Ćwiczenia 7

2023-12-11

Zadanie 1

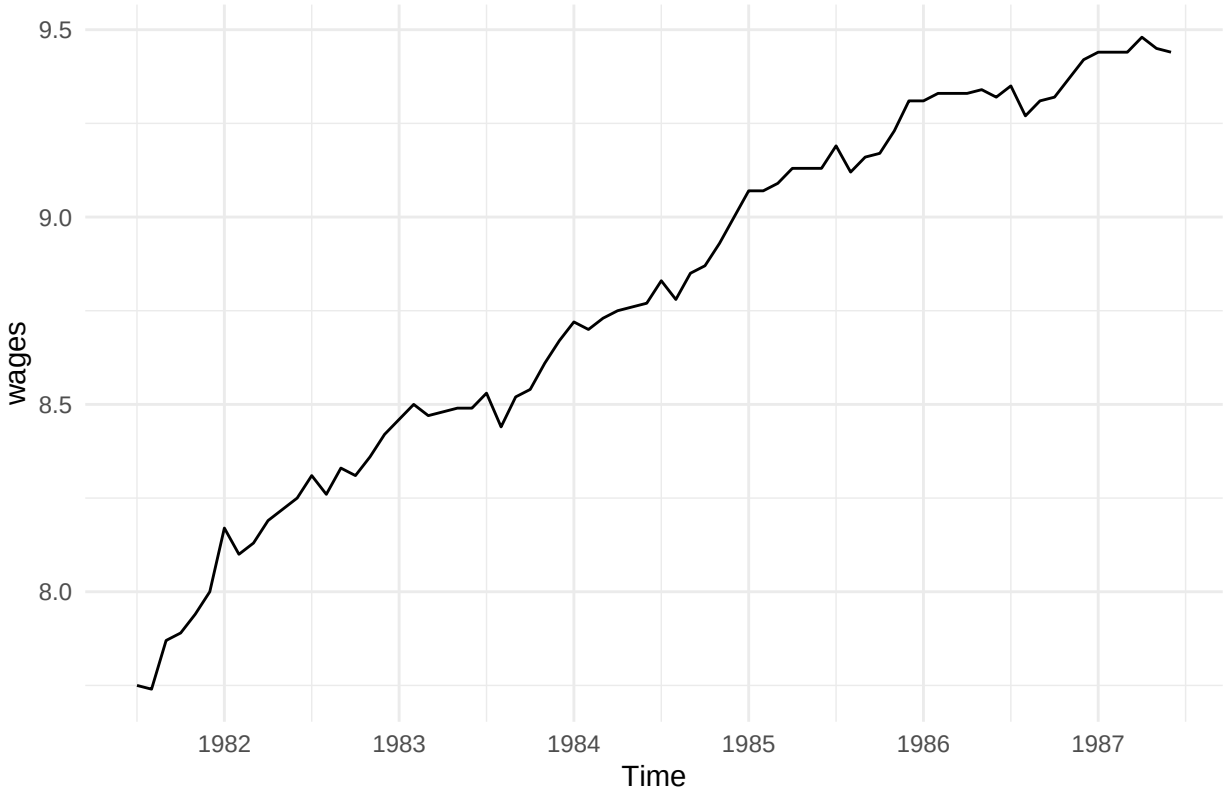
```
print(c(
  "auto"  = difftime(as.Date("2000-12-31"), as.Date("1901-01-01")) |> as.numeric(),
  "secs"  = difftime(as.Date("2000-12-31"), as.Date("1901-01-01"), units = "secs") |> as.numeric(),
  "mins"  = difftime(as.Date("2000-12-31"), as.Date("1901-01-01"), units = "mins") |> as.numeric(),
  "hours" = difftime(as.Date("2000-12-31"), as.Date("1901-01-01"), units = "hours") |> as.numeric(),
  "days"  = difftime(as.Date("2000-12-31"), as.Date("1901-01-01"), units = "days") |> as.numeric(),
  "weeks" = difftime(as.Date("2000-12-31"), as.Date("1901-01-01"), units = "weeks") |> as.numeric()
))
```

```
##         auto         secs         mins        hours         days        weeks
## 3.652400e+04 3.155674e+09 5.259456e+07 8.765760e+05 3.652400e+04 5.217714e+03
```

Zadanie 2

```
data(wages, package = "TSA")
```

```
autoplot(wages) +
  theme_minimal()
```



```r
df <- data.frame(
  y = wages |> as.numeric(),
  time = time(wages) |> as.numeric()
)
model_lin <- lm(y ~ time, data = df)
model_quad <- lm(y ~ time + I(time ^ 2), data = df)
print(summary(model_lin))
```

```
##
## Call:
## lm(formula = y ~ time, data = df)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.23828 -0.04981  0.01942  0.05845  0.13136
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -5.490e+02  1.115e+01  -49.24   <2e-16 ***
## time         2.811e-01  5.618e-03   50.03   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08257 on 70 degrees of freedom
## Multiple R-squared:  0.9728, Adjusted R-squared:  0.9724
## F-statistic:  2503 on 1 and 70 DF,  p-value: < 2.2e-16
```

```r
print(summary(model_quad))
```

```
##
## Call:
## lm(formula = y ~ time + I(time^2), data = df)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.148318 -0.041440  0.001563  0.050089  0.139839
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept) -8.495e+04  1.019e+04  -8.336 4.87e-12 ***
## time         8.534e+01  1.027e+01   8.309 5.44e-12 ***
## I(time^2)   -2.143e-02  2.588e-03  -8.282 6.10e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.05889 on 69 degrees of freedom
## Multiple R-squared:  0.9864, Adjusted R-squared:  0.986
## F-statistic:  2494 on 2 and 69 DF,  p-value: < 2.2e-16
```

```r
print(AIC(model_lin, model_quad))
```

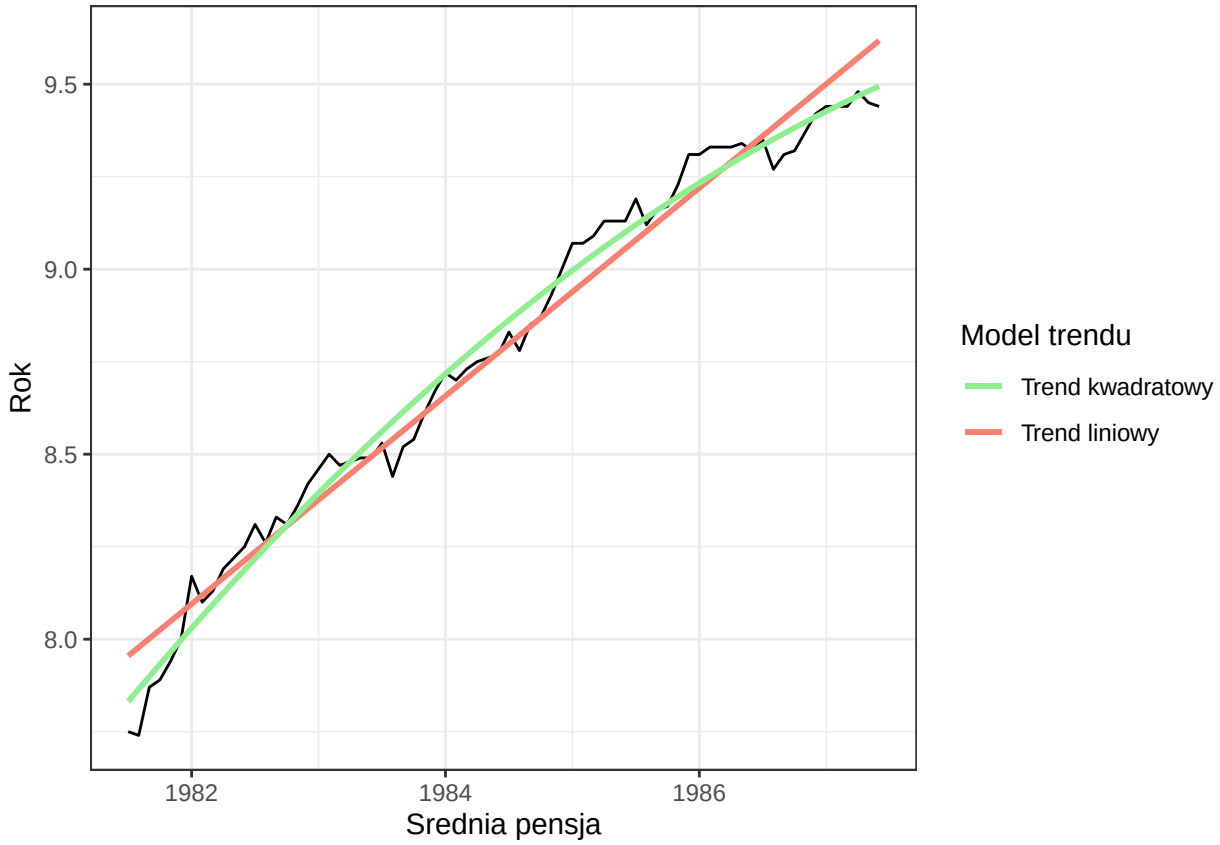
```
##            df       AIC
## model_lin   3 -150.8585
## model_quad  4 -198.5489
```

```r
print(BIC(model_lin, model_quad))
```

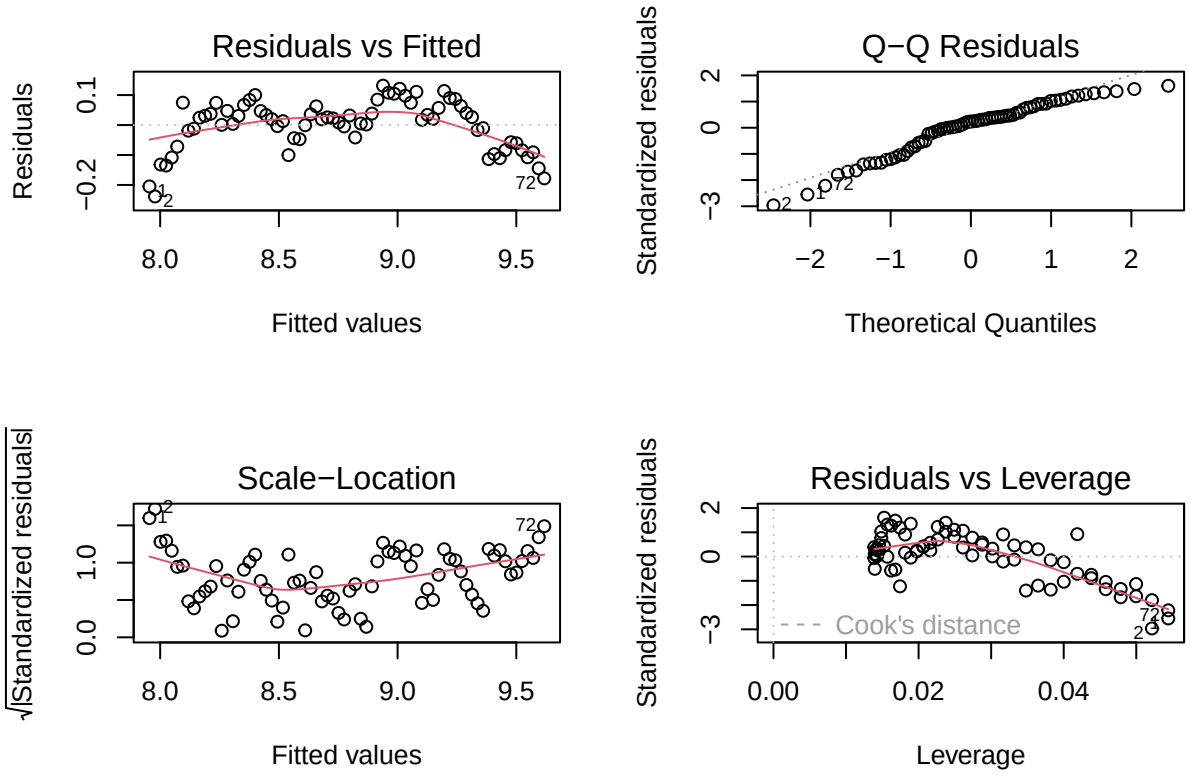
```
##             df       BIC
## model_lin    3 -144.0285
## model_quad   4 -189.4423
```

```r
df |>
  ggplot(aes(y = y, x = time)) +
  geom_line() +
  geom_smooth(method = "lm", se = FALSE,
              aes(col = "Trend liniowy")) +
  geom_smooth(method = "lm", se = FALSE,
              formula = y ~ x + I(x ^ 2),
              aes(col = "Trend kwadratowy")) +
  scale_color_manual(values = c("Trend liniowy" = "salmon",
                                "Trend kwadratowy" = "lightgreen")) +
  labs(color = "Model trendu",
       x = "Średnia pensja",
       y = "Rok") +
  theme_bw()
```

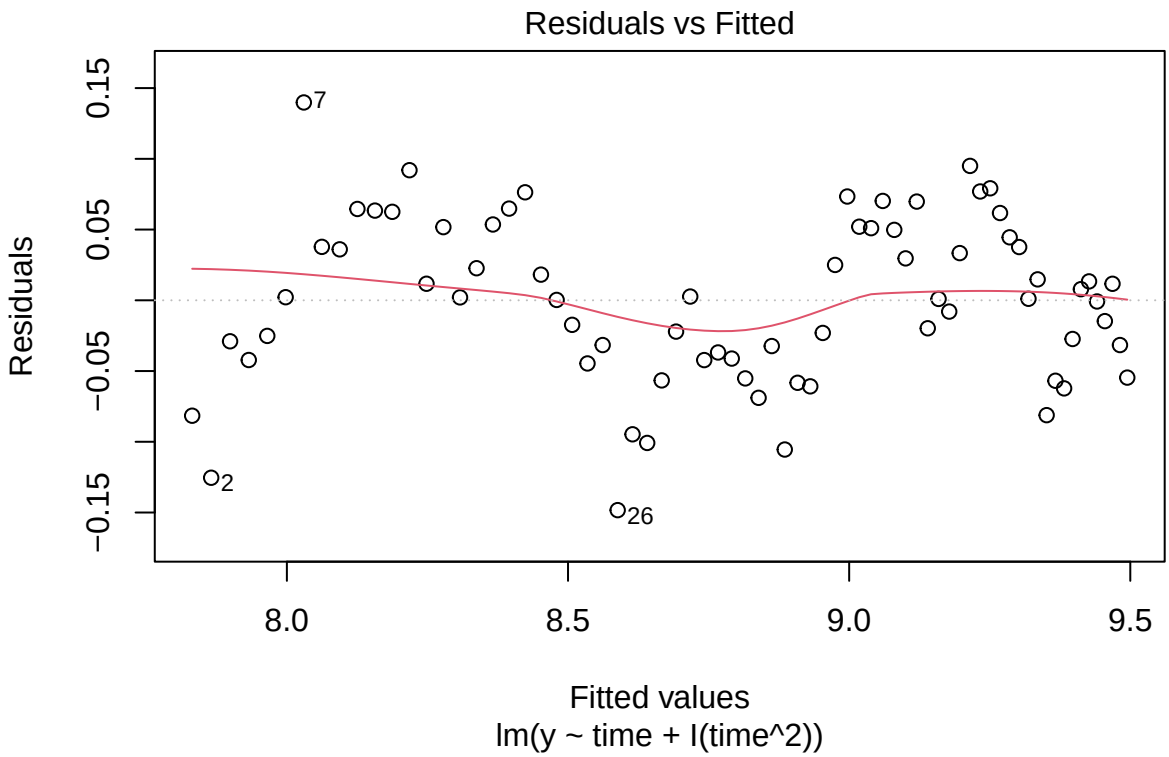
```
## `geom_smooth()` using formula = 'y ~ x'
```

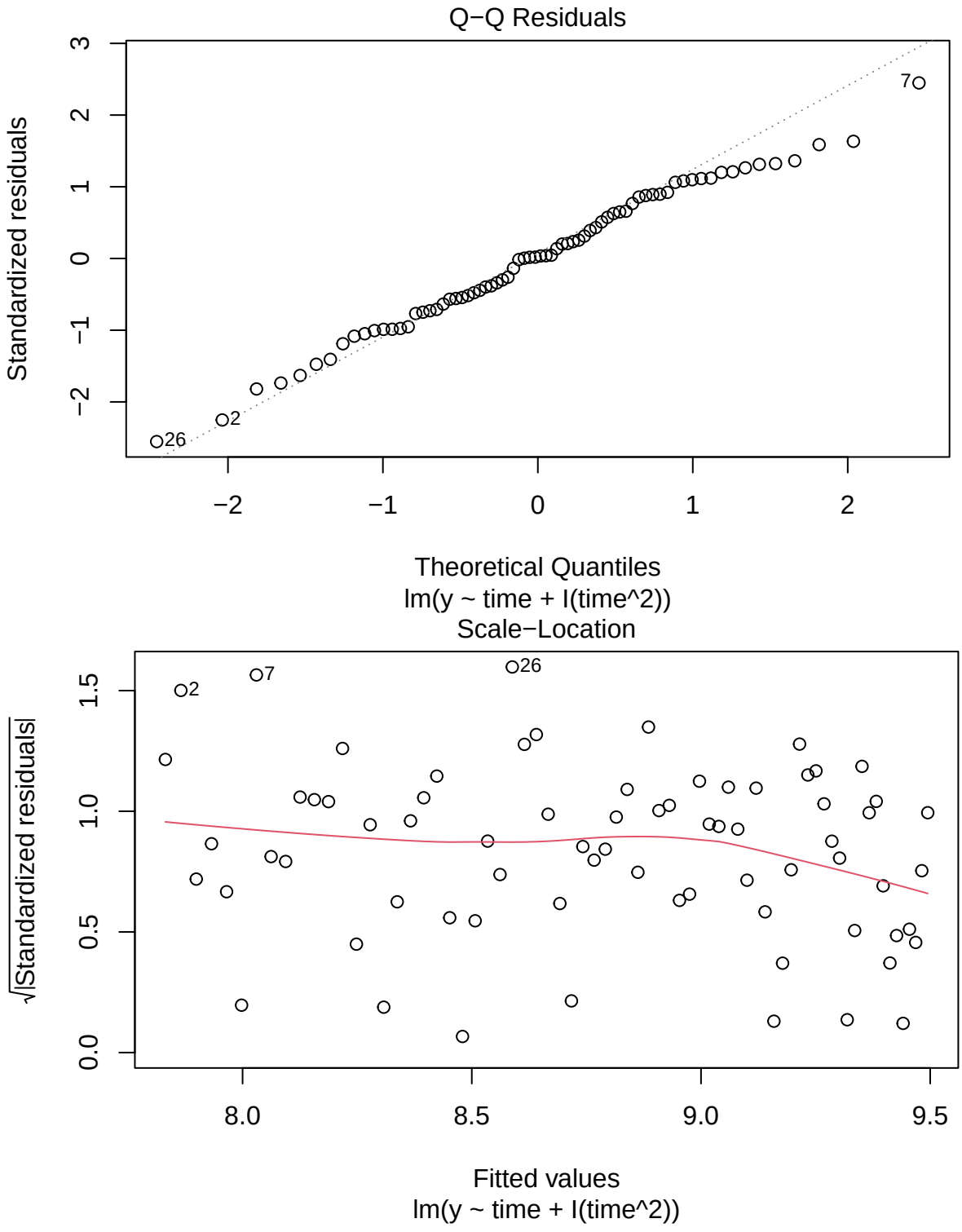


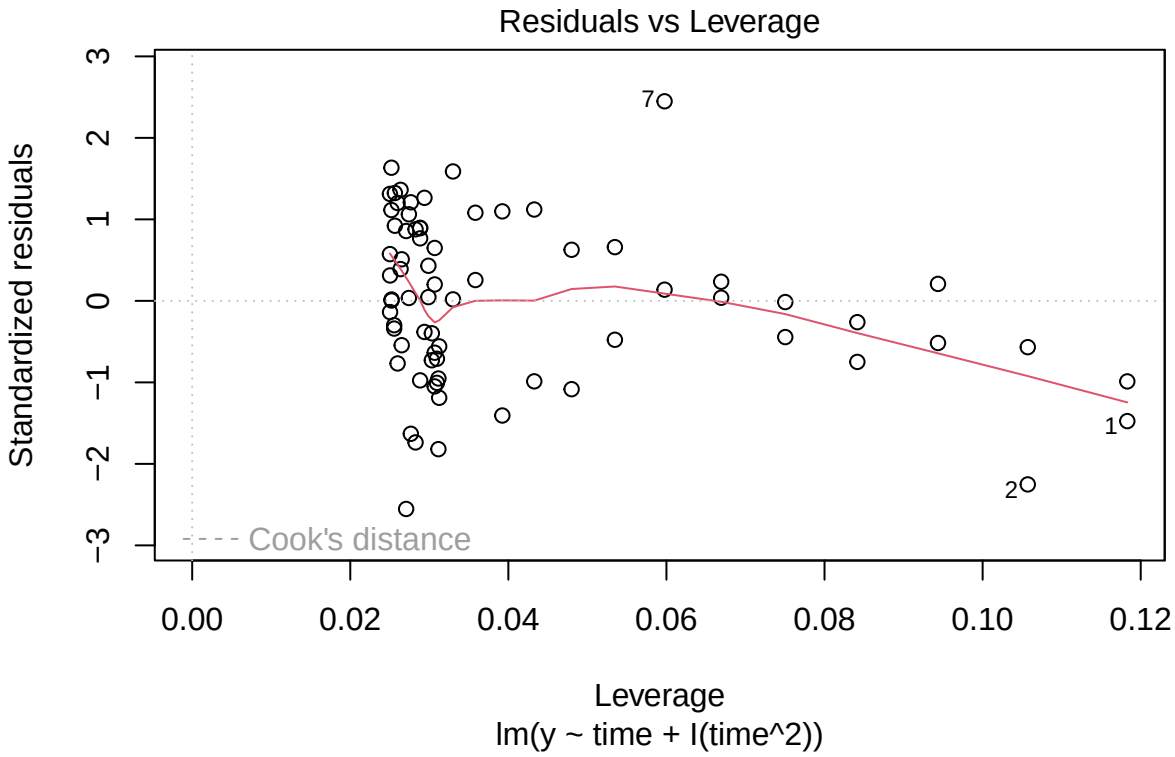

```r
par(mfrow = c(2, 2))
plot(model_lin, which = c(1:3, 5))
```




```
plot(model_quad, which = c(1:3, 5))
```




Q−Q Residuals
Standardized residuals
Theoretical Quantiles
lm(y ~ time + I(time^2))
Scale−Location
√|Standardized residuals|
Fitted values
lm(y ~ time + I(time^2))


Residuals vs Leverage
Standardized residuals
Leverage
lm(y ~ time + I(time^2))
Cook's distance
7
1
2
−3
−2
−1
0
1
2
3
0.00
0.02
0.04
0.06
0.08
0.10
0.12

Zadanie 3