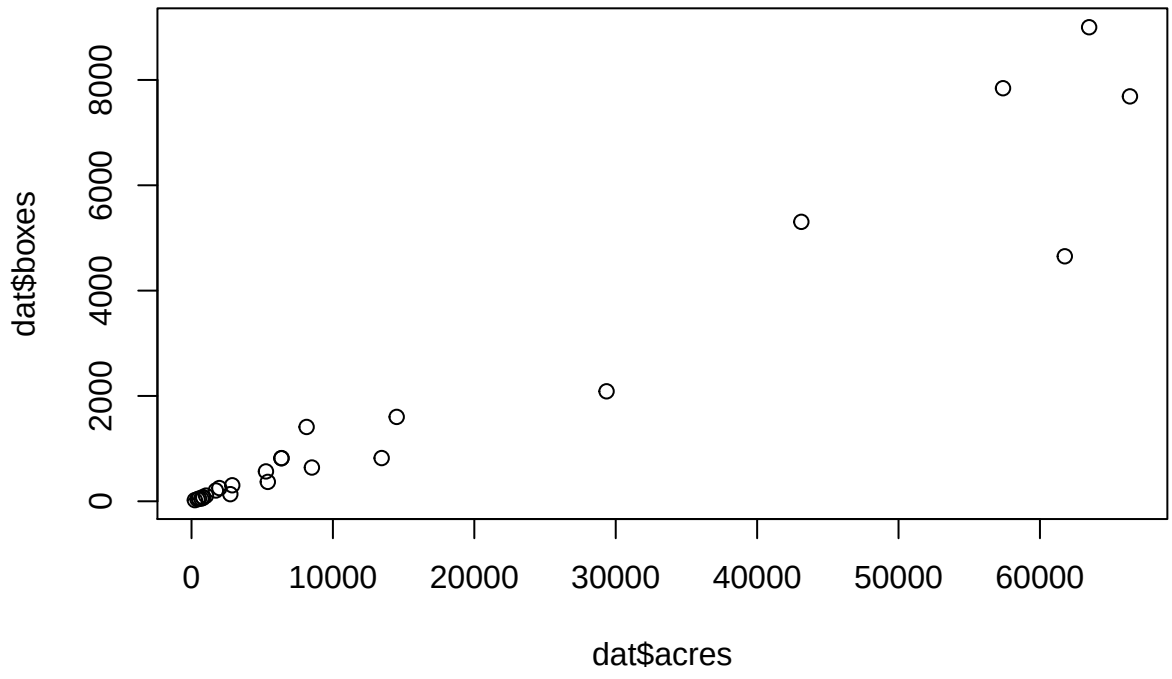
```
### Residual plots/diagnostics demo

## Florida oranges revisited
dat <- read.csv("florange.csv")
plot(dat$acres,dat$boxes)
```

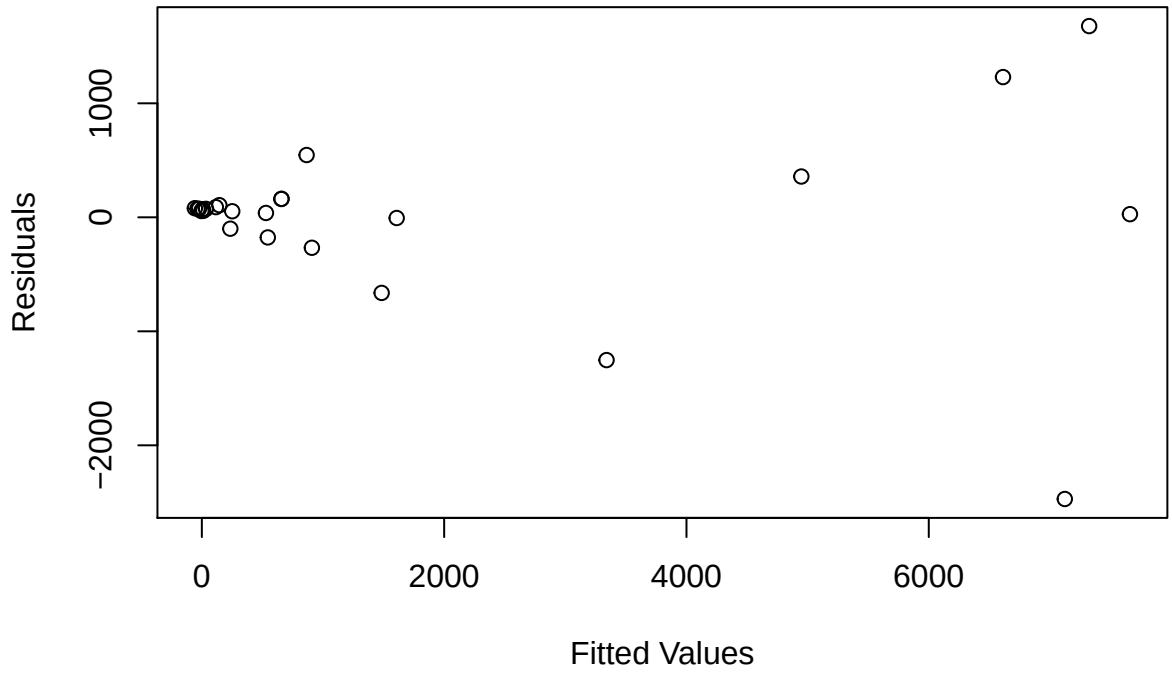



```
lm.1 <- lm(dat$boxes~dat$acres)
summary(lm.1)
```

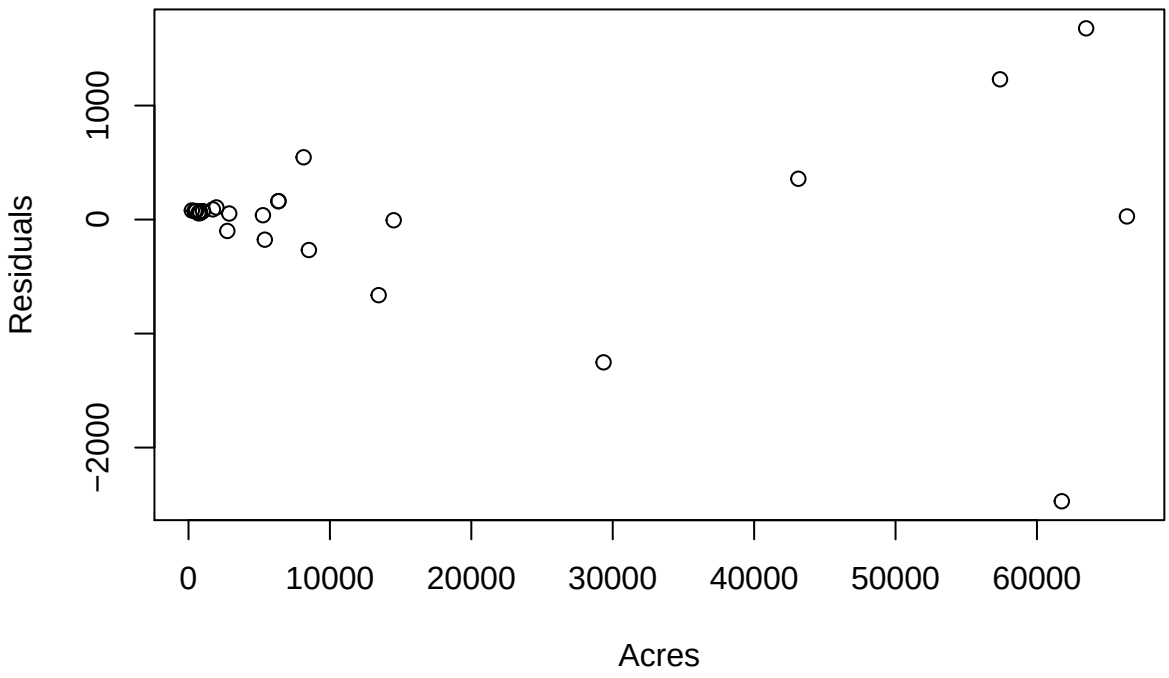
```
##
## Call:
## lm(formula = dat$boxes ~ dat$acres)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2470.81    -6.17    71.72   106.46  1677.32
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -85.391989 186.178031  -0.459    0.651
## dat$acres     0.116717   0.006761  17.263 1.16e-14 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 754.4 on 23 degrees of freedom
## Multiple R-squared:  0.9284, Adjusted R-squared:  0.9252
```

```
## F-statistic:   298 on 1 and 23 DF,  p-value: 1.164e-14
```

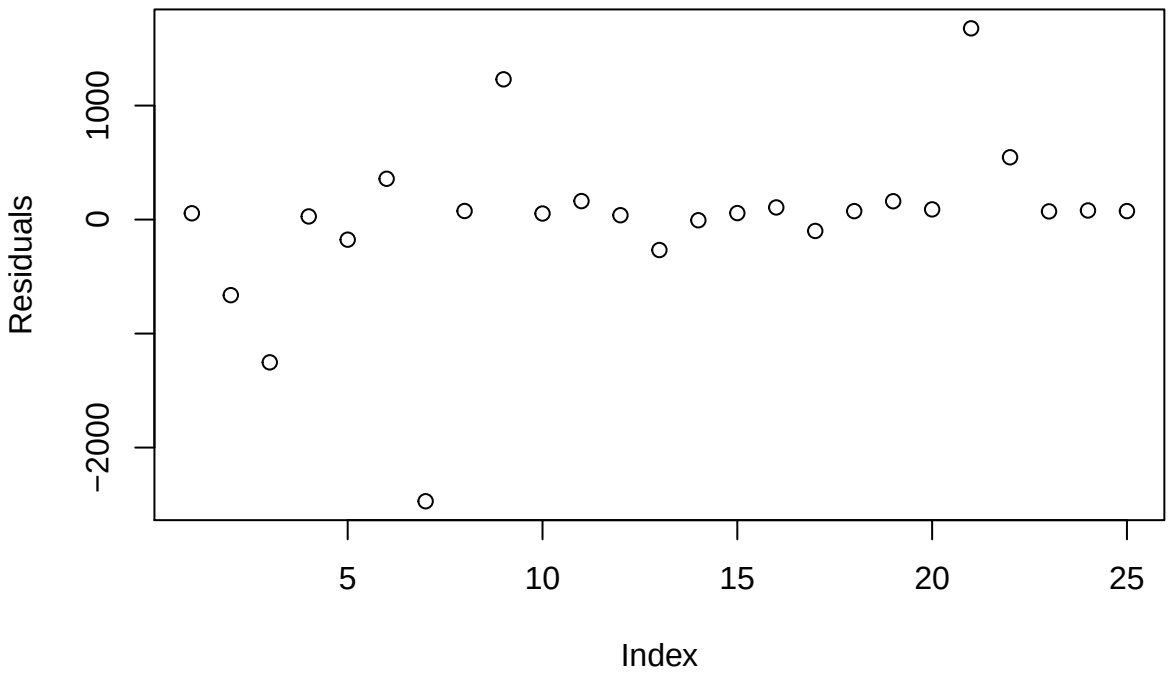
```
# Residual plot: vs fitted values
plot(lm.1$fitted.values, lm.1$residuals, xlab = "Fitted Values", ylab = "Residuals")
```



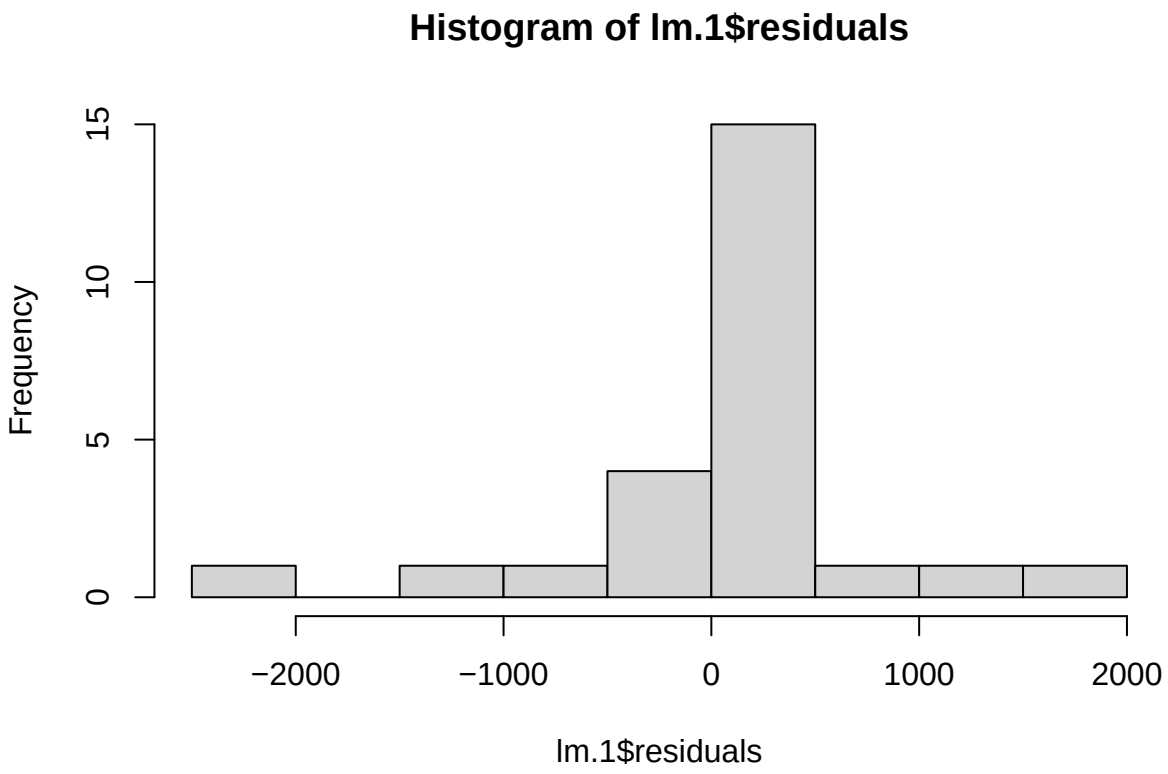

```
# Residual plot: vs predictor (just one in this case)
plot(dat$acres, lm.1$residuals, xlab = "Acres", ylab = "Residuals")
```



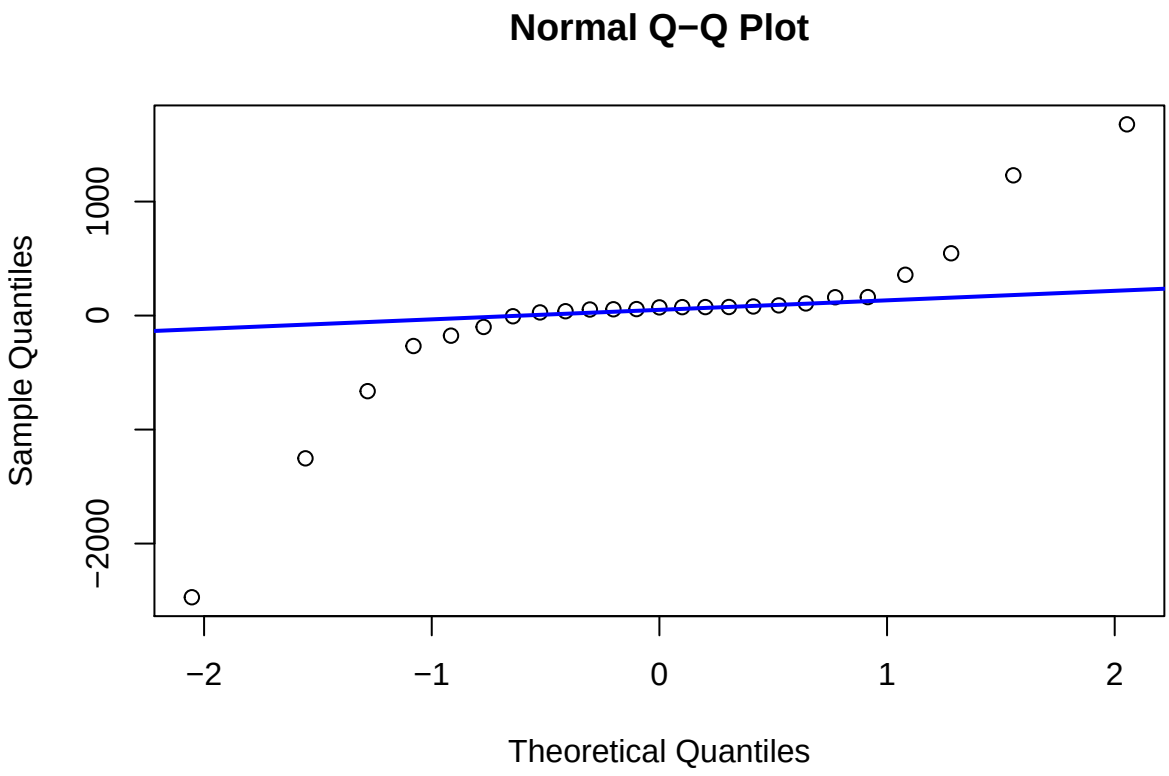

```
# Residual plot: vs i (just to demo plot; no time/space ordering here)
plot(1:nrow(dat), lm.1$residuals, xlab = "Index", ylab = "Residuals")
```




```
# Histogram of residuals
hist(lm.1$residuals)
```




```r
# QQ plot of residuals
qqnorm(lm.1$residuals)
qqline(lm.1$residuals, col="blue", lwd = 2)
```

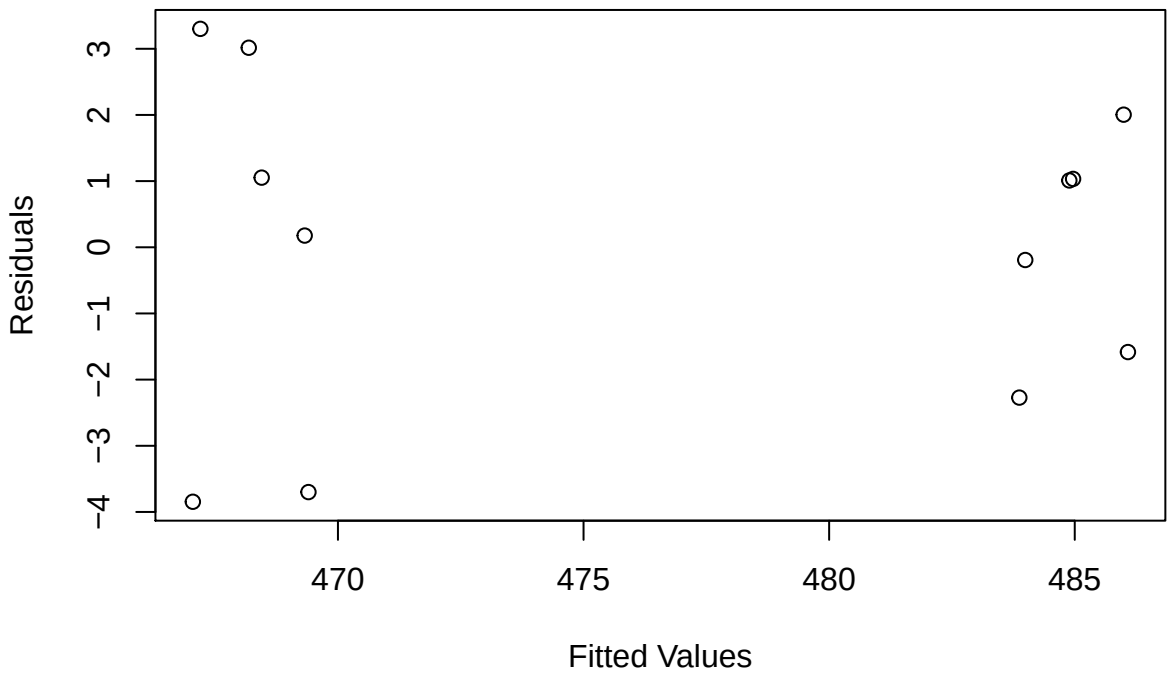



```
## Rocket data revisited
rocket <- read.csv(file="rocket.csv")
mr <- lm(thrust ~ nozzle + propratio, data = rocket)
summary(mr)
```

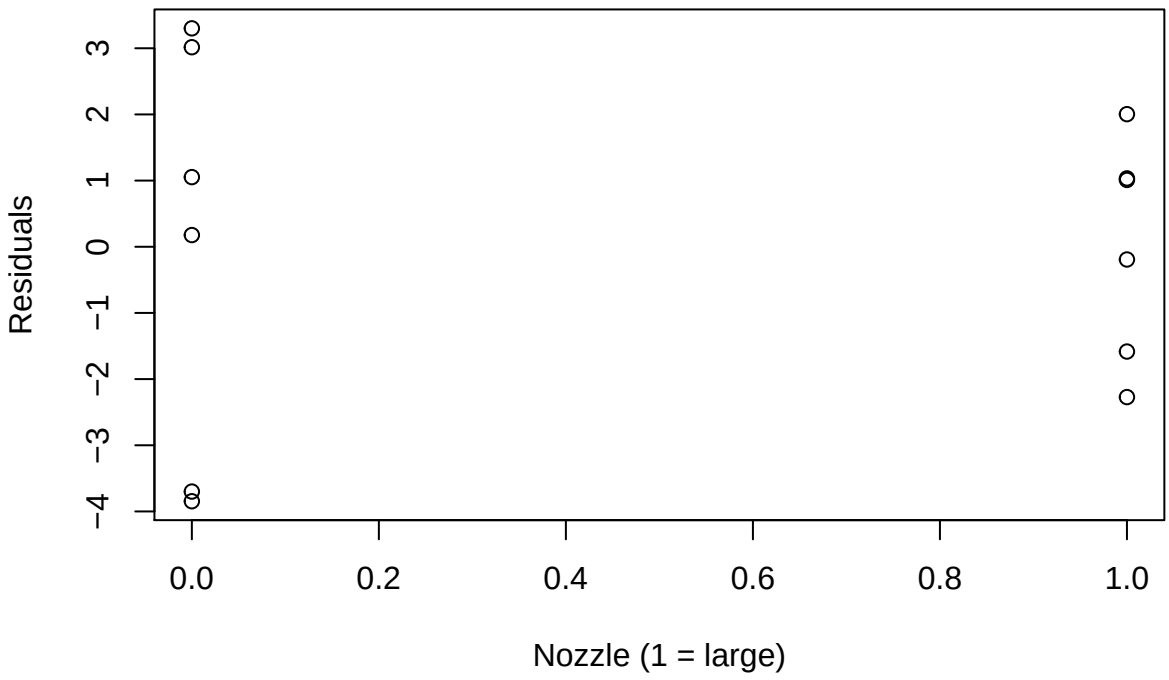
```
##
## Call:
## lm(formula = thrust ~ nozzle + propratio, data = rocket)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -3.8459 -1.7555  0.5934  1.2906  3.3008
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 473.6039     4.7158 100.430 4.88e-15 ***
## nozzle       16.7383     1.5329  10.919 1.71e-06 ***
## propratio    -1.0948     0.9414  -1.163    0.275
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.655 on 9 degrees of freedom
## Multiple R-squared:  0.9303, Adjusted R-squared:  0.9148
## F-statistic: 60.05 on 2 and 9 DF,  p-value: 6.238e-06
```

```
# Residual plot: vs fitted values
plot(mr$fitted.values, mr$residuals, xlab = "Fitted Values",
```

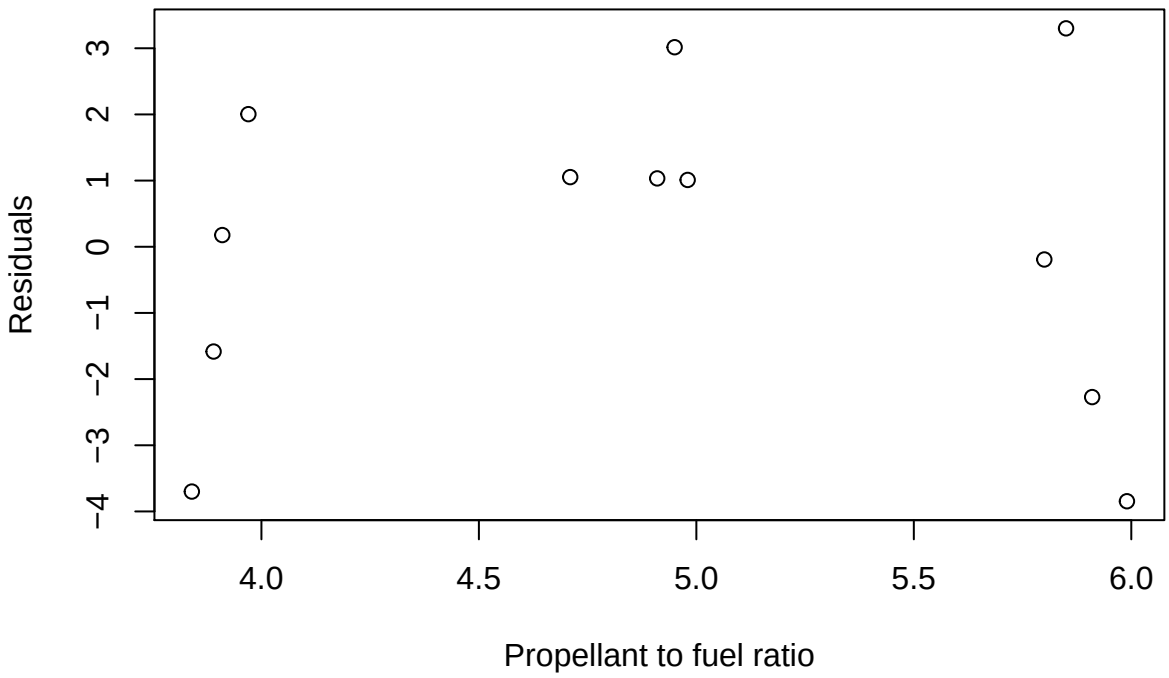
```
     ylab = "Residuals")
```



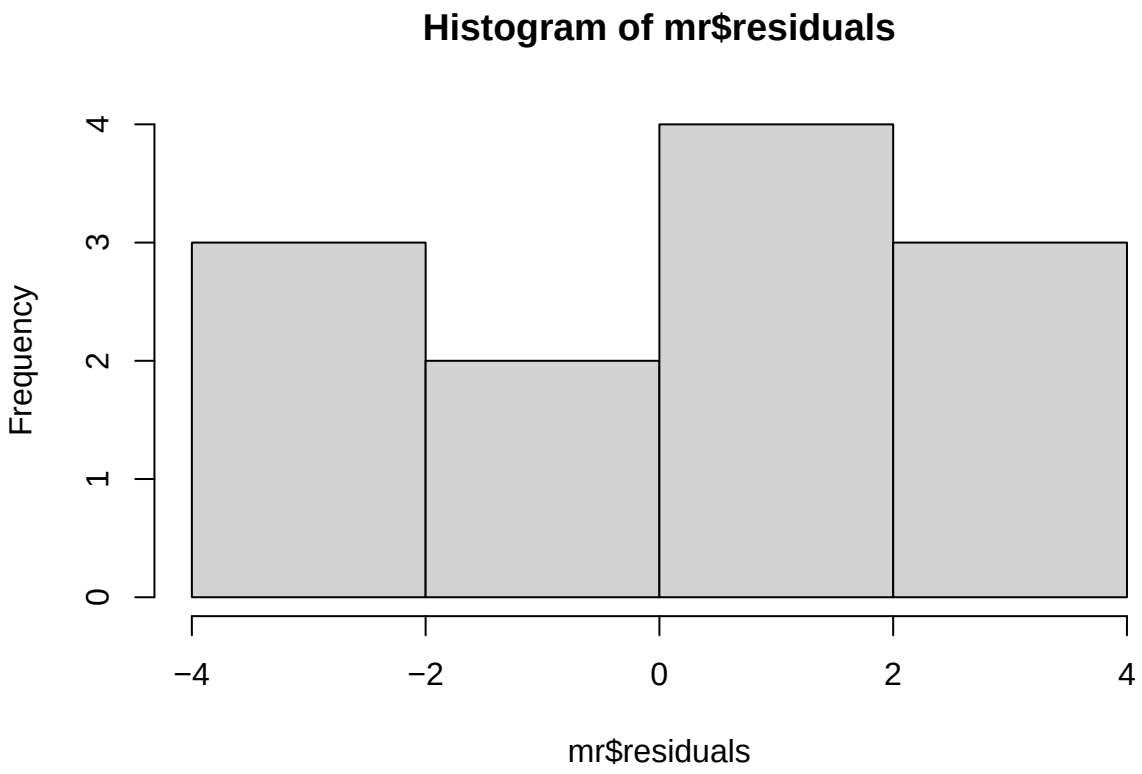

```
# Residual plot: vs predictors
plot(rocket$nozzle, mr$residuals, xlab = "Nozzle (1 = large)",
     ylab = "Residuals")
```



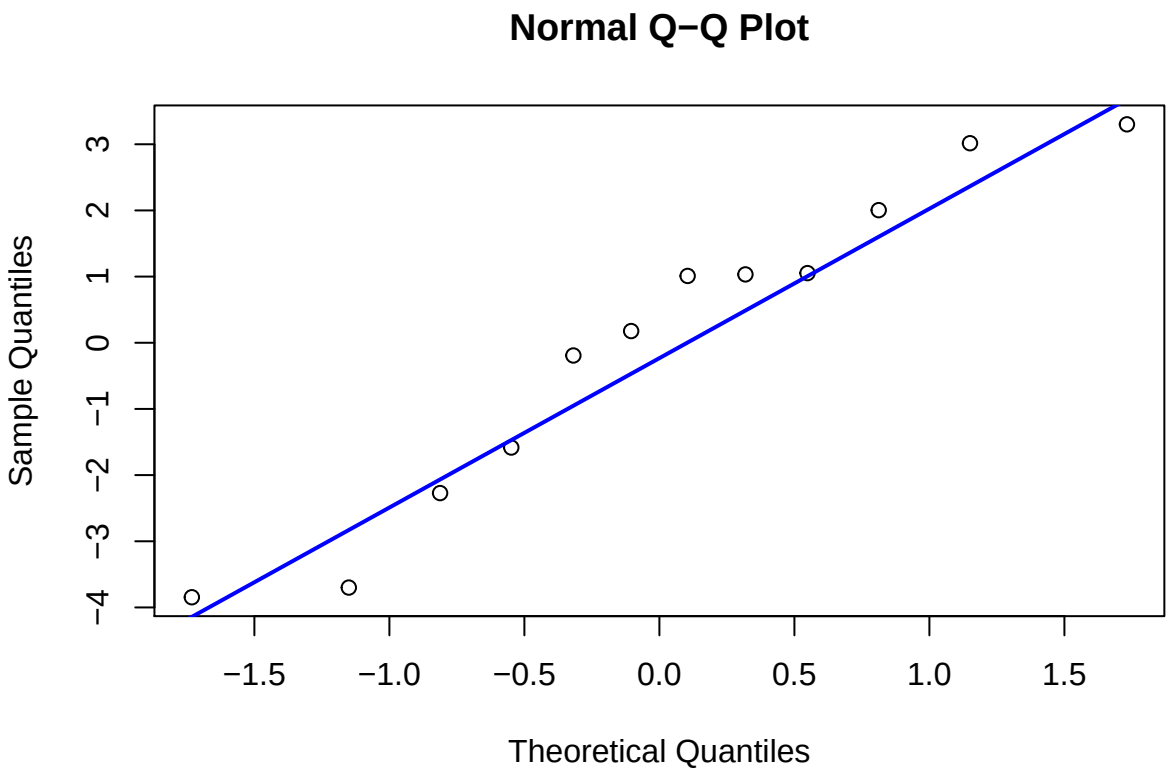

```
plot(rocket$propratio, mr$residuals, xlab = "Propellant to fuel ratio",
     ylab = "Residuals")
```




```r
# Histogram of residuals
hist(mr$residuals)
```




```
# QQ plot of residuals
qqnorm(mr$residuals)
qqline(mr$residuals, col="blue", lwd = 2)
```


Normal Q−Q Plot
Sample Quantiles
Theoretical Quantiles
−4
−3
−2
−1
0
1
2
3
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5