# Ejercicio # 1 Analisis de regresion

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#### 2023-05-28

## Laboratorio #3: Modelos de Regresión en R

Ejercicio #1: utilizando R realice una función que dado un dataframe cualquiera de dos columnas, donde la primera (índice 1) sea el valor de la variable independiente (X) y la segunda sea el valor de una variable dependiente (Y), devuelva una lista con los siguientes elementos:

- 1. Un arreglo con los valores de los estimadores para B0 y B1".
- 2. El valor del coeficiente de determinación r^2 del modelo.
- 3. El coeficiente de correlación r (raíz cuadrada de r^2).
- 4. Un arreglo con los valores de los residuos.
- 5. Una gráfica con la nube de puntos y la recta de regresión del modelo.

**Nota:** Para este ejercicio NO está permitido utilizar la función lm()para calcular ninguno de los elementos solicitados (incisos 1 al 4), sin embargo puede utilizar ggplot para realizar la gráfica del inciso 5

#### La funcion lineal:

$$\overline{y} = \hat{\beta}_1 x + \hat{\beta}_0$$

Recuerde de su curso de Econometria que:

$$\hat{\beta}_1 = \frac{\sum_{i=1}^n x_i y_i - n \overline{x} \overline{y}}{\left(\sum_{i=1}^n x_i^2\right) - n \overline{x}^2}$$

x = valores conocido de la variable independiente

y =valores conocido de la variable dependiente

 $\overline{x}=$ promedio de valores de las x

 $\overline{y}$  = promedio de valores de las y

n = numero de datos puntuales u observaciones

i = indice de la valuación

$$\hat{\beta}_0 = \overline{y} - \hat{\beta}_1 \overline{x}$$

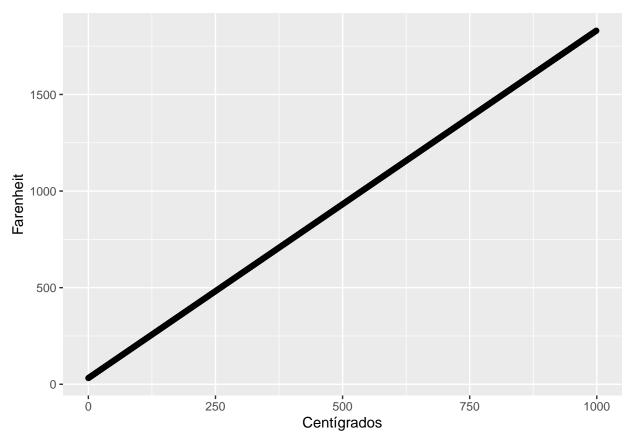
$$r^{2} = \frac{\sum_{i=1} (\hat{y}_{i} - \overline{y_{i}})^{2}}{\sum_{i=1} (y_{i} - \overline{y_{i}})^{2}}$$

$$r = \sqrt{r}$$

Recuerde que n representa la cantidad de filas en el dataset

## Leer el dataset

```
dataset = read.csv("grados.csv")
head(dataset)
## Centígrados Farenheit
      0
## 1
                    32.0
          1 33.8
2 35.6
3 37.4
4 39.2
## 2
## 3
## 4
## 5
## 6
           5 41.0
summary(dataset)
##
   Centígrados
                  Farenheit
## Min. : 0.0 Min. : 32.0
## 1st Qu.:249.8 1st Qu.: 481.6
## Median: 499.5 Median: 931.1
## Mean :499.5 Mean : 931.1
## 3rd Qu.:749.2 3rd Qu.:1380.7
## Max. :999.0 Max. :1830.2
# Cargar la biblioteca necesaria
library(ggplot2)
## Warning: package 'ggplot2' was built under R version 4.2.3
# generar gráfico
ggplot(dataset, aes(x=Centigrados, y=Farenheit)) +
           geom_point()
```



```
# Crear algunos datos de ejemplo
x \leftarrow dataset\\Centigrados
y <- dataset$Farenheit
# Calcular las medias
x_bar <- mean(x)</pre>
y_bar <- mean(y)</pre>
# Calcular las desviaciones
x_{dev} \leftarrow x - x_{bar}
y_dev <- y - y_bar</pre>
\# Calcular los coeficientes de regresión
beta_1 <- sum(x_dev * y_dev) / sum(x_dev^2)
beta_0 <- y_bar - beta_1 * x_bar
# Crear un arreglo con los valores de los estimadores para {\it BO} y {\it B1}
estimadores <- c(beta_0, beta_1)</pre>
# Calcular los valores predichos
y_predicha <- beta_0 + beta_1 * x</pre>
\# Calcular los residuos
residuos <- y - y_predicha
```

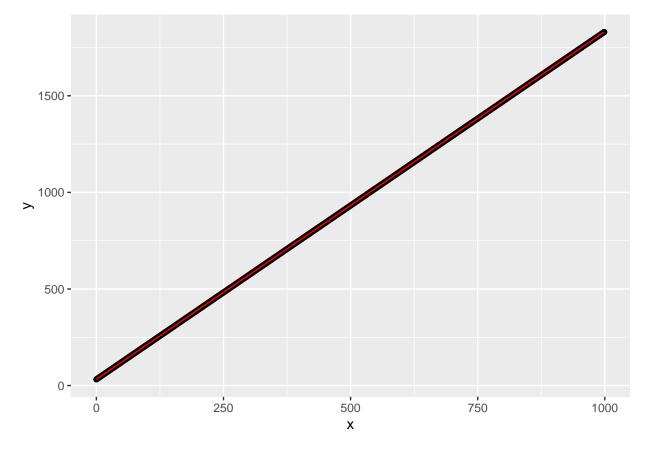
```
# Calcular R cuadrado
r_cuadrado <- 1 - sum(residuos^2) / sum((y - y_bar)^2)</pre>
# Calcular el coeficiente de correlación r
r <- sqrt(r_cuadrado)</pre>
# Crear una lista con los resultados
resultados <- list(estimadores = estimadores,
                   r_cuadrado = r_cuadrado,
                   r = r
                   residuos = residuos)
# Imprimir los resultados
print(resultados)
## $estimadores
## [1] 32.0 1.8
##
## $r_cuadrado
##
  [1] 1
##
## $r
  [1] 1
##
##
  $residuos
##
      [1] 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00 0.000000e+00
##
          0.000000e+00
                         0.000000e+00 0.000000e+00 0.000000e+00
                                                                   0.000000e+00
##
     [11]
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00 -7.105427e-15
                                                                   0.000000e+00
##
     Г16Т
           0.000000e+00
                         0.000000e+00 0.000000e+00 0.000000e+00
                                                                   0.000000e+00
##
     [21]
           0.000000e+00 -1.421085e-14
                                       0.000000e+00
                                                     0.000000e+00
                                                                   0.00000e+00
##
     [26]
           0.000000e+00 -1.421085e-14 0.000000e+00
                                                     0.000000e+00
                                                                   0.000000e+00
##
     [31]
           0.000000e+00 -1.421085e-14 0.000000e+00
                                                     0.000000e+00
                                                                   0.000000e+00
##
     [36]
                         0.000000e+00 -1.421085e-14
           0.000000e+00
                                                     0.000000e+00
                                                                   0.000000e+00
##
     [41]
           0.000000e+00
                         0.000000e+00 -1.421085e-14
                                                     0.000000e+00
                                                                   0.000000e+00
##
     [46]
           0.000000e+00
                         0.000000e+00 -1.421085e-14
                                                     0.000000e+00
                                                                   0.000000e+00
##
     [51]
           0.000000e+00
                         0.000000e+00 -1.421085e-14
                                                     0.000000e+00
                                                                   0.000000e+00
##
     [56]
           0.000000e+00
                         0.000000e+00 -2.842171e-14
                                                     0.000000e+00
                                                                   0.000000e+00
##
     [61]
                         0.000000e+00 -2.842171e-14
           0.000000e+00
                                                     0.000000e+00
                                                                   0.000000e+00
##
     [66]
           0.000000e+00
                         0.000000e+00 -2.842171e-14
                                                     0.000000e+00 0.000000e+00
##
                                                     0.000000e+00 -2.842171e-14
     [71]
           0.000000e+00
                         0.000000e+00 0.000000e+00
##
     [76]
           0.000000e+00
                         0.000000e+00 0.000000e+00
                                                     0.000000e+00 -2.842171e-14
##
     [81]
           0.000000e+00
                         0.000000e+00 0.000000e+00
                                                     0.000000e+00 -2.842171e-14
##
     [86]
                         0.000000e+00 0.000000e+00
                                                     0.000000e+00 -2.842171e-14
           0.000000e+00
##
     Г917
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
                                                     0.000000e+00 -2.842171e-14
     [96]
                                                     0.000000e+00 -2.842171e-14
##
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
##
    Γ101]
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
                                                     0.000000e+00 -2.842171e-14
##
    Γ1067
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
                                                     0.000000e+00 -2.842171e-14
##
   [111]
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
                                                     0.000000e+00 -2.842171e-14
##
   [116]
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
                                                     0.000000e+00 -2.842171e-14
##
   [121]
                                                     0.000000e+00 -2.842171e-14
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
##
   [126]
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
                                                     0.000000e+00 -5.684342e-14
##
    [131]
           0.000000e+00
                         0.000000e+00
                                       0.000000e+00
                                                     0.000000e+00 -5.684342e-14
##
    [136]
           0.000000e+00
                         0.000000e+00 0.000000e+00 0.000000e+00 -5.684342e-14
```

```
[141]
           0.000000e+00
                          0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
##
                                        0.000000e+00 -5.684342e-14
    Г1467
           0.000000e+00
                          0.000000e+00
                                                                      0.00000e+00
##
    [151]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
    [156]
                          0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
           0.000000e+00
##
    [161]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
                                        0.000000e+00 -5.684342e-14
##
    [166]
           0.000000e+00
                          0.000000e+00
                                                                      0.000000e+00
##
    Γ171
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
##
    [176]
           0.000000e+00
                          0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
    Γ181
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
    [186]
           0.000000e+00
                          0.00000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
##
    [191]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
    [196]
                                         0.000000e+00 -5.684342e-14
##
           0.000000e+00
                          0.000000e+00
                                                                      0.000000e+00
##
    [201]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
           0.000000e+00
                          0.000000e+00
                                                                      0.000000e+00
##
    [206]
                                         0.000000e+00 -5.684342e-14
##
    [211]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
##
    [216]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
                                         0.000000e+00 -5.684342e-14
##
    [221]
           0.000000e+00
                          0.00000e+00
                                                                      0.000000e+00
##
    [226]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
    [231]
##
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
##
    [236]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
##
    [241]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
    [246]
           0.000000e+00
                                         0.000000e+00 -5.684342e-14
##
                          0.000000e+00
                                                                      0.000000e+00
    [251]
                                         0.000000e+00 -5.684342e-14
##
           0.000000e+00
                          0.000000e+00
                                                                      0.000000e+00
    [256]
                                         0.000000e+00 -5.684342e-14
##
           0.000000e+00
                          0.000000e+00
                                                                      0.000000e+00
##
    [261]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
    [266]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -1.136868e-13
                                                                      0.000000e+00
    [271]
           0.000000e+00
                          0.00000e+00
                                         0.000000e+00 -1.136868e-13
##
                                                                      0.000000e+00
##
    [276]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -1.136868e-13
                                                                      0.000000e+00
##
    [281]
           0.000000e+00
                                         0.000000e+00 -1.136868e-13
                          0.000000e+00
                                                                      0.000000e+00
##
    [286]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [291]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [296]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [301]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [306]
                                         0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [311]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
                                                                      0.000000e+00
##
    [316]
                                        0.000000e+00
                                                       0.000000e+00
##
    [321]
           0.000000e+00 -1.136868e-13
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                                                       0.00000e+00
                                                                      0.000000e+00
##
    [326]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
    [331]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
           0.000000e+00 -1.136868e-13
##
    [336]
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [341]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [346]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
##
    Γ351
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [356]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [361]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
    [366]
           0.000000e+00 -1.136868e-13
##
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [371]
           0.000000e+00 -1.136868e-13
                                         0.00000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [376]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                                       0.000000e+00
##
    [381]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                                      0.000000e+00
##
    [386]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [391]
                                         0.00000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [396]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                                                      0.000000e+00
##
    [401]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
##
    [406]
           0.000000e+00 -1.136868e-13
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```

```
[411]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
##
    [416]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                        0.000000e+00
                                                                      0.000000e+00
##
    [421]
           0.000000e+00 -1.136868e-13
                                                       0.000000e+00
    [426]
           0.000000e+00 -1.136868e-13
                                                                      0.000000e+00
##
                                        0.000000e+00
                                                       0.000000e+00
##
    [431]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [436]
           0.000000e+00 -1.136868e-13
##
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [441]
           0.000000e+00 -1.136868e-13
                                        0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [446]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [451]
           0.000000e+00 -1.136868e-13
                                        0.00000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [456]
           0.000000e+00 -1.136868e-13
                                        0.00000e+00
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [461]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [466]
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [471]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                        0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [476]
           0.000000e+00 -1.136868e-13
##
    [481]
           0.000000e+00 -1.136868e-13
                                                       0.000000e+00
                                                                      0.00000e+00
                                        0.00000e+00
##
    [486]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [491]
           0.000000e+00 -1.136868e-13
                                        0.00000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [496]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
    [501]
##
                                        0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [506]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [511]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [516]
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [521]
           0.000000e+00 -1.136868e-13
##
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [526]
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [531]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [536]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
    [541]
           0.000000e+00 -1.136868e-13
##
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [546]
           0.000000e+00 -1.136868e-13
                                        0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [551]
           0.000000e+00 -1.136868e-13
                                                       0.00000e+00
                                        0.000000e+00
                                                                      0.000000e+00
##
    [556]
           0.000000e+00 -2.273737e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [561]
           0.000000e+00 -2.273737e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [566]
           0.000000e+00 -2.273737e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [571]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [576]
           0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [581]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                                      0.000000e+00
##
    [586]
                                                       0.000000e+00
##
    [591]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [596]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [601]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                                      0.000000e+00
##
                                                       0.00000e+00
##
    [606]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [611]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
    [616]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [621]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [626]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [631]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [636]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [641]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [646]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [651]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [656]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [661]
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [666]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                                                                      0.000000e+00
##
    [671]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
##
    [676]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
```

```
##
    [681]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [686]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
                                                                      0.000000e+00
##
    [691]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
    [696]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [701]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [706]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [711]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [716]
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [721]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [726]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [731]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
    [736]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [741]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [746]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [751]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [756]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [761]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [766]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [771]
           0.000000e+00
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [776]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [781]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [786]
           0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
    [791]
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
    [796]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                                       0.00000e+00
##
    [801]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                                      0.000000e+00
##
    [806]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
    [811]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [816]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [821]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
##
                                                                      0.000000e+00
##
    [826]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [831]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [836]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [841]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [846]
           0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [851]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
                          0.000000e+00 -2.273737e-13
##
    [856]
           0.000000e+00
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [861]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [866]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [871]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [876]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [881]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
    [886]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [891]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [896]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [901]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [906]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [911]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [916]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [921]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [926]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [931]
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [936]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [941]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [946]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
```

```
[951] 0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00 0.000000e+00
##
##
    [956] 0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00 0.000000e+00
    [961] 0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00
                                                                0.000000e+00
   [966] 0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00
##
                                                                0.000000e+00
##
   [971]
          0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00
                                                                0.000000e+00
   [976]
          0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00
                                                                0.000000e+00
##
   Г981]
          0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00
                                                                0.000000e+00
   [986]
          0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00
##
                                                                0.000000e+00
##
    [991]
          0.000000e+00
                       0.000000e+00 -2.273737e-13
                                                  0.000000e+00
                                                                0.000000e+00
   [996] 0.000000e+00 0.000000e+00 -2.273737e-13 0.000000e+00 0.000000e+00
```



## BO B1 R\_Cuadrado R

```
## 1 32 1.8
## 2 32 1.8
                     1 1
## 3 32 1.8
                     1 1
## 4 32 1.8
                     1 1
## 5 32 1.8
                     1 1
## 6 32 1.8
                     1 1
     c.0..0..0..0..0..0..0..0..0..0..0..0..7.105427357601e.15..
## 1
## 2
                                                                    0
## 3
                                                                    0
## 4
                                                                    0
                                                                    0
## 5
## 6
```

```
##
         ВО
                     В1
                               R Cuadrado
                                               R
          :32
                      :1.8
                             Min.
                                   :1
  Min.
               Min.
                                         Min.
                             1st Qu.:1
   1st Qu.:32
               1st Qu.:1.8
                                         1st Qu.:1
## Median :32
               Median :1.8
                             Median :1
                                         Median:1
## Mean
         :32
               Mean
                      :1.8
                             Mean :1
                                         Mean
## 3rd Qu.:32
                3rd Qu.:1.8
                             3rd Qu.:1
                                         3rd Qu.:1
## Max.
          :32
               Max.
                      :1.8
                             Max.
                                   :1
                                         Max.
## c.0..0..0..0..0..0..0..0..0..0..7.105427357601e.15..
## Min.
        :-2.274e-13
## 1st Qu.: 0.000e+00
## Median : 0.000e+00
## Mean :-2.893e-14
## 3rd Qu.: 0.000e+00
## Max. : 0.000e+00
```

### Resumen

1. Un arreglo con los valores de los estimadores para B0 y B1".

```
arreglo = c(beta_0, beta_1)
arreglo
```

```
## [1] 32.0 1.8
```

2. El valor del coeficiente de determinación r^2 del modelo.

```
r_cuadrado
```

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

3. El coeficiente de correlación r (raíz cuadrada de r^2).

r

## [1] 1

4. Un arreglo con los valores de los residuos.

```
residuos
```

```
##
      [1]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00
                                                                     0.000000e+00
##
      [6]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [11]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -7.105427e-15
                                                                     0.00000e+00
##
     [16]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.00000e+00
                                                                     0.00000e+00
##
     [21]
           0.000000e+00 -1.421085e-14
                                        0.000000e+00
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [26]
           0.000000e+00 -1.421085e-14
                                        0.000000e+00
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [31]
           0.000000e+00 -1.421085e-14
                                       0.000000e+00
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [36]
           0.000000e+00
                         0.000000e+00 -1.421085e-14
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [41]
                         0.000000e+00 -1.421085e-14
           0.000000e+00
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [46]
           0.000000e+00
                         0.000000e+00 -1.421085e-14
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [51]
           0.000000e+00
                         0.000000e+00 -1.421085e-14
                                                      0.000000e+00
                                                                     0.00000e+00
     [56]
##
           0.000000e+00
                         0.000000e+00 -2.842171e-14
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [61]
           0.000000e+00
                         0.000000e+00 -2.842171e-14
                                                      0.000000e+00
                                                                     0.000000e+00
##
     [66]
           0.000000e+00
                         0.000000e+00 -2.842171e-14
                                                      0.000000e+00
                                                                    0.000000e+00
##
     [71]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
##
           0.000000e+00
                         0.000000e+00 0.000000e+00
     [76]
                                                      0.000000e+00 -2.842171e-14
##
     [81]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
##
     [86]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
##
     [91]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
##
     [96]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
                                                      0.000000e+00 -2.842171e-14
##
    [101]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
##
    [106]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
##
    [111]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
##
    [116]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
##
    [121]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -2.842171e-14
    [126]
                                                      0.000000e+00 -5.684342e-14
##
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
##
    [131]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -5.684342e-14
##
    [136]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00
                                                      0.000000e+00 -5.684342e-14
    [141]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
##
                                                                    0.000000e+00
##
    [146]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                     0.000000e+00
                                        0.000000e+00 -5.684342e-14
##
    [151]
           0.000000e+00
                         0.000000e+00
                                                                     0.000000e+00
##
    [156]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                     0.00000e+00
    [161]
                                        0.000000e+00 -5.684342e-14
##
           0.000000e+00
                         0.000000e+00
                                                                     0.00000e+00
##
    [166]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                     0.000000e+00
##
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                     0.000000e+00
    [171]
##
    [176]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                     0.000000e+00
                                        0.000000e+00 -5.684342e-14
##
    [181]
           0.000000e+00
                         0.000000e+00
                                                                     0.00000e+00
    [186]
                                        0.000000e+00 -5.684342e-14
##
           0.000000e+00
                         0.000000e+00
                                                                     0.000000e+00
##
    [191]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                     0.000000e+00
##
    [196]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                     0.000000e+00
                                        0.000000e+00 -5.684342e-14
##
    [201]
           0.000000e+00
                         0.000000e+00
                                                                     0.000000e+00
##
    [206]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                     0.000000e+00
    [211]
           0.000000e+00
                         0.000000e+00
                                        0.000000e+00 -5.684342e-14
##
                                                                    0.000000e+00
```

```
[216]
           0.000000e+00
                          0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
##
    [221]
           0.000000e+00
                          0.000000e+00
                                        0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
##
    [226]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
    [231]
                                        0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
           0.000000e+00
                          0.000000e+00
##
    [236]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
                                         0.000000e+00 -5.684342e-14
##
    [241]
           0.000000e+00
                          0.000000e+00
                                                                      0.000000e+00
##
    [246]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
    [251]
           0.000000e+00
##
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
    [256]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.000000e+00
##
    [261]
           0.000000e+00
                          0.00000e+00
                                         0.000000e+00 -5.684342e-14
                                                                      0.00000e+00
##
    [266]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -1.136868e-13
                                                                      0.000000e+00
    [271]
                                         0.000000e+00 -1.136868e-13
##
           0.000000e+00
                          0.000000e+00
                                                                      0.000000e+00
##
    [276]
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -1.136868e-13
                                                                      0.000000e+00
           0.000000e+00
                          0.000000e+00
                                         0.000000e+00 -1.136868e-13
                                                                      0.000000e+00
##
    [281]
##
    [286]
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
##
    [291]
           0.000000e+00 -1.136868e-13
                                         0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [296]
           0.000000e+00 -1.136868e-13
                                         0.00000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [301]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
    [306]
##
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [311]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [316]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
    [321]
           0.000000e+00 -1.136868e-13
##
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [326]
           0.000000e+00 -1.136868e-13
##
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [331]
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [336]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [341]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [346]
           0.000000e+00 -1.136868e-13
                                         0.00000e+00
##
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [351]
           0.000000e+00 -1.136868e-13
                                         0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [356]
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [361]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [366]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [371]
           0.000000e+00 -1.136868e-13
                                         0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [376]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [381]
                                         0.00000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [386]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
           0.000000e+00 -1.136868e-13
                                                                      0.000000e+00
##
    [391]
                                         0.000000e+00
                                                       0.000000e+00
##
    [396]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [401]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [406]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                                      0.000000e+00
##
                                                       0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [411]
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [416]
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
    [421]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
##
    [426]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [431]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [436]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
    [441]
           0.000000e+00 -1.136868e-13
##
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [446]
           0.000000e+00 -1.136868e-13
                                         0.00000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [451]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [456]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [461]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [466]
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [471]
           0.000000e+00 -1.136868e-13
                                         0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
                                                                      0.000000e+00
##
    [476]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
##
    [481]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
```

```
##
    [486]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [491]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                        0.000000e+00
                                                                      0.000000e+00
##
    [496]
           0.000000e+00 -1.136868e-13
                                                       0.000000e+00
    [501]
           0.000000e+00 -1.136868e-13
##
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [506]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [511]
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [516]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                                       0.00000e+00
##
    [521]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                                      0.000000e+00
##
    [526]
           0.000000e+00 -1.136868e-13
                                        0.00000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [531]
           0.000000e+00 -1.136868e-13
                                        0.00000e+00
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [536]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
           0.000000e+00 -1.136868e-13
##
    [541]
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [546]
           0.000000e+00 -1.136868e-13
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                        0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [551]
           0.000000e+00 -1.136868e-13
##
    [556]
           0.000000e+00 -2.273737e-13
                                                                      0.00000e+00
                                        0.000000e+00
                                                       0.000000e+00
##
    [561]
           0.000000e+00 -2.273737e-13
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [566]
           0.000000e+00 -2.273737e-13
                                        0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [571]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [576]
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [581]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.00000e+00
##
    [586]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [591]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
                                                       0.00000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
    [596]
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
    [601]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
                                                       0.00000e+00
##
    [606]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                                      0.00000e+00
##
    [611]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [616]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [621]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [626]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [631]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [636]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [641]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [646]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [651]
           0.000000e+00
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [656]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                                      0.000000e+00
##
    [661]
           0.000000e+00
                                                       0.000000e+00
##
    [666]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [671]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [676]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
##
##
    [681]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [686]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
    [691]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [696]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [701]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
##
    [706]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
    [711]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [716]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [721]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [726]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [731]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                      0.000000e+00
           0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [736]
                                                       0.00000e+00
                                                                      0.000000e+00
##
    [741]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
                                                                      0.000000e+00
##
    [746]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
##
    [751]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.00000e+00
```

```
##
    [756]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [761]
           0.000000e+00
                                                       0.000000e+00
                                                                     0.00000e+00
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [766]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
    [771]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
##
    [776]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [781]
                          0.000000e+00 -2.273737e-13
##
    [786]
           0.000000e+00
                                                       0.000000e+00
                                                                     0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                                     0.00000e+00
##
    [791]
           0.000000e+00
                                                       0.000000e+00
##
    [796]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [801]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.00000e+00
##
    [806]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
    [811]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [816]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
           0.000000e+00
##
    [821]
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [826]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [831]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
                          0.000000e+00 -2.273737e-13
    [836]
           0.000000e+00
                                                       0.00000e+00
                                                                     0.000000e+00
##
    [841]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
    [846]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                     0.00000e+00
##
    [851]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.00000e+00
##
    [856]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [861]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
                          0.000000e+00 -2.273737e-13
    [866]
##
           0.00000e+00
                                                       0.000000e+00
                                                                     0.000000e+00
    [871]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [876]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [881]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [886]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [891]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [896]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.00000e+00
##
    [901]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [906]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [911]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [916]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
    [921]
                          0.000000e+00 -2.273737e-13
##
           0.000000e+00
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [926]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [931]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [936]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.00000e+00
##
    [941]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [946]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
           0.000000e+00
                          0.000000e+00 -2.273737e-13
    [951]
                                                       0.000000e+00
                                                                     0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [956]
           0.000000e+00
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [961]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.00000e+00
##
    [966]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.00000e+00
##
    [971]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.00000e+00
                                                                     0.000000e+00
                          0.000000e+00 -2.273737e-13
##
    [976]
           0.000000e+00
                                                       0.000000e+00
                                                                     0.000000e+00
                          0.000000e+00 -2.273737e-13
    [981]
           0.000000e+00
##
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [986]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                      0.000000e+00
##
    [991]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
##
    [996]
           0.000000e+00
                          0.000000e+00 -2.273737e-13
                                                       0.000000e+00
                                                                     0.000000e+00
```

5. Una gráfica con la nube de puntos y la recta de regresión del modelo.

## grafico

