# Tugas Individu Analisis Regresi Pertemuan 6

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## Library

```
library(readxl)
```

```
## Warning: package 'readxl' was built under R version 4.3.2
```

```
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(plotly)
```

```
## Warning: package 'plotly' was built under R version 4.3.2

## Loading required package: ggplot2

## Warning: package 'ggplot2' was built under R version 4.3.2

##
## Attaching package: 'plotly'

## The following object is masked from 'package:ggplot2':
##
##     last_plot

## The following object is masked from 'package:stats':
##
##     filter
```

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

```
library(lmtest)
```

```
## Warning: package 'lmtest' was built under R version 4.3.2
```

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

```
## Warning: package 'zoo' was built under R version 4.3.2
```

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

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

```
library(car)
```

```
## Loading required package: carData
```

```
##
## Attaching package: 'car'
```

```
## The following object is masked from 'package:dplyr':
##
##     recode
```

```
library(randtests)
library(lmtest)
```

# Data

```
data <- read_xlsx("C:/Users/Ghonniyu/Downloads/Anreg Individu.xlsx")
```

```
## New names:
## * `` -> `...1`
```

```
data
```

```
## # A tibble: 15 x 3
##     ...1     X     Y
##    <dbl> <dbl> <dbl>
##  1     1     2    54
##  2     2     5    50
```

```
##  3     3     7    45
##  4     4    10    37
##  5     5    14    35
##  6     6    19    25
##  7     7    26    20
##  8     8    31    16
##  9     9    34    18
## 10    10    38    13
## 11    11    45     8
## 12    12    52    11
## 13    13    53     8
## 14    14    60     4
## 15    15    65     6
```

## Model Awal

```
model = lm(formula = Y ~ X, data = data)
summary(model)
```

```
##
## Call:
## lm(formula = Y ~ X, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -7.1628 -4.7313 -0.9253  3.7386  9.0446
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 46.46041    2.76218   16.82 3.33e-10 ***
## X           -0.75251    0.07502  -10.03 1.74e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.891 on 13 degrees of freedom
## Multiple R-squared:  0.8856, Adjusted R-squared:  0.8768
## F-statistic: 100.6 on 1 and 13 DF,  p-value: 1.736e-07
```

Diperoleh model regresi sebagai berikut

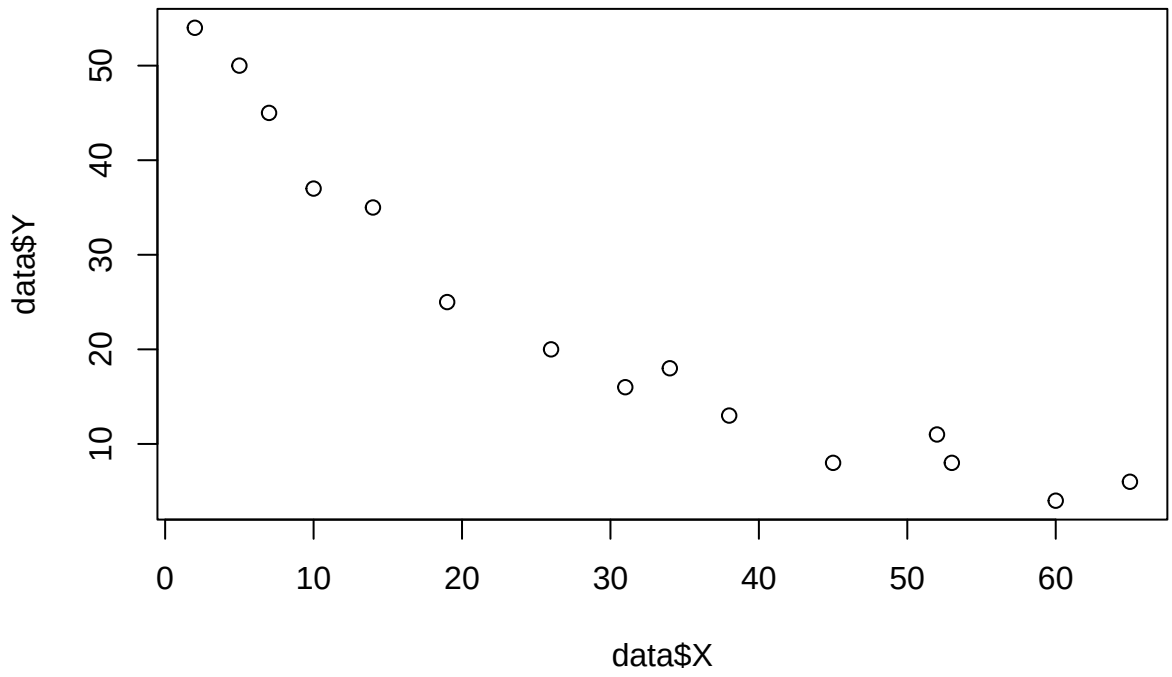
$$\hat{Y} = 46.46041 - 0.75251X + e$$

Model diatas belum bisa dikatakan menjadi model terbaik karena belum melalui serangkaian uji asumsi, sehingga diperlukan eksplorasi kondisi dan pengujian asumsi Gauss Markov dan normalitas untuk menghasilkan model terbaik.

## Eksplorasi

### Plot Hubungan X dan Y

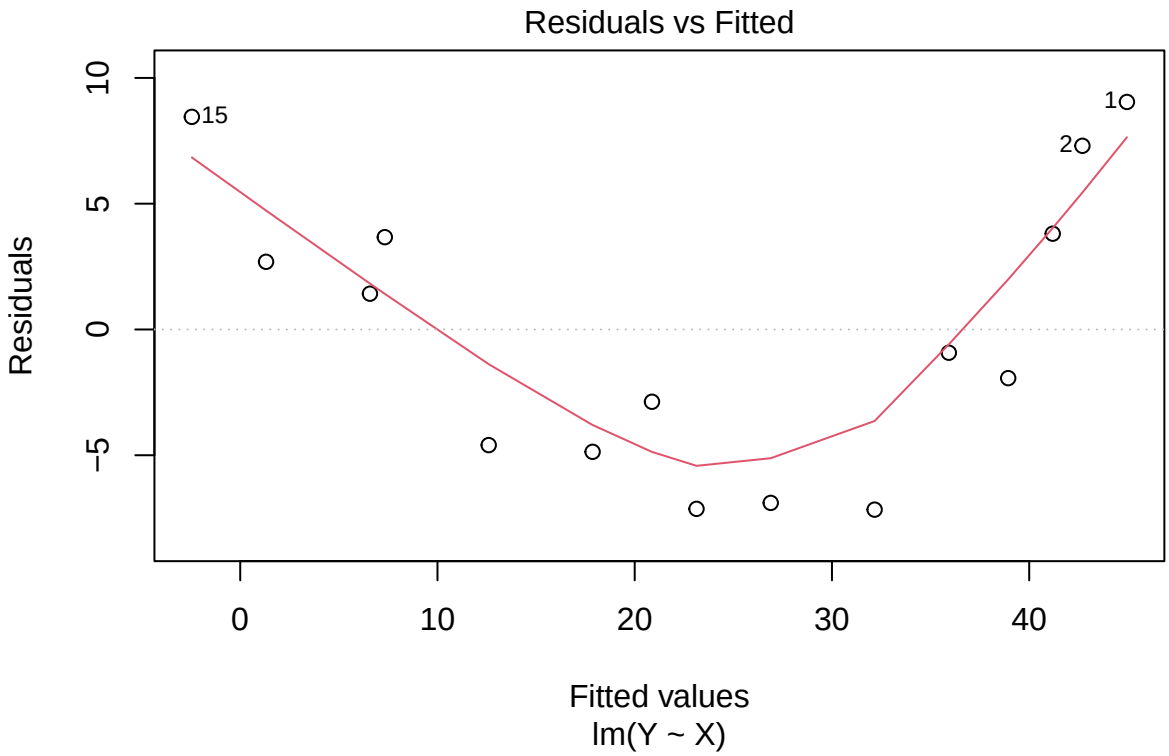
```
plot(x=data$X,y=data$Y)
```




Dari plot diatas dapat ditarik kesimpulan hubungan X dan Y memiliki hubungan yang tidak linear dan cenderung membentuk parabola

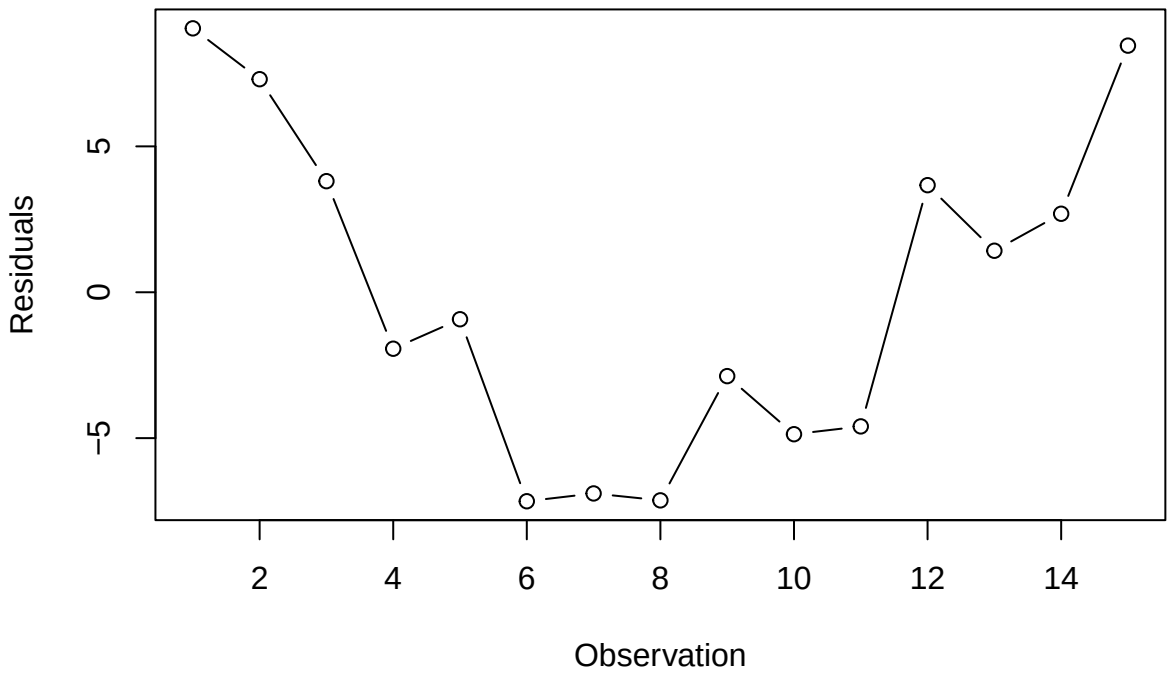
### Plot Sisaan vs Y duga

```
plot(model,1)
```




## Plot Sisaan vs Urutan

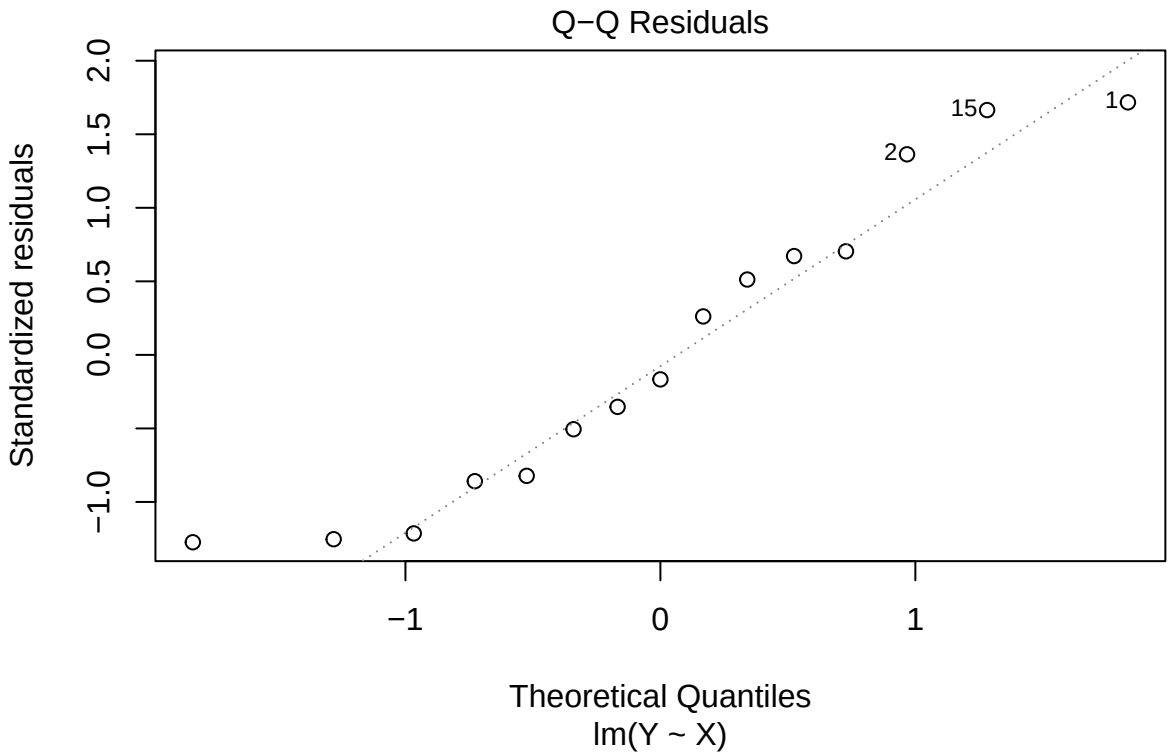
```
plot(x = 1:dim(data)[1],
y = model$residuals,
type = 'b',
ylab = "Residuals",
xlab = "Observation")
```




Tebaran membentuk pola kurva → Sisaan tidak saling bebas, model tidak pas

### Sisaan dengan QQ-Plot

```
plot(model,2)
```




# Uji Normalitas Sisaan

$H_0$ : Sisaan menyebar normal$H_1$ : Sisaan tidak menyebar normal

```
shapiro.test(model$residuals)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  model$residuals
## W = 0.92457, p-value = 0.226
```

Dapat dilihat p-value > alpha, maka tak tolak $H_0$, sisaan menyebar normal

## Uji Asumsi Gauss-Markov

### 1. Nilai Harapan Sisaan sama dengan nol

$H_0$ : Nilai harapan sama dengan 0$H_1$ : Nilai harapan tidak sama dengan 0

```
t.test(model$residuals,mu = 0,conf.level = 0.95)
```

```
##
##  One Sample t-test
```

```
##
## data:  model$residuals
## t = -3.5338e-16, df = 14, p-value = 1
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -3.143811  3.143811
## sample estimates:
##     mean of x
## -5.179884e-16
```

Dapat dilihat p-value > alpha , maka tak tolak $H_0$, nilai harapan sisaan sama dengan nol

## 2. Ragam Sisaan Homogen

$H_0$ : Ragam sisaan homogen$H_1$ : Ragam sisaan tidak homogen

```
kehomogenan = lm(formula = abs(model$residuals) ~ X, # y: abs residual
data = data)
summary(kehomogenan)
```

```
##
## Call:
## lm(formula = abs(model$residuals) ~ X, data = data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.2525 -1.7525  0.0235  2.0168  4.2681
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  5.45041    1.27241   4.284  0.00089 ***
## X           -0.01948    0.03456  -0.564  0.58266
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.714 on 13 degrees of freedom
## Multiple R-squared:  0.02385,    Adjusted R-squared:  -0.05124
## F-statistic: 0.3176 on 1 and 13 DF,  p-value: 0.5827
```

```
bptest(model)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  model
## BP = 0.52819, df = 1, p-value = 0.4674
```

Dapat dilihat p-value > alpha, maka tak tolak $H_0$, ragam sisaan homogen

### 3. Sisaan Saling Bebas

$$H_0 : \text{Sisaan saling bebas} H_1 : \text{Sisaan tidak saling bebas}$$

```
runs.test(model$residuals)
```

```
##
##  Runs Test
##
## data:  model$residuals
## statistic = -2.7817, runs = 3, n1 = 7, n2 = 7, n = 14, p-value =
## 0.005407
## alternative hypothesis: nonrandomness
```

```
dwtest(model)
```

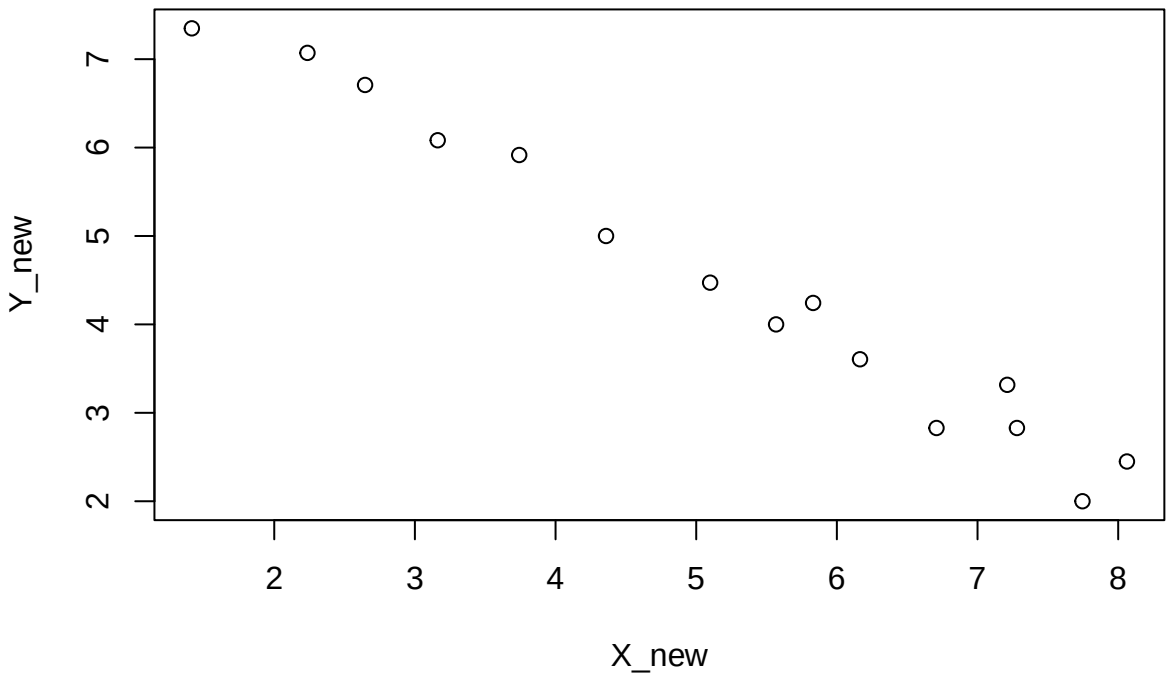
```
##
##  Durbin-Watson test
##
## data:  model
## DW = 0.48462, p-value = 1.333e-05
## alternative hypothesis: true autocorrelation is greater than 0
```

Dapat dilihat p-value (pada DW test) $<$ alpha , maka tolak $H_0$, sisaan tidak saling bebas.

Dari ketiga asumsi diatas menunjukkan adanya asumsi Gauss-Markov yang tidak terpenuhi yaitu pelanggaran asumsi tidak ada autokorelasi. Dapat dilihat dari Durbin Watson Test yang dilakukan.

## Transformasi Data

```
Y_new = sqrt(data$Y)
X_new = sqrt(data$X)
plot(x = X_new,y = Y_new)
```




```
model_new=lm(formula=Y_new~X_new)
summary(model_new)
```

```
##
## Call:
## lm(formula = Y_new ~ X_new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.42765 -0.17534 -0.05753  0.21223  0.46960
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  8.71245    0.19101   45.61 9.83e-16 ***
## X_new       -0.81339    0.03445  -23.61 4.64e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2743 on 13 degrees of freedom
## Multiple R-squared:  0.9772, Adjusted R-squared:  0.9755
## F-statistic: 557.3 on 1 and 13 DF,  p-value: 4.643e-12
```

Diperoleh model sebagai berikut

$$Y = 8.71245 - 0.81339X + e$$

```
dwtest(model_new)
```

```
##
##  Durbin-Watson test
##
## data:  model_new
## DW = 2.6803, p-value = 0.8629
## alternative hypothesis: true autocorrelation is greater than 0
```

Karena p-value>alpha, maka tak tolak $H_0$, sisaan saling bebas.

# Kesimpulan

Berdasarkan transformasi yang dilakukan yaitu transformasi $Y^{\frac{1}{2}}$dan$X^{\frac{1}{2}}$ akan menghasilkan model regresi yang lebih efektif disertai dengan semua asumsi telah terpenuhi dalam analisis regresi linear sederhana.

Model regresi setelah di transformasi adalah sebagai berikut :

$$Y^* = 8.71245 - 0.81339X^* + eY^* = \sqrt{Y}X^* = \sqrt{X}$$

Sehingga model terbaik untuk data ini adalah:

$$\hat{Y} = (8.71245 - 0.81339X^{\frac{1}{2}})^2 + e$$