwidth             0.74   0.18             0.18       0.64   -0.22   -0.64
## carheight            0.07  -0.06             0.26      -0.11   -0.32   -0.05
## curbweight           0.85   0.17             0.15       0.75   -0.27   -0.76
## enginesize           1.00   0.20             0.03       0.81   -0.24   -0.65
## stroke               0.20   1.00             0.19       0.08   -0.07   -0.04
## compressionratio     0.03   0.19             1.00      -0.20   -0.44    0.32
## horsepower           0.81   0.08            -0.20       1.00    0.13   -0.80
## peakrpm             -0.24  -0.07            -0.44       0.13    1.00   -0.11
## citympg             -0.65  -0.04             0.32      -0.80   -0.11    1.00
## highwaympg          -0.68  -0.04             0.27      -0.77   -0.05    0.97
## price                0.87   0.08             0.07       0.81   -0.09   -0.69
##                highwaympg price
## symboling            0.03 -0.08
## wheelbase           -0.54  0.58
## carlength           -0.70  0.68
## carwidth            -0.68  0.76
## carheight           -0.11  0.12
## curbweight          -0.80  0.84
## enginesize          -0.68  0.87
## stroke              -0.04  0.08
## compressionratio     0.27  0.07
## horsepower          -0.77  0.81
## peakrpm             -0.05 -0.09
## citympg              0.97 -0.69
## highwaympg           1.00 -0.70
## price               -0.70  1.00
##
## n= 205
##
##
## P
##               symboling wheelbase carlength carwidth carheight curbweight
## symboling               0.0000    0.0000    0.0008   0.0000    0.0010
## wheelbase     0.0000               0.0000    0.0000   0.0000    0.0000
## carlength     0.0000    0.0000               0.0000   0.0000    0.0000
## carwidth      0.0008    0.0000    0.0000              0.0000    0.0000
## carheight     0.0000    0.0000    0.0000    0.0000             0.0000
## curbweight    0.0010    0.0000    0.0000    0.0000   0.0000
```

```
## enginesize        0.1311    0.0000    0.0000    0.0000    0.3388    0.0000
## stroke            0.9011    0.0211    0.0642    0.0087    0.4309    0.0155
## compressionratio  0.0104    0.0003    0.0233    0.0093    0.0002    0.0303
## horsepower        0.3126    0.0000    0.0000    0.0000    0.1204    0.0000
## peakrpm           0.0000    0.0000    0.0000    0.0015    0.0000    0.0001
## citympg           0.6101    0.0000    0.0000    0.0000    0.4886    0.0000
## highwaympg        0.6223    0.0000    0.0000    0.0000    0.1255    0.0000
## price             0.2543    0.0000    0.0000    0.0000    0.0883    0.0000
##                   enginesize stroke compressionratio horsepower peakrpm citympg
## symboling         0.1311     0.9011 0.0104                      0.3126  0.0000 0.6101
## wheelbase         0.0000     0.0211 0.0003                      0.0000  0.0000 0.0000
## carlength         0.0000     0.0642 0.0233                      0.0000  0.0000 0.0000
## carwidth          0.0000     0.0087 0.0093                      0.0000  0.0015 0.0000
## carheight         0.3388     0.4309 0.0002                      0.1204  0.0000 0.4886
## curbweight        0.0000     0.0155 0.0303                      0.0000  0.0001 0.0000
## enginesize                   0.0035 0.6801                      0.0000  0.0004 0.0000
## stroke            0.0035            0.0075                      0.2486  0.3329 0.5485
## compressionratio 0.6801      0.0075                             0.0033  0.0000 0.0000
## horsepower        0.0000     0.2486 0.0033                              0.0610 0.0000
## peakrpm           0.0004     0.3329 0.0000                      0.0610         0.1050
## citympg           0.0000     0.5485 0.0000                      0.0000  0.1050
## highwaympg        0.0000     0.5317 0.0001                      0.0000  0.4396 0.0000
## price             0.0000     0.2575 0.3328                      0.0000  0.2241 0.0000
##                   highwaympg price
## symboling         0.6223     0.2543
## wheelbase         0.0000     0.0000
## carlength         0.0000     0.0000
## carwidth          0.0000     0.0000
## carheight         0.1255     0.0883
## curbweight        0.0000     0.0000
## enginesize        0.0000     0.0000
## stroke            0.5317     0.2575
## compressionratio 0.0001      0.3328
## horsepower        0.0000     0.0000
## peakrpm           0.4396     0.2241
## citympg           0.0000     0.0000
## highwaympg                   0.0000
## price             0.0000
```

```
correlacion<-round(cor(cuantitativas), 1)

corrplot(correlacion, method="number", type="upper")
```

Correlation matrix (corrplot):

Variables (rows and columns): symboling, wheelbase, carlength, carwidth, carheight, curbweight, enginesize, stroke, compressionratio, horsepower, peakrpm, citympg, highwaympg, price

	symboling	wheelbase	carlength	carwidth	carheight	curbweight	enginesize	stroke	compressionratio	horsepower	peakrpm	citympg	highwaympg	price
symboling	1.00	−0.5	−0.4	−0.5	−0.2	−0.1		−0.2		0.1	0.3			−0.1
wheelbase		1.00	0.9	0.8	0.6	0.8	0.6	0.2	0.2	0.4	−0.4	−0.5	−0.5	0.6
carlength			1.00	0.8	0.5	0.9	0.7	0.1	0.2	0.6		−0.7	−0.7	0.7
carwidth				1.00	0.3	0.9	0.7	0.2	0.2	0.6		−0.6	−0.7	0.8
carheight					1.00	0.3	0.4	−0.1	0.3		−0.3	−0.1	−0.1	0.1
curbweight						1.00	0.9	0.2	0.2	0.8		−0.8	−0.8	0.8
enginesize							1.00	0.2		0.8		−0.7	−0.7	0.9
stroke								1.00	0.2	0.4	−0.1			0.1
compressionratio									1.00	−0.4		0.3	0.3	0.1
horsepower										1.00		−0.8	−0.8	0.8
peakrpm											1.00	−0.4	−0.4	−0.1
citympg												1.00	0.9	−0.7
highwaympg													1.00	−0.7
price														1.00

```
chart.Correlation(cuantitativas, histogram = F, pch = 19)
```

```
## Warning in par(usr): argument 1 does not name a graphical parameter

## Warning in par(usr): argument 1 does not name a graphical parameter

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## Warning in par(usr): argument 1 does not name a graphical parameter

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```

```
lms <- lm(df$carheight ~ df$symboling)
plot(x=df$carheight, y=df$symboling, xlab = "Car heigh",ylab = "Symboling", main = 'Car height vs Symbol
abline(lms)
```

Car height vs Symboling
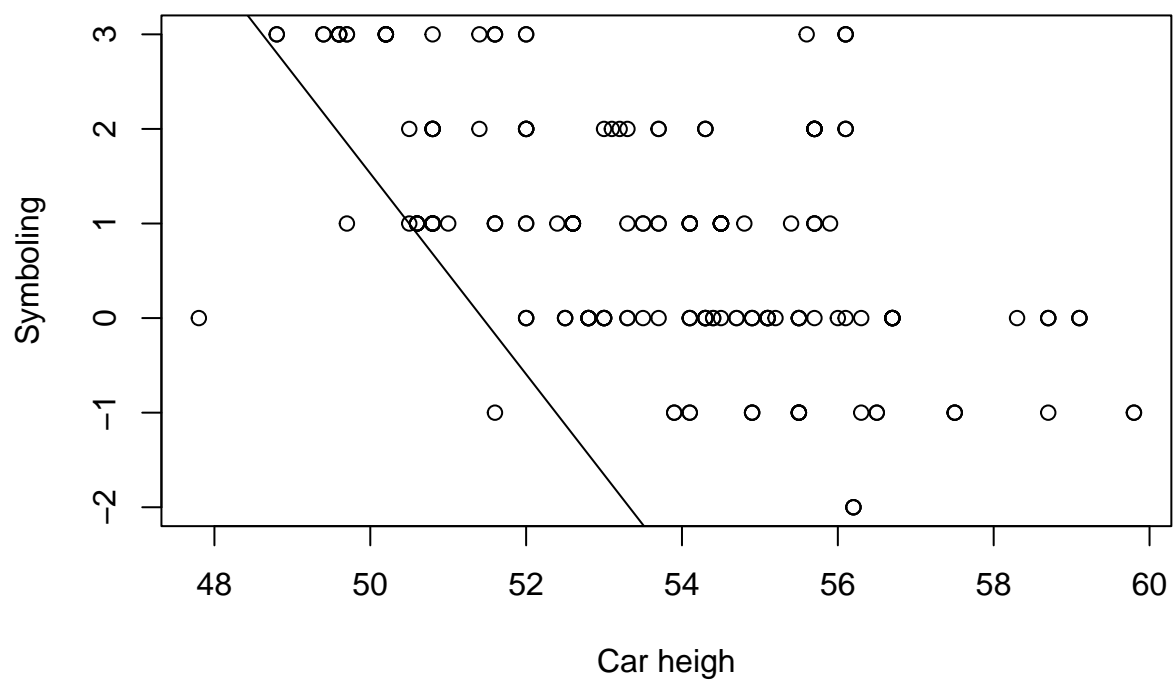

```
lmwb <- lm(df$wheelbase ~ df$carlength)
plot(x=df$wheelbase,y=df$carlength,xlab = "Wheel base",ylab = "Car length", main = 'Wheel base vs Car le
abline(lmwb)
```

Wheel base vs Car length
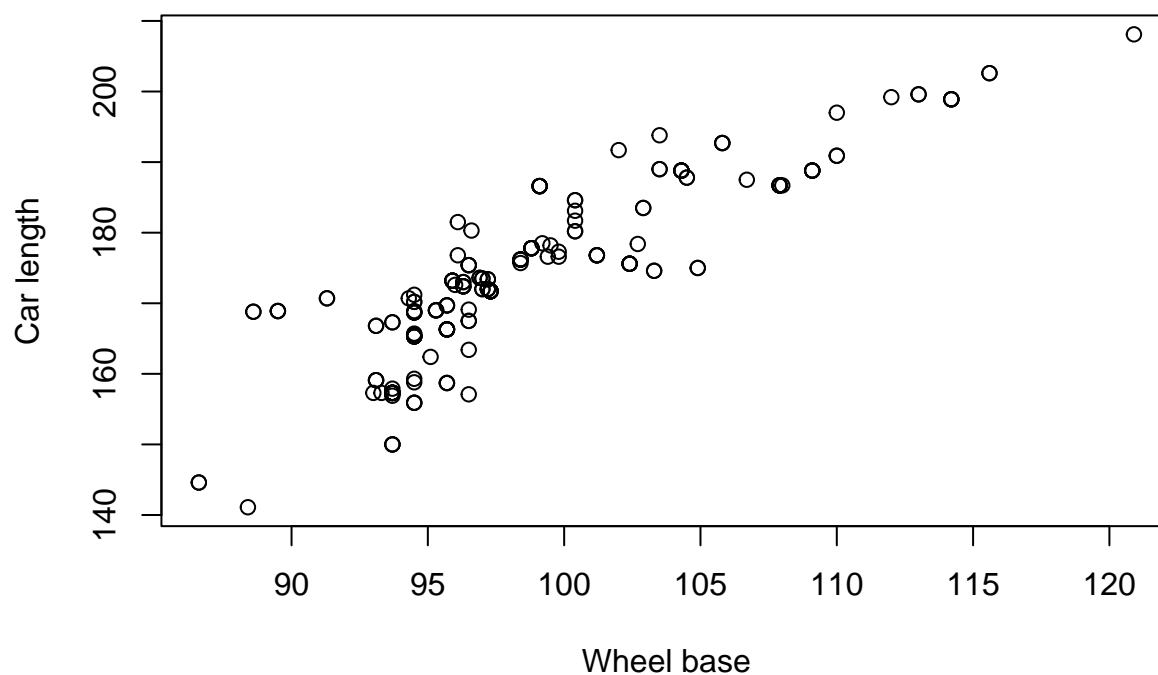

```
lmcl <- lm(df$carlength ~ df$curbweight)
plot(x=df$carlength,y=df$curbweight,xlab = "Car length",ylab = "Curb weight", main = 'Car length vs Curl
abline(lmcl)
```

Car length vs Curb weight
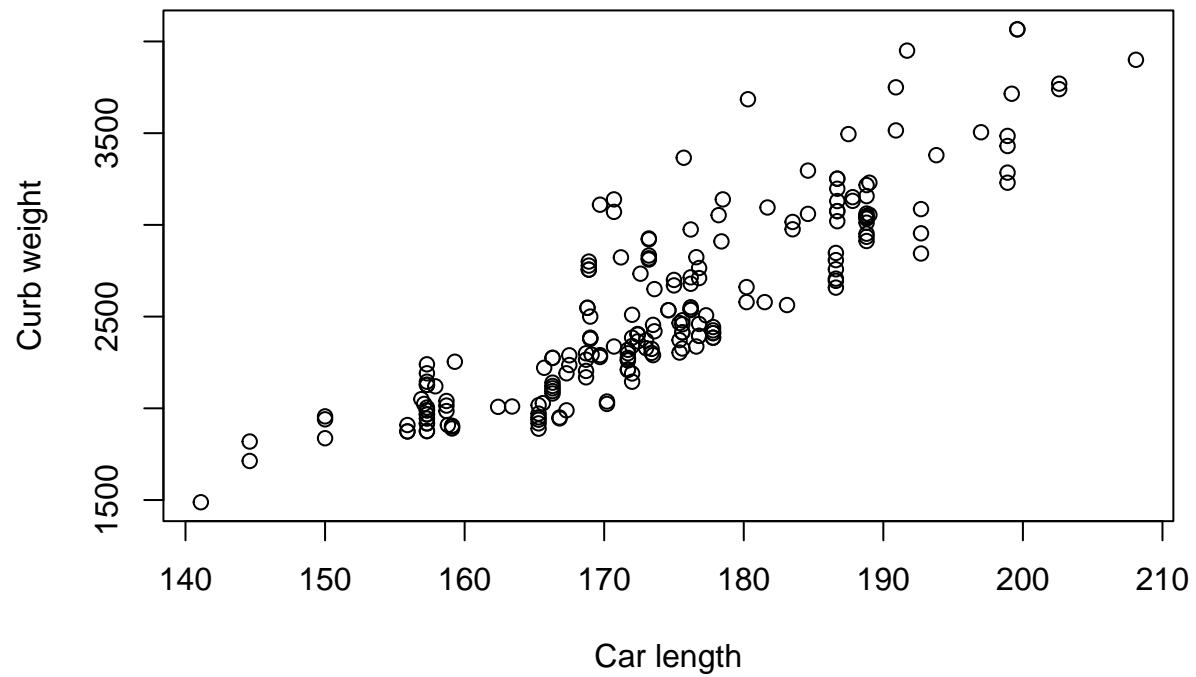

```
lmcw <- lm(df$carwidth ~ df$price)
plot(x=df$carwidth,y=df$price,xlab = "Car width",ylab = "Price", main = 'Car width vs Price')
abline(lmcw)
```

Car width vs Price
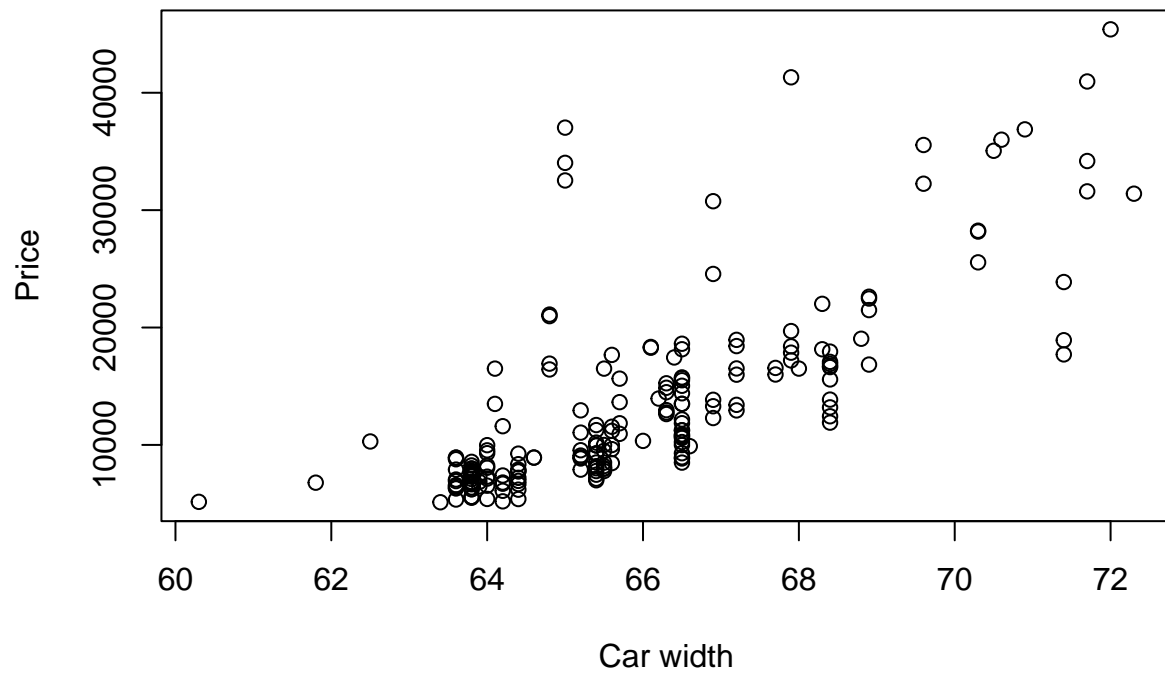

```
lmch <- lm(df$carheight ~ df$price)
plot(x=df$carheight,y=df$price,xlab = "Car height",ylab = "Price", main = 'Car height vs Price')
abline(lmch)
```

Car height vs Price
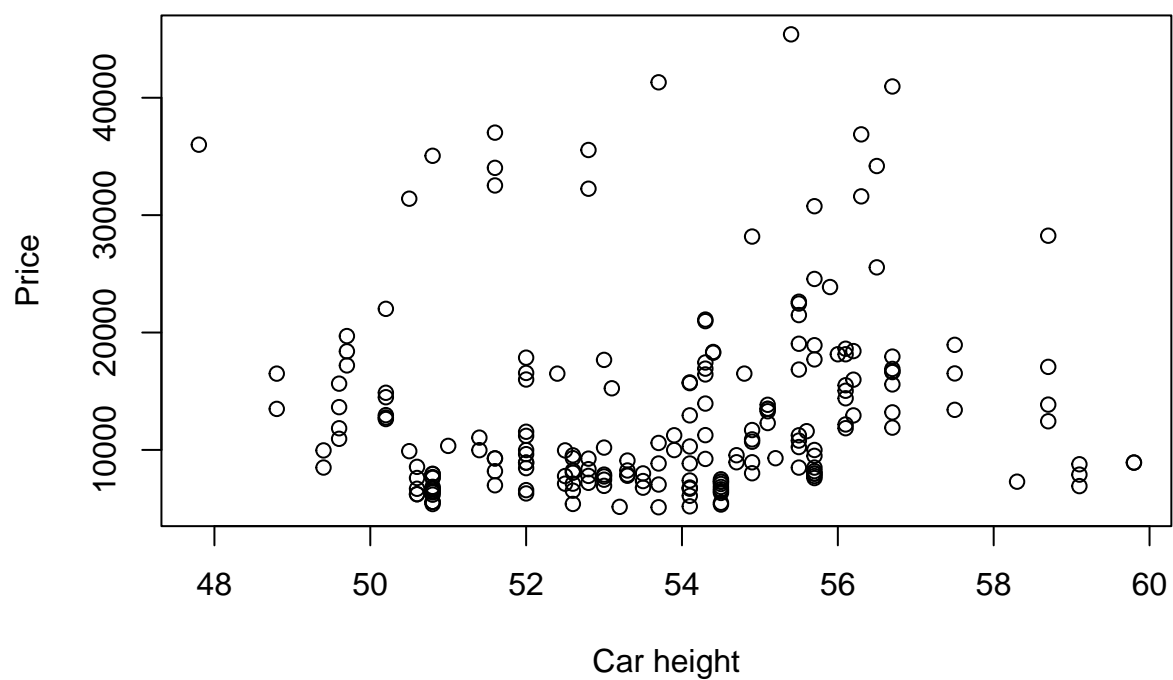

```
lmcuw <- lm(df$curbweight ~ df$price)
plot(x=df$curbweight,y=df$price,xlab = "Curb wight",ylab = "Price", main = 'Curb wight vs Price')
abline(lmcuw)
```

Curb wight vs Price
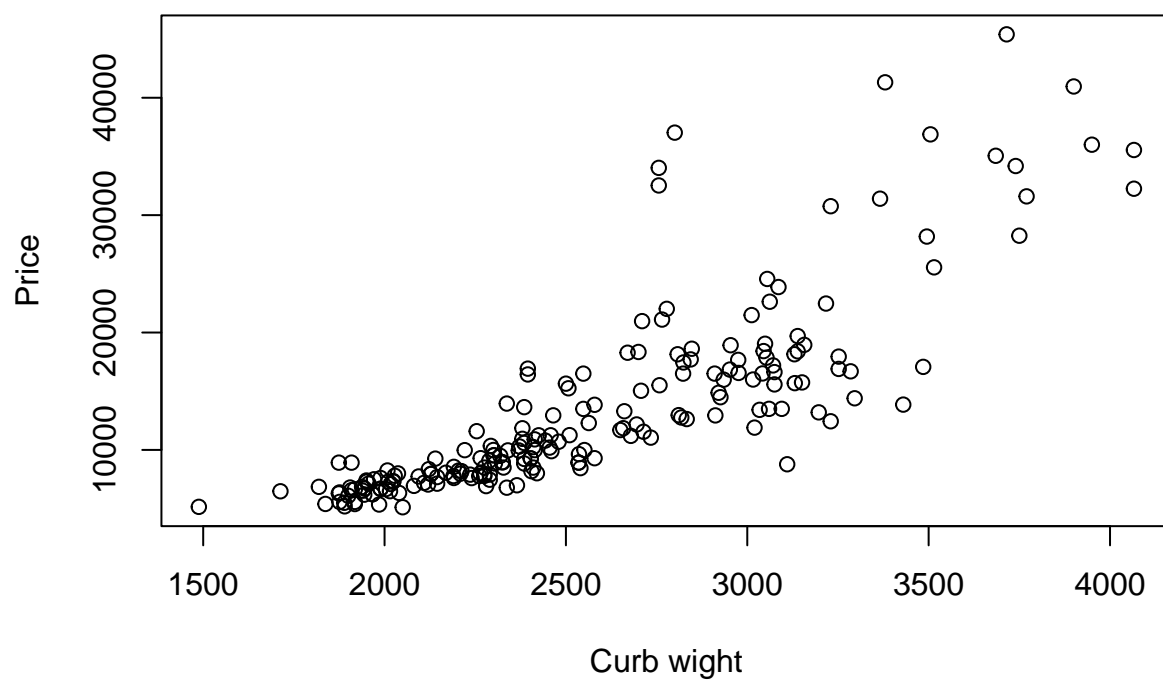

```
lmes <- lm(df$enginesize ~ df$price)
plot(x=df$enginesize,y=df$price,xlab = "Engine size ",ylab = "Price", main = 'Engine size vs Price')
abline(lmes)
```

Engine size vs Price
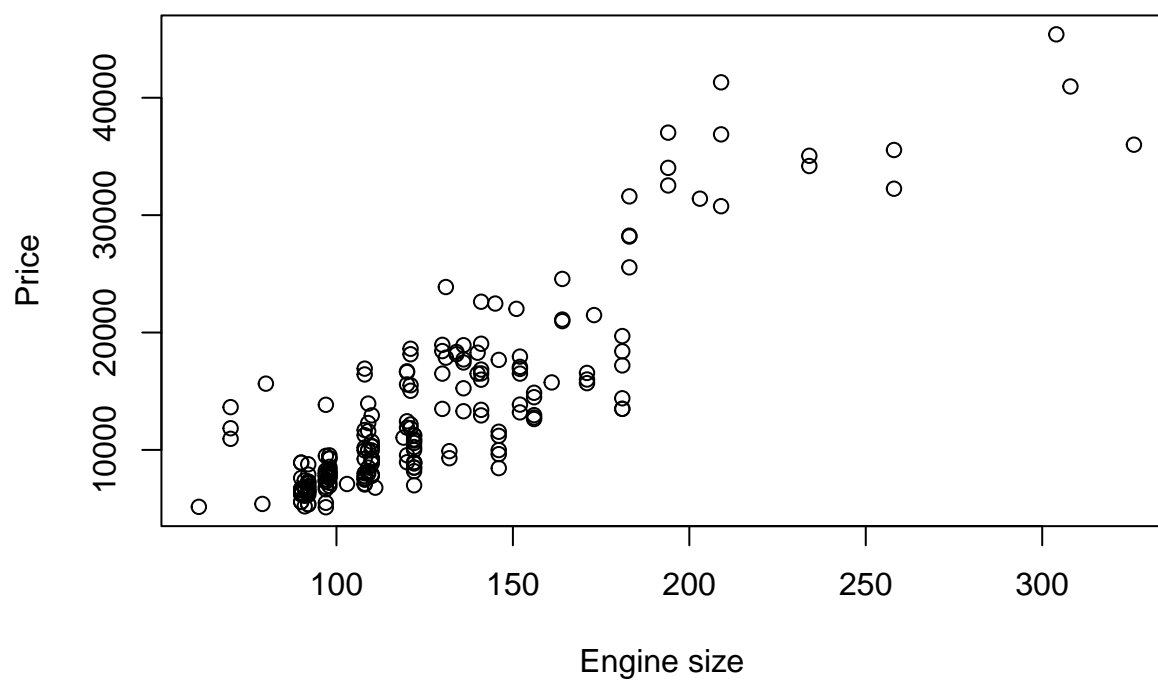

```
lmst <- lm(df$stroke ~ df$price)
plot(x=df$stroke,y=df$price,xlab = "Stroke ",ylab = "Price", main = 'Stroke vs Price')
abline(lmst)
```

Stroke vs Price
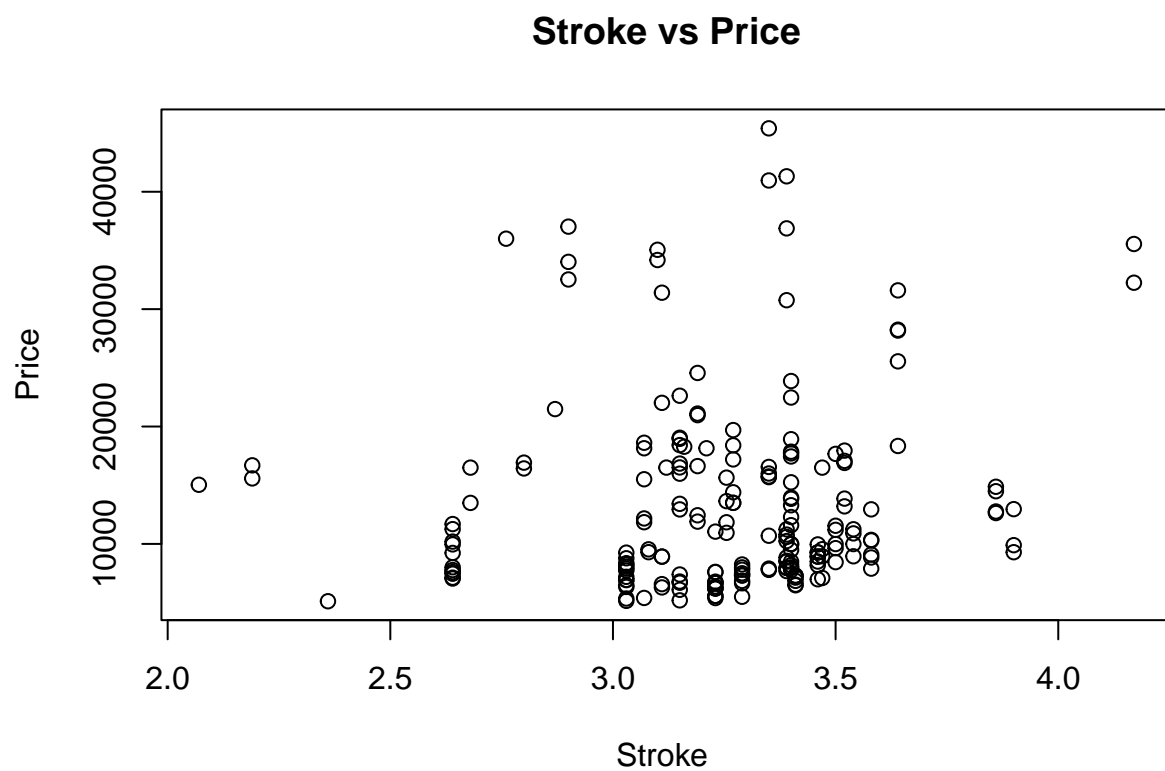

```
lmcr <- lm(df$compressionratio ~ df$price)
plot(x=df$compressionratio,y=df$price,xlab = "Compression ratio",ylab = "Price", main = 'Compression ra
abline(lmcr)
```

Compression ratio vs Price
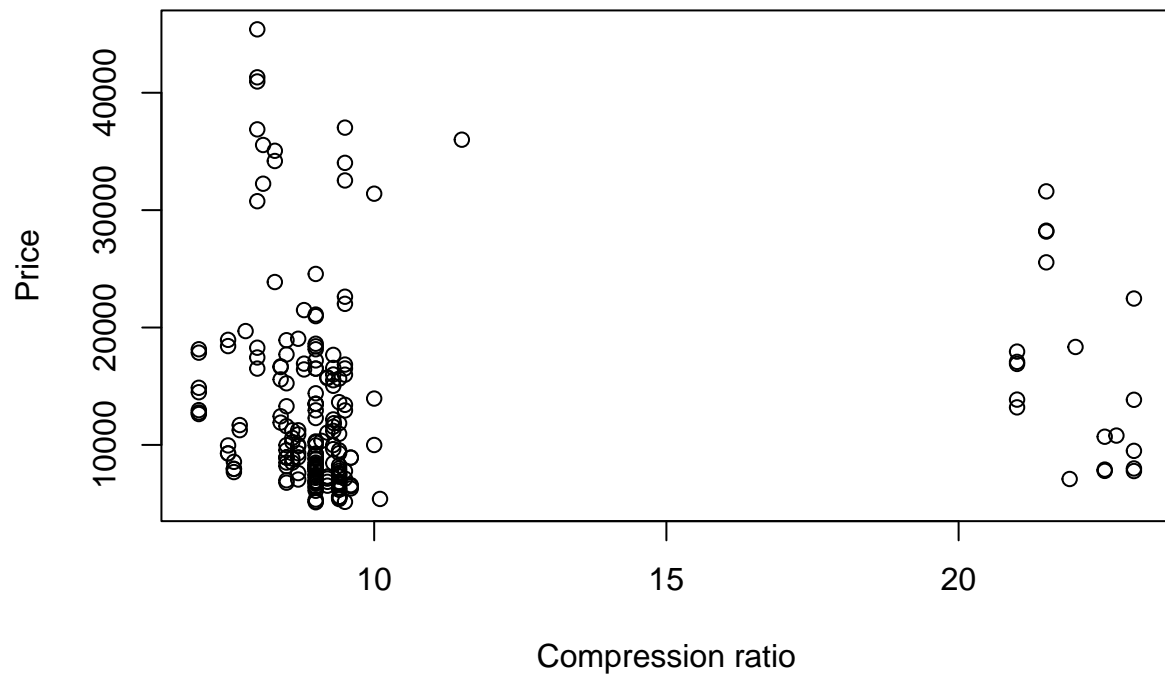

```
lmhp <- lm(df$horsepower ~ df$price)
plot(x=df$horsepower,y=df$price,xlab = "Horse power ",ylab = "Price", main = 'Horse power vs Price')
abline(lmhp)
```

Horse power vs Price
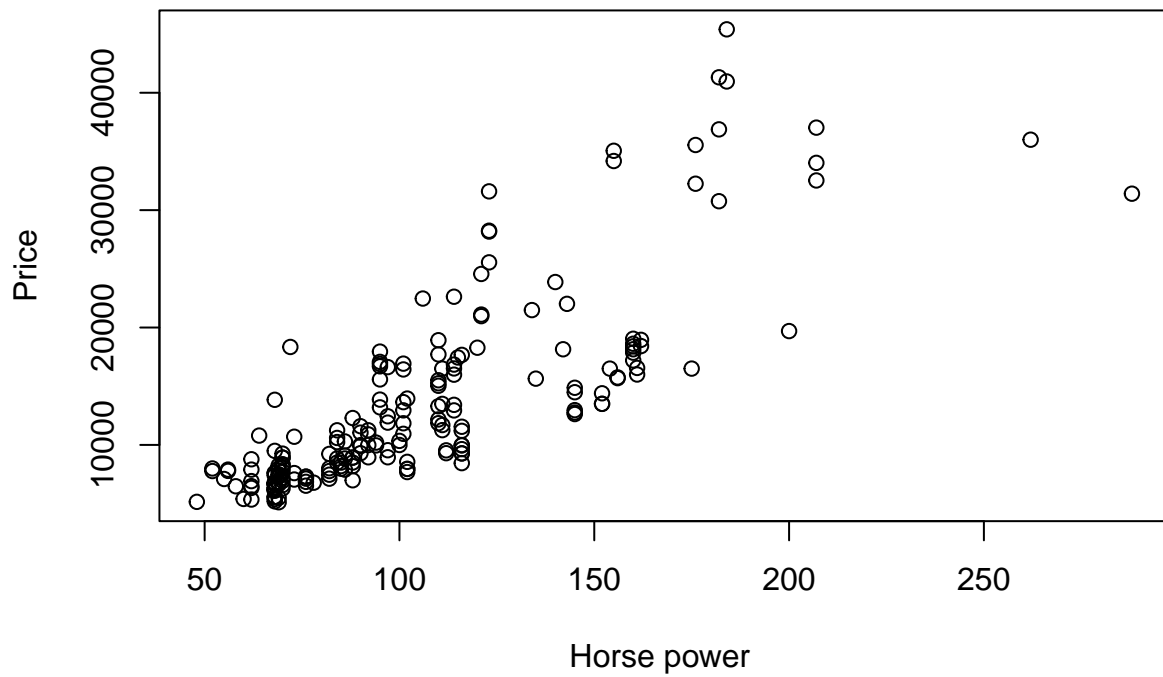

```
lmrpm <- lm(df$peakrpm ~ df$price)
plot(x=df$peakrpm,y=df$price,xlab = "Peak rpm",ylab = "Price", main = 'Peak rpm vs Price')
abline(lmrpm)
```

Peak rpm vs Price
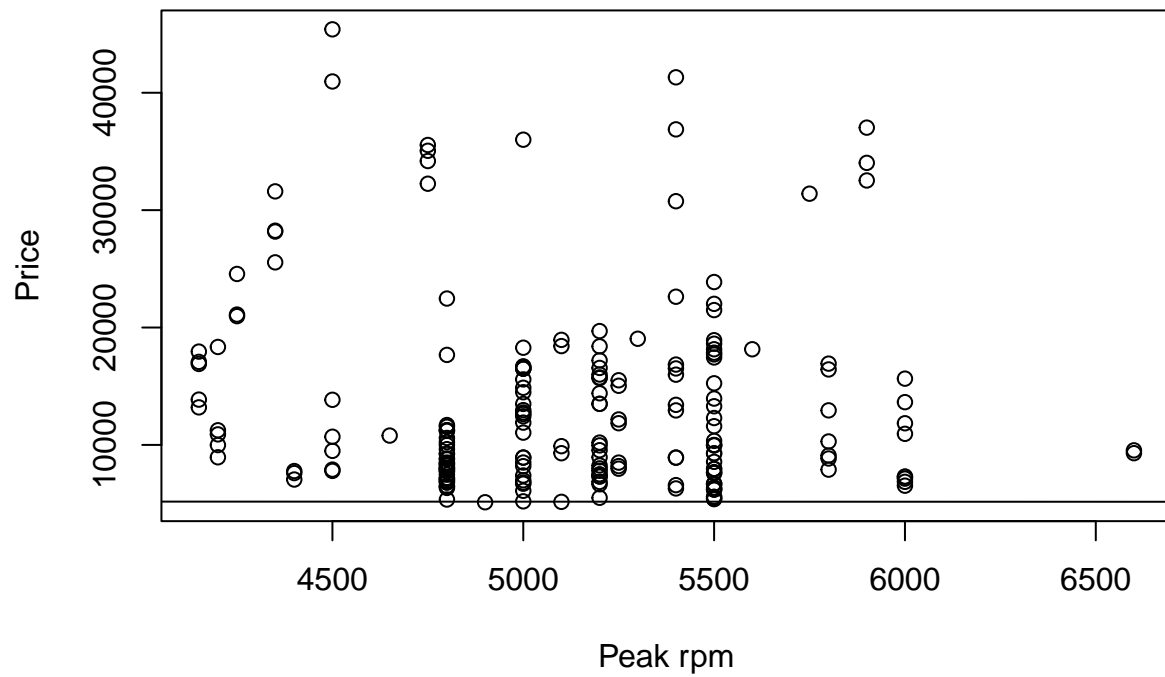

```
lmcmpg <- lm(df$citympg ~ df$price)
plot(x=df$citympg,y=df$price,xlab = "City mpg",ylab = "Price", main = 'City mpg vs Price')
abline(lmcmpg)
```

City mpg vs Price
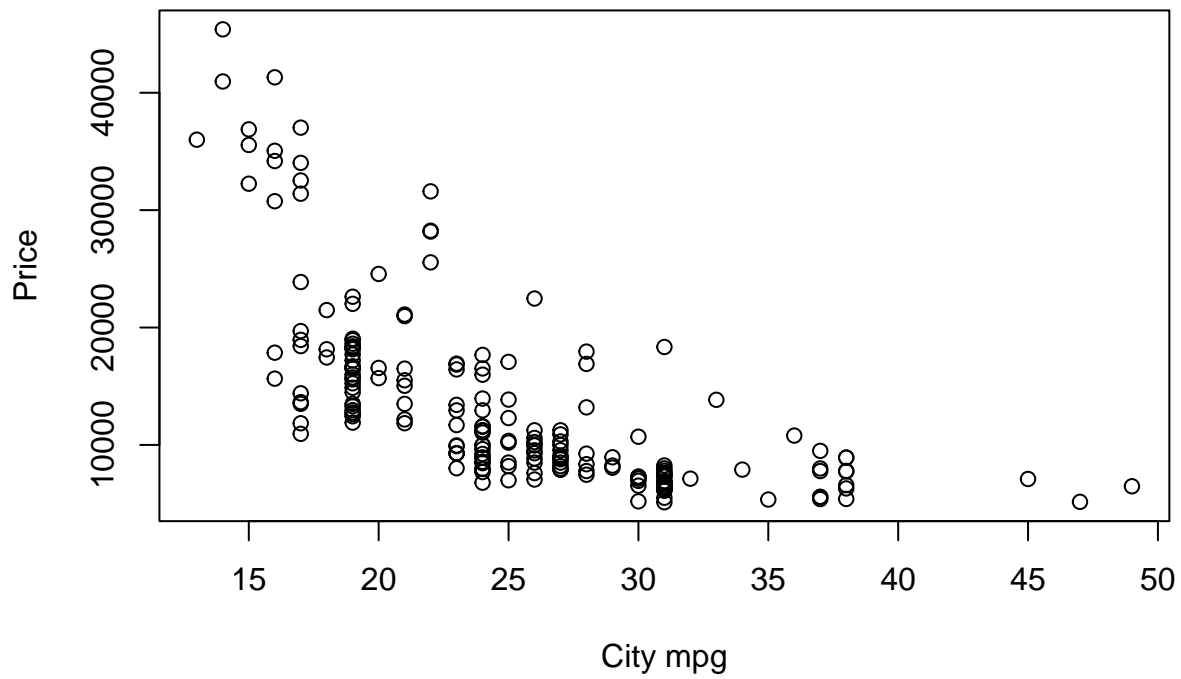

```
lmhmpg <- lm(df$highwaympg ~ df$price)
plot(x=df$highwaympg,y=df$price,xlab = "Highway mpg",ylab = "Price", main = 'Highway mpg vs Price')
abline(lmhmpg)
```

Highway mpg vs Price
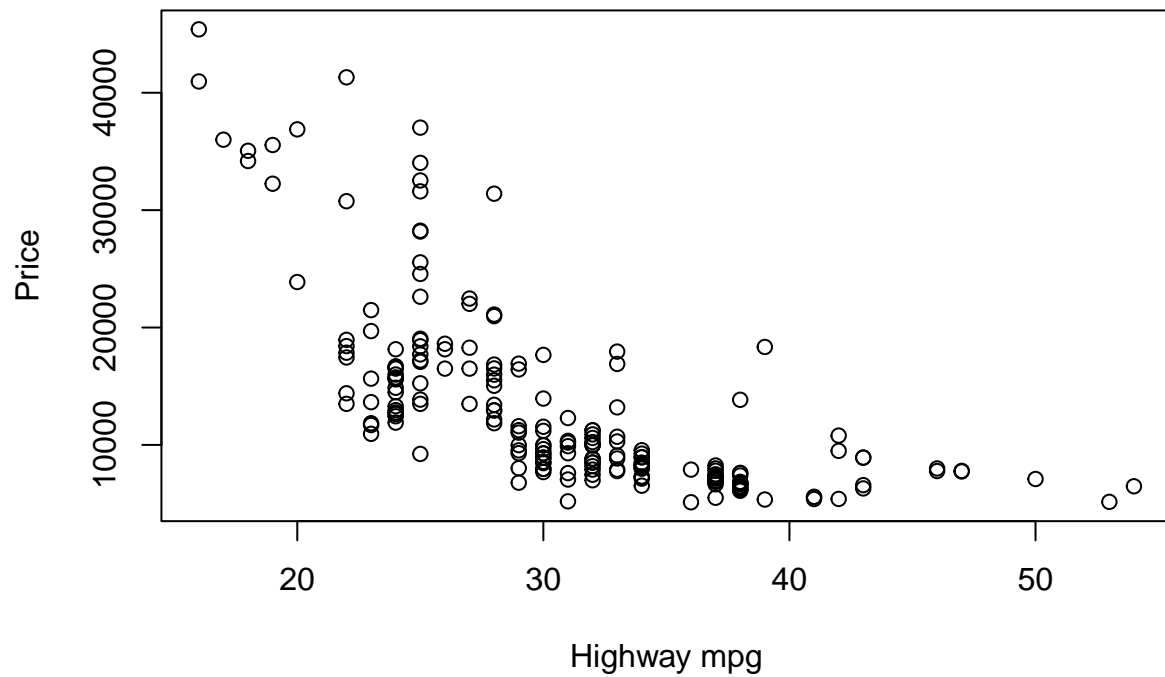

```
mean(df$symboling)
```

```
## [1] 0.8341463
```

```
mean(df$wheelbase)
```

```
## [1] 98.75659
```

```
mean(df$carlength)
```

```
## [1] 174.0493
```

```
mean(df$carwidth)
```

```
## [1] 65.9078
```

```
mean(df$carheight)
```

```
## [1] 53.72488
```

```
mean(df$curbweight)
```

[1] 2555.566

```
mean(df$enginesize)
```

[1] 126.9073

```
mean(df$stroke)
```

[1] 3.255415

```
mean(df$compressionratio)
```

[1] 10.14254

```
mean(df$horsepower)
```

[1] 104.1171

```
mean(df$peakrpm)
```

[1] 5125.122

```
mean(df$citympg)
```

[1] 25.21951

```
mean(df$highwaympg)
```

[1] 30.75122

```
mean(df$price)
```

[1] 13276.71

```
sd(df$symboling)
```

[1] 1.245307

```
sd(df$wheelbase)
```

[1] 6.021776

```
sd(df$carlength)
```

```
## [1] 12.33729
```

```
sd(df$carwidth)
```

```
## [1] 2.145204
```

```
sd(df$carheight)
```

```
## [1] 2.443522
```

```
sd(df$curbweight)
```

```
## [1] 520.6802
```

```
sd(df$enginesize)
```

```
## [1] 41.64269
```

```
sd(df$stroke)
```

```
## [1] 0.313597
```

```
sd(df$compressionratio)
```

```
## [1] 3.97204
```

```
sd(df$horsepower)
```

```
## [1] 39.54417
```

```
sd(df$peakrpm)
```

```
## [1] 476.9856
```

```
sd(df$citympg)
```

```
## [1] 6.542142
```

```
sd(df$highwaympg)
```

```
## [1] 6.886443
```

```
sd(df$price)
```

```
## [1] 7988.852
```

```
quantile(df$symboling)
```

```
##   0%  25%  50%  75% 100%
##   -2    0    1    2    3
```

```
quantile(df$wheelbase)
```

```
##    0%   25%   50%   75%  100%
##  86.6  94.5  97.0 102.4 120.9
```

```
quantile(df$carlength)
```

```
##    0%   25%   50%   75%  100%
## 141.1 166.3 173.2 183.1 208.1
```

```
quantile(df$carwidth)
```

```
##   0%  25%  50%  75% 100%
## 60.3 64.1 65.5 66.9 72.3
```

```
quantile(df$carheight)
```

```
##   0%  25%  50%  75% 100%
## 47.8 52.0 54.1 55.5 59.8
```

```
quantile(df$curbweight)
```

```
##   0%  25%  50%  75% 100%
## 1488 2145 2414 2935 4066
```

```
quantile(df$enginesize)
```

```
##   0%  25%  50%  75% 100%
##   61   97  120  141  326
```

```
quantile(df$stroke)
```

```
##   0%  25%  50%  75% 100%
## 2.07 3.11 3.29 3.41 4.17
```

```
quantile(df$compressionratio)
```

```
##    0%   25%   50%   75%  100%
##   7.0   8.6   9.0   9.4  23.0
```

```
quantile(df$horsepower)
```

```
##    0%   25%   50%   75%  100%
##    48    70    95   116   288
```

```
quantile(df$peakrpm)
```

```
##    0%   25%   50%   75%  100%
## 4150  4800  5200  5500  6600
```

```
quantile(df$citympg)
```

```
##    0%   25%   50%   75%  100%
##    13    19    24    30    49
```

```
quantile(df$highwaympg)
```

```
##    0%   25%   50%   75%  100%
##    16    25    30    34    54
```

```
quantile(df$price)
```

```
##     0%    25%    50%    75%   100%
##   5118   7788  10295  16503  45400
```

```
boxplot(df$symboling, main = 'Symboling')
```
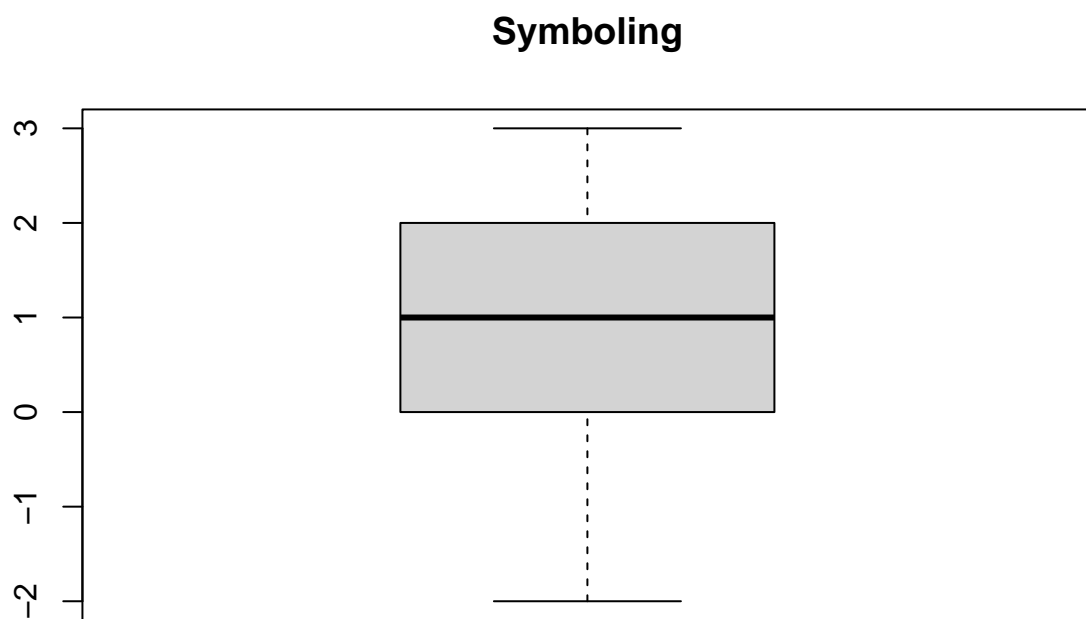
Symboling


```
hist(df$symboling, main = 'Symboling')
```

Symboling
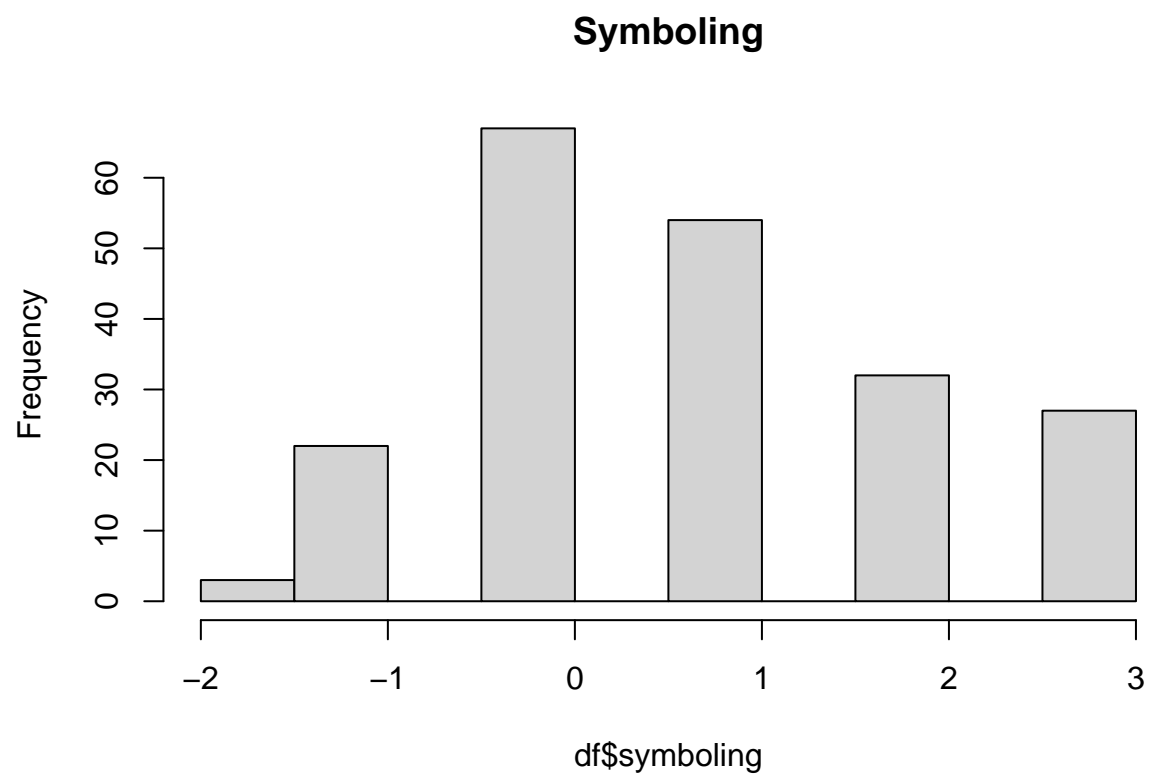

```
boxplot(df$wheelbase, main = 'Wheel base')
```
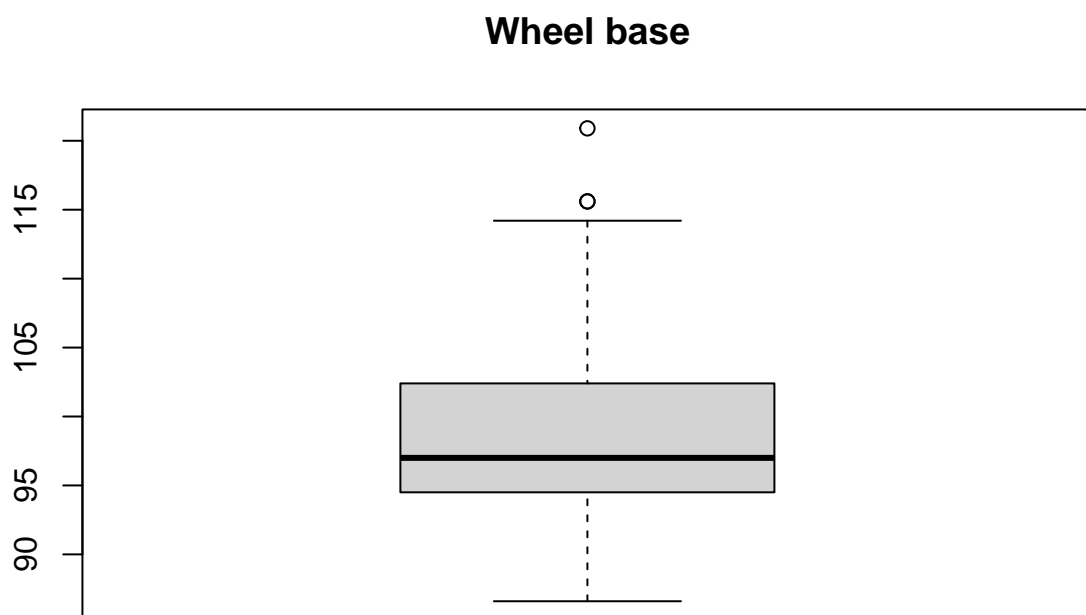
Wheel base


```
hist(df$wheelbase, main = 'Wheel base')
```

Wheel base

df$wheelbase
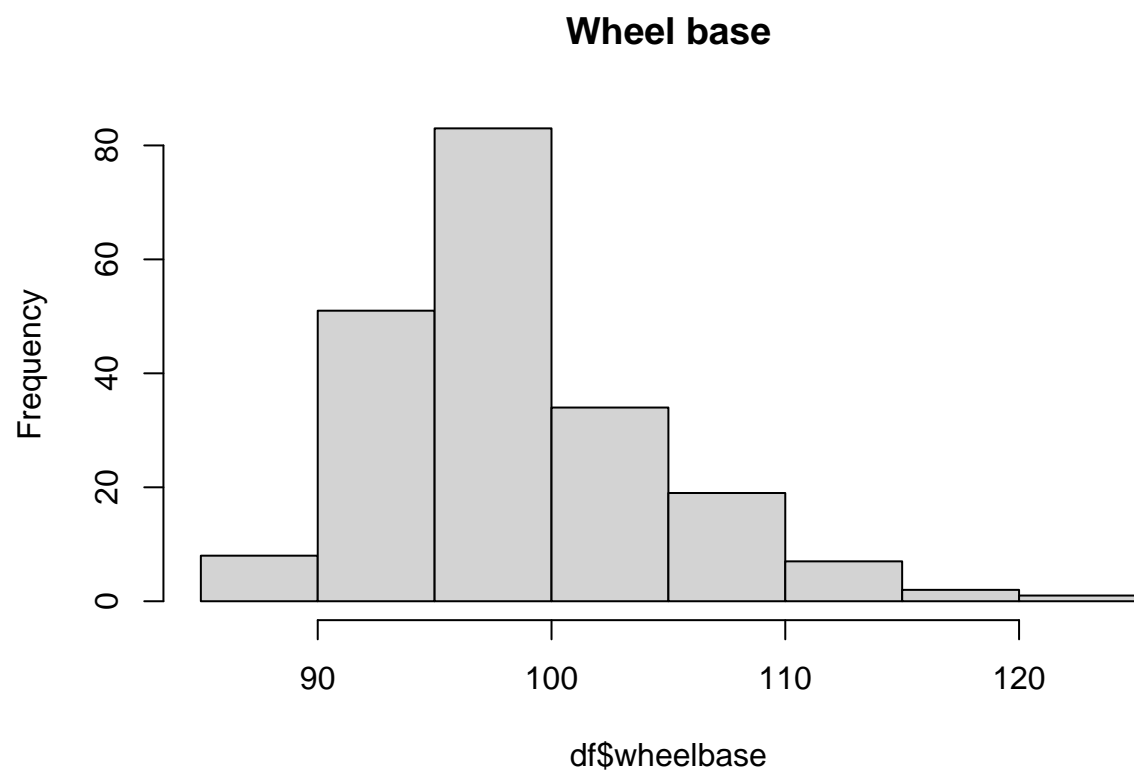
```
boxplot(df$carlength, main = 'Car length')
```
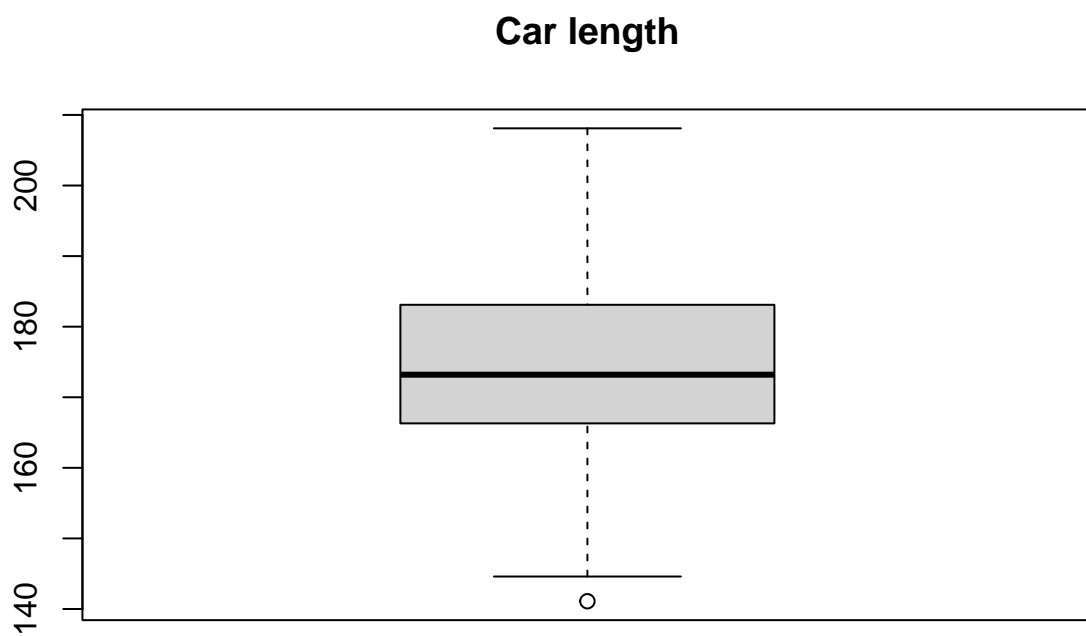
Car length


```
hist(df$carlength, main = 'Car length')
```

Car length

df$carlength
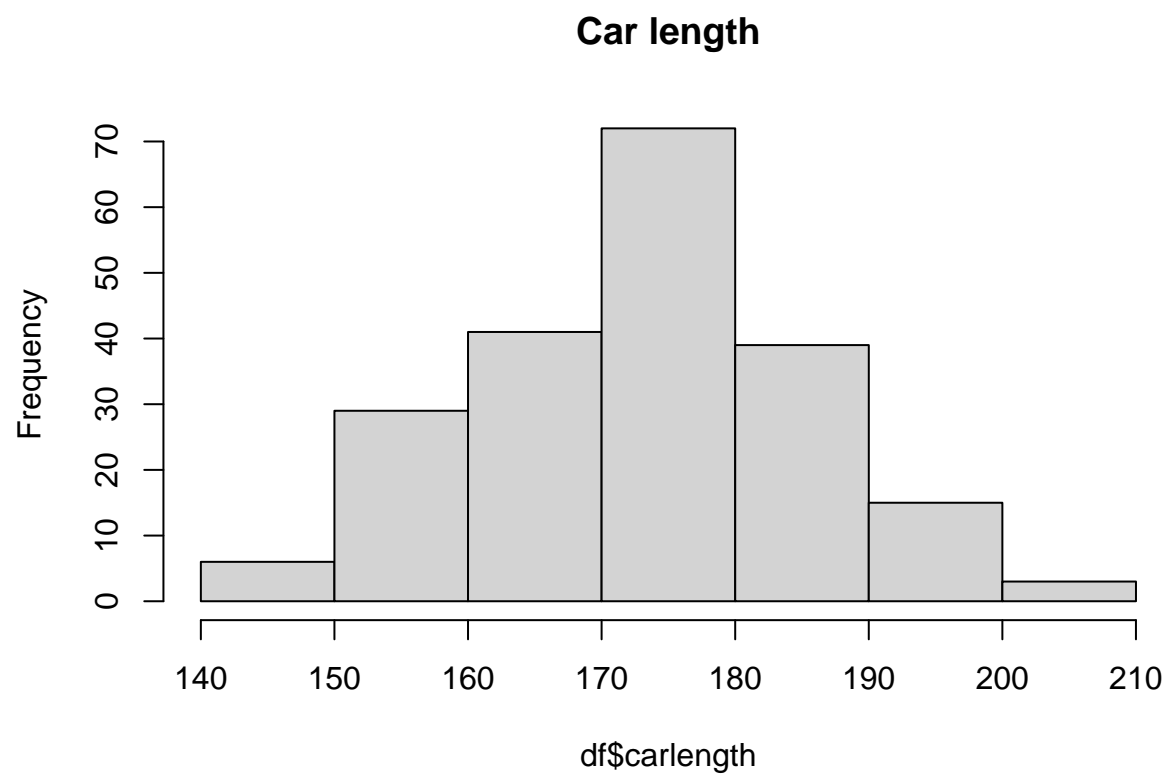
```
boxplot(df$carwidth, main = 'Car width')
```
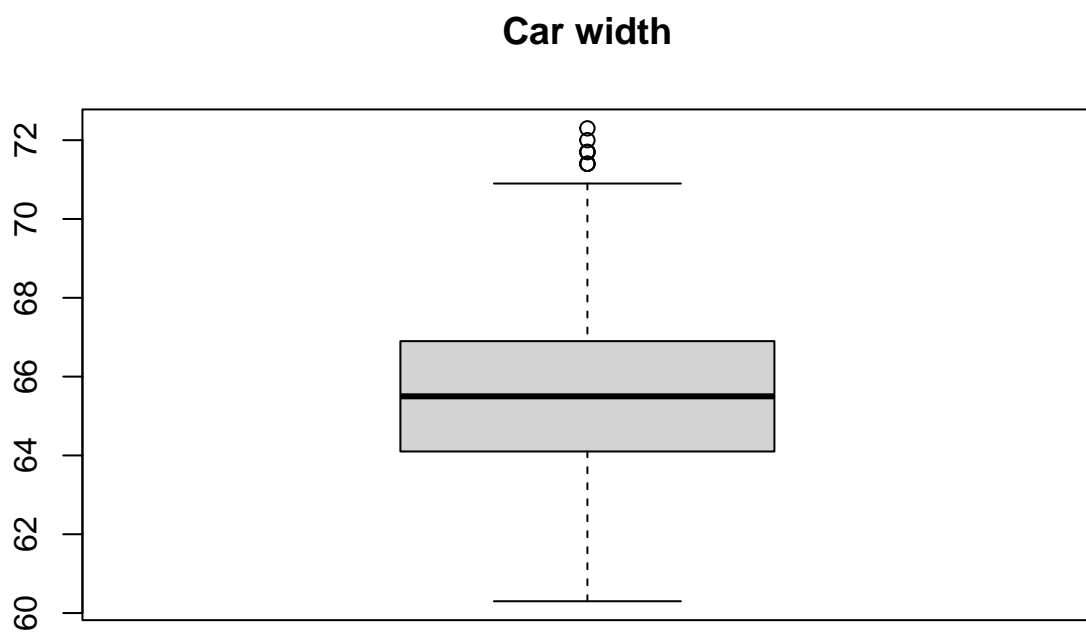
Car width


```
hist(df$carwidth, main = 'Car width')
```

Car width

df$carwidth
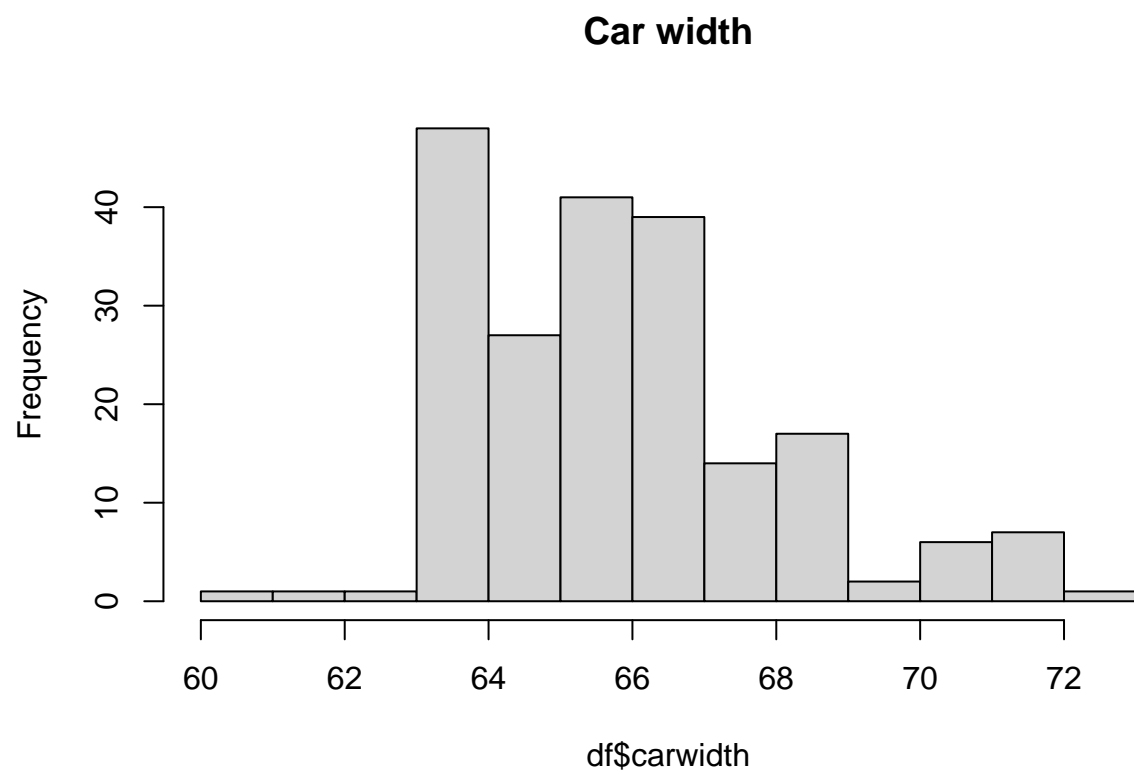
```
boxplot(df$carheight, main = 'Car height')
```
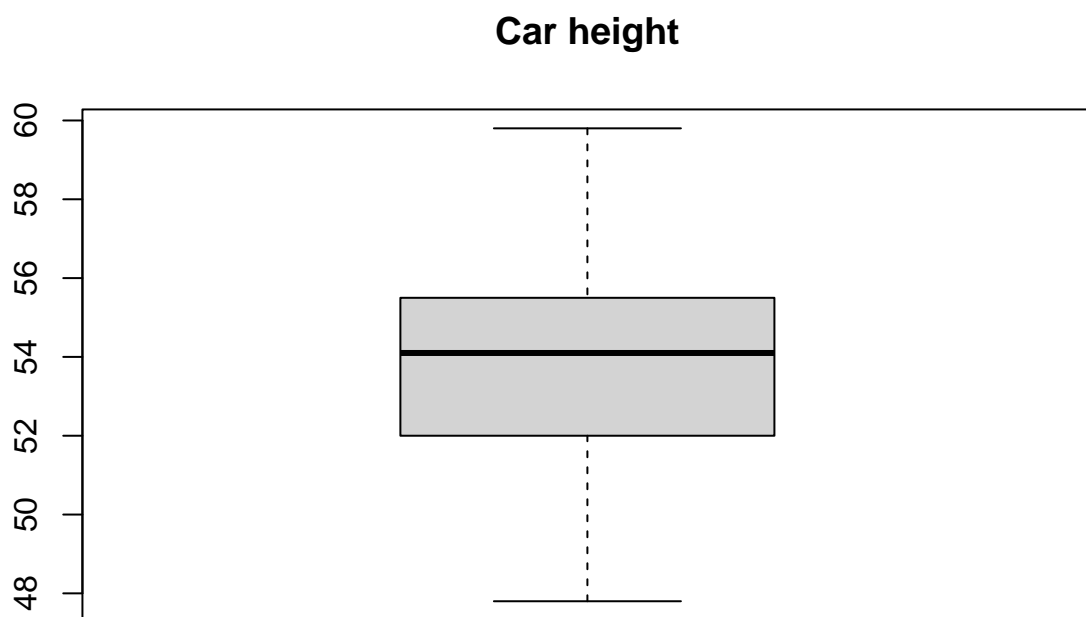
Car height


```
hist(df$carheight, main = 'Car height')
```

Car height

df$carheight
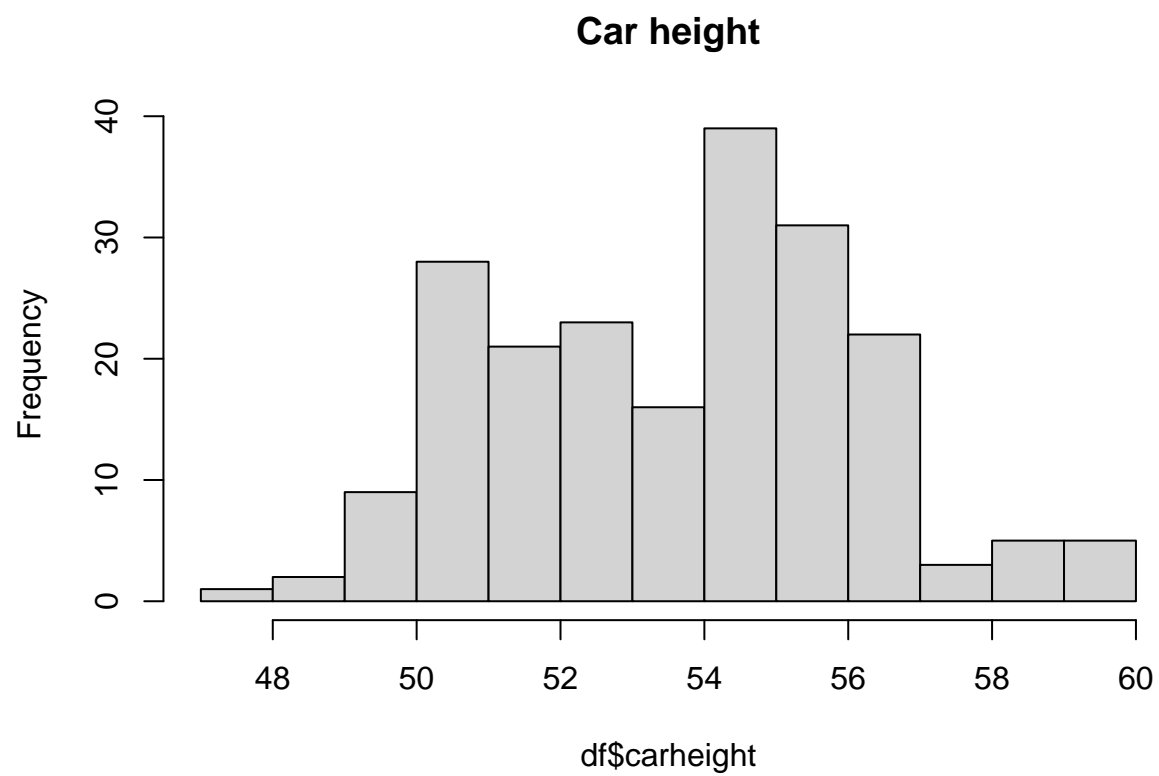
```
boxplot(df$curbweight, main = 'Curb weight')
```
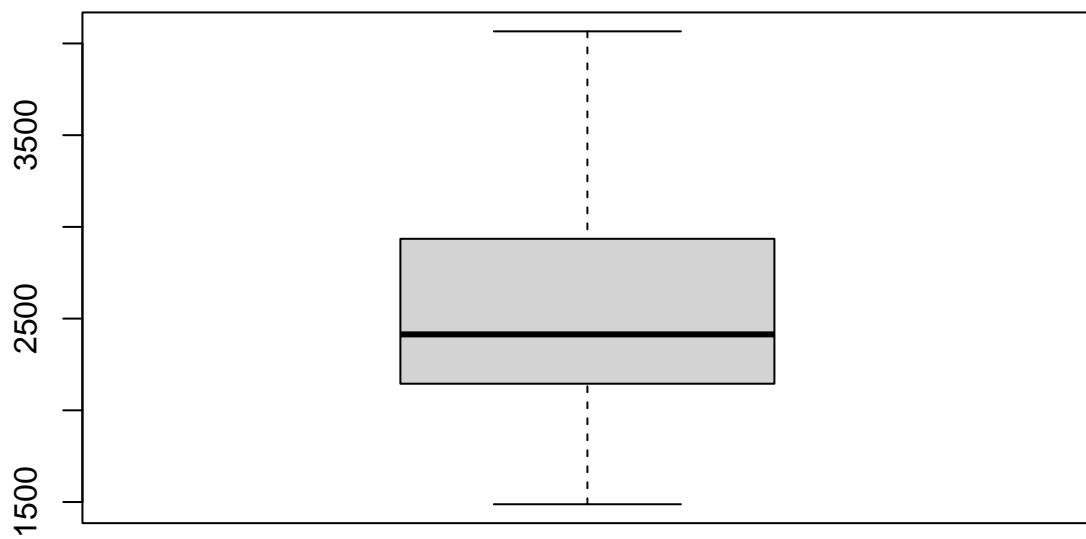
Curb weight


```
hist(df$curbweight, main = 'Curb weight')
```

Curb weight
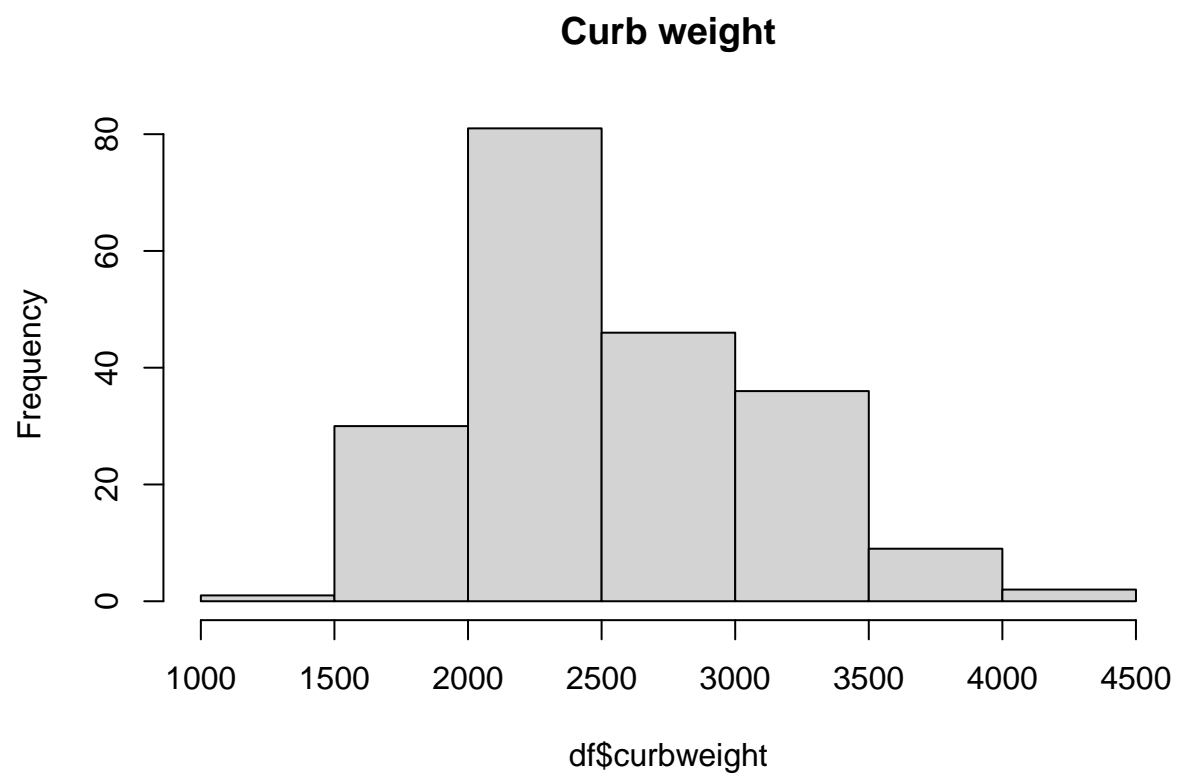

```
boxplot(df$enginesize, main = 'Engine size')
```
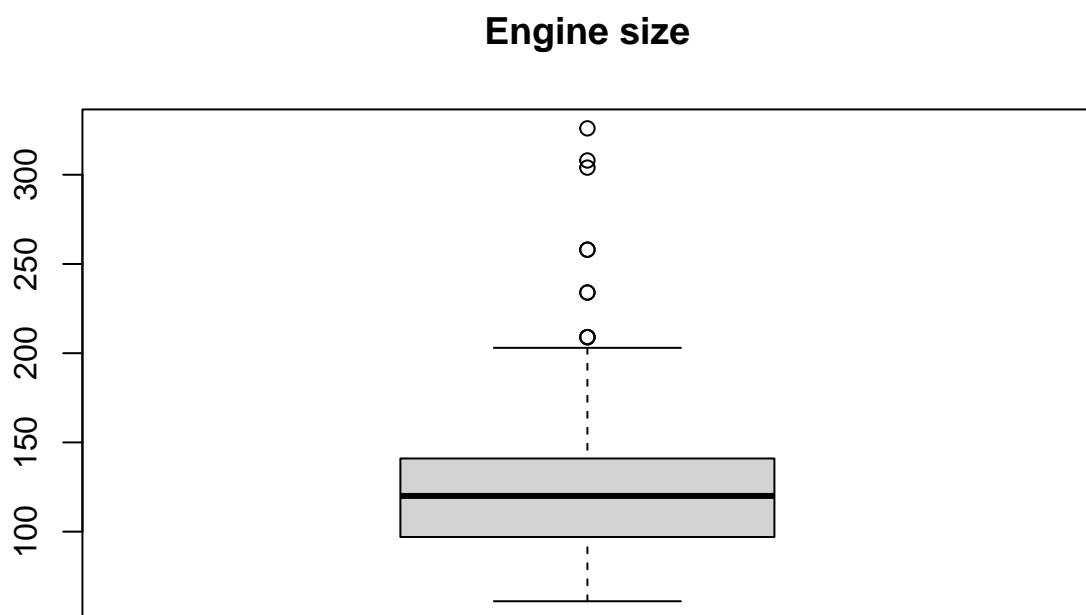
Engine size


```
hist(df$enginesize, main = 'Engine size')
```

Engine size
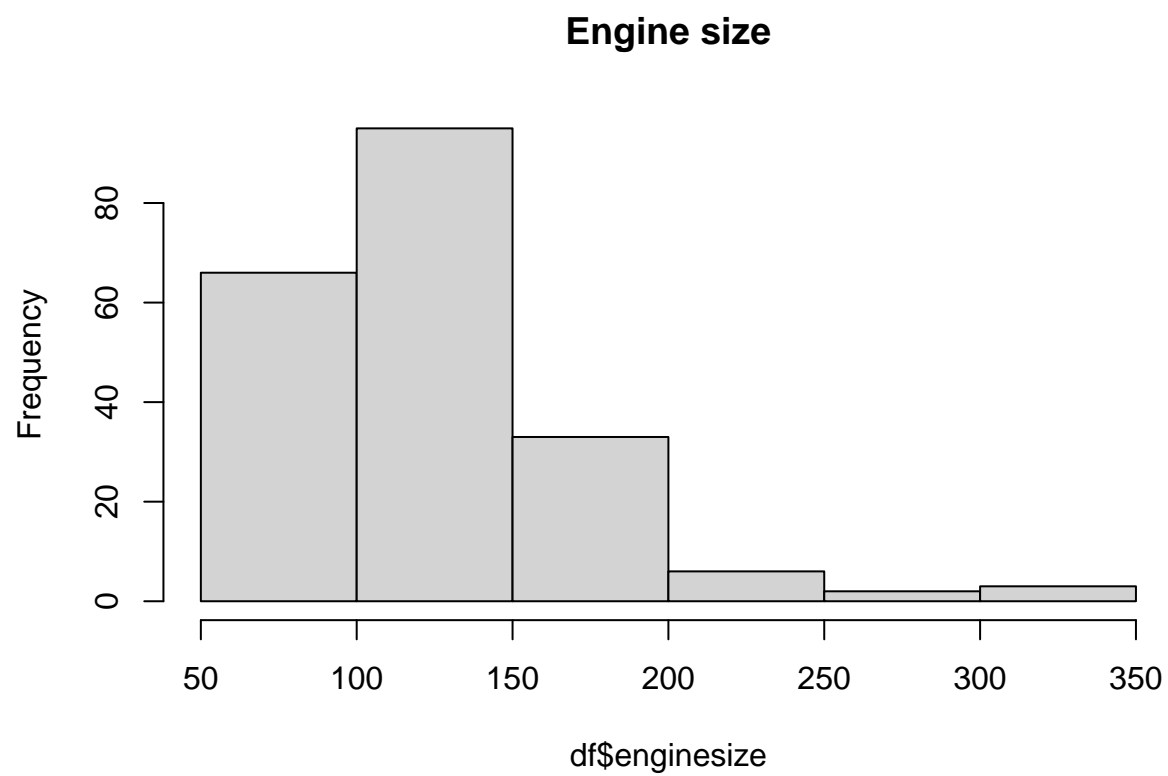

```
boxplot(df$stroke, main = 'Stroke')
```
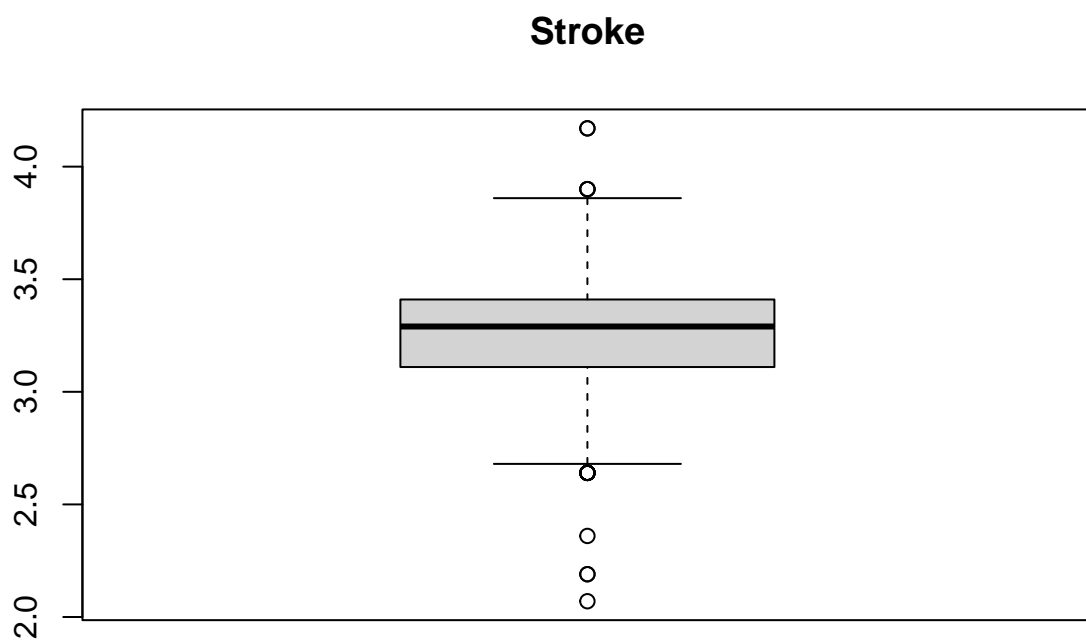
Stroke


```
hist(df$stroke, main = 'Stroke')
```

Stroke
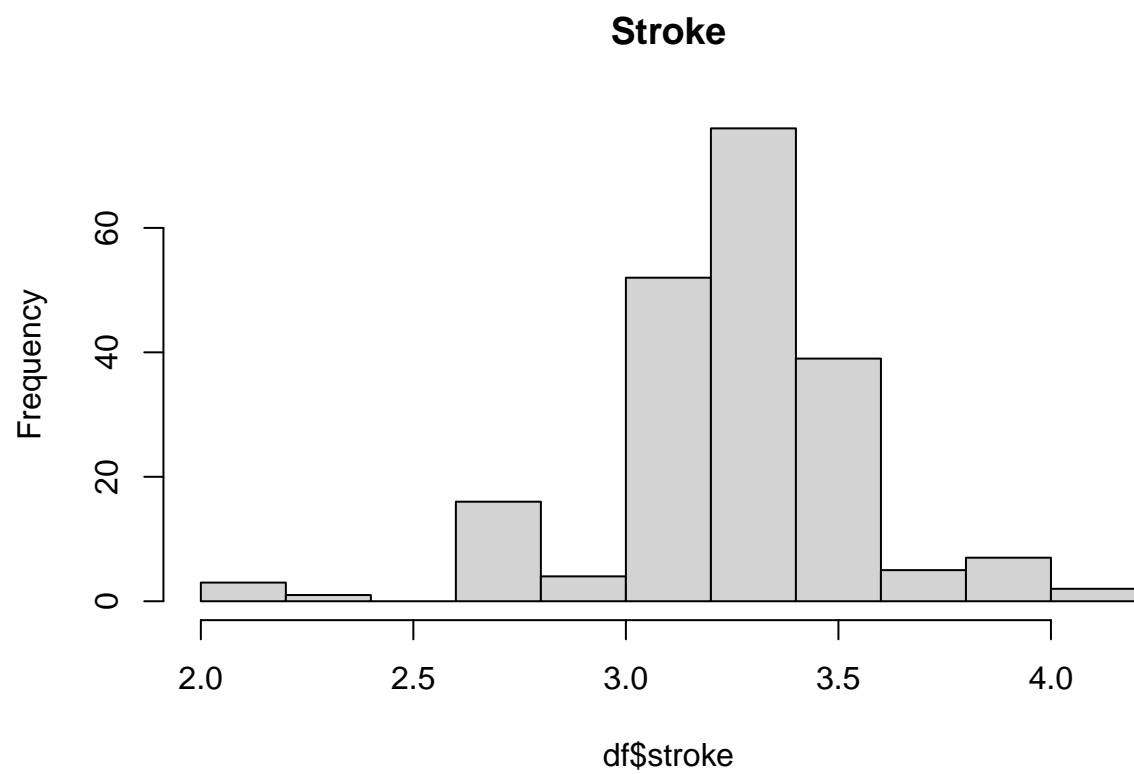

```
boxplot(df$compressionratio, main = 'Compression ratio')
```
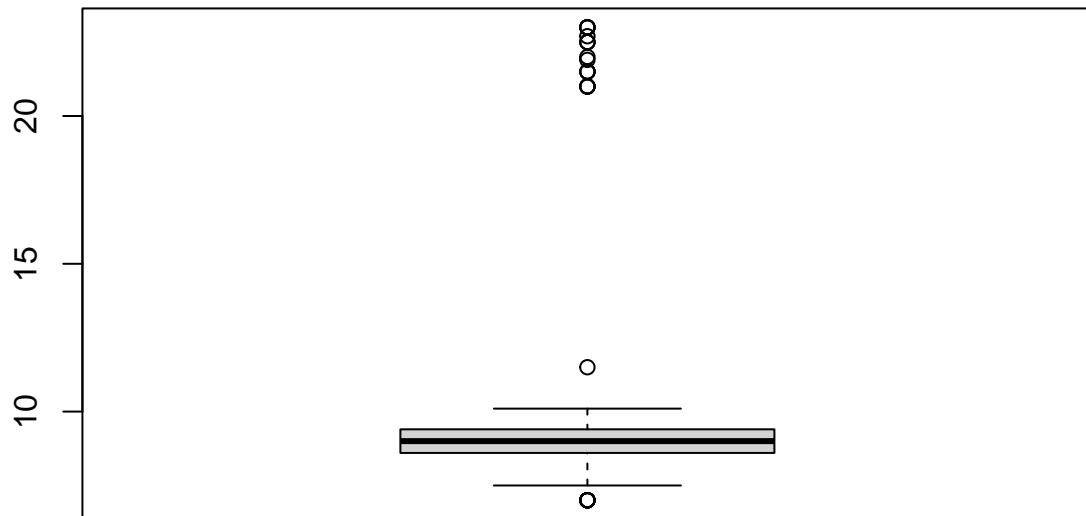
Compression ratio


```
hist(df$compressionratio, main = 'Compression ratio')
```

Compression ratio
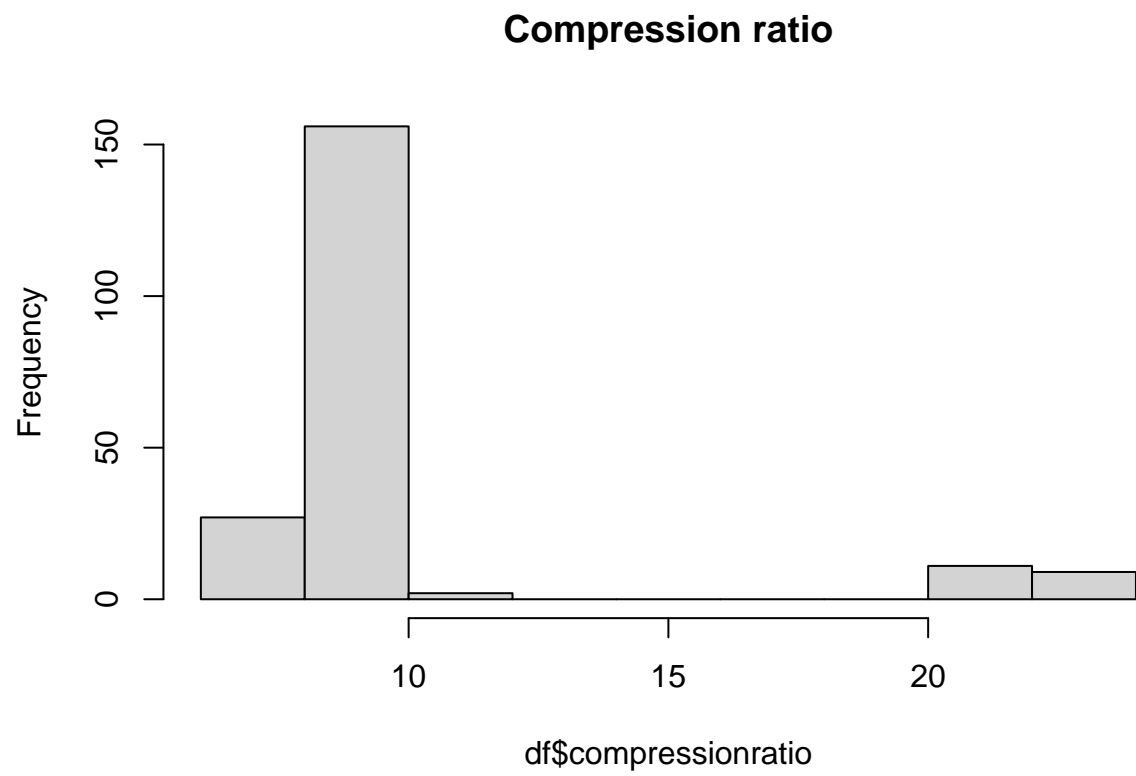

```
boxplot(df$horsepower, main = 'Horse power')
```
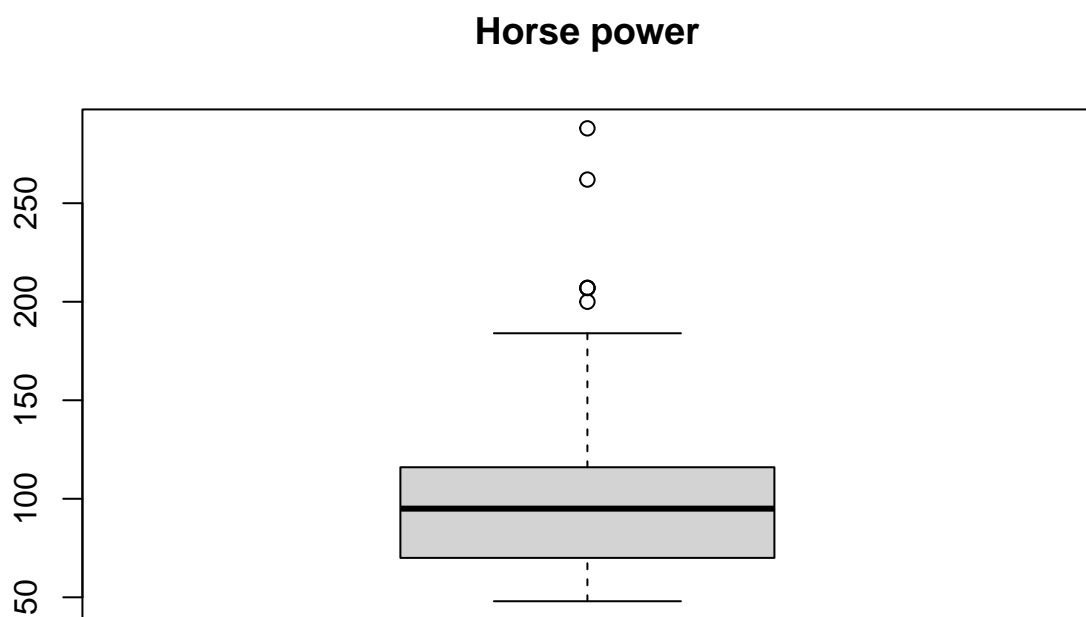
Horse power


```
hist(df$horsepower, main = 'Horse power')
```

Horse power
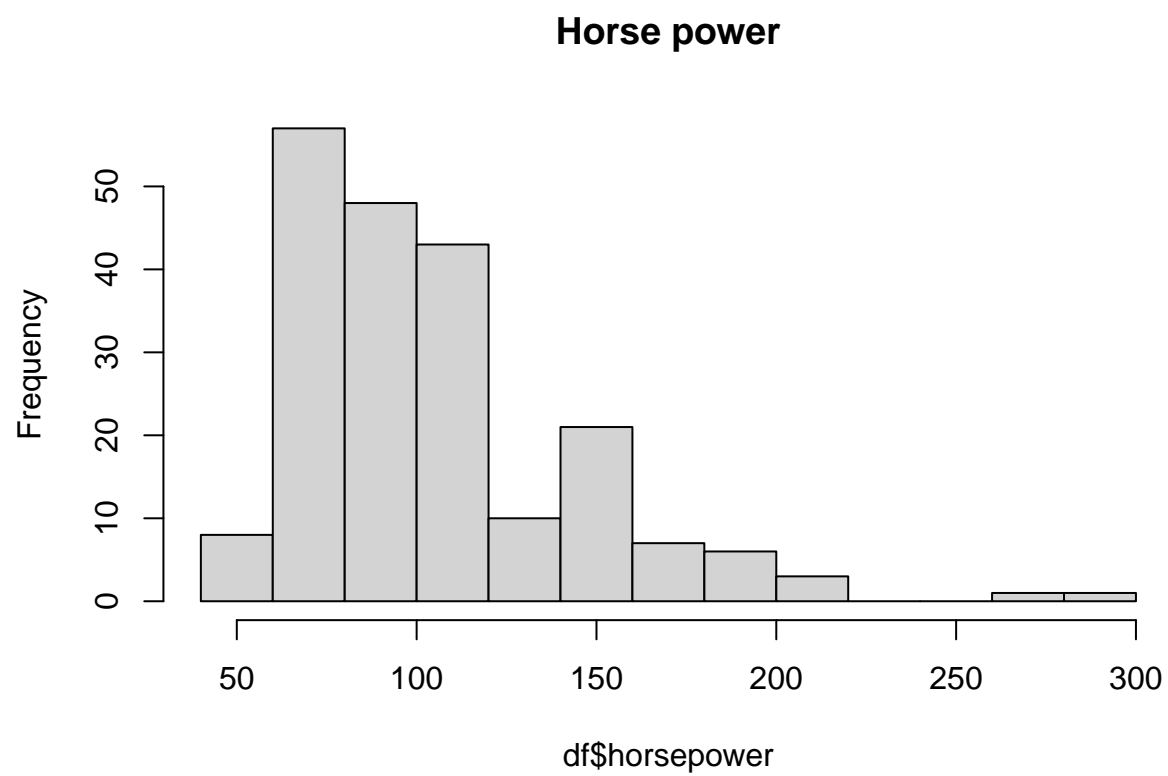

```
boxplot(df$peakrpm, main = 'Peak rpm')
```
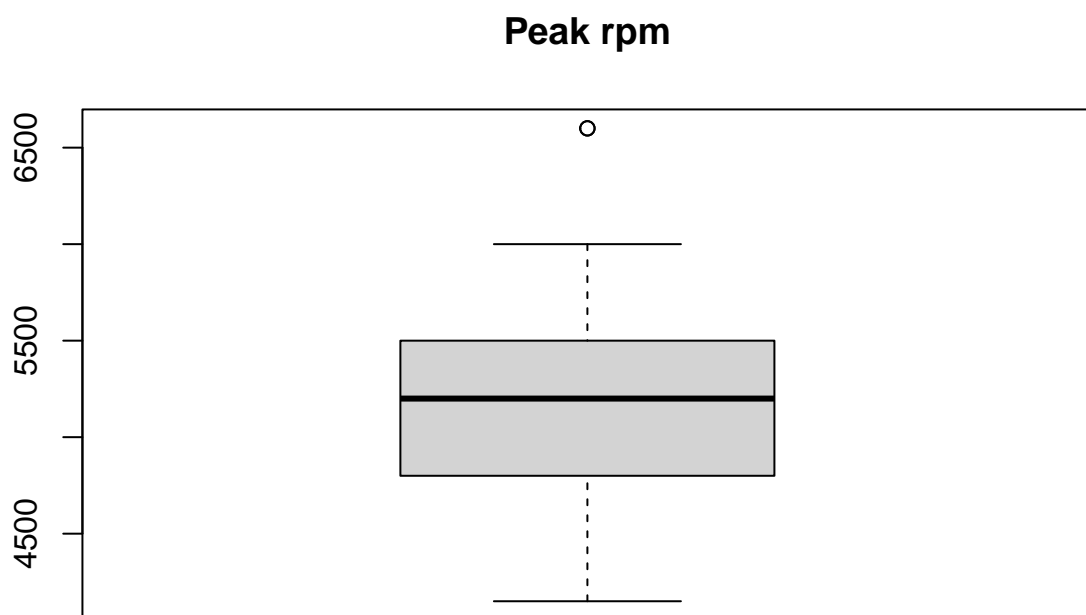
Peak rpm


```
hist(df$peakrpm, main = 'Peak rpm')
```

Peak rpm
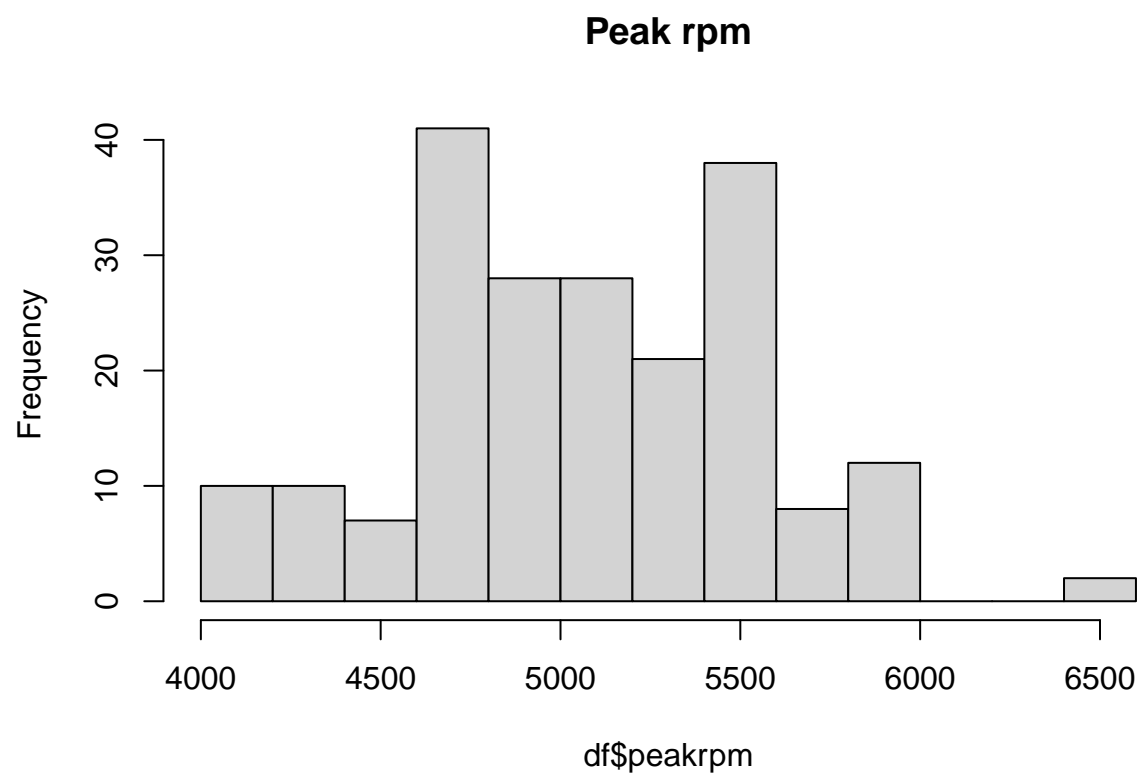

```
boxplot(df$citympg, main = 'City mpg')
```
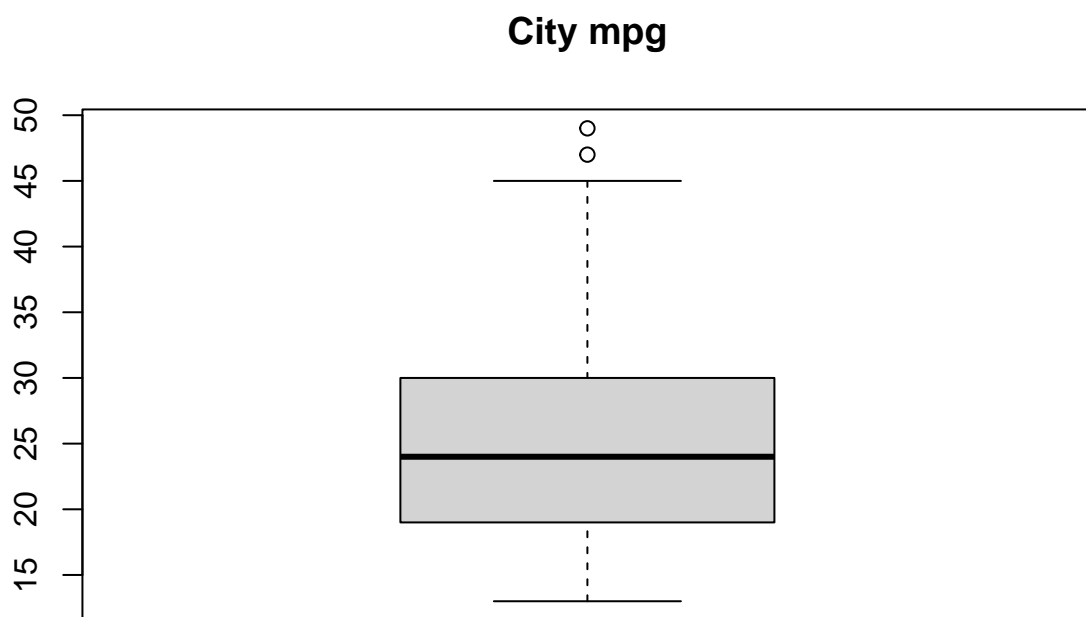
City mpg


```
hist(df$citympg, main = 'City mpg')
```

City mpg
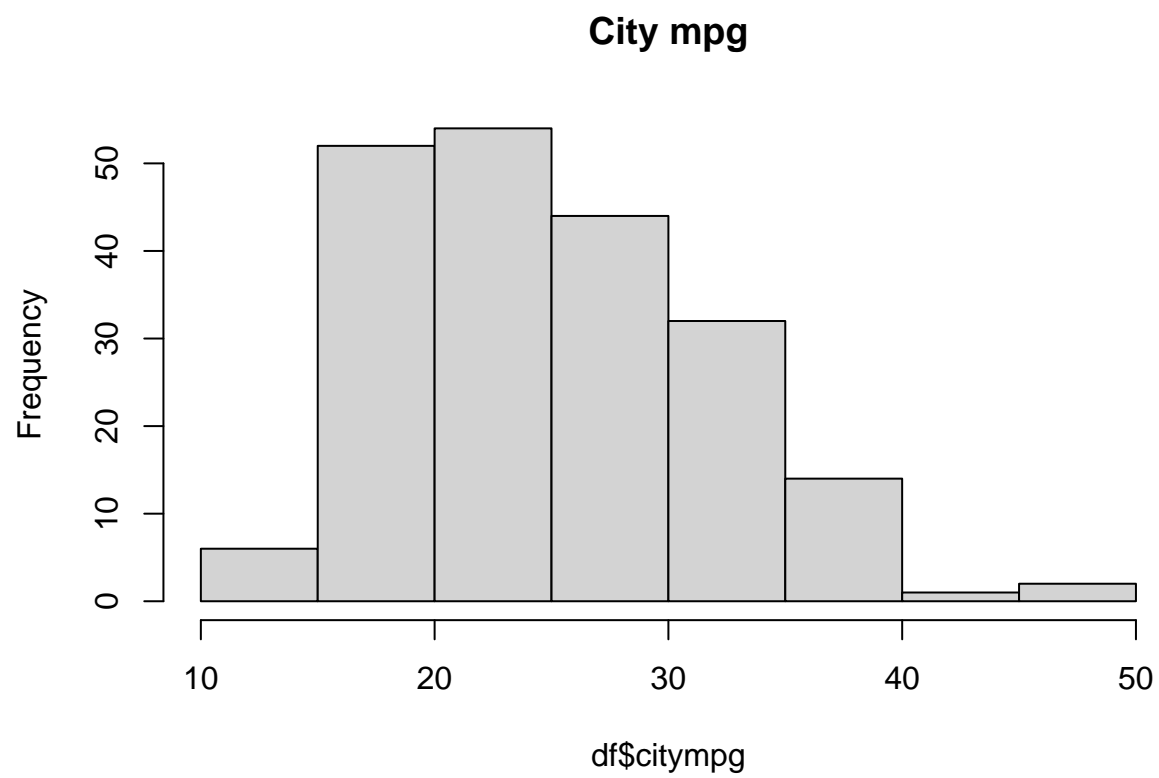

```
boxplot(df$highwaympg, main = 'Highway mpg')
```

Highway mpg


```
hist(df$highwaympg, main = 'Highway mpg')
```
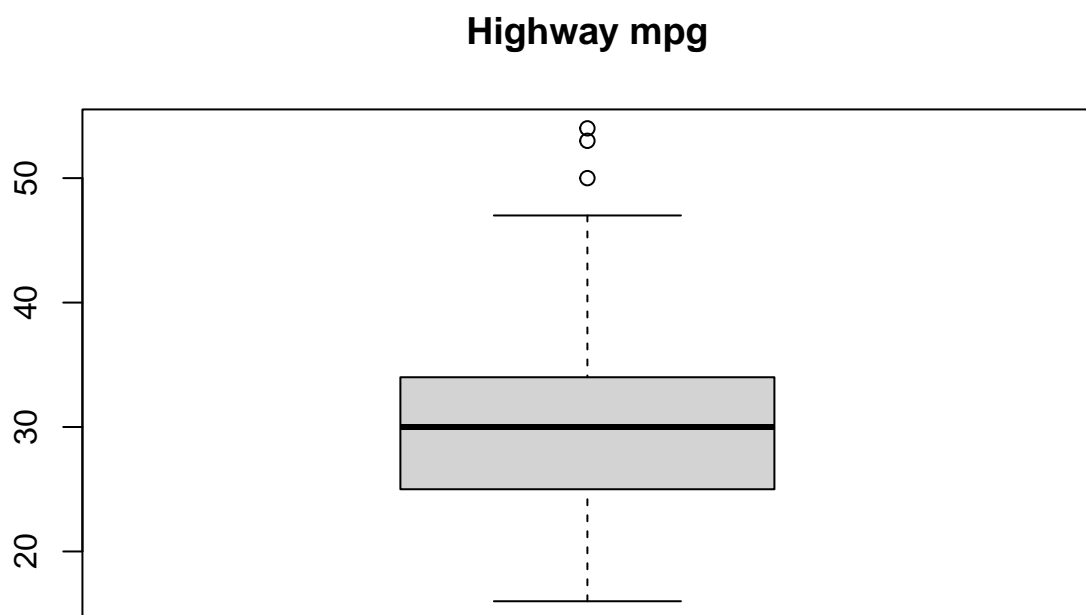
Highway mpg

df$highwaympg
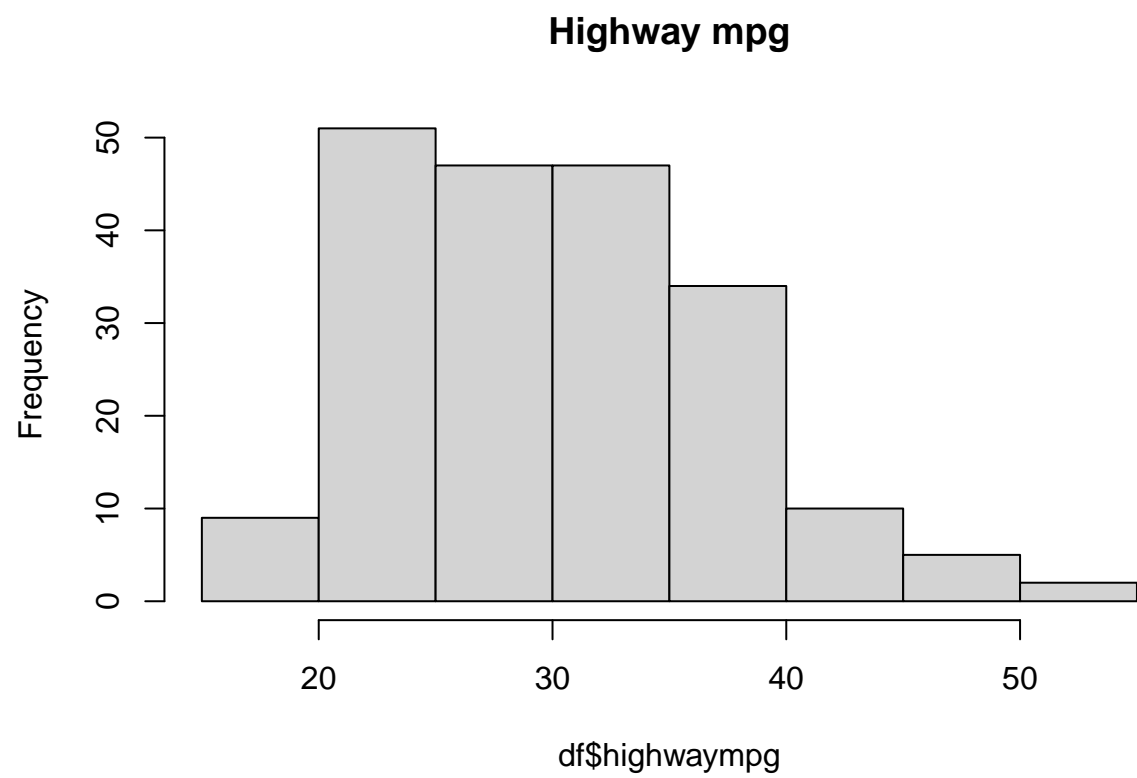
```
boxplot(df$price, main = 'Price')
```
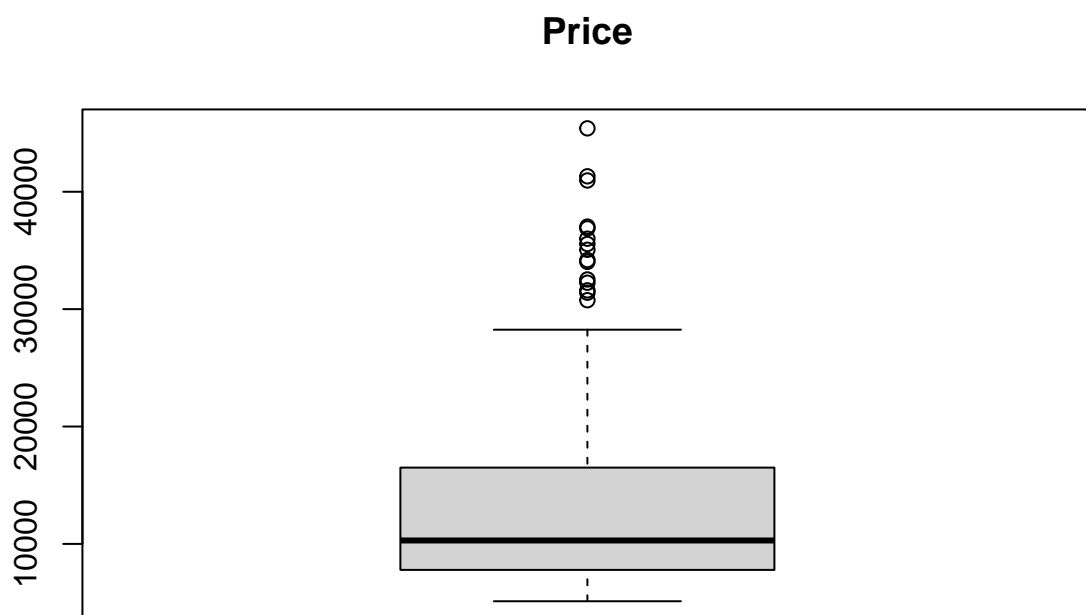
Price


```
hist(df$price, main = 'Price')
```

Price
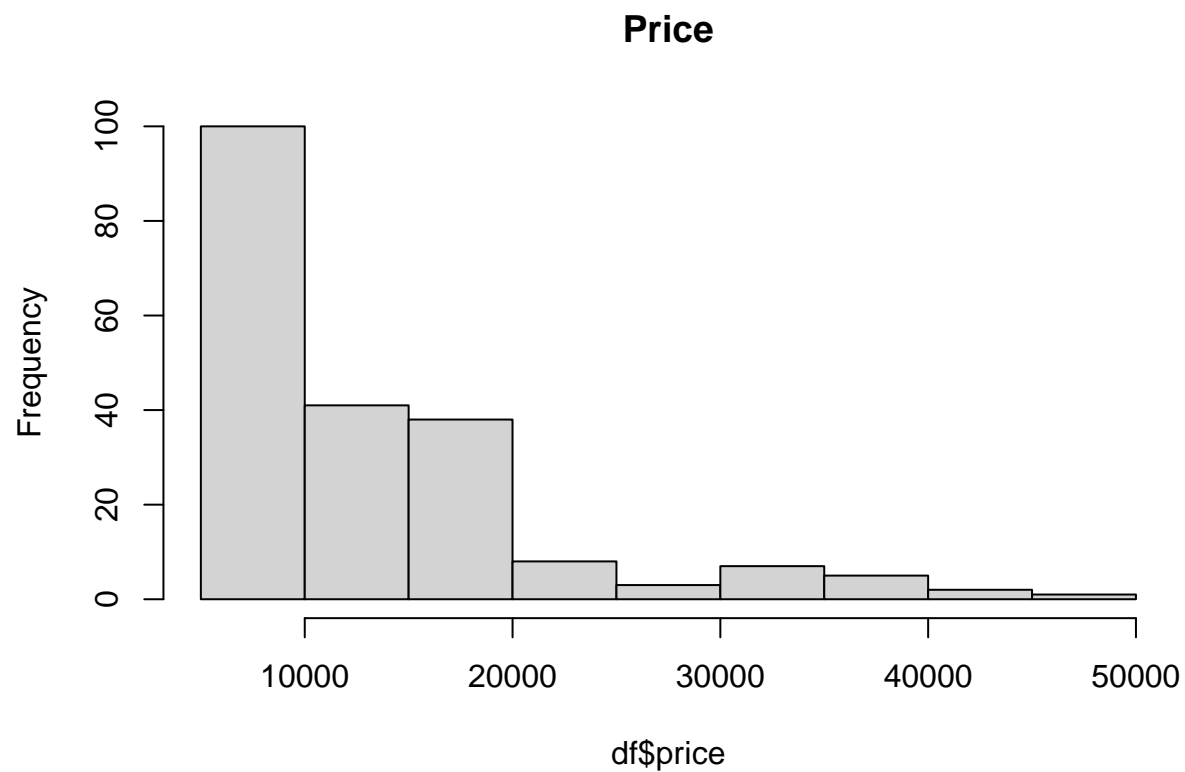

```
is.na(df)
```

```
##       symboling CarName fueltype carbody drivewheel enginelocation wheelbase
##  [1,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
##  [2,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
##  [3,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
##  [4,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
##  [5,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
##  [6,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
##  [7,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
##  [8,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
##  [9,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [10,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [11,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [12,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [13,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [14,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [15,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [16,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [17,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [18,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [19,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [20,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [21,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
## [22,]     FALSE   FALSE    FALSE   FALSE      FALSE          FALSE     FALSE
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##  [25,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [26,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [27,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [28,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [29,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [30,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [31,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [32,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [33,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [34,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [35,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [36,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
##  [37,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
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##  [39,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
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##  [41,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
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##  [43,]      FALSE  FALSE            FALSE      FALSE   FALSE   FALSE      FALSE
```

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## [92,]      FALSE FALSE           FALSE FALSE FALSE FALSE FALSE
## [93,]      FALSE FALSE           FALSE FALSE FALSE FALSE FALSE
## [94,]      FALSE FALSE           FALSE FALSE FALSE FALSE FALSE
## [95,]      FALSE FALSE           FALSE FALSE FALSE FALSE FALSE
## [96,]      FALSE FALSE           FALSE FALSE FALSE FALSE FALSE
## [97,]      FALSE FALSE           FALSE FALSE FALSE FALSE FALSE
```

```
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## [107,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
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## [109,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [110,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [111,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [112,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
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## [127,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
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## [130,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [131,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [132,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [133,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [134,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
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## [149,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [150,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
## [151,]     FALSE FALSE      FALSE   FALSE FALSE FALSE    FALSE
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## [152,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [153,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [154,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [163,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [164,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [165,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [167,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [168,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [170,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [171,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [172,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [173,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [180,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [181,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [182,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [184,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [187,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [193,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
## [194,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [200,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [202,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
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## [205,]      FALSE FALSE       FALSE    FALSE FALSE FALSE    FALSE
```

```
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##   [2,] FALSE
##   [3,] FALSE
##   [4,] FALSE
##   [5,] FALSE
##   [6,] FALSE
##   [7,] FALSE
##   [8,] FALSE
##   [9,] FALSE
##  [10,] FALSE
##  [11,] FALSE
##  [12,] FALSE
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##  [30,] FALSE
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##  [32,] FALSE
##  [33,] FALSE
##  [34,] FALSE
##  [35,] FALSE
##  [36,] FALSE
##  [37,] FALSE
##  [38,] FALSE
##  [39,] FALSE
##  [40,] FALSE
##  [41,] FALSE
##  [42,] FALSE
##  [43,] FALSE
##  [44,] FALSE
##  [45,] FALSE
##  [46,] FALSE
##  [47,] FALSE
##  [48,] FALSE
##  [49,] FALSE
##  [50,] FALSE
##  [51,] FALSE
##  [52,] FALSE
##  [53,] FALSE
```

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##  [54,] FALSE
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## [102,] FALSE
## [103,] FALSE
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## [106,] FALSE
## [107,] FALSE
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## [109,] FALSE
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## [162,] FALSE
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## [197,] FALSE
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## [201,] FALSE
## [202,] FALSE
## [203,] FALSE
## [204,] FALSE
## [205,] FALSE
```

modelo predictivo: regresion lineal

```
regresion <- lm(enginesize~ price, data= df )
plot(x=df$price, y=df$enginesize,xlab='Precio', ylab='Tamaño de motor')
abline(regresion)
```
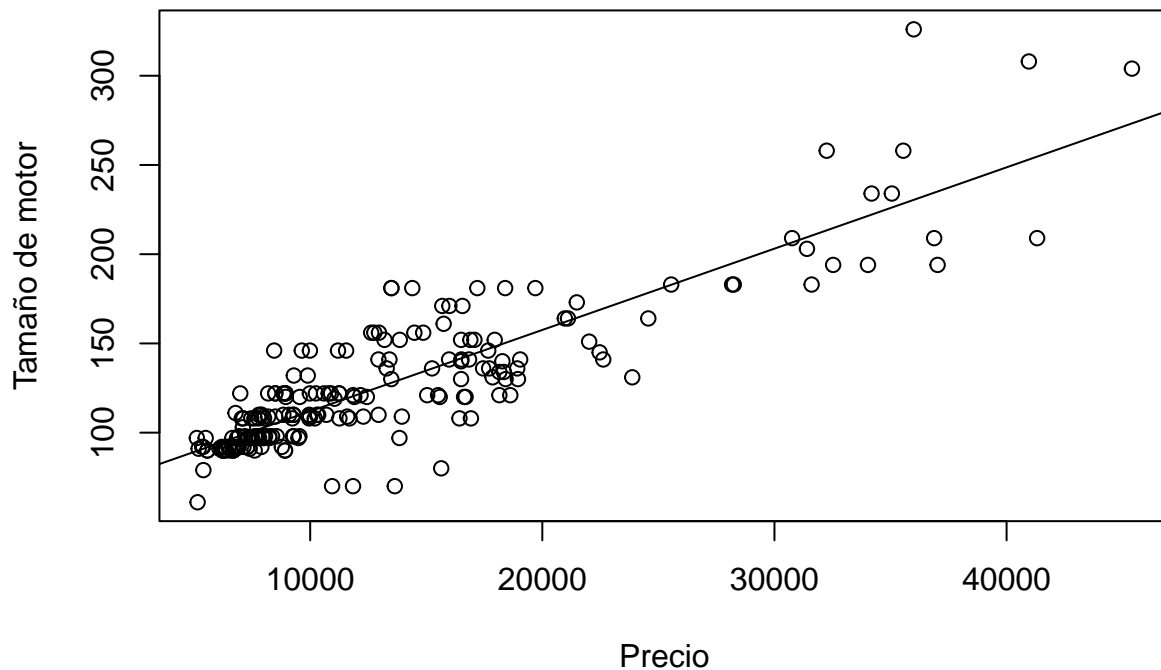
```
cor(df$price, df$enginesize, method = "spearman")
```

```
## [1] 0.8259962
```

```
df.fit = lm( df$price ~ df$enginesize , data = df)
summary(df.fit)
```

```
##
## Call:
## lm(formula = df$price ~ df$enginesize, data = df)
##
## Residuals:
##      Min       1Q    Median       3Q       Max
## -10664.2  -2225.0   -482.4    1588.0   14271.5
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -8005.446    873.221  -9.168   <2e-16 ***
## df$enginesize   167.698      6.539  25.645   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3889 on 203 degrees of freedom
## Multiple R-squared:  0.7641, Adjusted R-squared:  0.763
## F-statistic: 657.6 on 1 and 203 DF,  p-value: < 2.2e-16
```

```
df1 <- df[21,14]
df1
```

```
## [1] 90
```

```
df1 <- df %>% select(21, 14)
df1
```

```
##       price enginesize
## 1   13495.00        130
## 2   16500.00        130
## 3   16500.00        152
## 4   13950.00        109
## 5   17450.00        136
## 6   15250.00        136
## 7   17710.00        136
## 8   18920.00        136
## 9   23875.00        131
## 10  17859.17        131
## 11  16430.00        108
## 12  16925.00        108
## 13  20970.00        164
## 14  21105.00        164
## 15  24565.00        164
## 16  30760.00        209
## 17  41315.00        209
## 18  36880.00        209
## 19   5151.00         61
## 20   6295.00         90
## 21   6575.00         90
## 22   5572.00         90
## 23   6377.00         90
## 24   7957.00         98
## 25   6229.00         90
## 26   6692.00         90
## 27   7609.00         90
## 28   8558.00         98
## 29   8921.00        122
## 30  12964.00        156
## 31   6479.00         92
## 32   6855.00         92
## 33   5399.00         79
## 34   6529.00         92
## 35   7129.00         92
## 36   7295.00         92
## 37   7295.00         92
## 38   7895.00        110
## 39   9095.00        110
## 40   8845.00        110
## 41  10295.00        110
## 42  12945.00        110
## 43  10345.00        110
## 44   6785.00        111
```

```
## 45   8916.50         90
## 46   8916.50         90
## 47  11048.00        119
## 48  32250.00        258
## 49  35550.00        258
## 50  36000.00        326
## 51   5195.00         91
## 52   6095.00         91
## 53   6795.00         91
## 54   6695.00         91
## 55   7395.00         91
## 56  10945.00         70
## 57  11845.00         70
## 58  13645.00         70
## 59  15645.00         80
## 60   8845.00        122
## 61   8495.00        122
## 62  10595.00        122
## 63  10245.00        122
## 64  10795.00        122
## 65  11245.00        122
## 66  18280.00        140
## 67  18344.00        134
## 68  25552.00        183
## 69  28248.00        183
## 70  28176.00        183
## 71  31600.00        183
## 72  34184.00        234
## 73  35056.00        234
## 74  40960.00        308
## 75  45400.00        304
## 76  16503.00        140
## 77   5389.00         92
## 78   6189.00         92
## 79   6669.00         92
## 80   7689.00         98
## 81   9959.00        110
## 82   8499.00        122
## 83  12629.00        156
## 84  14869.00        156
## 85  14489.00        156
## 86   6989.00        122
## 87   8189.00        122
## 88   9279.00        110
## 89   9279.00        110
## 90   5499.00         97
## 91   7099.00        103
## 92   6649.00         97
## 93   6849.00         97
## 94   7349.00         97
## 95   7299.00         97
## 96   7799.00         97
## 97   7499.00         97
## 98   7999.00         97
```

```
## 99   8249.00        97
## 100  8949.00       120
## 101  9549.00       120
## 102 13499.00       181
## 103 14399.00       181
## 104 13499.00       181
## 105 17199.00       181
## 106 19699.00       181
## 107 18399.00       181
## 108 11900.00       120
## 109 13200.00       152
## 110 12440.00       120
## 111 13860.00       152
## 112 15580.00       120
## 113 16900.00       152
## 114 16695.00       120
## 115 17075.00       152
## 116 16630.00       120
## 117 17950.00       152
## 118 18150.00       134
## 119  5572.00        90
## 120  7957.00        98
## 121  6229.00        90
## 122  6692.00        90
## 123  7609.00        98
## 124  8921.00       122
## 125 12764.00       156
## 126 22018.00       151
## 127 32528.00       194
## 128 34028.00       194
## 129 37028.00       194
## 130 31400.50       203
## 131  9295.00       132
## 132  9895.00       132
## 133 11850.00       121
## 134 12170.00       121
## 135 15040.00       121
## 136 15510.00       121
## 137 18150.00       121
## 138 18620.00       121
## 139  5118.00        97
## 140  7053.00       108
## 141  7603.00       108
## 142  7126.00       108
## 143  7775.00       108
## 144  9960.00       108
## 145  9233.00       108
## 146 11259.00       108
## 147  7463.00       108
## 148 10198.00       108
## 149  8013.00       108
## 150 11694.00       108
## 151  5348.00        92
## 152  6338.00        92
```

```
## 153  6488.00          92
## 154  6918.00          92
## 155  7898.00          92
## 156  8778.00          92
## 157  6938.00          98
## 158  7198.00          98
## 159  7898.00         110
## 160  7788.00         110
## 161  7738.00          98
## 162  8358.00          98
## 163  9258.00          98
## 164  8058.00          98
## 165  8238.00          98
## 166  9298.00          98
## 167  9538.00          98
## 168  8449.00         146
## 169  9639.00         146
## 170  9989.00         146
## 171 11199.00         146
## 172 11549.00         146
## 173 17669.00         146
## 174  8948.00         122
## 175 10698.00         110
## 176  9988.00         122
## 177 10898.00         122
## 178 11248.00         122
## 179 16558.00         171
## 180 15998.00         171
## 181 15690.00         171
## 182 15750.00         161
## 183  7775.00          97
## 184  7975.00         109
## 185  7995.00          97
## 186  8195.00         109
## 187  8495.00         109
## 188  9495.00          97
## 189  9995.00         109
## 190 11595.00         109
## 191  9980.00         109
## 192 13295.00         136
## 193 13845.00          97
## 194 12290.00         109
## 195 12940.00         141
## 196 13415.00         141
## 197 15985.00         141
## 198 16515.00         141
## 199 18420.00         130
## 200 18950.00         130
## 201 16845.00         141
## 202 19045.00         141
## 203 21485.00         173
## 204 22470.00         145
## 205 22625.00         141
```

```
predict(regresion, df1)
```

```
##         1         2         3         4         5         6         7         8
## 127.90197 141.59445 141.59445 129.97521 145.92319 135.89874 147.10790 152.62135
##         9        10        11        12        13        14        15        16
## 175.19914 147.78759 141.27549 143.53099 161.96231 162.57745 178.34317 206.57110
##        17        18        19        20        21        22        23        24
## 254.66567 234.45730  89.88197  95.09468  96.37052  91.80028  95.46832 102.66770
##        25        26        27        28        29        30        31        32
##  94.79395  96.90364 101.08201 105.40619 107.06023 125.48243  95.93309  97.64636
##        33        34        35        36        37        38        39        40
##  91.01200  96.16092  98.89486  99.65125  99.65125 102.38519 107.85307 106.71393
##        41        42        43        44        45        46        47        48
## 113.32095 125.39586 113.54878  97.32740 107.03972 107.03972 116.75205 213.36039
##        49        50        51        52        53        54        55        56
## 228.39706 230.44752  90.08246  94.18337  97.37297  96.91731 100.10691 116.28272
##        57        58        59        60        61        62        63        64
## 120.38363 128.58545 137.69859 106.71393 105.11913 114.68792 113.09312 115.59924
##        65        66        67        68        69        70        71        72
## 117.64969 149.70514 149.99676 182.84050 195.12501 194.79693 210.39862 222.17279
##        73        74        75        76        77        78        79        80
## 226.14612 253.04809 273.27925 141.60812  90.96643  94.61169  96.79884 101.44654
##        81        82        83        84        85        86        87        88
## 111.78995 105.13736 123.95598 134.16269 132.43120  98.25694 103.72482 108.69148
##        89        90        91        92        93        94        95        96
## 108.69148  91.46765  98.75816  96.70771  97.61902  99.89730  99.66948 101.94776
##        97        98        99       100       101       102       103       104
## 100.58079 102.85907 103.99822 107.18781 109.92175 127.92019 132.02110 127.92019
##       105       106       107       108       109       110       111       112
## 144.77949 156.17091 150.24737 120.63424 126.55778 123.09479 129.56511 137.40241
##       113       114       115       116       117       118       119       120
## 143.41708 142.48298 144.21448 142.18681 148.20148 149.11279  91.80028 102.66770
##       121       122       123       124       125       126       127       128
##  94.79395  96.90364 101.08201 107.06023 124.57112 166.73759 214.62711 221.46197
##       129       130       131       132       133       134       135       136
## 235.13167 209.48959 108.76438 111.49832 120.40641 121.86452 134.94186 137.08345
##       137       138       139       140       141       142       143       144
## 149.11279 151.25438  89.73160  98.54856 101.05467  98.88119 101.83840 111.79450
##       145       146       147       148       149       150       151       152
## 108.48188 117.71348 100.41675 112.87896 102.92287 119.69559  90.77961  95.29061
##       153       154       155       156       157       158       159       160
##  95.97410  97.93342 102.39886 106.40864  98.02456  99.20926 102.39886 101.89764
##       161       162       163       164       165       166       167       168
## 101.66981 104.49488 108.59579 103.12791 103.94809 108.77805 109.87163 104.90953
##       169       170       171       172       173       174       175       176
## 110.33184 111.92664 117.44009 119.03489 146.92108 107.18326 115.15725 111.92209
##       177       178       179       180       181       182       183       184
## 116.06856 117.66336 141.85873 139.30706 137.90363 138.17703 101.83840 102.74972
##       185       186       187       188       189       190       191       192
## 102.84085 103.75216 105.11913 109.67570 111.95398 119.24449 111.88563 126.99065
##       193       194       195       196       197       198       199       200
## 129.49677 122.41130 125.37307 127.53744 139.24782 141.66280 150.34306 152.75804
##       201       202       203       204       205
```

```
## 143.16647 153.19092 164.30894 168.79716 169.50343
```

```
confint(regresion, level = 0.90)
```

```
##                      5 %          95 %
## (Intercept) 61.864717276 70.957463958
## price        0.004262967  0.004850168
```

```
t.test(df1)
```

```
##
##  One Sample t-test
##
## data:  df1
## t = 15.652, df = 409, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##   5860.100 7543.518
## sample estimates:
## mean of x
##   6701.809
```

```
# Grafico de dispersion y recta
plot(df1$price, df1$enginesize, xlab='Precio', ylab='Grasas')
abline(regresion)
```
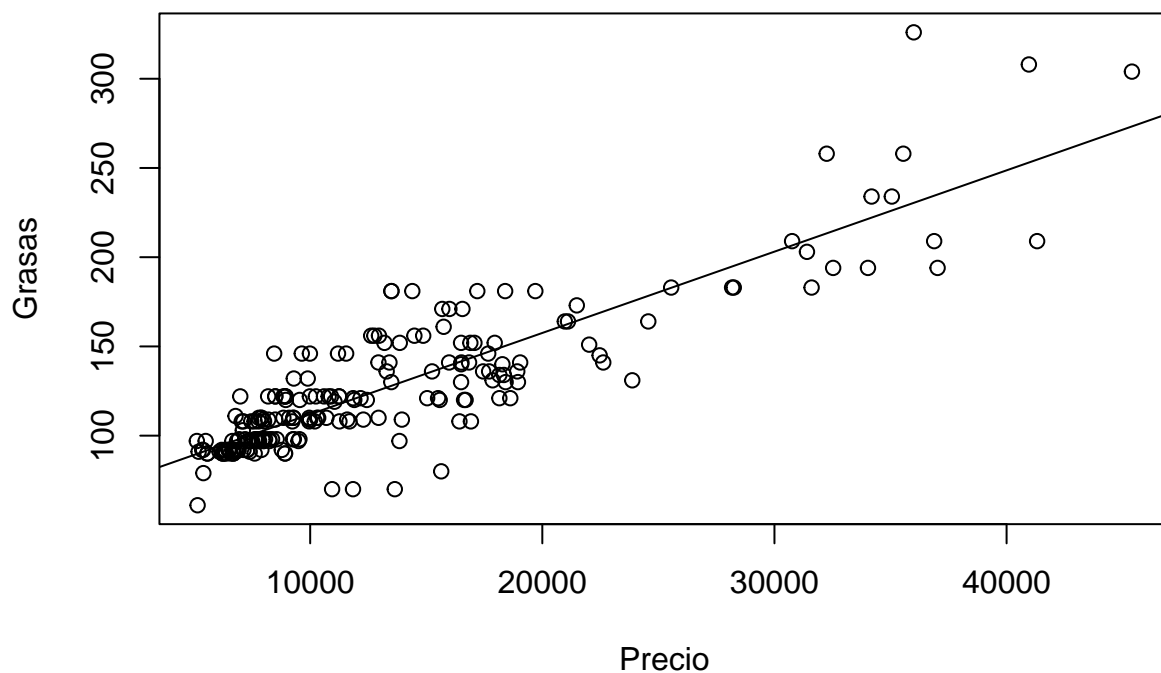
```r
# Intervalos de confianza de la respuesta media:
# ic es una matriz con tres columnas: la primera es la prediccion, las otras dos son los extremos del i
ic <- predict(regresion, df1, interval = 'confidence')
ic
```

```
##             fit       lwr       upr
## 1   127.90197 125.10895 130.69499
## 2   141.59445 138.58276 144.60615
## 3   141.59445 138.58276 144.60615
## 4   129.97521 127.17329 132.77712
## 5   145.92319 142.77157 149.07482
## 6   135.89874 133.02246 138.77503
## 7   147.10790 143.91300 150.30280
## 8   152.62135 149.20025 156.04244
## 9   175.19914 170.55355 179.84472
## 10  147.78759 144.56696 151.00822
## 11  141.27549 138.27291 144.27808
## 12  143.53099 140.46037 146.60162
## 13  161.96231 158.08165 165.84297
## 14  162.57745 158.66379 166.49110
## 15  178.34317 173.50220 183.18414
## 16  206.57110 199.83971 213.30250
## 17  254.66567 244.45369 264.87766
## 18  234.45730 225.72952 243.18507
## 19   89.88197  85.89460  93.86934
## 20   95.09468  91.38283  98.80654
## 21   96.37052  92.72256 100.01848
## 22   91.80028  87.91684  95.68373
## 23   95.46832  91.77533  99.16131
## 24  102.66770  99.31084 106.02456
## 25   94.79395  91.06682  98.52108
## 26   96.90364  93.28193 100.52535
## 27  101.08201  97.65597 104.50806
## 28  105.40619 102.16151 108.65088
## 29  107.06023 103.87845 110.24201
## 30  125.48243 122.68831 128.27655
## 31   95.93309  92.26339  99.60279
## 32   97.64636  94.06075 101.23197
## 33   91.01200  87.08619  94.93781
## 34   96.16092  92.50257  99.81927
## 35   98.89486  95.36869 102.42103
## 36   99.65125  96.16030 103.14220
## 37   99.65125  96.16030 103.14220
## 38  102.38519  99.01622 105.75416
## 39  107.85307 104.70008 111.00607
## 40  106.71393 103.51930 109.90856
## 41  113.32095 110.33996 116.30194
## 42  125.39586 122.60147 128.19025
## 43  113.54878 110.57388 116.52368
## 44   97.32740  93.72635 100.92845
## 45  107.03972 103.85719 110.22226
## 46  107.03972 103.85719 110.22226
## 47  116.75205 113.85295 119.65114
## 48  213.36039 206.15075 220.57002
```

```
## 49   228.39706 220.10941 236.68471
## 50   230.44752 222.01127 238.88377
## 51    90.08246  86.10608  94.05884
## 52    94.18337  90.42497  97.94176
## 53    97.37297  93.77413 100.97180
## 54    96.91731  93.29627 100.53835
## 55   100.10691  96.63687 103.57694
## 56   116.28272 113.37370 119.19174
## 57   120.38363 117.54696 123.22030
## 58   128.58545 125.79050 131.38040
## 59   137.69859 134.78594 140.61124
## 60   106.71393 103.51930 109.90856
## 61   105.11913 101.86314 108.37512
## 62   114.68792 111.74211 117.63373
## 63   113.09312 110.10595 116.08030
## 64   115.59924 112.67502 118.52345
## 65   117.64969 114.76842 120.53097
## 66   149.70514 146.40854 153.00174
## 67   149.99676 146.68818 153.30534
## 68   182.84050 177.71317 187.96783
## 69   195.12501 189.18317 201.06684
## 70   194.79693 188.87735 200.71652
## 71   210.39862 203.39838 217.39886
## 72   222.17279 214.33408 230.01151
## 73   226.14612 218.02121 234.27102
## 74   253.04809 242.95568 263.14050
## 75   273.27925 261.68405 284.87445
## 76   141.60812 138.59603 144.62021
## 77    90.96643  87.03816  94.89471
## 78    94.61169  90.87526  98.34812
## 79    96.79884  93.17199 100.42569
## 80   101.44654  98.03666 104.85642
## 81   111.78995 108.76569 114.81420
## 82   105.13736 101.88209 108.39263
## 83   123.95598 121.15480 126.75716
## 84   134.16269 131.31554 137.00985
## 85   132.43120 129.60710 135.25529
## 86    98.25694  94.70060 101.81328
## 87   103.72482 100.41240 107.03724
## 88   108.69148 105.56791 111.81504
## 89   108.69148 105.56791 111.81504
## 90    91.46765  87.56639  95.36892
## 91    98.75816  95.22556 102.29076
## 92    96.70771  93.07638 100.33903
## 93    97.61902  94.03209 101.20595
## 94    99.89730  96.41767 103.37693
## 95    99.66948  96.17936 103.15959
## 96   101.94776  98.55986 105.33566
## 97   100.58079  97.13226 104.02931
## 98   102.85907  99.51036 106.20778
## 99   103.99822 100.69706 107.29937
## 100  107.18781 104.01073 110.36490
## 101  109.92175 106.83944 113.00406
## 102  127.92019 125.12714 130.71325
```

```
## 103 132.02110 129.20158 134.84063
## 104 127.92019 125.12714 130.71325
## 105 144.77949 141.66769 147.89130
## 106 156.17091 152.58517 159.75665
## 107 150.24737 146.92842 153.56633
## 108 120.63424 117.80092 123.46757
## 109 126.55778 123.76568 129.34988
## 110 123.09479 120.28747 125.90211
## 111 129.56511 126.76567 132.36456
## 112 137.40241 134.49617 140.30865
## 113 143.41708 140.35009 146.48407
## 114 142.48298 139.44501 145.52095
## 115 144.21448 141.12161 147.30735
## 116 142.18681 139.15774 145.21587
## 117 148.20148 144.96486 151.43809
## 118 149.11279 145.84018 152.38540
## 119  91.80028  87.91684  95.68373
## 120 102.66770  99.31084 106.02456
## 121  94.79395  91.06682  98.52108
## 122  96.90364  93.28193 100.52535
## 123 101.08201  97.65597 104.50806
## 124 107.06023 103.87845 110.24201
## 125 124.57112 121.77337 127.36886
## 126 166.73759 162.59350 170.88168
## 127 214.62711 207.32759 221.92664
## 128 221.46197 213.67429 229.24964
## 129 235.13167 226.35475 243.90858
## 130 209.48959 202.55338 216.42579
## 131 108.76438 105.64333 111.88544
## 132 111.49832 108.46538 114.53127
## 133 120.40641 117.57005 123.24277
## 134 121.86452 119.04575 124.68328
## 135 134.94186 132.08237 137.80136
## 136 137.08345 134.18392 139.98298
## 137 149.11279 145.84018 152.38540
## 138 151.25438 147.89292 154.61583
## 139  89.73160  85.73597  93.72723
## 140  98.54856  95.00606 102.09106
## 141 101.05467  97.62741 104.48194
## 142  98.88119  95.35438 102.40800
## 143 101.83840  98.44573 105.23107
## 144 111.79450 108.77038 114.81862
## 145 108.48188 105.35105 111.61270
## 146 117.71348 114.83341 120.59355
## 147 100.41675  96.96081 103.87270
## 148 112.87896 109.88589 115.87204
## 149 102.92287  99.57686 106.26887
## 150 119.69559 116.84909 122.54209
## 151  90.77961  86.84122  94.71800
## 152  95.29061  91.58867  98.99256
## 153  95.97410  92.30645  99.64175
## 154  97.93342  94.36162 101.50523
## 155 102.39886  99.03048 105.76724
## 156 106.40864 103.20253 109.61475
```

```
## 157  98.02456  94.45712 101.59199
## 158  99.20926  95.69780 102.72072
## 159 102.39886  99.03048 105.76724
## 160 101.89764  98.50755 105.28772
## 161 101.66981  98.26976 105.06986
## 162 104.49488 101.21394 107.77582
## 163 108.59579 105.46892 111.72266
## 164 103.12791  99.79057 106.46525
## 165 103.94809 100.64488 107.25131
## 166 108.77805 105.65747 111.89864
## 167 109.87163 106.78768 112.95558
## 168 104.90953 101.64522 108.17384
## 169 110.33184 107.26276 113.40093
## 170 111.92664 108.90641 114.94687
## 171 117.44009 114.55479 120.32539
## 172 119.03489 116.17806 121.89172
## 173 146.92108 143.73314 150.10902
## 174 107.18326 104.00600 110.36051
## 175 115.15725 112.22275 118.09175
## 176 111.92209 108.90172 114.94245
## 177 116.06856 113.15487 118.98225
## 178 117.66336 114.78234 120.54438
## 179 141.85873 138.83936 144.87811
## 180 139.30706 136.35680 142.25732
## 181 137.90363 134.98646 140.82081
## 182 138.17703 135.25369 141.10037
## 183 101.83840  98.44573 105.23107
## 184 102.74972  99.39635 106.10308
## 185 102.84085  99.49136 106.19033
## 186 103.75216 100.44087 107.06345
## 187 105.11913 101.86314 108.37512
## 188 109.67570 106.58532 112.76607
## 189 111.95398 108.93455 114.97341
## 190 119.24449 116.39103 122.09795
## 191 111.88563 108.86420 114.90707
## 192 126.99065 124.19867 129.78263
## 193 129.49677 126.69770 132.29583
## 194 122.41130 119.59801 125.22459
## 195 125.37307 122.57861 128.16754
## 196 127.53744 124.74505 130.32983
## 197 139.24782 136.29903 142.19661
## 198 141.66280 138.64913 144.67647
## 199 150.34306 147.02012 153.66600
## 200 152.75804 149.33086 156.18522
## 201 143.16647 140.10740 146.22553
## 202 153.19092 149.74433 156.63750
## 203 164.30894 160.30087 168.31702
## 204 168.79716 164.53471 173.05961
## 205 169.50343 165.19980 173.80705
```

```r
# Intervalos de prediccion
ic1 <- predict(regresion, df1, interval = 'prediction')
ic1
```

```
##          fit       lwr      upr
## 1  127.90197  87.82956 167.9744
## 2  141.59445 101.50621 181.6827
## 3  141.59445 101.50621 181.6827
## 4  129.97521  89.90217 170.0482
## 5  145.92319 105.82419 186.0222
## 6  135.89874  95.82044 175.9770
## 7  147.10790 107.00547 187.2103
## 8  152.62135 112.50026 192.7424
## 9  175.19914 134.95515 215.4431
## 10 147.78759 107.68310 187.8921
## 11 141.27549 101.18793 181.3631
## 12 143.53099 103.43828 183.6237
## 13 161.96231 121.79943 202.1252
## 14 162.57745 122.41137 202.7435
## 15 178.34317 138.07616 218.6102
## 16 206.57110 166.03336 247.1089
## 17 254.66567 213.40695 295.9244
## 18 234.45730 193.54066 275.3739
## 19  89.88197  49.70864 130.0553
## 20  95.09468  54.94776 135.2416
## 21  96.37052  56.22946 136.5116
## 22  91.80028  51.63714 131.9634
## 23  95.46832  55.32314 135.6135
## 24 102.66770  62.55204 142.7834
## 25  94.79395  54.64561 134.9423
## 26  96.90364  56.76495 137.0423
## 27 101.08201  60.96051 141.2035
## 28 105.40619  65.29977 145.5126
## 29 107.06023  66.95884 147.1616
## 30 125.48243  85.40994 165.5549
## 31  95.93309  55.79005 136.0761
## 32  97.64636  57.51092 137.7818
## 33  91.01200  50.84473 131.1793
## 34  96.16092  56.01891 136.3029
## 35  98.89486  58.76468 139.0250
## 36  99.65125  59.52415 139.7783
## 37  99.65125  59.52415 139.7783
## 38 102.38519  62.26852 142.5019
## 39 107.85307  67.75396 147.9522
## 40 106.71393  66.61152 146.8163
## 41 113.32095  73.23500 153.4069
## 42 125.39586  85.32335 165.4684
## 43 113.54878  73.46328 153.6343
## 44  97.32740  57.19057 137.4642
## 45 107.03972  66.93828 147.1412
## 46 107.03972  66.93828 147.1412
## 47 116.75205  76.67210 156.8320
## 48 213.36039 172.74049 253.9803
## 49 228.39706 187.57204 269.2221
## 50 230.44752 189.59207 271.3030
## 51  90.08246  49.91022 130.2547
## 52  94.18337  54.03212 134.3346
## 53  97.37297  57.23634 137.5096
```

```
## 54    96.91731   56.77868 137.0559
## 55   100.10691   59.98162 140.2322
## 56   116.28272   76.20206 156.3634
## 57   120.38363   80.30815 160.4591
## 58   128.58545   88.51291 168.6580
## 59   137.69859   97.61766 177.7795
## 60   106.71393   66.61152 146.8163
## 61   105.11913   65.01179 145.2265
## 62   114.68792   74.60457 154.7713
## 63   113.09312   73.00671 153.1795
## 64   115.59924   75.51747 155.6810
## 65   117.64969   77.57103 157.7284
## 66   149.70514  109.59449 189.8158
## 67   149.99676  109.88512 190.1084
## 68   182.84050  142.53806 223.1429
## 69   195.12501  154.71087 235.5391
## 70   194.79693  154.38606 235.2078
## 71   210.39862  169.81537 250.9819
## 72   222.17279  181.43653 262.9090
## 73   226.14612  185.35382 266.9384
## 74   253.04809  211.81881 294.2774
## 75   273.27925  231.65659 314.9019
## 76   141.60812  101.51985 181.6964
## 77    90.96643   50.79893 131.1339
## 78    94.61169   54.46249 134.7609
## 79    96.79884   56.65969 136.9380
## 80   101.44654   61.32641 141.5667
## 81   111.78995   71.70075 151.8791
## 82   105.13736   65.03008 145.2446
## 83   123.95598   83.88300 164.0290
## 84   134.16269   94.08647 174.2389
## 85   132.43120   92.35661 172.5058
## 86    98.25694   58.12410 138.3898
## 87   103.72482   63.61286 143.8368
## 88   108.69148   68.59467 148.7883
## 89   108.69148   68.59467 148.7883
## 90    91.46765   51.30278 131.6325
## 91    98.75816   58.62742 138.8889
## 92    96.70771   56.56815 136.8473
## 93    97.61902   57.48346 137.7546
## 94    99.89730   59.77119 140.0234
## 95    99.66948   59.54245 139.7965
## 96   101.94776   61.82950 142.0660
## 97   100.58079   60.45736 140.7042
## 98   102.85907   62.74410 142.9740
## 99   103.99822   63.88718 144.1092
## 100  107.18781   67.08680 147.2888
## 101  109.92175   69.82814 150.0154
## 102  127.92019   87.84778 167.9926
## 103  132.02110   91.94684 172.0954
## 104  127.92019   87.84778 167.9926
## 105  144.77949  104.68360 184.8754
## 106  156.17091  116.03546 196.3064
## 107  150.24737  110.13487 190.3599
```

```
## 108 120.63424  80.55900 160.7095
## 109 126.55778  86.48543 166.6301
## 110 123.09479  83.02138 163.1682
## 111 129.56511  89.49225 169.6380
## 112 137.40241  97.32195 177.4829
## 113 143.41708 103.32464 183.5095
## 114 142.48298 102.39275 182.5732
## 115 144.21448 104.12005 184.3089
## 116 142.18681 102.09725 182.2764
## 117 148.20148 108.09570 188.3072
## 118 149.11279 109.00410 189.2215
## 119  91.80028  51.63714 131.9634
## 120 102.66770  62.55204 142.7834
## 121  94.79395  54.64561 134.9423
## 122  96.90364  56.76495 137.0423
## 123 101.08201  60.96051 141.2035
## 124 107.06023  66.95884 147.1616
## 125 124.57112  84.49838 164.6439
## 126 166.73759 126.54840 206.9268
## 127 214.62711 173.99117 255.2631
## 128 221.46197 180.73550 262.1884
## 129 235.13167 194.20452 276.0588
## 130 209.48959 168.91733 250.0618
## 131 108.76438  68.66777 148.8610
## 132 111.49832  71.40848 151.5882
## 133 120.40641  80.33096 160.4819
## 134 121.86452  81.79030 161.9387
## 135 134.94186  94.86476 175.0190
## 136 137.08345  97.00347 177.1634
## 137 149.11279 109.00410 189.2215
## 138 151.25438 111.13834 191.3704
## 139  89.73160  49.55745 129.9058
## 140  98.54856  58.41695 138.6802
## 141 101.05467  60.93306 141.1763
## 142  98.88119  58.75096 139.0114
## 143 101.83840  61.71973 141.9571
## 144 111.79450  71.70532 151.8837
## 145 108.48188  68.38450 148.5793
## 146 117.71348  77.63491 157.7921
## 147 100.41675  60.29269 140.5408
## 148 112.87896  72.79211 152.9658
## 149 102.92287  62.80812 143.0376
## 150 119.69559  79.61941 159.7718
## 151  90.77961  50.61112 130.9481
## 152  95.29061  55.14461 135.4366
## 153  95.97410  55.83124 136.1170
## 154  97.93342  57.79921 138.0676
## 155 102.39886  62.28224 142.5155
## 156 106.40864  66.30532 146.5120
## 157  98.02456  57.89073 138.1584
## 158  99.20926  59.08038 139.3381
## 159 102.39886  62.28224 142.5155
## 160 101.89764  61.77919 142.0161
## 161 101.66981  61.55052 141.7891
```

```
## 162 104.49488  64.38551 144.6043
## 163 108.59579  68.49873 148.6929
## 164 103.12791  63.01388 143.2419
## 165 103.94809  63.83689 144.0593
## 166 108.77805  68.68148 148.8746
## 167 109.87163  69.77789 149.9654
## 168 104.90953  64.80151 145.0175
## 169 110.33184  70.23924 150.4244
## 170 111.92664  71.83775 152.0155
## 171 117.44009  77.36114 157.5190
## 172 119.03489  78.95798 159.1118
## 173 146.92108 106.81921 187.0230
## 174 107.18326  67.08223 147.2843
## 175 115.15725  75.07473 155.2398
## 176 111.92209  71.83319 152.0110
## 177 116.06856  75.98756 156.1496
## 178 117.66336  77.58472 157.7420
## 179 141.85873 101.76991 181.9476
## 180 139.30706  99.22338 179.3907
## 181 137.90363  97.82238 177.9849
## 182 138.17703  98.09532 178.2587
## 183 101.83840  61.71973 141.9571
## 184 102.74972  62.63435 142.8651
## 185 102.84085  62.72581 142.9559
## 186 103.75216  63.64029 143.8640
## 187 105.11913  65.01179 145.2265
## 188 109.67570  69.58146 149.7699
## 189 111.95398  71.86515 152.0428
## 190 119.24449  79.16782 159.3212
## 191 111.88563  71.79665 151.9746
## 192 126.99065  86.91831 167.0630
## 193 129.49677  89.42393 169.5696
## 194 122.41130  82.33747 162.4851
## 195 125.37307  85.30056 165.4456
## 196 127.53744  87.46507 167.6098
## 197 139.24782  99.16425 179.3314
## 198 141.66280 101.57441 181.7512
## 199 150.34306 110.23023 190.4559
## 200 152.75804 112.63644 192.8796
## 201 143.16647 103.07463 183.2583
## 202 153.19092 113.06765 193.3142
## 203 164.30894 124.13355 204.4843
## 204 168.79716 128.59560 208.9987
## 205 169.50343 129.29748 209.7094
```
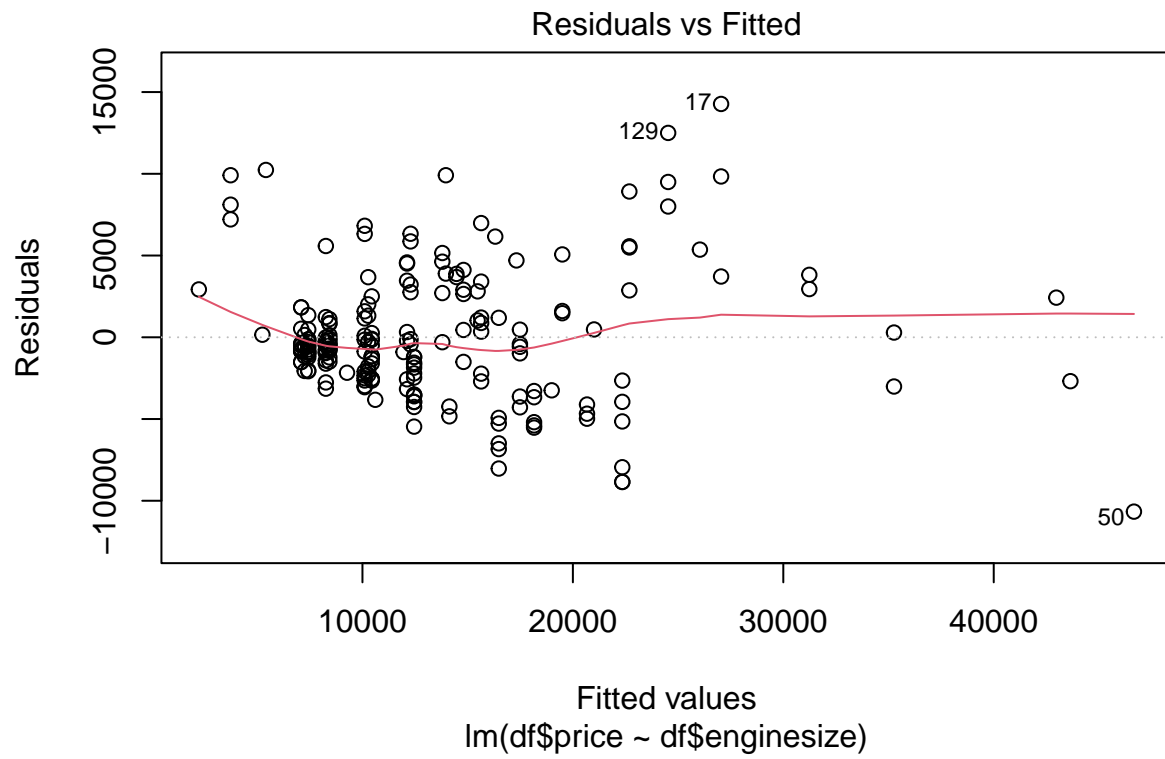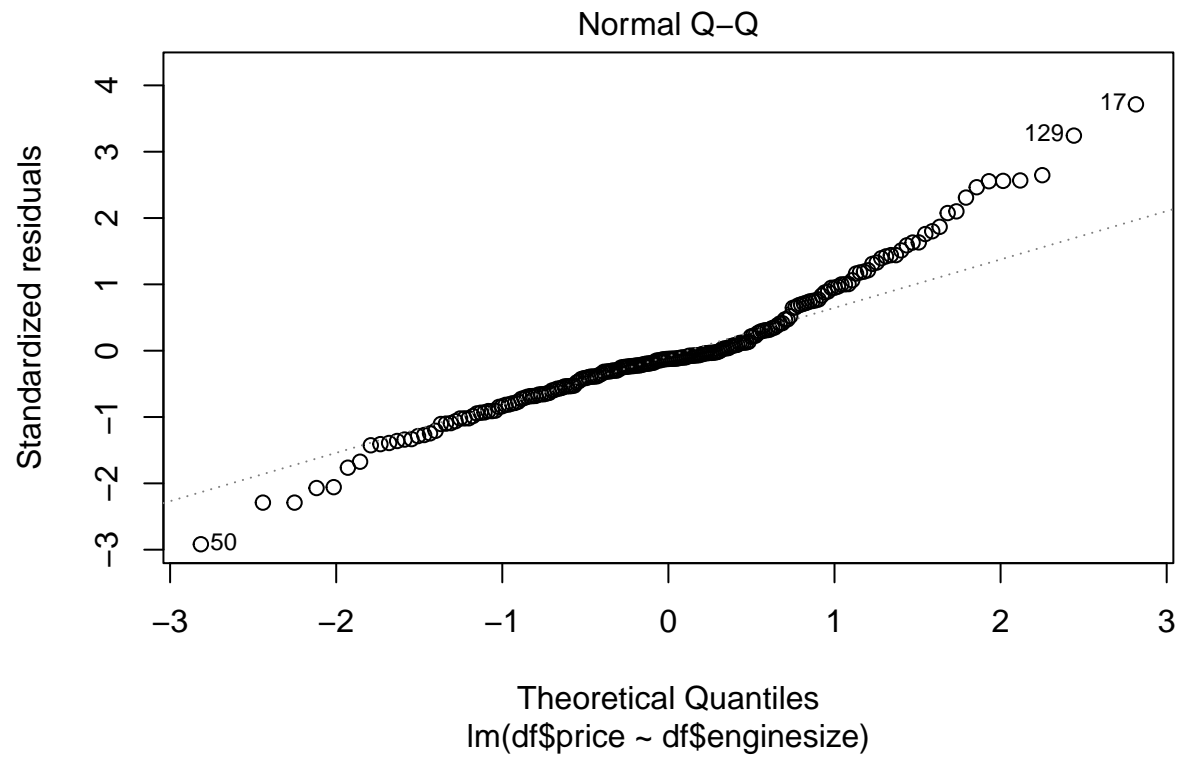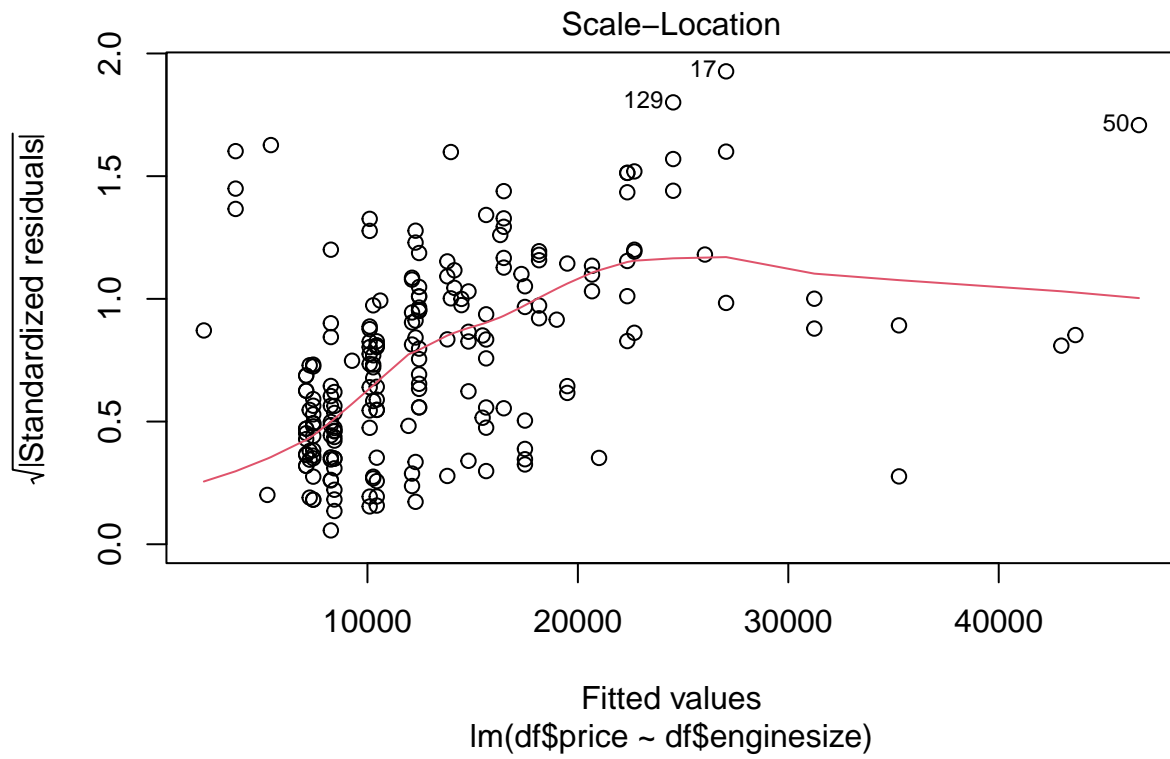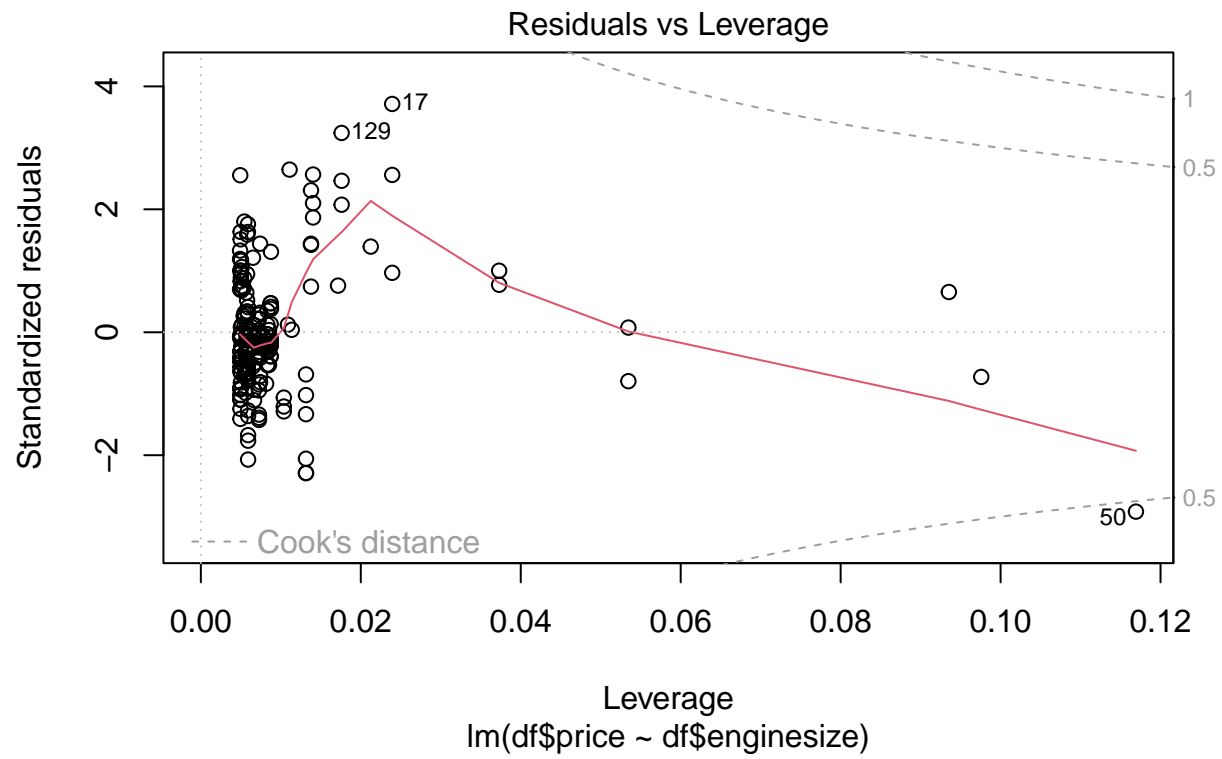
```
plot(ic,ic1)
```

```
plot(df.fit)
```

Residuals vs Fitted

Residuals

15000

5000

0

−10000

17
129

50

10000   20000   30000   40000

Fitted values
lm(df$price ~ df$enginesize)

Normal Q–Q

Theoretical Quantiles
lm(df$price ~ df$enginesize)

Scale–Location

17
129
50

√|Standardized residuals|

Fitted values
lm(df$price ~ df$enginesize)

Residuals vs Leverage
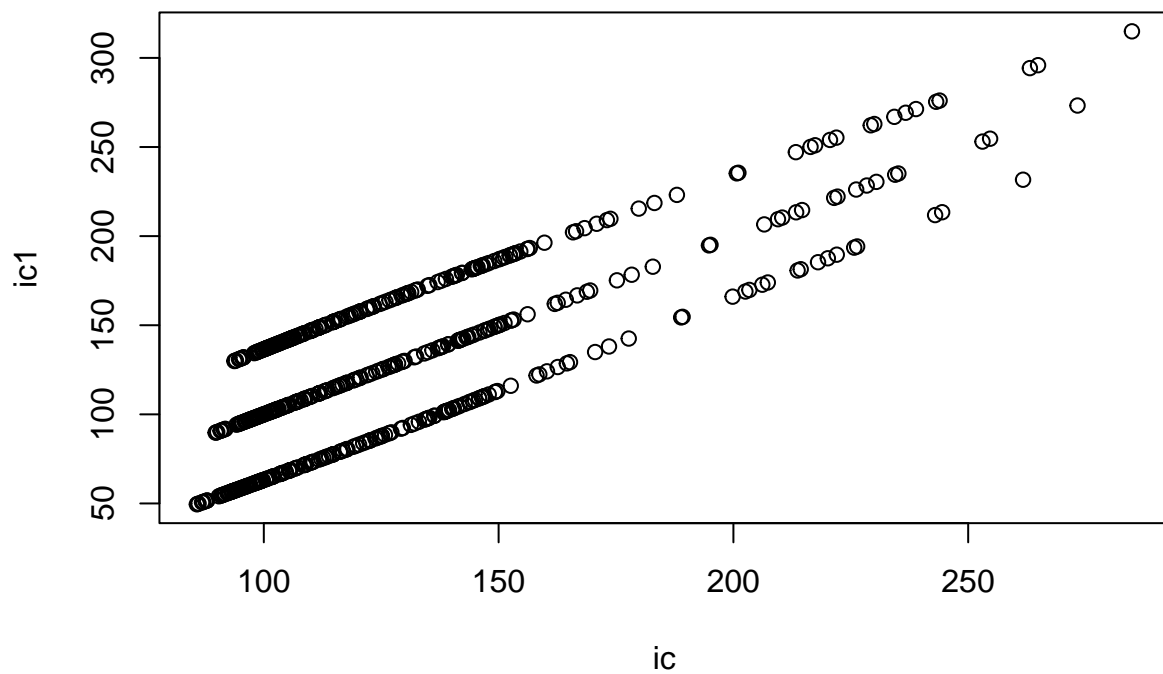

```
qqnorm(df.fit$residuals)
qqline(df.fit$residuals)
```

Normal Q−Q Plot
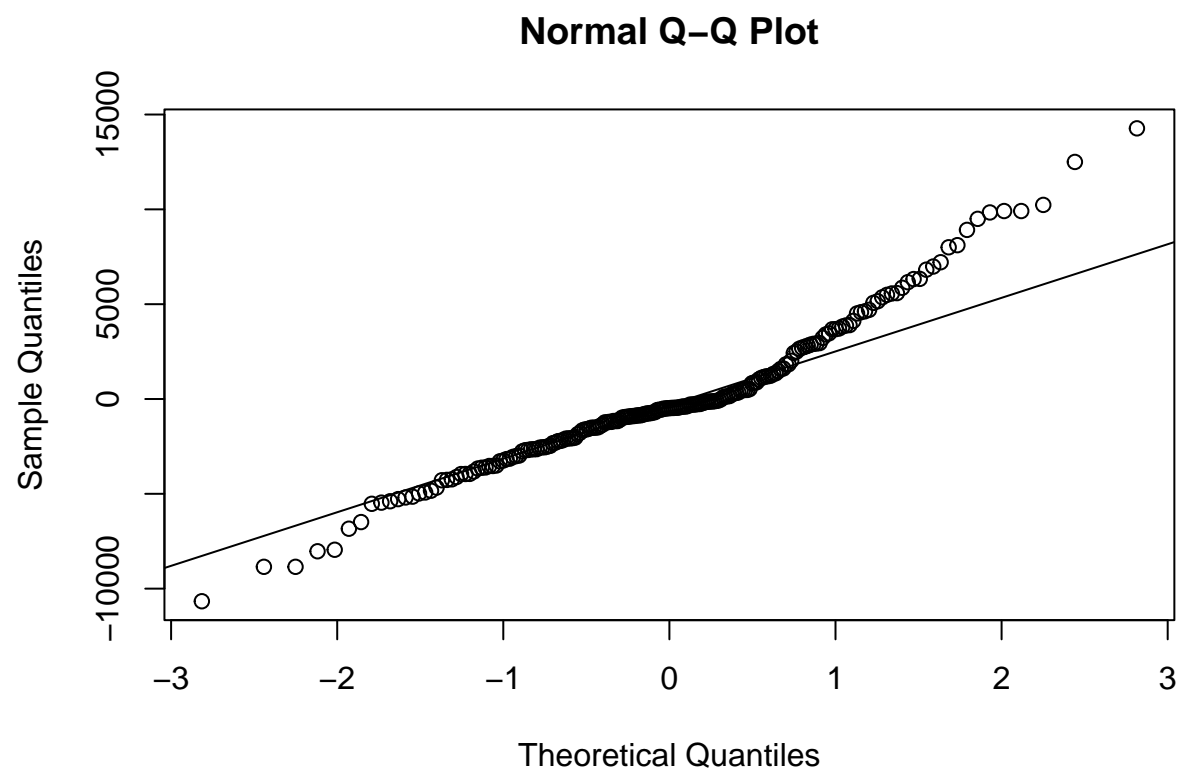

```
hist(df.fit$residuals)
```

Histogram of df.fit$residuals
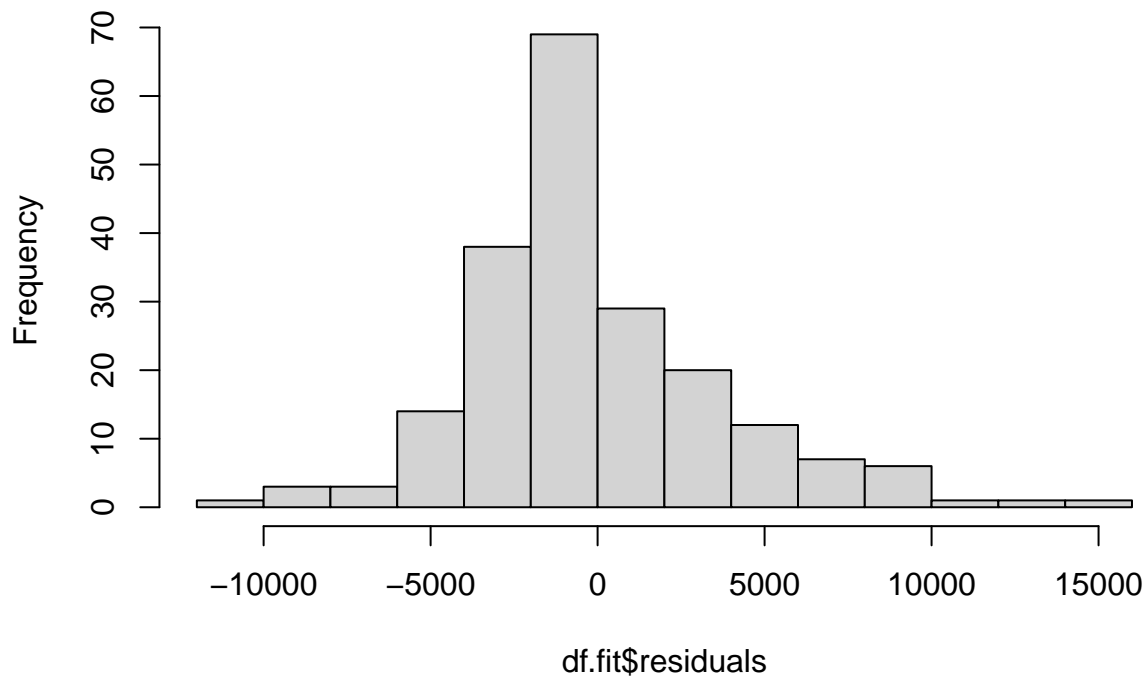

```
t.test(df.fit$residuals)
```

```
##
##  One Sample t-test
##
## data:  df.fit$residuals
## t = -4.0781e-16, df = 204, p-value = 1
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -534.2897  534.2897
## sample estimates:
##     mean of x
## -1.105111e-13
```